行政院所屬各機關因公出國人員出國報告書

（出國類別：　考察　）

赴德國進行環保科技園區招商工作、參訪當地環保產業及邀請來台投資，並進行官方雙邊環保產業與技術交流（上）

服務機關：行政院環境保護署

出國人　職　稱：署長　主任　處長　簡任秘書　簡任技正

姓　名：郝龍斌　阮國棟　陳雄文　任孝琦　劉佳鈞

出國地點：德國

出國期間：九十二年八月三十日　至　九十二年九月七日

報告日期：九十二年九月二十五日

行政院研考會/省（市）研考會編號欄
G14/ C09202935

行政院所屬各機關因公出國人員出國報告書

赴德國進行環保科技園區招商工作、參訪當地環保產業及邀請來台投資、並進行官方雙邊環保產業與技術交流

出國報告

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赴德國進行環保科技園區招商工作、參訪當地環保產業及邀請來台投資、並進行官方雙邊環保產業與技術交流

出國報告

壹、前言

台灣地區天然資源缺乏，且隨著工商業發展與生活水準的提升，國內廢棄物產生量與日俱增；而快速的經濟成長亦產生了大量拋棄式的消費型態，造成許多可用資源的浪費與廢棄物的大量增長。另國內每年工業廢棄物產生量高達兩千一百萬公噸，除了積極有效地建立各種處理管道之外，對於有害廢棄物的處理更需擷取先進國家的經驗與技術，作為國內廢棄物管理的政策參考。有鑑於此，本署近來乃積極推動資源回收、環保科技園區及廢棄物管理政策的規劃與執行工作。

為落實行政院挑戰二００八國家重點發展計畫，將於今年十月於台北國際會議中心辦理國際招商大會，及本署環保科技園區推動計畫之招商作業，由　署長率團帶領本署同仁及專家出訪德國，進行環保科技園區招商工作、考察當地環保產業並邀請來台投資，同時進行官方雙邊環保技術及環保產業發展之交流。

貳、成員名單

考察德國由　署長擔任團長，成員有本署科技顧問室阮國棟主任、廢管處陳雄文處長、署長室簡任祕書任孝琦及廢管處簡任技正劉佳鈞等五人及署外專家二人，合計七人；日期自本（九十二）年八月三十日至九月七日，共計九天。主要考察重點如下：

（一）拜訪德國環境、自然保育及核能安全部及經濟勞工部，介紹我國環保科技園區推動計畫，並進行官方雙邊環保技術交流及邀請來我國參訪。

（二）辦理環保科技園區招商說明會及邀請該國環保產業來台投資。

（三）參訪當地環保產業進行環保科技園區招商工作及邀請來台投資。

參、行程內容及參訪紀要

一、參訪德國行程

署長參訪德國行程表

日期	時間	地點	參訪行程	備註
8/30 (六)	下午 22:25 ｜ 上午 9:40	台北→阿姆斯特丹	華航 65 班機 下午 22:25 台北~阿姆斯特丹 (抵達時間上午 9:40)	1. 下午 21:20 前至第一航站中華航空櫃檯集合 2. 住宿飯店：Hilton Hotel 地址：Mohrenstrasse 30 10117 Berlin 電話：030 2023 0 FAX：030 2023 4269
8/31 (日)	下午 14:45 ｜ 下午 16:05	阿姆斯特丹→柏林	荷航 1827 班機下午 14:45 阿姆斯特丹~柏林 (抵達時間下午 16:05)	
9/1 (一)	上午 8:30 ｜ 下午 13:30	柏林 Gerwisch	參訪 CP treatment and sludge re-cycling technology, Madgeburg. Envitec Consult Hamburg Co.	地址：August-Bebel-Straße 35 39175 Gerwisch 電話：039292-26166 (Julius 01716367733)
	下午 14:30	經濟部	拜會德國經濟部政務次長 Rezzo Schlauch	地址：Scharnhorststr. 34-37, 10115 Berlin 電話：1888-615-0
	下午 16:00	柏林	參訪 Energy Forum/International Solar Center (Solar Energy School Berlin)	地址：Stralauer Platz 33/34, 10243 Berlin 電話：030-29-38-12-64
	下午	請駐德代表處安排時間	拜會駐德國代表處 聯絡人：唐小莉組長 電話：030-20361102 手機：0171-9150407 FAX：030-20361101 Mail：hltang212@sinamail.com	駐德國代表處胡代表晚宴
9/2 (二)	上午 10:00 ｜ 上午 11:30	柏林 ALBA waste manage-ment center Post-damer Square	參訪 ALBA waste management center at Postdamer Square	地址：ALBA AWU Service-Center Entsorgung, Flottenstraße 7-9 13407 Berlin 電話：030-351 82 351
	中午 12:00 ｜ 中午 12:45	柏林	拜會 Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, Min. Director Dr. Hendrik Vygen	地址：Alexanderplatz 6, 10178 Berlin 電話：1888 305-0
	下午 13:30 ｜ 下午 16:00	柏林	參觀柏林環保設施	

日期	時間	地點	參訪行程	備註
	下午 17:40 | 下午 18:45	柏林→慕尼黑	德航 1296 班機 下午 17:40 柏林~慕尼黑 （抵達時間下午 18:45）	1. 下午 16:40 到柏林機場 2. 住宿飯店：King' s Hotel First Class 地址：Dachauer Straße 13, D 80335, München 電話：089-551870 FAX：089-55187300
9/3 （三）	上午 11:30 | 下午 13:30	慕尼黑 Seehaus im Englischen Garten	招商說明會 11:30-11:40 報到 11:40-12:10 長官致詞 12:10-12:20 台灣「環保科技園區」介紹 12:20-13:30 綜合討論	1. 餐廳聯絡人：Ms. Anelika Obermeier 2. 電話：089-381613-11order10 3. 地址：Kleinhesselohe 3 80802 München 4. 駐慕尼黑辦事處：陳昌霖組長 電話：089-51267914 FAX：089-51267959
	下午 14:30 | 下午 18:00	慕尼黑 Penzberg	參訪 HAMOS 公司	地址：Im Thal 17, 82377 Penzberg 電話：08856-9261-0
9/4 （四）	上午 9:00 | 上午 11:30	慕尼黑	參訪 Valides hospital waste treatment	地址：Klinikum rechts der Isar, Ismaninger Straße 22, 81675 Müchen 電話：089-41400
	下午 14:00	慕尼黑 Augsburg	參訪 KUMAS center Augsburg and Augsburg BIFA(Bavarian Institute for applied and environmental research and technology)	地址：Am Mittleren Moos 48, 86167 Augsburg 電話：08217493-194
	下午 17:09 | 下午 20:08	Augsburg→法蘭克福	搭火車前往法蘭克福 (3 hours by ICE) 於火車上用晚餐	住宿飯店：Maritim Hotel Frankfurt 地址：Theodor-Heuss-Allee 3 60486 Frankfurt/Main 電話：069-7578-0 FAX：069-7578-1000
9/5 （五）	上午 9:00 | 上午 11:30	法蘭克福 FES-Frankfurt	參訪 FES-Frankfurt, composting facility & Europe' s biggest paper sorting facility	地址：Bioabfallbehandlungsanlage Rhein-Main Biokompost GmbH (RMB), Peter-Behrens-Straße 8, 60314 Frankfurt Abfallum-ladeanlage,(AUA), FES GmbH, Uhlfelderstr. 10 60314 Frankfurt
	下午 14:00 | 下午 16:30	法蘭克福 Harnau	參訪 Passavant-Roediger 公司	1. 陪同者：戴曉虎博士 2. 地址：Kinzigheimer Weg 104-106, 63450 Hanau 電話：0049-6181309-157 Mobil：0049-173-709-2521
9/6 （六） 9/7 （日）	上午 11:20 | 上午 7:15	法蘭克福→台北	華航 62 班機 上午 11:20 法蘭克福~台北 （抵達時間上午 7:15）	

二、德國考察摘要

德國考察地點包括柏林、慕尼黑與法蘭克福等地區，行程安排緊湊而豐富。考察團於柏林地區拜會德國經濟部與環保部、考察廢水之物理化學處理及污泥資源化、太陽能相關之技術訓練與百貨商圈之廢棄物收集等技術。於慕尼黑地區辦理環保科技園區招商說明會、考察混合廢料中分離貴重金屬及塑膠與醫療廢棄物高溫滅菌等技術，同時拜訪環保技術研究單位，接著於法蘭克福地區考察垃圾收集系統及含有機物資源化與廢水處理及有機廢棄物發酵、沼氣發電等技術。德國考察行程紀要報告摘要如下：

（一）八月三十一日下午六點，拜會駐德代表處，討論本考察團於德國柏林的行程與拜會對象的安排情形。

（二）九月一日上午十點，拜訪 Envitec Consult Hamburg Co.，該公司將含有害物質（如重金屬）之工業廢水，先進行物理化學之前處理，去除有害物質，無害化的污泥再進一步進行生物消化、脫水及乾燥等程序，以減少體積及其後處理費用或製成肥料。

（三）九月一日下午兩點三十分，拜會德國經濟勞工部政務次長 Mr. Rezzo Schlauch，說明拜會目的與環保科技園區計畫內容。

（四）九月一日下午三點三十分，拜訪 Solar School Berlin，為柏林地區建立一所再生能源技術發展

訓練中心，主要的內容為以太陽熱能系統、光電流系統、能源效用系統及生物能量系統等之利用。

（五）九月二日上午十點三十分，拜訪 ALBA waste management center，該公司利用百貨商圈的地下室進行商業廢棄物的分類收集，各項廢棄物貼上條碼以物品物流管理的方式進行廢棄物管理收集清運。

（六）九月二日上午十二點，拜會德國環境、自然保育及核能安全部負責東亞事務處長 Dr. Hendrik Vygen，說明拜會目的與環保科技園區計畫內容，請該部提供德國發展之環保技術相關的資料，並協助我國參與國際各項環保相關的活動。

（七）九月三日上午十一點三十分，辦理環保科技園區招商說明會，德國雖然處於暑假期間，廠商出席踴躍，計有二十家廠商代表、德國聯邦政府國會議員費爾（綠黨籍）和巴伐利亞邦工業總會代表艾柏茲等四十五人出席說明會。說明會由署長等多人詳細介紹環保科技園區設置的內容、特色及獎勵措施與台灣的投資優勢等。

（八）九月三日下午三點三十分，拜訪 Hamos Company，該公司利用靜電原理分離混合廢料，本技術將提高分離效率，以提昇再生物質的附加價值。目前已有台灣廠商運用此技術於電子混合廢

料之分離。

（九）九月四日上午九點，由 B.I.M.E 公司代表介紹 真空高溫滅菌的方式處理醫療廢棄物，並參觀實際應用在慕尼黑大學附設醫院的運作情形。

（十）九月四日下午兩點十五分，拜訪 KUMAS 與 BifA，KUMAS 是一個由許多環保公司組成的機構，也是德國環保公司的聯絡網。BifA 是一個非營利性的組織，為國際性的研究、發展及工程顧問公司，提供實用化的環保研究技術及商業化的實用技術，幫助業界達成節省能源、資源及操作成本。

（十一）九月五日上午九點，拜訪 FES-Frankfurt，法蘭克福市政府於一九九五年六月由市議會決議釋出官股百分之四十九與民營公司共同經營，而以股份有限公司型式成立 Frankfurter Entsorgung-sund Service (FES)，FES 負責垃圾收集清運工作，其中有機廢棄物則以厭氧發酵或堆肥的方式製成肥料，廢紙則利用自動化設備進行分類，分類後的廢紙可以提昇其利用之附加價值。

（十二）九月五日下午兩點，拜訪 Passavant and Roediger，該公司為先進的廢水處理、發展再生能源與污泥處理公司，污泥於厭氧發酵過程中將產生沼氣，沼氣回收再利用進行發電。

三、德國考察紀要報告

九十二年八月三十一日下午六點及九月一日下午五時

拜會駐德代表處

（一）、接待人員：

胡為真代表

唐小莉組長

黃文主先生

（二）、會談紀要：

1、了解本考察團於德國柏林的行程與拜會對象的安排情形，最後確認行程與出國前安排之行程相同，無行程變更。

2、於德國柏林的重要拜會行程包括九月一日下午兩點三十分，拜會德國經濟勞工部與九月二日上午十二點，拜會德國環境、自然保育及核能安全部。其他行程包括九月一日上午十點，拜訪 Envitec Consult Hamburg Co.、九月一日下午三點三十分，拜訪 Solar School Berlin 與九月二日上午十點三十分，拜訪 ALBA waste management center。

3、於九月二日搭乘德航飛往慕尼黑進行其他行程。

（三）、拜會照片

胡代表與考察團會談

胡代表與考察團所有成員共同合影

九月一日上午十點

參訪 Envitec Consult Hamburg Co.

（一）、接待人員：

Mr. Wilfried Schlobohm

Mr. Alexander M. Julius

（二）、背景簡介：

Envitec 提供工業廢水的物理/化學處理方法及技術顧問公司，將有毒或有害之廢水進行無毒化或無害化處理，以確保不會對人或環境產生傷害，無毒及無害性液態廢棄物的處理已經有近百年的歷史，所以在其處理效率及經濟效益上已經被成功的驗證過，一般來說有毒或有害液態廢棄物的短距離運輸以管線泵送，最具效益及容易控制，無毒及無害液態廢棄物的短距離輸送則以重力流，最具經濟效益。生物處理液態廢棄物前，必須將其中的油脂、生物毒性物質，先進行預處理，經由物理/化學預處理單元(CPB)處理後的廢液即可進入傳統的民生污水處理廠進行處理，經由 CPB 預處理單元的操作可以將有毒或有害廢液的體積大量減少至 10%以下，如此可以為工業界節省大量的廢水處理單的建造及操作費用，CPB 操作單元甚至可以有毒或有害廢液完全無毒化。

物理/化學預處理單元(CPB)幾乎可以處理各種類的工業有毒或有害廢液，處理單元為模組化的設計，並以電腦系統進行自動控制，如此可以節省人力，及避免人員接觸的風險。

實際應用技術；

- 為了經濟且有效的處理客戶的有毒或有害廢液，於設備製造及交運前，將針對先進行實驗室測試，以確保可以有效處理。
- 處理後的廢液將被泵入貯槽中，進一步進行生物毒性試驗，以確保後續的廢水生物處理系統不受影響。
- 油脂、浮渣等可於確定無害化後，進入回收再利用體系，無害化的污泥可以進一步進行生物消化、脫水及乾燥等程序，以減少體積及其後處理費用。
- 單元設計將以環境友善的觀點為主要考量，將盡量避免使用大量化學物質，或產生其他型式的新有害物質。
- 處理單元將以電腦進行操控，以減少人力需求，及避免人員接觸的風險。避免污染土壤及地下水亦是本技術單元設計/製造的主要要求之一。

本 CPB 處理單元需要使用土地面積為 700 – 10,000 平方公尺，最小要求必須有 500 平方公尺以上，為考量土壤及地下水污染的預防，本單元必須設置防護系統，故必須為符合要求的新建的建築，建議不使用舊有建築設施。

（三）、參訪紀要

1、首先由 Mr. Alexander M. Julius 進行簡報，說明公司各項業務與技術，簡報結束後進行廢水處理廠之參觀，處理廠佔地面積約一公頃。

2、該公司將含有害物質（如重金屬）之工業廢水，先進行物理化學之前處理，去除有害物質，無害化的污泥再進一步進行生物消化、脫水及乾燥等程序，以減少體積及其後處理費用或製成肥料。

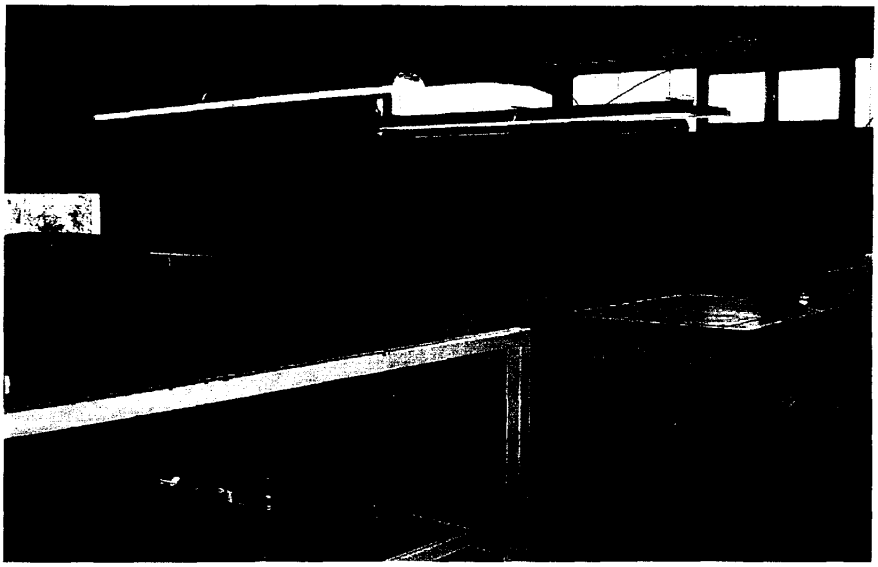
3、處理廠投資金額約 600 萬歐元（新台幣約 2.4 億元），年營業額 75-80 萬歐元（新台幣約 3,000-3,200 萬元），營業所得大部分來自於廢水處理，有機肥料僅佔少部分。

4、邀請該公司赴台灣投資廢水處理與污泥資源化處理等業務，協助台灣解決廢水處理與污泥資源化的問題。

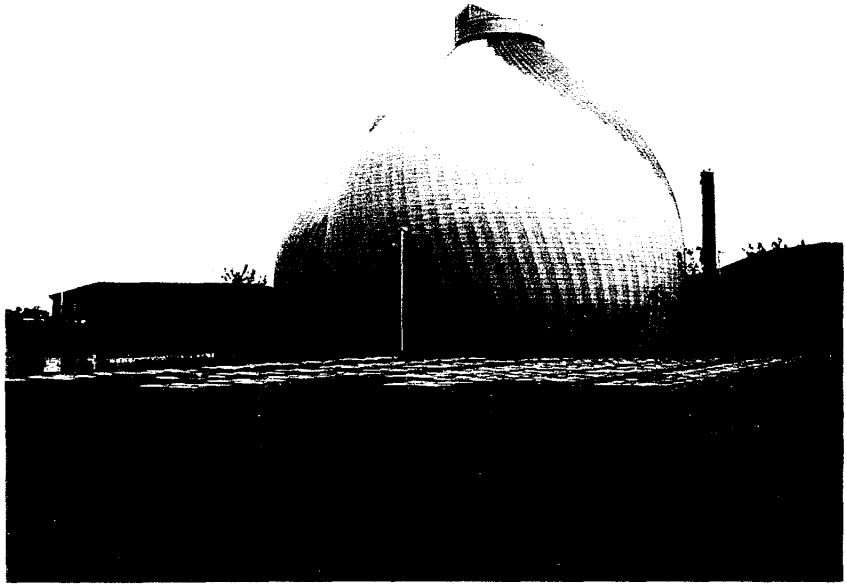
（四）、參訪照片

Mr. Alexander M. Julius 進行公司產品及技術之簡報

考察團仔細聆聽簡報內容



污泥處理設施



蛋形污泥消化槽

九月一日下午兩點三十分

拜會德國經濟勞工部

（一）、會談人員：

政務次長 Mr. Rezzo Schlauch

東亞司司長 Dr. Lutz Werner

（二）、討論議題：

1、介紹我國環保科技園區推動計畫

2、環保科技技術與產業，雙邊環保技術與產業之交流與合作

3、再生能源、太陽能及風力發電技術在德國應用

（三）、拜會紀要

1、首先由署長說明拜會的目的，與台灣推動環保科技園區計畫，接著由楊致行顧問詳細說明我國環保科技園區推動計畫，令在場德方官員得以了解我國以經濟手段解決環保問題的務實做法，並邀請德國環保相關廠商投資台灣環保科技園區。

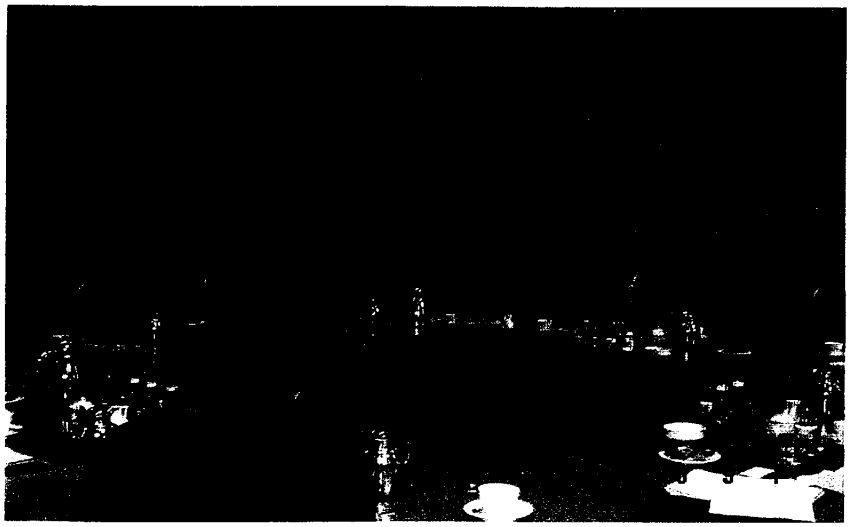
2、德國企業大部分為中小企業於海外進行事業投資時，將相對保守，因此業者需要了解台灣投資環境與相關法令之規定。

3、為促進雙方合作與交流，經濟勞工部政務次長 Mr. Rezzo Schlauch 承諾將率領德國環保相關的廠商拜訪台灣，尋求投資台灣的商機。

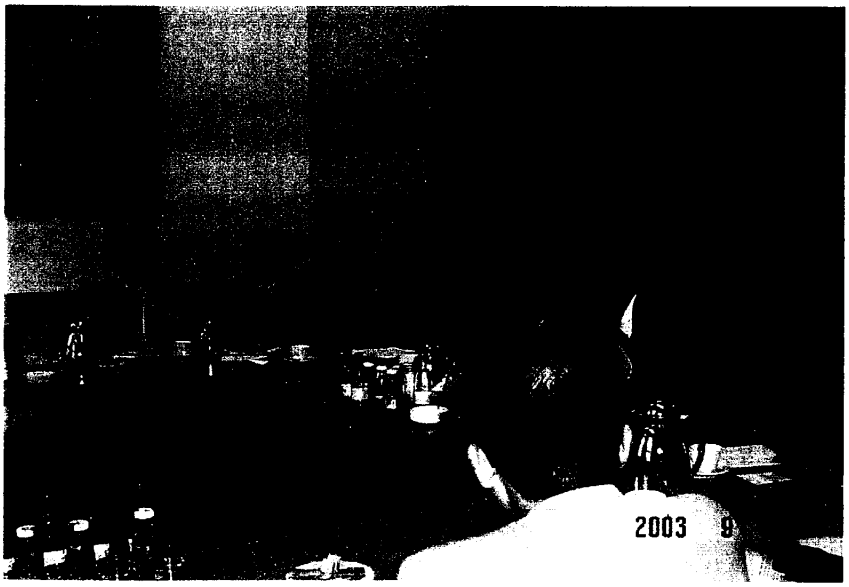
4、目前德國於新能源的發展方向，以太陽能、風力能為主力。此方向與台灣正要推展的能源政策互相吻合，

為節省能資源的耗用及充分利用自然能源的情況下，環保科技園區引進太陽能或再生能源是有其必要性。

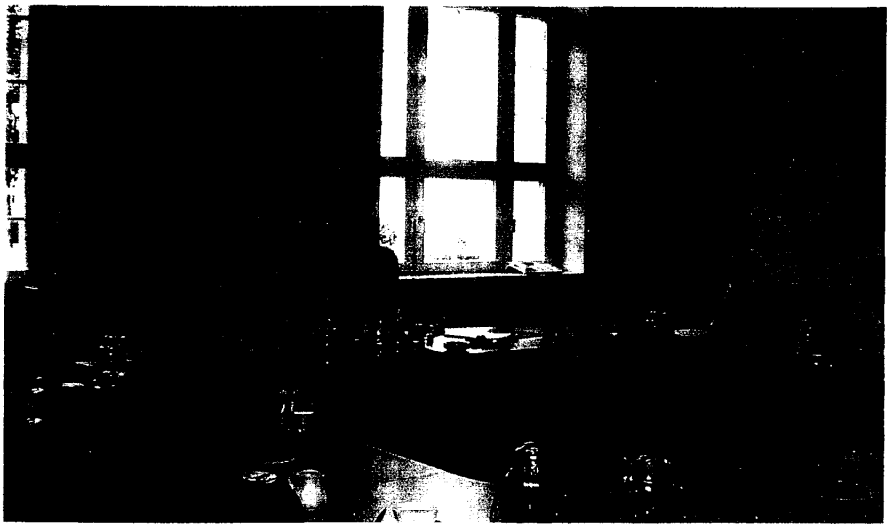
（四）、拜會照片



署長說明拜會的目的及環保科技園區



楊副主任說明環保科技園區計畫內容



雙方會談暨議題討論的情形

署長說明環保科技園區相關之文宣資料

九月一日下午三點三十分

參訪 Solar School Berlin

（一）、背景簡介

1996 成立的學校，是為柏林地區建立一所再生能源技術發展訓練中心，主要的課程乃以太陽熱能系統、光電流系統、能源效用系統及生物能量系統等之利用。這些課程提供設計、計畫、實用、操作、維護等一連串相關性之再生能源系統利用。其中經過這些訓練者已超過1,500 位，並分別在技工、工程師、設計師等都相當有成就。

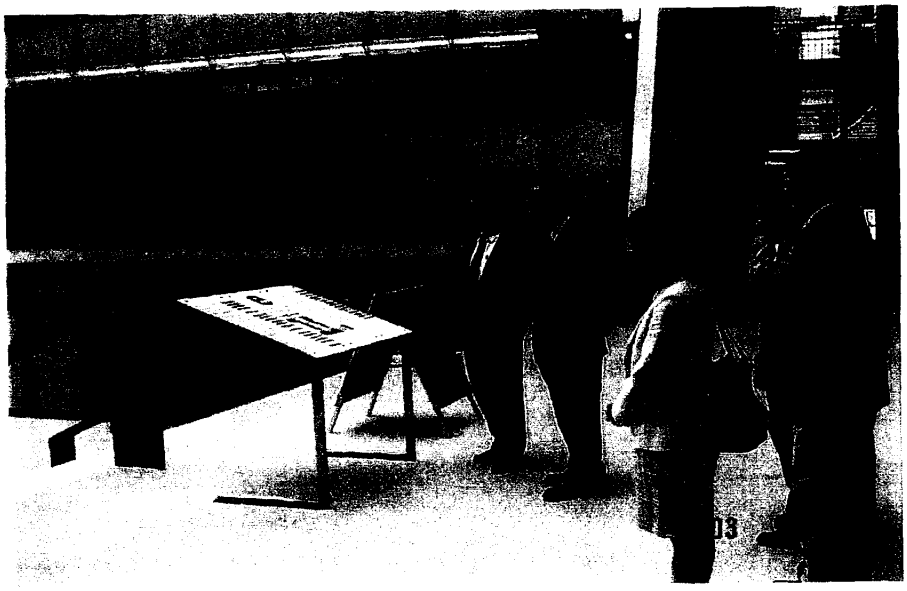
（二）、參訪紀要

1、首先由訓練中心的技術人員說明 Solar School 成立的背景及太陽能應用技術。

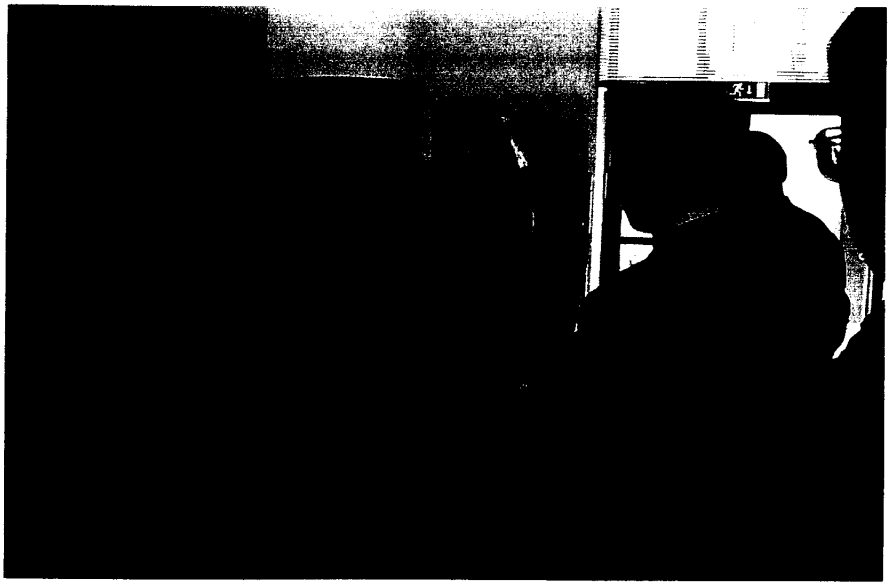
2、引導參觀各項太陽光電能相關的訓練設施，並說明各項設施的使用效率與特色，依目前的技術太陽能之光電轉換效率約 30-35%。最後參觀位於該大樓外牆上的太陽能板，以了解實際運用情況。

(三)、參訪照片

技術人員說明 Solar School 成立的背景及太陽能應用技術



考察團仔細聆聽介紹說明



考察團參觀太陽光電能轉換研究設施

大樓外牆太陽能板應用實例

九月二日上午十點三十分

參訪 ALBA waste management center

（一）、接待人員：

Mr. Angelika Kirnich

Mr. Friedrich Wilhelm Garn

（二）、背景簡介

ALBA 於 1968 年成立。依去年的統計：擁有員工 5200 人，總營業額為歐元六億九千七百萬，並在 2002 年繼續投資歐元五千萬元於環保科技的開發。本著投資開發及永續經營的理念，亦在東歐設立分公司，以確立東歐國家環保技術之需求。其公司之技術服務範圍，分述如下：

1.廢棄物管理顧問：針對一般公司給予廢棄物管理技術支援，並以顧問方式承攬業務。蒐集廢棄物，成立廢棄物處理回收中心，再以資源化。

2.擁有許多廢棄物處理廠：包括廢鐵回收處理、玻璃回收處理、廢塑膠回收處理（每年可處理二萬多公噸）、廢紙回收等多項處理工廠。

3.PET 寶特瓶處理廠：是德國屬一屬二的大型寶特瓶處理廠，擁有最新設備以因應德國寶特瓶處理之需求。

4.擁有龐大雄厚之資金投資環保事業之發展，且利用盈餘投入公益事業，支持柏林棒球對等體育活動。

（三）、參訪紀要

1、本次參訪地點位於百貨商圈的地下室，因此將車輛直

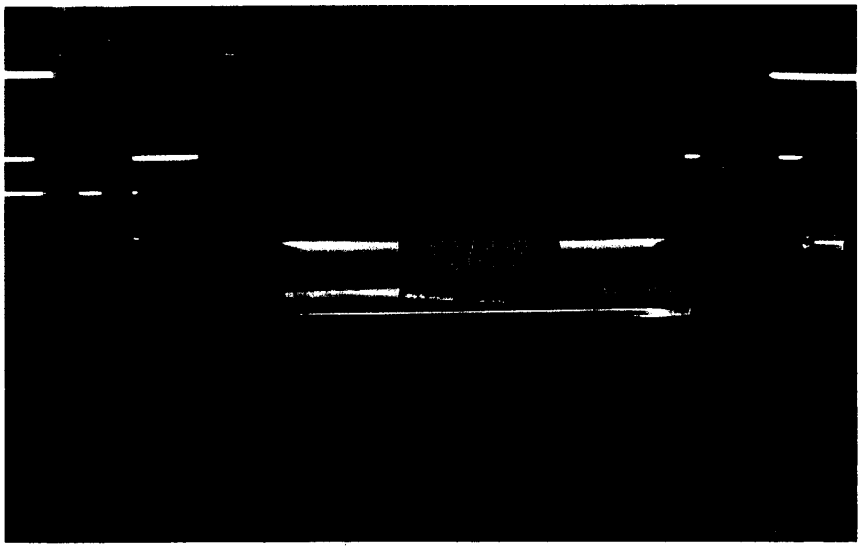
接開往地下室，於地下室由接待人員進行口頭的說明。

2、利用百貨商圈的地下室進行商業廢棄物的分類收集，將各類廢棄物分項收集，並於各項廢棄物收集統貼上條碼以物品物流管理的方式進行廢棄物管理收集清運，現場實際了解其運作方式。

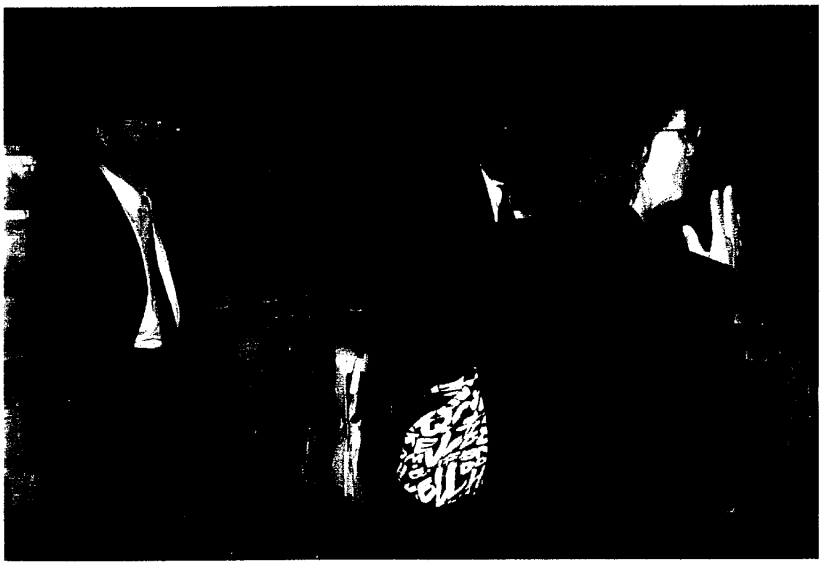
3、最後再前往位於一樓的百貨商圈，觀察百貨營業情況及廢棄物收集狀況。

（四）、參訪照片

接待人員於地下室說明廢棄物管理運作模式



位於地下室之商業廢棄物收集桶



位於地下室之廢紙貯存場

地上百貨商圈情況

九月二日上午十二點

拜會德國環境、自然保育及核能安全部

（一）、會談人員

Min. Director Dr. Hendrik Vygen

Dr. Hans-Jurgen Pettelkau

（二）、討論議題：

1、介紹我國環保科技園區推動計畫

2、環保科技技術與產業，雙邊環保技術與產業之交流與合作

3、再生能源、太陽能及風力發電技術在德國應用

4 請德國協助參與國際公約

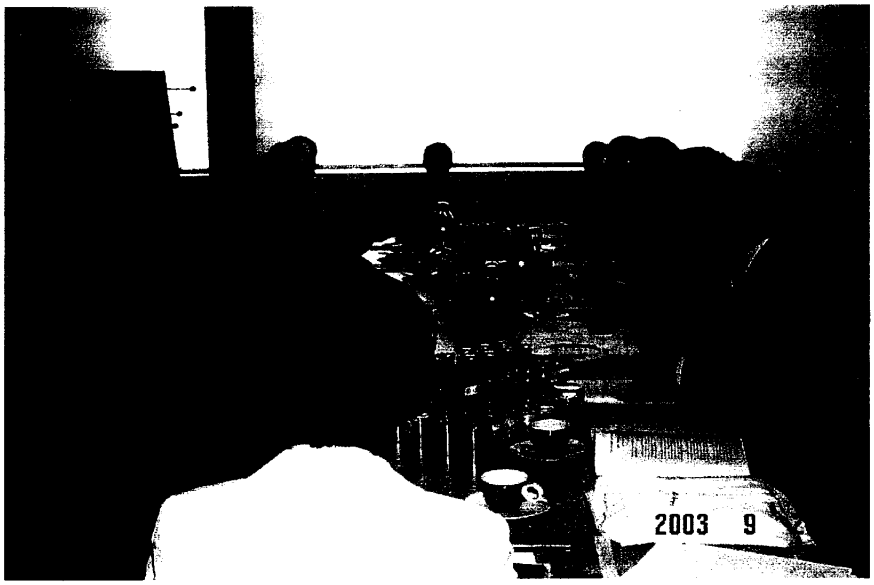
（三）、會談紀要

1、首先由署長說明拜會的目的，與台灣推動環保科技園區計畫，接著由楊致行副主任詳細說明我國環保科技園區推動計畫，令在場德方官員得以了解我國以經濟手段解決環保問題的務實做法，並邀請德國環保相關廠商投資台灣環保科技園區。

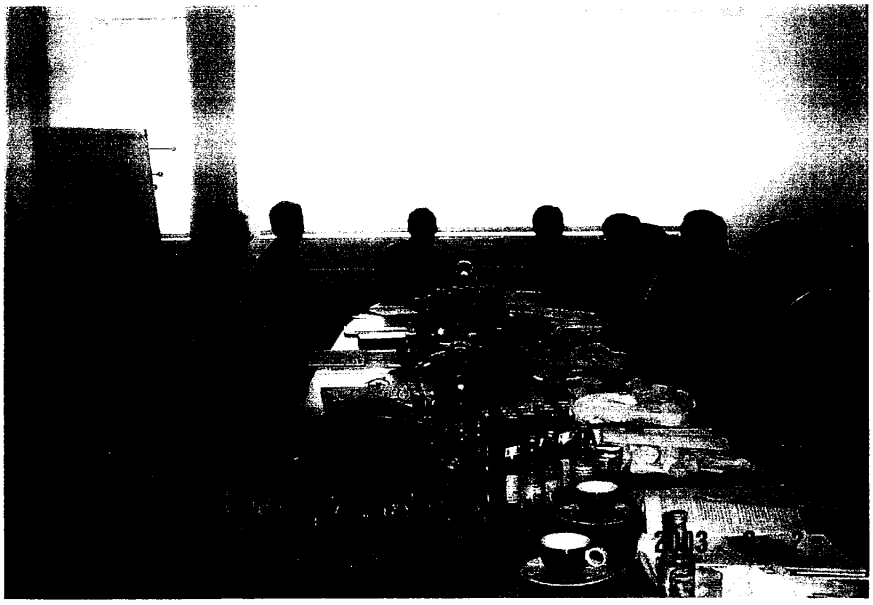
2、該部承諾將協助宣導台灣環保科技園區招商事宜，並加強德國與台灣雙邊的環保技術與產業之交流與合作。各種環保技術資訊的傳遞得以透過德國駐台辦事處或利用各種通訊設施進行。

3、環境部將盡力協助我國參與國際公約。

（四）、拜會照片



雙方會談情形



雙方討論議題的情形

九月三日上午十一點三十分

辦理環保科技園區招商說明會

（一）、地點

Seehaus im Englischen Garten 慕尼黑

（二）、會議議程

時間	講題	主持人/主講者
11:30-11:40	報	到
11:40-12:10	長官致詞 （原則上每位約 10 分鐘）	環保署郝龍斌署長 代表處胡為真代表 德國出席貴賓
12:10-12:20	台灣『環保科技園區』介紹	工研院 楊致行副主任
12:20-13:30	綜合討論及午餐	環保署 代表處 工研院

（三）、德國出席貴賓

德國聯邦政府國會議員費爾（綠黨）

巴伐利亞邦工業總會代表艾柏茲

（四）、署長與楊副主任說明資料

1、署長致詞稿

Remarks at the ESTP Introductory Meeting

11:30 – 13:30, September 3, 2003

Representative Hu, distinguished guests, ladies and gentlemen,

It is my pleasure and honor to be here today. On behalf of the Taiwan Environmental Protection Administration, I want to thank you for taking time out of your busy schedule to find out more about Taiwan's environmental science and technology parks. I also want to thank the Taiwan representative office in Munich for arranging this meeting and making this gathering possible.

Although Taiwan and Germany are half-an-earth apart geographically, the minds of the people between these two countries have never been so close as it is now. The historical link dates back about 150 years ago when Germans came to the Greater China region in an effort to promote bilateral trade and industrial collaboration. For example, Siemens products and Tsing Dao beer, both of German origin, are household names and part of people's life in Taiwan.

Since then Germany and Taiwan have progressed greatly with

industrial upgrading and technology advancement. We are now in an era of knowledge explosion, as information, nano- and bio-technologies dominate the current life and future trends of the world. In view of the individual strength of our two economies, I do believe that there are many fronts that our two countries can complement each other and work together, to enhance human welfare in a global sense.

There is no doubt that, blessed with top-notched technology and a soundly protected environment, Germany stands high in terms of living standard, green competitiveness and national sustainability. It has set a good example on how a country with many natural constraints, can manage its material and energy resources so effectively, enjoy sound economic performance while ensuring that traditional values are duly respected and preserved.

In this visit, the delegation will have numerous productive dialogues with many German experts in the areas of water recycling, resource recovery, air quality management, land reclamation, cleaner production, and eco-industry. We can already witness the many outstanding achievements of German technology. The collective wisdom and professional integrity are definitely serving this country well.

On the other hand, the most valuable lesson this delegation has learned is that, it is the "innovative" and "entrepreneurial" drive for a balanced economic growth, now deeply rooted in the mindset of the public as well as the industry, which effectively makes what Germany is today.

This is where I believe that Taiwan and Germany can benefit most from each other. I'd like to see more sharing of the value concepts and development experience, through exchange of information and personnel, technology transfer and training, joint research and application, cooperative project and business.

Recognizing the compelling need to go "green" and develop a sustainable circular economy, the Taiwan Environmental Protection Administration has recently embarked on a significant 10-year "Environmental Science and Technology Park" Project. Two ESTPs are being planned strategically on the island, notably in Kaohsiung and Hualien, to facilitate the development of high value-added green industries, in the categories of cleaner production, resource recovery, renewable energy and material, eco-industry, and advanced environmental technology.

To encourage "innovative" and "entrepreneurial" green businesses to join this worthwhile effort, lucrative incentives are be-

ing offered to qualified partnerships on land leasing, capital expenditure, R&D expenses, tax breaks, among others. Preference will be given to those who have lined up complementary strength among international expert companies and local industrial partners.

I would like to take this opportunity to invite all interested companies in Germany to explore and capitalize this golden opportunity. It not only helps them to build an attractive business base in Taiwan but also helps them to set up a strong business hold to serve the Asia region, where Taiwan connection has already established effective economic networks by a wide range of trade and investment activities.

Again, our best wishes to everybody, and I hope to see many of you in Taiwan soon. Come to talk with us and we will be happy to assist you in whatever form to make your business deal a smooth and rewarding one.

（二）楊副主任環保科技園區計畫說明稿

Inviting German Companies to Invest in ESTPs

Good Morning, Ladies and Gentlemen:

My name is Jyh-Shing Yang. I am the consultant of ROC-EPA and the Deputy General Director of Center for Environmental, Safety and Health Technology Development of Industrial Technology Research Institute in Taiwan.

Following Dr. Hau's speech concerning the Environmental Science and Technology Parks, it is my great privilege to give you the more detailed explanation about the strategic thinking, the incentives provided by ROC Government, the current priority list of the selected industries, and all the reasons for you to find partners and to invest in Taiwan.

◎Backgrounds description

Taiwan is a small island which has the area of 36 thousands square kilometers (about one tenth of the area of Germany) crowded with 23 million people and 90 thousands factories. The shortage of natural resources had fostered the mature re-

source recycling industries in Taiwan during its industrialization period starting from early 50's. –Today, 45% of the steel, 80% of the Zinc and 90% of the aluminum consumed in Taiwan are produced from scrapes either generated locally or imported from abroad.

In order to promote the resource recovery and establish the supporting infrastructure in Taiwan, ROC Government initiated the Resource Recycle and Reuse Act last year. Based on the technical and economic consideration, this Act prioritized the utilization of natural resource and materials as the following sequence: reduce, reuse, regeneration, energy recovery and disposal. It also introduced the most advanced strategic thinking developed in Europe, such as Extended Producer's Responsibility.

In fact, many waste recycling systems had been run smoothly in the past ten years or so. The major targets for collection and recycling in Taiwan were packaging material as well as what we call "Four Machines and One Computers"—TV sets, refrigerators, washing machines, air conditioners and different type of computers.

However, we realize that Germany leads the world not only in waste recovery regulations and supporting implementation sys-

tems but also in resource regeneration technologies. Actually, whenever we think about resource recovery and the development of renewable energy, we always expect to learn things as well as to transfer technologies from you.

As a nation highly depends on the international trade (international trade exceed 12 billion US dollars per month), Taiwanese companies are highly sensitive to all kinds of international trend and pressure – especially to the so-called "possibly environmental related technical barrier to trade". Today, many local businesses fall in line with international trend for continuous improvement of environmental performance, creating business opportunities in green supply chain, resource recovery, and the application of all means to reduce the burden to the environment. Up to now, there have been more than twelve hundred companies in Taiwan already got the ISO 14001 certificates.

In response to the active international environmental trend, the Government is actively developing green industries and promoting renewable energy facilities. For a country with smallest allowable ecological footprints in every environmental aspect, the environmental abatement for the industries in Taiwan had always been a big challenge. However, if you think about the successfulness of Taiwanese industries had overcome all of

the step-wised stringent environmental standards and implemented the end-of-pipe treatments as well as waste minimization, you will find that Taiwanese companies are most suitable partners to develop a sustainable environmental business and extended to other developing countries –particularly in Asian area.

◎The promotion of Environmental Science and Technology Parks

Following the environmental trend of the world, Taiwan has been actively planning and constructing the environmental science and technology parks (ESTP), which are expected to trigger the growth of green industry, set up a resource circular society and develop a global-oriented environmental market.

The ESTPs are based on the principles of symbiotic growth, resource sharing, information exchange, and risk reduction, to establish three major categories of industries: advanced resource recovery technology, advanced environmental technology, and renewable energy. Cooperative partnerships with world-class environmental companies are being sought to join in this endeavor, with an aim of developing low-pollution, high value-added, eco-business model, hence balancing the consid-

erations of production, living, and ecology.

Each ESTP consists of mass production area, R&D area, support facility area, as well as a management center and an education and exhibition center. The buildings and operation facilities will adopt eco-engineering and landscaping to foster an ecologically friendly environment. Planning of each ESTP will match the needs of the surrounding industries, to ensure a synergistic industrial clustering effect, leading to promising and lucrative business opportunities.

Given the current government policy and international trends, investment in ESTP is the best option for realizing green industry. Specifically, this will include cleaner production, resource recovery, renewable energy, strategic environmental industry, wastewater recycling, soil remediation, waste separation and regeneration. Invitation is extended to independent investment, technology transfer, as well as joint ventures with domestic partners.

◎Incentives provided by ROC Government

In recent years, the Taiwan Government has been progressively developing sound strategies and policies to enhance further ad-

vancement of industries. Backed by a strong economy and high-tech competence, Taiwan has acquired the same competitive edge as the world's leading developed countries.

The general incentives for investing in Taiwan include: tax breaks and exemptions provided in the Promotion of Industrial Upgrade Statutes, wage subsidies provided in the Introduction of Overseas Specialists to Taiwan Plan, as well as the Enterprises Operation Headquarters Plan, and Promotion of Foreign Enterprises to Set Up R&D Centers in Taiwan Plan.

Those companies that have been approved to invest in the ESTPs will receive further subsidies, regarding land leasing, production expenditures, and R&D expenses. Assistance will also be provided in marketing, securing of raw materials, setting product standards and specifications, and preferential procurement of green products. Other incentives include one-stop administrative service, and assistance of professional staff to acquire licenses in an efficient and expedient manner.

◎The current ESTP sites

In terms of administrative and software services, a park administration center and a one-stop service window will be provided.

The professional staff will assist companies in obtaining permits and all other operations management services, such as information sharing, environmental personnel training, and corporate image building.

Currently, two environmental science and technology parks are under planning and construction:

1) Fenglin ESTP in Hualian County (at the east coast of Taiwan): covering a 22-hectare area. The region is notable for its granite materials and cement industries. The park's target industries will be biotechnology, life science and granite-resource recycling industries.

2) Benzhou ESTP in Kaohsiung County (in southern part of Taiwan): covering an area of 40 hectares. This region is an industrial center for metal, steel, and petrochemical industries. The Kaohsiung eco-park will be devoted to renewable energy, key environmental equipment parts, and resource recovery technologies.

You can find the detailed information about those two parks in the material we presented. ROC-EPA is in the process of selecting and promoting the third ESTP in the coming two months.

◎Conclusion

Taiwan presents itself as the best partner for developing green industry in the Asia-Pacific region, while it has the most advantages and potential. In addition to a democratic, liberalized and free economy, the successful experience of developing and running the Hsinchu Science-Based Industrial Park has set a good foundation for future development for advanced technology. Moreover, the rich capital, economic strength, long-term experience in international trade and cooperation, abundance of human resource, and the drive for globalization, all give Taiwan a renewed and competitive business environment for the future.

Ladies and gentlemen, if you believe that the market of advanced environmental technology, resource recovery and renewable energy in Asian region will enjoy a high growth rate in the next decade, my introduction can assure that this is the right time to invest on green industry in Taiwan. With the successful experience of Taiwan's electronic and photonic industries in the past 30 years, we believe that investing in advanced environmental technology in Taiwan will create another green economic miracle. Hope you can join us in the near future.

Thank you very much for your attention.

（四）、說明會紀要

1、在駐德辦事處的鼎力協助下於慕尼黑圓滿完成環保科技園區說明會，本說明會以餐會方式進行，德國雖然處於暑假期間，廠商出席踴躍，德國聯邦政府國會議員費爾（綠黨籍）和巴伐利亞邦工業總會代表艾柏茲出席參加本說明會，參與本說明會的廠家數總計二十家，出席人次共計四十五人，除此中國時報駐慕尼黑記者亦參與此盛會並作成報導。

2、說明會首先由胡代表為真介紹郝署長龍斌致詞，接著邀請德國出席的貴賓致詞，致詞結束後由楊顧問致行詳細介紹環保科技園區設置的內容、特色及獎勵措施與台灣的投資優勢等。德國聯邦政府國會議員費爾（綠黨籍）和巴伐利亞邦工業總會代表艾柏茲，致詞時特別公開稱讚台灣禁用塑膠袋政策的迅速與效率。

3、與會者對於台灣的招商興趣濃厚，紛紛提出許多相關細節的問題，他們關心的主要是台灣廢棄物現況、廢棄物處理費用及廢水等相關問題，最重要的是市場獲利的遠景，相關問題分別由陳處長與阮主任詳細回答，使得在場人士了解台灣環保的初步概況。

4、分組進行意見交換與討論，討論氣氛非常熱烈，使得彼此能更進一步台灣投資的優勢及商機。於討論中了解德國企業大部分為中小企業，因此進行海外事業投資時，將相對保守，業者表示為了於投資初期降低投資風險將於台灣尋求合作夥伴利用技術移轉或技術

合作等方式作為投資的主要策略。

5、署長同時承諾在場公司代表，將會協助開拓市場、推展業務、引介台灣當地合作廠商。同時全力協助有意願進駐環保科技園區投資的廠商辦理各項申請作業，並排除相關投資障礙，順利完成投資計畫，因此獲得與會廠商的熱烈反應，紛紛表達願意於台灣進行投資。

（五）、開會照片

◎ 廠商報到與會場

廠商報到情形

廠商報到後入座情形

◎ 貴賓致詞

胡為真代表致詞

郝龍斌署長致詞

巴伐利亞邦工業總會代表艾柏茲致詞

德國聯邦政府國會議員費爾致詞

◎ 環保科技園區計畫說明與討論

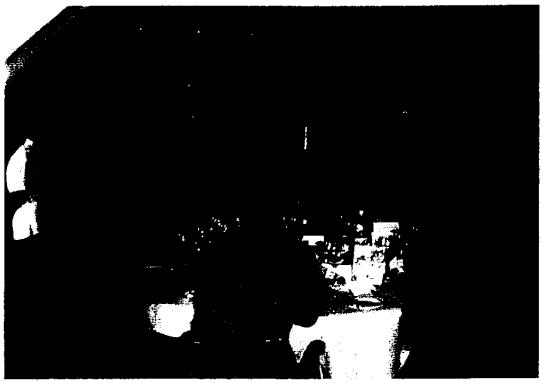
楊致行副主任說明環保科技園區計畫

與會廠商提出問題詢問

陳雄文處長說明國內廢棄物現況與處理費

阮國棟主任說明國內廢水處理現況

◎ 分組意見交流與討論






九月三日下午三點三十分

參訪 Hamos Company

（一）、接待人員

HAMOS : Dr. Rainer Kohnlechner

Robert Schmidt-Halswick International Trading :

Mr. Robert Schmidt-Halswick

（二）、背景簡介

Hamos 為世界先進的廢棄物分選回收技術廠商，可提供各類廢棄物的先進分選回收技術，包括；廢塑膠、廢電纜、廢電子零件，及由混合廢料中分離金屬、塑膠、食物與其他物質之回收技術，Hamos 可以為歐洲及全球顧客提供經濟、有效的最佳廢棄物分離回收系統及設備，同時可為顧客解決有關廢棄物分選回收的所有問題。主要分離回收技術包括靜電分選金屬/塑膠廢棄物、靜電分選金屬塑膠/塑膠廢棄物、各種類的金屬篩選、磁力分選，及其他廢棄物的分選等。

Hamos 可以經由海外分公司為顧客提供全天候、高品質的完整服務。

（三）、參訪紀要

1、首先由該公司 Dr. Rainer Kohnlechner 進行簡報，說明靜電原理分離技術、業務範圍及應用實績等。簡報結束後進行工廠參觀，示範塑膠靜電分離作業，工廠佔地不大，設置分離機械與塑膠押出機等。

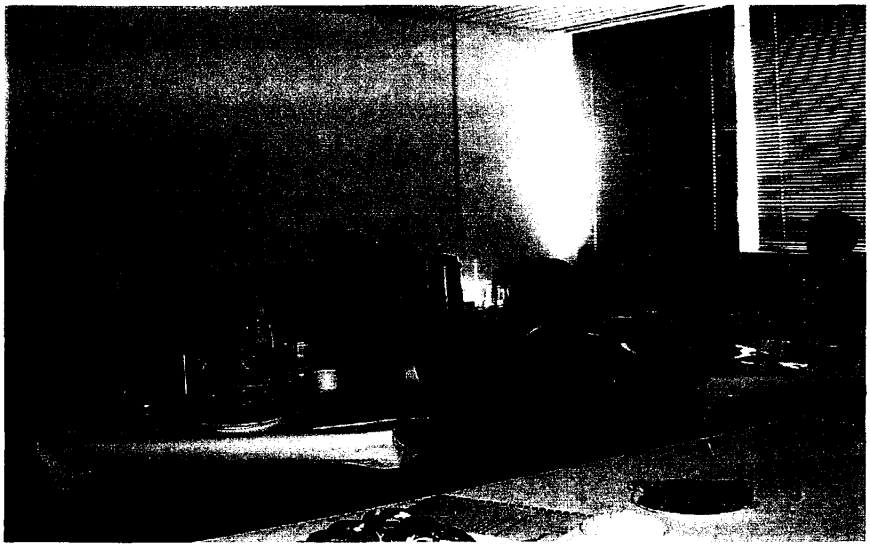
2、靜電原理分離技術將提高混合廢料的分離效率，以提

昇再生物質的附加價值。

3、台灣廠商全亞冠及佳龍公司運用此技術於電子混合廢料之分離作業。

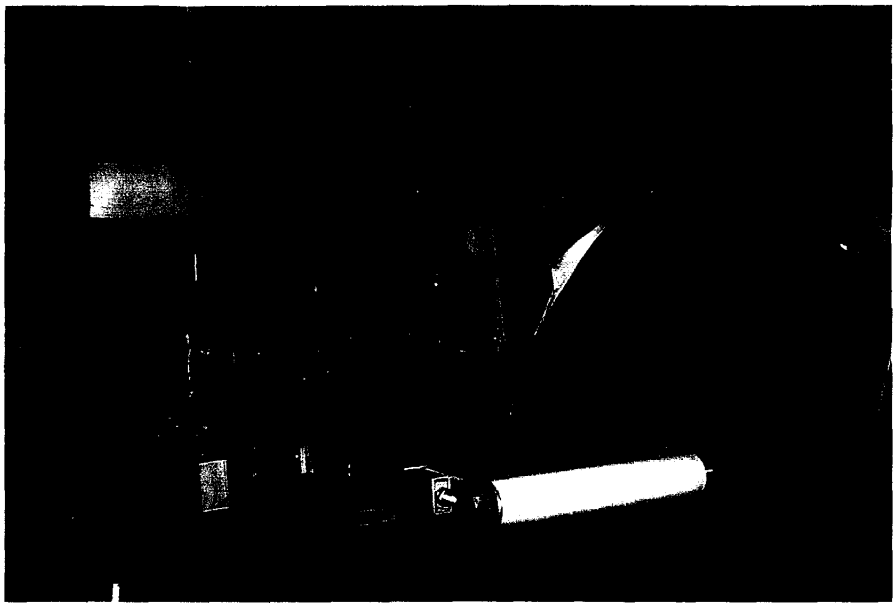
（四）、參訪照片

Dr. Rainer Kohnlechner 進行公司產品及技術之簡報



雙方進行技術交流

參觀現場，了解分離後的產品純度



參觀現場，分離後塑膠進行擠押成行作業

九月四日上午九點

考察 Valides 醫療廢棄物處理系統

（一）、接待人員

B.I.M.E. : Mr. Edurad Kneifel

H A International Envitech : Mr. Yih-Hang Hwang

ETLog GmbH : Mr. Jan-Gerd Kuhling

BA-MO division : Mr. Richard Bastian

（二）、背景簡介

原為"B.I.M.E"公司已有 10 年的醫療廢棄物處理經驗，後來決定開發新型的 VALIDES 真空高溫滅菌處理系統， 並成功的將整個系統技術轉移給在 Saarbrücken 的"HA International Envitech Co."，經由該公司將此系統商品化並外銷至國外，及因為 SARS 的問題必須處理高感染性醫療廢棄物的亞洲國家，包括香港、新加坡、大陸及台灣。

◎感染性醫療廢棄物的處理：

醫療廢棄物的處理為廢棄物處理中比較複雜的問題，尤其是 B、C 類感染性醫療廢棄物的處理，必須同時注意收集及處理過程的感染控制與預防。感染性醫療廢棄物的消毒處理，其方法及設施必須依當地的法規、實際情況進行規劃與管理，以確保後續可以有效的管理，以保其後續廢棄物處理可以符合環保法規的要求。經由一組由感染控制與預防專業人員、醫療專業人員、法規訂定人員可以至海外進行技術支援

服務，以協助訂立出如何安全、有效的管理、處理感染性醫療廢棄物的方法及設施。

現地消毒為感染性醫療廢棄物處理的最經濟有效與環境友善的方式之一，消毒後的醫療廢棄物即可以較經濟有效的方式進行清運與管理，其廢液及廢棄物即可依一般廢棄物處理系統進行管理。

◎產品適用範圍：

具感染性之廢棄物；如，生物實驗室、醫院、工廠及研究單位等，產品主要為訂購後生產，所以可以完全配合客戶的需求進行製造，故具有安裝容易、拆卸簡單及機動性高之特性，產品可適用客戶於處理所有感染性廢棄物的需求。同時可以針對客戶要求提供各種可行的全方位服務。

◎感染性醫療廢棄物的收集

感染性醫療廢棄物可以堅固容器收集，此容器可以經由壓力鍋消毒後回收再使用，或以可棄式容器收集，收集容器被設計成；當消毒室的門關上以後可以自動打開，如此可以避免操作人員的感染風險，消毒後的廢棄物可以設計成人工清理或自動清理方式，消毒後的廢棄物也可以立即進一步處理，或進行切割後外送處理。

◎技術：

我們的服務可以完全依照客戶的需求進行設計與設備製造，VALIDES 的標準系統為組合式模組式設

計，最基本單元為單室式消毒設備，也可以組合 1-4 個基本消毒單元設備，或依各別客戶的需要進行設計與製造。

消毒單元為具備抽真空設備之單元，故可以符合美國 A、B、C、D 類感染性醫療廢棄物處理的規定。

焚化處理的廢熱，可依客戶要求設計成回收蒸汽，或產生電力。所有設備均為成熟商業化應用之技術，如微波加熱等技術。

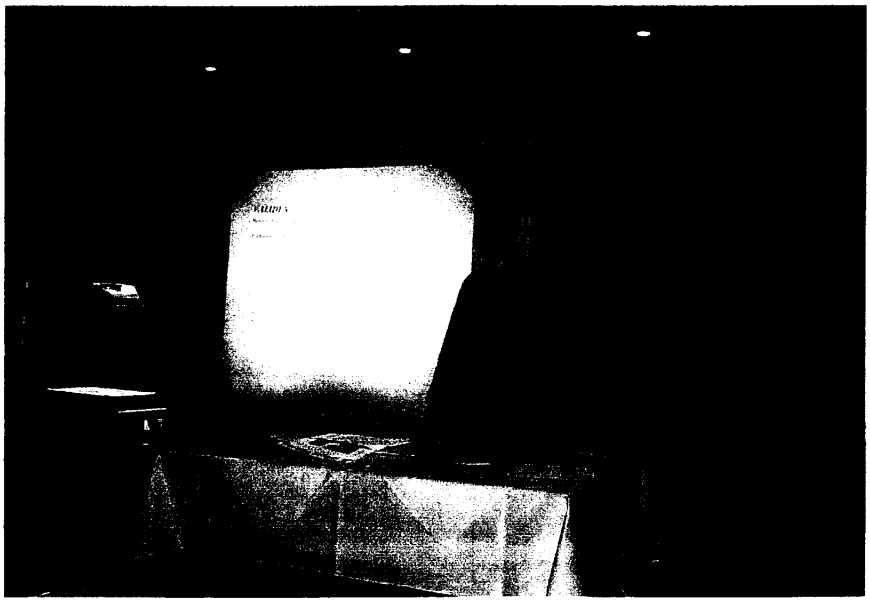
消毒室中之壓力可以設計應用於，低真空(65 mbar)紅外線滅菌，或加壓(2050 mbar) 高溫(121°C)滅菌 and a temperature of = 250 F。

（三）、參訪紀要

1、利用住宿飯店會議室由 B.I.M.E 公司代表簡報介紹 Valides 系統真空高溫滅菌的方式處理醫療廢棄物，並參觀實際應用在慕尼黑大學附設醫院的運作情形。

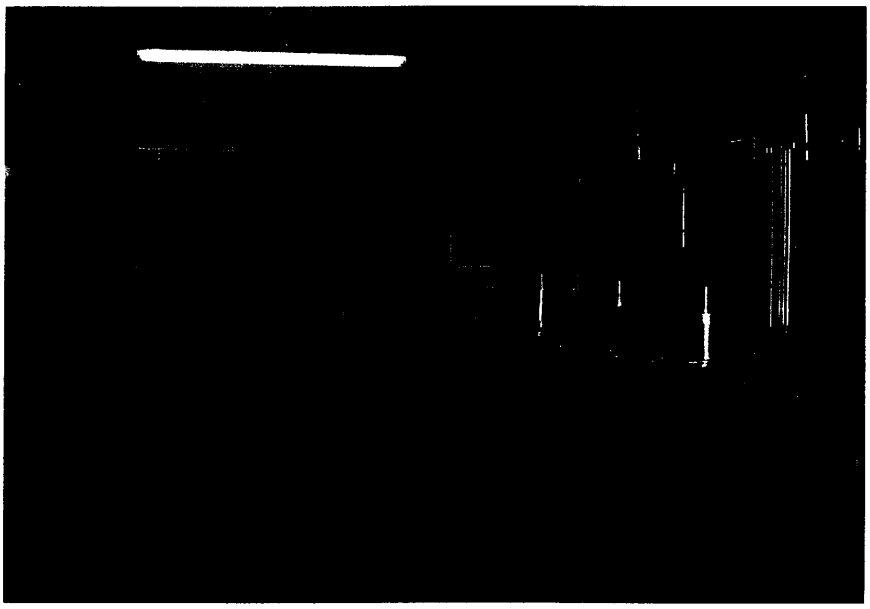
2、感染性醫療廢棄物利用特殊塑膠帶與塑膠桶等容器分類收集，直接將塑膠帶與塑膠桶置入 Valides 系統進行真空高溫滅菌處理，不需要作任何破帶的作業，以避免作業人員受到感染。

（四）、參訪照片

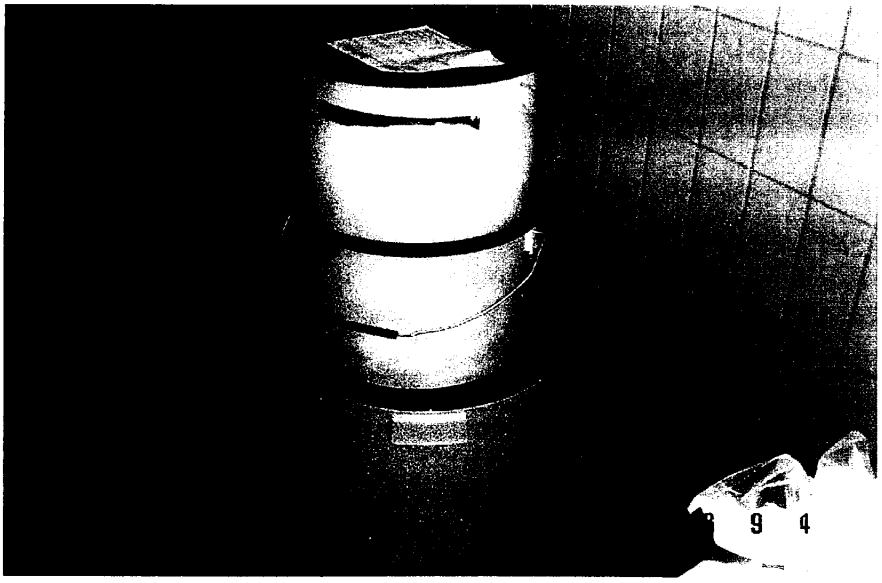


Mr. Edurad Kneifel 進行公司產品及技術之簡報

考察團仔細聆聽簡報內容



參觀考察 Valides 系統運作情形



感染性醫療廢棄物收集桶

九月四日下午兩點十五分

參訪 KUMAS 與 BifA，KUMAS

（一）、接待人員

Kumas 公司 Mr. Egon Beckord

BifA 公司 Dr. Waldemar Mathews

（二）、背景簡介

- KUMAS

該公司是一個由許多環保公司組成的機構，也是德國環保公司的聯絡網，目前已有 88 位會員。他們的技術業務範圍十分廣泛，包括以下七大項：

1.承接德國環保科技公司產品的外銷事務及環保技術之移轉。

2.辦理環保教育工作，與德國大學及專科學校合作成立系所，對環保教育貢獻之大。

3.環保管理業務：承接一般工程公司之環保管理、工業公司之環保管理、一般事務公司等之環保管理業務。

4.辦理環保治療業務：包括一般藥品公司衍生之過敏症，玻璃纖維工廠衍生之皮膚過敏原之治療等之業務。

5.再生能源：包括高科技之再生能源、能源廠操作管理技術支援等。

6.永續發展：承接一般公司環保管理、技術開發、再生資源等之業務及永續經營之效益。

7.環保資訊之提供：隨時提供環保科技新知，提昇環保技術之進步與發展，並以維持科技技術之品質。

- BifA

◎巴伐利亞工業技術協會(BifA)的歷史；

1989 年 4 月；巴伐利亞經濟發展局在省長於 1989 年 4 月指示下，提供技術與發展資金為 BifA 的設立基金。

1991 年 6 月；BifA 正式設立

◎BifA 的組織；

BifA 是一個現代化、高科技的服務性機構，BifA 雖然是一個非營利的政府機構，但卻以民營公司的經營方式在管理，以協助公民營企業的環保問題為經營策略。我們同時與多數的工商產業、工程公司、大學、研究單位及其他政府單位建立合作關係。能提供實用化的環保研究技術及商業化的實用技術，幫助業界達成節省能源、資源及操作成本。BifA 是一個國際性的研究、發展及工程顧問公司，是以整合性的環保技術，以達到管末處理的最佳化。

BifA 主要有四大部門，其為；環境化學，環境工程，環境經濟，環境毒物、環境衛生及生物技術，及一個專利與技術國際移轉小組，這些單位相互合作以達成 BifA 的目標 - 以整合性的環保技術，以達到管末處理的最佳化。整體而言已經達到協助本地企業創造利潤。

BifA 是以國際的環保業務為市場，可以安排研討會、行銷展示會等等工作，同時可以最佳方式安排向各種國際基金進行報告以取得貸款，如，世界銀行、歐洲開發銀行、及"Kreditanstalt für Wiederaufbau"銀行等，經由德國巴伐利亞總部，或世界各地分公司，很容易與各大學或政府機構建立合作關係。

BifA 進行個別研究的整合工作，可以避免重複、無謂的人力與資源浪費，BifA 針對業界的問題提供解決方案，同時協助業界由實驗室技術進行實驗工廠規劃、設計，有能力為個別客戶的特殊問題建立實驗工廠。

許多的創新可能忽略了經濟效益，BifA 在創新的過程中會將經濟效益列入考量重點之一。

（三）、參訪紀要

1、首先由 Mr. Egon Beckord 進行 KUMAS 公司業務及技術之簡報，說明業務的服務範圍及組織之任務，接著由 Dr. Waldemar Mathews 進行 BifA 業務及技術之簡報，說明協會業務的服務範圍及組織之任務。

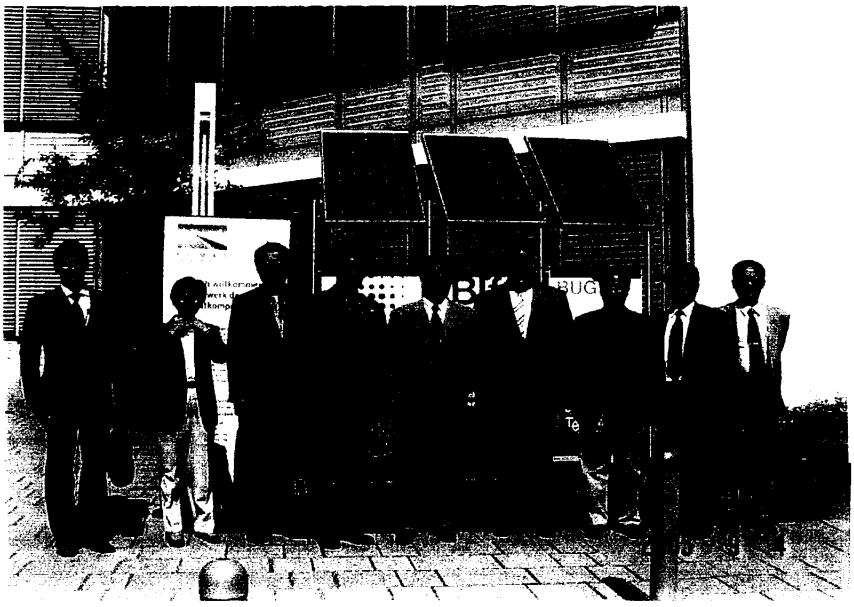
2、德國大部分為中小企業，因此業者個別進行研究發展有其困難性，改以策略聯盟的方式如 KUMAS 或非營利的政府機構 BifA 進行各項研發工作，使得企業得以永續經營。

3、BifA 之組織特性及任務與台灣工研院相類似，每年經費約 500 萬歐元（約新台幣 1.9 億元），研究經費

分別來自於中央政府、地方政府與業界等單位。

4、BifA 可以提供實用化的環保研究技術及商業化的實用技術，幫助業界達成節省能源、資源及操作成本。設置資源化實驗廠房，廠房內具備灰渣資源化、廢棄物破碎、分選等設施、完備的戴奧辛分析儀器設備，其他設施包括移動式檢測分析車。

（四）、參訪照片



全體於太陽能收集板下合影以見證德國發展太陽能的具體行動

Mr. Egon Beckord 進行 KUMAS 公司業務及技術之簡報

Dr. Waldemar Mathews 進行 BifA 業務及技術之簡報

參觀實驗工廠，廠內具有分選、灰渣資源化等設施

參觀移動式監測車，車內配置空氣污染分析儀器

九月五日上午九點

參訪 FES-Frankfurt

（一）、接待人員

FES-Frankfurt : Mr. Benjamin F. Scheffler

Von Ludowig GmbH : Mr. Volker von Ludowig

（二）、背景簡介

FES 是 1873 年法蘭克福市政府成立之基金會，經過一百多年後，於 1995 年六月由市議會決議釋出官股 49%，與民營公司共同經營，而以股份有限公司型式成立。1995 年八月正式登記「FES GmbH」公司並設立完成，於 1996 年元月正式開工營運，1998 年元月正式與 Rathmann 公司合作。

直到去年，總共有 1,580 位員工，擁有二十多種不同功能的設施，以服務大眾，同時廢棄物的處理工作亦達到 60,000 公噸。

FES 公司營運項目包括：

◎廢棄物處理：（2002 年營運成果）

都市的廢棄物處理 （193,450 公噸）

輕量級物品包裝回收與轉運（9,200 公噸）

生物與有機化學廢棄物之回收與轉運（23,300 公噸）

使用紙類之回收分類與轉運（51,910 公噸）

下水道污水處理（30,446 公噸）

家庭大型物件丟棄之處理（27,090 公噸）

有害物質之回收處理（280 公噸）

容器之回收與分類處理（以玻璃為例：以玻璃顏色分類處理共 17,560 公噸）

金屬回收處理（11,200 公噸）

建築用之廢棄物處理（120,000 公噸）

◎清潔服務：

街道之清潔服務：每週處理三億平方公里

冬天街道之清理服務：每週處理 1,200 公噸的砂礫

不合法傾倒的垃圾移除工作

植栽修剪服務

雜草移除工作

建築物堆砌清理服務

公共廁所清理服務

油污分離器／油脂圈套（捕捉機）／砂石移除等服務

小型垃圾箱之清理工作：每週處理 10,000 公升的垃圾箱

道路安全的清理工作

◎工廠與工程之服務：以廢棄物處理與回收工廠為對象

廢紙分類中心

生物廢棄物處理廠（發酵與堆肥）

廢棄物焚化廠（處置與熱能回收）

◎工程服務項目

車輛、大型結構貨櫃之修理與服務

建築物維護

（三）、參訪紀要

1、首先由 Mr. Benjamin F. Scheffler 進行 FES 公司業務之簡報，說明業務的服務範圍及運作方式，接著由 Mr. Volker von Ludowig 進行 RATHMANN 公司業務之簡報，說明公司業務的服務範圍。

2、法蘭克福為提昇垃圾清運效率及經濟效益，遂於一九九五年六月由市議會決議釋出官股百分之四十九與民營公司共同經營，而以股份有限公司型式成立 Frankfurter Entsorgungsund Service (FES) 由民營公司接收所有的員工，FES 負責垃圾收集清運工作，於法蘭克福街道上到處可以看到 FES 的垃圾收集桶，目前也收集事業廢棄物。

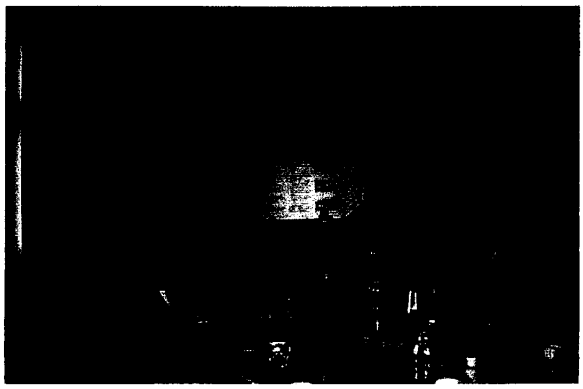
3、收集垃圾中含有機成分的廢棄物進行資源化，利用厭氧發酵或堆肥技術製成肥料，肥料製造的時間約一個月。考察團於參觀肥料製造工廠時，發現於廠房附近不會產生任何的臭味，環境乾淨而整齊。該肥料製造廠的總投資額約 3,600 萬歐元（約新台幣 13.7 億元）。

4、廢紙則利用自動化設備進行分類，原人工分類每人每天的平均工作量約 600 公斤，改自動化之後平均工作量提升為 3 公噸，大大提供作業效率，而且分類後的廢紙可以提昇其利用之附加價值。

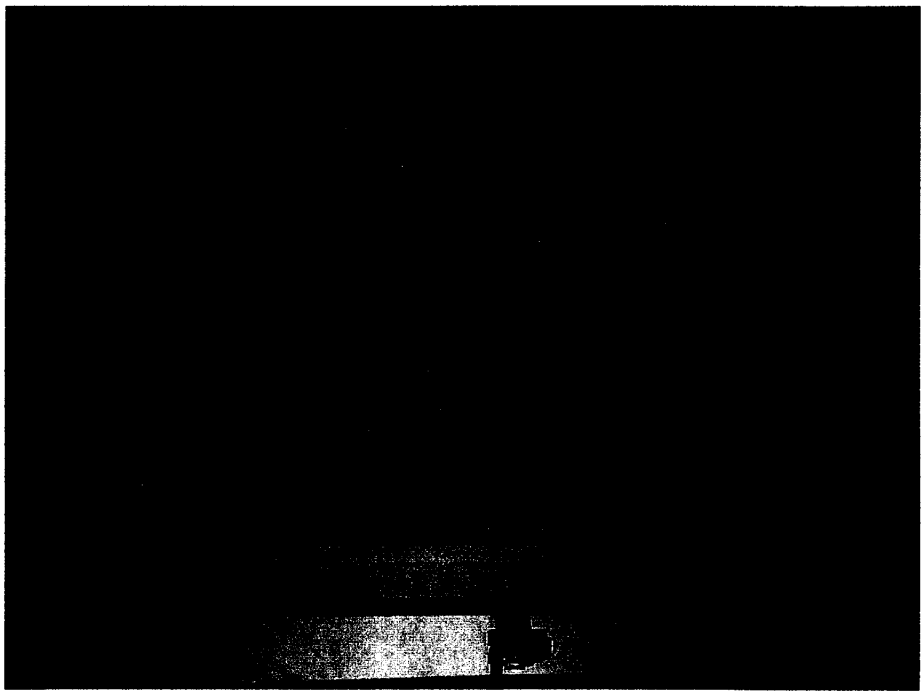
（五）1998 年 RATHMANN 民營公司加入 FES 的經營，設置資源回收園區（Recycling Park）進行各類廢棄物資源化的工作。

（四）、參訪照片

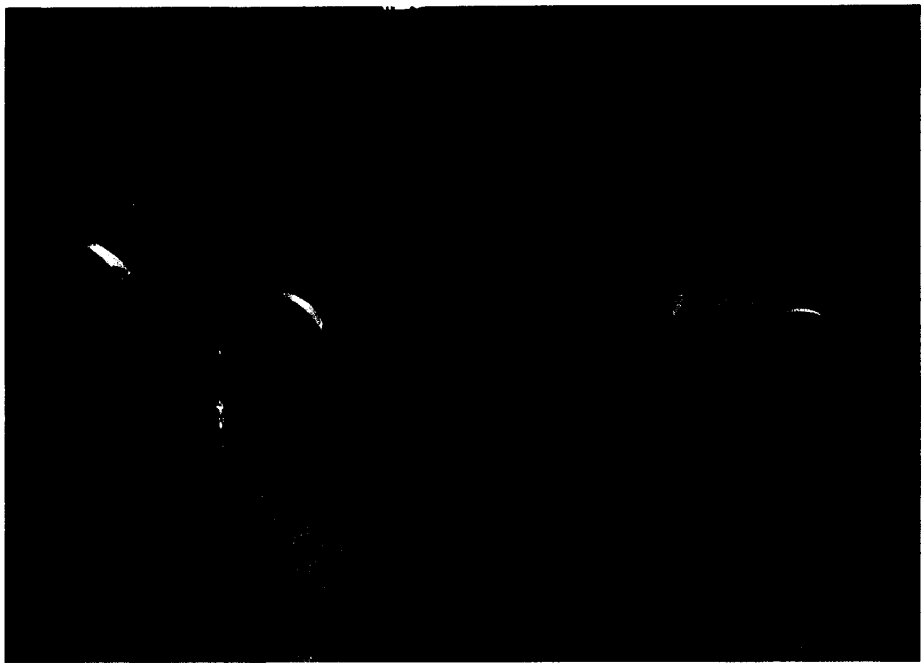
Mr. Benjamin F. Scheffler 進行 FES 公司業務之簡報



Mr. Volker von Ludowig 進行 RATHMANN 公司業務之簡報



RATHMANN 公司設置資源回收園區之俯視圖



參觀有機廢棄物資源化工廠
廠內將廚餘與植物廢棄物分開處理

參觀廢紙分類工廠，採用自動化設施分類
廢紙每年處理量約 10 萬公噸

九月五日下午兩點

參訪 Passavant and Roediger

（一）、接待人員

Mr. Robert Huth

Dr. Xiao-Hu Dai

（二）、背景簡介

Passavant 為德國先進的廢水處理、污泥處理、 沼氣發電等技術及設備的廠商，於全球有 6000 以上個污水及原水處理廠的實績，Passavant 並有工廠從事相關機器設備的製造，

PASSAVANT-ROEDIGER PRODUCTS GmbH 為 PASSAVANT 集團成員之一，其生產環保相關設備有：

生活廢棄物處理廠

工業廢水處理廠

沼氣發電廠

原水及飲用水處理廠

冷卻水塔

等整廠設計、建造及安裝等服務

（三）、參訪紀要

1、首先由 Dr. Xiao-Hu Dai 帶領參觀廢水處理廠、污泥沼氣產生設施與沼氣發電廠等，參觀結束後赴 PASSAVANT-ROEDIGER 公司聽取簡報，由 Mr. Robert Huth 說明公司業務範圍與實績。

2、PASSAVANT-ROEDIGER 公司由廢水處理產生的有機

污泥進行資源化處理以產生沼氣，再將所產生的沼氣運用於發電，產生再生能源，污泥可以再進一步製成肥料，此處理程序為廢水處理的典範。

3、依據該公司的經驗表示每公斤廢棄物中含有的有機物約百分之五十至六十（乾基），有機物轉換成沼氣的百分比約百分之五十，每公噸垃圾可以產生的沼氣量約 800-1000 立方公尺。

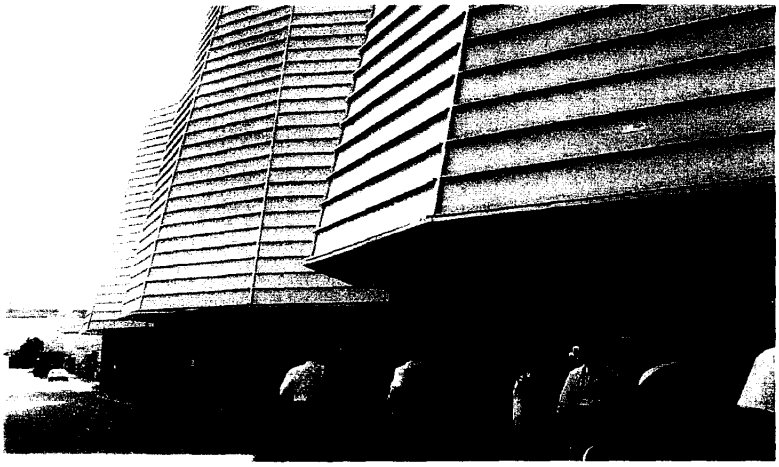
4、該公司反應與台灣地方政府或部分廠商接洽計畫時，花費很長的時間，投入大量人力皆無法獲得實質的成果。署長承諾如該公司有意願投資台灣，環保署將展現高效率的行政作業，全力協助解決各項問題。

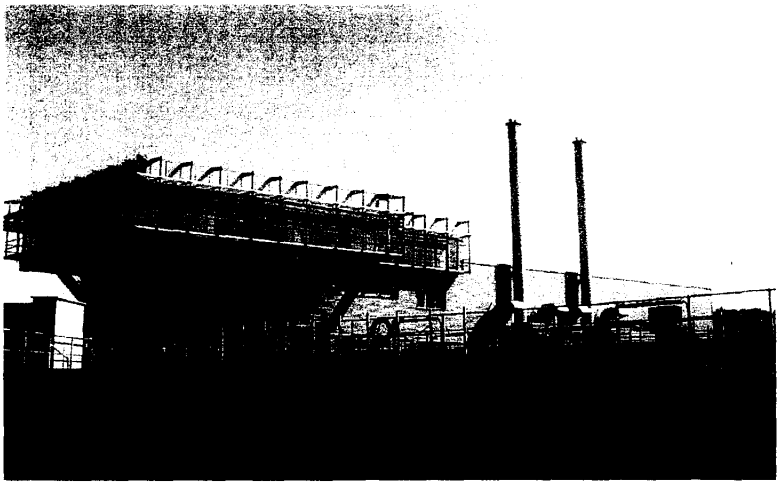
（四）、參訪照片

Mr. Robert Huth 進行公司業務及技術之簡報

雙方進行技術交流

署長介紹環保科技園區相關文宣資料





廢水處理

有機污泥

污泥厭氧處理槽

沼氣

沼氣發電

肆、心得摘要

由本次之出國招商與考察情形，我們觀察到下列的心得：

一、我國環保科技園區設置的內容、特色及獎勵措施與台灣的投資優勢等，均獲得國外廠商的熱烈反應，紛紛表達願意來台灣進行投資。

二、德國政府經濟勞工部已了解台灣環保科技園區的計畫內容，同時經濟勞工部政務次長 Mr. Rezzo Schlauch 承諾將於近期率領環保相關廠商拜訪台灣，尋求投資台灣的商機。環境、自然保育與核子安全部門主管 Dr. Hendrik Vygen 承諾將協助宣導台灣環保科技園區招商事宜，並加強德國與台灣雙邊的環保技術與產業之交流與合作。

三、德國企業大部分為中小企業於海外進行事業投資時，相對保守，因此業者表示於投資初期與台灣廠商合作，利用技術移轉或技術合作等方式作為投資的主要策略。

四、於招商過程中，發現德國具有回收技術廠商大部分為中小企業，自有資金不夠雄厚，且對台灣市場規模、法令規範不甚瞭解，希望與台灣的廠商合作，投資模式以部分自有資金、技術移轉或技術合作的方式進行。

五、德國之資源回收再生技術與固體廢棄物處理技術，在台灣均有被應用，但相關技術也不斷推陳出新，藉以提高再生物質的經濟價值。

六、德國環境部均積極運用環保政策、資源循環、水循環、污染零排放與提高回收物質的附加價值等策略，發展綠色產業，以促進環境永續發展。

七、德國為達成零廢棄物與零掩埋，對於廢棄物減量、資源循環再利用、污染零排放與提高回收物質的附加價值等環境友善的推動工作不餘餘力。

八、德國積極開發潔淨能源與再生能源，潔淨能源以太陽能與風力能為主要技術開發對象，生質能則利用有機廢棄物經由消化作用所產生之沼氣進一步發電產生再生能源。

伍、結論與建議

根據觀察到的心得，未來環保科技園區之引進產業與招商作法，結論如下：

一、表達積極投資我國環保科技園區意願的廠商，應有十家以上，本署相關單位應盡全力協助其進行投資計畫。

二、署長承諾政府將全力協助來台投資廠商辦理各項申請作業，同時排除相關投資障礙，因此本署應積極尋求有意願與國外技術合作廠商，透過不同管道協助技術移轉或技術合作等方式作為未來招商投資的主要策略。

三、本署應加強與先進國家進行官方雙邊環保技術交流，並主動邀請部長級官員來我國參訪。

四、為引進外國企業於台灣進行環保產業投資工作，未來應加強掌握市場規模、法令規範、台灣的合作夥伴與資源回收再利用法之運作，以擴大市場規模，作為未來招商的籌碼。

五、本署應運用環保政策、資源循環、水循環與零廢棄物等策略來擴張環保產業，帶動環保科技園區計畫的發展遠景；也就是說，透過經濟的手段，以解決環保問題，促進環保產業的發展，同時創造就業機會，符合先進國家推動永續發展的國際潮流趨勢。

六、為達成零廢棄物與零掩埋、再生資源多元化回收再利用、提昇再生物質的附加價值、減少管末處理量等目標，將以廢棄物分類收集管理、廢棄物資源化技術、開發新能源及再生能源與其他綠色產業等作為環保科技園區之產業引進的重要課題，例如德國法蘭克福 RATHMANN 民營公司設置資源回收園區（Recycling Park）進行各類廢棄物資源化的工作。有機廢棄物則利用消化或堆肥等程序，將產生的沼氣再利用於發電產生再生能源，再進一步製成肥料。

七、太陽能與風力能等潔淨能源與新能源的引進方面，除了環保科技園區的優惠獎勵之外，政府其他部會對此也有相關優惠補助，本署應彙整國內相關資訊，提供給廠商參考，以吸引廠商進駐環保科技園區，對於資源有限的我國應積極開發其技術並應用推廣。

附件

報告單位：廢棄物管理處

報告事項：赴德國進行環保科技園區招商工作、參訪當地環保產業及邀請來台投資，並進行官方雙邊環保技術交流情形報告。

說明：

一、為配合行政院挑戰二００八國家重點發展計畫，於本（九十二）年十月於世貿中心辦理國際招商大會，由　署長率團出訪新加坡與德國，進行環保科技園區招商工作、參訪當地環保產業及邀請來台投資，並進行官方雙邊環保技術交流。

二、考察德國由　署長率團擔任團長，成員有本署科技顧問室阮國棟主任、廢管處陳雄文處長、署長室簡任祕書任孝琦及廢管處簡任技正劉佳鈞等五人及署外專家二人，合計七人；日期自本（九十二）年八月三十日至九月七日，共計九天。主要考察重點如下：

（一）拜訪德國環境、自然保育及核能安全部及經濟勞工部，介紹我國環保科技園區推動計畫，並進行官方雙邊環保技術交流及邀請來我國參訪。

（二）辦理環保科技園區招商說明會及邀請該國環保產業來台投資。

（三）參訪當地環保產業進行環保科技園區招商工作及邀請來台投資。

三、考察項目及內容豐富，限於篇幅僅就重要成果提出報告，其餘內容彙整於出國報告書中。

四、德國考察紀要報告摘要如下：

（一）本（九十二）年八月三十一日下午六點，拜會駐德代表處，討論本考察團於德國柏林的行程與拜會對象的安排情形。

（二）本（九十二）年九月一日上午十點，拜訪 Envitec Consult Hamburg Co.，該公司將含有害物質（如重金屬）之工業廢水，先進行物理化學之前處理，去除有害物質，無害化的污泥再進一步進行生物消化、脫水及乾燥等程序，以減少體積及其後處理費用或製成肥料。

（三）本（九十二）年九月一日下午兩點三十分，拜會德國經濟勞工部政務次長 Mr. Rezzo Schlauch，說明拜會目的與環保科技園區計畫內容。

（四）本（九十二）年九月一日下午三點三十分，拜訪 Solar School Berlin，為柏林地區建立一所再生能源技術發展訓練中心，主要的內容為以太陽熱能系統、光電流系統、能源效用系統及生物能量系統等之利用。

（五）本（九十二）年九月二日上午十點三十分，拜訪 ALBA waste management center，該公司利用百貨商圈的地下室進行商業廢棄物的分類收集，各項廢棄物貼上條碼以物

品物流管理的方式進行廢棄物管理收集清運。

（六）本（九十二）年九月二日上午十二點，拜會德國環境、自然保育及核能安全部負責東亞事務處長 Dr. Hendrik Vygen，說明拜會目的與環保科技園區計畫內容，請該部提供德國發展之環保技術相關的資料，並協助我國參與國際各項環保相關的活動。

（七）本（九十二）年九月三日上午十一點三十分，辦理環保科技園區招商說明會，德國雖然處於暑假期間，廠商出席踴躍，計有二十家廠商代表、德國聯邦政府國會議員費爾（綠黨籍）和巴伐利亞邦工業總會代表艾柏茲等四十五人出席說明會。說明會由署長等多人詳細介紹環保科技園區設置的內容、特色及獎勵措施與台灣的投資優勢等。

（八）本（九十二）年九月三日下午三點三十分，拜訪 Hamos Company，該公司利用靜電原理分離混合廢料，本技術將提高分離效率，以提昇再生物質的附加價值。目前已有台灣廠商運用此技術於電子混合廢料之分離。

（九）本（九十二）年九月四日上午九點，由 B.I.M.E 公司代表介紹 真空高溫滅菌的方式處理醫療廢棄物，並參觀實際應用在慕尼黑大學附設醫院的運作情形。

（十）本（九十二）年九月四日下午兩點十五分，拜訪 KUMAS 與 BifA，KUMAS 是一個由許多環保公司組成的機構，也是德國環保公司的聯絡網。BifA 是一個非營利性的組織，為國際性的研究、發展及工程顧問公司，提供實用化的環保研究技術及商業化的實用技術，幫助業界達成節省能源、資源及操作成本。

（十一）本（九十二）年九月五日上午九點，拜訪 FES-Frankfurt，法蘭克福市政府於一九九五年六月由市議會決議釋出官股百分之四十九與民營公司共同經營，而以股份有限公司型式成立 Frankfurter Entsorgungsund Service (FES)，FES 負責垃圾收集清運工作，其中有機廢棄物則以厭氧發酵或堆肥的方式製成肥料，廢紙則利用自動化設備進行分類，分類後的廢紙可以提昇其利用之附加價值。

（十二）本（九十二）年九月五日下午兩點，拜訪 Passavant and Roediger，該公司為先進的廢水處理、發展再生能源與污泥處理公司，污泥於厭氧發酵過程中將產生沼氣，沼氣回收再利用進行發電。

五、心得與結論

（一）、由出國招商與考察情形，我們觀察到下列的心得：

1．我國環保科技園區設置的內容、特色及獎勵措施與台灣的投資優勢等，均獲得國外廠商的熱烈反應，紛紛表達願意來台灣進行投資。

2．德國政府經濟勞工部已了解台灣環保科技園區的計畫內容，經濟勞工部政務次長 Mr. Rezzo Schlauch 承諾將於近期率領環保相關廠商拜訪台灣，尋求投資台灣的商機。環境、自然保育與核子安全部門主管 Dr. Hendrik Vygen 承諾將協助宣導台灣環保科技園區招商事宜，並加強德國與台灣雙邊的環保技術與產業之交流與合作。

3．德國企業大部分為中小企業於海外進行事業投資時，相對保守，因此業者表示

於投資初期將於台灣尋求合作夥伴，利用技術移轉或技術合作等方式作為投資的主要策略。

4．於招商過程中，發現德國具有回收技術廠商大部分為中小企業，自有資金不夠雄厚，且對台灣市場規模、法令規範不甚瞭解，希望與台灣的廠商合作，投資模式以部分自有資金、技術移轉或技術合作的方式進行。

5．資源回收再生技術與固體廢棄物處理技術，在台灣均有被應用，但相關技術也不斷推陳出新，藉以提高再生物質的經濟價值。

6．德國環境部均積極運用環保政策、資源循環、水循環、污染零排放與提高回收物質的附加價值等策略，發展綠色產業，以促進環境永續發展。

7．德國為達成零廢棄物與零掩埋，對於廢棄物減量、資源循環再利用、污染零排放與提高回收物質的附加價值等環境友善的推動工作不餘餘力。

8．德國積極開發潔淨能源與再生能源，潔淨能源以太陽能與風力能為主要技術開發對象，生質能則利用有機廢棄物經由消化作用所產生之沼氣進一步發電產生再生能源。

（二）、根據觀察到的心得，未來環保科技園區之引進產業與招商作法，結論如下：

1．表達積極投資我國環保科技園區意願的廠商，應有十家以上，本署相關單位應盡全力協助其進行投資計畫。

2．署長承諾政府將全力協助來台投資廠商辦理各項申請作業，同時排除相關投資障礙，因此本署應積極尋求有意願與國外技術合作廠商，透過不同管道協助技術移轉或技術合作等方式作為未來招商投資的主要策略。

3．本署應加強與先進國家進行官方雙邊環保技術交流，並主動邀請部長級官員來我國參訪。

4．為引進外國企業於台灣進行環保產業投資工作，未來應加強掌握市場規模、法令規範、台灣的合作夥伴與資源回收再利用法之運作，以擴大市場規模，作為未來招商的籌碼。

5．本署應運用環保政策、資源循環、水循環與零廢棄物等策略來擴張環保產業，帶動環保科技園區計畫的發展遠景；也就是說，透過經濟的手段，以解決環保問題，促進環保產業的發展，同時創造就業機會，符合先進國家推動永續發展的國際潮流趨勢。

6．為達成零廢棄物與零掩埋、再生資源多元化回收再利用、提昇再生物質的附加價值、減少管末處理量等目標，將以廢棄物分類收集管理、廢棄物資源化技術、開發新能源及再生能源與其他綠色產業等作為環保科技園區之產業引進的重要課題，例如德國法蘭克福 RATHMANN 民營公司設置資源回收園區（Recycling Park）進行各類廢棄物資源化的工作。有機廢棄物則利用消化或堆肥等程序，將產生的沼氣再利用於發電產生再生能源，再進一步製成肥料。

7．太陽能與風力能等潔淨能源與新能源的引進方面，除了環保科技園區的優惠獎勵之外，政府其他部會對此也有相關優惠補助，本署應彙整國內相關資訊，提供給廠商參考，以吸引廠商進駐環保科技園區，對於資源有限的我國應積極開發其技術並應用推廣。

拜會與參訪人員之名片（一）

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胡為真
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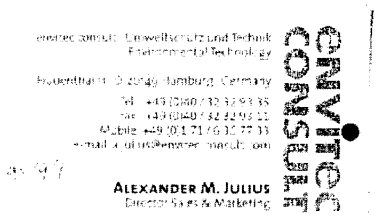
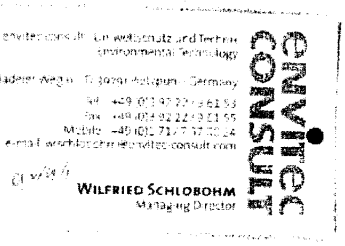
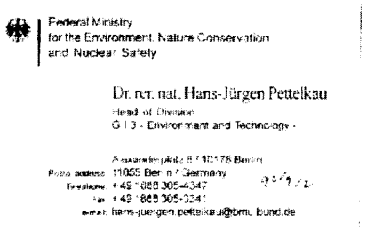
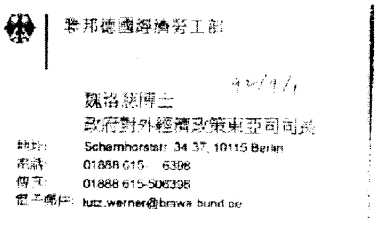
拜會與參訪人員之名片（二）

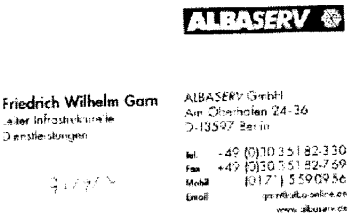
拜會與參訪人員之名片（三）

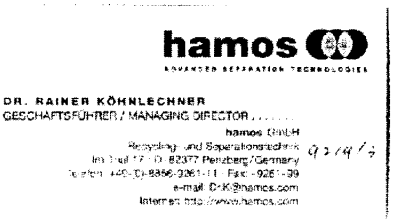




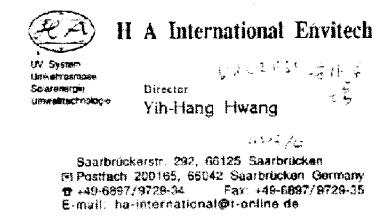


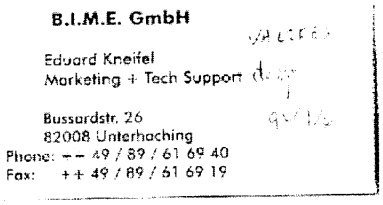


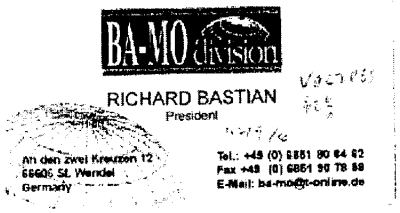


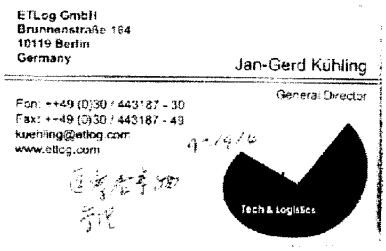


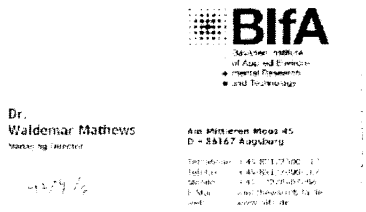
拜會與參訪人員之名片（四）

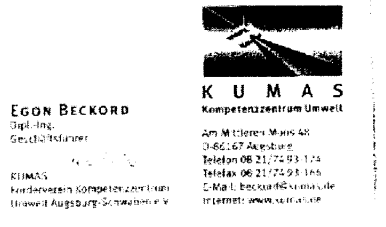












拜會與參訪人員之名片（五）

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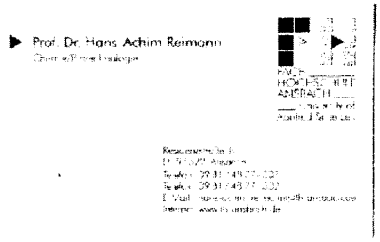
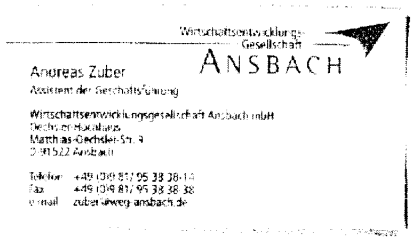
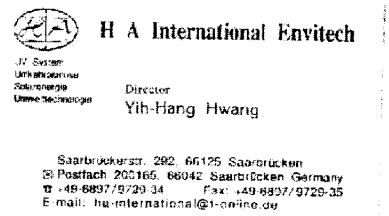
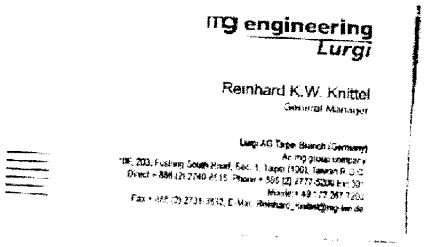
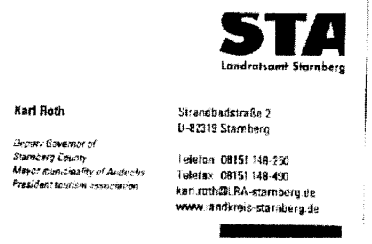
拜會與參訪人員之名片（六）

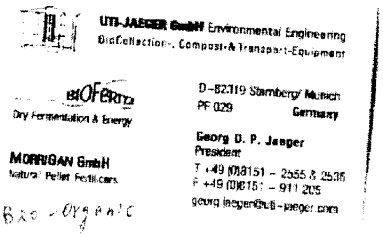


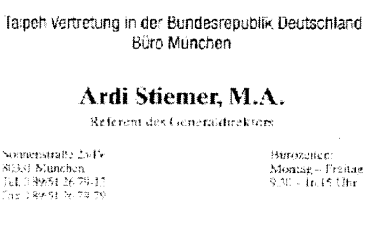


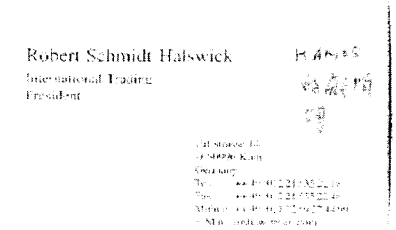




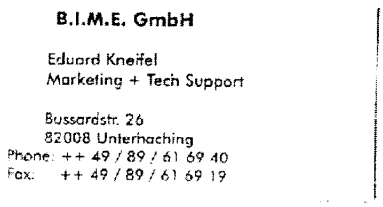


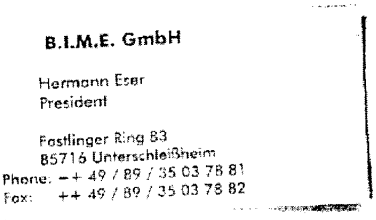


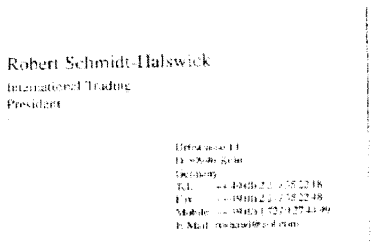


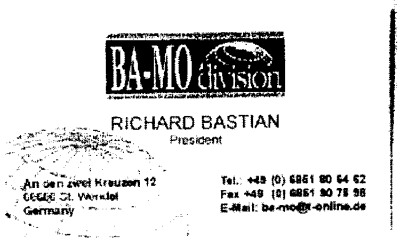


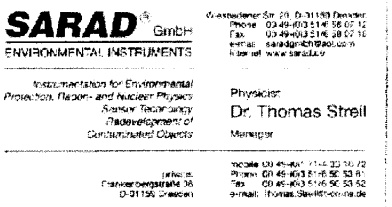
拜會與參訪人員之名片（七）

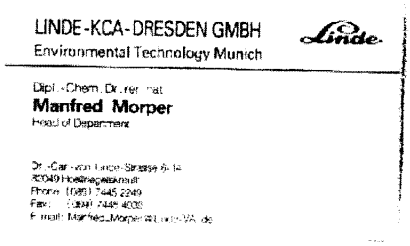




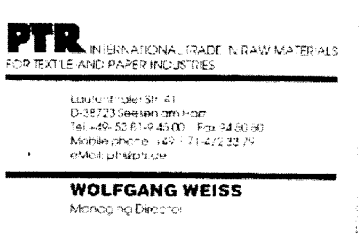




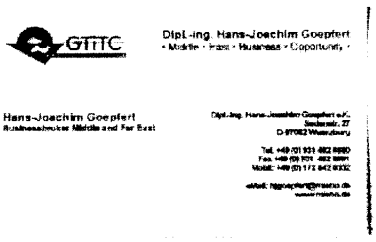




拜會與參訪人員之名片（八）


PTR INTERNATIONAL TRADE IN RAW MATERIALS FOR TEXTILE AND PAPER INDUSTRIES

WOLFGANG WEISS
Managing Director


GTTC

Dipl.-Ing. Hans-Joachim Goepfert
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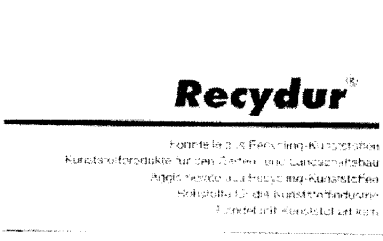
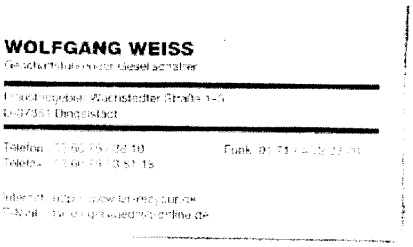
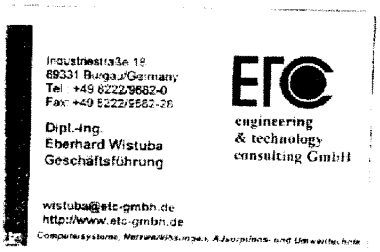
Hans-Joachim Goepfert


Recydur®


WOLFGANG WEISS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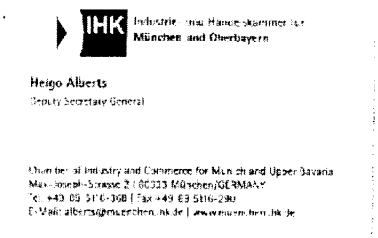
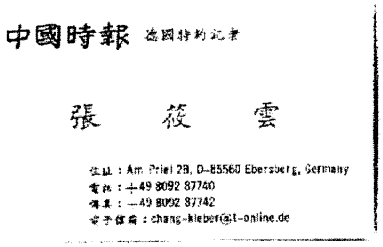
拜會與參訪人員之名片（九）





中國時報新聞稿

2003.09.04 中國時報

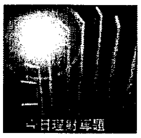
環署德國招商 邀環保廠商進駐

張筱雲/慕尼黑報導

環保署署長郝龍斌一行人，九月三日抵達慕尼黑市，當天上午十一點三十分，由駐德代表胡為真陪同，假該市著名的英國公園內湖畔餐廳舉行招商說明會。德國聯邦政府國會議員費爾（綠黨籍）和巴伐利亞邦工業總會代表艾柏茲特別公開稱讚台灣禁用塑膠袋政策的迅速與效率。

郝署長開場致詞介紹位於高雄、花蓮的工業特區，為世界第一個環保科技園區，硬體部份已經規劃完成，提供財稅、用地租售補助費、金融貸款、生產補助、研究補助等有利條件，希望借重德國領先全球的環保科技，邀請相關廠商進駐台灣投資設廠。

與會者興趣濃厚，紛紛提出許多相關細節的問題，他們關心的主要是市場獲利的遠景。郝署長表示，環保科技方興未艾，整個亞洲有很大發展空間，以台灣作為平台，推展到鄰近例如香港、大陸、泰國、印尼、馬來西亞等國家，大有可為，鑑於市場需求與商機，德國駐台北經濟辦事處甚至成立環保科技專案部門。郝署長同時承諾在場公司代表，將會協助開拓市場、推展業務、引介台灣當地合作廠商。



掌握投資時機，新型基金是不錯的選擇！
在眾多投資工具中，共同基金能有效地分散風險，已是目前投資市場的趨勢！
其中結合「B類基金」與定存的新型投資組合，投資人可獲得定存利率加碼後，利率最高可達7%的超值優惠，不僅將投資金額發揮100%的投資效益，更讓投資人安心進行中長期投資與理財規劃。
» 詳全文

其中幾家特別積極的廠商，例如德國知名的分類、再生公司HAMOS和VALIDES公司，說明會後除邀請環保署到總部，簡報公司狀況及業務，並安排實地參觀，VALIDES公司並帶領環保署前往慕尼黑工業大學醫學系附設醫院實際考察該公司醫療廢棄物之高科技資源回收處理情形。

此環保招商訪問團九月一日、二日停留柏林期間，除參訪當地多家垃圾處理、回收、再生及太陽能公司，並拜會德國聯邦政府經濟部政務次長史勞荷及環保、核子安全部門負責主管芙裕根，進行環保政策及環保技術之交流，慕尼黑招商說明會後，回程經過法蘭克福，順道參訪FES公司的有機垃圾處理廠和Passavand-Roediger 污水處理廠。

而對於環保署的國際招商行動，綠色公民行動聯盟秘書長賴偉傑表示，台灣工廠廢棄物總量為三千九百九十萬公噸，再利用率為70%，也就是說事業體的回收已經做的不錯了，所以比較嚴重的問題其實是「有毒事業廢棄物」任意傾倒掩埋。

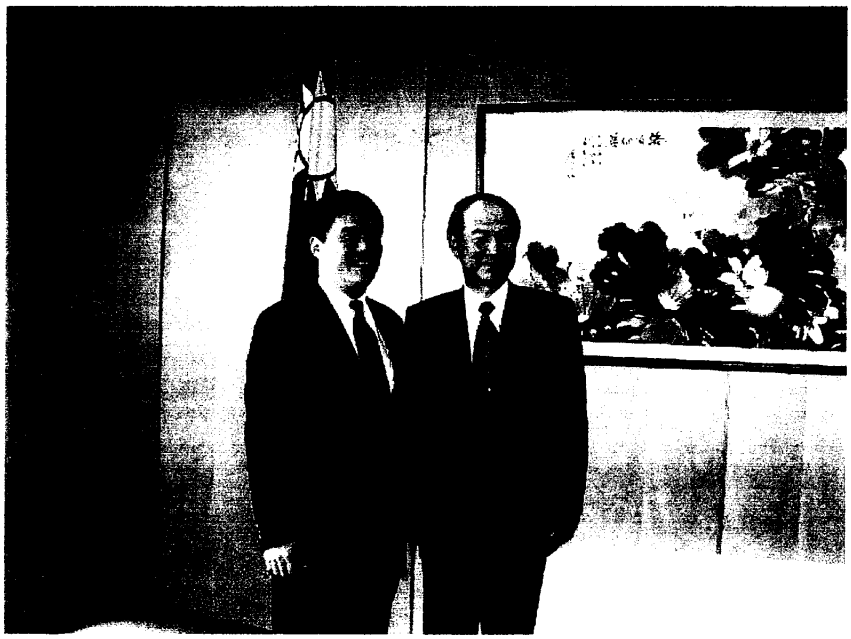
簡訊 2003.09.04
- 殺燒爵士樂送您1490
- 線上沖印 宅配到府
- 買電池不用買記憶卡

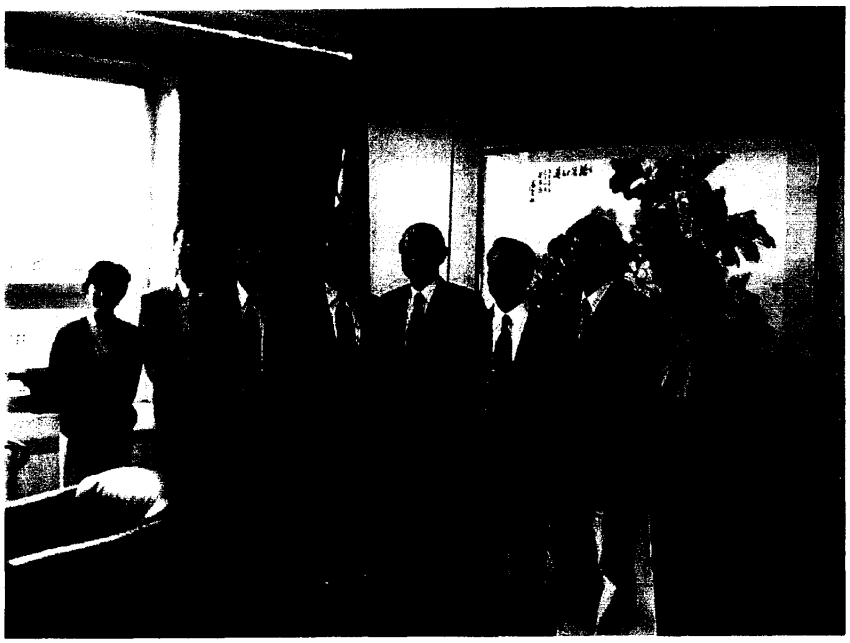
即時最新10則
- 阿拉法特：美國中東和平計劃已失敗(23:55)
- 沈文德遭槍殺 案情仍陷膠著(23:50)
- 國三女未婚懷孕 家長怒控性侵害(23:46)
- 昨夜豪雨 萬丹泥火山噴發 稻田被淹沒(23:40)
- 倫敦警方：英國面臨自殺炸彈客威脅(23:34)
- 代車主繳罰款 竊車賊心虛洩底(23:28)
- 納亞夫爆炸死者出殯 哈金弟誓美佔領軍應負責(23:22)
- 蘇州拍賣太湖無人島 第一位島主是金鷹湛(23:15)
- 職棒 兄弟象8:7勝統一獅(23:08)
- 獅象大戰 兄弟8:7力克統一(23:06)

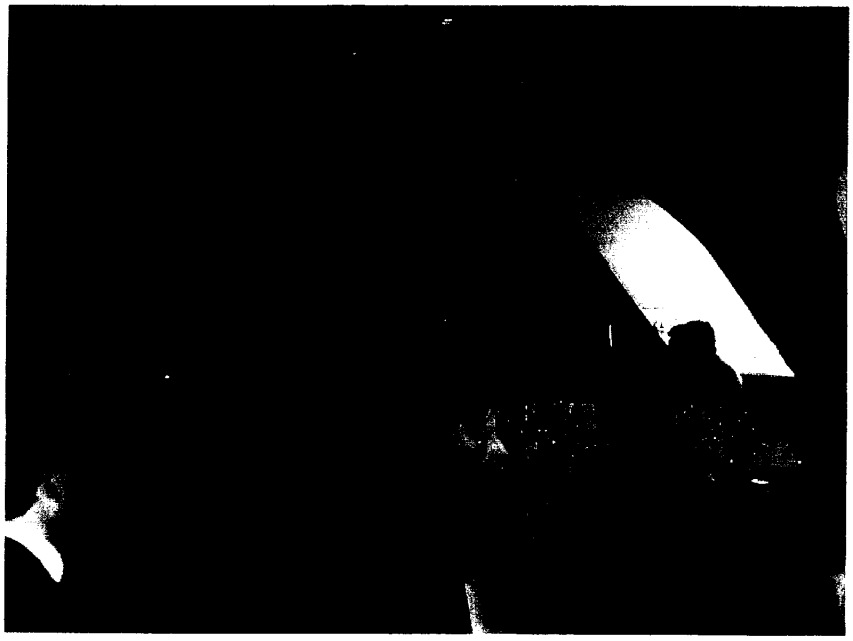
網路好康
- 訂工商時報送遠見及公事包！
- 名牌貝殼機低價便宜大拍賣！
- 大陸尋奇珍藏版新降價1799！
- 感而柔情人組合買十送五！
- 水滸傳22DVD特惠990元！
- 超級省！打大陸每30秒二元

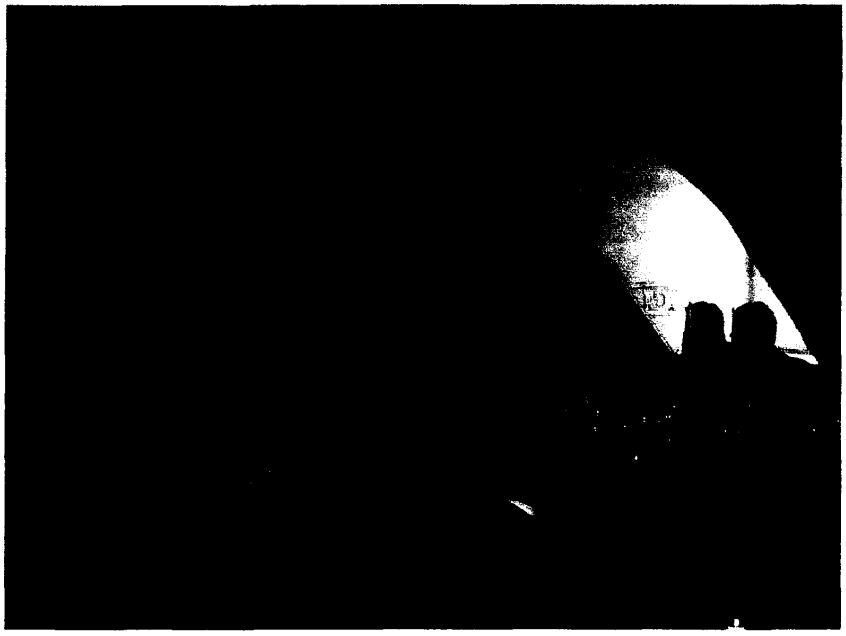
消費集中贏
- 日系精品，獨家限時搶購
- 愛不釋手的北歐設計師精品
- 指紋分析，透視命運圖騰
- 買電池不用買記憶卡
- 線上房屋出租新通路
- 照片出清，線上沖印一次搞定

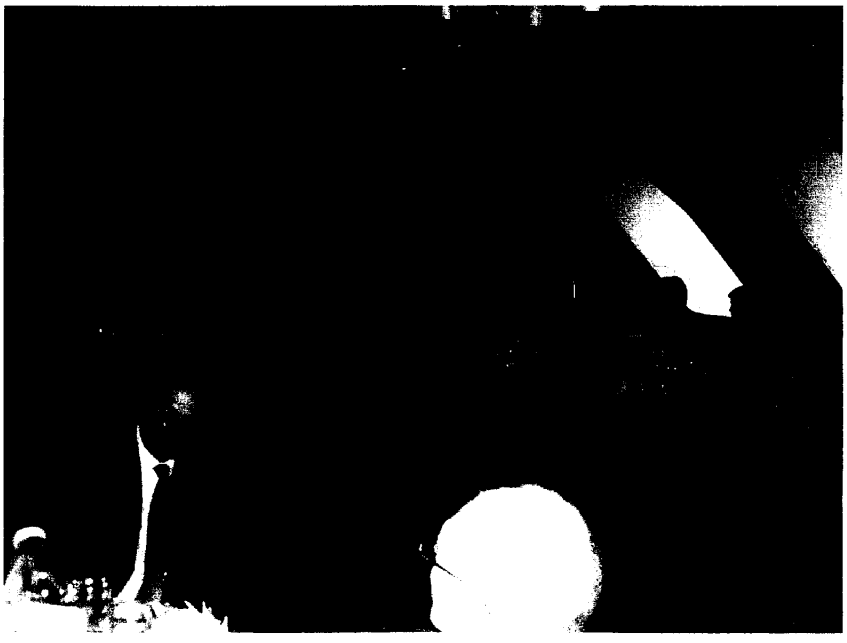
時周精選

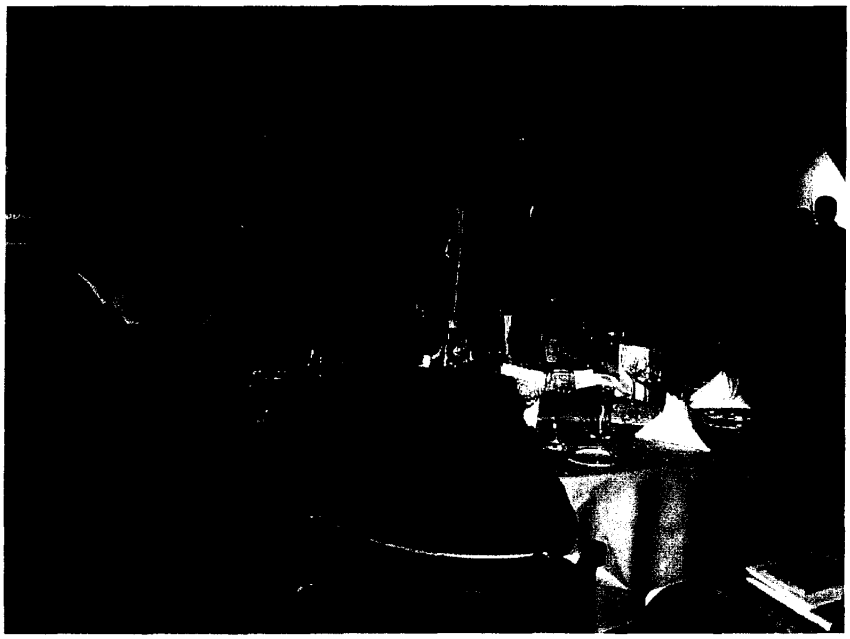


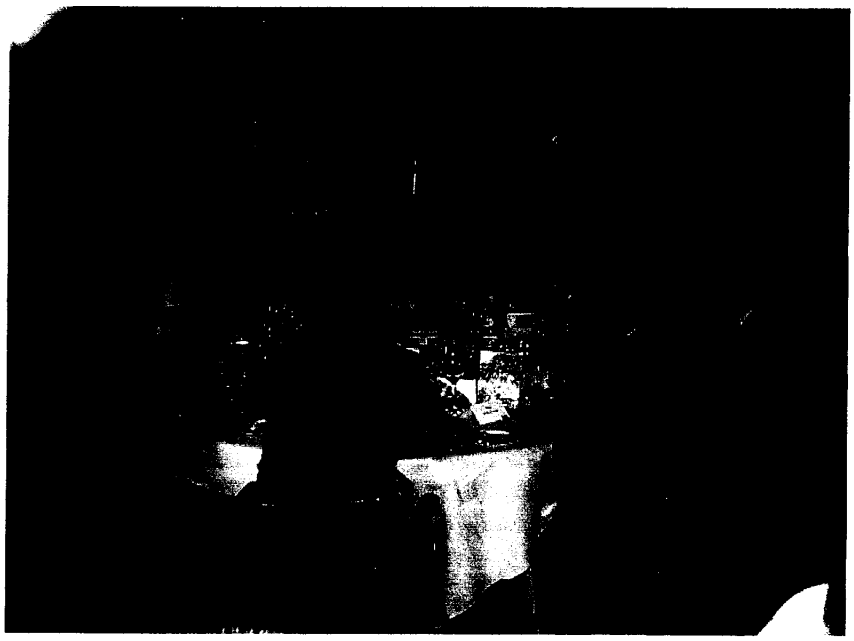


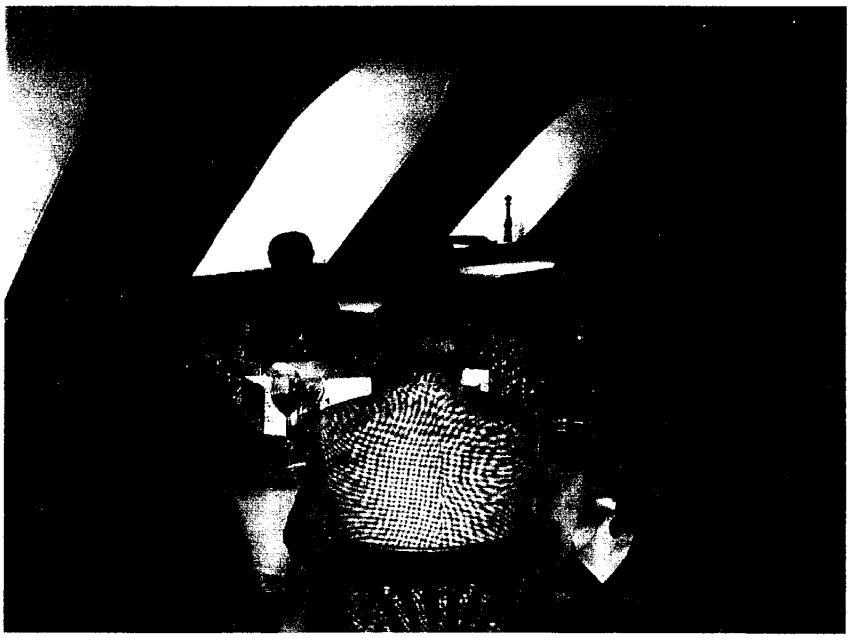


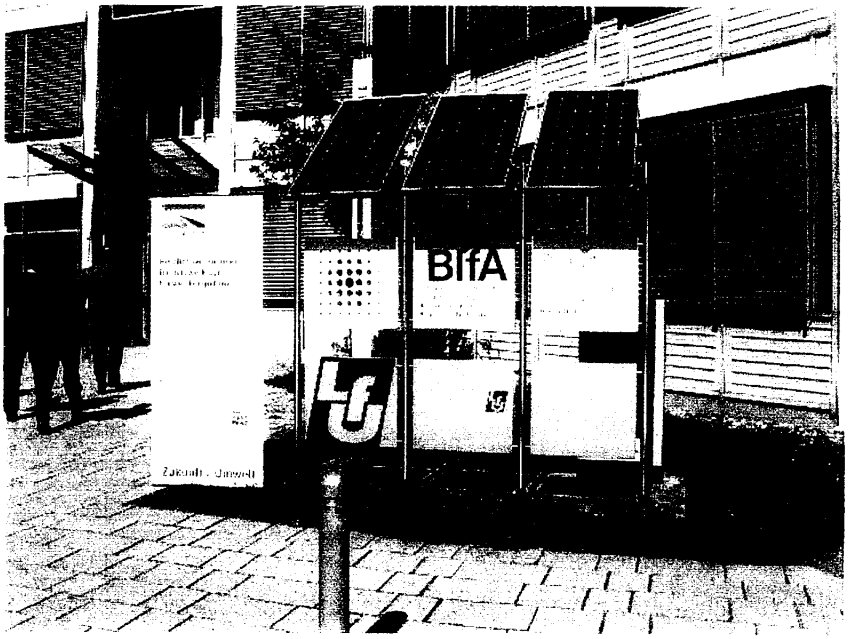




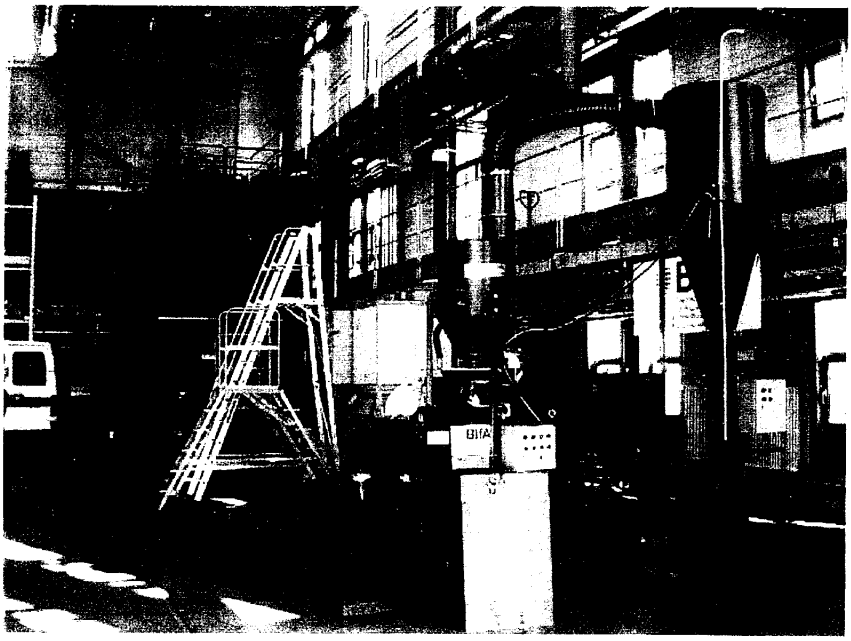


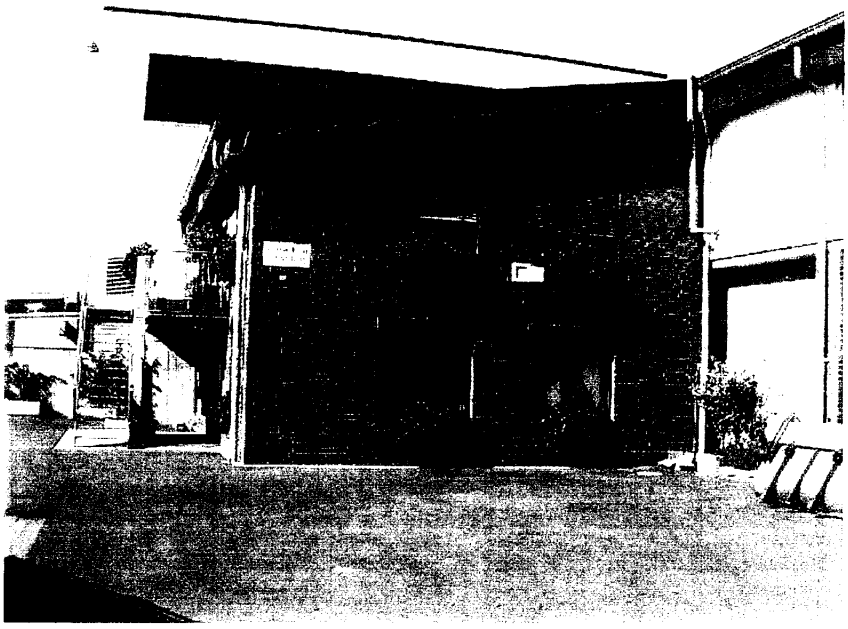


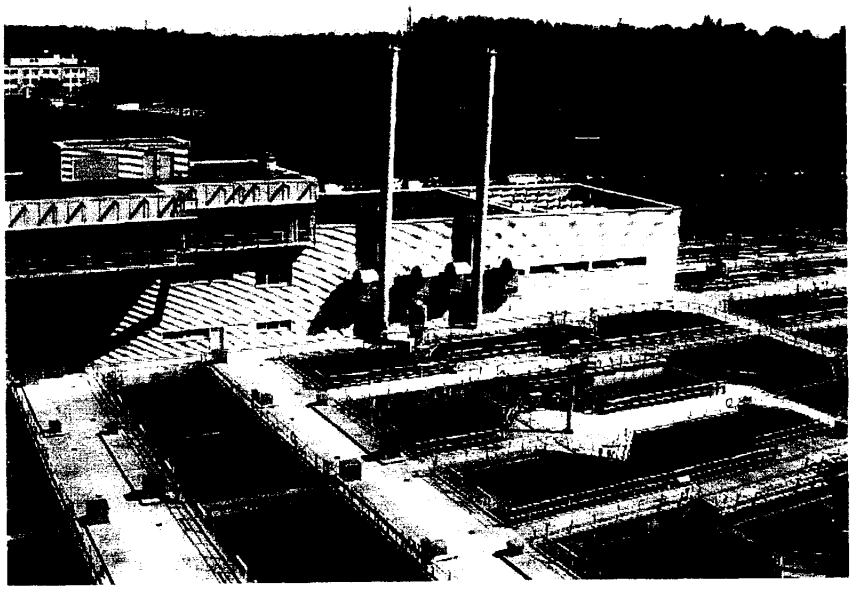


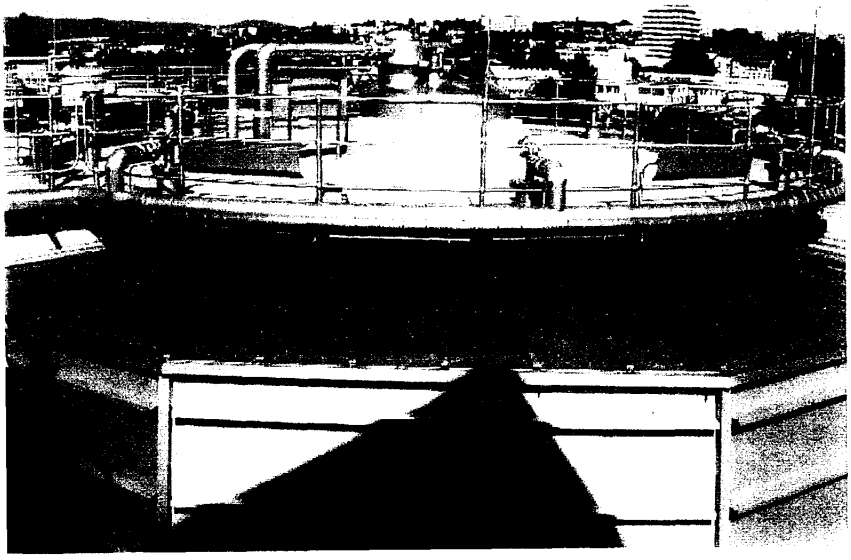

BIfA


BIfA
BUGA
Josef-Vogl
Technikum
Umwelt









The Envitec BioCycle

The Envitec CPB-plant

Physio-chemical treatment of industrial sludge and waste water for biological recycling in sewage treatment plants.

The Envitec converter of sewage sludge & bio waste

Conversion of sewage sludge and biological waste into the 100 % biological and hygienic fertilizer HumaCult.

The HumaCult Bio fertilizer

HumaCult is the 100 % biological soil cultivating NPK fertilizer.

The Envitec BioCycle

The basic concept of a recycling economy

- Recycling of animal and vegetable waste for a return to agriculture in form of fertilizers for new growth and self-sustaining yields.

- Utilization of sewage sludge und biological waste on agricultural areas for reintroduction into the natural life cycle of nutrients.

The Envitec BioCycle

The sewage sludge and biological waste problem

In 2001 Germany collected about 3 million tonnes of dry matter from sewage sludge.

- 45 % of this dry matter were utilized agriculturally. Only 20 % of this quantity contained nutrients.
- The remaining 55 % were being deposited and burnt leading to increased CO_2 emissions.
- Further harmful emissions were added by the truck transport + heavy equipment for application on agricultural areas.
- Sewage treatment plants serve the water protection. With the application of polluted dry matter harmful substances again return into our ground water.

The Envitec BioCycle

The sewage sludge and biological waste problem

- Added fillings and flocculants intensify the portion of pollutants by about 1 million tonnes of chemicals in the German sewage sludge.
- The EU wastewater directive will increase the EU tonnage from 5.7 million tonnes of dry matter in 1995 to an estimated 15-20 million tonnes in 2005.
- The planned EU amendment of the sewage sludge directives corresponds to the already valid regulations in Germany.

The Envitec BioCycle

The cost problem

- Costly disposal of sludge by local sewage treatment plant operators.
- Dry matter contains 70 % water which has to be shipped from the plant to a growing number of certified disposal areas. This means extra shipping cost of 70 %.
- Maintenance of storage facilities.
- Sinking of pollutant-impacted waste into the ground water reduces the water cleaning efficiency of the treatment plant. Consequently, according costs go up.

The Envitec BioCycle

The cost problem

- Dry matter usage as fertilizer is of limited success: the majority is being carried off or sinks into the ground water and is not reaching the plant.
- Sludge application on agricultural fields demands heavy equipment.
- The odour nuisance of applied sludge often demands a cost intensive “smell protection” !!!

The Envitec BioCycle

The solution

- Measuring out the nutrients in sewage sludge and biological waste and usage as biological fertilizer!
- Increase of the dry matter rate to 95 % for a reduction in freight costs and harmful emissions!
- Environmentally friendly disposal of separated pollutants!
- Establishment of a biological cycle at low cost and parallel improvement of the soil structure!

… and all guaranteed through Envitec and HumaCult!

The Envitec BioCycle

The BioCycle of the Envitec recycling system

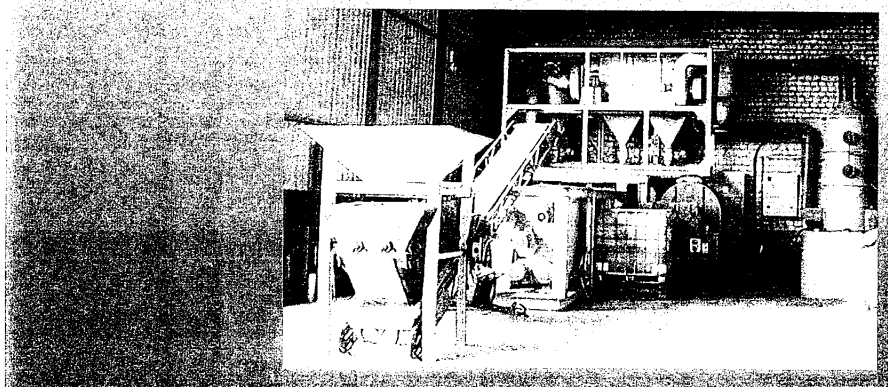
- Envitec is a thermal mechanical process to extract heavy metals and to destroy polycyclic aromatic hydrocarbon.
- Envitec separates in water reduced heavy metal saline to sluice them out of the exhaust system. This conversion pasteurises and removes hygienically critical substances.
- Envitec converts sewage sludge and biological waste into a bacteriologically hygienic, fully organic bio-fertilizer.
- Envitec is using exhaust heat of communal power stations for operating the conversion system and avoids additional CO_2 emissions (specified in attachm. E1).

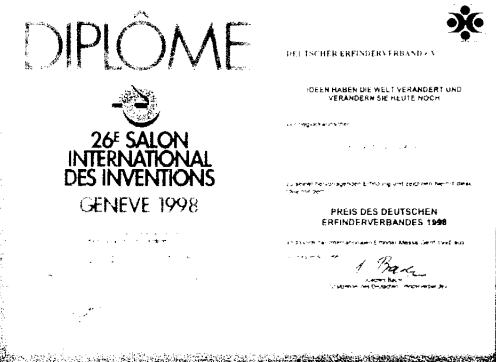
The Envitec BioCycle

The BioCycle of the Envitec recycling system

HumaCult Envitec is the missing link of the bio cycle that returns sewage sludge and biological waste in form of saved energy and nutrients back into soil.

HumaCult Envitec is the conversion process, already awarded with Gold in 1998 on the International Inventors Fair in Geneva.





The Envitec BioCycle

Process description

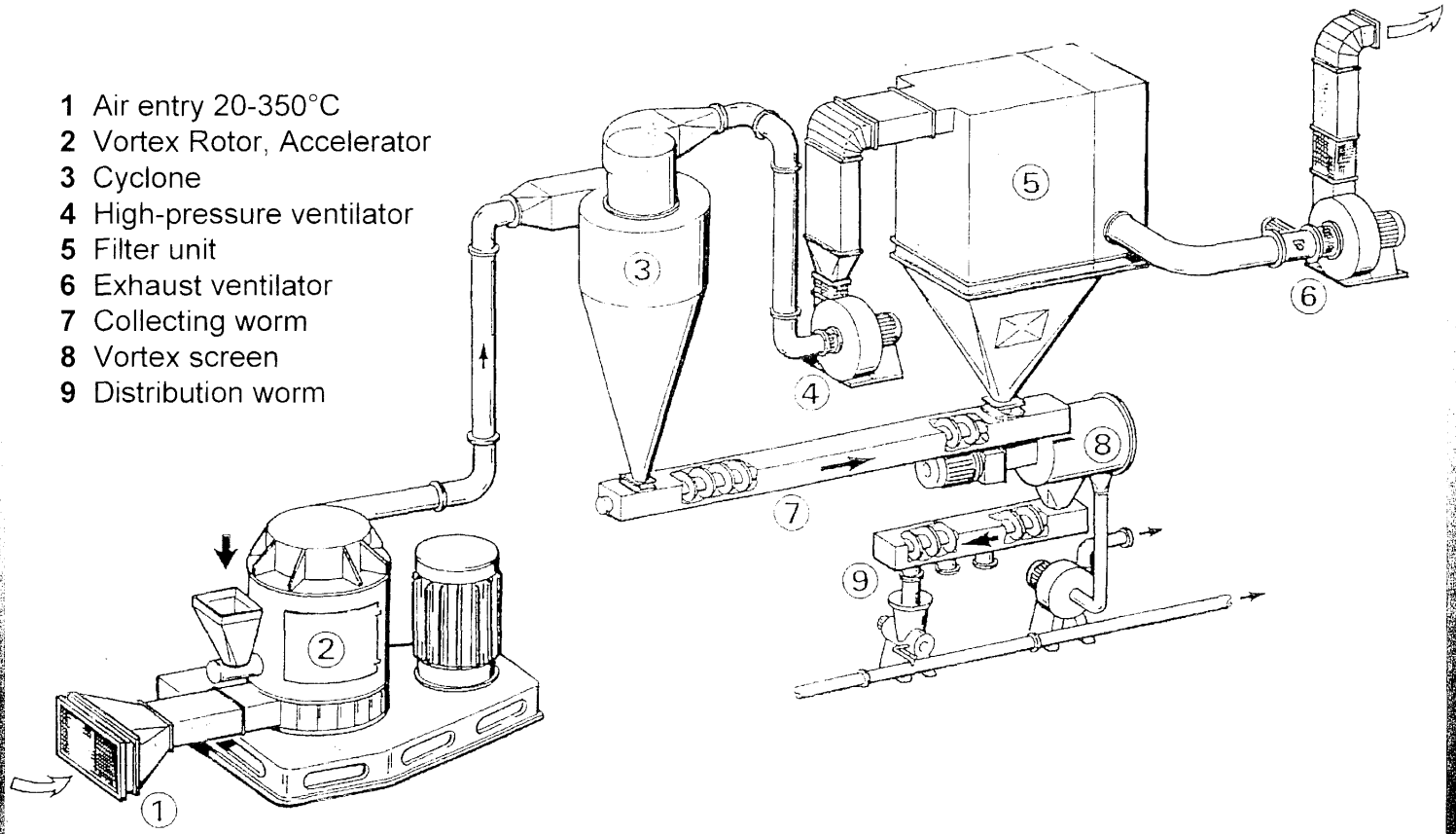
Air and sludge are inducted into a vortex rotor and set into turbulences. This creates a stream and other necessary conditions to make the substance particles collide at high speed. This Impact energy heats up the particles for a very short time causing an enlargement of the particle surface and vaporization of the adhesive moisture.

The established dry dust is being removed from exhaust via a cyclone and a back-end filter. The final product is being discharged via a conveyer system for further usage or processing.

The Envitec BioCycle

The Envitec Converter

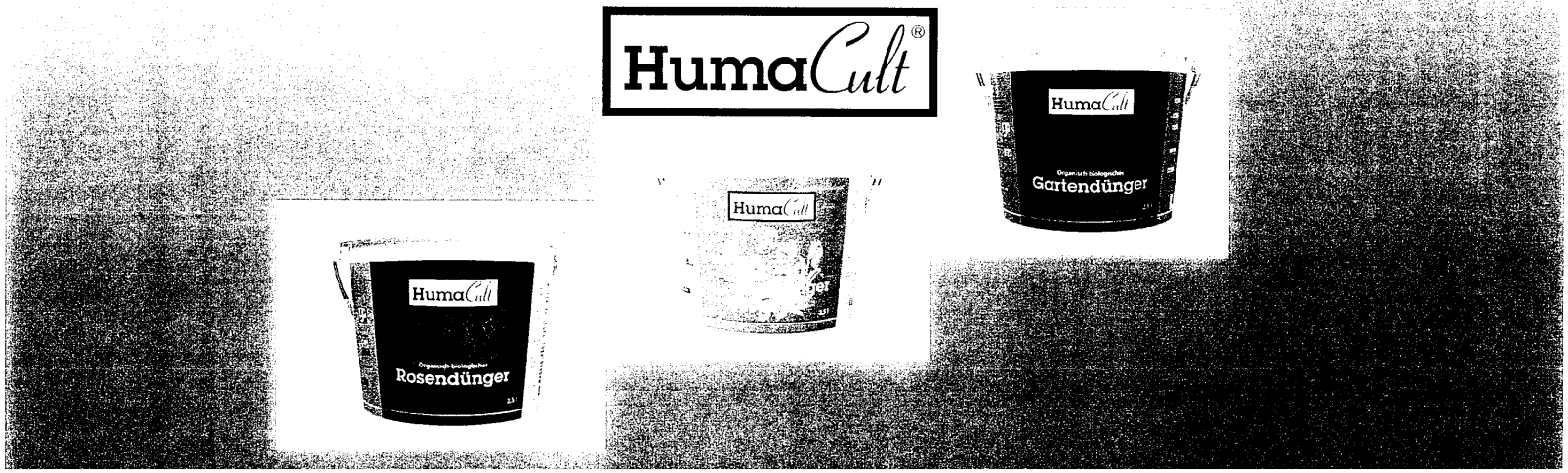
1 Air entry 20-350°C
2 Vortex Rotor, Accelerator
3 Cyclone
4 High-pressure ventilator
5 Filter unit
6 Exhaust ventilator
7 Collecting worm
8 Vortex screen
9 Distribution worm



The Envitec BioCycle

The HumaCult bio-fertilizer

HumaCult is a certified NPK-fertilizer successfully tested in an extensive trials by the “Bundesforschungsanstalt für Landwirtschaft Braunschweig-Völkenrode (FAL)”.



The Envitec BioCycle

The HumaCult bio-fertilizer

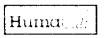
The 7 features of HumaCult:

- HumaCult is slurry dust which sticks to the soil by adhesion and does not sink into the ground. In turn, an even distribution of nutrients is being supplied and is made available to the plant for the long term!
- HumaCult is being macerated by the plant's root acid. The plant is consuming the required nutrient portions via a capillary and/or osmotic process!
- HumaCult production process creates a "positive" charge in the fertilizer. Due to the fact that soil has almost always a "negative" charge, the polarity makes HumaCult particles stick to the ground and do not sink to the ground water!

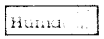
The Envitec BioCycle

The HumaCult bio-fertilizer

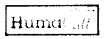
The 7 features of HumaCult:



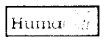
HumaCult remains in place till the final usage by the plant and does not dissolve like mineral fertilizer. One fertilisation per year is enough!



HumaCult contains all nutrients in a balanced ratio. This turns into a regular & healthy growth and the plant is only ingesting as many nutrients as needed!



HumaCult avoids root etching, caused by excess mineral salt!



HumaCult reactivates microorganisms in the ground through a high portion of organic components and work against emaciated soil!

The Envitec BioCycle

The HumaCult bio-fertilizer

Areas of application of HumaCult

- Fertilisation of ornamented plants
- Improvement and revitalizing of acidic soil
- Activating fertilizer in the forestry, as well as in the …
- Horticulture landscape culture
- Curing of ill or damaged plants
- Intermixing in substrate

The Envitec BioCycle

The HumaCult bio-fertilizer

HumaCult successes so far!

- HumaCult was successfully tested by the FAL.
- HumaCult has been successfully tested for one year already by the Versuchs- und Beratungsring Baumschulen Schleswig-Holstein (Trial and Advising Ass. for Tree Nurseries)
- HumaCult rose fertilizer has been successfully distributed as premium fertilizer by one of the major rose growers.
- HumaCult has been successfully marketed (since March '03) by one of the leading European garden market chains as their first and only fully organic bio-fertilizer.

The Envitec BioCycle

The HumaCult bio-fertilizer

Further features of HumaCult

- HumaCult has a low content of organic pollutants and counteracts a creeping absorption of heavily degradable pollutants, as can happen with wet sludge with contains higher volumes.
- HumaCult production process causes a homogeneous distribution of nutrients permitting precise analysis and contents adjustment, if necessary.
- HumaCult distinguishes itself by having a very low content of carcinogenic polycyclic, aromatic hydrocarbon (PAK).

The Envitec BioCycle

The HumaCult bio-fertilizer

- HumaCult increases the pH-value in the root area and supports the ingestion of magnesium (photosynthesis).
- HumaCult nourished plants show a higher content of the nutrients calcium and magnesium (structural and functional elements of the metabolism).
- HumaCult mineralised nutrients need to be converted by the plant into a better digestible form. In turn, the nutrient flow is slower with a longer lasting fertilizing effect.
- HumaCult's smaller particle size but active surface area participates in a fast and encompassing exchange in the process after fertilization.
- HumaCult embedding into the ground avoids erosion on the surface through wind and water.

The Envitec BioCycle

The HumaCult bio-fertilizer

HumaCult contains a very low portion of organic pollutants and elutable heavy metals.

Heavy metals content acc. to the existing limits acc. KSVo

Heavy Metals	HumaCult mg/kg	Perm. Limits in Dry Mat (mg/kg)	Used (%) of Limits
Lead (Pb)	74	900	8,2
Cadmium (Cd)	1,24	10/5*	12,4
Chrome (Cr)	42	900	4,7
Copper (Cu)	108,0	800	13,5
Nickel (Ni)	22	200	11
Mercury (HG)	0,28	8	3,5
Zinc (Zn)	623	2500/2000*	24,9

*for light soil with clay content <5% or a pH-value of >5<6

The Envitec BioCycle

The HumaCult bio-fertilizer

- Agriculturally used sludge of the former east German states achieve a utilization of these limits of 45 % for copper and 40 % for zinc.
- HumaCult contains only the essential heavy metals (in form of nutrients) zinc, copper and molybdenum at a quarter of the permitted limits.
- HumaCult concentration of iron, aluminium, lead and chrome continuously decreases in the dry matter of the plant with an increasing fertilization.

The Envitec BioCycle

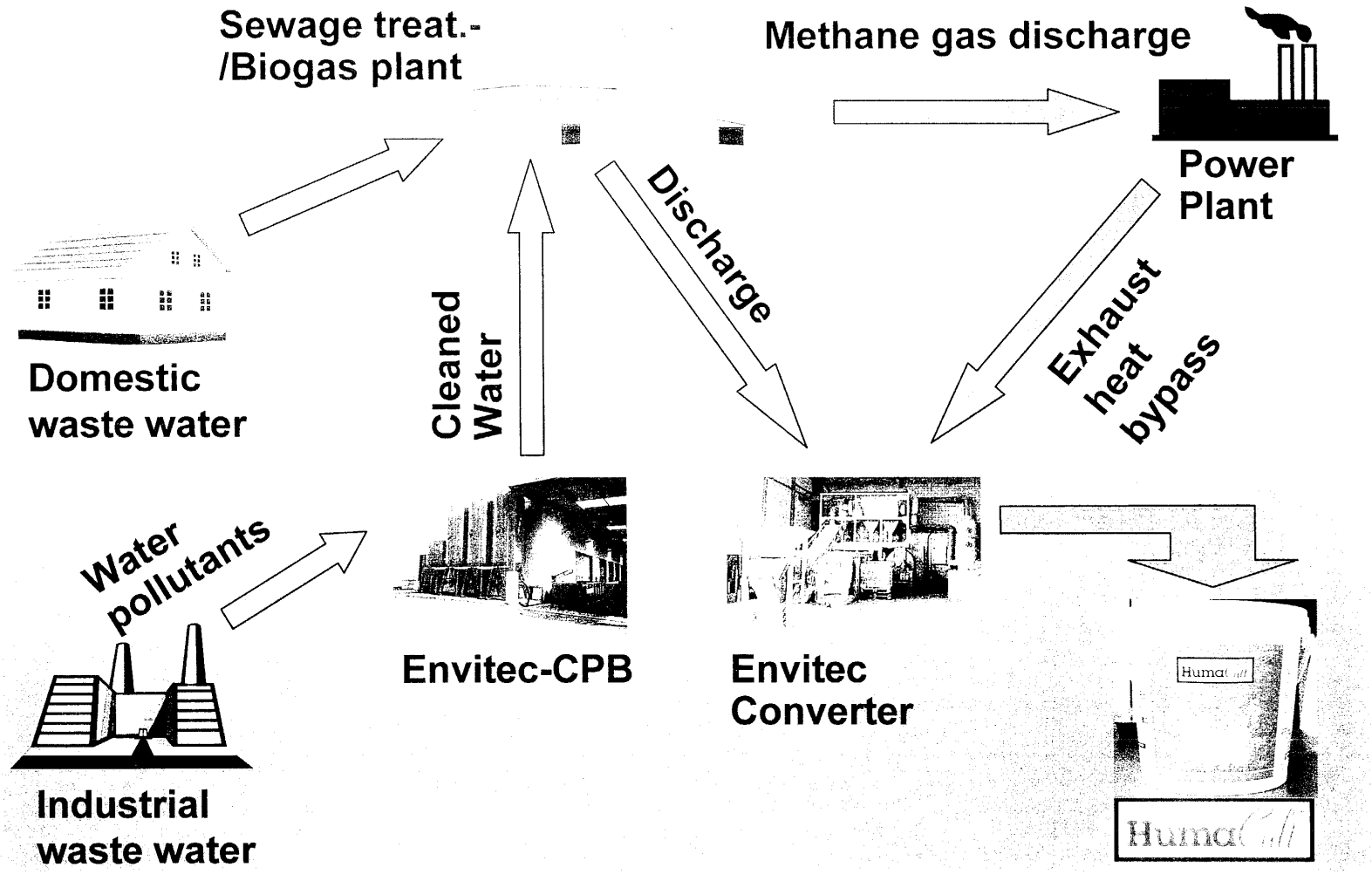
The HumaCult bio-fertilizer

Conclusion

HumaCult is ideal to go easy on resources versus conventional sludge : HumaCult requires 90 % less in transport freight, less storage space, contains less pollutants, is pasteurised and requires smaller quantities on fertilizing areas which also leads to lessening the stress to the soil caused by heavy machinery.

The Envitec bio cycle shown in the diagram:

The Envitec BioCycle

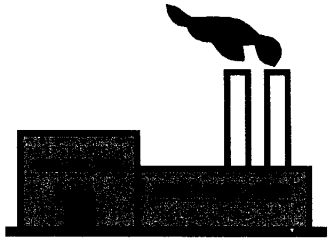


Attachment E1 - Envitec
Biological Waste and Exhaust heat Converter

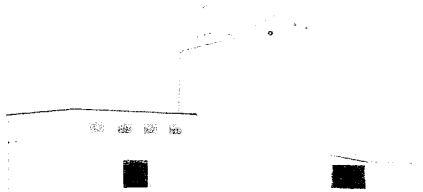
- Methane gas produced in biogas plants is being diverted to the power plants.
- Power plants are using ca. 2/3 of the fed energy for the production of heat & electric power. The balance of 1/3 is being repelled as exhaust heat.
- The Envitec converter is using 100 % of the exhaust heat to produce fully biological fertilizer out of the fermented arrears.
- Consequently, Envitec is not subject to the CO_2 regulation (as burning plants are) and saves power plants the costly cooling of exhaust heat.
- Envitec supports the alternative usage of fermented arrears and is being operated by environmentally friendly exhaust heat.

Attachment E1 - Envitec Biological Waste and Exhaust heat Converter

Methane gas ex biogas plant



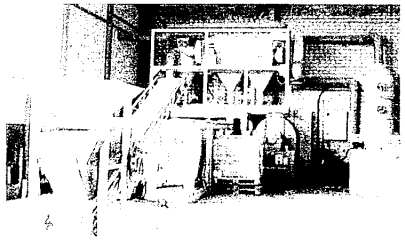
Power plant (BHKW)



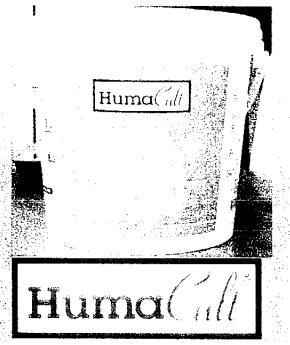
Exhaust bypass

to Envitec converter

Bio waste to Envitec



Operating Envitec with exhaust heat



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The HumaCult Bio-Fertilizer

MDR (Mitteldeutscher Rundfunk)
Broadcast of 13th April 1999

This is not topsoil, but a case for a special waste incinerating plant: sewage sludge – disgusting and noxious.

Wilfried Schlobohm knows how sewage sludge can be turned into a natural fertilizer. With his colleagues he developed a process, decontaminating sewage sludge and destroying all bacteria and germs.

The idea: pre-dried sludge is being swirled in tubes at high temperatures (as shown). A rotor creates an air stream in which the sludge is being jumbled creating a temperature of almost 300°C – hot enough to destroy all bacteria and germs. The heat also vaporizes the heavy metals contained and left is the dry and cleaned sewage sludge. This fully biological fertilizer can be embedded to the soil in form of powder, pellet, granules or in a water soluble foil.

The fertilizer remains at the root till it is fully used up. One fertilization per year is sufficient. In our test at least the fertilized kohlrabi reached double the weight.

(Translation of the original German broadcast incl. in the Envitec presentation)

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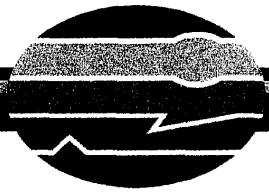
Federal Ministry
for the Environment,
Nature Conservation and
Nuclear Safety

ENVIRONMENTAL POLICY

IT'S OUR FUTURE



RENEWABLE ENERGY

- CURRENT GERMAN AND EUROPEAN LEGISLATION AND MORE -

RENEWABLE ENERGY

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as of: May 2002

Preface

Over the past years the German Government has paved the way for a fundamentally new energy supply that fulfils the criteria of a sustainable development. Within the government, the goal of the Federal Ministry for the Environment is to create an energy system without nuclear power, that protects the climate, the environment and the natural resources, an energy system that gradually cuts back its use of fossil fuels, that uses energy efficiently, that rapidly expands renewable energies and that in the long term becomes a solar energy supply system based only on renewable energies.

In Germany, the short-term goal is to double the share of electricity from renewable energies to 12.5 per cent by 2010 compared to the year 2000. As a long-term target, by 2050, at least 50 per cent of the total energy supply should be obtained from renewable energies.

To reach these goals, the German Government has pushed through substantial progressive measures. These include, first and foremost, the Renewable Energy Act 2000, which has proved to be highly efficient for accelerating the expansion of renewable energies. This Act, with its compulsory purchase of and compensation for electricity from renewable sources fed into the grid, creates the stable conditions necessary to double the renewable energies share by 2010. The Renewable Energy Act has enabled wind energy capacity to treble over the past three years, to its current level of around 9000 MW in May 2002! At present, this is the highest installed wind capacity in the world; by the year 2025, the share of wind power shall rise to at least 25% of Germany's total electricity consumption. This will be achieved particularly through offshore wind farms. The Federal Government developed principles for establishing such offshore wind farms. Germany aims to start similar success stories for the other renewable energies, using the Renewable Energy Act and supplementary instruments as the Ordinance on Generation of Electricity from Biomass.

On the European Union level, the Directive on the Promotion of Electricity from Renewable Energy Sources aims to help meet the Kyoto commitments and achieve the target of doubling renewable energy's contribution to Europe's gross energy consumption from its current share of 6% to 12% in 2010. Promotion of renewable energy is an absolute priority for the European Union (EU).

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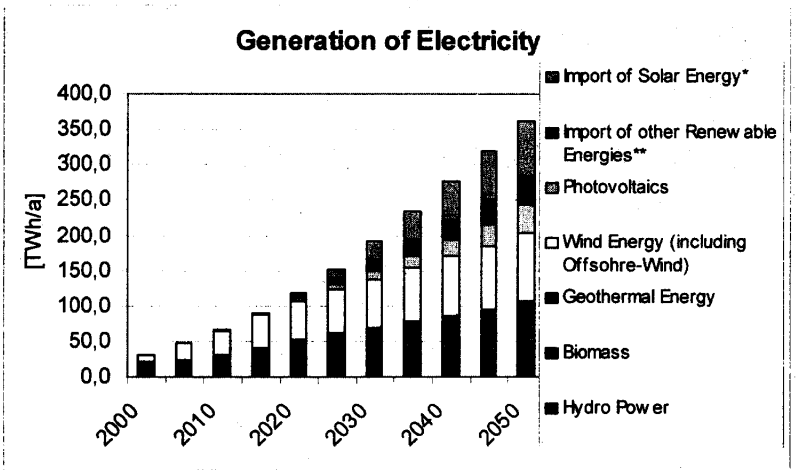
I. Introduction

A. Renewable Energy Act

The Act on Granting Priority to Renewable Energy Sources (Renewable Energy Act) entered into force on 1 April 2000.

The objective of the Renewable Energy Act is to promote the development of renewable energy sources for electricity generation as a key element of climate protection, environmental protection and sustainable development, and to increase the share of renewable energy sources in electricity supply, aiming to at least double this share by the year 2010, in accordance with the targets of the European Union and Germany and in order to reach a share of at least 50 per cent by 2050.



Instrument: Minimum price regulation, with the nearest grid operator under the obligation to accept and pay compensation for electricity from renewable energy sources; passing on compensation payments to the transmission grid operator (high voltage grids) with the obligation to a nation-wide equalisation of unequally distributed burdens. In addition to this the utility companies which supply electricity to the end-user shall be obliged to purchase the corresponding proportion of electricity generated from renewable sources. This will allow regionally varying burdens to be distributed nation-wide. The process leads to an average increase in the purchasing costs of electricity for the end user to about 0.05 cent per kWh at present. With the desired strong growth of renewable energies this sum will only rise to around 0.1 cent per kWh in the course of a few years.

In the minimum compensation rates to the parties feeding electricity into the grid, the level of compensation depends on the type of renewable energies, on the size of the plants and, in the case of wind energy, on wind location. Planning and investment security is guaranteed by fixed cent amounts per kWh fed into the grid, and a maximum duration of 20 years. This creates the incentive to invest in these plants. In addition to continuing an intensive development of wind energy use, the Renewable Energy Act also aims at producing similar developments in biomass use, and at introducing photovoltaics and geothermal power for electricity generation. Degressive

compensation rates for new plants installed as from 1 January 2002 were introduced. Regular reviews of the compensation rates for new installations are planned for every two years.

The individual regulations of the Renewable Energy Act:

§ 1 Purpose:

Priority of renewable energy sources for electricity provision, in consideration of climate protection, environmental protection and sustainable development.
Increasing the contribution of renewable energy sources to electricity generation, in order to at least double their share by 2010.

§ 2 Scope of Application:

Purchase of, and compensation payments for, electricity from

- hydropower, landfill gas, sewer gas: each to a maximum of 5MW installed electrical capacity
- wind energy
- solar radiation: to a maximum of 100 kW installed electrical capacity (where special construction measures have been implemented), or 5 MW electrical capacity (on roofs, façades, on noise protection walls, etc.);
- Biomass: raising the upper limit from 5 to 20 MW installed electrical capacity; authorising the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety to adopt an ordinance laying down the definition of the term biomass (substances, processes, environmental requirements). This ordinance was made in agreement with the Federal Ministry of Food, Agriculture and Forestry and the Federal Ministry for Economics and Technology and subject to approval by the German *Bundestag* (see text below).
- Geothermal energy
- Mine gas (not a renewable energy in the strict sense of the term, but its release without incineration is damaging to the climate, as it contains high proportions of methane, similar to sewer gas, landfill gas, and biogas);

The electricity to be accepted and compensated must be obtained within the scope of application of the Act or in the exclusive economic zone. This allows electricity from wind offshore plants outside the 12-mile zone to be fed into the grid.

The Act now also includes utility companies.

Reactivated or modernised existing installations shall be considered to be new installations if the modernisation costs amount to at least 50% of the cost required to construct a completely new installation.

§ 3 Obligation to purchase and pay compensation

The nearest operator of a suitable grid is obliged to purchase and pay compensation for electricity generated from renewable sources. This includes the economically viable upgrading of the grid. If a grid is not technically capable of feeding in the electricity, the obligation applies to the nearest grid

of a higher voltage. The upstream or nearest transmission grid operator (high voltage) is then obliged to purchase and pay compensation for this fed in electricity.

§ 4 Compensation to be Paid for Electricity Generated from Hydropower, Gas from Landfills, Mines, and Sewage Treatment Plants

7.67 cent per kWh for up to 500 kW installed electrical capacity,
6.65 cent per kWh for over 500 kW installed electrical capacity (compensation for hydropower, landfill gas and sewer gas is restricted to a 5 MW ceiling);

§ 5 Compensation to be Paid for Electricity Generated from Biomass:

10.23 cent per kWh for up to 500 kW installed electrical capacity;
9.21 cent per kWh for up to 5 MW installed electrical capacity,
8.70 cent per kWh for an installed electrical capacity ranging from 5 MW to an upper limit of 20 MW installed electrical capacity.

Degression: As from 1 January 2002 the minimum compensation for plants which have then become newly operational will be reduced by 1% annually.

Cent/kWh	**2002**	**2003**	**2004**	**...**
Up to 500 kW	10.1	10	9.9	...
Up to 5 MW	9.1	9	8.9	...
Up to 20 MW	8.6	8.5	8.4	...

§ 6 Compensation to be paid for Electricity Generated from Geothermal Energy:

8.95 cent per kWh for up to 20 MW installed electrical capacity
7.16 cent per kWh for over 20 MW installed electrical capacity

§ 7 Compensation to be Paid for Electricity Generated from Wind Energy

9.10 cent per kWh for at least the first 5 years.
6.19 cent per kWh after a reference yield has been attained.

The reference yield is calculated by the quantity of electricity fed into the grid in the first five years, taking into consideration a certified measurement of the power windspeed curve (P-V curve). The reference location is an averagely good wind location with 5.5 m/s wind speed at a height of 30 metres. The calculation of the reference yield is determined in the annex. The Federal Ministry of Economics and Technology is authorised to issue provisions to secure the calculation of the reference yield. (NB: A guide for calculating the reference yield is provided on the internet at http://www.dewi.de , by the *Deutsche Windenergie-Institut* (The German Wind Energy Institute), Wilhelmshaven.

Effect of this reference yield model: The reduced compensation rate will be achieved more quickly at very good locations than at less efficient ones, resulting in compensation payment differentiation according to wind location based on a technically neutral reference yield model. Current cost

estimates indicate that typical locations will therefore achieve the following average compensation payments over a 20-year period:

- for locations with average wind conditions: about 8.3 cent per kWh (corresponds to the compensation in 1999)
- for locations on the coast with very good wind conditions: about 7 cent per kWh
- for good to poorer locations: 8.5 to a maximum of 8.95 cent per kWh.

The differentiation according to location alleviates the pressure on coastal areas, as economically viable operation is also possible at inland locations with good wind conditions. For offshore installations of 3 sea miles or more from the coastline, there is a high starting compensation of 8.95 cent per kWh for a period of 9 years (instead of five years), in order to allow economically viable operation in these installations too (on account of the current higher specific construction and maintenance costs). This regulation is restricted to installations which become operational by 31 December 2006.

For existing installations, the high starting compensation rate will be calculated on the basis of half of their operating life to date. This high rate is valid for at least 4 years after the Renewable Energy Act has entered into force (protection of existing plants).

Annual degression of the compensation rates for newly operational wind installations from 1 January 2002: 1.5%.

Cent/kWh	**2002**	**2003**	**2004**	**...**
Starting rate	9	8,8	8,7	...
Reduced rate	6,1	6	5,9	...

§ 8 Compensation to be Paid for Electricity Generated from Solar Radiation Energy

50.62 cent per kWh; The regulation applies until 1000 MW installed electrical capacity (170 MW to date (May 2002)) has been achieved; there must be prompt appropriate follow-up regulation.

Degression of the compensation rates: from 1 January 2002, an annual reduction of 5% for installations constructed after this date.

Cent/kWh	**2002**	**2003**	**2004**	**...**
	48,1			...

§ 9 Common Provisions:

Limiting compensation payments for new installations to 20 years in each case, except for hydropower (on account of longer amortization times); Regulation governing the calculation for several installations e.g. cumulative calculation for wind farms.

§10 Grid costs:

The costs of connecting installations shall be borne 100% by the installation operators; necessary upgrading costs shall be borne 100% by the installation operators. These costs can be taken into

account when calculating the charges for the use of the grid. In case of dispute: clearing centre at the Federal Ministry of Economics and Technology.

§11 Nation-wide Equalisation Scheme:

The operators of transmission grids are obliged to record the quantity of energy purchased and the compensation payments made under § 3 and equalise them among themselves. The average share of electricity compensated under the Renewable Energy Act shall be calculated; transmission grid operators exceeding this average shall receive the surplus compensation payments from those transmission grid operators who fall below it. In this way the costs are equalised nation-wide. This produces current costs of about 0.05 cent per kWh. Even the targeted strong development of renewable energies will lead to costs of only 0.1 cent per kWh in the course of a few years.

On the other hand, utility companies supplying electricity to end consumers must purchase from the transmission grid operators electricity compensated in accordance with the Renewable Energy Act. Electricity thus acquired by these utility companies may not be purchased below the average compensation payments of the Renewable Energy Act (avoidance of dumping prices), if it is being marketed as Renewable Energy Sources electricity. In this way, not only the costs are passed on, but also the corresponding quantities of electricity. Thus there is an obligation to purchase electricity from renewable energy sources, with a quota corresponding to the average amount fed into the grid under the Renewable Energy Act.

§ 12 Progress Report

A progress report must be submitted to the German *Bundestag* every two years by the Federal Ministry of Economics and Technology, in consultation with the Federal Ministry of the Environment, Nature Conservation and Nuclear Safety and the Federal Ministry of Food, Agriculture and Forestry. The first report was due 30 June 2002. The report must deal with technical and cost-related developments and, where necessary, propose adjustments to the level of compensation for new installations.

The full text of the Act is also available on the Internet in German and English:
http://www.bmu.de.

B. Biomass Ordinance

The Ordinance on Generation of Electricity from Biomass (Biomass Ordinance – BiomasseV) of 21 June 2001 is another important element in the switch to sustainable energy which Germany has started. It will trigger investments of several billion Euro in this sector, creating jobs particularly in rural areas and resulting in climate friendly energy production from regenerative raw materials such as wood, other plant wastes, and slurry.

The Ordinance has its roots in the Renewable Energy Act 2000 and regulates which substances are defined as biomass, which technical processes for electricity generation fall under the scope of this Act, and the environmental requirements for the generation of electricity from biomass. The entry into force of the Ordinance in June 2001 has introduced compensation for biomass-generated electricity of between 8.7 and 10.23 cent per kilowatt-hour, depending on the plant's installed capacity.

In Germany, bioenergy is considered to have the potential for a similar dynamic growth like wind power. The development of power generation from biomass, however, is about 10 years behind that of wind power. A definite boost was needed in this sector to develop an energy supply which is viable for the future, and to achieve our climate protection targets. Experts estimate that under suitable conditions, by 2010 the use of biomass would allow an annual saving of around 5 to 10 million tonnes of carbon dioxide. Bioenergy is very versatile: A wide range of materials which at present often entail high costs for their waste management - as is the case with wood products - can in future be used to produce electricity, heat or a combination of both (co-generation).

C. EU-Directive on the promotion of electricity from renewable energy sources

The Directive 2001/77/EC of the European Parliament and of the Council of 27 September 2001 on the promotion of electricity produced from renewable energy sources in the internal electricity market entered into force 27 October 2002. The aim of the Directive is to help meet the Kyoto commitments and achieve the target of doubling renewable energy's contribution to Europe's gross energy consumption from its current share of 6% to 12% in 2010. In the Directive the Member States undertake to meet national targets for their future consumption of electricity from renewable energy sources, to set up a system to guarantee the origin of 'green' electricity and to put in place accompanying measures designed to create fair conditions and facilitate penetration by renewables on the internal electricity market.

Promotion of renewable energy is an absolute priority for the European Union (EU). The EU cannot achieve the Kyoto objectives for greenhouse gas emissions unless it rebalances in favour of such sources.

Background:

The Directive creates the conditions for a significant medium-term increase in green electricity in the European Union and facilitates its access to the internal electricity market. It calls on Member States to take the requisite steps to pursue this development in accordance with the energy and environmental objectives set at both national and Community level. The Directive thus provides the assurance of a regulatory framework while allowing each Member State considerable autonomy to deal with its own particular circumstances, in accordance with the principle of subsidiarity.

The Directive provides for a series of immediate and longer-term measures.
Firstly, it

- requires Member States to set national targets for their future consumption of electricity produced from renewable energy sources; and
- stipulates that the Commission is to check that these national targets are consistent with:
    - the global indicative target of 12% of gross national energy consumption at Community level,
    - the specific indicative target of generating 22% of electricity consumption from renewables,
    - the Community's climate change commitments.

Should these objectives not be met, the Commission should put forward proposals, possibly containing mandatory targets.

Secondly, with regard to schemes to support electricity from renewable energy sources, the Directive does not propose a harmonised Community-wide support scheme. Nonetheless, four years after the Directive enters into force the Commission may produce a proposal on a more harmonised support system. This proposal would take account of the experience gained by Member States from application of the various national support systems. It would be based on an evaluation by the

Commission of the various support schemes, not just for renewable sources but also for conventional energy production. In any event, it should allow for transitional periods of seven more years;

Thirdly, Member States are required to:

- ensure priority access for electricity from renewable energy sources;
- ensure accurate and reliable guarantees of origin for such electricity within two years of the Directive's entry into force,
- improve and expedite the authorisation procedures applying to plants generating green electricity,
- ensure that the method for calculating the connection costs for new producers is transparent and non-discriminatory.

ANNEX: INDICATIVE NATIONAL TARGETS

COUNTRY	**% OF ELECTRICITY FROM RENEWABLES IN 1997**	**% OF ELECTRICITY FROM RENEWABLES IN 2010**
Belgium	1.1	6.0
Denmark	8.7	29.0
Germany	4.5	12.5
Greece	8.6	20.1
Spain	19.9	29.4
France	15.0	21.0
Ireland	3.6	13.2
Italy	16.0	25.0
Luxembourg	2.1	5.7
Netherlands	3.5	9.0
Austria	70.0	78.1
Portugal	38.5	39.0
Finland	24.7	31.5
Sweden	49.1	60.0
United Kingdom	1.7	10.0
TOTAL	**13.9%**	**22%**

II. Regulations

A. Renewable Energy Act

Act on Granting Priority to Renewable Energy Sources
(Renewable Energy Act)

Section 1
Purpose

The purpose of this Act is to facilitate a sustainable development of energy supply in the interest of managing global warming and protecting the environment and to achieve a substantial increase in the percentage contribution made by renewable energy sources to power supply in order at least to double the share of renewable energy sources in total energy consumption by the year 2010, in keeping with the objectives defined by the European Union and by the Federal Republic of Germany.

Section 2
Scope of Application

(1) This Act deals with the purchase of, and the compensation to be paid for, electricity generated exclusively from hydrodynamic power, wind energy, solar radiation energy, geothermal energy, gas from sanitary landfills, sewage treatment plants, mines, or biomass within the territorial scope of this Act or within Germany's exclusive economic zone, by utility companies which operate grids for public power supply (grid operators). The Federal Ministry for Environment, Nature Conservation and Nuclear Safety shall be authorised to lay down rules– in agreement with the Federal Ministry of Food, Agriculture and Forestry as well as the Federal Ministry of Economics and Technology – by adopting an ordinance, which shall be subject to approval by the German Bundestag. Said ordinance shall specify what substances and technical processes used in connection with biomass fall within the scope of application of this Act; in addition, the ordinance shall lay down the relevant environmental standards.

(2) This Act shall not apply to electricity

1. produced by hydro-electric power plants and installations fuelled by gas from landfills or sewage treatment plants with an installed electrical capacity of over 5 megawatts, or by installations in which electricity is generated from biomass, with an installed electrical capacity of over 20 megawatts, and

2. produced by installations of which over 25 per cent is owned by the Federal Republic of Germany or one of Germany's federal states, and

3. produced by installations for the generation of electricity from solar radiation energy, with an installed electrical capacity of over five megawatts. In the case of installations for the generation of electricity from solar radiation energy which are not attached to or built on structures which

are primarily used for purposes other than the generation of electricity from solar radiation energy, the upper capacity limit specified in the first sentence above shall be 100 kilowatts.

(3) New installations shall be installations which were commissioned after [add: date of entry into force of this Act]. Reactivated or modernised installations shall be considered as new installations if major components of the installations were replaced. Modernisation work shall be deemed to be major if the modernisation costs amount to at least 50 per cent of the investment cost required to build a completely new installation. Existing installations shall be installations which were commissioned prior to [add: date of entry into force of this Act].

Section 3
Obligation to Purchase and Pay Compensation

(1) Grid operators shall be obliged to connect to their grids electricity generation installations as defined in Section 2 above, to purchase electricity available from these installations as a priority, and to compensate the suppliers of this electricity in accordance with the provisions in Sections 4 to 8 below. This obligation shall apply to the grid operator whose grid is closest to the location of the electricity generation installation, providing that the grid is technically suitable to feed in this electricity. A grid shall be considered to be technically suitable even if – notwithstanding the priority to be granted pursuant to the first sentence above – a grid operator needs to upgrade its grid at reasonable economic expense to feed in the electricity; in this case, the grid operator shall be obliged to upgrade its grid without delay if this is requested by a party interested in feeding in electricity. Grid data and data of the electricity generation installation shall be disclosed where this is necessary for the grid operator and the party interested in feeding in electricity to do their planning and to determine the technical suitability of a grid.

(2) Pursuant to Sections 4 to 8 below, the upstream transmission grid operator shall be obliged to purchase, and pay compensation for, the amount of energy purchased by the grid operator in accordance with clause (1) above. If there is no domestic transmission grid in the area serviced by the grid operator entitled to sell electricity, the next closest domestic transmission grid operator shall be obliged to purchase and pay compensation for this electricity as specified in the first sentence above.

Section 4
Compensation to be Paid for Electricity Generated from Hydrodynamic Power, Gas from Landfills, Mines, and Sewage Treatment Plants

The compensation to be paid for electricity generated from hydrodynamic power and gas from landfills, mines and sewage treatment plants shall amount to at least 7.67 cent per kilowatt-hour. In the case of electricity generation installations with an electrical capacity of over 500 kilowatts, this shall apply only to that part of the total amount of electricity fed in during a given accounting year which corresponds to the ratio of 500 kilowatts to the total capacity of the installation in kilowatts; the capacity shall be calculated as the annual average of the mean effective electrical capacity measured in the various months of the year. The price to be paid for other electricity shall be at least 6.65 cent per kilowatt-hour.

Section 5
Compensation to be Paid for Electricity Generated from Biomass

(1) The following compensation shall be paid for electricity generated from biomass:
1. At least 10.23 cent per kilowatt-hour in the case of installations with an installed electrical capacity of up to 500 kilowatts.
2. At least 9.21 cent per kilowatt-hour in the case of installations with an installed electrical capacity of up to 5 megawatts.
3. At least 8.70 cent per kilowatt-hour in the case of installations with an installed effective electrical capacity of over 5 megawatts; however, this provision shall not be effective before the date of the entry into force of the ordinance specified in the second sentence of Section 2(1).

The first clause of the second sentence in Section 4 above shall apply mutatis mutandis.

(1) As of 1 January 2002, the minimum compensation amounts specified in (1) above shall be reduced by one per cent annually for new installations commissioned as of this date; the amounts payable shall be rounded to one decimal.

Section 6
Compensation to be Paid for Electricity Generated from Geothermal Energy

The following compensation shall be paid for electricity generated from geothermal energy:
1. At least 8.95 cent per kilowatt-hour if the installation involved has an installed electrical capacity of up to 20 megawatts, and
2. At least 7.16 cent per kilowatt-hour if the installation involved has an installed electrical capacity of over 20 megawatts.

The first clause of the second sentence in Section 4 above shall apply mutatis mutandis.

Section 7
Compensation to be Paid for Electricity Generated from Wind Energy

(1) The compensation to be paid for electricity generated from wind energy shall be at least 9.10 cent per kilowatt-hour for a period of five years starting from the date of commissioning. Hence, the compensation to be paid for installations which, during this period of time, achieve150 per cent of the reference yield calculated for the reference installation as described in the Annex to this Act shall be at least 6.19 cent per kilowatt-hour. For other installations, the period mentioned in the first sentence above shall be prolonged by two months for every 0.75 per cent which their yield stays below 150 per cent of the reference yield. If the electricity is generated by installations which are located at least three nautical miles seawards from the baselines used to demarcate territorial waters and if these installations are commissioned no later than 31 December 2006, the periods specified in the first sentence and in the second sentence above shall be nine years.

(2) For existing installations, the date of commissioning as defined in the first sentence of (1) above shall be [add: the date of the entry into force of this Act]. For these installations, the period defined in the first 3 sentences of (1) above shall be reduced by half of the operating life of an installation as of [add: the date of the entry into force of this Act]; in any case, however, this

period shall not be less than four years starting from [add: the date of the entry into force of this Act]. If P-V curves are not available for such installations, an authorised institution as defined in the Annex may perform the necessary calculations on the basis of the design documents of the type of installation concerned.

(3) As of 1 January 2002, the minimum compensation amounts specified in (1) above shall be reduced by 1.5 per cent annually for new installations commissioned as of this date; the amounts payable shall be rounded to one decimal.

(4) For the implementation of the provisions in (1) above, the Federal Ministry of Economics and Technology shall be authorised to adopt an ordinance laying down rules for the calculation of the reference yield.

Section 8
Compensation to be Paid for Electricity Generated from Solar Radiation Energy

(1) The compensation to be paid for electricity generated from solar radiation energy shall be at least 50.62 cent per kilowatt-hour. As of 1 January 2002, the minimum compensation paid shall be reduced by 5 per cent annually for new electricity generation installations commissioned as of this date; the amounts payable shall be rounded to one decimal.

(2) The obligation to pay compensation as specified in (1) above shall not apply to photovoltaic installations which are commissioned after 31 December of the year following the year in which photovoltaic installations which are eligible for compensation under this Act reach a total installed capacity of 350 megawatts. Prior to the discontinuation of the obligation to pay compensation as specified in (1) above, the German Bundestag shall adopt a follow-up compensation scheme which shall enable installation operators to manage their installations cost-effectively, taking into consideration the decline of marginal unit cost achieved by then in the field of system engineering.

Section 9
Common Provisions

(1) The minimum compensation amounts specified in Sections 4 to 8 shall be payable for newly commissioned installations for a period of 20 years after the year of commissioning, except for installations which generate electricity from hydrodynamic power. For installations which were commissioned prior to the entry into force of this Act, the year 2000 shall be considered to be the year of commissioning.

(2) If electricity generated from various installations is billed via a common metering device, the calculation of the amounts of the different rates of compensation payable shall be based on the maximum effective capacity of each individual installation. If electricity is generated from several wind energy converters, the calculation of the compensation shall – notwithstanding the first sentence above – be based on the cumulative values of these installations.

Section 10

Grid Costs

(1) The costs associated with connecting installations as specified in Section 2 above to the technically and economically most suitable grid connecting point shall be borne by the installation operators. The implementation of this connection must comply with the grid operator's technical requirements in a given case and with the provisions laid down in Section 16 of the *Energiewirtschaftsgesetz* (Energy Management Act) of 24 April 1998 (Federal Law Gazette I, p. 730). The installation operator shall be entitled to have the connection implemented either by the grid operator or by a qualified third party.

(2) The costs associated with upgrading the grid exclusively in order to connect new installations in accordance with Section 2 for accepting and transmitting energy fed into the grid for public power supply shall be borne by the grid operator whose grid will have to be upgraded. The grid operator shall specify the concrete investment required by presenting the costs in detail. The grid operators shall be entitled to add the costs borne by them when determining the charges for the use of the grid.

(3) Any disputes shall be settled by a clearing centre which shall be established within the Federal Ministry of Economics and Technology, with the involvement of the parties concerned.

Section 11
Nation-wide Equalisation Scheme

(1) Transmission grid operators shall be obliged to record any differences in the amount of energy purchased and compensation payments made under Section 3 above and to equalise such differences amongst themselves as specified in (2) below.

(2) By 31 March of each year, the transmission grid operators shall determine the amount of energy purchased in accordance with Section 3 above and the percentage share which this amount represents relative to the overall amount of energy delivered to final consumers either directly by the operator or indirectly via downstream grids. If transmission grid operators have purchased amounts of energy that are greater than this average share, they shall be entitled to sell energy to, and receive compensation from, the other transmission grid operators in accordance with Sections 3 to 8 above, until these other grid operators have purchased a volume of energy which is equal to the average share mentioned above.

(3) Monthly instalments shall be paid in accordance with the equalisation amounts and payments to be expected.

(4) Utility companies which deliver electricity to final consumers shall be obliged to purchase and pay compensation for that part of the electricity which their regular transmission grid operator purchased in accordance with the provisions of (2) above. The first sentence shall not apply to utility companies if, relative to the total amount of electricity they deliver, at least 50 per cent of the electricity delivered is electricity as defined in Section 2 (1) in conjunction with (2) above. The part of the electricity to be purchased by a utility company in accordance with the first sentence shall be related to the amount of electricity delivered by the utility company concerned and shall be determined in such a way that each utility company will receive a relatively equal share. The compulsory amount to be purchased (part) shall be calculated as the ratio of the total amount of electricity fed into the grid under Section 3 to the total amount of electricity sold to final consumers; furthermore, it is necessary to deduct from this sum the amount of electricity

delivered by utility companies in accordance with the second sentence above. The compensation as specified in the first sentence above shall be calculated as the average compensation per kilowatt-hour paid by all grid operators two quarters earlier in accordance with Section 3. Electricity purchased in accordance with the first sentence shall not be sold at the compensation paid in accordance with the fifth sentence, if that electricity is marketed as electricity pursuant to Section 2 or as comparable electricity.

(5) Each grid operator shall be obliged to make available in good time to the other grid operators the data required to perform the calculations referred to in (1) and (2) above. Each grid operator shall be entitled to request that the other grid operators have their data audited by a chartered accountant or a sworn auditor appointed by mutual agreement. If no agreement can be reached, the chartered accountant or sworn auditor shall be appointed by the President of the Higher Regional Court which has jurisdiction at the seat of the grid operator eligible to receive equalisation payments.

Section 12
Progress Report

By 30 June, every two years after the entry into force of this Act, the Federal Ministry of Economics and Technology shall submit a report – drafted in consultation with the Federal Ministry for Environment, Nature Conservation and Nuclear Safety as well as the Federal Ministry of Food, Agriculture and Forestry – on the progress achieved in terms of the market introduction and the cost development of power generation installations as specified in Section 2; and by 1 January, every two years after the year of entry into force of this Act, the Ministry shall, where necessary, propose adjustments of the compensation amounts specified in Sections 4 to 8 and of their reduction rates, in keeping with technological progress and market developments with regard to new installations; furthermore, the Ministry shall propose a prolongation of the period for calculating the yield of a wind energy converter as specified in the Annex, based on the experience made with the period defined in this Act.

Annex

1. The reference installation shall be a wind energy converter of a specific type for which a yield at the level of the reference yield can be calculated on the basis of P-V curve (power-wind speed curve) measured by an authorised institution at the reference site.

2. The reference yield shall be the amount of electricity which each specific type of wind energy converter, including the respective hub heights, would yield during five years of operation – calculated on the basis of measured P-V curves – if it were built at the reference site.

3. The type of a wind energy converter shall be defined by the model designation, the swept rotor area, the rated power output and the hub height as specified by the manufacturer.

4. The reference site shall be a site determined by means of a Rayleigh distribution with a mean annual wind speed of 5.5 metres per second at a height of 30 metres, a logarithmic wind shear profile and a roughness length of 0.1 metres.

5. The P-V curve shall be the correlation between wind speed and power output (irrespective of hub height) determined for each type of wind energy converter. P-V curves shall be determined in accordance with the standard procedure defined in the *Technische Richtlinien für Windenergieanlagen* (Technical Guidelines for Wind Energy Converters), rev. 13, as of 1 January 2000, published by *Fördergesellschaft Windenergie e.V.* (FGW), Hamburg, or in the Power Performance Measurement Procedure, version 1, published in September 1997 by the Network of European Measuring Institutes (MEASNET), Brussels/Belgium,. P-V curves which were determined by means of a comparable procedure prior to 1 January 2000 can also be used instead of P-V curves as specified in the second sentence, providing that the construction of wind energy converters of the type to which they apply is not initiated within the territorial scope of this Act after 31 December 2001.

6. Measurements of the P-V curves and calculations of the reference yields of different types of wind energy converters at reference sites shall be carried out for the purposes of this Act by institutions which are accredited for the measurement of P-V curves as defined in (5) above in accordance with the General Criteria for the Operation of Test Laboratories (DIN EN 45001) of May 1990. The names of these institutions shall be published in the Federal Official Gazette by the Federal Ministry of Economics and Technology for the information of interested parties.

B. Renewable Energy Act - Explanatory Memorandum

A. General Provisions

For the sake of protecting the environment and managing global warming as well as guaranteeing a reliable energy supply, the German Federal Government and the German Bundestag – in agreement with the European Union – have set themselves the objective of at least doubling the percentage share of renewable energy sources in total energy supply by the year 2010. This objective is related to the envisaged commitment on the part of the Federal Republic of Germany to reduce greenhouse gas emissions by 21 per cent by the year 2010 in the framework of the European Union's burden sharing as laid down in the Kyoto Protocol to the Framework Climate Convention of the United Nations; and this objective is linked to the German Federal Government's objective to reduce carbon dioxide emissions by 25 per cent by the year 2005, relative to 1990.

In order to attain this objective, it is necessary to mobilise the so-called new renewable energy sources. Traditional hydrodynamic power from large dams accounts for the overwhelming share of the renewable energy sources used today. For geographical reasons, the utilisation potential of hydrodynamic power is largely exhausted. For this reason, it is necessary additionally to generate electricity from wind energy, solar radiation energy, biomass, and hydrodynamic power of rivers in order to attain the objective set for Europe as a whole by the year 2010. To this end, the currently used potential of these energy sources will have to grow fivefold.

In order to translate this objective into reality, the European Commission has proposed a number of energy policy measures in its communication entitled "The Energy Policy Dimension of Climate Change", in which renewable energy sources play a key role. The purpose of the Act on Granting Priority to Renewable Energy Sources (Renewable Energy Act) is intended to help attain these objectives and to implement the European Union's "Campaign for a Breakthrough of Renewable Energy Sources". In view of growing meteorological evidence of a warming of the Earth's atmosphere and the increase in the frequency of natural disasters world-wide, prompt action by the legislator is indispensable in the interest of protecting the environment and managing global warming.

Currently, renewables are unevenly and insufficiently used, although many renewable energy sources are available in large quantities. Despite their considerable economic potential, they account for an extremely low share of the total, statistically identified gross domestic energy consumption. If we fail to cover a much larger share of our energy requirements by means of renewable energy sources, there will be two consequences: not only will we find it more and more difficult to meet our obligations in the fields of environmental protection and global warming management, at both European and international level, but we will also miss out on major economic development opportunities. Renewables are domestic energy sources which can help to reduce our dependence on energy imports, thereby making our energy supply more reliable. Currently, the EU depends on energy imports to cover approximately 50 per cent of its energy consumption; and there is a risk that this figure will rise to 60 per cent by the year 2010 and 70 per cent by the year 2020 if we do not tap the potential of renewable energy sources.

Greater use of renewable energy sources will create jobs, especially in the sector of small and medium-sized enterprises, which play a crucial role in the economic structure of the Federal Republic of Germany. Small and medium-sized enterprises are not only an important factor in crafts and trades; they also provide an impetus for a variety of industries, including the metal industry, electrical engineering, mechanical engineering, engine and equipment engineering, as well as the

building materials industry. The stimulation of the use of biomass for electricity generation associated with the adoption of this Act will also provide a major impetus for an economic recovery of the agricultural sector. Furthermore, the production and use of renewable energy sources will promote sustainable regional development, which will help to improve the social and economic cohesion within the Community and to harmonise living conditions within the Federal Republic of Germany.

In three European countries – Germany, Denmark and Spain – national legislation has been adopted to introduce minimum prices for feeding into grids electricity generated from renewable energy sources. It is owing exclusively to the national legislation of these three countries that the European Union witnessed the emergence of a wind turbine manufacturing industry which offers cutting-edge technology in the world market today. This also proved that it was wrong to assume that the introduction of minimum price systems would hamper productivity, because in all the three countries mentioned above the introduction of wind energy converters was based on minimum prices guaranteed by law. This has stimulated a market development – initially in the wind energy sector – which led to an efficient industry with considerable export opportunities, which has created jobs for over 20,000 people in Germany alone. As a result of the associated economies of scale and the global competition initiated among manufacturers of wind energy converters, production costs as well as the compensation paid in real terms have been successfully reduced by 50 per cent since 1991. Owing to technological progress, there is growing demand in the world market; in the next ten years, demand for wind energy converters alone may amount to over 100,000 megawatts. Against this background, the market introduction of renewable energy sources should not be underestimated in terms of its importance for industrial policy, not least because it can be safely assumed in view of global climate problems that there will be rapidly growing demand world-wide. It can be expected that the impact which the Renewable Energy Act will have on other sectors in which renewable energy sources are used will be similar to the effects which it will have on the wind energy sector.

In the past, the *Stromeinspeisungsgesetz für Erneuerbare Energien* (Act on Feeding into the Grid Electricity Generated from Renewable Energy Sources)[1], which entered into force on 1 January 1991, has mainly provided an impetus for the wind energy sector because the compensation rates laid down in the Act made this possible. By the end of 1999, i.e. nine years after the entry into force of the Act, as much as approximately 4,400 megawatts had been installed within the territorial scope of the Act, accounting for about one-third of the capacity installed world-wide. For hydro-electric power plants below the capacity limit of five megawatts laid down in this Act, the compensation rates specified have been more or less sufficient to permit cost-effective operation. Nevertheless, the Act has not brought about a level of utilisation of the existing potential that would be comparable to the use of wind energy because there are still many licensing obstacles that are beyond the scope of this Act; at least the Act has helped to stabilise the potential of hydro-electric power plants which was partially jeopardised before the entry into force of this Act. However, the compensation rates have not been sufficient to stimulate a large-scale market introduction of electricity generated from other sources, especially photovoltaic cells and biomass. For this reason, the compensation rates have been modified in the Renewable Energy Act, which replaces the Electricity Feed Act[1], in order to promote large-scale generation of electricity from all kinds of renewable energy sources.

However, the adoption of the Renewable Energy Act has also become necessary for other reasons:

- The coupling of the current compensation rates to the development of the power rates can no longer be maintained without risking a disruption in the use of renewable energy sources. The

[1] also referred to as Act on the Sale of Electricity to the Grid

non-simultaneity of liberalisation in the various national electricity markets of the European Union without any practicable reciprocity clauses between markets that are already fully liberalised and others which are still protected; the abundance of capacity which was created without risk during the days of territorial monopolies and which has been largely written off; the fact that the "unbundling" of electricity generation, transmission and distribution is far from being implemented; the competitive advantages enjoyed by the German utility corporations due to the fact that they can use their tax-free nuclear provisions (which by now amount to over DM 70 billion) at their discretion for investments: for all of these reasons, it is not likely that a price will settle down in the electricity market which will reflect the actual medium-term and long-term costs of electrical power supply. For this reason, it is initially necessary to set fixed prices for renewable energy sources in order to safeguard a continuous increase in the use of renewable energy sources, which is undeniably necessary.

- The Electricity Feed Act[1] currently in force has led to an unequal distribution of burdens among the utility companies which are obliged to pay compensation. The percentage "capping" of the amount of electricity that can be fed into the grid, which was introduced with the second amendment of 1998, needs adjusting because this upper limit brings the utilisation of wind energy in the northern German region already close to the point of market introduction. The purpose of the Renewable Energy Act is therefore to abolish this upper limit, while at the same time introducing an non-bureaucratic mechanism that will evenly distribute extra cost among all utility companies.

- Since the previous Electricity Feed Act[1] was aimed at utility companies which could act as producers, regional grid operators and distributors at the same time, it is now necessary because of the new energy management legislation to redefine both the addressee of electricity to be fed into the grid and the company obliged to pay compensation.

The compensation scheme defined in the Renewable Energy Act is based on the systematic approach introduced in the Electricity Feed Act[1] and guided by the recommendations presented by the European Commission in its White Paper on "Energy for the Future: Renewable Sources of Energy" as well as the relevant resolutions adopted by the European Parliament. The compensation rates specified in the Renewable Energy Act have been determined by means of scientific studies, subject to the proviso that the rates identified should make it possible for an installation – when managed efficiently – to be operated cost-effectively, based on the use of state-of-the-art technology and depending on the renewable energy sources naturally available in a given geographical environment. However, there is no guarantee that the cost of a given installation will be covered.

In some cases, the cost of the production of renewable energy sources is still much higher than the production cost of conventional energy sources. This is largely due to the fact that the overwhelming share of the external costs associated with the generation of electricity from conventional energy sources is not reflected in the price; instead, these costs are borne by the general public and by future generations. In addition, conventional energy sources still benefit from substantial governmental subsidies which keep their price artificially low. Another reason for the higher costs is the structural discrimination of new technologies. Their lower market share does not allow economies of scale to become effective. Lower production volumes lead to higher unit cost and thus reduce competitiveness, which in turn prevents higher production volumes, like in a vicious circle.

For this reason, the purpose of this Act is not only to protect the operation of existing installations but also to break this vicious circle and to stimulate a dynamic development in all fields of electricity generation from renewable energy sources. In combination with measures aimed at

internalising external costs, the purpose of this pricing regime is to bring renewable energy sources closer to conventional energy sources in terms of their competitiveness. In order to continue to facilitate major improvements in technological efficiency, the compensation rates specified in the Renewable Energy Act vary, depending on the energy sources, the sites and the installation sizes involved; furthermore, they will decline over time and will remain in effect for a limited period of time. The fact that the rates will be reviewed every two years guarantees that they will be updated continuously and at short intervals to reflect market and cost trends.

The German Bundestag and the German Federal Government feel – in line with the established practice of the European Court of Justice – that the Renewable Energy Act does not constitute aid granted by a Member State or through state resources as defined in Article 87 of the Treaty Establishing the European Community (ECT).

In accordance with the wording of Article 87 ECT, the European Court of Justice has consistently ruled that the only benefits which can be regarded as state aid as defined in the Treaty are benefits which are granted – directly or indirectly – from state resources. This obviously does not apply to the Renewable Energy Act. It does not imply any benefits in cash or kind to be made available – either directly or indirectly or subsequently – by public authorities, nor does it imply any renunciation of tax revenues or other payments in cash or in kind owed to the public sector. Instead, the compensation payments made are straightforward financial transfers which, in accordance with the 'polluter pays' principle laid down in Community law, are used directly to cover electricity production costs. In a case involving a similar pricing regime, the European Court of Justice therefore stated quite clearly that a measure which is characterised by the fact that minimum prices are set with the objective of benefiting the seller of a product exclusively at the expense of the consumer did not constitute state aid.

In addition, compensation paid under this Act cannot be state aid from a terminological perspective because operators of installations for the generation of electricity from renewable energy sources are not granted any benefits; instead, the Act compensates disadvantages which such operators have in comparison with conventional electricity producers. After all, most of the social and ecological follow-up costs associated with conventional electricity generation are currently not borne by the operators of such installations but by the general public, the taxpayers and future generations. The Renewable Energy Act merely reduces this competitive advantage which conventional electricity generators have vis-à-vis operators generating electricity from renewable energy sources which cause only limited external costs.

In no other field is the introduction of a pricing regime at the expense of polluters more legitimate and more justifiable than in the field of energy supply because of the ecological damage associated with conventional electricity generation. The Renewable Energy Act, which is designed to promote the market introduction of emission-free and sustainable energy sources to substitute for conventional energy sources, provides for strictly consistent, equal burden sharing among all power suppliers. This is in keeping with the 'polluter pays' principle established in environmental protection. This principle is part and parcel of the primary law laid down in the EC Treaty, which in its Article 6 stipulates compliance with ecological interests.

The Renewable Energy Sources for which the Act provides compensation payments cannot be obtained anywhere at lower prices. For this reason, the pricing scheme specified in the Act is not an instrument for artificially supporting the "commodity" kilowatt-hour of electricity generated from renewable energy sources; instead, the prices specified in the Act will permit operators to manage their installations cost-effectively in the first place.

The key regulatory element contained in the Renewable Energy Act is the obligation to purchase electricity generated from renewable energy sources, based on the amount of electricity generated during a calendar year, calculated as a ratio of the total amount of electricity sold. Such obligations are usually imposed when the movement of goods poses serious risks to external interests and when those who are responsible for such risks are not expected to take any voluntary action or sufficient action to prevent such risks. The consumption of electricity in the free market poses such risks to the climate and to the environment. Hence, the Renewable Energy Act can be characterised as a protective standard. Such standards are quite commonly used without this constituting state aid: The fact that it is prohibited to sell alcoholic beverages to adolescents, for instance, does not constitute state aid for non-alcoholic beverages. And systematically reducing the price of lead-free petrol despite higher production costs does not constitute state aid; instead, it is a buying and investing incentive based on the 'polluter pays' principle.

The provisions of the Renewable Energy Act are based on Directive 96/92/EC of the European Parliament and the Council of 19 December 1996 concerning common rules for the internal market in electricity, in particular Articles 3 (2), 7 (5), 8 (3) and (4), as well as Art. 11 (3); furthermore, these provisions are designed to implement Article 20a of the German Constitution, which stipulates that, as a responsibility vis-à-vis future generations, natural resources must be protected because they are the very basis of human survival; and finally, the provisions are aimed at implementing the environmental protection objectives laid down in Articles 2, 6, and 10 of the Treaty Establishing the European Community.

B. Special Provisions

Section 1

Paragraph 1

Paragraph 1 specifies the purpose of this Act. The Act is designed to achieve sustainable energy supply in the interest of protecting the environment and managing global warming. Hence, it is an instrument for the implementation of the objectives agreed in the United Nations Framework Climate Convention and for the implementation of the climate strategies pursued by the European Union and the Federal Republic of Germany.

Paragraph 2

The objective of doubling the percentage share of renewable energy sources in total energy supply was already stipulated in the European Commission's White Paper on "Energy for the Future: Renewable Sources of Energy", and it has been confirmed by the Council of Ministers. The German Federal Government has also endorsed this objective. And the Renewable Energy Act is evidence of the German Bundestag's explicit support of this objective.

In the next few decades, renewable energy sources will have to make relevant contributions to energy supply and thus to global warming management. Hence, in the interest of sustainable energy supply, it will be necessary in the next decade to double or triple the contribution made by renewable energy sources to electricity generation. The European Commission feels that renewable energy sources should account for 23.5 per cent of total European power supply by the year 2010. Germany – where renewable energy sources currently account for approximately six per cent of the national power supply – is far below the European average.

Section 2

Paragraph 1

Paragraph 1 provides a positive list of the renewable energy sources to which this Act applies. Like the Electricity Feed Act[1], it covers hydrodynamic power, wind energy, landfill gas, gas from sewage treatment plants, and biomass.

The term "solar energy", which was still used in the Electricity Feed Act[1], has been replaced by "solar radiation energy", which is correct in terms of physics. The installations which this term refers to include in particular photovoltaic installations and installations for solar thermal electricity generation.

Geothermal energy, which had not been covered by the Electricity Feed Act[1], has been added to the scope of application of this Act in order to render the vast potential of geothermal energy accessible for use.

The use of mine gas for electricity generation will improve the carbon dioxide and methane balance, relative to the release of these substances into the atmosphere without utilising them. For this reason, mine gas was included in the scope of application of this Act.

In this Act – like in the Electricity Feed Act[1] – hydrodynamic power means the use of original, renewable hydrodynamic power in run-of-river and storage power stations fed exclusively from natural water resources.

The term "biomass" has not been conclusively defined. However, with a view to the purpose of this Act as specified in Section 1, it certainly does not include fossil fuels such as oil, coal and gas which will not be renewed within reasonable periods of time. The term "biomass" comprises solid, liquid and gaseous fuels which originate in recently harvested crops including timber and harvest residues, as well as waste wood and organic waste from food production and animal husbandry.

This Act maintains the principle of exclusive use introduced in the Electricity Feed Act[1]. According to this principle, privileges under the Act will be granted only to those forms of electricity generation which are based exclusively on the use of the energy sources specified, unless the generation of electricity from renewable energy sources is only possible in the presence of priming or supporting fuels. As a general rule, it is not in keeping with the principle of exclusive use if materials such as harbour sludge, surface-treated railway sleepers, particle boards with synthetic components or other types of contaminated waste wood are used for the generation of electricity. In accordance with the purpose of this Act as specified in Section 1, the key criterion is that the electricity generation process used should not compromise the environment or the climate. In order not to rule out from the very beginning processes which make ecological and economic sense but which are still under development, und in order to correct misguided developments where necessary, the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety will be in charge of monitoring and reviewing developments; and the Ministry is authorised to adopt provisions which will specify what substances and technical processes in the biomass segment fall into the scope of application of the Act, and what environmental standards will have to be observed. What is important for the legislator in the final analysis is that the various processes used should make sure that the harmful substances contained in the biomass will, as far as possible, be

accumulated in the residues instead of being released to the environment via the atmosphere or water.

In all other respects, the provisions of the *Gesetz zum Schutz vor schädlichen Umwelteinwirkungen durch Luftverunreinigungen, Geräusche, Erschütterungen und ähnliche Vorgänge* (*Bundesimmissionsschutzgesetz* – Act for the Protection against Harmful Environmental Effects Caused by Air Pollution, Noise, Vibration and Similar Factors – Federal Ambient Pollution Control Act)[2] as well as the relevant implementing regulations will apply. In addition, an implementing regulation for the *Kreislaufwirtschafts- und Abfallgesetz* (Recycling and Waste Management Act)[3], which will deal with the treatment of waste wood, is in the process of being prepared.

The scope of application of the Act also covers biogas which is generated elsewhere and fed into the gas network when such biogas is used for electricity generation, providing that proof is furnished of the origin of this gas and providing that there are calculations which prove that the energy content of the gas quantity used is equal to the energy content of the biogas quantity fed into the network.

The scope of application of the Act is extended to include the exclusive economic area located outside the 12-mile zone in order to facilitate the implementation of offshore wind projects in this area.

The term "grid operator" is used as defined in the *Gesetz über die Elektrizitäts- und Gasversorgung* (Electricity and Gas Supply Act). It should be emphasised that only operators of public supply grids are obliged to purchase and pay compensation for electricity fed into their grids.

Paragraph 2

Paragraph 2 specifies electricity generation installations which are excluded from the scope of application of this Act. Like the Electricity Feed Act[1], the present Act does not cover large-scale hydro-electric power plants, as well as large installations generating electricity from landfill gas and gas from sewage treatment plants. On the one hand, this is because it can be assumed that large-scale installations can be operated cost-effectively even without being included in the scope of application of this Act; and on the other hand, it is intended that especially decentralised smaller installations should become the pillar of future energy supply.

As far as electricity generation from biomass is concerned, this Act covers a wider range of installations than previous legislation. The scope of application covers biomass installations with a capacity of up to 20 megawatts in order to tap additional potential and mobilise efficiency reserves.

In addition, physically separate installations will be treated separately in terms of the scope of application, even if they use a common line to feed in electricity.

In the interest of equal treatment, the scope of application now also covers installations operated by electricity producers which had been excluded in the past. The "unbundling" of the activities of producers, regional grid operators and distributors, which the new energy legislation calls for, legally puts producers of electricity from renewable energy sources on an equal footing with conventional electricity producers. As a result, all producers will be motivated to invest in renewable energy sources.

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[2] also referred to as Federal Immission Control Act

[3] also referred to as Closed Substance Cycle and Waste Management Act

In addition, there is a limitation for installations used for the generation of electricity from solar radiation energy. The purpose of this limitation is to prevent a continuation of the sealing of open spaces. The building structures specified in the Act which are covered by the rules on compensation include roofs, facades, noise protection walls and in some cases also embankments not exclusively designed for the purpose of electricity generation from solar radiation energy.

Paragraph 3

Paragraph 3 defines the terms "existing installations" and "new installations" as used in this Act. These definitions are particularly relevant for wind energy converters. Hence, the yardstick for determining the investment cost associated with the construction of a new installation is only the cost incurred above the foundation level.

Section 3

Paragraph 1

The obligation to connect electricity generators, purchase their electricity and pay compensation for the electricity purchased is now incumbent upon the grid operator whose grid is geographically closest to the electricity generator. This makes more economic sense than the reference to supply areas found in the provisions of the Electricity Feed Act[1].

The grid operators still are the right addressees for the obligation to connect electricity generators, purchase electricity, and pay compensation for, the electricity purchased because they own a natural monopoly which in practice is not jeopardised by the deglomeration of utility companies and the liberalisation of the electricity market.

It is clearly stated that the obligation to purchase, and pay compensation for, electricity is not limited to "excess electricity"; instead, this obligation applies to the entire amount of electricity offered to the grid operator.

In line with the European Union's Internal Market for Electricity Directive, the Act stipulates that renewable energy sources should be granted priority when purchasing and paying compensation for electricity. Consequently, grid operators cannot refuse to purchase and pay compensation for electricity generated from renewable energy sources by stating that the power supply requirements of their grids are already fully met by means of conventionally generated electricity. For the same reason, it will only be necessary to expand the grid if the grid's power supply requirements are already fully met by means of electricity generated from renewable energy sources. This will tend to be the exception to the rule. For this reason, it is justified that the grid operator in this rare case will be obliged to upgrade the grid if an eligible electricity generator, as defined in this Act, wants to feed in electricity. In keeping with the principle of proportionality, this obligation on the part of the grid operators is limited by what is economically no longer reasonable.

Since both grid operators and electricity generators interested in feeding in electricity have to carry out complex planning processes and take decisions affecting the use of their assets, both are obliged to provide to the other the data required.

Paragraph 2

The transmission grid operator which is upstream from the grid operator as defined in paragraph 2 is obliged to accept the electricity purchased by the grid operator under this Act, and to pay compensation for this electricity as specified in Sections 4 to 8.

Sections 4 to 8

The compensation scheme laid down for all renewable energy sources which are within the scope of application of this Act is guided by the principle that operators of optimised installations for the generation of electricity from renewable energy sources should generally be enabled to run these installations cost-effectively when these are managed efficiently. The most important factors included in the calculation of the compensation rates are the investment cost, the operating cost, the metering cost and the cost of capital for a specific type of installation relative to the service life, as well as the market return on capital employed.

In order to limit the administrative effort required– especially for the parties feeding electricity into the grid from small decentralised installations, but also for grid operators and governmental authorities – the Act upholds the principle of applying a uniform compensation rate nation-wide because this dispenses with the need for examining the cost or controlling the economic efficiency of electricity generating installations on a case-by-case basis. Such a lump-sum approach cannot and will not guarantee that a profitable compensation will be paid in every single case. For this reason, the compensation rates specified in this Act are minimum amounts; hence, higher compensation rates can be paid as a means of systematically promoting specific technologies. In this way, it is possible to attain the objectives pursued by this Act more effectively than by exclusively applying the lump-sum provisions contained in this Act.

It is up to the Federal Ministry of Economics and Technology – in agreement with the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety and the Federal Ministry of Food, Agriculture and Forestry – to monitor developments in this field and, where necessary, to propose differentiated adjustments of the compensation rates to be paid for new installations in accordance with Section 12 of this Act.

In order to allow for technological progress and the expected reduction of costs, the compensation rates will be subject to nominal degressive annual reductions as of the year 2002; these reductions – which will apply across the board to all electricity generating installations built in the same year – will amount to 1 per cent for biomass, 1.5 per cent for wind energy, and 5 per cent for photovoltaic energy. As far as installations for the generation of electricity from hydrodynamic power, landfill gas, mine gas and gas from sewage treatment plants are concerned, on the other hand, their cost reduction potential has already largely been exhausted. The remaining cost-cutting potential will be adequately covered by the inflation rate. Currently, there is no need to introduce specific provisions for geothermal electricity generating installations because it will take some years before such systems will be operational.

With the exception of wind energy converters, existing and newly built installations will be treated alike. This general rule does not apply to wind energy converters because under the former Electricity Feed Act[1], the latter have already benefited from compensation payments which have permitted a cost-effective operation of such installations at suitable sites. For this reason, the period

of time during which the higher initial compensation rate applies is reduced from five to four years for existing wind energy converters. This should be sufficient to safeguard existing installations.

Section 4

The provisions contained in the Electricity Feed Act[1] with regard to electricity generation from hydrodynamic power, landfill gas and gas from sewage treatment plants have essentially been maintained because they have proven to be effective in the past; the scope of these provisions was extended to include installations generating electricity from mine gas.

Section 5

The use of biomass for the purpose of electricity generation represents a hitherto inadequately used potential to supply energy in a way which does not lead to an adverse impact on the climate. At the same time, biomass provides additional perspectives for the domestic agriculture and forestry. The compensation rates have to be increased substantially above the rates laid down in the Electricity Feed Act[1] in order to enable operators of biomass installations to operate their installations cost-effectively, thereby initiating a dynamic development. Compensation rates differ in accordance with the electrical capacity of installations in order to give due account to the fact that the power production costs of smaller decentralised installations are higher.

The provision to the effect that compensation will not be paid before the entry into force of the ordinance applies only to electricity generating installations with a capacity of over five megawatts. Compensation for electricity from installations with a capacity less than 5 megawatts will be paid after the entry into force of this Act.

Section 6

The use of geothermal energy for the purpose of electricity generation depends on the presence of a reliable legal setting for investors; the purpose of the provisions in Section 6 is to create such a setting.

Section 7

The previous provisions applying in the field of wind energy systems did not give due account to the differences prevailing between various sites. In the amended version of the relevant provisions, different compensation rates are specified; irrespective of the type of technology used, the rates vary as a function of site profitability. Compared to the previous provisions, the new provisions – when applied to electricity generating installations over a service life of twenty years – on balance lead to the following results: at very good sites, compensation rates will be reduced to 13.5 pfennigs per kilowatt-hour; at sites with average wind conditions, the rates will be stabilised at 16.4 pfennigs per kilowatt-hour, and at inland sites, the rates will be moderately increased to 17.3 pfennigs per kilowatt-hour. The purpose of these new provisions is to avoid payment of compensation rates that

are higher than what is required for a cost-effective operation of such installations, and to create an incentive for installing wind energy converters at inland sites. Compensation rates differ because of the different periods of time during which the initial compensation rates will be paid. In addition, the higher initial compensation rate will facilitate the financing of wind energy converters which was increasingly being questioned by credit institutions when the previous provisions were in force.

The period during which the higher initial compensation rate will be paid is calculated by means of a comparison with a reference installation. This calculation is based on the P-V curve of the reference installation, determined either in accordance with the technical guidelines for wind energy converters published by *Fördergesellschaft Windenergie* (FGW – Association for the Promotion of Wind Energy) or in accordance with the Power Performance Measurement Procedure defined by the Network of European Measuring Institutes (MEASNET), which was funded by the European Commission. The purpose of the provisions concerning the key features to be used to determine identical installation models is first of all to prevent manipulation by turbine manufacturers or operators; and secondly, the provisions are designed to clarify that it will not be necessary to repeat the calculation every time the installation is modified.

The following example may help to illustrate how to calculate the prolongation of the period during which the higher initial compensation rate will be paid: A site with a reference yield of 144 is six percentage points below the reference level of 150. Divided by 0.75 per cent of the reference yield, as specified in the provisions of Section 7 (1), these six percentage points give 8, which must then be multiplied by 2 months, again as specified in the provisions. The result is 16 months, which must be added to the basic period of five years. Hence, the higher compensation rate will be paid for a period of 6 years and 4 months.

The electricity production costs of offshore wind energy converters are expected to decrease substantially in the future. At present, however, the investment cost is much higher than the cost of onshore installations due to the lack of experience, higher expenses for new converter models, complicated foundation work and the lack of economies of scale. The purpose of the special provisions for offshore installations, which will be in effect for a limited period of time, is to make up for this shortcoming and to create incentives for investments. The relevant provisions apply to wind energy converters which are located at least three nautical miles seawards from the baselines. However, the resulting line is not completely identical with the seaward demarcation line of the former three-mile zone.

Section 8

Paragraph 1

In the long term, the use of solar radiation energy holds the greatest potential for providing energy supply which does not have an adverse impact on the climate. This energy source both requires sophisticated technology and will attain considerable economic importance in the future. The relatively high compensation rate is due to the fact that, because of insufficient demand, these electricity generating installations are currently not yet produced in sufficient quantities.

As soon as this Act has created sufficient demand, the large production volumes which will result can be expected to lead to a substantial reduction in manufacturing cost, and hence, in electricity production cost, so that the compensation rates can be allowed to decrease rapidly. In addition to the real reduction of compensation payments due to inflation, the development described above is

anticipated in this Act by stipulating degressive compensation rates. For electricity generating installations which will become operational after 1 January 2003 and in subsequent years, the compensation rates – for newly commissioned installations only – will once again be reduced degressively by five percent.

In combination with the "100,000 Roofs Programme", the provisions in Section 8 (1) lead to compensation payments which for the first time make electricity generation from solar radiation energy an attractive option for private investors; however, in many cases, the compensation specified does not permit a profitable operation of such installations at all times. The level of compensation has also been influenced by the compensation rates currently paid in Spain. In this context, it should be borne in mind that solar radiation intensity is much greater in Spain than in Germany.

Paragraph 2

For electricity generated from solar radiation energy, the obligation to pay the compensation rates specified in Section 8 (2) will end as of 31 December of the year following the year in which the total installed capacity of photovoltaic installations which are eligible to receive compensation under the present Act surpasses the limit of 350 megawatts. The waiting period of twelve months has been introduced in order not to create any uncertainty in the market and to enable market players to prepare for a smooth transition. The limit of 350 megawatts was calculated by adding the 300-megawatt target of the "100,000 Roofs Programme" to the capacity of the currently installed base.

In the framework of the present Act, the German Bundestag will introduce provisions for compensation payments to be made during the follow-up period to ensure that cost-effective operation of photovoltaic installations will be possible – giving due account of the decline in the marginal unit cost achieved by then – and to ensure that the photovoltaic sector will grow at an increasing pace.

Section 9

Paragraph 1

The fact that compensation payments are limited to a period of 20 years is in keeping with calculation formulas and amortisation cycles commonly used in the energy sector. Only in the case of hydroelectric power is this period usually not sufficient to safeguard the profitability of the installations.

The fact that the period during which compensation will be paid for electricity generated from already existing installations is calculated as of 1 January 2000 is designed to protect the installed base of operators of such existing installations.

Paragraph 2

If electricity supplied from several wind energy converters is billed on the basis of a single metering device, these electricity generating installations will be treated as a single entity for the purpose of determining the level of the compensation to be paid.

Section 10

Paragraph 1

The provisions concerning the connection charges are designed to avoid legal disputes, and hence, to provide transparency and legal certainty.

If another grid, which is not used for public power supply, is located between an electricity generating installation and a grid whose operator is obliged to purchase electricity under the provisions of this Act, the electricity generating installation can be connected to this other grid if this is technically feasible. This will help to avoid cost which would not make any economic sense.

Paragraph 2

In line with the rules introduced in Denmark in 1997 with the approval of the European Commission, the cost associated with upgrading the grid – which also involves the necessary grid expansion – will have to be borne by the grid operator. For the sake of transparency, the grid operators will be obliged to present detailed calculations of the investments required because these expenses can be included by grid operators when calculating their service charges.

Paragraph 3

A clearing centre, which will be attached to the Federal Ministry of Economics and Technology, will be established for the settlement of disputes. The parties concerned include in particular the associations of grid operators and of operators of electricity generating installations as defined in Section 2 of this Act.

Section 11

Section 11 must be seen in close connection with Section 3. The provisions laid down in both sections, taken together, constitute a multi-level equalising system for electricity purchases and compensation payments.

Level 1, which is dealt with in Section 3(1), provides for the connection of an electricity generating installation to the next closest suitable grid. This grid will usually be a local low-voltage grid. However, if the installation to be connected is a large wind farm, the grid may also be a higher voltage grid, or even a transmission grid. The operator of the grid concerned will be obliged to purchase, and pay compensation for, the electricity delivered.

Level 2, which is dealt with in Section 3(2), provides for the purchase of, and compensation payments to be made for, electricity by the upstream transmission grid operator. If the grid to which an installation is connected is already a transmission grid, there will be no upstream transmission grid. In that case, level 2 will not apply.

Level 3, which is dealt with in Section 11 (1) to (3), provides for fair nation-wide equalisation among transmission grid operators in terms of electricity volumes purchased and compensation payments made. This provision is designed to remedy a shortcoming in the former Electricity Feed Act[1], as a result of which the electricity purchases to be made under the Electricity Feed Act[1] in some regions were far above average. The equalisation provision in the present Act is aimed at the operators of transmission grids because this is a small group with a limited number of players which will easily be able to handle the transactions associated with the equalisation scheme and which will also be able to monitor each other. After the implementation of the equalisation procedure, each transmission grid operator will carry the same percentage share of electricity (fed in under this Act), relative to the total amount of electricity transmitted via the grid of the operator concerned.

Level 4, which is dealt with in Section 11(4), provides for another step to be taken. Pursuant to the provisions in this paragraph, transmission grid operators will evenly distribute the electricity purchased under this Act among electricity distributors operating within their sales territory, and the latter will be obliged to pay the same compensation rates for this electricity nation-wide. The result of this provision is that each utility company which supplies electricity will have to purchase the same percentage share of electricity and pay the same percentage share of the compensation due. Level 4 ideally complements the principle of deglomeration for utility companies insofar as that it imposes a similar obligation on electricity distributors which are responsible for energy production methods that jeopardise the climate and the environment.

The obligation to purchase, and pay compensation for, electricity as specified in Section 11(4) will not apply to utility companies if over half of the electricity they deliver is generated from renewables because – again in accordance with the 'polluter pays' principle – such companies have already done enough to protect the environment and manage global warming.

Electricity purchased at the compensation rates specified in Sections 4 to 8 must not be marketed as electricity from renewable energy sources at prices which are below the average compensation rates. In other words, when electricity which was fed into the grid under the provisions of this Act is marketed, the compensation rates paid will be regarded as the electricity generation costs to which other cost items (e.g. grid operating charges, licence fees, ecotax and value-added tax) have to be added in order to obtain the market price. The purpose of this provision is to combat price dumping in the renewables electricity market. There is a risk of price dumping because the overwhelming share of the electricity to be purchased under this Act will be purchased by the large utility companies which still have a dominant position in the market. The reference period for calculating the average compensation rate will be the period two quarters earlier. During the first quarter after the entry into force of the Renewable Energy Act, the compensation payments made under the Electricity Feed Act[1] can be used mutatis mutandis.

The purpose of the provisions in Section 11(5) is to ensure transparency with regard to electricity purchases and compensation payments by grid operators which are obliged under this Act to connect electricity generators to their grids; and to equalise among transmission grid operators the amounts of electricity purchased and the compensation payments made.

Section 12

These provisions are designed to monitor the market penetration achieved and the technological progress made by installations for the generation of electricity from renewable energy sources and, where necessary, to adjust the level of the compensation rates.

Adjustments of compensation rates will have to be announced early enough prior to their introduction. However, such adjustments can only apply to new installations; otherwise, there would be no reliable basis for operators of installations to make their investments, and it would be impossible for credit institutions involved in financing such installations to estimate the cost of such investments.

C. Ordinance on Generation of Electricity from Biomass

(Biomass Ordinance – BiomasseV)
of 21 June 2001

Pursuant to Art. 2 (1) sentence 2 of the Renewable Energy Act of 29 March 2000 (Federal Law Gazette I p. 305) in conjunction with Art. 56 (1) of the Act on the Adaptation of Responsibilities of 18 March 1975 (Federal Law Gazette I p. 205) and the Chancellor's Decree of 22 January 2001 (Federal Law Gazette I p. 127), the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, acting in agreement with the Federal Ministries for Consumer Protection, Food and Agriculture and for Economics and Technology, and respecting the rights of the German Bundestag, hereby decrees:

Art. 1
Scope of Application

This Ordinance sets forth, for the scope of application of the Renewable Energy Act, what substances shall be considered biomass, what technical processes for generating electricity from biomass fall within the Act's scope of application, and what environmental standards must be met in the generation of electricity from biomass.

Art. 2
Included Biomass

(1) Biomass within the meaning of this Ordinance shall be taken to mean fuels made of phytomass and zoomass. This shall also include products, by-products, residues and waste from phytomass and zoomass whose energy content comes from phytomass and zoomass.

(2) Biomass within the meaning of paragraph 1 shall include in particular:

1. Plants and parts of plants

2. Fuels made from plants or parts of plants whose components and intermediate products have all been produced from biomass within the meaning of paragraph 1

3. Waste and by-products of plant and animal origin from agriculture, forestry and commercial fish production

4. Biological waste within the meaning of Art. 2 No. 1 of the Biological Waste Ordinance (Bioabfallverordnung)

5. Gas produced from biomass within the meaning of paragraph 1, by gasification or pyrolysis, and all resulting products and by-products

6. Alcohols produced from biomass within the meaning of paragraph 1, whose components, intermediate products, products and by-products have been produced from biomass.

(3) Without prejudice to paragraph 1, the following shall be considered biomass within the meaning of this Ordinance:

1. Waste wood, comprising used wood (used products made from wood, wood materials and composites with a proportionally high wood content) or industrial waste wood (waste wood from woodworking and wood processing operations and waste wood from operations in the wood materials industry) which is considered waste, except where this conflicts with sentence 2 or where the waste wood, pursuant to Art. 3 No. 4 is not recognised as biomass.

2. Gas produced from waste wood within the meaning of No. 1, except where this conflicts with sentence 3 or the waste wood is not recognised as biomass under Art. 3 No. 4.

3. Plant-oil methyl ester, except where this conflicts with sentence 3.

4. Flotsam from waterbody management and from shoreline management and cleaning.

5. Biogas produced by anaerobic fermentation, where fermentation does not involve the use of materials included in Art. 3 Nos. 3, 7 and 9 or where more than 10% by weight of sewage sludge is used. Sentence 1 No. 1 shall apply to waste wood which contains residue from wood-preserving agents or contains halogenorganic compounds in its coating only in cases where it is used in installations whose certification for establishment and operation is granted under Art. 4 in conjunction with Art. 6 or Art. 16 of the Federal Immission Control Act (Bundes-Immissionsschutzgesetz) no later than three years from the date this Ordinance enters into force. Wood-preserving agents shall include substances used in processing and finishing wood that have biocidal effects on wood-damaging insect pests or fungi, and also substances that reduce the flammability of wood. Sentence 2 shall apply as appropriate to the use of gas produced from waste wood as defined in sentence 1, no. 1.

Sentence 1 No. 3 shall apply only to use in installations that go into operation three years from the date this Ordinance enters into force or, where installations are involved that are subject to certification under the Federal Immission Control Act, whose certification for establishment and operation has been issued in accordance with Art. 4 in conjunction with Art. 6 or Art. 16 of the Federal Immission Control Act.

(4) Substances from which electricity is produced in old installations within the meaning of Art. 2 (3) sentence 4 of the Renewable Energy Act, and for which compensation has been received for electricity produced from biomass prior to 1 April 2000, shall continue to be recognised as biomass in these installations. This shall not apply to substances as defined in Art. 3 (4) and Art. 5 (2).

Art. 3
Excluded Biomass

The following shall not be considered biomass within the meaning of this Ordinance:

1. Fossil fuels and products and by-products made from them.

2. Peat.

3. Mixed municipal solid waste from private households and similar waste from other source areas.

4. Waste wood:

a) that contains more than 0.005% by weight of polychlorinated biphenyls (PCB) oder polychlorinated terphenyls (PCT) within the meaning of the provisions of the PCB/PCT Waste Ordinance (Abfallverordnung) of 26 June 2000 (Federal Law Gazette I p. 923)

b) that contains more than 0.0001% by weight of mercury

c) of other types, if its thermal exploitation as waste for recovery is prohibited under the Closed Substance Cycle and Waste Management Act.

5. Paper, cardboard, pasteboard.

6. Sewage sludges within the meaning of the Sewage Sludge Ordinance (Klärschlammverordnung).

7. Harbour sludge and other waterbody sludges and sediments.

8. Textiles.

9. Animal carcasses or parts thereof and products within the meaning of Art. 1 (1) of the Animal Carcass Disposal Act (Tierkörperbeseitigungsgesetzes), which are to be disposed of in slaughter houses pursuant to ordinances enacted thereunder, and substances which occur through their disposal or through other means.

10. Landfill gas.

11. Gas from sewage treatment installations.

Art. 4
Technical Processes

(1) Technical processes for generation of electricity from biomass within the meaning of this Ordinance include single-stage and multi-stage electricity generation processes carried out by the following types of installations:

1. Combustion systems in combination with steam turbine, steam engine, Stirling engine and gas turbine processes, including organic rankine cycle (ORC) processes.

2. Combustion engine systems.

3. Gas turbine systems.

4. Fuel cell systems.

5. Other types of installations that, like the technical processes listed in Numbers 1 through 4, are operated with regard to the aim of climate and environmental protection.

(2) Where, by a process pursuant to paragraph 1, electricity generation from biomass within the meaning of this Ordinance is only possible by means of ignition or supporting combustion using substances other than biomass, then such other substances may be used.

(3) In installations as defined in paragraph 1 and 2, sewage sludge gas or gas produced by thermal processes under oxygen deficiency (synthesis gas) may be used when the gas (synthesis gas) is

produced from sewage sludge within the meaning of the Sewage Sludge Ordinance (Klärschlammverordnung).

Art. 5
Environmental Standards

(1) In order to prevent and control pollution, to protect and safeguard against harmful environmental impacts, to prevent danger, to conserve resources and to ensure environmentally compatible treatment of waste, the statutory provisions that apply to the relevant technical processes and to use of the relevant substances must be complied with.

(2) For the use of waste wood within the meaning of Art. 2 (3) No. 1 that

1. contains residues from wood-preserving agents or

2. contains halogenorganic compounds in their coating, the installation must, on the basis of its license, meet the standards of the Ordinance Combustion of Waste and Similar Combustible Materials of 23 November 1990 (Federal Law Gazette I p. 2545, 2832) last amended by Art. 8 of the Act of 3 May 2000 (Federal Law Gazette I p. 632); Art. 1 (1) sentence 1 and Art. 5 (3) of the Ordinance shall not apply. The same shall apply for the use of gas within the meaning of Art. 2 (3) No. 3 produced from waste wood within the meaning of sentence 1, no. 1 or 2.

(3) In the use of waste wood within the meaning of paragraph 2, sentence 1 in combustion systems in combination with steam-turbine processes as defined in Art. 4 (1) with an installed electrical capacity of more than 5 megawatts, whose heat is not passed to a third party and for which no obligation exists under pollution control certification procedures to use the produced heat in the installation itself, those systems must also achieve the following efficiency levels for gross electricity generation:

a) A minimum of 25 per cent in electricity generation of more than 5 megawatts up to and including 10 megawatts.

b) A minimum of 27 per cent in electricity generation of more than 10 megawatts up to and including 15 megawatts.

c) A minimum of 29 per cent in electricity generation of more than 15 megawatts up to and including 20 megawatts.

These efficiency standards shall also apply to the condensation-only operating mode of installations of this type which at times operate with condensation but mostly operate in condensation-only mode. The electrical efficiency level is thus defined as the relationship between the output power and generation of combustion heat at 100% output, without heat recovery.

Art. 6
Entry into Force

This Ordinance shall enter into force on the day following its promulgation.

The *Bundesrat* has given its consent.

Berlin, 21 June 2001

The Federal Minister for the Environment, Nature Conservation and Nuclear Safety
Jürgen Trittin

D. Explanatory Memorandum

I. General Provisions

In Art. 2 (1) sentence 2 of the Renewable Energy Act (EEG) of 29 March 2000, legislature authorised the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), in agreement with the Federal Ministry for Consumer Protection, Food and Agriculture and the Federal Ministry of Economics and Technology, to issue provisions, via ordinances subject to approval by the German Bundestag, specifying what substances and technical processes for biomass fall within the scope of application of the EEG and what environmental standards must be met. In fulfilment of this authorisation, the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) submits the present draft.

The overarching objective behind the Biomass Ordinance – BiomasseV – is the task presented by the Renewable Energy Act (EEG): to contribute to sustainable development of the energy supply in the interests of climate and environmental protection. In order to at least double the percentage share of renewable energy sources in total energy supply by the year 2010, the Renewable Energy Act gives renewable energy sources priority status within the meaning of Directive 96/92/EC of the European Parliament and Council of 19 December 1996 concerning common rules for the internal market in electricity (cf. Art. 8 (3) of the Directive and Reason No. 28).

The Ordinance serves legal determination of the types of use of biogenic material in electricity generation to be covered by the provisions of the Renewable Energy Act. The Renewable Energy Act has changed the terms for sale to the grid of electricity from biomass in contrast to the relevant terms in the preceding law, the Act on the Sale of Electricity to the Grid (Stromeinspeisungsgesetz - StrEG). On the one hand, the Act now includes installations with an installed electricity capacity of over 5 megawatts (up to 20 megawatts, cf. Section 2 (2) No. 1 EEG). On the other hand, a higher minimum compensation for electricity from biomass now applies (cf. Section 5 EEG). The purpose of these changes is to increase use of biomass in electricity generation.

To guide the intended use of biomass along orderly pathways that are desirable and acceptable in terms of energy policy and environmental policy, and thus to prevent conceivable undesirable developments, it is necessary for the Ordinance to describe technologies that are considered useful in terms of energy and climate policy and to formulate minimum standards for these technologies.

With the new provisions of the Renewable Energy Act as regards biomass, legislature builds on the existing provisions of the StEG. Delegation of legislative authority for BiomasseV to the executive branch of government does not constitute a departure from the existing legal situation or any intention to remove certain types of biomass use for electricity generation from the scope of application of the priority provision. In general, no negative experience, in terms of energy or environmental policy, has been had in practise with existing types of biomass use. Thus, the draft is based on the assumption that already practised procedures are basically in line with the required energy policy and environmental policy standards. On the other hand, new procedures and installations should at least meet these achieved standards. As a result, the Ordinance should also provide incentives for technological advancement.

The Ordinance's concept provides for regulation of environmental standards for processes for electricity generation from biomass via interaction between the Ordinance's definitions of requirements for biofuels (cf. Art. 2 and 3) on the one hand, and the relevant process technologies (cf. Art. 4) for other environmental standards prescribed by specialised provisions of environmental

law (cf. Art. 5) on the other. With the exception of the special provisions of Art. 5 (2) and (3), the establishment of additional requirements for the relevant technologies, i.e. requirements that diverge from standards of relevant specialised provisions of environmental law, is intentionally avoided.

The requirements applied to the substances used (cf. Arts. 2 and 3) ensure that no admixtures of foreign substances whose combustion could undermine the purpose of the Renewable Energy Act may be added to renewable energy sources. Specifically, this applies to admixtures of fossil origin.

Certain types of waste are also recognised as biomass. This will have some impact on the waste management sector. Inclusion of use for energy recovery of certain biogenic waste, within the priority provisions of the Renewable Energy Act, is based solely on the energy and climate policy consideration that use of these fuels for electricity generation represents a useful contribution to substitution of conventional fuels and to the establishment of a sustainable energy supply system. Such inclusion is not based on intentions that originate with waste management. On the other hand, use of waste for electricity generation should not be permitted where this would result in undesirable developments in the waste management sector (such as greater environmental pollution or displacement of other types of waste recycling that are to be preferred for reasons of resources conservation).

From a technical standpoint (cf. Art. 4), relevant installations must not lag behind the current state of the art in electricity generation from biomass as regards the aims of climate and environmental protection. The intention here is to help initiate advancement.

Furthermore, it does not seem necessary, in terms of energy and environmental policy, to establish separate environmental standards that go beyond the environmental requirements established by specialised laws (cf. Art. 5). The establishment of such standards would also be problematical as regards the legal system and the fact that legislature has chosen to shape the legal situation, within the framework of the EEG, solely under civil law, i.e. to refrain from involving monitoring or control authorities. If this policy is to be continued, then establishment of specific environmental requirements for specific process technologies would require energy producers themselves to monitor compliance with these requirements, to make such compliance transparent for buyers of the generated electricity and, in cases of doubt, to prove such compliance. Through submission of suitable documents (such as licenses or other certification), it will be relatively simple for operators to prove, on a regular basis, their compliance with the requirements of specialised laws and with the provisions governing the nature of the material used in relevant installations. Any proof of compliance with special environment-oriented requirements would involve disproportionately greater effort.

In deviation from the described principle, Art. 5 (2) and (3) contain special requirements for the use of EEG compensation provisions for combustion of waste wood materials which contain toxic substances. Compensation under the EEG for electricity produced from biomass which involves combustion of waste wood materials containing toxic substances shall apply solely in cases where the strict requirements of the Ordinance Combustion of Waste and Similar Combustible Materials (17. BlmSchV) are met without exception and when the minimum requirements for electricity efficiency are met in specific installations with an electricity capacity of more than 5 megawatts. Thus, the provision also offers an indirect incentive for the use of particularly modern environmental technologies without the need to change or impose existing pollution control laws and without the need for autonomous proof of compliance. Through the submission of their license or other certification, EEG addressees can prove compliance with the requirements with a minimum amount of effort.

II. Specific Provisions

1. Re. Art. 1

Art. 1 describes the Ordinance's tasks as defined by the authorisation of the EEG (Section 2 (1) sentence 2). These tasks include:

a) Definition of 'substances' which are biomass within the meaning of the EEG

b) Definition of "technical processes" available for generation of electricity from biomass within the meaning of the EEG

c) Definition of environmental standards which, when complied with, mean that the electricity generated from biomass with one of the defined processes falls under the EEG's priority provisions.

The meaning of the individual definitions of this Ordinance applies solely to the scope of application of the EEG.

2. Re. Art. 2

a) General Information

The task of Art. 2 and 3 is to identify the types of biomass used in electricity generation that fall under the EEG's priority provisions. The spectrum of theoretically acceptable substances is limited by the specification of substance requirements to ensure that only those biomass types receive priority whose use in electricity generation conforms to the EEG's objectives. Only these types are considered "biomass" within the meaning of the Ordinance and, thus, of the EEG.

For reasons of climate protection and resources conservation, the granting of priority status can, in principle, be justified where biogenic substances that are not of fossil origin are involved. Thus fossil fuels can not be considered as biomass within the meaning of the EEG. In addition, the following are also excluded: use of substances or materials whose use of energy generation, from an environmental policy standpoint (for example, because substance use for recovery is preferred), is not desired or not desired with priority or whose use for energy generation does not require any additional financial impetus.

The objectives of the EEG preclude the inclusion of fossil fuels within the scope of application of the Ordinance. Therefore, it must be ensured that no fossil components may be mixed in with the desired substances. This is the only way to meet the exclusivity principle set forth in Section 2 (1) sentence 1 of the EEG, which, under the Act's priority provisions, prohibits inclusion of any fuels not listed in the relevant provision. This also rules out any inclusion of waste incineration where the waste concerned is not *exclusively* biomass within the meaning of the Ordinance.

On the other hand, some types of biomass that fell under the priority provisions of the StrEG contained (minimal amounts of) unavoidable production-related or use-related components of fossil origin whose extraction is not possible or would require such great effort/expense that use of the remaining biomass would no longer be cost-effective, even taking the minimum compensation into account. Such necessary impurities are to be accepted (by exception).

In this light, a general definition of the term "biomass" within the meaning of the EEG is initially given in paragraph 1, sentence 1 and 2, but *without* permitting any inclusion of other substances

(either as admixtures or impurities). Paragraph 2 contains special provisions for certain types of biomass that are typically used in electricity generation and that are already covered by the StrEG; in some of the cases mentioned in this provision necessary impurities are tolerated under certain conditions. The purpose of this approach is to ensure that types of biomass use that already fall under the priority provisions of the StrEG do not lose their priority status due to (unavoidable) impurities – and without making it possible for fossil fuels, as new types of "impurities", to be mixed with biomass with the aim of increasing its energy content. The same applies to the biomass types mentioned under paragraph 3; in those cases, the (unavoidable) degree of impurity may be so high that the biomass' qualification as such may be in doubt unless special provisions apply. Finally, paragraph 3 generally excludes certain substances and materials from the scope of application of the previous provision.

b) Re. Para. 1

Sentence 1 contains a general definition of the term "biomass" for the scope of application of the EEG, a definition basically derived from common scientific terminology for biomass of plant and animal origin ("phytomass and zoomass"). No distinction has been made as to whether the substances should be exclusively of phytomass or zoomass origin or are made up of components of both sources of origin.

Pursuant to **sentence 2,** "biomass" includes products and by-products, residues and waste whose energy content, i.e. their available energy for electricity generation, also originates from phytomass and zoomass. This allows in particular the inclusion in some areas of desirable procedures for energy recovery from waste in line with energy and environmental policy.

This means that substances, products and mixtures whose energy content is partly of non-biogenic origin may not generally be considered biomass. This implements the exclusivity principle of Section 2 (1) sentence 1 of the EEG in respect of biomass. Admixtures of other thermally exploitable substances are not permitted. Other arrangements apply only where they are expressly permitted under special provision.

The context of sentence 1 refers not to "substances" but to "fuels", since the relevant substances are considered in their capacity as substances used for the generation of (electrical) energy.

The provision of paragraph 1 applies in all cases not covered by the special provisions of paragraphs 2 and 3. The general clause of paragraph 1 may be significant, especially with regard to the development of new processes for exploiting the energy content of biofuels other than those commonly used in electricity generation to date.

c) Re. Para. 2

Paragraph 2 contains special provisions for certain types of biomass that do not require any verification of compliance with the characteristics specified in sentence 1. This provision covers the great majority of biomass types used in electricity generation, but should not be seen as an exhaustive catalogue. Its non-exhaustive nature is expressed by the use of the word "especially".

If a material used as a biofuel falls within the catalogue of sentence 2, such material should be deemed biomass, including in cases where it may contain certain unavoidable impurities. This applies only where the relevant foreign substances are covered by the definition of the relevant

applicable individual characteristic (No. 1 through No. 6) in terms of their type and their amount. The addition of other substances is not permitted.

If a substance does not fall within the catalogue of paragraph 2 (or of paragraph 3), it should be verified pursuant to paragraph 1.

No. 1 mentions plants and plant parts. It does not matter whether such plants are cultivated especially for energy production or whether they are cultivated for other purposes.

No. 2 deals with fuels produced from plant materials used especially for energy production (for example, rapeseed oil). Such fuels are included here only where the relevant production and processing processes do not add any non-biogenic substances. A special case that departs from this arrangement is covered by paragraph 3 (2).

No. 3 and **No. 4** deal with certain waste types within the meaning of the Closed Substance Cycle and Waste Management Act (Kreislaufswirtschafts- und Abfallgesetz - KrW-/AbfG). Their formulations serve clarification of the relevant definitions, and the differentiation and useful linking of the two relevant legal areas.

In the case of **No. 3** (waste and by-products of plant and animal origin from agriculture, forestry and commercial fish production), the reasons for the inclusion of this provision in the catalogue of acceptable biomass types is self-evident. Acceptable substances include, for example, straw, liquid and solid manure from animal husbandry, left-over wood from forests, grass and bush cuttings. By-products are mentioned because it may be unclear whether certain substances possess "waste" characteristics (for example, wood from forestry, liquid manure as a potential fertiliser). The extent to which the use of such substances in installations for energy production is permissible depends on the relevant specialised statutory laws. For example, the requirements of Art. 6 (2) KrW-/AbfG must be complied with.

No. 4 provides for the inclusion of other biological waste (not covered by No. 3) within the meaning of the Biological Waste Ordinance (Bioabfallverordnung - BioAbfV) issued pursuant to the Closed Substance Cycle and Waste Management Act (KrW-/AbfG). This can include, for example, biodegradable waste from food production, compostable waste from kitchens and cafeterias, separated waste from private households and small businesses, biodegradable waste from wood processing and finishing, and waste from landscape management. It must be remembered that use of such waste for energy recovery must conform with the requirements pursuant to Art. 6 (2) KrW-/AbfG. This means, for example, that such waste must have a caloric value of 11,000 kJ per kg. The extent to which such substances are considered biomass within the meaning of this Ordinance is directly indicated by the BioAbfV. Use of terminology that deviates from common waste law terminology is not appropriate in this area and would create considerable practical problems.

In the area of biological waste, certain impurities cannot be avoided (for example, small pieces of paper in kitchen waste). The addition of such substances for the purposes of energy production is not permitted, however. Substances for which special regulations exist (for example, sewage sludges, cf. para. 3, no. 4) are also excluded.

Nos. 5 and **6** list secondary fuels that are produced from biomass and that can be directly used for electricity generation. Due to the nature of their origin, these secondary fuels are also classified as biomass. In addition to gas produced from biomass within the meaning of para. 2, sentence 1, through gasification or pyrolysis, and of resulting products and by-products (No. 5), this also applies to alcohols produced from biomass within the meaning of para. 2, sentence 1, whose components

and intermediate products have been produced from biomass (such as biomethanol and bioethanol). In connection with such substances, it must be ensured that neither the end product used for electricity generation nor any intermediate product contains any non-biogenic foreign substances.

d) Re. Para. 3

Paragraph 3 contains special provisions for areas in which compliance with biomass criteria within the meaning of paragraph 1 might be in doubt due to the presence of (unavoidable) foreign substance content that could have a certain impact on the energy content of the overall mass. Inclusion of the substance groups listed here is nonetheless desirable given the objectives of the EEG, as their use in electricity generation can contribute significantly to substitution of other fuels and, assuming compliance with environmental requirements of relevant specialised laws (cf. para. 5), does not present any major concerns – in other words, the relevant substance groups must be considered to have positive overall climate and environmental compatibility.

Sentence 1, No. 1 deals with waste wood. A special provision is required in this area in that waste wood is considered waste pursuant to the provisions of the Closed Substance Cycle and Waste Management Act.

The provision provides a legal definition of the term "waste wood" within the meaning of the Ordinance. On the one hand, it can mean used products with a high proportion of wood content (used wood), while on the other, it can mean left-over wood and wood processing waste from the types of installations described in the provision (industrial wood waste). In the latter case, waste from composite materials is not included in the waste wood definition. In both cases, the materials must constitute waste, i.e. they must have the legally defined characteristics of waste. Untreated wood is biomass by default (cf. para. 2, sentence 1, no.1, and para. 1). In all other cases, wood can be a component of other biomass types (cf. for example para. 2, nos. 3 and 4).

Waste wood can contain not inconsiderable pollutants that dictate higher pollution control standards for the incineration of such wood. Pursuant to the concept of the Ordinance, waste wood is not included in the biomass definition where such waste wood – particularly due to its pollutant content – may not be used for energy recovery as "waste for recovery" (cf. Art. 3) under the provisions of the Closed Substance and Waste Management Act (Kreislaufwirtschafts- und Abfallrecht). In addition, compliance with an especially high pollution control standard is required for the relevant waste wood categories as regards their pollutant potential (cf. Art. 5 (2)).

In all other cases, there is no requirement, either in the interests of climate protection or environmental protection, for further limits on potentially usable waste wood. Given the efforts to introduce substitutes for conventional fuels in electricity generation, it would be illogical not to provide an incentive for electricity generation from thermal exploitation of these relatively high energy content substances when – ensured by the high environmental standards and additionally by the provisions of Art. 5 (2) – there are no grounds to fear diversion of the pollutant loads into the air or waterways.

The environmental compatibility review carried out in preparation of this Ordinance has shown that, given such requirements, there are no basic grounds to preclude the use of railway ties, pressboard with synthetic components and other pollutant-containing woods in electricity generation (the reasoning of the EEG sees such use as possibly undesirable). Since the legislature – in keeping with the objectives of the EEG – must give decisive attention to the environmental/climate compatibility of each relevant procedure, there was no need for general exclusion of the aforementioned biomass types from the definition of biomass.

If, at the current level of development in environmental technology (and always in compliance with strict pollution control standards), use of pollutant-containing woods in energy production is seen as an acceptable form of pollutant disposal, then it would be illogical to hamper such use by removing it from the priority provisions of the EEG. However, it must be ensured that enhancement of environmental technologies is promoted rather than hampered by such an approach. Furthermore, overcapacities should be avoided.

In order to prevent undesirable developments in this direction, sentence 2 sets forth that the group of waste woods that contains residues of preserving agents or whose coatings contain halogenorganic compounds shall only apply to installations that go into operation within three years from the date this Ordinance enters into force. The categories mentioned include common types of waste wood like window frames, window surrounds, exterior doors, outdoor building timbers, structural timbers, timber and demolition timber with pollutant impurities, railway ties, articles from garden and landscape construction, garden furniture, painted, varnished, and veneered furniture, waste wood from bulk waste (mixed).

The purpose of the time restriction – in keeping with the idea of Art. 9 (1) EEG – is to focus on the fact that the energy generation installations must go into operation by the date stated. As the installations which may be considered for incineration of the types of waste wood described are installations that are subject to certification within the meaning of the Federal Immission Control Act (cf. Art. 5 (2)), it is thus feasible, in legal and planning terms, to link this not to the actual date an installation goes into operation, but rather to the date authorisation is granted for the establishment and bringing into operation of an installation (full authorisation within the meaning of Art. 4 in conjunction with Art. 6 or similar amendment authorisation within the meaning of Art. 16 BImSchG; cf. Art. 2 of 17 BImSchV). This will ensure that any delay in the date an installation goes into operation due to legal certification processes will not impact on the application of BiomasseV in cases where the courts later determine the legality of the certification. If focus were to be placed on the legality of the certification, there would be a danger that a legally safe installation would not fall within the three-year period because of the postponing effect of any claims (including unjustified claims).

The use of such biomass will remain possible in these installations beyond the date stated.

The government agency issuing the ordinance is called upon to closely monitor further developments in this sector, to evaluate such developments from a climate and environmental protection standpoint and, in the interests of avoiding undesirable developments, to make subsequent provision for such installations. Special consideration should be given to innovative processes with particularly positive environmental protection effects.

Sentence 1, No. 2 deals with gas produced from waste wood. Where appropriate, the same restrictions apply as for the direct use of waste wood. The provision therefore expressly refers to the restrictions in Sentence 3 and of Art. 3, No. 4. In compliance with sentence 3, the time restriction for installations for the direct use of waste wood containing certain pollutants prescribed in sentence 2 shall also apply to installations that use gas produced from the respective contaminated waste wood. Thus equal treatment of waste wood gas and incineration of waste wood is achieved.

In **Sentence 1, No. 3,** plant-oil methyl esters are listed separately. These are fuels (such as rapeseed oil methyl ester (RME)) produced from plants specially cultivated for energy production (such as rapeseed) which were already covered by the provisions of the StrEG and have, to a certain extent, already come into use as fuels for electricity generation. Current processes for the production of

plant-oil methyl esters make use of methanol of fossil origin. Such processes should be retained to ensure that existing incentives for use of biomass (in nearly biomass-only form) in electricity generation are not abolished before commercially viable alternatives have been found. This approach is justified from a climate protection and resources conservation standpoint, as the manufacturing process for plant methyl ester produces similar amounts of biogenic glycerine and thus permits substitution of glycerine of fossil fuel origin. The overall result is thus a reduction in the use of conventional fuels.

In the longer term, however, such circumstances are unsatisfactory. The use of plant-oil methyl ester in electricity generation is given particular consideration because a certain need is seen for the enhancement of suitable engines for other types of plant oils that could be used. It can be assumed that suitable processes for electricity recovery from plant oils will be available by the date stated. Thus, sentence 4 of the provision also prescribes a time restriction on the use of plant-oil methyl ester. The restriction in turn is formulated with regard to types of installations (as in sentence 2 with regard to waste wood and in sentence 3 in respect of gas produced from waste wood), since any other approach would not have guaranteed the necessary investment protection. In other words, in installations that go into operation within three years from the date this Ordinance enters into force, plant-oil methyl ester will continue to count, even after this date, as biomass within the meaning of this Ordinance. Attention should be given, however, to the fact that certain of the respective installations may be subject to certification within the meaning of the Federal Immission Control Act. In such cases, the deciding factor should not be the time the installation goes into operation, but rather the granting of the license (full or operational) as defined in Art. 4 in conjunction with Arts. 6 and 16 of the BImSchG.

Another important aspect as regards the use of plant oil methyl ester is that the ordinance issuer should be called upon, after evaluating experience with the current ordinance, to issue a suitable subsequent regulation for installations that go into operation after that date.

Sentence 1, No. 4 deals with flotsam that accumulates as waste in connection with management and care of waterbodies and shoreline areas. Such flotsam consists predominantly of biogenic substances (such as algae, plant cover remains, see grass, sedge, wood). It may also contain foreign substances (such as small bits of waste that have collected in shoreline areas). The sorting out of such foreign substances can achieve a biomass portion of over 90%.

Sentence 1, No. 5 deals with biogas. Such gas, as indicated by the legal definition for the scope of application for this Ordinance, consists of gas mixtures generated by anaerobic fermentation. Substances used in such fermentation may contain certain amounts of foreign substances of synthetic origin – substances for which no cost-effect method of separation is currently available (for example, synthetic formic acid which cannot be chemically differentiated from natural formic acid). Nonetheless, biogas should be classified as biomass within the meaning of the EEG, since, due to its origin, it is composed predominantly of biogenic material and can make an important contribution to substitution of conventional fuels.

The general definition of biogas also applies to gas from landfills and sewage treatment installations. The EEG, however, contains special provisions for compensation in this area. The formulation chosen here indicates that such gases, for the purposes of such special provisions, cannot be considered biomass within the meaning of the EEG. The purpose here is to ensure that gas mixtures produced from municipal solid waste, harbour sludge, other waterbody sludges and sediments, animal carcasses, parts of animal carcasses and products within the meaning of Art. 1 (1) of the Animal Carcass Disposal Act (Tierkörperbeseitigungsgesetz) which, in accordance with that act and ordinances issued on the basis of that act, are to be disposed of in licensed slaughter houses,

and substances produced as a result of their disposal or which occur otherwise or are produced with more than 10% by weight of sewage sludge. Such substances are not considered biomass in accordance with Art. 3, Nos. 3, 6, 7 and 9. The purpose of the 10% clause for the mixing of sewage sludge is to acknowledge an already practised and safe process. Restricting the portion to 10% by weight ensures that the special compensation rate anchored in the EEG is not circumvented.

The exclusivity principle set out in Art. 2 (1) sentence 1 of the EEG in no way hinders this approach as it serves the general removal of the use of a mixture of conventional and renewable fuels from the scope of applicability of the Act. The aim is the use of mixtures of various renewable fuels. Since the EEG lacks a special provision for compensation in cases where such (authorised) mixtures are used, but this type of mixing in the use of sludge gas (fuel produced from anaerobic fermentation of sewage sludge) and biogas (fuel produced from anaerobic fermentation of biomass) is of certain practical relevance, it is feasible to dictate a limit up to which sewage sludge portions in biomass within the meaning of the Act can be expected/are acceptable.

If the sewage sludge portion of the source material exceeds 10% by weight, the gas produced is no longer considered biomass within the meaning of this Ordinance. In consequence, the compensation rate for biogas of this constellation cannot be applied. In such cases, the compensation rate is prorated relative to biomass within the meaning of this Ordinance and to the sewage sludge content.

e) Re. Art. 4

The provisions of Art. 2 (4) are based on the protection of the sphere of trust towards operators of existing installations for electricity recovery from biomass which are already covered by the StrG. The cost-effectiveness of such installations should not come under question by the substance-related requirements of BiomasseV. No exceptions will be made for reasons of environmental protection to the exclusivity provisions for certain types of waste wood (Art. 3 No. 4). Art. 5 (2) should thus not apply. Otherwise the sphere of trust provision would effectively be redundant. A phased alignment with enhanced pollution reduction technologies will take some time as the respective installations, in accordance with general pollution control laws, are subject to the state of available technology (cf. Art. 5 (1) of this Ordinance and Art. 5 (1) No. 2 BlmSchG) and could thus be subject to subsequent directives (cf. Art. 17 BlmSchG).

This provision is expected to be of only minimal importance as the substance-related provisions of BiomassV do not restrict the spectrum of substances considered as biomass in the practice of the StrG (with the exception of sludge and landfill gas whose energy recovery is subject to a special compensation rate, cf. Art. 4 EEG). The clarification provided by the provision will avoid unnecessary disputes in the transition period for the application of the EEG. The formulation generally serves as a collective clause.

3. Re Art. 3

Art. 3 identifies biomass types which might theoretically be accepted in this context but shall not be considered biomass within the meaning of the EEG.

For reasons of environment and energy policy, all types of fossil fuels, including their by-products and end products, are excluded (**No. 1**: see the general remarks in this connection). This applies especially to coal, mineral oil, natural gas, bitumen, tar sand, shale oil and stack gas. For reasons of clarification, **No. 2** handles the exclusion of peat separately.

No. 3 contains the clarification, derived from the exclusivity principle set out in Art. 2 (1) sentence 1 of the EEG, that mixed settlement waste and comparable waste mixtures are not biomass.

No. 4 deals with the exclusion of certain waste woods. Under letter c), the provision contains a general collective provision, and under letters a) and b) it contains special provisions for certain types of waste wood.

Letter c) mandates that waste wood may not be considered biomass when its use in energy generation as waste for recovery is prohibited by the Closed Substance Cycle and Waste Management Act (KrW-/AbfG). For such exclusion to become effective, a general blanket legal provision is required pursuant to which such use in energy generation as waste for recovery is not permitted. This is the case, for example, when the provision implies that, due to its nature or type, substance recycling is to be given priority for the relevant waste wood or only processing as waste for disposal is permitted. In such cases, granting priority status within the framework of the EEG is not justified since the EEG should not countermand the aims of the Close Substance Cycle and Waste Management Act.

In differentiating waste "for recovery" from waste "for disposal", and in determining priority for "substance" or "energy" recycling, considerable problems have arisen in the practical application of the KrW-/AbfG. The underlying law uses in the main vague legal terminology that requires interpretation and can generate disputes. The decisive issue in the distinction between energy recovery and disposal is whether the relevant measure, in terms of its main purpose, focuses on the use of substances contained in the material or on the disposal of pollutants (cf. Art. 4 (3) and (4)). Among the types of recovery available, priority status is given to the most environmentally compatible type of recovery (cf. Art. 6 (1) sentence 1 and 2 KrW-/AbfG); priority status of a specific type of recovery can be determined through issuance of a suitable ordinance (cf. Art 6 (1) sentence 4 KrW-/AbfG).

Given the fact that considerable uncertainty results from classification of specific types of waste which are made on the basis of these vague legal terms, we should not rely solely on those terms. To ensure a high degree of legal certainty, users of the provision, in terms of inclusion of waste wood within the scope of application of the term "biomass", should be able to make valid assumptions regarding the nature of the relevant biomass unless waste law provisions expressly preclude this.

In using the phrase "on the basis of" (in contrast to "through"), letter c) is thus designed to express the fact that qualification as biomass is not automatically ruled out when the provisions of the KrW-/AbfG have to be interpreted or subsumed in such a manner that the respective waste is deemed as waste for disposal or waste primarily for substance recycling; such disqualification is not prescribed until a more specific provision is issued on the basis of the KrW-/AbfG.

Requirements of closed substance cycle and waste management law on the handling of waste wood should soon be specified by a waste wood ordinance that refers to Art. 5 (3) KrW-/AbfG. Issue of such an ordinance is currently being prepared. The waste wood ordinance could be significant with regard to application of the provision under letter c) and should thus provide additional legal certainty.

Letters a) and b), on the other hand, deal with special cases. In dealing with waste wood that contains PCB/PCT, letter a) touches on an area in which the relevant material has been declared waste "for disposal" in an EU Directive implemented by the PCB/PCT Waste Management Act of 26 June 2000 (Federal Law Gazette I, p. 932). Letter b) concerns a special type of waste wood which contains mercury, a special pollutant. When such wood is burned, particularly when it has

high mercury concentrations, stricter requirements must be imposed as regards the cleaning of contaminated exhaust air. Furthermore, elimination of the pollutant is normally the central focus of any thermal processing of such wood. This provision serves in particular the exclusion of kyanised waste wood, i.e. waste wood impregnated with mercury compounds such as cable masts, hop poles and vineyard poles.

For paper, cardboard and pasteboard (**No. 5**), substance recycling plays a particularly significant role in respect of energy and CO_2 balances. In addition, electricity-oriented incineration of waste paper collections which do not lend themselves to substance recycling requires no priority status within the framework of the EEG.

The incineration of sewage sludge (**No. 6**) and harbour sludge and other waterbody sludges and sediments (**No. 7**) for the purpose of electricity generation likewise requires no priority status within the framework of the EEG. Whereas for harbour sludge, the main purpose of incineration is to dispose of pollutants, incineration of sewage sludge, when considering the entire process, provides no significant energy gain. Furthermore, gas produced from sewage sludge is subject to the special compensation provision in Art. 4 (1) EEG.

For textiles (**No. 8**), priority is given to reuse and substance recycling. The term textiles is to be interpreted in its broadest sense. Thus, textiles include not only articles of clothing, but also interior and flooring textiles. In the case of incineration for electricity generation, there is no apparent need for priority status within the framework of the EEG. If textiles were included as biomass within the meaning of the EEG, difficulties would arise in differentiating between textiles made of biogenic materials and textiles of synthetic origin. Nonetheless, the presence of natural textiles as an unavoidable impurity – for example, in biological waste – does not lead to disqualification as biomass.

No. 9 determines that animal carcasses, parts of animal carcasses and products which, pursuant to the Animal Carcass Disposal Act, must be disposed of in licensed slaughter houses, are not recognised as biomass. Thus, the formulation does not cover substances of the relevant type for which the Animal Carcass Disposal Act permits processing, sale or disposal in places other than licensed slaughter houses. The provision thus also excludes such substances from the term "biomass" as are produced in the course of disposal or occur otherwise (for example, meat and bone meal, animal digest, animal fat). An important aspect is the fact that, together with incineration, the term "disposal" used in the provision, and within the meaning of the Animal Carcass Disposal Act, also covers the treatment and recycling of animal carcasses, parts of animal carcasses and products (cf. Art. 1 (2) of the Animal Carcass Disposal Act). The term "disposal" thus is not compatible with the same term used in the Waste Management Act (Abfallrecht).

Exclusion of the relevant substances listed in No. 9 from the scope of application of this Ordinance is particularly justified in that to date no satisfactory experience has been gained in the production of electricity from such substances which could reliably indicate the relevant effect of its use for electricity recovery pursuant to the objectives of Art. 1 EEG.

Landfill gas (**No. 10**) and sewage gas (**No. 11**) are excluded from the scope of application of the term "biomass" within the meaning of this Ordinance because the EEG contains a special priority provision with a special compensation provision for these two substance classes (cf. Art. 4 sentence 1 EEG).

4. Re Art. 4

a) Para 1.

Art. 4 (1) defines the technical processes for generation of electricity from biomass within the meaning of the Ordinance and thus of the EEG. Only generation of electricity from biomass by one of the installation types referred to or described in Art. 4 (1) falls within the scope of application of the EEG.

In order to simplify legal application, the possible technical processes are described and defined by reference to the standard installation types. While the wording of the ordinance authorisation contains definitions of "technical processes", the technical processes for electricity generation are clear by reference to or description of the relevant installation types. Therefore, it does not exceed the bounds of the legal authorisation to use "installation" as the point of legal reference, as is done here. In practical terms, this approach is useful as it uses the same point of legal reference as underlies the provisions of the Federal Immission Control Act, which is normally the standard for certification of installations.

The installations referred to in **Nos. 1 through 4** thus refer to those technical processes for electricity generation that are currently available.

No. 5 contains a collective provision for other types of installations and other processes for electricity generation. This provision is needed to ensure that reference to already tested installation types will not hinder research and development. The rather broad legal phrase used by the provision: "using other technical processes which are comparable with those listed in Nos. 1 through 4 and are operated with respect to the aim of climate and environmental protection", matches the objective of the EEG and serves to describe the required minimum standards in terms of energy and environmental policy. Substandard technologies are excluded from the scope of support provided by the EEG. Certification of installations will be subject to the prevailing specialised laws.

b) Re Para. 2

Paragraph 2 permits the use of non-biogenic substances for ignition and combustion support purposes where technically possible using only substances other than biomass. In cases where gaseous biomass is used, the provision permits the use of diesel engines in electricity generation (injection). The use of diesel engines enables higher levels of electricity exploitation to be achieved, particularly in decentralised biogas installations whose energy production is typically low. The exception for support combustion is also required as the use of smaller amounts of fossil fuels is sometimes unavoidable – for example, in maintaining combustion as such or in stabilising a combustion temperature that is required under pollution control law.

c) Re Para. 3

Sewage gas and synthesis gas produced from the gasification of sewage sludge is not as such covered by the term biomass. The proportional mixture of sewage gas or synthesis gas from the gasification of sewage sludge in the generation of electricity from biomass (for example, in the use of waste wood) would, however, appear both safe from a climate policy standpoint and useful in terms of research policy given that the technical process allows combined use of biomass with sewage gas or synthesis gas produced from the gasification of sewage sludge which results in a development potential – primarily in cogeneration – which would otherwise not exist. However, mixing in electricity generation can only be recognised within the meaning of the Biomass

Ordinance when the portion of biomass is proportionally high and only sewage sludge is used to produce synthesis gas.
This is the only way to steer this technically feasible innovation in the desired direction.

5. Re Art. 5

a) Re Para. 1

The provision expresses the fact that the priority provision pursuant to the EEG is not intended as any exemption from requirements of relevant specialised environmental protection laws. In its choice of words, the provision refers to several terms used in environmental law. It uses the broad term "pollution prevention and control" from the EU's IPC Directive, thereby emphasising its reference to all types of pollution of environmental media (air, soil, water, human well-being). This includes environmental protection with respect to climate protection, resources conservation and nature conservation.

For the sake of emphasis – and not restriction – reference is also made to special protection orientations of the Immission Control Act (protection and precaution against harmful environmental impacts), the Closed Substance Cycle and Waste Management Act (resources conservation and ensuring environmentally compatible handling of waste) and the general laws governing prevention of danger (protection and precaution against dangers and nuisances from third parties). This includes accident prevention provisions and work safety provisions.

The provision contains no restriction on certain types of environmental protection provisions (for example, installation-specific provisions). In some cases, substance-specific provisions might also be involved (for example, provisions of waste, fertiliser and food laws).

The failure of the provision, apart from the provisions of paragraphs 2 and 3, to set forth separate provisions on environmental protection is justified for the following reasons of legal technicality:

In the relevant legislative concept, the EEG, which underlies BiomasseV, neither provides for nor permits public monitoring of compliance with environmental standards. As a result, separate environmental standards would have to be "enforced" directly by the users of the EEG (electricity providers, on the one hand, and electricity purchasers, on the other). Those potentially required to accept the electricity could block feeding of the electricity into the grid if the relevant requirements were not met. In cases of doubt, civil proceedings would be required to determine whether the electricity generated from biomass was generated in accordance with the provisions. Definition of environmental standards that diverged from the relevant specialised laws would thus produce considerable uncertainty and could prove counterproductive to achieving the aims of the EEG.

The provisions of BiomassV may be revised as necessary, particularly with respect to amendment of existing ordinances, or issue of new ordinances relative to other specialised laws (for example, of pollution control and waste management law). The Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) has been charged with observing and revealing respective developments. Economically and ecologically useful processes that are still under development should not be excluded; any undesirable developments should be corrected as necessary. Changes may be made as necessary within the framework of alignments to BiomasseV.

b) Re Art. 2

The provision makes the use of the special provisions of the EEG in cases where certain waste wood types are used for electricity generation subject to compliance with special requirements. This applies, on the one hand, to waste wood that contains residues of wood preserves and to waste wood that contains halogenorganic compounds in its coating on the other.

Current provisions of pollution control law apply differing standards in respect to various types of waste wood. The highest standards are formulated in the Ordinance Combustion of Waste and Similar Combustible Materials (17. BlmSchv), which currently applies when the material for incineration contains residues of wood preserves (cf. Art. 1 (2) sentence 1, and (3) of 17 BlmSchV). If the content of such types of waste wood is below 25%, the requirements for pollution control apply proportionately (so-called "mixing provision", cf. Art. 1 (2) sentence 1, Art. 5 (3) of 17. BlmSchV).

Sentence 1 provides that the requirements of 17. BlmSchV also apply in respect of waste wood with halogenorganic compounds in its coating, as such materials will, pursuant to the new Directive 2000/76/7/EC of the European Parliament and the Council of 4 December 2000 on the Combustion of Waste (ABL.EG Nr. L 332 of 28.12.2000, p. 91), anyway be included in the scope of application of 17. BlmSchV. Further, in order to ensure particularly high environmental standards in the generation of electricity from the relevant types of waste wood, no use of the mixing provisions set forth in 17. BlmSchV shall be made for the two waste wood categories covered by the scope of application of BiomassV. Pursuant to sentence 2, the same shall apply to cases in which gas produced from either of the types of waste wood mentioned is used for the purposes of electricity generation.

The recommended provisions will result in the fact that incineration for electricity generation of the two types of waste wood described (and the relevant use of gas produced from them) can only be compensated for under the provisions of the EEG when their incineration takes place in an installation which is certified pursuant to 17. BlmSchV and for which no "mixing provisions" were applied in their certification. Thus, in such cases, a requirement is necessary which determines that, in consideration of pollution reduction, incineration should take place in specially designed and highly sophisticated installations.

Fulfilment of these special provisions can reasonably be expected from the operators from an economic standpoint. As a rule, the pollution control authorities in the individual *Länder* (states) automatically apply appropriate requirements in their certification process as, from a technical standpoint, it cannot be ruled out that the proportion of the especially pollutant-bearing combustion material would not at times exceed 25%.

The provision remains legally restricted to the scope of application of the EEG. It covers neither material nor does it have a formal impact on existing pollution control law. The provision constitutes no independent administration authority, but rather serves as an indirect incentive to "over fulfilment" of pollution control law standards and thus effects a mere refocusing of installation operators' interests in case scenarios which are anyway required under the certification process.

The provision has no effect on other cases of application of 17. BlmSchV.

The recommended provision is also practical in terms of the application of the EEG. The installation operators can provide the buyer of the electricity proof of compliance with the requirements by showing the respective certification or amendment authority and the respective determining act of administration.

c) Re Para. 3

Paragraph 3 contains further requirements for the scope of application of paragraph 2 to installations with an installed electrical capacity output of over 6 megawatts, in order to ensure a high degree of energy efficiency in the overall balance. Thus, the respective installations, in cases where the heat produced in electricity generation is not utilised (that is, where cogeneration is not utilised), must prove/demonstrate a reasonably high electricity efficiency level.

Sentences 1, 2 and 3 contain provisions for the event that despite provision for the application of Art. 8 sentence 1 of 17. BImSChv as set forth in para. 2, no obligation exists to utilise the heat produced in the installation itself and such heat is not passed to a third party. This is feasible when the use of the heat in the installation itself is not technically possible due to the type and location of the installation or is unreasonable or incompatible with the obligations set forth in Art. 5 (1), nos. 1 through 3 of the Federal Immission Control Act (cf. Art. 8 sentence 1 of 17. BImSchV).

In the area of electricity generation from waste wood, relatively high electricity efficiency levels can be achieved through the use of modern technologies. The higher the installed electrical output, the better the achievable level of efficiency. Against this background, sentence 1 requires compliance with specific minimum electricity efficiency levels and thus differentiates between the size of the respective installations. In such cases, consideration must be given to the fact that there is usually a correlation between particularly high standards as regards pollutant control and reductions in efficiency levels. The required environmental standards give consideration to both issues.

Pursuant to sentence 2, the same shall also apply to the condensation-only operating mode of installations that mostly operate in condensation-only mode. This requirement targets in particular installations that only partly recover heat to supply district heating networks or end customers (buyers). These installations usually operate only 2,000 to 3,000 hours per annum with cogeneration, but operate for the remainder of the year in condensation-only mode. Due to the low temperature level of the recovered heat, design changes can reasonably be expected to achieve the same electricity efficiency levels in condensation-only operation as in installations of similar sizes that are designed purely for condensation-only operation. It is therefore appropriate to require that such installations, during the time in which they operate using condensation-only mode, achieve the same minimum electricity efficiency level as installations that operate solely in condensation-only mode.

Where the respective installations mainly operate in cogeneration mode, it is illogical to require compliance with specific electricity efficiency levels as the overall energy balance is already improved through heat recovery and heat recovery can also lead to a reduced electricity efficiency level.

Sentence 3 defines the term "electricity efficiency level" for the scope of application of the provision.

6 Re Art. 6

The provision contained in Art. 6 governs the Ordinance's entry into force.

E. Offshore Installations Ordinance

Ordinance on Offshore Installations Seaward of the Limit of the German Territorial Sea (Offshore Installations Ordinance *SeeAnlV*)

Dated 23 January 1997
(BGBl. I p. 57)

- **amended by Article 432 of the Ordinance dated 29 October 2001 (BGBl. I p. 2785)**
- **amended by Article 2 of the Act Reforming the Law on Nature Conservation and Landscape Care and Adapting Other Legal Provisions (BNatSchGNeuregG), dated 25 March 2002 (BGBl. I p. 1193**

On the basis of Article 9 (1) first sentence No. 4a, paragraph (2) first sentence No. 1 in conjunction with Article 1 No. 10a of the Federal Maritime Responsibilities Act (*Gesetz über die Aufgaben des Bundes auf dem Gebiet der Seeschifffahrt*) in the version promulgated on 27 September 1994 (BGBl. I p. 2802), of which Article 9 (1) first sentence No. 4a and Article 1 No. 10a were inserted through Article 1 of the Act of 6 June 1995 (BGBl. I p. 778), the Federal Ministry of Transport has issued the following Ordinance:

Article 1

Scope of the Ordinance

(1) This Ordinance shall apply to the erection and operation of installations

1. in the area of the exclusive economic zone of the Federal Republic of Germany and

2. on the high sea, provided that the proprietor is a German national domiciled within the scope of the Basic Law.

General partnerships, limited partnerships and legal persons having their seat in this area shall be deemed to be the same as German nationals domiciled within the scope of the Basic Law ; this provision shall apply to

a) general partnerships and limited partnerships if the majority of both the general partners and the partners having executive and representational authority over the business consists of German nationals and if furthermore the German partners have the majority of votes under the partnership agreement,

b) legal persons if German nationals have a majority on the board or in the management.

This Ordinance shall also apply to alterations to such an installation or its operation.

(2) Installations within the meaning of this Ordinance shall be all structural or technical facilities which are fixed or floating in a fixed location, including construction works and artificial islands which are used

1. to generate energy from water, current or wind or

2. for other economic purposes

Installations as defined by this Ordinance shall not include ships, navigational marks, industrial mining installations, installations requiring supervision within the meaning of Article 2 (2a) of the Safety of Equipment Act, passive fishing gear and installations for scientific marine research.

Article 2

Licencing of installations

Erection and operation of and any substantial alteration to installations or their operation shall require a licence issued by the Federal Maritime and Hydrographic Agency of Germany, insofar as they are not exempt from the licencing requirement pursuant to Article 10. The purpose of the licencing requirement is to avert dangers to the safety and smoothness of traffic and to the marine environment. It shall not replace the administrative acts required under other legal provisions.

Article 2a

Environmental Impact Assessment

For projects which require a licence under Article 2 and at the same time are projects as defined in Article 3 of the Environmental Impact Assessment Act, an environmental impact assessment shall be carried out pursuant to this Act. In the application of the provisions of the Administrative Procedures Act in accordance with Article 9 (1) second sentence of the Environmental Impact Assessment Act, the licencing authority shall take the place of the municipality. The public shall be informed of the documents being presented for public inspection pursuant to Article 6 of the Environmental Impact Assessment Act by means of an official announcement in the licencing authority's journal of legal notices and by publication in two supraregional daily newspapers.

Article 3

Refusal of the licence

Issuance of a licence shall be refused if the safety and smoothness of traffic is disrupted or the marine environment is endangered and these negative effects cannot be prevented or compensated for by imposition of a time limit, condition or additional requirement. Particular grounds for a refusal shall be deemed to exist in cases where

1. operation and effect of navigational installations and marks or

2. use of shipping lanes or airspace or navigation

would be disrupted;

3. pollution of the marine environment as defined in Article 1 (1) No. 4 of the United Nations Convention on the Law of the Sea of 10 December 1982 (BGBl. 1994 II p. 1798) is to be feared, or if

4. bird migration is endangered.

The licence shall not be refused if no grounds for refusal within the meaning of the first sentence above exist.

Article 3a

Particularly suitable areas for wind farms

(1) The Federal Ministry of Transport, Building and Housing shall specify, in agreement with the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, with the participation of other Federal Ministries concerned, the participation of the public and after consultation with the *Länder*, areas particularly suitable for wind farms. The Federal Ministry of Transport, Building and Housing may transfer its powers under the first sentence to a subordinate authority within its sphere of activity. The Federal Ministry for the Environment, Nature Conservation and Nuclear Safety may transfer its powers under the first sentence to the Federal Agency for Nature Conservation. Identification of a particularly suitable area shall only be permissible if no grounds for refusal pursuant to Article 3 and no protected area designations in accordance with Article 38 of the Federal Nature Conservation Act oppose the choice of locations for wind farms in the areas concerned. Particularly suitable areas shall be specified and updated according to the latest experience and scientific knowledge available, especially with a view to to be designated under Article 38 of the Federal Nature Conservation Act. Particularly suitable areas shall be announced by publication in the Joint Ministerial Journal (*Gemeinsames Ministerialblatt*) and in two supraregional newspapers and be listed in the Annex to this Ordinance.

(2) In the licencing procedure, the identification of a particularly suitable area pursuant to paragraph (1) above shall have the effect of an expert opinion with regard to the choice of location for installations. The requirements concerning the environmental impact assessment for projects pursuant to Article 2a shall remain unaffected.

Article 4

Technical standards and incidental provisions

(1) To prevent or compensate for any disruption to the safety and smoothness of traffic, or a danger to the marine environment, the licence may be limited to a specified period of time. The Federal Maritime and Hydrographic Agency of Germany may repeatedly extend the licence if no disruption to the safety and smoothness of traffic or no danger to the marine environment is to be expected.

(2) The licence may stipulate compliance with certain technical standards, or be tied to conditions and additional requirements. Such conditions and additional requirementsshall only be permissible to prevent and compensate for any negative effects on the safety and smoothness of traffic or on the marine environment.

(3) Subsequent inclusion, amendment or supplement of additional requirements shall be permitted.

Article 5

Licencing procedure

(1) The licence shall require an application in writing. A description of the plant and its operation, including safety and precautionary measures, shall be enclosed with the application, together with

sketches, explanations and plans. If these documents are not sufficient for an assessment, the applicant shall, at the request of the licensing authority, supplement them within an appropriate time; otherwise the application shall become void. If several applications have been submitted for the same location or for any neighbouring locations, a decision shall first be taken on the application which first fulfils these requirements (priority principle).

(2) For the evaluation of the technical characteristics of an installation and its operation, the applicant shall, if so required by the licencing authority, submit to the latter an expert opinion of a recognized ship-surveying company, confirming that the installation conforms to generally recognized technological standards.

(3) When issuing a licence, the licencing authority shall take into consideration the opinions of the authorities and other offices whose sphere of duties is affected by the project.

Article 6

Approval

Before issuing a licence, the licencing authority shall obtain approval from the responsible local Water and Shipping Directorate (*Wasser- und Schifffahrtsdirektion*). Such approval may only be refused if there is reason to fear disruption to the safety and smoothness of traffic which cannot be prevented or compensated for by imposing any conditions or additional requirements.

Article 7

Safety zones

The licencing authority shall establish safety zones within the exclusive economic zone around the installations if this is necessary to ensure the safety of shipping or of the installations. Safety zones are areas of water which extend around the installations at a distance of up to 500 m, measured from every point of the outer edge. The breadth of the safety zone may exceed 500 m if generally recognized international standards so permit or if the responsible international organisation so recommends.

Article 8

Announcement of the installations and their safety zones

The Federal Maritime and Hydrographic Agency of Germany shall announce the installations it has licenced and those notified pursuant to Article 11 and the safety zones it has established in accordance with Article 7 of this Ordinance in the *Nachrichten für Seefahrer* (official shipping publication of the Federal Maritime and Hydrographic Agency of Germany) and shall register them in the official nautical charts.

Article 9

Expiry of a licence

The licence shall expire if

1. erection or operation of the installation has not commenced within an appropriate period of time laid down by the licencing authority or if

2. the installation has not been operated for a period of more than three years

or if

3. a deadline laid down in accordance with Article 4 (1) has expired.

Article 10

Installations not requiring a licence

The Federal Maritime and Hydrographic Agency of Germany may exempt certain types of installations of simple design and function from the licencing requirement, if these are clearly no disruption to the safety and smoothness of traffic or a danger to the marine environment. The exemption shall cover the erection and operation of the installations. Approval shall be obtained from the local responsible Water and Shipping Directorate in accordance with Article 6. The exemption from the licencing requirement for all installations of a particular type shall be announced in the Official Journal of the Federal Ministry of Transport, Building and Housing (*Amtsblatt des Bundesministeriums für Verkehr, Bau- und Wohnungswesen*).

Article 11

Notification requirements

(1) Installations not requiring a licence shall be notified to the Federal Maritime and Hydrographic Agency of Germany before erection commences. The notification shall indicate the type, purpose and exact location of the installation.

(2) Any minor alterations to licenced and non-licenced installations and their operation and the intention to discontinue operation shall be notified to the Federal Maritime and Hydrographic Agency of Germany immediately. The date of the alteration or the discontinuation of operation shall be indicated in the notification.

Article 12

Removal of installations

(1) Installations requiring a licence shall be removed after expiry of the licence if they represent an obstacle for traffic or fishing, or if such removal is necessary for the protection of the marine environment.

(2) Installations not requiring a licence shall be removed after operation has been permanently discontinued where these relinquished installations represent obstacles for traffic or fishing, or where such removal is necessary for the protection of the marine environment.

(3) This removal shall observe as minimum standards the generally recognised international standards for removal.

Article 13

Obligations of the operator of an installation

The operator shall ensure during operation or after discontinuation of operation that no disruption to the safety or smoothness of traffic or dangers to the marine environment emanate from the installation.

Article 14

Responsible persons

(1) Responsibility for meeting the obligations arising from this Ordinance or from any administrative acts on the erection, operation or discontinuation of operation of installations rests with

1. the holder of the licence or the operator of an installation not requiring a licence; for legal persons and trading partnerships, those persons entitled to represent them in accordance with the law, with articles of incorporation or with the partnership agreement, and

2. those persons instructed within their duties and powers to manage or supervise the operation or a part thereof.

(2) Employment in responsible positions as described in paragraph (1) No. 2 above shall be limited to persons who possess the necessary reliability, expertise and physical suitability for the discharge of their duties and powers.

(3) Responsible persons within the meaning of paragraph (1) No. 2 shall be appointed in sufficient numbers as are necessary for the timely and safe management of the operation. The duties and powers of the responsible persons shall be clearly and fully laid down and coordinated in such a way as to ensure well-regulated cooperation.

(4) Appointment and dismissal of the responsible persons shall be declared in writing. In the appointment note, their duties and powers shall be accurately described, and the powers shall correspond to the duties. The responsible persons shall be named to the Federal Maritime and Hydrographic Agency of Germany immediately after their appointment, with details on their position within the operation and their qualifications. Any alteration of their position within the operation or the departure of responsible persons shall be notified to the Federal Maritime and Hydrographic Agency of Germany without undue delay.

Article 15

Surveillance of installations

(1) The installations and their operation are subject to surveillance by the Federal Maritime and Hydrographic Agency of Germany. Where such surveillance promotes the safety and smoothness of traffic, the local responsible Water and Shipping Directorate shall be involved in this process.
In individual cases, the Federal Maritime and Hydrographic Agency of Germany may issue instructions necessary for the implementation of this Ordinance.

(3) If any installation or its operation results in disruption to the safety and smoothness of traffic or in a danger to the marine environment, the Federal Maritime and Hydrographic Agency of Germany may temporarily prohibit operation either wholly or in part, until due conditions are re-established, insofar as the disruption or danger cannot be averted by any other means or if discontinuation of operation is vital for ascertaining the causes of such disruption or danger. If the disruption or danger cannot be averted by any other means, the Federal Maritime and Hydrographic Agency of Germany may order the removal of the installation.

(4) If an installation requiring a licence is erected or operated without a licence, or if an installation not requiring licence is erected and operated without notification, or if an installation is substantially altered without a licence, the Federal Maritime and Hydrographic Agency of Germany may temporarily or permanently prohibit the continuation of the activity. The Agency may order the removal of an installation erected, operated or substantially altered without the necessary licence or notification. It shall order removal of an installation if the safety and smoothness of traffic or the marine environment cannot be adequately protected by any other means.

(5) The Federal Maritime and Hydrographic Agency of Germany may prohibit the further operation of an installation by the operator or by any person authorised to manage the operation if there is any evidence demonstrating the unreliability of these persons with regard to compliance with legal provisions to protect the safety and smoothness of traffic or the marine environment. The operator of the installation shall, on application, be issued a permission to have the installation operated by a person who guarantees proper operation of the installation.

Article 16

Administrative enforcement

Administrative acts for the implementation of this Ordinance shall be enforced by federal enforcement officers pursuant to the Administrative Enforcement Act and the Act on Direct Enforcement in the Exercise of Public Authority. Direct enforcement shall be applied by the enforcement officers of the Federal Water and Shipping Administration, using the powers of the river and shipping police, and by the enforcement officers of the Federal Border Guard and the customs authorities. The Federal Ministry of Transport, Building and Housing, the Federal Ministry of the Interior, the Federal Ministry of Finance, the Federal Ministry for Consumer Protection, Food and Agriculture and the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety shall regulate cooperation between the Federal Water and Shipping Administration, the Federal Border Guard and the customs authorities.

Article 17

Entry into force

This Ordinance shall enter into force on the day following its promulgation.

Bonn, 23 January 1997

The Federal Minister of Transport
Wissmann

F. EU-Directive on the promotion of electricity from renewable energy sources

DIRECTIVE 2001/77/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

of 27 September 2001

on the promotion of electricity produced from renewable energy sources in the internal electricity market

THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION,

Having regard to the Treaty establishing the European Community, and in particular Article 175(1) thereof,

Having regard to the proposal from the Commission [1],

Having regard to the opinion of the Economic and Social Committee [2],

Having regard to the opinion of the Committee of the Regions [3],

Acting in accordance with the procedure laid down in Article 251 of the Treaty [4],

Whereas:

(1) The potential for the exploitation of renewable energy sources is underused in the Community at present. The Community recognises the need to promote renewable energy sources as a priority measure given that their exploitation contributes to environmental protection and sustainable development. In addition this can also create local employment, have a positive impact on social cohesion, contribute to security of supply and make it possible to meet Kyoto targets more quickly. It is therefore necessary to ensure that this potential is better exploited within the framework of the internal electricity market.

(2) The promotion of electricity produced from renewable energy sources is a high Community priority as outlined in the White Paper on Renewable Energy Sources (hereinafter referred to as 'the White Paper') for reasons of security and diversification of energy supply, of environmental protection and of social and economic cohesion. That was endorsed by the Council in its resolution of 8 June 1998 on renewable sources of energy [5], and by the European Parliament in its resolution on the White Paper. [6]

(3) The increased use of electricity produced from renewable energy sources constitutes an important part of the package of measures needed to comply with the Kyoto Protocol to the United Nations Framework Convention on Climate Change, and of any policy package to meet further commitments.

(4) The Council in its conclusions of 11 May 1999 and the European Parliament in its resolution of 17 June 1998 on electricity from renewable energy sources [7] have invited the Commission to submit a concrete proposal for a Community framework on access for electricity produced from renewable energy sources to the internal market. Furthermore, the European Parliament in its resolution of 30 March 2000 on electricity from renewable energy sources and the internal electricity market [8] underlined that binding and ambitious renewable energy targets at the national level are essential for obtaining results and achieving the Community targets.

(5) To ensure increased market penetration of electricity produced from renewable energy sources in the medium term, all Member States should be required to set national indicative targets for the consumption of electricity produced from renewable sources.

(6) These national indicative targets should be consistent with any national commitment made as part of the climate change commitments accepted by the Community under the Kyoto Protocol.

(7) The Commission should assess to what extent Member States have made progress towards achieving their national indicative targets, and to what extent the national indicative targets are consistent with the global indicative target of 12 % of gross domestic energy consumption by 2010, considering that the White Paper's indicative target of 12 % for the Community as a whole by 2010 provides useful guidance for increased efforts at Community level as well as in Member States, bearing in mind the need to reflect differing national circumstances. If necessary for the achievement of the targets, the Commission should submit proposals to the European Parliament and the Council which may include mandatory targets.

(8) Where they use waste as an energy source, Member States must comply with current Community legislation on waste management. The application of this Directive is without prejudice to the definitions set out in Annex 2a and 2b to Council Directive 75/442/EEC of 15 July 1975 on waste [9]. Support for renewable energy sources should be consistent with other Community objectives, in particular respect for the waste treatment hierarchy.

[1] OJ C 311 E, 31.10.2000, p. 320 and OJ C 154 E, 29.5.2001, p. 89.
[2] OJ C 367, 20.12.2000, p. 5.
[3] OJ C 22, 24.1.2001, p. 27.
[4] Opinion of the European Parliament of 16 November 2000 (OJ C 223, 8.8.2001, p. 294), Council Common Position of 23 March 2001 (OJ C 142, 15.5.2001, p. 5) and Decision of the European Parliament of 4 July 2001 (not yet published in the Official Journal). Council Decision of 7 September 2001.
[5] OJ C 198, 24.6.1998, p. 1.
[6] OJ C 210, 6.7.1998, p. 215.
[7] OJ C 210, 6.7.1998, p. 143.
[8] OJ C 378, 29.12.2000, p. 89.
[9] OJ L 194, 25.7.1975, p. 39. Directive as last amended by Commission Decision 96/350/EC (OJ L 135, 6.6.1996, p. 32).

Therefore, the incineration of non-separated municipal waste should not be promoted under a future support system for renewable energy sources, if such promotion were to undermine the hierarchy.

(9) The definition of biomass used in this Directive does not prejudge the use of a different definition in national legislation, for purposes other than those set out in this Directive.

(10) This Directive does not require Member States to recognise the purchase of a guarantee of origin from other Member States or the corresponding purchase of electricity as a contribution to the fulfilment of a national quota obligation. However, to facilitate trade in electricity produced from renewable energy sources and to increase transparency for the consumer's choice between electricity produced from non-renewable and electricity produced from renewable energy sources, the guarantee of origin of such electricity is necessary. Schemes for the guarantee of origin do not by themselves imply a right to benefit from national support mechanisms established in different Member States. It is important that all forms of electricity produced from renewable energy sources are covered by such guarantees of origin.

(11) It is important to distinguish guarantees of origin clearly from exchangeable green certificates.

(12) The need for public support in favour of renewable energy sources is recognised in the Community guidelines for State aid for environmental protection [1], which, amongst other options, take account of the need to internalise external costs of electricity generation. However, the rules of the Treaty, and in particular Articles 87 and 88 thereof, will continue to apply to such public support.

(13) A legislative framework for the market in renewable energy sources needs to be established.

(14) Member States operate different mechanisms of support for renewable energy sources at the national level, including green certificates, investment aid, tax exemptions or reductions, tax refunds and direct price support schemes. One important means to achieve the aim of this Directive is to guarantee the proper functioning of these mechanisms, until a Community framework is put into operation, in order to maintain investor confidence.

(15) It is too early to decide on a Community-wide framework regarding support schemes, in view of the limited experience with national schemes and the current relatively low share of price supported electricity produced from renewable energy sources in the Community.

(16) It is, however necessary to adapt, after a sufficient transitional period, support schemes to the developing internal electricity market. It is therefore appropriate that the Commission monitor the situation and present a report on experience gained with the application of national schemes. If necessary, the Commission should, in the light of the conclusions of this report, make a proposal for a Community framework with regard to support schemes for electricity produced from renewable energy sources. That proposal should contribute to the achievement of the national indicative targets, be compatible with the principles of the internal electricity market and take into account the characteristics of the different sources of renewable energy, together with the different technologies and geographical differences. It should also promote the use of renewable energy sources in an effective way, and be simple and at the same time as efficient as possible, particularly in terms of cost, and include sufficient transitional periods of at least seven years, maintain investors' confidence and avoid stranded costs. This framework would enable electricity from renewable energy sources to compete with electricity produced from non-renewable energy sources and limit the cost to the consumer, while, in the medium term, reduce the need for public support.

(17) Increased market penetration of electricity produced from renewable energy sources will allow for economies of scale, thereby reducing costs.

(18) It is important to utilise the strength of the market forces and the internal market and make electricity produced from renewable energy sources competitive and attractive to European citizens.

(19) When favouring the development of a market for renewable energy sources, it is necessary to take into account the positive impact on regional and local development opportunities, export prospects, social cohesion and employment opportunities, especially as concerns small and medium-sized undertakings as well as independent power producers.

(20) The specific structure of the renewable energy sources sector should be taken into account, especially when reviewing the administrative procedures for obtaining permission to construct plants producing electricity from renewable energy sources.

(21) In certain circumstances it is not possible to ensure fully transmission and distribution of electricity produced from renewable energy sources without affecting the reliability and safety of the grid system and guarantees in this context may therefore include financial compensation.

(22) The costs of connecting new producers of electricity from renewable energy sources should be objective, transparent and non-discriminatory and due account should be taken of the benefit embedded generators bring to the grid.

[1] OJ C 37, 3.2.2001, p. 3.

(23) Since the general objectives of the proposed action cannot be sufficiently achieved by the Member States and can therefore, by reason of the scale or effects of the action, be better achieved at Community level, the Community may adopt measures, in accordance with the principle of subsidiarity as set out in Article 5 of the Treaty. Their detailed implementation should, however, be left to the Member States, thus allowing each Member State to choose the regime which corresponds best to its particular situation. In accordance with the principle of proportionality, as set out in that Article, this Directive does not go beyond what is necessary in order to achieve those objectives,

HAVE ADOPTED THIS DIRECTIVE:

Article 1

Purpose

The purpose of this Directive is to promote an increase in the contribution of renewable energy sources to electricity production in the internal market for electricity and to create a basis for a future Community framework thereof.

Article 2

Definitions

For the purposes of this Directive, the following definitions shall apply:

(a) *'renewable energy sources'* shall mean renewable non-fossil energy sources (wind, solar, geothermal, wave, tidal, hydropower, biomass, landfill gas, sewage treatment plant gas and biogases);

(b) *'biomass'* shall mean the biodegradable fraction of products, waste and residues from agriculture (including vegetal and animal substances), forestry and related industries, as well as the biodegradable fraction of industrial and municipal waste;

(c) *'electricity produced from renewable energy sources'* shall mean electricity produced by plants using only renewable energy sources, as well as the proportion of electricity produced from renewable energy sources in hybrid plants also using conventional energy sources and including renewable electricity used for filling storage systems, and excluding electricity produced as a result of storage systems;

(d) *'consumption of electricity'* shall mean national electricity production, including autoproduction, plus imports, minus exports (gross national electricity consumption).

In addition, the definitions in Directive 96/92/EC of the European Parliament and of the Council of 19 December 1996 concerning common rules for the internal market of electricity [1] shall apply.

[1] OJ L 27, 30.1.1997, p. 20.

Article 3

National indicative targets

1. Member States shall take appropriate steps to encourage greater consumption of electricity produced from renewable energy sources in conformity with the national indicative targets referred to in paragraph 2. These steps must be in proportion to the objective to be attained.

2. Not later than 27 October 2002 and every five years thereafter, Member States shall adopt and publish a report setting national indicative targets for future consumption of electricity produced from renewable energy sources in terms of a percentage of electricity consumption for the next 10 years. The report shall also outline the measures taken or planned, at national level, to achieve these national indicative targets. To set these targets until the year 2010, the Member States shall:

— take account of the reference values in the Annex,

— ensure that the targets are compatible with any national commitments accepted in the context of the climate change commitments accepted by the Community pursuant to the Kyoto Protocol to the United Nations Framework Convention on Climate Change.

3. Member States shall publish, for the first time not later than 27 October 2003 and thereafter every two years, a report which includes an analysis of success in meeting the national indicative targets taking account, in particular, of climatic factors likely to affect the achievement of those targets and which indicates to what extent the measures taken are consistent with the national climate change commitment.

4. On the basis of the Member States' reports referred to in paragraphs 2 and 3, the Commission shall assess to what extent:

— Member States have made progress towards achieving their national indicative targets,

— the national indicative targets are consistent with the global indicative target of 12 % of gross national energy consumption by 2010 and in particular with the 22,1 % indicative share of electricity produced from renewable energy sources in total Community electricity consumption by 2010.

The Commission shall publish its conclusions in a report, for the first time not later than 27 October 2004 and thereafter every two years. This report shall be accompanied, as appropriate, by proposals to the European Parliament and to the Council.

If the report referred to in the second subparagraph concludes that the national indicative targets are likely to be inconsistent, for reasons that are unjustified and/or do not relate to new scientific evidence, with the global indicative target, these proposals shall address national targets, including possible mandatory targets, in the appropriate form.

Article 4

Support schemes

1. Without prejudice to Articles 87 and 88 of the Treaty, the Commission shall evaluate the application of mechanisms used in Member States according to which a producer of electricity, on the basis of regulations issued by the public authorities, receives direct or indirect support, and which could have the effect of restricting trade, on the basis that these contribute to the objectives set out in Articles 6 and 174 of the Treaty.

2. The Commission shall, not later than 27 October 2005, present a well-documented report on experience gained with the application and coexistence of the different mechanisms referred to in paragraph 1. The report shall assess the success, including cost-effectiveness, of the support systems referred to in paragraph 1 in promoting the consumption of electricity produced from renewable energy sources in conformity with the national indicative targets referred to in Article 3(2). This report shall, if necessary, be accompanied by a proposal for a Community framework with regard to support schemes for electricity produced from renewable energy sources.

Any proposal for a framework should:

(a) contribute to the achievement of the national indicative targets;

(b) be compatible with the principles of the internal electricity market;

(c) take into account the characteristics of different sources of renewable energy, together with the different technologies, and geographical differences;

(d) promote the use of renewable energy sources in an effective way, and be simple and, at the same time, as efficient as possible, particularly in terms of cost;

(e) include sufficient transitional periods for national support systems of at least seven years and maintain investor confidence.

Article 5

Guarantee of origin of electricity produced from renewable energy sources

1. Member States shall, not later than 27 October 2003, ensure that the origin of electricity produced from renewable energy sources can be guaranteed as such within the meaning of this Directive according to objective, transparent and non-discriminatory criteria laid down by each Member State. They shall ensure that a guarantee of origin is issued to this effect in response to a request.

2. Member States may designate one or more competent bodies, independent of generation and distribution activities, to supervise the issue of such guarantees of origin.

3. A guarantee of origin shall:

— specify the energy source from which the electricity was produced, specifying the dates and places of production, and in the case of hydroelectric installations, indicate the capacity;

— serve to enable producers of electricity from renewable energy sources to demonstrate that the electricity they sell is produced from renewable energy sources within the meaning of this Directive.

4. Such guarantees of origin, issued according to paragraph 2, should be mutually recognised by the Member States, exclusively as proof of the elements referred to in paragraph 3. Any refusal to recognise a guarantee of origin as such proof, in particular for reasons relating to the prevention of fraud, must be based on objective, transparent and non-discriminatory criteria. In the event of refusal to recognise a guarantee of origin, the Commission may compel the refusing party to recognise it, particularly with regard to objective, transparent and non-discriminatory criteria on which such recognition is based.

5. Member States or the competent bodies shall put in place appropriate mechanisms to ensure that guarantees of origin are both accurate and reliable and they shall outline in the report referred to in Article 3(3) the measures taken to ensure the reliability of the guarantee system.

6. After having consulted the Member States, the Commission shall, in the report referred to in Article 8, consider the form and methods that Member States could follow in order to guarantee the origin of electricity produced from renewable energy sources. If necessary, the Commission shall propose to the European Parliament and the Council the adoption of common rules in this respect.

Article 6

Administrative procedures

1. Member States or the competent bodies appointed by the Member States shall evaluate the existing legislative and regulatory framework with regard to authorisation procedures or the other procedures laid down in Article 4 of Directive 96/92/EC, which are applicable to production plants for electricity produced from renewable energy sources, with a view to:

— reducing the regulatory and non-regulatory barriers to the increase in electricity production from renewable energy sources,

— streamlining and expediting procedures at the appropriate administrative level, and

— ensuring that the rules are objective, transparent and non-discriminatory, and take fully into account the particularities of the various renewable energy source technologies.

2. Member States shall publish, not later than 27 October 2003, a report on the evaluation referred to in paragraph 1, indicating, where appropriate, the actions taken. The purpose of this report is to provide, where this is appropriate in the context of national legislation, an indication of the stage reached specifically in:

— coordination between the different administrative bodies as regards deadlines, reception and treatment of applications for authorisations,

— drawing up possible guidelines for the activities referred to in paragraph 1, and the feasibility of a fast-track planning procedure for producers of electricity from renewable energy sources, and

— the designation of authorities to act as mediators in disputes between authorities responsible for issuing authorisations and applicants for authorisations.

3. The Commission shall, in the report referred to in Article 8 and on the basis of the Member States' reports referred to in paragraph 2 of this Article, assess best practices with a view to achieving the objectives referred to in paragraph 1.

Article 7

Grid system issues

1. Without prejudice to the maintenance of the reliability and safety of the grid, Member States shall take the necessary measures to ensure that transmission system operators and distribution system operators in their territory guarantee the transmission and distribution of electricity produced from renewable energy sources. They may also provide for priority access to the grid system of electricity produced from renewable energy sources. When dispatching generating installations, transmission system operators shall give priority to generating installations using renewable energy sources insofar as the operation of the national electricity system permits.

2. Member States shall put into place a legal framework or require transmission system operators and distribution system operators to set up and publish their standard rules relating to the bearing of costs of technical adaptations, such as grid connections and grid reinforcements, which are necessary in order to integrate new producers feeding electricity produced from renewable energy sources into the interconnected grid.

These rules shall be based on objective, transparent and non-discriminatory criteria taking particular account of all the costs and benefits associated with the connection of these producers to the grid. The rules may provide for different types of connection.

3. Where appropriate, Member States may require transmission system operators and distribution system operators to bear, in full or in part, the costs referred to in paragraph 2.

4. Transmission system operators and distribution system operators shall be required to provide any new producer wishing to be connected with a comprehensive and detailed estimate of the costs associated with the connection. Member States may allow producers of electricity from renewable energy sources wishing to be connected to the grid to issue a call for tender for the connection work.

5. Member States shall put into place a legal framework or require transmission system operators and distribution system operators to set up and publish their standard rules relating to the sharing of costs of system installations, such as grid connections and reinforcements, between all producers benefiting from them.

The sharing shall be enforced by a mechanism based on objective, transparent and non-discriminatory criteria taking into account the benefits which initially and subsequently connected producers as well as transmission system operators and distribution system operators derive from the connections.

6. Member States shall ensure that the charging of transmission and distribution fees does not discriminate against electricity from renewable energy sources, including in particular electricity from renewable energy sources produced in peripheral regions, such as island regions and regions of low population density.

Where appropriate, Member States shall put in place a legal framework or require transmission system operators and distribution system operators to ensure that fees charged for the transmission and distribution of electricity from plants using renewable energy sources reflect realisable cost benefits resulting from the plant's connection to the network. Such cost benefits could arise from the direct use of the low-voltage grid.

7. Member States shall, in the report referred to in Article 6(2), also consider the measures to be taken to facilitate access to the grid system of electricity produced from renewable energy sources. That report shall examine, *inter alia*, the feasibility of introducing two-way metering.

Article 8

Summary report

On the basis of the reports by Member States pursuant to Article 3(3) and Article 6(2), the Commission shall present to the European Parliament and the Council, no later than 31 December 2005 and thereafter every five years, a summary report on the implementation of this Directive.

This report shall:

— consider the progress made in reflecting the external costs of electricity produced from non-renewable energy sources and the impact of public support granted to electricity production,

— take into account the possibility for Member States to meet the national indicative targets established in Article 3(2), the global indicative target referred to in Article 3(4) and the existence of discrimination between different energy sources.

If appropriate, the Commission shall submit with the report further proposals to the European Parliament and the Council.

Article 9

Transposition

Member States shall bring into force the laws, regulations and administrative provisions necessary to comply with this Directive not later than 27 October 2003. They shall forthwith inform the Commission thereof.

When Member States adopt these measures, they shall contain a reference to this Directive or shall be accompanied by such a reference on the occasion of their official publication. The methods of making such reference shall be laid down by the Member States.

Article 10

Entry into force

This Directive shall enter into force on the day of its publication in the *Official Journal of the European Communities*.

Article 11

Addressees

This Directive is addressed to the Member States.

Done at Brussels, 27 September 2001.

For the European Parliament	*For the Council*
The President	*The President*
N. FONTAINE	C. PICQUÉ

ANNEX

Reference values for Member States' national indicative targets for the contribution of electricity produced from renewable energy sources to gross electricity consumption by 2010 (*)

This Annex gives reference values for the fixing of national indicative targets for electricity produced from renewable energy sources ('RES-E'), as referred to in Article 3(2):

	RES-E TWh 1997 (**)	RES-E % 1997 (***)	RES-E % 2010 (***)
Belgium	0,86	1,1	6,0
Denmark	3,21	8,7	29,0
Germany	24,91	4,5	12,5
Greece	3,94	8,6	20,1
Spain	37,15	19,9	29,4
France	66,00	15,0	21,0
Ireland	0,84	3,6	13,2
Italy	46,46	16,0	25,0 (1)
Luxembourg	0,14	2,1	5,7 (2)
Netherlands	3,45	3,5	9,0
Austria	39,05	70,0	78,1 (3)
Portugal	14,30	38,5	39,0 (4)
Finland	19,03	24,7	31,5 (5)
Sweden	72,03	49,1	60,0 (6)
United Kingdom	7,04	1,7	10,0
Community	338,41	13,9 %	22 % (****)

(*) In taking into account the reference values set out in this Annex, Member States make the necessary assumption that the State aid guidelines for environmental protection allow for the existence of national support schemes for the promotion of electricity produced from renewable energy sources.

(**) Data refer to the national production of RES-E in 1997.

(***) The percentage contributions of RES-E in 1997 and 2010 are based on the national production of RES-E divided by the gross national electricity consumption. In the case of internal trade of RES-E (with recognised certification or origin registered) the calculation of these percentages will influence 2010 figures by Member State but not the Community total.

(****) Rounded figure resulting from the reference values above.

(1) Italy states that 22 % would be a realistic figure, on the assumption that in 2010 gross national electricity consumption will be 340 TWh. When taking into account the reference values set out in this Annex, Italy has assumed that gross national electricity production from renewable energy sources will attain up to 76 TWh in 2010. This figure includes the contribution of the non-biodegradable fraction of municipal and industrial waste used in compliance with Community legislation on waste management.
In this respect, the capability to reach the indicative target as referred to in this Annex, is contingent, *inter alia*, upon the effective level of the national demand for electric energy in 2010.

(2) Taking into account the indicative reference values set out in this Annex, Luxembourg takes the view that the objective set for 2010 can be achieved only if:
— total electricity consumption in 2010 does not exceed that of 1997,
— wind-generated electricity can be multiplied by a factor of 15,

— biogas-generated electricity can be multiplied by a factor of 208,
— electricity produced from the only municipal waste incinerator in Luxembourg, which in 1997 accounted for half the electricity produced from renewable energy sources, can be taken into account in its entirety,
— photovoltaically generated electricity can be raised to 80 GWh, and

in so far as the above points can be achieved from the technical standpoint in the time allowed.

In the absence of natural resources, an additional increase in electricity generated by hydroelectric power stations is ruled out.

(3) *Austria* states that 78,1 % would be a realistic figure, on the assumption that in 2010 gross national electricity consumption will be 56,1 TWh. Due to the fact that the production of electricity from renewable sources is highly dependent on hydropower and therefore on the annual rainfall, the figures for 1997 and 2010 should be calculated on a long-range model based on hydrologic and climatic conditions.

(4) *Portugal*, when taking into account the reference values, set out in this Annex, states that to maintain the 1997 share of electricity produced from renewable sources as an indicative target for 2010 it was assumed that:
— it will be possible to continue the national electricity plan building new hydro capacity higher than 10 MW,
— other renewable capacity, only possible with financial state aid, will increase at an annual rate eight times higher than has occurred recently.

These assumptions imply that new capacity for producing electricity from renewable sources, excluding large hydro, will increase at a rate twice as high as the rate of increase of gross national electricity consumption.

(5) In the *Finnish* action plan for renewable energy sources, objectives are set for the volume of renewable energy sources used in 2010. These objectives have been set on the basis of extensive background studies. The action plan was approved within the Government in October 1999.

According to the Finnish action plan, the share of electricity produced from renewable energy sources by 2010 would be 31 %. This indicative target is very ambitious and its realisation would require extensive promotion measures in Finland.

(6) When taking into account the reference values set out in this Annex, *Sweden* notes that the possibility of reaching the target is highly dependent upon climatic factors heavily affecting the level of hydropower production, in particular variations in pluviometry, timing of rainfall during the year and inflow. The electricity produced from hydropower can vary substantially. During extremely dry years production may amount to 51 TWh, whereas in wet years it could amount to 78 TWh. The figure for 1997 should thus be calculated with a long-range model based on scientific facts on hydrology and climatic change.

It is a generally applied method in countries with important shares of hydropower production to use water inflow statistics covering a time span of 30 to 60 years. Thus, according to the Swedish methodology and based on conditions during the period 1950-1999, correcting for differences in total hydropower production capacity and inflow over the years, average hydropower production amounts to 64 TWh which corresponds to a figure for 1997 of 46 %, and in this context Sweden considers 52 % to be a more realistic figure for 2010.

Furthermore, the ability of Sweden to achieve the target is limited by the fact that the remaining unexploited rivers are protected by law. Moreover, the ability of Sweden to reach the target is heavily contingent upon:
— the expansion of combined heat and power (CHP) depending on population density, demand for heat and technology development, in particular for black liquor gasification, and
— authorisation for wind power plants in accordance with national laws, public acceptance, technology development and expansion of grids.

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New Research Focus for Renewable Energies

as of: April2002

DAS HAT ZUKUNFT.

Berlin, April 2002

New Research Focus for Renewable Energies

€ 30 million research funds awarded under German Government Future Investment Programme by the Federal Environment Ministry

In May 2001 the Budget Committee of Germany's Federal Parliament allocated approx. € 30 million to the Federal Environment Ministry to finance research and development in the field of green energies. This will permit R&D projects in the following fields by the end of 2003 as part of the German government's Future Investment Programme (ZIP):

1 geothermal power generation

2 solar thermal power generation

3 ecological research associated with offshore wind farms

4 ecological research associated with stationary fuel cells

5 ecological research associated with the use of biomass

Some 50 project proposals were submitted with a total financial requirement of over € 65 million. Under participation of corresponding departments of the Federal Environment Ministry, the Federal Environmental Agency (UBA), the Nature Conservation Agency (BfN) and the project carriers (German Redevelopment Bank – KfW for solar thermal power generation and Projektträger Jülich for the other fields) about 20 of these projects were selected and negotiated with the applicants. The funding applied for these projects had to be reduced substantially and the defined tasks were amended accordingly. The projects and partners are summed up below.

1 Geothermal Power Generation

The energy stored within the earth is inexhaustible by human standards. Because this energy is available at any time of day and in any season, it can be used to generate base load power and thereby to substitute about a quarter of Germany's current electricity requirements while producing almost no emissions. Geothermal energy can also be used for district heating as well as power generation, and combined heat and power (CHP) stations obtain both forms of energy at once with particular efficiency.

However, the right technologies must be developed to unleash this potential. The programme will serve to promote power generation, both on its own and in CHP facilities. Three technological approaches are being explored, depending on regional conditions:

- In the **hot dry rock process (HDR)** subterranean heat exchange surfaces are created within hot, dry layers of rock. This is achieved by drilling down to levels of 4,000 metres or more, thereby triggering heavy stimulation. Water circulating in the resultant artificial fractures is heated before returning above ground, where it can be converted into power in a conventional power station or an ORC unit. The HDR process can be established in almost any region, but in Germany it is typically associated with the crystalline rock in the south of the country and the volcanic rock of the northern plain.

- **Hot water from aquifers** can also be extracted directly to provide power and heat. However, the application calls for certain location factors, which are relatively rare in Germany. Exceptions include the Upper Rhine Valley and the foothills of the Alps. The water is converted into electricity above ground and then returned to the earth via a second borehole.

- The third process is using **existing boreholes** – drilled, for example, for identifying cavities for nuclear waste storages or for searching natural gas – to evaporate liquids with low boiling points and thereby derive power from geothermal energy.

Projects for research in geothermal power generation

1	Further development of the HDR process in the crystalline rock of Southern Germany at the Bad Urach site in Baden Württemberg
Partner	Bad Urach Council
Objective	appraisal of options for geothermal power generation in Southern Germany; preparations for the construction of a power station
2	Further development of the HDR process in the volcanic rock of the North German Plain at the Gross Schönebeck site in Brandenburg
Partner	Georesearch Centre Potsdam
Objective	appraisal of options for geothermal power generation in the North German Plain; preparations for the construction of a power station
3	Geothermal power generation in Upper Rhine muschelkalk at the Offenbach site in Rhineland-Palatinate
Partner	Hot Rock EWK Offenbach/Pfalz GmbH, Karlsruhe
Objective	specimen demonstration of cost-effective geothermal power generation in the Upper Rhine trough using thermal water from aquifers
4	Geothermal power generation in the Bavarian Molassebecken using the Kalina Cycle system at the Unterhaching site
Partner	Unterhaching Council
Objective	demonstrating the scope for generating power from mildly thermal deep-lying water in the Malmkarst; retrieval of surplus hydraulic energy
5	Closed geothermal heat exchange
Partner	Technical University Berlin
Objective	demonstrating the use of existing boreholes to produce electricity
6	Networking and evaluating activities in the field of geothermal power generation
Partner	Institut für Energetik und Umwelt, Leipzig
Objective	promotion of scientific exchange, including the organisation of conferences and the compiling of information; analysis of current research with a view to future projects

2 Solar Thermal Power Generation

In solar thermal power stations, concentrated reflector systems produce high-temperature thermal energy to generate electricity. Process heat and space heating can be drawn off, and space cooling can also be provided. Storage technologies permit nighttime and base load operation. Only direct radiation can be bundled in this way, which means, that most potential locations are in dry, hot zones south of latitude 40°

This technology could play a major role in combating global warming by means of the flexible instruments defined in the Kyoto Protocol. Not only German companies, but also German research institutes are among the global pacesetters in this relatively unexploited form of renewable energy.

There are three significant processes for solar thermal power generating:

- **Parabolic trough systems**, which focus the sun's light onto an absorber tube by means of concave parabolic reflectors. The resulting heat produces steam, which is converted to electricity in a power station block. Parabolic trough systems are currently the most economical option for generating solar power, thereby presenting the greatest opportunity for a large-scale implementation in the short term.

- **Solar tower plants**, where solar radiation is concentrated by individually positioned heliostats. The absorber is in a central position on the tower. The high temperatures obtained offer particularly favourable conditions for integrating gas turbines or highly efficient gas and steam units.

- **Solar dish systems**, consisting of individually positioned parabolic mirrors with an integrated thermal power generator. This is usually a Stirling (hot air) engine driven by continuous heat input. The system can be run around the clock by integrating storage capacity or additional fossil fuel firing. This is why solar dish systems are well suited for the use in decentralised power networks unconnected to a national or other large-scale grid.

Projects for research in solar thermal power generation

1	Parabolic trough technology
Partners	German Aerospace Center (DLR), Cologne/Stuttgart; Flabeg, Cologne; Schlaich Bergermann & Partners, Stuttgart; Schott, Mitterteich
Objectives	a) further development of a prototype European power plant concept (Eurotrough) as a major step towards serial production; assembly and testing of a mirror in California for commercial power generation b) further development of the absorber tube to market maturity c) further development of the storage technology d) development of mobile measurement equipment to optimise solar fields
2	Fresnel trough technology
Partners	Fraunhofer Institute for Solar Energy Systems, Freiburg; E.ON, Munich
Objective	model calculations; optimisation and feasibility study for a trough collector system built over flat mirrors
3	Solar tower technology
Partners	German Aerospace Center (DLR), Cologne/Stuttgart; Kraftanlagen München GmbH, Munich; G+H Isolite GmbH, Ludwigshafen
Objective	improving the efficiency and reducing the cost of the solar tower technology for a medium-term installation of a demonstration plant

4	EnviroDish
Partners	German Aerospace Center (DLR), Cologne/Almeria (Spain); Klein + Stekl, Stuttgart; Mero, Würzburg, Schlaich Bergermann & Partners, Stuttgart; Solo, Sindelfingen
Objective	preparations for small series production of the dish/Stirling technology; creation of a reference units
5	Solar dish system with thermo chemical storage
Partner	BSR Solar Technologies GmbH, Lörrach
Objective	Development of a zero-series prototype for a solar dish system with innovative low-temperature Stirling engine and storage
6	Sokrates
Partner	German Aerospace Center (DLR), Cologne/Stuttgart
Objective	technological appraisal and support for the market launch of solar thermal power plant in conjunction with a satellite-based geographical database

3 Ecological research associated with offshore wind farms

To achieve the German government's targets for the expansion of renewable energies, offshore wind farms with a total capacity of approx. 3,000 MW are to be constructed by 2010. By 2025 to 2030 about 15 per cent of the demand for power – equal to an installed capacity of 20,000 to 25,000 MW – is to be met by these maritime wind farms. In the launch phase there is a particular need for research into the impact of this expansion on the environment and natural resources.

The projects on the list include surveys of bird and bat flight paths as well as the measurement of sonic spectra and intensities. Some of the work is to be conducted on measuring platforms set up as part of the R&D ZIP programme run by the Federal Ministry of Economics and Technology (BMWi). One research output will be recommended thresholds, for example, for acoustic emissions from offshore wind farms. This requires prior investigation into the hearing of small whales and harbour seals. Other projects will address the optimisation of pilings to shield wind farms from collisions with seagoing vessels and the routing of undersea cables with due respect for the requirements of natural protection and legal provisions.

At the same time, the population and distribution of resting birds and sea mammals will be recorded over large areas. This will help to assess head counts undertaken in smaller areas by operators applying to build wind farms at specific sites.

Given the specific problems raised by applying the IPPC Directive in the Exclusive Economic Zone (EEZ), legal and technical instruments are to be developed to assist in environmental planning and the definition of precautionary measures during the licensing process for offshore wind farms.

One particular objective of this research will be supporting the identification of suitable areas for offshore power generation and, by the same token, areas within the EEZ, which merit special protection by the German government.

Projects for ecological research associated with offshore wind farms

1	Warm-blooded marine fauna in the North and Baltic Seas
Partners	Wattenmeer National Park Authority, Tönning (lead partner); Deutsches Meeresmuseum, Stralsund; West Coast Research and Technology Centre, Kiel University; Marine Fishing Institute, BFA, Hamburg; Marine Studies Institute, Kiel University; Ruhr University, Bochum
Objective	monitoring of the population, behaviour and acoustic sensitivity of marine resting birds, divers, marine ducks and mammals
2	Nature protection requirements of bird protection areas
Partner	Schreiber Umweltplanung, Bramsche
Objective	preliminary research for the designation of protected areas and suitable wind farm locations in the EEZ
3	Platform-based field studies on the impact of offshore wind farms on the marine environment (BEOFINO)
Partner	Alfred Wegener Foundation, Polar and Marine Research Institute, Bremerhaven
Objective	Monitoring bird migration paths and benthos communities in the vicinity of piles; determining the impact of electromagnetic fields on marine life; procedural proposals for IPPC implementation
4	Evaluation of foundations for offshore wind farms with a view to potential shipping collisions
Partner	Technical University Hamburg Harburg
Objective	model calculations for shipping collisions with wind farms; formulation of recommendations for different pilings
5	Acoustic pollution of the marine environment by offshore wind farm emissions
Partners	Curt Risch Institute of Dynamics, Sound and Measurement Technology, Technical University of Hanover (lead partner); German Wind Energy Institute, Wilhelmshaven; Institute of Technical and Applied Physics, Oldenburg
Objective	monitoring of sonic spectra and intensities; formulation of recommendations for acoustic emission thresholds for future offshore wind farms
6	Environmentally compatible sound grid connections for offshore wind parks
Partner	Schreiber Umweltplanung, Bramsche
Objective	formulation of criteria for routing undersea cables given the requirements of nature protection and legal provisions
7	Environmental planning tools for the licensing of offshore wind farms
Partner	Technical University Berlin
Objective	development and adjustment of precautionary and planning instruments for the use in the licensing of offshore wind farms in the light of technical and legal factors

4 Ecological research in association with fuel cell applications

Fuel cells are galvanic elements used for energy conversion. They generate power and heat due to a direct reaction between the fuel cell and ambient oxygen. Compared with conventional combustion systems, they display lower emissions and potentially greater electrical efficiency. Moreover, the efficient operation at partial load and the modular construction permit a broad range of applications, from powering laptops via vehicle propulsions to power plants in the megawatt class. With the aid of networked, decentralised combined heat and power units in buildings, they can even be used to run "virtual" power stations.

Fuel cells can be operated with different fuels. They are particularly helpful as a smooth transition from fossil fuels to renewable energies. This makes them an important stepping-stone on the road to sustainable energy supply.

Combined project for ecological research associated with fuel cell applications

1	Environmental impact, framework conditions and market potential of decentralised fuel cell systems
Partners	German Aerospace Center (DLR), Cologne/Stuttgart (lead partner); Fraunhofer Institute for Solar Energy Systems, Freiburg; Institute of Energy and Environment Research, Heidelberg; Ruhr University, Bochum; Wuppertal Climate, Environment and Energy Institute; Centre of Solar Energy and Hydrogen Research, Stuttgart
Objective	analysis of the entire fuel cell process chain (production, operation and disposal/recycling) regarding the operation experience of existing fuel cell systems; scenario-based calculations on the development potential for different fuel cell technologies in the German energy sector; appraisal of the environmental impact of fuel cell systems

5 Ecological research in association with the use of biomass

For achieving the targets, which have been set to expand renewable energies and ensure a sustainable energy supply, it will be essential to make greater use of biomass. The term covers a broad spectrum of possible materials of plant and animal origin. Biomass can be used to obtain propellant fuels, electricity, heat and also combined heat and power. As it can be stored, energy can be produced at base load. The diversity of biogenic inputs also encourages innovative conversion technologies, including the Stirling engine and fuel cells.

Under the Renewable Energies Act and the Biomass Ordinance the Federal Environment Ministry has been entrusted with monitoring the use of biomass for energy purposes and , if necessary, rectifying counter-productive trends. Therefore the energy and environmental balances, induced by the use of different types of phytomass and zoo mass combined with various conversion technologies must be evaluated. Research also includes the generating of development scenarios founded on a variety of assumptions and conditions for the use of biomass.

Combined project for ecological research associated with the use of biomass

1	Material flow analysis for a sustainable use of biomass in energy applications
Partners	Öko-Institut, Darmstadt/Freiburg/Berlin (lead partner); Fraunhofer Institute for Environmental, Security and Energy Technologies, Oberhausen; Institut für Energetik und Umwelt, Leipzig; Institute of Energy and Environment Research, Heidelberg; Institute of Future Energy Systems, Saarbrücken; Institute of Geoecology, Department of Environmental Systems Analysis, Technical University, Brunswick; Weihenstephan Scientific Centre for Food, Land Use and the Environment, Munich
Objective	material flow analysis for the requirement "biomass in energy applications"; development of a model and analysis of possible future trends based on scenarios; formulation of an ecologically compatible strategy for using the biomass potential in Germany for energy conversion

Federal Ministry for the
Environment, Nature Conservation
and Nuclear Safety

Contents

The Federal Environment Ministry funds industrial demonstration projects in ecologically important sectors such as climate protection, water body protection, renewable energies and transport. The aim is to show how innovative processes for reducing and avoiding environmental pollution can be realized.

This programme supports projects with a high demonstration impact and corresponding multiplier effect. The projects also provide data for further developing the state-of-the-art in technology and environmental regulations. Priority for funding is given to small to medium sized companies.

As a rule, funded companies receive an interest rate subsidy from the Federal Environment Ministry on a loan from the Deutsche Ausgleichsbank (DtA). An investment allowance can also be granted in exceptional cases. The DtA undertakes the administrative and financial work of the programme, while the Federal Environmental Agency conducts specialist monitoring.

This brochure presents 11 model projects.

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Dear Readers

Sustainable development cannot be achieved without innovative environmental technology. Modern technologies are vital for further reducing the continued high use of energy and resources in production processes and consumption.

The German Government's ambitious environmental policy has created the conditions for the breakthrough of state-of-the-art technology - for example in the field of energy saving. This also creates jobs and opens up competition opportunities. Environmental technology from Germany already leads the market in many sectors. The Federal Environment Ministry supports investments with a demonstration impact in order to show how advanced processes for avoiding or reducing pollution can be put into practice.

In this brochure we want to make it clear that technical progress and environmental protection are absolutely compatible and that such a combination can lead to economically attractive solutions. To illustrate this, 11 projects are presented covering the whole range of environmental protection fields: Climate protection, sustainable development, integrated technologies, closed substance cycles and water body protection. We hope to achieve a major multiplier effect with these demonstration projects, but will also use the results for the further development of environmental regulations and state-of-the-art technology.

The findings from the demonstration projects funded by the Federal Environment Ministry have been incorporated into the EU information sheets on "best available technologies", thus contributing to European harmonisation. Furthermore, the findings are also included in national regulations such as the amendment to the Technical Instructions on Air Quality Control (TA Luft).

As the examples show, technical innovation is by no means only a matter for large enterprises. Small to mediums sized companies are revealing their own potential more and more.

I very much hope that these examples will be imitated and that they will encourage other companies to commit themselves to environmental protection.

Jürgen Trittin
Federal Minister for the Environment,
Nature Conservation and Nuclear Safety

WOOD PROVIDES ELECTRICITY, HEAT AND COOLING

Burning fossil fuels releases carbon dioxide which impacts negatively on the climate. In contrast, wood has a neutral effect when burned, as the CO2 it contains returns to the regenerative biomass. The town of Pfaffenhofen in Bavaria is thus setting new standards with a biomass thermal power plant which generates electricity from natural wood and bark and sawmill wood waste. The plant furthermore supplies the town with steam, district heating and cooling.

Since mid 2001, the Pfaffenhofen biomass thermal power plant has fed around 42 gigawatt hours of electricity per year into the public grid, via a 6-megawatt turbine. This electricity volume covers the needs of about 10,000 households. At the same time this environment friendly power plant provides up to 150 consumers with district heating via a 17 kilometre long network. These consumers include a clinic, industrial operations, schools, the Pfaffenhofen town hall and many private households.

In Pfaffenhofen, 80,000 tonnes of wood - from the surrounding forests and from sawmill and wood processing industry wastes - replace around 24 million litres of heating oil, saving the atmosphere about 65,000 tonnes of additional carbon dioxide each year. The biomass thermal power plant solves the problem of pollutant emission from waste gases by using a downstream gas cleaning system. Depending on the type of operation, dust emissions are between 60 and 70 percent lower than the values prescribed in the Technical Instructions on Air Quality Control, TA Luft. For carbon monoxide, it is around 60 percent lower than the TA Luft limit values. Nitrogen and sulphur dioxide emissions undercut these values by as much as 80 per cent.

Pfaffenhofen is the first municipality in Germany to reach the Federal Republic's climate protection target. The 22,000 inhabitants now produce 32 per cent less greenhouse gases than in 1990.

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Project information

The total costs for the thermal power plant, fuel logistics, provision of steam and district heating, the suppliers service installation and cooling amounted to 41 million euros. The Federal Environment Ministry funded the biomass thermal power plant with an interest rate subsidy of around 3.9 million euros.

Technical highlights

- use of heat and power co-generation, with electricity, heat and cooling used simultaneously and continuously
- use of wood wastes as fuel

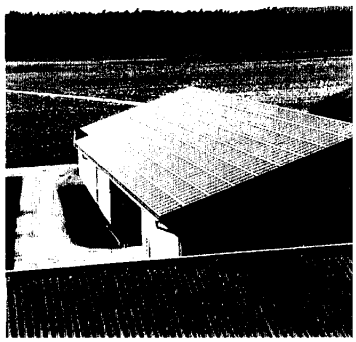
SOLAR ENERGY FROM THE BARN ROOF

On the roofs of the Albrecht Beck farm in the Lower Frankonian village of Volkach-Dimbach a photovoltaics system has been set up which can feed several percent more electricity into the grid than comparable systems. The reason for this lies in its innovative inverter circuitry.

The solar cell system at the Beck farm covers around 1,000 square metres of roof surface and under optimum solar radiation can achieve a photovoltaic capacity of 123 kilowatt. A new type of inverter circuitry considerably improves the system's overall efficiency factor.

Before it can be fed into the grid, direct current produced by the solar cells must be transformed into alternating current. This formerly took place either through a central large inverter or with a number of string inverters attached directly to each of the solar modules. Depending on weather conditions, the current efficiency varies these two concepts. The innovative circuitry in the Beck farm system exploits the advantages of each. A desirable side-effect of the new circuitry is the improved quality of the electricity fed to the grid.

The results of Volkach-Dimbach show that modern technology and beautiful scenery do not have to be a contradiction in terms. The solar cells on the roofs of the Beck farm in a long-established village do not spoil the landscape but present a good example of putting roof space available on agricultural buildings to economic use. In this sense, the project is also a model of how agricultural operations can tap new sources of income.



Project information

A new type of photovoltaics system with a new inverter concept was installed on three roofs of the Beck farm. The Federal Environment Ministry funded the project with around 184,000 euros from its investment programme for reducing environmental pollution. The system is part of a communal project under which Dimbach municipality's total energy requirements will in future be obtained from renewable sources.

Technical highlights

- use of a new type of inverter
- improved quality of electricity from photovoltaics systems

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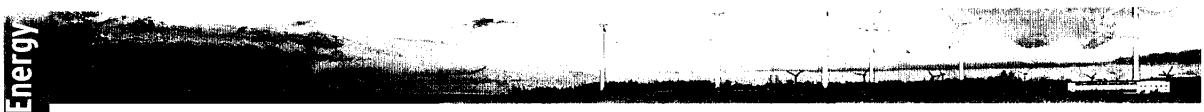

WIND POWER IN LIGNITE DISTRICT

In Klettwitz, Brandenburg, the slag heaps in Lusitz left behind from lignite mining have come to symbolise the transition from conventional electricity generation to renewable energies. One of the largest wind parks in Europe has developed on their ridges: 38 wind turbines with a hub height of 78 metres, creating around 111,000 megawatt hours of electricity per year.

The 38 wind turbines on the former lignite mine heaps in Klettwitz have a total capacity of 62.7 megawatt. They can generate around 110 million kilowatt hours of electricity per year - a volume which covers the electricity needs of all private households in a town like Cottbus.

After the mines in the 200-year-old Senftenberg lignite-mining district were closed in the 1990s, the tips that remained at Klettwitz, rising 50 to 60 metres above the surrounding area, proved suitable for wind energy generation. Indeed, the wind frequency and force here is above average. Nevertheless, the ground was unstable and therefore the wind turbines in Klettwitz, measuring up to 111 metres to the blade tip, had to have special foundations. Furthermore, only a large wind park could compensate for the relatively long distance needed for the electricity cable to the nearest possible feed-in point.

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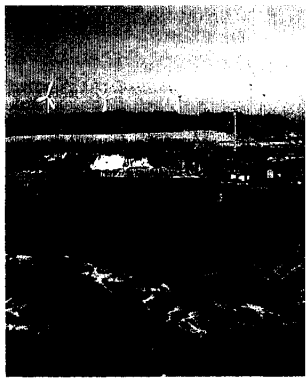


Wind energy is proving to be a driving force for the development of renewable energies and the reduction of carbon dioxide emissions. Germany holds a leading position on the international market in this sector - with at present 9,200 megawatts of installed wind energy capacity - produced by around 12,000 plants. Over one third of the global wind energy capacity set up in 2001 began operations in the Federal Republic. Three percent of our electricity is currently already generated by wind energy.

Project information

In the Klettwitz wind park 38 wind turbines type Vestas V66 with a hub height of 78 metres were erected. Each has a rated power of 1.65 megawatt. Every year the park can generate 110,998-megawatt hours of electricity, thus saving the emission of 122,097 tonnes of carbon dioxide from conventional power plants.

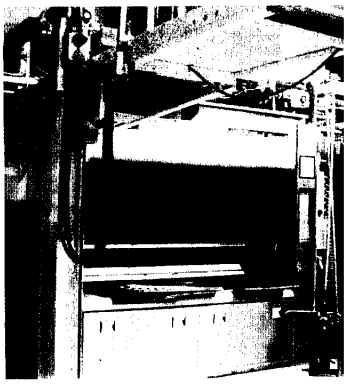
Technical highlights

- erection of the turbines on special foundations in relatively loose, unstable soil
- overcoming large distances to the feed in point for the electricity grid

WHOLEMEAL BREAD ROLLS FROM THE ECO-BAKERY

A bakery that satisfies ecological demands not only with its ingredients and products, but also with its entire production process. The greatest environmental burden from conventional bakeries is energy consumption. In Etting near Weilheim in Upper Bavaria, the Schwarzmaier family has set up a unique ecological project. The production-related energy consumption has been significantly reduced by means of a package of coordinated energy-saving measures.

This bakery is located in a timber-frame low-energy building also comprising a living area and a seminar room. Natural construction materials were used for the building wherever possible. In order to minimize fuel consumption a site was chosen that makes delivery routes as short as possible. The centrepiece of this concept is the newly developed CO2-neutral oven, which is fuelled by wooden pellets and replaces an oven fuelled by heating oil. There are also additional measures contributing to energy saving, for example the waste heat from the oven and the cooling cells and heat generated by the baking process are used to heat water and the building itself. Lighting dependent of daylight also contributes to low electricity consumption, which is primarily covered by renewable energies following a switch to a green electricity provider.



The total annual reduction in energy consumption as compared with a conventional bakery has been 240,000 kWh. In other words, a reduction in CO2 emissions of around 65 tonnes. Training is on offer at the bakery for other bakeries interested in this concept of an environmentally sound way of living and working. Many small and medium-sized bakeries can introduce the above energy-saving measures. The huge level of energy saving means that the necessary investment is quickly recouped.

Project information

The Schwarzmaier bakery not only produces wholemeal bread, cakes and pastries - it does it in an environmentally sound way. Its package of energy-saving measures sets an example to other bakeries of how to drastically reduce energy consumption. The Federal Environment Ministry provided around 150,000 euros for this project.

Technical highlights

- Use of a modern oven fuelled by wooden pellets
- Heat recovery and use of heat storers
- Lighting dependent of daylight

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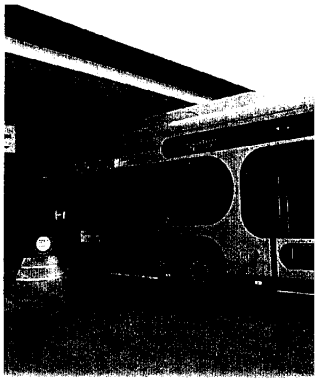
QUIET BUSES WITH CLEAN FUEL

To be able to solve traffic-related environmental problems especially in city centres and built-up areas, we need alternative concepts for power and fuel. In the battle against summer smog, soot particles and noise, the üstra Hannoversche Verkehrsbetriebe AG is using natural gas powered buses to point the way for local public transport. The Federal Environment Ministry was a major supporter of the project.

For several years, 56 natural-gas buses have been in service in Hannover, giving a daily demonstration of the practical nature of this new form of power for routine use. Quite incidentally, they also improve the environmental image of local public transport and give other local authorities an example of how they can get in form for the quality competition of the future.

Compared to conventional diesel engines, natural gas buses emit significantly lower quantities of nitrogen and soot particles - and in this regard already meet the pollution limit values which will apply as of 2008. Furthermore, their potential for ozone formation is around 80 per cent lower and two natural gas powered buses only make as much noise as one diesel bus. In particular in the city centres and built-up areas they make an important contribution to air quality control and climate protection.



On top of these clear advantages for environmental protection, natural gas engines are currently the only alternatives to petrol and diesel powered vehicles which are immediately available. In future, they will also be able to use biogas. Compared to natural gas, biogas has the advantage of having a virtually CO^2 neutral combustion.

Project information

Since EXPO 2000, 56 natural gas powered Mercedes-Benz Citaro buses have been in daily use in Hannover. The 40 saloon vehicles and 16 articulated buses were designed by James Irvine of Milan. The tank for the fuel compressed natural gas (CNG) is located in the roof. The Federal Environment Ministry and the Deutsche Ausgleichsbank (DtA) supported the procurement through üstra Hannoversche Verkehrsbetriebe AG with around 2.8 million euros.

Technical highlights

- use of the alternative fuel natural gas
- biogas can also be used
- advanced tank technology

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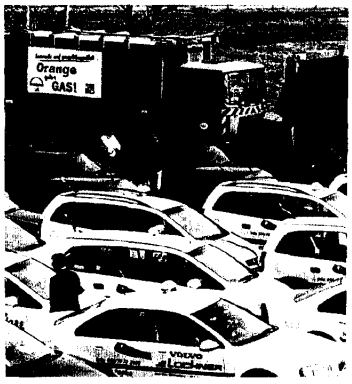
BERLIN TAXIS - ENVIRONMENTALLY SOUND WITH NATURAL GAS

The practical use of natural gas powered passenger cars will soon be demonstrated on the streets of Germany's capital city with 1,000 taxis and 100 driving school vehicles. This is the objective of the initiative 1,000 environmental taxis in Berlin (Tausend Umwelttaxis in Berlin - TUT). The project is supported by the Berlin Senate, the gas industry and the Federal Environment Ministry.

Good for the Berlin air: in the framework of the TUT initiative, the first natural gas-powered taxis and driving school vehicles have been on the road since September 2001. The environmentally friendly fuel is now available at twelve filling stations in the capital, thus providing an adequate infrastructure for driving within the city.

Natural gas fuel has a very high environmental potential. It plays a significant role in reducing traffic-related pollution arising from soot, nitrogen and carbon dioxide. Appropriate engines which can burn this fuel are fully developed, ready to use and very quiet. In contrast, other alternative fuels which may help ease the environmental burden arising from traffic, are only expected on the market in the mid to long term.



For those who drive often and for fleet operators in the Berlin area, procuring natural gas vehicles pays off from the very first kilometre. The higher costs at present still incurred in the purchase of these vehicles are easily compensated for by a good 75 per cent reduction in the mineral oil tax. This reduced tax rate will apply to natural gas as a fuel until 2020.

In order to go beyond Berlin and show other cities and urban areas that the alternative fuel natural gas makes environmentally sound mobility both possible and economically viable, the gas company GASAG has announced that up to the end of 2004 the purchase price for natural gas fuel will be kept at least 30 per cent below the average price for diesel fuel.

Project information

Berlin's model project 1,000 environmental taxis for Berlin (TUT) aims to forward the introduction onto the market of low-pollution low noise natural gas vehicles, and to set up a suitable network of filling stations. Especially in city centres and built-up areas, natural gas vehicles play a role in air quality control, in avoiding summer smog and in climate protection. They are thus an important building block for sustainable mobility and one which is already available now. The Federal Environment Ministry assists the initiative with around 4 million euros.

Technical highlights

- use of alternative fuel natural gas
- adequately developed infrastructure for natural gas filling pumps

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THE EARTHWORM PRINCIPLE - TRACK CONSTRUCTION IN CONTINOUS CYCLE

Rail track construction underwent a technical revolution with the grade improvement machine RPM 2002. In the past, renewal work on the sub-grade required first removing the rails, then renewing the ballast and finally relaying the tracks; now an innovative "factory on wheels" can achieve this in one step.

Every 15 to 20 years a rail bed has to be cleaned in order to restore load-bearing capacity and stability for rail traffic. In conventional construction methods, the tracks are first dismantled and the track ballast and sub-grade removed using diggers and bulldozers. Roads are laid along the track to transport used ballast to landfills by lorry, while interim storage areas are set up which must be dismantled and recultivated on conclusion of the work. Often, new track ballast must be obtained from distant stone quarries.

The company H.F. Wiebe GmbH & Co. KG from Achim near Bremen has now developed a huge rail construction machine which enables sections of track to be completely rehabilitated in one working process. Without dismantling the track, the RPM 2002 removes and reprocesses track ballast and sub-grade. As the route no longer needs to be closed, transport of material to the construction site and the management of wastes is undertaken solely via the rail track.

With an annual capacity of a good 100 km of rail track, this equipment can save a total of more than 150,000 cubic metres, or 250,000 tonnes of new track ballast. As the old ballast no longer has to be landfilled, 9,300 lorry transports with a total of 930,000 road kilometres are rendered unnecessary. This means that around 500,000 litres of diesel are no longer burnt, thus saving an annual burden on the atmosphere of 5,050 kg carbon monoxide, 2,020 kg hydrocarbons, 32,825 kg nitrogen, 556 kg particles and 1,340,000 kg carbon dioxide.

Project information

The RPM 2002 is currently the world's largest and highest performance subterranean improvement machine for track construction. The core measures 145 metres, weighs 680 tonnes and is driven by a 2,794 kW diesel engine. The Federal Environment Ministry funded the development and procurement of the machine with over 1 million euros.

Technical highlights

- saving of up to 250,000 tonnes per year in new track ballast
- 60 per cent lower landfill and transport costs
- annual saving of 1,340 tonnes carbon dioxide emissions

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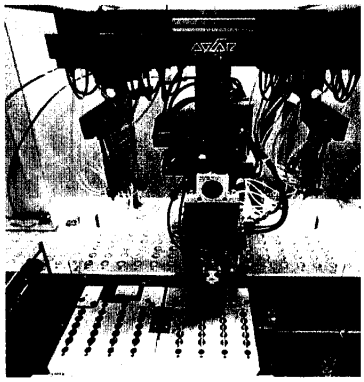
CLEAN BATTERIES FROM CLEANER PRODUCTION

The recent boom in mobile phones and the growing number of small electronic aids in our daily lives has a less agreeable side to it which largely ends up in domestic waste: used batteries. This presents manufacturers with a challenge to develop long-life and environmentally friendly batteries.

For several years in Ellwangen, Swabia, Varta AG subsidiary Microbattery GmbH has pursued a new course. Its most recent innovation is a system for the large-scale production of small lithium polymer batteries for mobiles and notebooks.

The company has completely banned the health-hazardous cobalt - up to now usual in small batteries - from its rechargeable microbattery product and replaced it with environmentally friendly lithium manganese oxide.



It was also possible to replace the previously used liquid electrolyte with a conductive synthetic material. The polymer technology has the advantage that the batteries are easy to recycle after use. It is furthermore a safe technology since the solid synthetic electrolyte cannot leak out; the products are also guaranteed a long life as the small lithium polymer batteries can be recharged up to 1,000 times.

Ellwanger drew attention in 1998 when Varta's production of rechargeable button cells was moved from Singapore to Baden-Württemberg. The Swabians beat the Asian city state for the location due to the area's higher level of expertise. The project's aim was to replace the toxic heavy metals in button cells with more environmentally friendly substances. The relief to the environment is evident, with an annual saving of 90 tonnes cadmium and 10 tonnes mercury.

Project information

The VARTA Microbattery GmbH in Ellwangen, a subsidiary of Varta AG, has succeeded in producing, in an environmentally sound process, rechargeable lithium-polymer batteries for electronic products such as mobile phones and notebooks, and microsystem technology. The innovative batteries are completely free of heavy metals. The Federal Environment Ministry funds the pilot project with an interest rate subsidy amounting to over 2 million euros. Conversion necessary to remove cadmium and mercury from the production of button cells was also supported by the Federal Environment Ministry with around 1.4 million euros.

Technical highlights

- batteries free of heavy metals for telephones, notebook computers and microsytem technology
- substitution of health-hazardous cobalt with lithium manganese oxide
- safe and recycling-friendly polymer technology

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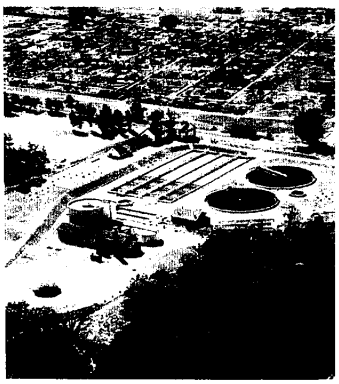
TWO COUNTRIES, TWO TOWNS - ONE WASTEWATER TREATMENT PLANT



The German-Polish wastewater treatment plant Gubin-Guben is a successful example of how border regions can help themselves by helping each other. The development and use of joint technology development became the catalyst for overcoming economic, legal and even psychological problems in a Europe which is growing closer together.

The planning, development and construction of the joint wastewater treatment plant in Gubin not only stimulated economic development on both sides of the border, it was also of benefit to the ecology. Thanks to state-of-the-art technology, the Neisse and Oder Rivers, and consequently also the Baltic Sea, are now considerably less polluted. The pollution load of the Neisse was reduced annually by around 3,400 tonnes of organic compounds. Nitrogen pollution dropped by 270 tonnes per year. The phosphorous input was reduced by 50 tonnes per year.

The mechanical-biological plant located at Gubin has an end-of-pipe biological three phase cleaning process. It has facilities for 90,000 population equivalents. The biogas from the sewage sludge in a fermenter powers a gas engine of around 190 kilowatts electric and 335 kW of thermal capacity. Electricity and heat are then used to operate the sewage works.

The transboundary wastewater treatment at the Gubin location is a model in many respects. Firstly, the plant plays an important role in easing the burden on the environment as it makes a sustainable contribution to improving the water quality of the Neisse, Oder and Baltic Sea. But the project is also an EU model with regard to Poland's planned accession to the EU, as it complies with stringent EU standards. Altogether the project can be seen as a prototype for a new type of German-Polish environmental protection cooperation.

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Project information

The mechanical-biological wastewater treatment plant Gubin-Guben purifies practically the entire wastewater of the Polish town of Gubin and the German town of Guben. It is equipped for 90,000 population equivalents. The construction of the plant in the Polish Gubin, which complies with all EU effluent values, was funded by the Federal Environment Ministry with around 3.3 million euros.

Technical highlights

- mechanical biological wastewater treatment with end-of-pipe biological three phase cleaning process
- regulated waste disposal according to EU standards

ENVIRONMENTALLY SOUND FLOODLIGHTING

The Radium Lampenwerke in Wipperfürth uses a new production process to manufacture halogen lamps in an environmentally sound way, allowing raw materials consumption and the consumption of energy and water to be reduced considerably. The economic benefits to the company go hand-in-hand with climate and resource protection.

For a long time, the radium Lampenwerk GmbH in Wipperfürth, North-Rhine Westphalia has specialised in the production of rod-shaped, double-socket halogen lamps like those found in floodlights of 200 to 2,000 watts. A new production process now allows the company to save around 34 per cent wolfram, 53 per cent electricity and 33 per cent water and still maintain the quality of its products. Molybdenum and mixed acid no longer has to be used at all.

The successful concept does not use components which in the past were essential to a halogen lamp significantly reducing the number of steps in the production. The filament must no longer be wound on the molybdenum wire and repeatedly annealed into shape. The new process no longer requires this molybdenum wire, nor consequently the saltpetre and hydrochloric acid mixture which were previously used to bring the wire chemically into solution in order to expose the filament. Radium Lampenwerke engineers succeeded in reducing the production process from a total of eleven steps to just three.

The new halogen lamps also have an innovative construction concept: the filament is now supported not by wolfram rings, but by quartz nubs in the body of the lamp, thus completely saving the use of wolfram.

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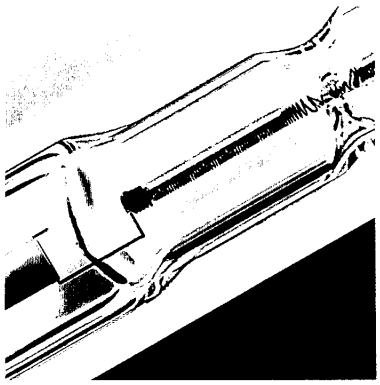

Project information

Radium Lampenwerk GmbH succeeded in considerably reducing the use of raw materials and the consumption of energy and water with a new product design and production process in the manufacture of halogen lamps. The Federal Environment Ministry funded the pilot project with 1 million euros.

Technical highlights

- environmentally sound construction of a halogen lamp
- innovative organisation of the production process

RUBBER ISN'T SIMPLY RUBBER

For the production of the synthetic rubber therban, Bayer AG developed an innovative synthesis process which very efficiently recycles the catalyst rhodium. This unique technology unites efficiency in production with integrated environmental protection.

Rubber is an extremely versatile material, not least because the term itself covers a number of polymers which differ widely in their properties. While today natural rubber covers 35 per cent of global market requirements, synthetic rubber actually makes up the bulk of the approximately 15 million tonnes total consumed in 2000.

Many of today's applications cannot use natural rubber. Bayer has been producing an extremely heat resistant synthetic rubber called therban in Germany since October 2000, establishing the world's most modern production facility of its kind in Leverkusen. The name of the rubber comes from "thermally stable Butadiene AcryloNitrile".

The construction of the therban plant took full account of the concept of environmental protection, especially integrated environmental protection. In the past it was practically impossible to recycle rhodium, the catalyst needed for the synthesis. The new plant can recycle it with an innovative ion exchange procedure.

This means that around 300,000 tonnes less rhodium ore must be mined each year. Furthermore, Bayer saves 20,000 tonnes of steam per year with its new facility, and emits around 5,000 cubic metres fewer solvent-containing waste gases. The new vulcanization process also reduces emission of nitrogen by 300,000 cubic metres.

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Project information

In conventional production of the rubber therban, the catalyst rhodium mostly remains in the polymer. Only a costly wet-chemical procedure made recycling possible. Bayer AG's new production plant uses an innovative synthesis process in which the rhodium is recycled by means of ion exchangers. The Federal Environment Ministry funded the construction of the plant with about 700,000 euros.

Technical highlights

- recycling the catalyst rhodium with an ion exchange procedure
- lowering material consumption and emissions
- cutting edge technology in the growing global market for therban

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"Mindful also of its responsibility toward future generations, the state shall protect the natural bases of life..."
Basic Law of the Federal Republic of Germany, Article 20A

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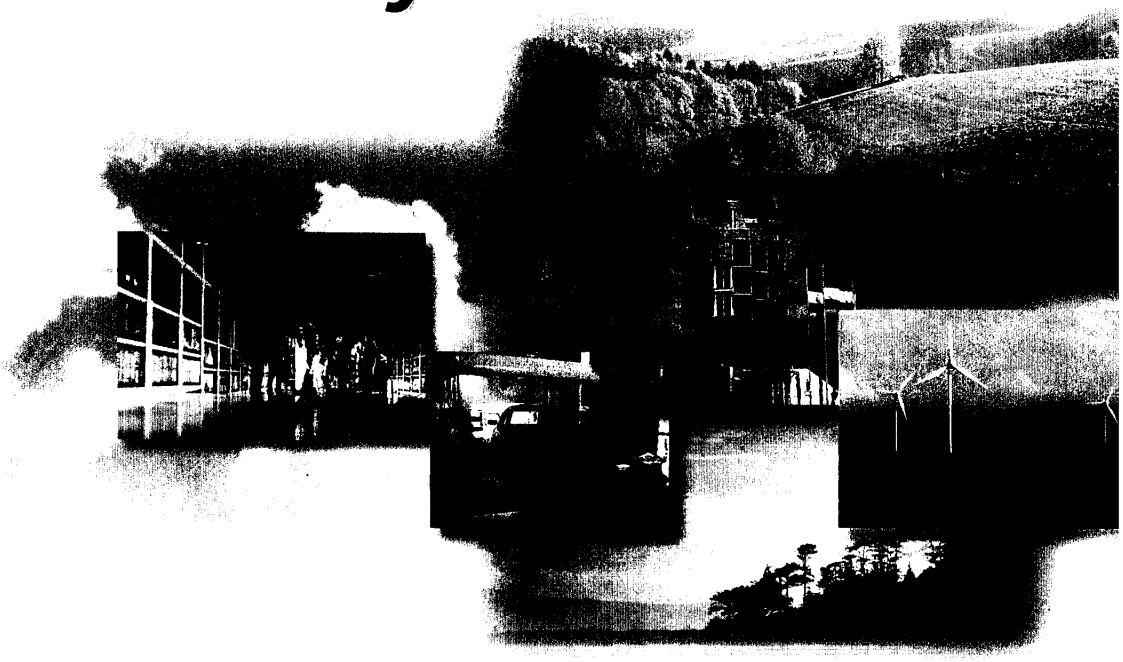
IT'S OUR FUTURE

Bundesministerium
für Umwelt, Naturschutz
und Reaktorsicherheit

Cleaner Production Germany



cleaner production germany

Umwelt Bundes Amt
für Mensch und Umwelt

Cleaner Production Germany

The consistent prevention-oriented environmental policy of the last decades, the high level of environmental awareness amongst the population and big efforts in many areas of society and business have all contributed to Germany having achieved an internationally high level of environmental protection. The establishment of the most modern technology in both fixed installations and mobile sources has led to drastic reductions in harmful emissions. This development will be continue through the gradual replacement or modernisation of old installations, equipment and vehicles and through updating the existing regulations relating to technical progress.

Many of the environmental problems we face today are increasingly of an international character. As a leading industrial nation Germany will continue to play a major role in solving global environmental problems.

The federal government is pursuing these aims both through appropriate measures at home and through the active ongoing development of conservation measures within international organisations (UN, particularly CSD and UNEP, EU, ECE, OECD, G7/G8, World Bank), in the context of international environmental conferences and through bilateral co-operation with other countries.

One important outcome of the UN Environment and Development conference in Rio de Janeiro in 1992 was the recognition by all participants that a more intensive exchange of technology is an essential precondition for sustainable global development. In Agenda 21 and the Rio Convention the industrial nations have committed themselves to greater technical co-operation, including the transfer of such technologies.Both developing and threshold countries and central and eastern European states rely particularly heavily on access to progressive environmental technology to solve their environmental problems and build up sustainable economic structures.

With this brochure we wish to draw attention to examples of German technical environmental protection methods and to the process of creating the political and legal conditions which have led to innovative technical solutions and to awaken interest in a range of German environmental technologies.

In accordance with the Agenda 21requirement to promote access to environmentally sustainable technologies we have established in addition to this brochure an internet information system about German environmental technology ("Cleaner Production Germany"). This platform should improve access to commercial technical or organisational environmental solutions and also to German contacts.

With a further extension of this "navigation system" we want to boost international environmental and developmental co-operation and promote the transfer of environmental technologies.

Jürgen Trittin
Federal Minister for the Environment, Nature Conservation and Nuclear Safety

Environmental priorities have changed in the last 25 years during which environmental protection has been systematically practised in Germany. Geographically this change has progressed from local (e.g. air quality in industrial regions) through regional (e.g. forest destruction) as far as international environmental problems such as the greenhouse effect or the depletion of the stratospheric ozone layer. As the two international examples show, attention is shifting away from problems directly detectable by the senses to others which can either only be sensed indirectly or not at all.

Additional changes: The main focus of activity has moved from environmental aftercare to precautionary measures. Actions based on just one environmental medium – for example air or water - do not do justice to contemporary environmental protection demands: What is needed is a multi-medial and interdisciplinary approach and the setting of new priorities.

One thing above all is necessary to achieve this: We have to formulate and put in concrete terms the modern environmental protection model illustrated by the term "sustainable development" worldwide. Demanding long-term objectives for environmental quality form the basis for sustainable development appropriate for the environment. These can form a reliable framework for future economic and social development.

Technical development must not just be geared towards the use of integrated environmental technologies which reduce both emissions and the use of resources. Efforts to protect the environment during production must extend from raw materials, product design and distribution of goods right through to their final disposal. Nature limits our customary creative freedom. However, it offers opportunities for environmentally friendly - and wealth-creating - innovations. Energy-efficient processes and products using fewer raw materials which are developed today and used tomorrow help to solve worldwide environmental problems of the near future.

We must be clear about one thing in particular: Lasting, environmentally sustainable development cannot be achieved through constant improvement of applied technologies alone. Alongside the "efficiency revolution" we also need changes in the awareness and behaviour of commerce and consumers, meaning a change in social values which in turn itself favours technical adaptations in a sustainable environmentally favourable direction.

And finally concepts are needed for the quick and effective transfer of knowledge gained through our steps towards sustainable development to other countries who at present still have pronounced environmental deficiencies. Our national efforts are essential prerequisites for achieving necessary international progress.

Our Internet-Portal "Cleaner Production Germany" should make a contribution to this.

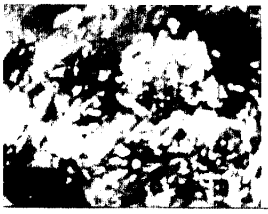
Prof. Dr. Andreas Troge
President of the Federal
Environmental Agency

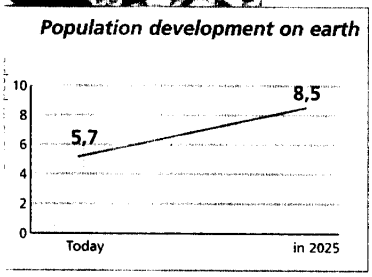
Ways to technical conservation

Contents

Global challenge

The world economy has entered an intensified phase of dynamic development. National boundaries are opening up. Products which were once manufactured exclusively in the old industrial nations and were designed for their domestic markets are nowadays traded and produced world-wide. At the same time new suppliers of high quality products from previously less industrialised countries have established themselves in international markets. The world is becoming more open and growing together.





Population growth: the growth of the world's population is, despite several successes almost undiminished. More and more people demand the right to wealth and their own development.

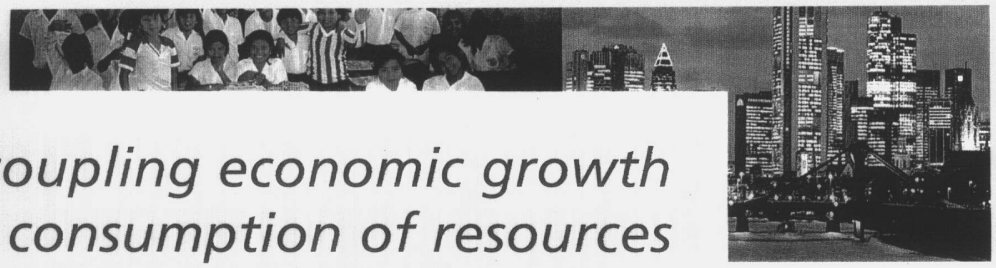
The global challenge is however not limited to the economy. Environmental protection is also affected by this development. Global warming, increasingly frequent natural disasters, the growing waste mountains as well as a shortage of clean water and material resources are challenges which all peoples face together, albeit to varying degrees and with varying immediacy. Air pollution in cities of threshold countries is comparable to the smog situation in cities in industrial countries in the 1960s.

In the next 20 years the OECD expects dynamic economic growth in the threshold countries. This will be combined with greater demands on natural resources and the ecological system.

An unchanged projection of the current development and industry model with its high specific consumption of energy and raw materials as well as uncontained population growth will limit not only the chances of developing and threshold countries of abolishing poverty but also the life chances of future generations world-wide.

How far the conflict between the legitimate wish for affluence and a secure future and the related pressure on nature can be solved is directly proportional to the extent to which economic growth can be decoupled from the consumption of resources and energy.

It is above all up to the industrial nations to develop innovative and transferable solutions, to introduce them in their own countries and make them globally available. Technical improvements in efficiency are not sufficient here. The process before us will demand efforts and sacrifices from both present and future generations.



Decoupling economic growth from the consumption of resources

For the industrial nations "think global, act local" means developing resource- and energy-efficient solutions at home as well as changing ways of thinking, attitudes, lifestyles and patterns of consumption which can serve as a basis for a world-wide development process.

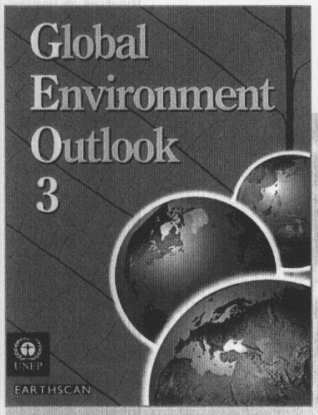
It must be clear to all that the maintenance of the natural foundations for human existence actually requires great efforts and an unprecedented degree of international co-operation.

"The strategy for the 21st. century must combine economic and social responsibility and environmental protection in order to guarantee fair development opportunities for all and to preserve the natural foundations for human existence for the coming generation. The Federal Republic of Germany, which in 1994 anchored environmental precautions as a national goal in the constitution, is facing up to the challenge." (Extract from the federal ministry for the environment, conservation and reactor safety's "Agenda 21" documentation).

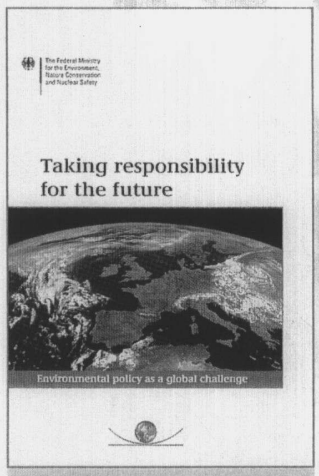
Future economic growth

... with low energy and raw material consumption	...with lower harmful emissions	... through reduced enviromental costs.
Research task	*Research task*	*Research task*
Reduce and better exploit the use of energy and process materials with lower harmful pollutant emissions.	*Ensure harmful substances are not created in the first place through integrated environmental protection.*	*Work out possibilities for the reduction of costs and fees in environmental protection.*

What is needed is the decoupling of economic growth from the consumption of resources and the use of land as well as the overall reduction of pressure on material resources through life-cycle management.



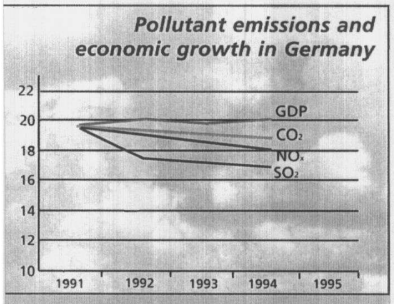
Global Environment Outlook 2002, Publisher UNEP; 2002
www.grida.no/geo



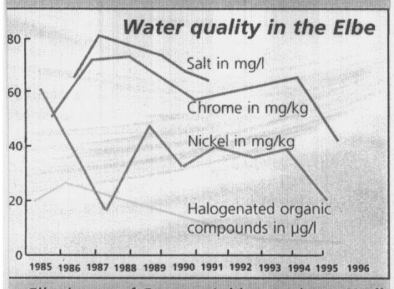
Taking responsibility for the future, Publisher BMU, January 2000
www.bmu.de

Improving the environmental situation

The environmental situation in Germany has clearly improved in many areas in the last few decades. Pollution of environmental media could be recognisably reduced through technical measures such as cleansing of industrial exhaust gases and the connection of almost all households to sewage treatment plants. This has improved the quality of life noticeably, particularly in industrial areas and cities.



ir quality has improved noticeably in recent ears. Through the introduction of waste gas eansing systems and catalytic converters in ehicles emission production has been decou- ed from economic growth.



e Elbe is one of Germany's biggest rivers. Until erman reunification it was highly polluted by dustrial waste from the former GDR. Through mprehensive cleansing treatment it has been ssible to greatly improve the water quality in e last 8 years.

e total amount of waste in Germany remains re or less constant. In recent years however amount recycled rose significantly from 20 % 1993 to 60 % in 1996.

Air quality

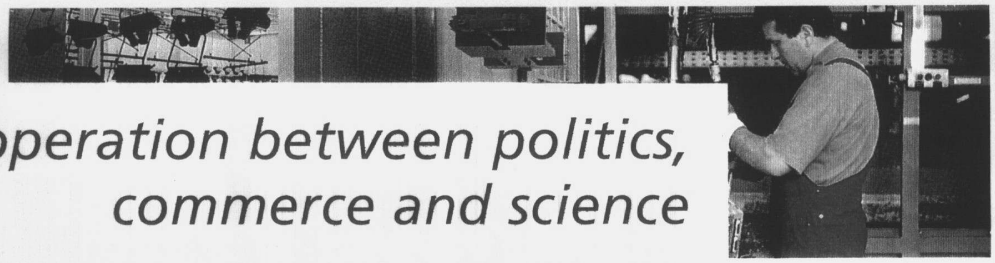
This is particularly evident with a number of significant air pollutants. It has been possible to significantly reduce the release of SO_2, NO_x and in part also VOC (volatile organic compounds) by industry through the use of efficient exhaust gas cleansing systems, low-emission manufacturing processes and the use of environmentally friendly products such as low-sulphur fuels or lacquers containing reduced amounts of solvent. Improved insulation in buildings and the conversion from coal heating to more efficient gas- and oil-burning equipment contributed to the lowering of specific energy consumption.

Water quality

The quality of the water in German rivers and lakes has improved decisively in the last few decades. Almost all households are now connected to public or private sewage treatment plants. Industry is obliged to keep to the prescribed waste water limits. A waste water charge must be paid for introducing waste water containing pollutants. It has been possible to re-establish formerly native fish in most German rivers. Provision of clean drinking water for the population is guaranteed across the whole country.

Waste production

Waste for disposal production has been significantly reduced in recent years. Industry has made a contribution to this reduction through the use of less polluting raw materials and environmentally friendly processes in numerous production processes. Recycling processes were developed and more enviromentally friendly disposal methods used for the waste generated. Domestic waste is sorted into numerous categories by householders. Paper, glass, packaging and organic waste are generally passed on to be recycled only a small amount of waste has to be deposited or incinerated. In future organic waste will not be dumped in order to rule out long-term risks and unwanted methane emissions completely.



Co-operation between politics, commerce and science

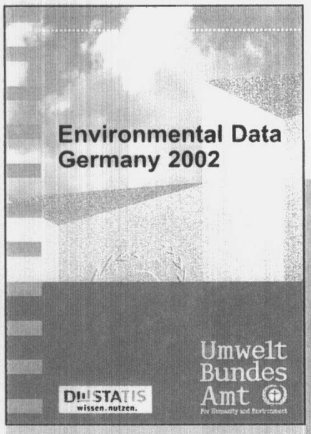
The improvement in the environmental situation has been reached through an effective combination of different measures and instruments.

Company-level environmental protection measures in Germany in the past 30 years have been shaped above all by regulatory guidelines, for example minimum standards set by the state. The economy adjusted and became innovative. Along these guidelines it further developed the state of environmental technology and implemented new commercial environmental protection methods. This meant that extraordinary progress in environmental protection was achieved and that German environmental technology reached a leading position world-wide.

The implementation of legal guidelines (such as fixed environmental standards) was combined at times with intense debate between industry and state. The general public frequently played a not unimportant role in accelerating development in this critical phase through citizens' action groups. Looking back, all participants agree that this was the right way. Today nobody demands to return to the old "unregulated" times. Some areas of commerce have recognised that environmental technologies can be worthwhile. It not only improves the company image but can at best bring extra business management advantages.

The law alone however only sets a framework. A co-operational partnership between commerce and state has developed to secure and project forward the successes for which the strengthening of individual responsibility, voluntary agreement of environmental goals and financial incentives have been implemented as complementary instruments.

This is in addition to a forward-looking research policy, which supports co-operation between commerce and science by promoting research. Working together on concrete environmental problems and searching for practicable solutions jump-start innovation in the economy.



„Environmental Data Germany"
Published by:
Umweltbundesamt, Berlin

www.environment-germany.net

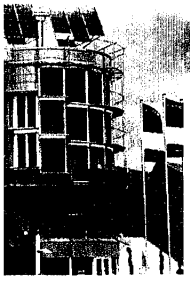
www.GEIN.de

Environmental protection is worthwhile for Daimler

STUTTGART (pja). For the automotive group DaimlerChrysler environmental protection is also worthwhile in a competitive market. Last year the automotive group invested 2.4 billion DM in conservation. As Werner Pollman, environmental representative for the German American enterprise announced in Auburn Hills near Detroit, the lion's share (around 1.5 billion DM) goes on the research and development of environmentally friendly products and manufacturing processes.

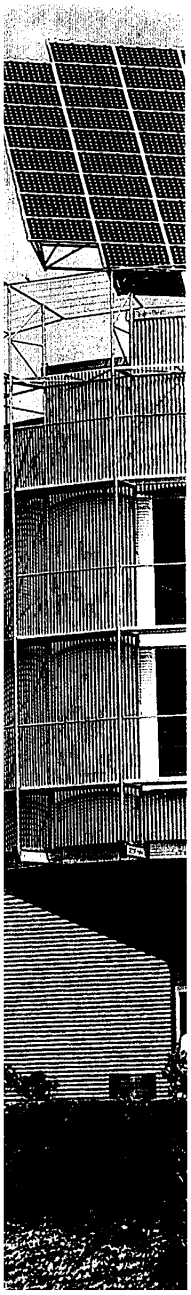
A newly installed process for recycling paint in the Mercedes-Benz plant in Düsseldorf serves as a perfect example of environmental endeavours. Recycling saves 30 tons of paint. Apart from this around 70 percent of the accumulated paint sludge no longer has to be disposed of. According to Pollmann the savings mean that the investment of around 700,000 DM has paid for itself after three years.

Stuttgarter Zeitung, 20.08.99



Environmental protection as a factor in choosing location

Forward-looking and effective environmental protection improves and secures the quality of the environment and of life in equal measure. Risks of incidents are minimised, the health of the population is guaranteed and the risks involved in subsequent expensive cleaning-up of former hazardous waste sites are reduced. An intact environment and reliable supply and disposal are also important decision-making criteria in a company's choice of location.

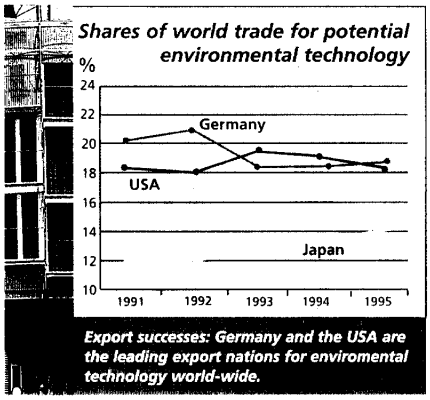


Investment in additive pollution abatement equipment – so-called end-of-pipe facilities – and the use of integrated environmental protection technologies can in individual cases represent a significant financial burden for the company. In many cases however these costs pay for themselves within a reasonable period of time if disposal or dischargement fees can be saved, production materials reintroduced into the manufacturing cycle, resource productivity increased or even revenue raised from the sale of residual waste. In addition the risk of future expenditure on aftercare and remedial actions is reduced.

Apart from these direct financial burdens and possible savings, adherence to ambitious conservational standards also secures long-term strategic advantages for companies. The early development and introduction of environmentally friendly technologies and processes gives companies an innovative head start which is reflected in competitive advantages when the standards are applied generally and also secures their production long-term.

This is also the reason why companies implement environmental management systems. They are not only a planning instrument which raises efficiency but can also, if correspondingly equipped, contribute to more transparency within the company, better employee motivation, and as result higher productivity. At the same time the company's environmental protection efforts have a positive effect on the company image in the eyes of customers and the general public.

In short:
companies with demanding environmental standards are also innovatively and and economically successful in the long term!



Export successes: Germany and the USA are the leading export nations for enviromental technology world-wide.

Innovative and ecologically responsible

Growth market environmental protection

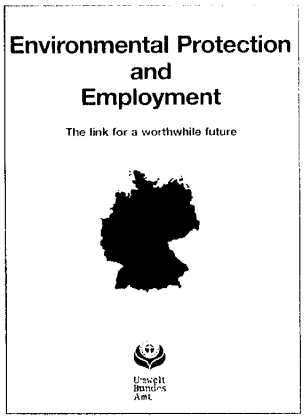
In Germany a powerful and successful environmental industry has arisen on the basis of a consistent environmental policy. According to estimates about 1 million jobs were directly or indirectly dependent on enviromental protection in 1994 – that is around 2.7 % of all employed persons. Environmental protection is therefore also important for the economy and the labour market. At the same time the growing world market in environmental technology offers economic opportunities. Germany takes the lead internationally together with the USA with a share of over 18 % (1995) of world trade in conservation goods. Great growth potential is already emerging for the use of integrated technologies, in particular for rational energy use and for the raising of energy efficiency, and also for environmentally friendly solutions in the area of mobility.

Change of location for environmental protection reasons?

At the beginning of the 1990s various economic associations declared that the relatively strict environmental regulations in Germany would cause companies to move to locations abroad. Since then numerous studies about the importance given to the costs of the "environmental factor" have been published which come to the conclusion that environmental requirements do not significantly cause firms to relocate to countries with lower environmental standards.

The economy needs environmental protection

Certain branches of industry need particularly favourable environmental conditions for manufacturing and services; amongst these are the semiconductor industry, which especially needs clean water and clean air during production. For agriculture and forestry, drinking water supply and tourism for example a largely natural and intact environment is a high priority. The environmental image of a region or community is of great significance for the recruitment of qualified employees and therefore ultimately also for the choice of company location.



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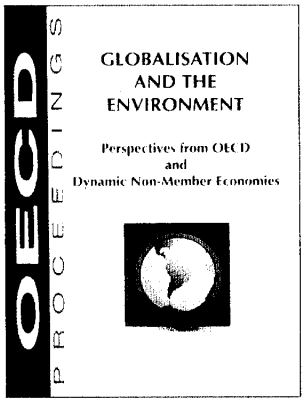
www.umweltbundesamt.de



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About Germany's technological competitiveness, BMBF, 1999
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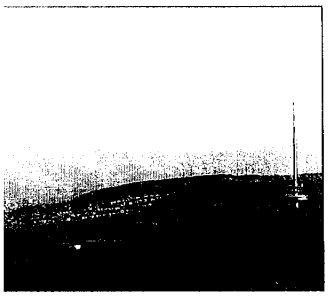
German environmental policy

German environmental policy has gone through numerous phases in its long history. First it concentrated on fending off immediate health risks; today prevention is the foremost priority. In future it should become an integrated part of all political areas.



ıe 1950s smog in north European cities many people their lives. Smog is a ɔr cause of chronic respiratory infec- s.

use of sulphurous fuels in power stations other fuel plants and also in road icles are the main causes of air pollution ɔnurbations.

precantionary principle is a major element of environmental policy. Beyond the ding off of pending threats and the elimination of damage already done, nature uld be protected and demands on it should be made sparingly. Through appro- te measures the production of pollution should be prevented; pollution should ıvoided wherever possible or limited to a minimum according to the current state echnology. Ecological considerations should be taken into account and it should ınsured that relief in one area does not cause pollution to move to other areas.

As long ago as the 1950s the first measures to ensure clean air and water were taken under the assumption of an immediate threat to human health, for example through smog in cities. The immediate result of measures was an improvement in the local environment.

In this first phase environmental policy was reactive and strongly oriented towards immediate problems. The local situation was thereby improved. Curing symptoms however often resulted in problems being shifted to other environmental media and to more distant regions.

In the 1970s the source and media-oriented approach was taken and the principle of prevention pursued. Limits for industrial plants and environmental media were prescribed. The most important legal settlements were the renewing of the laws relating to clean air and water and the waste act.

As a precaution the limits were oriented towards the current state of technology. That which was technically possible and economically justifiable was to be implemented. In this way the environmental situation improved noticeably and numerous technical innovations could be proposed and successfully implemented.

In the 1980s the population and politics turned their attention to the global aspect of environmental protection (the deterioration of central European forests, the hole in the ozone layer, global warming). Reports such as the Brundtland report (1982) set off intense discussion in Germany and contributed at least partly to the development of a strong environmental movement.

In this way it became clear to those responsible in industry and politics that not only output – the emissions – is problematic, but that also input in the form of high raw material and energy consumption represents a central problem that stands in the way of sustainable development.

For this reason politics and industry are seeking ways to integrate environmental protection into manufacturing, that is to design energy-efficient technical processes and products which use less raw materials .

Environmental policy in a state of change

The controversy over power stations

With the construction of tall chimneys local pollution from power stations was considerably reduced. This did not however solve the problems but simply shifted them to more distant regions. In the 1970s and 1980s a broad debate broke out about forests dying. SO_2 emissions spread over a wide area were recognised as a particular cause of forest deterioration.

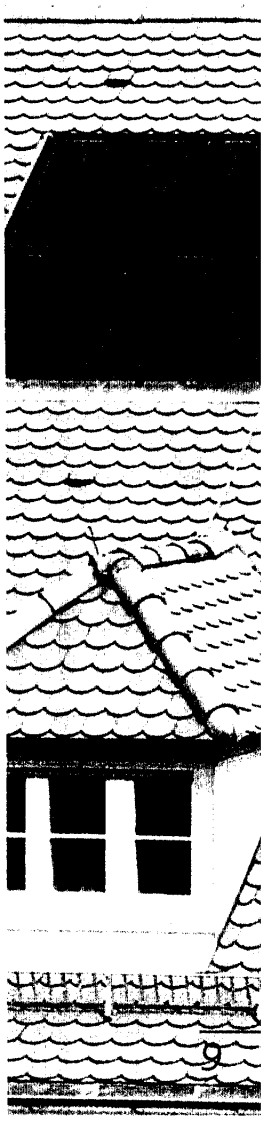
Farmers and forestry pressed for a tightening of limits. The media picked up the subject and the terms "forest deterioration" and "acid rain" became synonyms for the irresponsible way that mankind treated nature. Power station operators were opposed to a tightening of the limits because of the associated high investment costs, technical uncertainty due to conversion and because the use of cheap, sulphurous coal was limited.

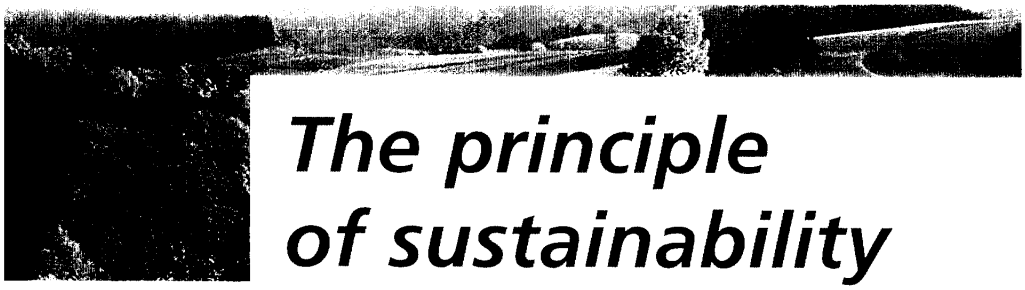
The tighter limits were finally introduced with interim solutions for old plants. In this way intensive research activity and innovations in clean air technology could be triggered and conversion to low-sulphur fuels, oil and gas could be speeded up.

Environmental aftercare policy		Sustainable environmental policy
• Fending off hazards and limiting damage through the disposal or reduction of pollution already present	Limiting of emissions into environmental media through post-production process measures	• Sustainable development model • Source-oriented approach, by which use of materials and energy is reduced through the design of suitable products and production processes
• Local responsibility	Regional/national responsibility	• Global responsibility
• Reactive • Focussed on immissions • Focussed on limits	Oriented towards residual materials and emissions	• Integrated • Conserving resources • Life-cycle-oriented
• Immediate threat to health	growing environmental awareness of the population	• Thorough environmental education of the general public
• Restorative environmental techniques	Additive environmental technologies (filter technology, catalytic converters)	• Production- and product-integrated environmental technologies
• Immission-focussed laws	Medium-based laws	• Price and quantity policies (taxes, duties, licences)
1970s	**1980s**	**1990s**

2000

Development of environmental policy in Germany





The principle of sustainability

German environmental policy today follows the sustainable development model. The term sustainability originates from forestry and means there that no more trees are taken out of the forest than will grow back in the same period of time. Translated into the language of commerce this means live from the interest and not from the capital. Environmental policy has taken over this goal: To guarantee the right of people living today to wealth and an intact environment without limiting the life chances of future generations.

ɟenerative energies will play a more important ɜ in the future. The federal government has ıed an extensive programme of subsidies for commercial introduction of solar technologies.

Sustainable development does not have the same meaning in every society. For developing countries for example economic growth, overcoming poverty, education and with it the guarantee of a life fit for human beings are the most important priorities. For industrial nations adapting their resource-intensive and polluting lifestyle and economies to the model represents the biggest challenge.

A world-wide improvement in living conditions will in the long term only be possible within the boundaries set by the finiteness of resources and the limited resilience of natural systems.

In order to do justice to these demands the following basic principles of action have been formulated by the German Bundestag:

- The use of a resource (eg wood or fish stocks) may not be greater than its regeneration rate or the rate of substitution of all its functions.
- The release of substances may not in the long term be greater than the capacity of environmental media or their ability to assimilate (for example forests and oceans).
- Threats and justifiable risks for mankind and the environment from anthropogenic effects should be avoided.
- The intensity of anthropogenic interventions in the environment must be balanced against the time which the environment requires for a stabilising reaction.

Dimensions of sustainability

1. Regeneration:
Renewable natural resources may only be used long-term within the limits of their regeneration capabilities, otherwise they would be lost to future generations.

2. Substitution:
Non-renewable natural resources may only be used to the extent that their function can be substituted by other materials or other energy sources.

3. Adaptability:
The release of substances or energy long-term may not be greater than the adaptability of the eco-system – for example of the climate, the forests and the oceans.

New instruments, ambitious goals

Co-operative and integrated policy approach

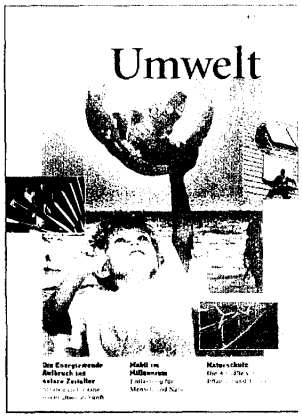
The realisation of a lasting environmental policy requires an integrated, cross-media and cross-departmental policy approach. Economic, financial, agricultural and transport policy decision-making will in future include environmental considerations.

A regulatory policy will continue to play a significant part, but in view of the improvements already achieved this will describe more of a framework within which society and industry act. This classic approach will be rounded off with the co-operation principle and the strengthening of personal responsibility.

This includes the expectation that industry does not lessen its efforts to fulfil its extended responsibilities. Approaches include the realisation of measures to raise resource efficiency through technical innovation, the completion of material life cycles and through the ecological design of products and services.

Citizens and consumers are also encouraged to take on responsibility. The federal government therefore actively supports initiatives to implement the "Local Agenda 21". Many opportunities exist to follow ecological, social and economic goals within concrete projects. One important task is the realisation of sustainable consumption.

Until now environmental policy had no known, generally recognised measure for success or failure. In order to ensure conservation's appropriate importance in the political discussion about sustainable development, including ecological, economical and social goals, it also has to have a few units of measure (indicators) with which it can be described. The "German Environmental Barometer", which contains such indicators, was introduced for this reason.



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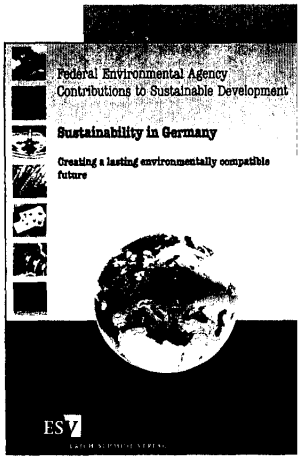


Federal Environmental Agency,
Federal Republic of Germany:
Sustainability in Germany

Erich Schmidt Verlag, Berlin, 2002

Objectives

In 1994 conservation was written into the constitution with the newly created Article 20a. On the strength of this Germany committed itself to a series of objectives aimed at reducing pollution and recognising its responsibility as a large industrial nation. Particular topics are climate protection and conservation of resources. In the area of climate protection special emphasis is placed on the reduction of greenhouse gases from industry, transport and households.

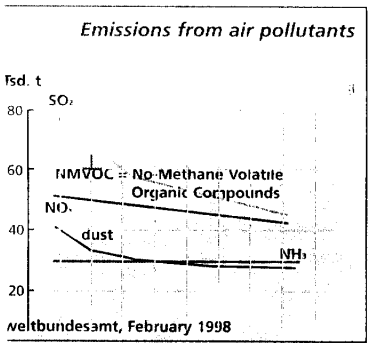
To conserve natural resources for example it is hoped to increase resource productivity by 2,5 times by 2020. Germany has committed itself internationally to reducing CO_2 emissions by 25 % by 2005.

Reducing emissions in the air

Clean, pollution-free air is of vital importance for people, animals and plants. Emissions from industrial processes, power stations, from heating buildings and from transport pollute the air with harmful substances such as sulphur dioxide, nitrous oxide, carbon monoxide, hydrocarbons, heavy metals, soot or dust. Several of these harmful substances contribute amongst other things to acid rain and summer and winter smog.

irest deterioration, caused by acid rain, was ie of the first visible signs of increasing pollu- on from airborne emissions.

irest deterioration also made people aware at airborne emissions can have a damaging fect not only locally but also some distance vay.



issions from air pollutants from transport, lustry, households, small-scale consumers, lustrial incineration, power stations and dis- t heating systems.

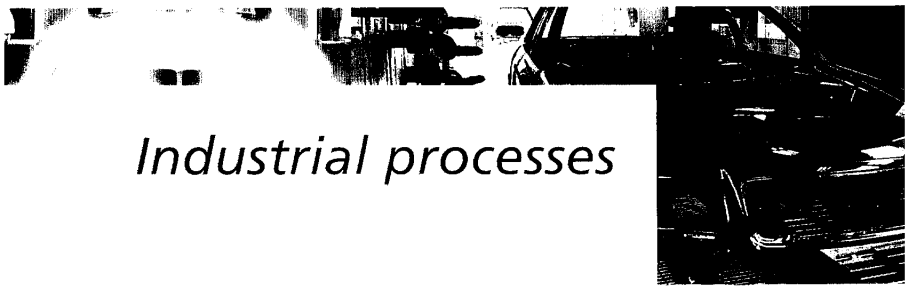
the former Federal Republic SO_2 emissions creased by 70 % in the 1980s. This is above all e to increased desulphurisation in power sta- ns and the substitution of high-emission fuels. he new federal states SO_2 emissions rose until 37. Through economic restructuring, the clos- of outdated plants and the use of lower- ission fuels emissions have been lowered sub- ntially since 1990.

The clean air regulations currently in force in Germany are among the strictest in the world. Limits are updated periodically according to the current state of technology. The valid principle is:

precaution is better than aftercare. Successes are impressive: whilst economic growth is increasing the emission of many pollutants has greatly decreased.

- Sulphur dioxide emissions from power stations could be reduced from 1980 (5.000 kt SO_2) to 1998 (about 900 kt SO_2) by over 80 %.
- Dust, sulphur dioxide, nitrous oxide and hydrocarbon emissions from industrial plants could be halved in the last 10 years.
- In the period between 1987 and 1993 carbon dioxide emissions in Germany have decreased by around 16 %; by 2005 it should be reduced by 21%.
- In 1998 more than 200 coal-fired power station blocks with an electrical production capacity of over 53.000 MW were equipped with exhaust gas desulphurisation systems.

Since air pollutants can often be carried thousands of kilometres by the wind a successful strategy requires not just national but an international action. For this reason Germany is closely involved in work on European documentation of the best available technology.



Industrial processes

Organic air pollutants arise from transport and the use of solvents in industry, commerce and the home. In 1996 in Germany a total of 1.9 million tons of organic pollutants were released into the atmosphere compared with 3.16 tons in 1990. The 40 % reduction can be mainly attributed to the implementation of emission-reducing measures which were carried out not least on the basis of legal regulations.

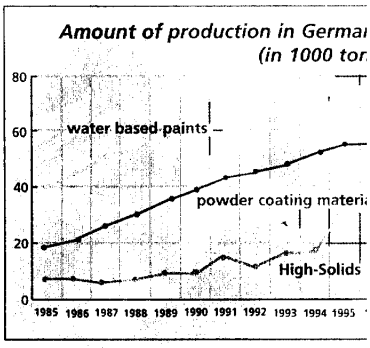
Solvents are used as reaction media in chemical processes, in paint technology and in the cleaning of surfaces. The greatest potential for reduction in use lay in painting and cleaning surfaces.

In the past surfaces tainted with grease and oil were generally cleaned with chlorinated hydrocarbons. The introduction of strict emission limits for organic air pollutants led on the one hand to the fitting of effective air filters, on the other to the development of new cleaning processes. Above all the introduction of aqueous cleaning systems led to a reduction in the significance of chlorinated hydrocarbons in Germany. Currently most cleaning processes are carried out with aqueous systems, often with better cleaning results and lower costs. Apart from aqueous systems physical processes such as pyrolysis, high pressure water jets, the plasma process and laser technology have been successfully introduced to clean surfaces.

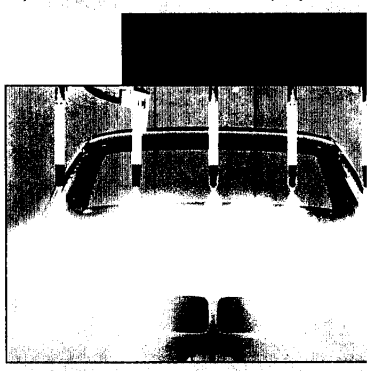
As a result it can clearly be seen that it was possible to reduce emissions of organic solvents to clean surfaces, on the one hand through improved exhaust gas cleansing, on the other through the substitution of solvent-based cleansing with solvent-free processes.

A further major source of emissions for organic pollutants is painting, in particular industrial spray painting, during which considerable quantities of organic solvents are emitted. Because of stricter emission reduction requirements exhaust filtering plants took up an increasingly large share of investment and running costs. Rising costs for exhaust cleansing led to the development of water-based paints, which have in recent years at least in large-scale paint plants taken over from traditional solvents-based paints. Water-based paints have now reached the same level of quality as traditional solvent-based paints. Emissions of organic pollutants from spray painting plants could be significantly reduced by widespread use of water-based paints.

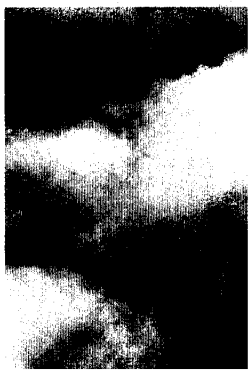
The next consistent step towards emission reduction was the introduction of powder paints, the use of which produces practically no organic pollutants. Powder paint is an economic alternative process to twin- and multiple-coat coatings of liquid paint because the necessary paint thickness can be applied in one run. Powder paints have now found their way into almost all areas of painting including serial vehicle painting. Using powder paint not only reduces organic pollutants in the atmosphere, it also produces next to no waste as the paint is not altered during application and can easily be re-introduced into the painting process.



Low-solvent paint: for more than ten years the production amounts have risen rapidly.

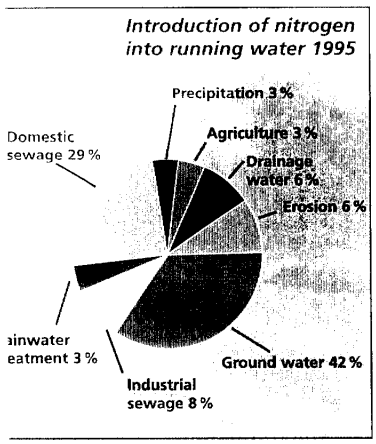


Environmentally friendly and economic, powd paint technology is finding ever new areas of Modern powder paints therefore offer remark surface quality coupled with lower process co higher productivity and material exploitation, reduced energy and labour costs and - above the elimination of solvent emissions.

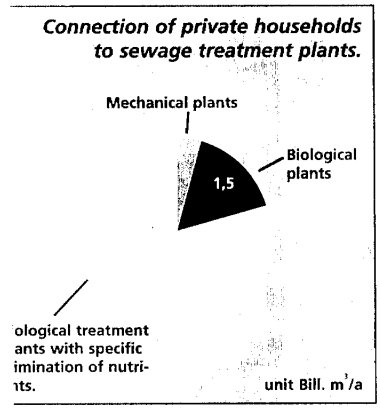


Water resource protection

Due to climatic conditions sufficient water is available in Germany. However, the principle of economic use of water resources is gaining more and more importance. Despite sufficient water being available there are deficient areas and regions where ground water quality is reduced by anthropogenic influences.



he introduction of nitrogen contributes mainly o pollution of surface water with fertiliser. Main source is agriculture, apart from through irect introduction unused nutrients reach rivers ia ground water and erosion.



Water protection:
n 1995 over 89 % of households were connected to sewage plants. 82 % of these had specific nutrient elimination. This achieved a significant eduction of nutrients in rivers.

Currently 70 % of drinking water comes from ground water. Ground water protection is therefore of particular importance. Drinking water supplies are endangered through the introduction of pollutants from industrial and domestic sewage, through ground pollution, through intensive agriculture with phosphates, nitrates and pesticides, through improperly disposed of harmful waste, accidents with dangerous substances and through the introduction of air pollutants.

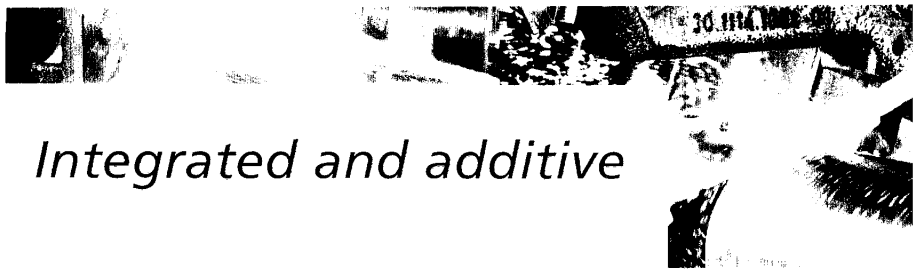
Surface water delivers not only drinking water but also water for agriculture and industry and is at the same time a habitat for many plants and animals. Sewage must be treated and cleansed before introduction into these waters to ensure their protection and improvement and to maintain the ecological function of the water.

This is regulated by the water management act (WHG). The discharge of sewage into surface water is only permissible if levels of pollutants in the sewage are kept as low as is technically possible.

In addition a charge is levied for introducing sewage into surface waters according to the level of pollutants the sewage contains. This charge gives companies an ecologic incentive to implement technologies for the reduction of pollutants, to substitute pollutant substances and to avoid or reduce production of sewage through integrated environmental technologies.

Germany has by now achieved a recognised high standard in sew age cleansing technology. Through the treatment of municipal and ind trial sewage in appropriate plants th water condition has significantly improved in recent years. This is partic larly true of the oxygen balance anc biochemical water quality.

Despite great progress further efforts are still necessary to gua antee lasting protection for surface and ground water.



Integrated and additive

Electroplating

Apart from heavy metals waste water from electroplating plants contains toxic compounds such as cyanide and chromium, which would cause considerable damage if they got into ground water or biological sewage treatment plants. For this reason emissions of pollutants from electroplating plants were regulated by legal guidelines from an early stage. The current guidelines, whose core requirements have now been accepted as a European standard (Helcom/-Parcom Recommendations), not only set out the maximum limits for the concentration of individual pollutants but also requirements for the economical use of water.

The result of the early introduction and enforcement of legal requirements was not only that electroplating plants installed effective sewage treatment plants but also that they were forced to be economical with water.

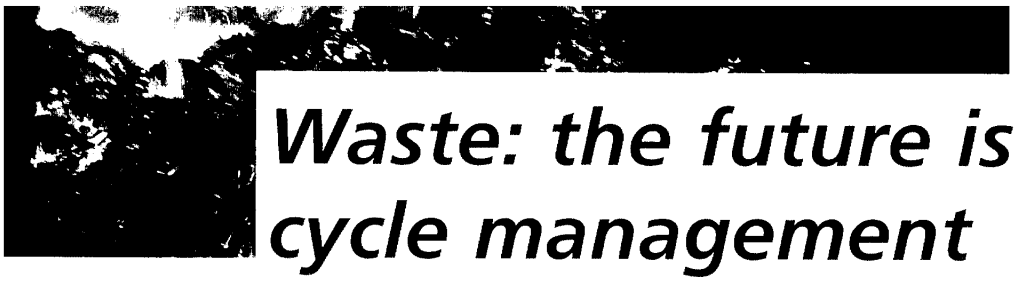
The introduction of integrated environmental protection measures, in particular the installation of multistage rinsing technology, meant that water consumption and the amount of sewage could be reduced, with the added advantage that much smaller modern sewage plants could be built. This results in savings in investment and running costs. With special rinsing techniques it is possible to collect rinsed-out process materials from the process baths in a fairly high concentration and to enable their technical and economic return to the manufacturing process.

In modern electroplating plants it is normal to use various integrated environmental protection measures which ease the strain on the environment. Reduction of water consumption is the biggest priority, through which a simultaneous reduction of sewage amounts is possible. Water consumption in modern plants in the 1990s is only 5 – 20 % of that of plants from the 1970s and 1980s. With water prices between 3 and 7 Euro/m3 these measures to reduce water consumption are definitely economical.

Further benefits for the environment have been achieved through the reduction of raw material wastage, whether through direct measures or through returning raw materials salvaged from rinsing baths back into the production process. Less washed-out process chemicals mean less loss of raw materials, lower use of chemicals and less waste.

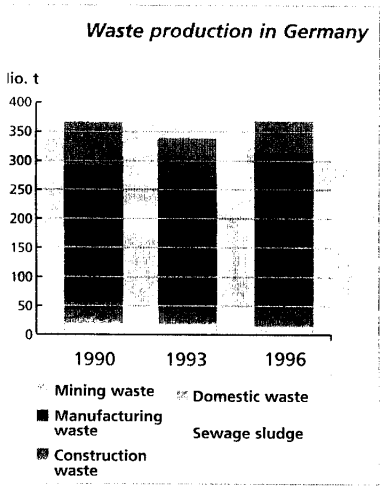
The modern electroplating plant is distinguished by the following characteristics:

- Water-saving rinsing technology (three rinsing stages are generally a requirement)
- Longer standing period for process solutions through specific regeneration processes (such as filtration, activated charcoal treatment, selective electrolysis).
- Keeping back production materials in the process bath (for example lengthening and optimising the drip-dry process, constructive measures to goods carriers and goods).
- Return of raw materials to the process solutions directly from the rinsing baths or following concentration (for example through steaming, evaporation).



Waste: the future is life cycle management

The aim of the recycling and waste management law is to save resources long-term and to strengthen the responsibility of industry, for example through product responsibility. Used products and materials should remain within the economic cycle for as long as possible and in an as environmentally friendly way as possible. Production waste should be avoided or recycled as far as possible. This requires life-cycle strategies and technologies as well as logistic systems, which complete product- and production-integrated environmental protection.

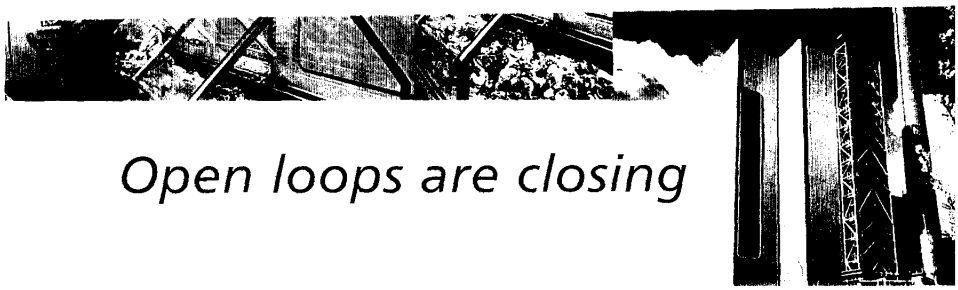


ith the exception of construction waste there s been a significant reduction in the total ıount of all the types of waste depicted here. is is most noticeable with manufacturing waste, ıere the amount has been nearly halved.

Affluent society produces large quantities of waste. Every single German citizen produces on average 428 kg of waste per year (as of 1993). Packaging alone made up around 13%. The packaging regulations, the first regulations relating to life-cycle management, date from 1991. It obliges manufacturers and traders of packaging and packaged goods to take back used packaging and either reuse or arrange for it to be recycled at their own expense. In addition, amongst other things, high minimum recycling quotas are prescribed. This has resulted not only in a significant reduction in waste but also to reduction in the amount of packaging used. The principle of product responsibility has gained entry to other areas (old cars, batteries, information technology equipment). The quantities of domestic waste which have to be dumped or incinerated have also been greatly reduced through increasing organic waste collection and recycling.

Waste comes not only from households but also from industry, commerce, agriculture and hospitals. Around 10 million tons of hazardous waste is produced every year. This includes waste which is a danger to health, air and water or is explosive or inflammable. There are strict regulations concerning the declaration for such waste and it may not be disposed of together with domestic waste. Avoidance and recycling have a higher priority than disposal. This is particularly true for hazardous waste. In many cases it has been possible to convert industrial processes with integrated technologies so that either less waste or none at all is produced. After appropriate preparation the remaining waste could in many cases be recycled.

In industrial production there is still substantial potential for innovation to avoid waste and to raise resource efficiency. In particular intra- and inter-company material flow management offers new possibilities. With the introduction of this instrument inner- and inter-company material flows are categorised and assigned to specific processes. On the basis of this information a purposeful and economically rational optimisation of material use and at the same time a minimisation of waste in the complete system is possible.



Open loops are closing

Galvanizing

Hot galvanising involves dipping workpieces into smelted zinc to cover them with a protective zinc coating against corrosion. A grease-free, bare metal surface is necessary before the zinc coating can be applied. The process of preparing of the workpiece surface for hot galvanising by degreasing, pickling and fluxing produces a great deal of waste.

Workpieces and insufficiently heated galvanised pieces are treated with hydrochloric acid, during which process the acid is used up and enriched with metal ions. This process produces around 40,000 tons of spent mixed pickling waste containing zinc and iron every year in Germany which until now was disposed of as hazardous waste. Since the commissioning of a central fluid waste cleansing plant once non-recyclable waste can be turned into pure iron and zinc chloride solutions which are used as raw materials in the chemical industry. Recycling proved to be more economical than disposal.

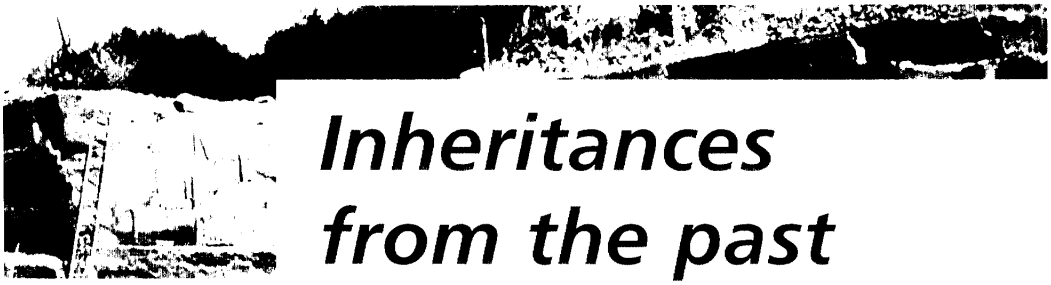
During fluxing work-pieces are immersed in an aqueous ammonium chloride solution (flux bath). The flux baths are contaminated with remains from previous degreasing and pickling processes and must be periodically renewed. Since disposing of ammonium solutions is expensive and polluting it makes sense to regenerate used flux. For this reason a central reprocessing plant was set up which is able to process all the used flux produced in Germany.

During reprocessing unwanted iron is separated with chemical precipitants and organic contaminants are removed by oxidation. After removal of unwanted materials the solution is brought back up to the required production quality through the reintroduction of missing components and delivered back to the galvanising plants. Apart from a significant reduction in pollution the advantages of the process are reduced costs for the hot galvanising companies, who no longer have to pay for disposal, and a refund for the useful components in the used flux when purchasing recycled new flux.

Galvanizing

Recycling diluted (sulphuric) acids

The recycling of diluted acids in the chemical industry is a further example of the implementation of life-cycle management. Till the end of 1989 the large amounts of waste sulphuric acid arising from the production of titanium dioxide were released into the North Sea. Due to international agreements this has been illegal since 1989. As an alternative to dumping in the North Sea the German titanium industry developed modern processes for the reintroduction of used acids into the production process. The core of the reprocessing plant is a multi-stage distillation of the diluted acid from 25 % up to 90 %. The salts dissolved in the acid which are precipitated during the distillation are filtered off and thermally split into metal oxides and sulphur dioxide. After cleansing the sulphur dioxide is turned into sulphuric acid and returned to the process whilst the metal oxides (mainly iron oxide) are dumped.



Inheritances from the past

Hazardous waste sites are inheritances from the past. These can be contaminated sites of old factories where chemicals were improperly handled, or abandoned waste disposal sites which from a modern point of view were not correctly run. Locations which were formerly used by the military or for arms production (military harmful sites) are also classified as possible contaminated sites.

A variety of waste from various sources was stored on old landfills. The safety systems were inadequate.

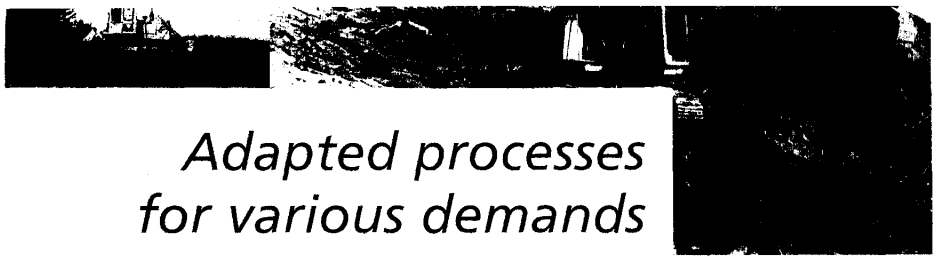
Hazardous waste sites are a classic example of a short-sighted environmental policy. Due to lack of regulations, carelessness or in the interest of short-term profit chemicals such as chlorinated hydrocarbons and other dangerous substances were used without due care. Dangerous substances seeped into the ground or were stored on insufficiently secured landfills.

As a rule there was no immediate danger; it was only many years later that these substances polluted the soil and contaminated the ground water. Those responsible could often no longer be found, so that in many cases the cost of treatment and cleaning up had to be borne by the general public.

The procedure for investigating, evaluating and cleaning up contaminated sites is set out in the federal law for the conservation of the soil. This law sets out the regionally-specific regulated course of action with which an overview of the situation, an assessment of the extent of pollution and the need for cleaning up can be quickly gained.

As a first step a potentially polluted site is categorised depending on how it was previously used. If this gives grounds to suspect pollution, the soil contamination is technically investigated. The data thus gathered then serves as a basis for an assessment of the extent of the pollution and for the introduction of possible cleaning up measures. Nationally standardised values based on the current usage of the site are used for this evaluation. The test values are based on scenarios which arise from the use to which the plot of ground is put; this means that stricter regulations apply for children's playgrounds than for industrial sites.

On the basis of this assessment a decision is made as to whether cleaning up is necessary or not. Cleaning up measures which could be taken include measures to remove contamination (decontamination measures), for example ground decontamination, or measures which prevent or lessen the further spread of contamination (securing measures) such as encapsulation.



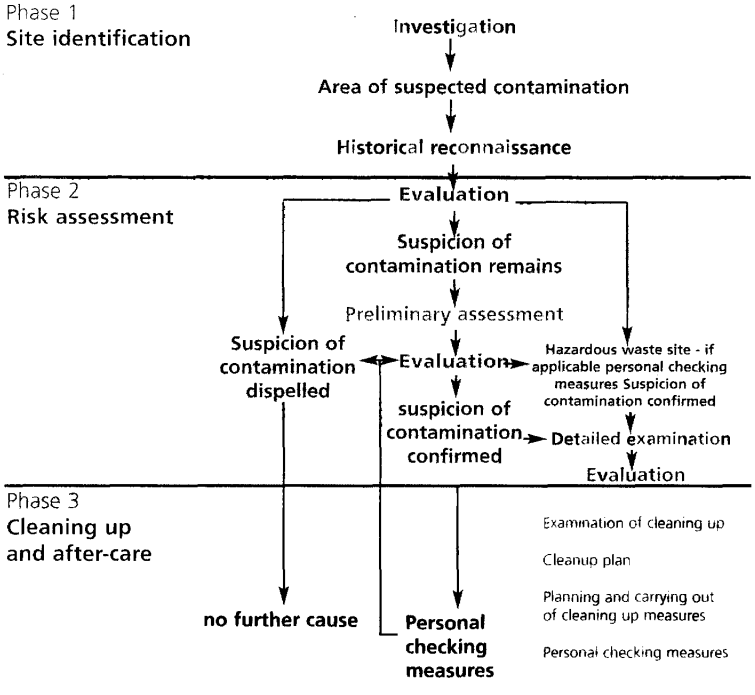
Adapted processes for various demands

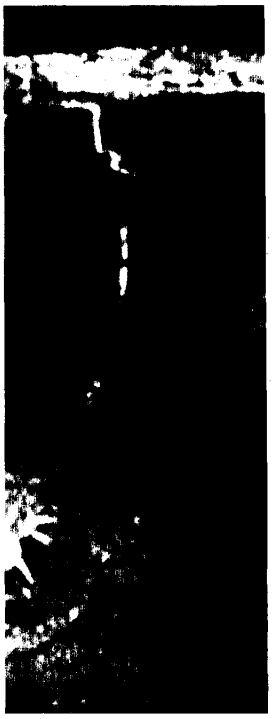
Considerable efforts have been made in Germany in the past 20 years to develop cleansing procedures for hazardous waste sites to a stage where they can be used on a large scale. As a result industry in the market has created the capacity to treat around 4 million t/a of contaminated soil. The technologies on offer cover the whole range of the technically possible and are so organised that almost all kinds of contamination can be dealt with. Today the problem is often less the general technical feasibility then the high renovation costs. Current research and development efforts are therefore concentrated on the setting up of cost-efficient cleansing techniques and strategies. Not just ground water decontamination techniques such as building in "reactive walls" but also strategies based on the natural breakdown of pollutants. Germany has thorough experience in the use of soil decontamination techniques of all kinds.

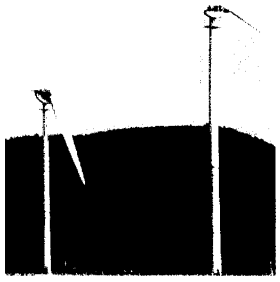
Information:

- *Wegweiser für Altlasten- und Bodensanierung; Published by UBA, 1992; Erich Schmidt Verlag*
- *Evaluation of Demonstrated and Emerging Technologies for the Treatment and Clean Up of Contaminated Land and Groundwater Published by NATO/CCMS, 1998, www.nato.int/ccms*

Schematic depiction of the processes involved in the investigation and cleaning up of hazardous waste sites

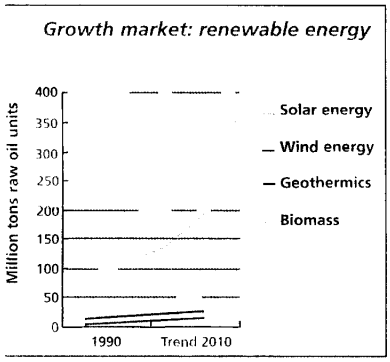






Achieving the energy turnaround

We are faced with the task of developing a modern, future-oriented energy policy. The requirements of a lasting development containing environmental sustainability, social acceptability and ecological efficiency must be met.



Renewable energy sources will in future grow in importance. In addition to saving energy they will contribute significantly to a reduction in greenhouse gas emissions.

Regenerative energy production from sun and wind are promoted in Germany by the renewable energy act, which guarantees a minimum price for sun and wind energy, as well as by the 100,000 Roofs Programme.

Two key areas in the creation of a sustainable energy supply system and use on a national, EU-wide and international level have to be fulfilled:

- improvement in energy efficiency and energy savings and
- increased use of renewable energies.

Both strategies need to progress hand in hand. Both are "necessary preconditions" for a viable and sustained development.

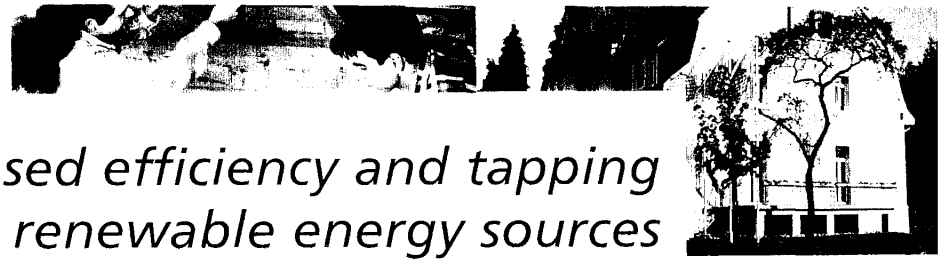
In the last few years German industry has continuously reduced its share of total energy consumption so that this has sunk from 50 % in the 1950s to 27 % today. Total final energy consumption by German industry sank by 14 percent between 1980 and 1992 despite simultaneously increasing industrial production.

Almost 40 percent of energy used in Germany is used in buildings – above all for heating and for producing hot water. Farsighted planning, style of building and building modernisation – especially in old buildings – can contribute significantly to efficient and enviromentally friendly energy use.

The development of renewable energy systems is an essential part of an effective climate protection strategy. Renewable energy systems mean sparing use of resources, allow the establishment of a decentralised energy structure, make the use of atomic energy unnecessary and in an international context also help developing countries to solve numerous problems.

Sun, wind, water, biomass and geothermics globally demonstrate long-term potential which corre-sponds to a multiplication of their present use. This potential can of course only be used gradually.

To promote renewable energies the federal government started the 100,000 Roofs Programme in January 1999 to promote the installation of 100,000 photovoltaic units. A graduated ecology tax on energy was introduced as from 1.4.99 as an economic instrument to increase energy efficiency.



Increased efficiency and tapping renewable energy sources

The potential for improvements in electricity production in power stations has been more or less exhausted. Further options arise through improvements in energy production efficiency as a whole and through the use of potential to make savings.

With cogeneration (combined heat and powergeneration) for example the normally unused waste heat created during electricity production can be used for heating. This virtually doubles the total effectiveness of power stations. By 2010 a doubling of energy production from cogeneration is planned. There is further potential for increasing efficiency by the use of heat pumps which make low-temperature energy usable for heating and cooling.

One of the largest consumers of energy is the heating and cooling of buildings. Significant savings are possible through the use of better insulation and through passive use of sun energy. The insulation regulations prescribe a high level of insulation for new buildings.

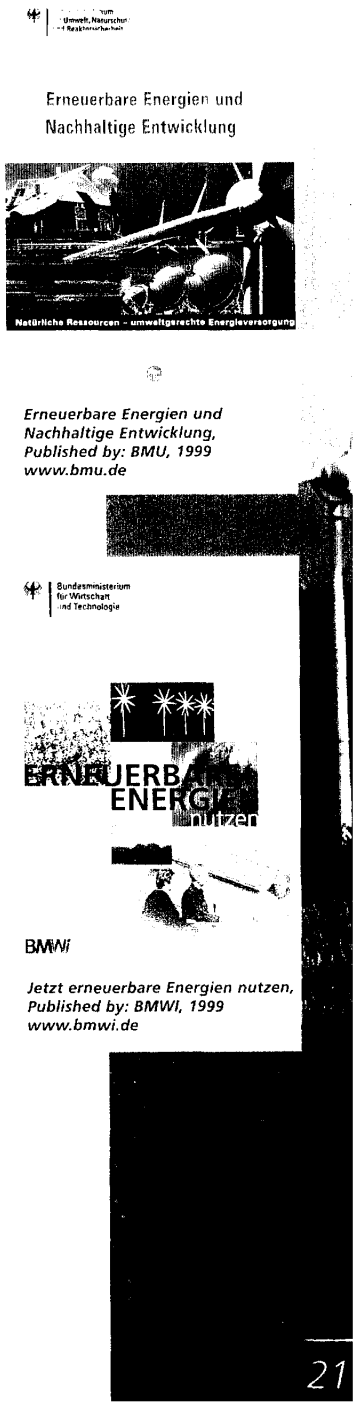
Electrical appliances standing idle also swallow up large amounts of energy, for example the stand-by functions of electronic entertainment appliances. In Germany the amount of energy wasted annually through appliances standing idle is estimated at 20 billion kilowatt hours. This is equal to the annual production capacity of two large power stations.

Here the consumer can save energy very simply. Manufacturers of electronic entertainment appliances in particular are called upon to develop intelligent energy efficiency and sensor concepts.

The energy source geothermics has largely been ignored. It has mainly been used in areas of geothermic anomalies (for example in Iceland or Laderello in Tuscany), that is in areas where the earth's crust is especially thin. This form of energy production uses energy stored in the earth itself. It can now also be used under normal geological conditions.

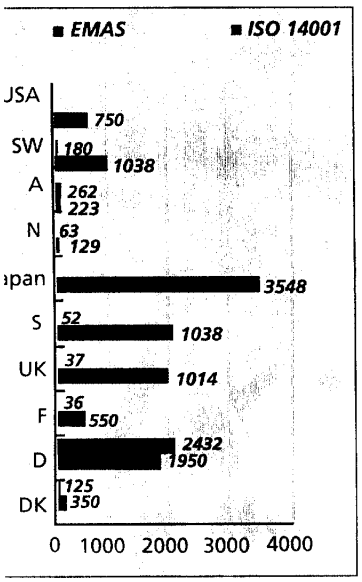
Water is injected 200 to 2000 metres deep into the earth, heated up and then pumped back to the top. The heated water is used for heating or cooling, either directly or via a heat pump.

The heating and cooling system in the German Bundestag and in the parliament buildings in Berlin is for example based on geothermics. Here only a part of the heat is produced conventionally; the greater part of heat and cooling comes from geothermic "heat" stores in the earth deep below the buildings.



Environmental management for companies

A modern enterprise needs capable management. This is just as true for the individual employer with just a few employees as it is for a big concern with several hierarchical levels and complex organisational structures. In order to make sound strategic and operational decisions those responsible must have access to precise, up to date, suitable information. For this purpose a set of agreed indicators for any given operational situation which can give an overview of the development of the firm and its critical factors can be of great use.



umber of EMAS and ISO 14001-egistered companies in various ountries.

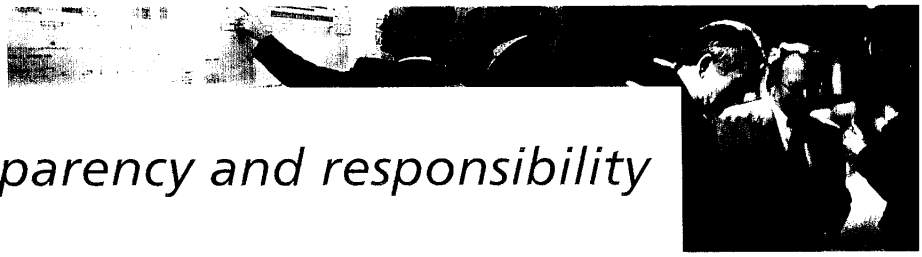
urther information:
www.ihk-umkis.de

The same principles apply for the environment and for material and energy flow management. Savings potential cannot be discovered and forward-looking decisions about sustainable development of the company cannot be made in time without clear responsibilities and clear factual information.

Standardised processes for the implementation of a company environmental management system are available in the international standard ISO 14001 "Environmental Management Systems" and the European environmental audit prescription (EMAS – Eco Management and Audit Scheme"). Use of these systems aims at transparency and reliability of company environmental protection efforts and promotes the continuous improvement of environmental performance

The federal government sees the introduction of environmental management systems as an important area in which to strengthen individual company responsibility. Companies with their own controlling department for the environment pose less of a risk. These concerns enjoy a high degree of acceptance overall with the general public and with the authorities. In April 2000 2432 companies in the Federal Republic were registered as particpants in the EG environmental audit system EMAS, and 1950 companies had had their environmental management system registered under ISO 14001 – quite a few in fact use both systems.

In Autumn and Winter 1998 the Federal Environmental Agency asked the companies which at that time had participated in EMAS about their motivation to take part, their experiences and expectations and received over 1200 replies. In answer to the question as to which advantages taking part in EMAS had brought most companies said that the most important result was the "improved organisation and documentation". This applies (completely) to over 80 % of those asked. Well over half of the registered organisation locations were able to increase their legal security, improve their image and motivate employees.



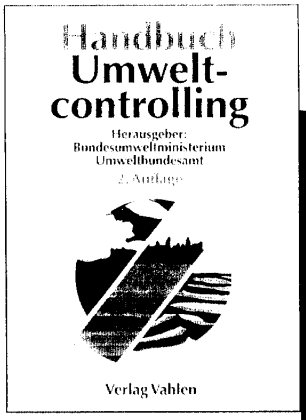
Transparency and responsibility

In several federal regions the rules for surveillance and the issuing of permits have been simplified for companies which are certificated or validated. The efforts of the companies to strengthen their own surveillance are thus recognised, and at the same time they also carry yet more responsibility – they are themselves to a large extent responsible for observance of regulations.

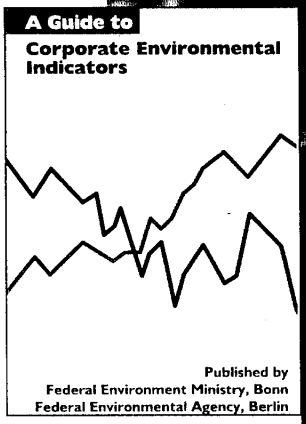
Company environmental management is the systematic cataloguing, assessment and optimisation of the effects of a company's activities, products and services on the environment. This requires permanent controlling alongside the actual management system which sets the responsibilities, competences and processes of company conservation. The company sets itself environmental goals and regularly checks whether these have been achieved to the expected extent, and which supplementary measures are necessary to guarantee their achievement.

Just as in other management tasks indicator code systems can be very useful in helping to make the development of the company's environmental performance clear to the decision-makers. Such enviromental codes can relate directly to the environmental effects of the company, for example as "hazardous waste production per DM turnover", or as "Energy use per ton of product x". They can however also give a view of the performance of the environmental management system itself, for example as "number of environmental training sessions for employees per month". If there are variances from the planned figures the causes can be quickly found and necessary corrections carried out.

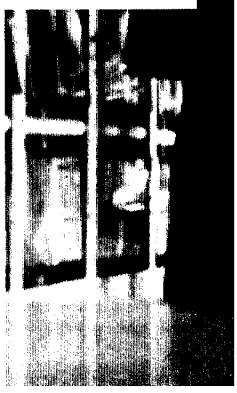
This can be done especially efficiently in larger companies with the help of business environmental information systems (BUIS), which are able permanently to observe material and energy flows in the company and constantly offer up-to-date and aggregated data on energy and material use. To avoid having to collect information especially, which is expensive and complicated, BUIS should as far as possible fetch their information from existing databases. Modern system architecture with concepts such as data warehousing and data mining are available, or the coupling of the BUIS to production planning and control systems already installed (PPS). A link to the company accountancy department is also desirable in order to be able to collect material flow data directly together with cost information. In this way it is also possible to reveal inefficiencies in resource use from a monetary point of view.



Handbuch Umweltcontrolling, Published by: BMU-UBA, München 2001, Vahlen Verlag



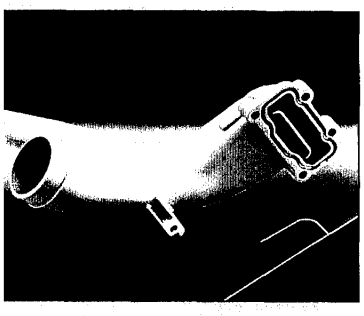
A Guide to Corporate Environmental Indicators Published by: BMU-UBA, Berlin 1997



Cleaner Production

Terms such as "cleaner production", "integrated environmental technology", "eco-efficiency" and "zero-emission" are today seen as keys with which to solve the conflict between the growing demands of society and the Earth's finite resources, and also the limited absorption capacity of ecosystems.

ed materials are collected separately and sed on to be recycled.



iew casting method was used to produce this tion manifold: the so called lost-foam-process. s process doesn't generate waste foundry ids containing binders. It allows to cast more nplex parts and saves energy.

Behind these key concepts are technical and organisational measures which contribute to making available more utilisation with less environmental consumption.

Production processes will in future use less raw materials. Processes in which expensive raw materials are needed, for example for painting or galvanisation, lead the way here.

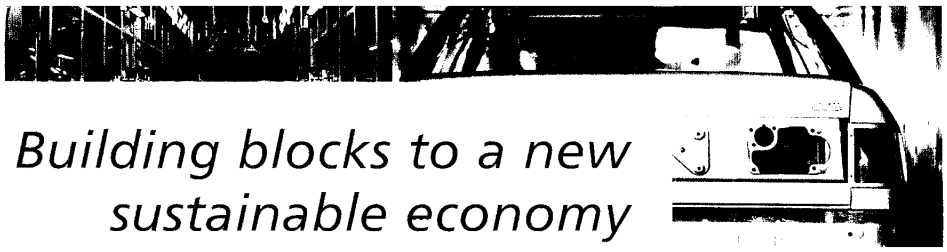
Materials with damaging effects on human health or the environment should be gradually replaced. Toxic substances such as PCB or certain heavy metals are today already either not permitted or have been removed to large extent from the production process.

Production materials and construction principles are not chosen just from a functional point of view but also optimised with regard to recyclability. Products which are designed from an ecological standpoint consist of as few different materials as possible, are constructed so as to be easy to dismantle, and the materials used are simple to recycle. Many high quality goods such as television sets or cars are today already designed with this in mind in order to produce as few emissions during manufacture as possible. The recycling industry is developing ever more into a branch of the economy with significant effects on the processes, materials and products of manufacturing industry.

As part of the recycling of packaging a network of plants for the recycling of plastics has been established. Recycling used products from for example old cars and electronic appliances is growing in importance. These few examples demonstrate that the recycling industry is already an important raw material supplier.

The recycling, reuse and continued use of used products will in future be an influential and also lucrative market sector in a modern life-cycle management system.

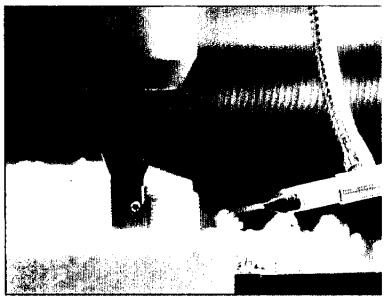
All these approaches will contribute to a reduction in environmental consumption.



Building blocks to a new sustainable economy

Efficient production

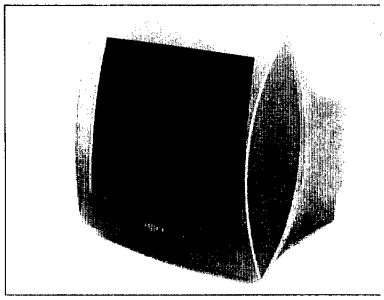
At present the main way of cooling in metal cutting processes is still with cooling lubricants. Using cooling lubricants involves a great deal of time, energy (and example health risks, cleaning and maintenance, disposal of used cooling lubricants and chips covered in oil) and also money. The further development of metal cutting technology and machinery mean that for certain purposes cooling lubricants are no longer necessary or the amount required can be reduced. By dosing exactly the right amount of lubricant the recycling, care and preparation of the lubricant is no longer necessary and the work pieces remain almost dry. This means less pollution in the cleansing process which normally follows and the chips produced can be recycled without extra processing.



With the help of a suitable spray facility a smal amount of cooling lubricant is sprayed on to the work piece at precisely the spot to be worked on.

Designing products ecologically: "Green TV"

Not just functionality, quality and design but the entire life cycle of the product is included in the design of ecologically sound products. A television has for example three life cycles: manufacture, use and disposal. The amount and variety of materials is reduced overall. Solder containing lead and material containing brominated flame retardants is not used and the picture tubes are made of recycled glass. For the use phase the energy consumption of the television is reduced. The appliance is built in a modular way and therefore easy to repair and designed to last. The modular design makes dismantling easier. Reusable materials can be more easily removed and the materials are simple to recycle.



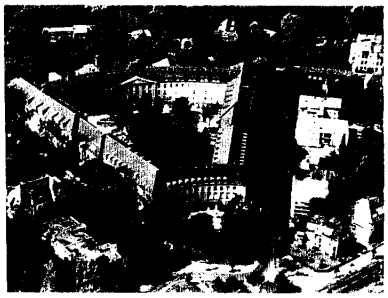
The main motivation behind the Green TV project was the recyclability of as many of the materials as possible. Through the use of new materials up to 95 % of this appliance can be recycled.

Using products instead of owing them: Photocopiers

The big photocopier manufacturers no longer sell their appliances, they rent them. The manufacturer moves into the service sector and is therefore interested in high quality maintenance and the longevity of his property. After the use phase the machines are not disposed of but reconditioned and turned into "new" machines. The old machine can be almost completely reused. The production cycle, controlled responsibly by the manufacturer, is generally completed. This concept is basically applicable to all high quality consumer goods.

Research secures progress

Research plays a central role in solving environmental problems. It delivers the basis for analysis and assessment and develops concepts and technologies with the main players of industry and society to solve problems.



Federal Environmental Agency in Berlin, main building at Bismarckplatz 1

Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit

Umwelt Bundes Amt für Mensch und Umwelt

UMWELT STIFTUNG

bmb+f Bundesministerium für Bildung und Forschung

A main theme is the analysis of the causes and the effect of anthropogenic influences on the environment. With this in mind research develops for example suggestions as to how landscapes and environmental systems can be formed and used by people without damaging the quality of life of present or future generations. This includes a better knowledge of the operating conditions and pollution limits of natural systems, from regional ecosystems up to the global climate system.

A second point is the development of technical solutions. This second area is directed at people running businesses. The aim is to so design manufacturing and cosumption processes that they are as consistently built in to natural material cycles as possible. This aims on the one hand to raise resource efficiency in product design and manufacture, in other words integrated environmental technologies. On the other hand environmental aftercare technologies are still required to protect the soil, water and air, which are however to be developed with a view to reducing costs.

Apart from technical developments, social action approaches are being investigated, for example training in sustainable consumer patterns and use of products. Changes in usage behaviour cannot be forced; environmental education therefore plays a central role in this area.

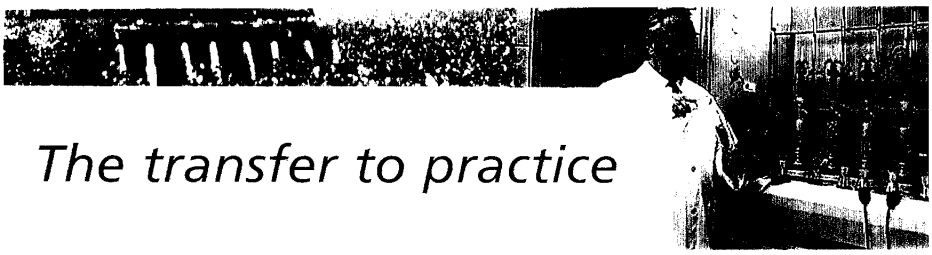
Research and development happens within a network of state-owned and private organisations and in co-operation with business and social groups. Apart from the federal research ministry on the state side, the respective specialised ministries are involved in the planning and implementation of research programmes on a national level.

The technologically oriented research programmes are often carried out in joint projects involving the participation of companies to ensure workable and transferability.

A modern research policy has the goal of promoting transferable and workable concepts and technologies. This includes the development of new environmentally sustainable production processes and products.

To promote the vertical transfer – from research to practical use – research is carried out in joint projects in which research facilities and one or more companies are involved.

The further development of existing technical environmental solution approaches which reflect the current state of technology will be targeted for promotion by pilot projects in individual companies through to a stage where they can be used. These pilot projects demonstrate their usability to other companies and should motivate them to use the solution themselves.



The transfer to practice

The transfer of innovations from one company to a whole industry sector is a particular challenge. For this horizontal transfer it is important to promote an open company culture, open-mindedness towards new ideas, the qualifications of the decision-makers and the availability of know-how and practical experience. A whole series of semi-private facilities and also privately organised advice companies play an important role in the transfer of research results.

Co-operation between manufacturers and recycling companies

Choice of materials and the design of products have a major influence on the quality and the economic viability of recycling processes. Product design and recycling technologies must be co-ordinated. Co-operation and the exchange of know-how between manufacturers and recycling firms is not yet common practice, but an important precondition for the development of life-cycle management. A research project has investigated what the advantages such co-operation can have for both sides.

Within the scope of co-operation with the recycling company the composition of the materials was altered so that the iron and plastic parts can be recycled in future. Disposal costs for the end-of-life product were thus significantly lowered.

With the documentation about product composition and construction developed during the research project the recycling company can in future plan its recycling processes in advance and thus design them more efficiently.

Such co-operation also offers both sides economic advantages and at the same time improves the environmental situation.

Forschung für die Umwelt
Published by: bmbf, 1998
www.bmbf.de

Main points about research for the environment

Environmentally friendly processes

- Environmentally friendly and low-resource removal of raw materials from the biosphere
- Environmentally friendly low-waste and low-emission manufacturing processes through substitution of polluting raw and other materials, alteration of process technology, process-integrated completion of cyclic management

Completion of cyclic management circle

- Production remainders recycled as far as possible and recycled into other manufacturing processes
- Return of remainders which can no longer be recycled to the biosphere in an environmentally friendly form achieved through specialised pretreatment

Design of environmentally friendly products

- Environmentally sustainable product design for environmentally friendly use, maintenance and reuse or recycling.

Complete assessment; analysis; measurement

- Accompanying the promotion concept, methods and instruments for the analysis, prognosis and solution of manufacturing and product-related environmental problems round off the promotional activities.

International technology transfer

Environmental impact is being increasingly recognised as an international problem. Internationally a detailed environmental and development working programme for the 21st century has been created in the Agenda 21. The number of bilateral agreements in which conservation appears as a major theme has increased in recent years. Germany is already deeply involved in technology transfer to developing and threshold countries and also in mid and eastern European states.

Prunérov power station(Czech Republic)

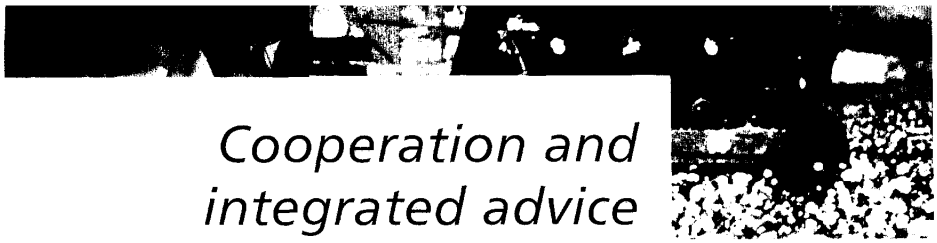
Flue gas equipment for four blocks of the Prunérov power station

International co-operation for the transfer of environmental technology involves not only the export of the actual technology but also the transfer of know-how about legal basics, standards and administrative basics, management aspects within the company and the co-operation the various participants – ministries, authorities, associations, training facilities, etc. This know-how forms the basis for understanding sustainable management and its implementation.

In Germany several institutions are active in the field of environmental technology transfer. Amongst other players the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) and the Federal Environmental Agency (UBA) are strongly involved in international co-operation on environmental policy. With its projects abroad the BMU promotes the aim of permanently reducing cross-border pollution both in Germany and in partner countries and to improve co-operation at state and municipal level as well as between the companies involved.

The federal ministry for economic co-operation and development (BMZ) also promotes the transfer of environmental technology within various programmes. For example, it supports partner countries in disseminating environmental technologies by financing studies. On a specialised technical level the BMU is supported by the "Deutsche Gesellschaft für Technische Zusammenarbeit" (German Society for Technical Co-operation- GTZ) and also by the "Kreditanstalt für Wiederaufbau" (Credit Institute for Reconstruction – KfW) in financial co-operation.

The federal ministry for education and research (BMBF) works with threshold countries in the area of scientific technical co-operation. One goal of this co-operation is to intensify contact between industry, science and politics in Germany and in the respective partner country. Often there is a need for research and development in a technology adapted for partner countries. Transnational co-operation is supported between at least two companies, possibly complemented by research in one or more areas.



Cooperation and integrated advice

ITUT

The "International Transfer Centre for Environmental Technology" (ITUT) was set up in Leipzig in 1996 to strengthen German activities in the area of environmental technology transfer. The ITUT's aim is to improve technical, scientific and political co-operation in conservation between Germany and partner countries in south east Asia, China and India, in mid- and eastern Europe as well as Latin America. In addition it co-ordinates the activities of the environmental area managers who are present in the 11 chosen German foreign chambers of commerce. The environmental area managers inform about the possibilities for international co-operation, find suitable German and foreign partner companies, pass on the German range of technology and organise regular meetings to exchange experiences.

www.itut.de

GTZ

The task of technical co-operation was passed to the "German Society for Technical Co-operation" (GTZ) by the federal ministry for economic co-operation and development in 1974. The GTZ is active in 135 countries, has its own offices in over 50 countries and has decades of experience with which to suitably solve development problems in partner countries. In recent years the GTZ has concentrated on supporting partner countries in securing their ecological basics with a view to sustainable development.

www.gtz.de

Federal Environmental Agency

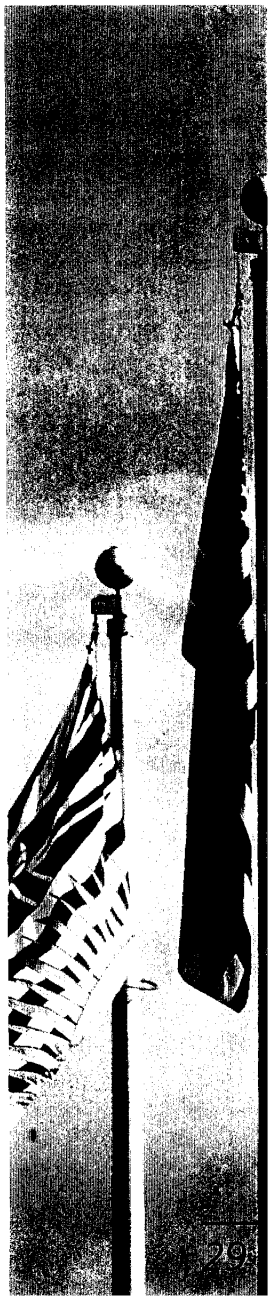
The Federal Environmental Agency plays a central role in the area of environmental technology in Germany. Apart from active co-operation with many international organisations to strengthen international conservation (for example work to find the best technology available on a European level) it carries out international projects with eastern European states within the auspices of the TRANSFORM and TWINNING programmes. With the internet information system "Cleaner Production Germany" the Federal Environmental Agency offers a national and international platform to improve access to German environmental technology.

www.umweltbundesamt.de

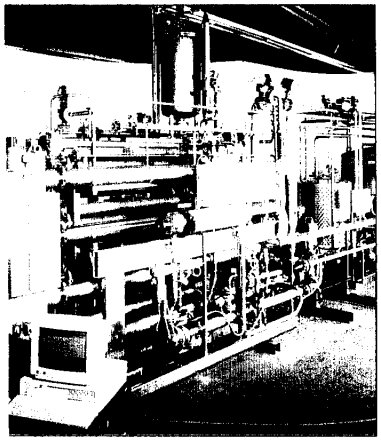
KfW

As part of the financial co-operation of the Federal Republic of Germany with development countries the "Credit Institute for Reconstruction" (KfW) finances investment and project-oriented advice services on the extension of the social and economic infrastructure and the commercial economy as well as on environmental and resource protection on behalf of the German government. The KfW checks the worthiness of the plans with regard to development policy, supports partner countries in carrying out the plan and provides a final assessment of success.

www.kfw.de



Examples of foreign projects in Poland, Brazil and India



This ultra-filtration plant was developed and implemented as part of a German-Brazilian research project.

German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU)

Since 1992 the BMU has provided financial support for ten foreign investments close to the German border. Support was given above all for sewage treatment plants and clean air projects. A significant improvement in the ecological situation at the respective locations has been achieved through these projects.
One of the most outstanding results of German-Polish co-operation is the realisation of the sewage treatment plant and sewage sludge disposal tip in Swinemünde (Swinoujscie). With this it was possible to make a lasting improvement to the environmental situation along the Oder and in the waters of the Stettin lagoon and also in the Baltic. As part of the support a mechanical-biological sewage treatment plant with nitrification and denitrification as well as biological phosphor elimination was built. Since 1997 up to 7,000 m^3 of sewage is treated daily, although the quality of the treated sewage does not meet the requirements of EU guidelines on "municipal sewage". To recycle energy from the sludge produced a sludge collection plant was built. The resulting biogas is used to produce electrical energy with the help of two gas-driven generators. The heat produced is used to heat the sludge containers and other parts of the sewage plant. The sludge disposal concept guarantees regulated disposal paths for the first time. The Swinemünde (Swinoujscie) sludge disposal plant has now become a model of modern disposal technology in Poland.

Federal ministry for education and research

The Brazilian textile industry is expecting a tightening of the regulations for the release of cleansed sewage at a time when many firms' sewage plants are working at the limits of their capacity. Companies are therefore looking for precautionary and process-integrated processes to minimise pollution as well as new ways to close in processes which were once carried out in the open.

A scientific-technical co-operation project to reuse dyes and smoothing agents was carried out with the German and Brazilian textile industry and a German textile industry research institute. Smoothing agents are natural and synthetic chemicals which make the cotton fibres easier to work on the textile machines. German machines to recycle the used smoothing agent and dyes were installed and optimised in the factories of four big Brazilian textile manufacturers.

Federal Ministry for Economic Co-operation and Development

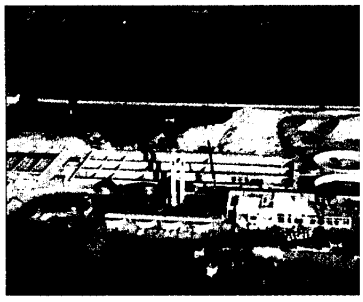
A project to save energy in industry was carried out in India.

Through consistent exploitation of all energy saving potential in Indian industry a theoretical 1.5 billion US Dollars could be saved or put to more sensible economic use elsewhere. Running and overall economic costs could be reduced, the reliability of power supply increased, pollution reduced and climate protection improved.

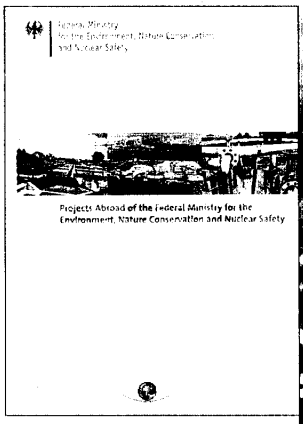
The "Industrial Energy-saving" project is an attempt to lower energy costs in particular industry segments through more efficient energy use. The project begins pragmatically directly with the organisational and technical factors which influence the decisions of company owners in this context.

The core of the "Industrial Energy-saving" project is the establishment and running of an advice service for the efficient and economic use of energy sources on a fee basis. This must work so successfully and convincingly that its advice is actually followed by big, mid-sized and small companies and the costs arising from its services are acceptable. This will only succeed if recommendations are actually implemented by customers and produce short- to mid-term economic advantages for the companies.

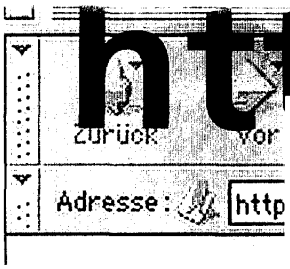
The advice service is built up together with the Energy Management Centre of the Ministry of Energy, the originator of the project, on the one hand, and with the private Tata Energy Research Institute on the other. The fact that a state ministry is using a private organisation to achieve its project aims is an unprecedented new departure for India..



Swinemünde sewage treatment plant (Poland)



Federal Environment Ministry foreign projects, 1999 www.bmu.de

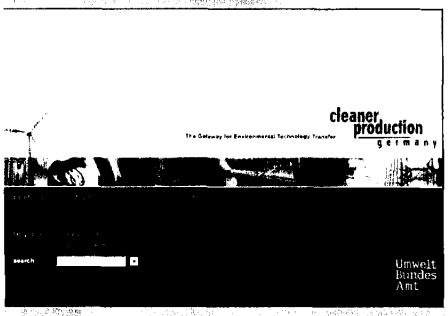


http://www/

Sources of information about German environmental technolog

At the UN conference on environment and development in Rio de Janeiro in 1992 all participating states recognised the need for an intensification of the transfer of technology. Chapter 34 of Agenda 21 rated the availability of scientific and technical information as well as access to enviromentally sustainable technologies and their transfer as a major requirement for sustainable development. Apart from concrete technological co-operation an effective technology transfer needs a guaranteed continuous flow of information, for example in the form of selected bilateral projects.

"Cleaner Production Germany" Internet system



www.cleaner-production.de

The German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety and the Federal Environment Agency offer the "Cleaner Production Germany" internet information system. This platform serves to improve access to technical and organisational solutions in company environmental protection for both German and foreign companies.

Extensively systematised information can be obtained gratis. In co-operation with other institutions the project provides a roof under which communication and the exchange of information between international and national institutions can be promoted.

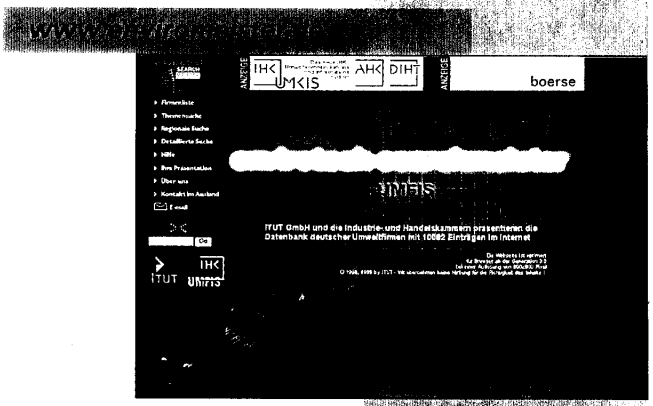
Apart from the facility to receive required information via a search machine, structured information on the following themes is offered:

- German suppliers of environmental technology
- German environmental technology promotion programmes
- Results of promoted technology projects
- Technologies (for example environmental biotechnology)
- Environmental technology in specialised branches of industry
- Company-level environmental protection and economy (for example environmental management)
- German technology transfer institutions
- German foreign economic support for environmental technology
- Environmental information from abroad

The environment goes online

Envirotech-Searchmeister

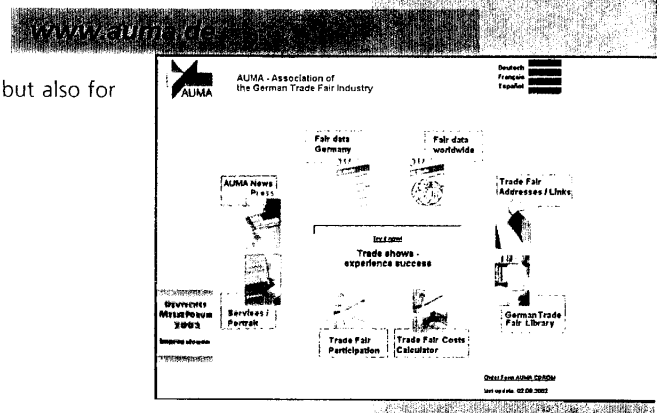
The "ENVIROTECH-SEARCHMEISTER" offered by the "International Environmental Technology Transfer Centre" (ITUT) in Leipzig contains almost all environmental offerings for small and mid-sized companies. This environmental company information system includes core information on around 8300 suppliers, complemented by company profiles. Information about technology and service companies is offered under 1200 different keywords. The aim is to close the gap between German firms and potential users of German environmental technology.



AUMA Association of the German Trade Fair Industry

AUMA informs exhibitors and visitors about dates, product ranges and vistor figures for German and foreign events, including environmental trade fairs. As a complement to this, it publishes specialist brochures for the preparation and staging of trade fair participations. The German Trade Fair Library is open to anyone who is professionally involved with trade fairs.

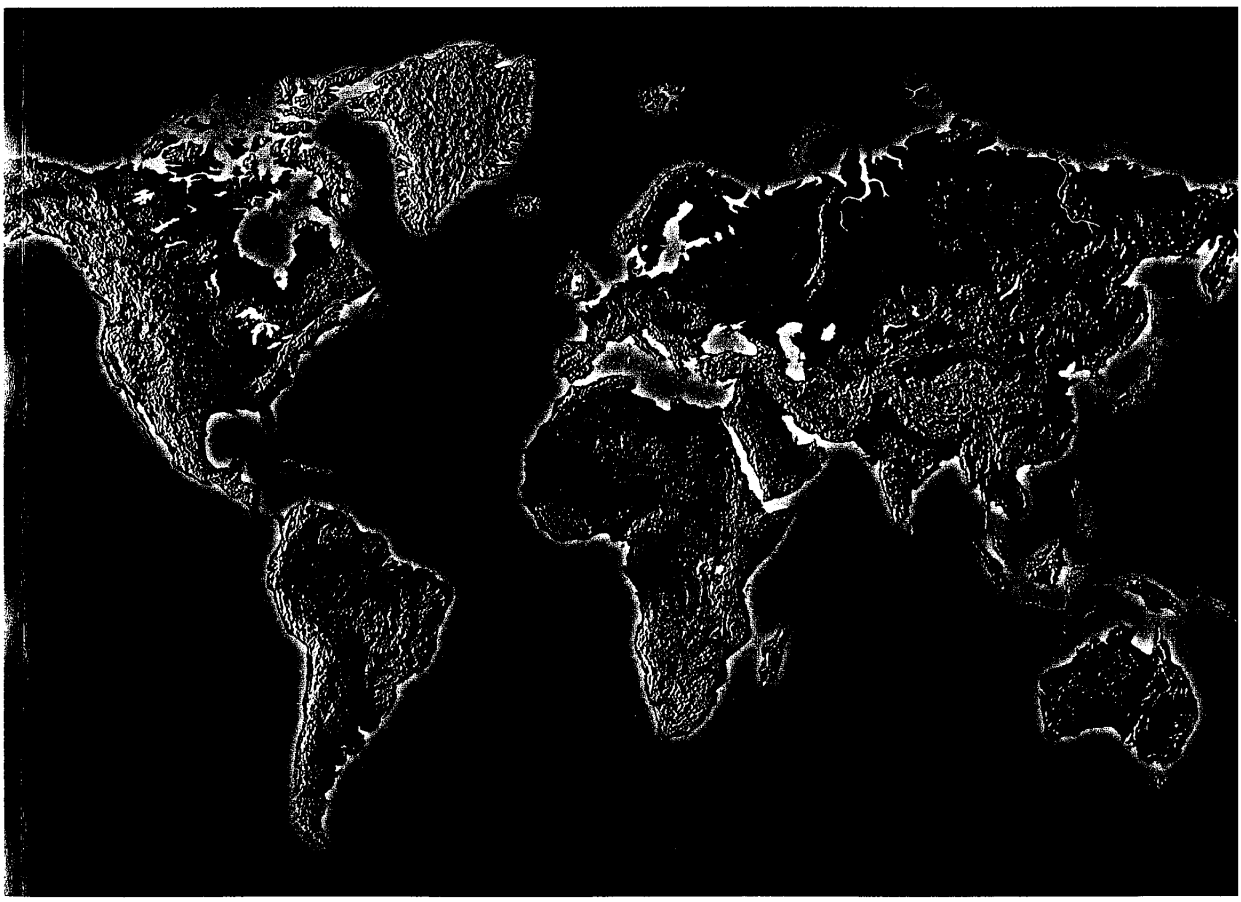
AUMA prepares the official German trade fair programme abroad. Within the framework of this programme the Federal Government provides financial assistance for German companies joint participations at foreign events, but also for independent presentation by German industry abroad.



The Federal Ministry
for the Environment,
Nature Conservation
and Nuclear Safety

TAKING RESPONSIBILITY FOR THE FUTURE

ENVIRONMENTAL POLICY AS A GLOBAL CHALLENGE



Sustainable development - our future depends on it

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As of: February 2002

Dear reader,

There can no longer be any doubt that, despite all our efforts to date, we are continuing to push the planet to the brink of ecological collapse: we are still overexploiting its resources and compromising the development opportunities of future generations. Taking responsibility for the future of the planet and its present and future inhabitants means reversing this trend and ensuring that global development is in line with the principle of sustainable development.

In recent years the German Federal Government has therefore introduced decisive steps towards an ecological modernisation of society and industry. For example, we have made our energy policy sustainable by giving massive support to renewable energy and improved energy efficiency and by reaching an agreement to phase out nuclear power because of the high-risk technology it involves. With this we are both protecting the climate and opening up our economy to new markets in the future-oriented technologies of wind and solar power.

But no nation acting on its own can reverse this global trend. This can only happen through concerted international co-operation. International environmental and development partnership must therefore be further consolidated and intensified if we are to avert ecological, economic and social crises. For international environmental policy is always a policy of peace: it can stop damage to the environment and destruction of natural resources from spiralling into international conflicts.

In August 2002 the World Summit for Sustainable Development will be held in Johannesburg, South Africa. The international community will then be called upon to give an account of what has been achieved since the 1992 Earth Summit in Rio de Janeiro. In some areas we have chalked up some notable successes: for example, 2001 was a highly successful year for international climate protection, the Climate Conferences in Bonn and Marrakech seeing a breakthrough in negotiations that allowed the Kyoto Protocol to enter into force. Similarly, in the field of protection from hazardous substances, we have taken a gigantic stride forward: in May 2001, the POP Convention was signed in Stockholm, taking the twelve most dangerous chemicals off the market worldwide. Nevertheless, we must acknowledge that we still have a long way to go before we can truly talk of sustainable global development. It is therefore crucial that the World Summit in Johannesburg is an "Implementation Summit." We have to find the new momentum we need to translate the resolutions made at and since Rio into reality.

The central challenge currently facing us is increasing globalisation. It offers opportunities, but it also contains great risks. I see my remit as being to proactively shape globalisation – for the benefit of people and the environment. The world economy has reached a level of integration that requires global ecological governance if we are to prevent environmental dumping and ensure that the environment is protected even in the face of international competition. This calls for new alliances between the world of politics, industry and the public.

The path to global sustainable development is long and arduous. Setbacks are inevitable. But, if we are to avert the destruction of the very foundations upon which life on this planet depends, there is no alternative. And it will be worth making the effort, because a better environment also means a higher quality of life – for us and for future generations.

Jürgen Trittin
Federal Minister for the Environment, Nature Conservation and Nuclear Safety

Contents

The Blue Planet in crisis

If you happen to pick up a dictionary from the early 1960s and leaf through its pages, you will probably search in vain for entries such as "environment" or "ecology." Today, less than 40 years on, there is a whole host of reference works devoting entire chapters to these topics. For, at the beginning of the 21st century, we have come to understand that the fragile natural systems that support life on our Earth, a planet described in awe by the first astronauts as a "blue pearl in space," are in acute danger, and that averting these threats is ultimately a question of the survival of the human race and thus must be a central aim of any political agenda.

Another realisation that has also long been widely accepted is that the consequences of ecological destruction and threats to the environment do not stop at national frontiers. The most serious environmental problems facing us today are international, or even global in character.

● *The dual threat to the Earth's atmosphere*

Human activities, such as the burning of the fossil fuels coal, oil, gas and wood, have significantly raised the concentration of carbon dioxide (CO_2) and other greenhouse gases in the atmosphere. We must assume that by the year 2100 the mean global air temperature will have risen by between 1.4° C and 5.8° C (above the 1990 baseline) and that the sea level will be between 10 and 90 cm higher than in 1990.

The careless use of chlorofluorocarbons (CFCs) and similar chemicals, e.g. in aerosols or in the production of foam plastics, has seriously damaged the protective ozone layer in the stratosphere. The process of ozone depletion, which was first observed over the Antarctic in the late 1970s, has now appeared over the Arctic and is worsening from year to year. It is through the resulting "hole" in the ozone layer that more harmful UV-B rays from the sun are now reaching the Earth, resulting in a higher incidence of skin cancer, cataracts and other diseases.

● *The loss of biological diversity*

The loss of entire species of animals and plants along with their habitats as a result of human activity is now proceeding at an alarming rate. The Earth has not lost so many species in such a short time since the last Ice Age some 65 million years ago. Every organism alive today is the product of 3.6 billion years of evolution, and their extermination means that nature is irrevocably impoverished. Biodiversity, in other words the diversity of ecosystems and species as well as genetic diversity within species, provides us with clean water, fertile soil and fresh air. Thus, the current wave of extermination and destruction of ecosystems caused by human activity represents a threat to the very basis of human life.

● *The destruction of forests*

Since the middle of the last century, there has been a sharp increase in deforestation, especially the destruction of tropical forests by clear felling, improper management and human settlement. If this trend is not

checked, the area covered by tropical forest will have shrunk from its present size of nearly 1,800 million to just 600 million hectares by the year 2050. And deforestation also feeds into the processes of climate change, desertification and irreversible loss of biodiversity.

● *The pollution of oceans*

We are subjecting marine ecosystems to a variety of stresses: pollutants and nutrients from air and rivers, shipping, oil and natural gas exploitation, and fisheries. One of the results has been an alarming decline in fish stocks worldwide. This development represents a threat to one of humankind's major food sources.

● *The wastage and destruction of freshwater resources*

Although, from a global perspective, there is still plenty of freshwater, it is distributed very unevenly around the Earth. While in the industrial nations water is often used carelessly and wastefully, some 1.2 billion people, mainly in the developing world, live without access to clean drinking water. The conflicts in the Middle East, for instance, over the use of water from rivers such as the Jordan, Euphrates and Tigris, are an example of how disputes over scarce freshwater resources can threaten regional stability and have consequences for the whole world.

● *The threat to soil*

In many parts of the world, human activities have damaged soils, making them less valuable for agricultural purposes and sometimes rendering them completely unusable. Worldwide, almost 2,000 million hectares of soil are already showing at least some signs of degradation. That is about 15 percent of the Earth's ice-free land surface. One third of our planet's soil cover is of only limited use.

Exacerbating the situation is the spiralling growth in the world population, accompanied by increasingly rapid consumption of raw material reserves and natural resources. Just 50 years ago, a little over two billion people shared the Earth's finite resources, its freshwater, clean air and abundance of animal and plant life. Today, this figure has trebled, and in another 50 years the Earth will be inhabited by almost ten billion people.

All these problems point to the fact that we are still approaching the limits of our planet's natural capacities, beginning to overtax its natural life-support systems and curtailing the development opportunities of future generations. If we fail to halt this trend in time, indeed reverse it, one of the consequences of deepening environmental and development problems will be a growing threat to peace and security in the world. The scarcer environmental resources become, the higher the risk of war being waged over what remains. If we carry on plundering the Earth in this way, it is not natural disasters or atomic bombs that will one day make vast areas of our world uninhabitable: humankind will have committed ecological suicide.

Taking responsibility for the future of the planet and its present and future inhabitants will mean reversing this trend and aligning global development with the principle of sustainability. This cannot be done by any one nation acting alone but only through systematic international co-operation. The government of the Federal Republic of Germany therefore wants to systematically consolidate and intensify international environmental and development partnership in an effort to prevent ecological, economic and social crises. It is actively pursuing this goal by advancing the cause of environmental protection in all the relevant international organisations and bodies, in the framework of international environmental conventions and through bilateral co-operation with other countries.

Successful international cooperation on environmental issues needs ambitious countries that are prepared to make the running and set a good example. Germany has successfully played this role in recent years. An example of this is our Renewable Energy Act, which came into force in April 2000: designed to promote solar energy, wind power, hydrological power and energy from biomass, it is a pioneering piece of legislation and has already been imitated in other countries. Through the successful process of ecological modernisation that we have already begun to put in place in our own country, the German Federal Government will continue to promote environmental policy in the international arena. Our aim will always be to move towards sustainable global development - for the benefit of people and the environment.

I. Objectives of an international environmental policy

A. Sustainable development

Back in 1992, the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro reflected a growing awareness throughout the world of the dangers posed by increasingly acute environmental problems. The conference established "sustainable development" as the central paradigm for future global action. The term had been coined by the Brundtland Commission, i.e. the World Commission on Environment and Development set up by the UN General Assembly in 1983 and named after its chairwoman, the then Norwegian Prime Minister Gro Harlem-Brundtland. It defined sustainable development as follows:

> The present generation should meet its needs without compromising the ability of future generations to meet their own needs

Today, ten years after the Rio Earth Summit and in the run-up to the World Summit on Sustainable Development in Johannesburg in August 2002, these brief yet profound words are just as relevant as ever. They express nothing less than a duty to abandon those lifestyles and economic practices that are pursued at other people's expense and to the detriment of generations to come. The aim of this definition is to identify a common denominator linking economic efficiency, social responsibility and environmental protection that will not only give the countries of the Third World equitable opportunities for development but will also keep the natural systems that support life on Earth intact for future generations.

Ten years after Rio, the World Summit on Sustainable Development offers us the opportunity to take stock and inject new impetus into global environmental policy and the entire field of sustainable development policy. The Federal Government's aim is to conclude in Johannesburg a "global deal" between the industrialised countries and the developing countries in which action-focused decisions are taken to translate the idea of sustainable global development into reality. This includes decisions in the spheres of poverty alleviation, environmental protection, conservation of resources, green forms of energy and strengthening global

environmental institutions. We would like to see the Johannesburg summit create the prerequisites for the concept of sustainable development to acquire greater practical significance.

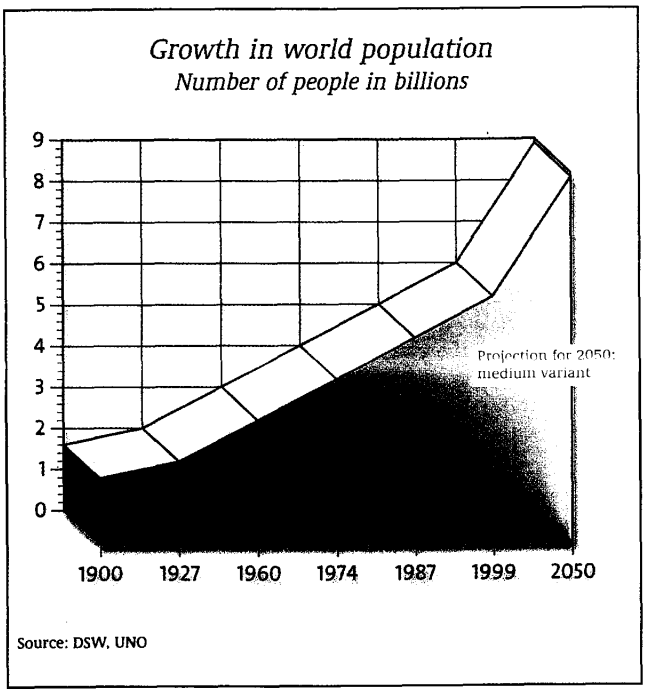
The Rio Earth Summit passed a number of fundamental and far-reaching resolutions, including a declaration committing the international community to the following key principles of environmental policy:

- The *precautionary principle* goes beyond the need to avert imminent threats by requiring active measures, based on the best available science and technology, to reduce risks to people and the environment.
- The *polluter-pays principle* means that the costs of preventing and dealing with environmental pollution shall be borne by those responsible for causing it.
- According to the *co-operation principle,* environmental protection is a joint task to be shared by government, citizens and industry.
- The *integration principle* states that environmental protection is not an issue to be treated in isolation but that environmental aspects must always be taken into account when framing and implementing policies in many other fields such as transport, energy and agriculture.

Seeking to turn the vision of sustainable development into reality, the Rio Conference adopted Agenda 21, a worldwide action programme for the 21st century. It requires every country to devise concepts and strategies for sustainable development. The Rio summit made both industrialised and developing countries jointly responsible for the achievement of sustainable development, while at the same time distinguishing different degrees of responsibility to match the different levels of development:

- The *industrialised countries* face the task of bringing their resource-intensive and environmentally damaging lifestyles and economic activities into permanent harmony with the Earth's natural systems on which our survival depends. Let us consider two examples:

- Only 25 percent of the world's population live in the industrialised nations, yet they account for 75 percent of global annual energy consumption and are therefore responsible for a correspondingly high proportion of emissions of the greenhouse gas CO_2. If every Chinese and every Indian citizen were to consume as much energy as



a West European, world energy consumption would more than double, with the associated consequences for the climate.

- According to projections by the United Nations Development Programme (UNDP), a child born today in London, Paris or Berlin will, in the course of his or her life, consume more, generate more waste and pollute the environment more than fifty children in a developing country.

In other words, if the developing countries were to adopt the lifestyles and economic practices of the industrialised countries, the ecological collapse of our planet would be a foregone conclusion. That is why the industrial nations must not only make fundamental changes in their own behaviour but also support the developing countries in their attempts to find ways of raising living standards whilst significantly lowering consumption of energy and raw materials and radically reducing pollution. With its strategy of ecological modernisation of industry and society, Germany will continue to make an important contribution to this.

- The most immediate task for the developing countries is to combat poverty. Poverty is a major cause of non-sustainable production methods and living conditions. Successful poverty alleviation is therefore an important prerequisite for effective environmental protection. The economic development needed to combat poverty must also conform to ecological criteria. This means there must be the right legal foundations, properly functioning and economically efficient institutions in the environmental sector, an appropriate economic environment and the necessary human resource capacity. The financial resources for this will, for the most part, have to be raised by the countries concerned, but the industrialised countries also have a special responsibility and Agenda 21 commits them to provide support in the form of financial aid and technological co-operation.

To ensure that environmental protection is given the status it deserves in relation to the social and economic aspects of sustainable development, a means must be found of describing environmental developments using just a few key indicators which, like the gross national product or the rate of inflation, compress a great deal of information into a succinct form. Indicators of this kind enable us to monitor progress using clearly defined parameters and can be used as a basis for policy-making and to track development trends.

Germany is currently developing a set of indicators of this kind as part of work to formulate a national sustainability strategy. We are able to build on a series of preliminary work in the international arena, carried out by the United Nations and the OECD, for example, but also some work carried out in Germany itself. For example, Germany was a test country in the programme of work on sustainability indicators carried out by the UN Commission for Sustainable Development which laid valuable foundations for future work. We shall also be able to make use of our experience with the "German Environment Barometer." This system of environmental indicators, which is already up and running, includes indicators for climate, air quality, soil, nature, water, energy consumption and use of raw materials. Each indicator is linked to specific targets to allow progress to be monitored.

B. Environmental protection in a globalised world economy

A new challenge facing environmental protection is the increasing degree of integration of the global economy. Globalisation is leading to tougher competition between different economic centres.

Nowadays, an international corporation seeking to set up a factory offering several thousand jobs will look not only for the country or city that can offer the most favourable transport links and other infrastructure advantages but also the location where it will have to pay the lowest taxes and comply with the least demanding environmental standards. This places governments under increasing pressure from those who argue that, by setting national environmental standards higher than the standards faced by competitors abroad, they make domestic industry less competitive and put jobs at risk.

However, the relocation of environmentally harmful production to countries with less stringent regulations is not an acceptable response to the globalisation of the economy. Submitting to such arguments would only result in environmental dumping. On the other hand, we must also be wary of those who may use environmental standards as a pretext for keeping products from developing countries out of the industrialised countries.

An agreement on international environmental standards has, not least for these reasons, become increasingly urgent. Germany is committed to creating a set of global ecological regulations to ensure that environmental protection does not go by the board in the face of international competition. Eight measures in particular are needed (see box).

Elements of a global system of ecological regulation

1. Conclusion and constant updating of multilateral environmental agreements that set high standards
2. Strengthening the UN structures relevant to the environment and sustainable development in order to consolidate and raise the profile of environmental issues
3. Agreement on international strategies to draw up minimum environmental standards, under the auspices of the OECD and UNEP, for example
4. Pilot projects to disseminate these minimum standards in selected fields
5. Voluntary international initiatives such as commitments by industry or certification of environmentally friendly products (eco-labels)
6. Integration of environmental criteria into the standards issued by the International Organization for Standardization (ISO)
7. Application and dissemination of "Codes of Conduct" regulating the environmental conduct of multinationals, such as the OECD Guidelines for Multinational Enterprises.
8. Environmental manuals for international finance institutions

C. Integration of environmental protection into other policy sectors

Neither in our own country nor at international level can we continue to regard environmental protection as an isolated policy sector. Important ecological objectives such as economical and rational use of energy, environmentally friendly food production, conservation of animal and plant species and their habitats, or environmentally sound mobility, cannot be achieved by environment policy measures alone. We need overarching strategies to ensure that environmental imperatives are properly reflected in energy and transport policies as well as in international agreements, cooperation arrangements with developing countries and international trading, investment and financing activities.

In Germany's view, four tasks are particularly important here:

1. Agreement on international strategies to use resources more sparingly, e.g. in the water, energy and transport sectors
2. Closer integration of environmental aspects into the rules of the World Trade Organization (WTO), including in the negotiations on environmental issues in the new round of world trade talks.
3. Greater consideration of environmental aspects in the provision of international financial services, for instance by tying government export credit guarantees to mandatory requirements relating to the environment
4. Tackling the global challenge of ensuring that development assistance has a clear environmental focus

D. Better implementation of existing agreements

The last thirty years have seen rapid growth in the field of international environmental law. Depending on the method of counting, we now have between 200 and 500 international agreements, which have either the partial or exclusive aim of protecting the environment. However, these agreements have not yet made an adequate contribution to improving the situation of the environment. This is often due to the fact that countries have difficulty in meeting the obligations set out by the agreements. For example, the provisions agreed under international law are sometimes not applied in the individual countries to the extent required, and/or are not enforced consistently enough.

To eliminate these deficits, Germany is committed to the following principles:

- When negotiating environmental agreements, attention must be paid to ease of implementation, and, where necessary, provision be made for supporting countries, especially developing countries, in capacity building;
- The agreements must be furnished with adequate mechanisms for control and sanctions, to prevent countries from believing they will be able to shirk their commitments.

In both these elements governments need the backing of environmental associations and other representatives of civic society. The Federal Government therefore attaches great importance to agreements being transparent and involving the public, because the special knowledge of NGOs often plays a decisive role in helping to create workable rules and uncovering any contraventions that might occur.

E. The environment and security

Local, regional and global environmental changes combined with the increasing shortage of vital resources like freshwater, fossil fuels and fertile soil can cause or aggravate armed conflicts, especially in and between developing countries. The permanent loss of the very foundations of life, such as

- inhabitable land, due to desertification or the rise in sea levels,
- agriculturally productive land, due to soil erosion,
- adequate drinking water reserves, due to prolonged periods of drought

can lead to social problems and violent conflicts both within and between States. When one country in need of more water decides to create a reservoir by damming the only river supplying the entire region, any neighbours also dependent on that source will not stand by and let it happen. Or when entire peoples are forced to leave their homes because the land is no longer able to feed them they are hardly likely to be received with open arms by the inhabitants of more fertile regions. Even today, the number of environmental refugees throughout the world is estimated at 25 million and the trend is rising.

Alongside the potential for conflict inherent in environmental change, great potential for international cooperation exists in the field of environmental protection. Environmental projects are particularly well suited to fostering trust between nations in situations of tension. This was recently demonstrated by transfrontier environmental cooperation projects in South-eastern Europe, which are being funded under the Balkan Stability Pact concluded in July 1999.

No wonder, then, that more attention is being paid to the issue of "ecological security." Consequentially, in April 2000 the Federal Security Council passed an overall concept put forward by the Federal Government on "Prevention of civil crises, conflict resolution and consolidation of peace" which is designed to better link environment and development policy with foreign and security policy. In its involvement in international organisations, the Federal Government is also committed to international policies that focus more on the interaction between environmental protection goals and security goals.

Under the chairmanship of the German Environment Ministry, working in co-operation with the US Defence Ministry in NATO's Committee on the Challenges to Modern Society (CCMS), recommendations for action in the fields of environmental and development policy have therefore been drawn up. Furthermore environmental and security issues are also on the agenda within the EU, the OSCE and the UNECE. Germany believes that in future the United Nation's Environment Programme (UNEP) should also be given a mandate to take forward global and regional work on this topic, especially since the connections between destruction of the

environment and the consequential social and political tensions were emphasised in the United Nation's Millennium Declaration issued in September 2000. In view of the political sensitivity of this topic, considerable work will, however, need to be done to convince many UN Member States.

F. European integration and European Union enlargement

Today, environment policy is one of the central functions of the European Union. EU environmental law now embraces almost all environmental sectors to at least some extent. We have seen a succession of initiatives from Brussels encouraging or requiring Member States to update their national environmental legislation.

In many areas the Community sets minimum standards which the Member States must not fall below but may exceed. This applies, for instance, to emission standards for large firing installations or the discharge of substances into waters. However, rules governing the production sphere, such as restrictions on emissions from machines and equipment, only allow more stringent national standards to be imposed under certain special conditions, so as not to impede free trade.

With a view to reconciling this tension between EU and national legislation within the Community, the declared aim of the German Federal Government is

- to have Germany's own national environmental targets reflected in Community environment policy so that the EU will, as far as possible, have a common set of legislative provisions aimed at high standards,
- to open up national law to new, more far-reaching approaches that derive from the traditions of other countries, and, at the same time,
- to retain and utilise the necessary latitude for national solutions, e.g. through eco-taxation.

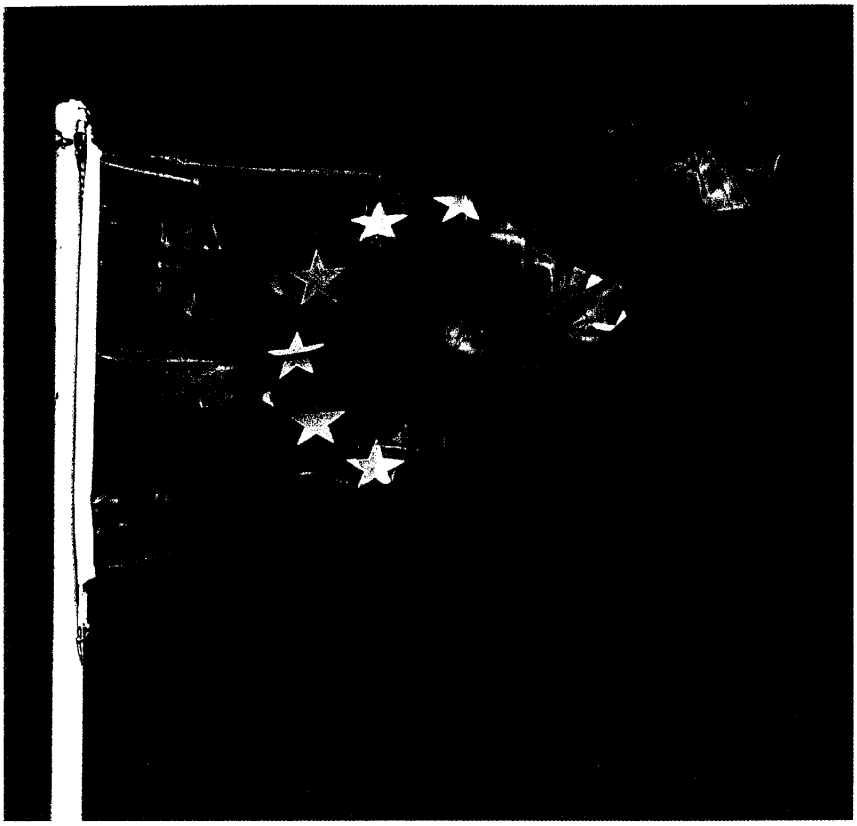
The EU has also developed into a driving force in the field of international environment policy, Policy on climate change is a case in point. Germany intends to continue playing an active role in helping to shape the policy of the European Union in the realm of international environmental co-operation by formulating ambitious targets and putting them into practice.

The state of the environment in the European Union has improved in certain respects in recent years, for example in the field of air pollution and water quality. However, there is still a great deal to be done. This is evident from Environmental Signals, the indicator-based reports published annually by the European Environment Agency.

The state of the environment in the European Union in 2001

- Air: Emissions of many air pollutants fell significantly between 1990-1996, e.g. sulphur dioxide (SO_2) -46%, oxides of nitrogen (NO_X) -16%, ammonia (NH_3) -8%. Targets for 2010: SO_2: -77%, NO_X: -51% NH_3: -18%.
- Climate: Emissions of the six Kyoto Protocol greenhouse gases fell by 4% between 1990 and 1999. Target for 2008-2012: -8%.
- Seas: Input of harmful substances (heavy metals and organic substances) into the Northeast Atlantic dropped between 1990 and 1998.
- Rivers: Input of harmful substances into most European rivers has fallen; however, the nitrate concentration in rivers is still high. There has been no change.
- Volume of waste: The quantity of waste generated continues to rise: by 5-10% between 1995 and 1998.
- Energy: The share of renewable sources of energy in electricity generation rose between 1990 and 1998 from 11% to 14%; the share of combined heat and power rose from 9% to 11%. Targets for 2010: 22% renewable energy sources, 18% combined heat and power.
- Land use: From 1990 to 1998, approx. 10 hectares of land (10 football pitches) were lost each day to motorway construction in the EU.
- Biodiversity: The number of areas protected under the EU Directive on bird protection is rising, although pressure on other land, such as particularly sensitive grassland, continues to rise.

Source: European Environment Agency



Based on an analysis of the outcome of the fifth Environmental Action Programme, the European Commission presented its proposal for the sixth Environmental Action Programme in January 2001. The EU Council of Environment Ministers discussed the Commission's proposal and presented a revised Draft Resolution to the European Parliament. The European Parliament and Council of Environment Ministers are expected to jointly adopt the programme before the end of 2002.

The programme formulates objectives, strategies and measures for the EU's environment policy up to 2010 and seeks to maintain the EU's pioneering role in international environmental protection. It was primarily as a result of the German initiative that it was possible to agree far-reaching concrete goals and time frames and to develop the proposed measures and put them into concrete terms. The Environmental Action Programme will be reviewed in 2006 in the light of how the state of the environment has changed and will be conclusively evaluated in 2010.

Furthermore, the EU heads of state and heads of government (European Council) adopted a sustainability strategy for the European Union in June 2001 in Gothenburg. In future, the economic, social and ecological effects of all areas of policy are to be reviewed in a coordinated fashion and taken into account when adopting resolutions. The first stage of the sustainability strategy addresses four areas which the German Federal Government believes are of central importance for sustainable development: climate protection, transport, health and natural resources. Agriculture will be addressed in detail in connection with natural resources. The incorporation of the environmental dimension into all relevant areas of Community policy-making is to be further developed. The sustainability strategy and its objectives open up new economic opportunities by funding the development of more environmentally sound technologies. Economic growth and use of resources are to be decoupled. The European Council will use indicators to regularly review the implementation of the strategy at its spring meetings, and will, where necessary, establish further policy guidelines.

An essential component of further European integration is the eastward enlargement of the EU. The entry of Estonia, Latvia, Lithuania, Poland, Slovenia, the Czech Republic, Slovakia, Hungary, Rumania, Bulgaria, Cyprus and Malta into the EU presents some major challenges both to the accession countries and the Community. For example, the accession countries must redesign their entire body of domestic law to bring it into line with Community law. This obviously applies to the environment sector, too, where they lag particularly far behind.

This adjustment process is of considerable importance. Accession without the comprehensive adoption and effective application of the environmental law of the Community would lead to major discrepancies within the enlarged Union. That would create problems not only in terms of environmental protection but also from the point of view of the single internal market. The enlargement, however, also provides a great opportunity for the environment since there would probably be no other way of achieving such a comprehensive

Key areas and aims of the EU's Sixth Environmental Action Programme

1. Climate protection

- *Goal*: Stabilisation of the quantity of greenhouse gases in the atmosphere at a level that the global climate can tolerate, i.e. limiting the rise in the mean global temperature to +2 °C and concentrations of CO2 to 550 ppm
- *Stages*: Reduction in emissions of greenhouse gases in the EU by 2008-2012 by 8% below the 1990 baseline; in the medium term: further reductions during the second commitment period of the Kyoto Protocol; in the long term: 70% reduction in emissions
- *Measures*: Implementation of the European climate protection programme, which involves introducing emissions trading, promoting renewable sources of energy and increasing energy efficiency; harmonisation of energy taxation and other measures in the energy, transport and industry and household sectors.

2. Protection of nature and biodiversity

- *Goal*: Halt the decline in biodiversity by 2020; protect natural systems so that they begin to function again, preserve biodiversity in the EU and worldwide, protect soils from erosion and pollution
- *Measures*: Protect the most valuable habitats by consistent implementation and expansion of the network of nature reserves ("Natura 2000"), implement the EU's action plans to protect biodiversity, develop a European soil protection strategy, incorporate biodiversity into the Common Agricultural Policy, develop a European strategy on the protection of marine environments.

3. The environment and health

- *Goal*: Raise the quality of the environment (central factors: chemicals, water, air, noise, urban environment) to a level at which there are no significant health risks.
- *Measures*: New legislation on chemicals designed to ensure that chemicals are only produced and used in such a way that they have no significant negative effects on health and the environment, a strategy for sustainable use of pesticides; across-the-board air quality control strategy targeting all air pollutants; noise abatement measures particularly relating to traffic; strategy for the urban environment.

4. Natural resources and waste

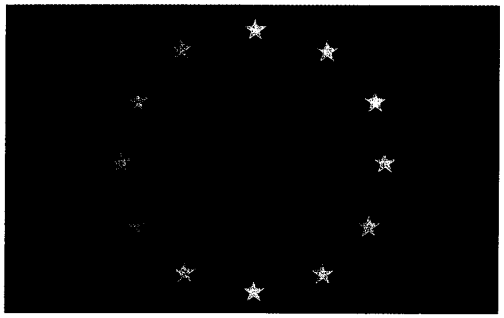
- *Goal*: Achieve a situation in which the use of resources does not exceed the limits of what the environment can bear, along with the decoupling of economic growth and use of resources
- *Stages*: Share of renewable sources of energy in electricity generation in the EU: 22% by 2010; develop concrete goals for reducing volumes of waste, particularly landfilled waste;
- *Measures*: EU Directive to promote renewable sources of energy; development and implementation of strategies for resource management and waste recycling, extend producers' liability for their products, fund production methods that are environmentally friendly and conserve resources.

improvement in the state of the environment in Central and Eastern Europe.

This massive task must be tackled first and foremost by the accession countries themselves. The Community is assisting them. The central goal is to build up effective administrative structures (institution building). This support is provided within the framework of the Accession Partnerships agreed between the European Union and the candidate countries. The key instrument for providing advice and expertise on institution building will be "twinnings," i.e. partnerships in which institutions in the Member States link up with

institutions in the candidate countries. The idea here is to facilitate a direct transfer of knowledge and experience. This approach is also expected to forge contacts that will continue beyond the duration of the projects and have a sustained impact. The programme was launched in 1996 and is scheduled to run for ten years, in other words beyond the date of the first accessions.

The central pillar of each twinning project is the secondment of a long-term expert from an administrative department of an EU Member State to the respective Central or Eastern European partner country. Project objectives will also be supported by the dispatch of short-term experts, the setting up of partnerships between comparable institutions in the Member States and the accession States and the provision of special training courses. Germany has drawn up proposals for projects in the environment sector with all the candidate countries and is already participating – for the most part with lead responsibility - in projects in Bulgaria, Estonia, Lithuania, Poland, Romania, Slovakia, Slovenia, the Czech Republic and Hungary. As the box below shows, Germany is playing a leading role in the EU with this commitment.



Twinning projects in the field of the environment

Aim:

Transfer of knowledge and experience from EU Member States to accession countries in order to strengthen environmental protection

Audit of EU twinning projects (1998-2001)

EU twinning projects in the field of the environment	55
■ of those Germany participates in:	28
■ of those Germany is project leader in:	19

Examples of German twinning projects:

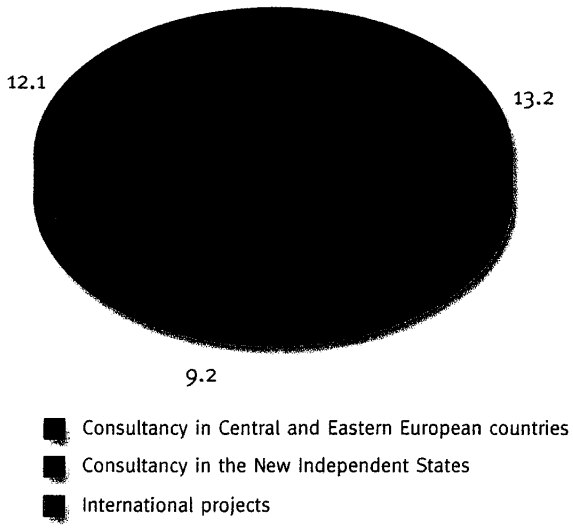
- Support for the Czech Republic in setting up and organising state environment authorities
- Support for Bulgaria in developing a national environment strategy and action plan up to 2006
- Support for Poland in transposing EU regulations on environmental impact assessments into national law

G. Support for the States of Central and Eastern Europe

Following the collapse of the communist system in Eastern Europe, the public suddenly learned of the full extent of the disastrous state of the environment in some of these countries. Although a lot has been done since then, the Central and Eastern Europe (CEE) States still have enormous efforts to make to safeguard the natural environment. This will demand nothing less than a root-and-branch reform of the civil service, legislation, the judiciary and social organisations in order to create the political infrastructure required for a socially and ecologically oriented market economy and a democratic social system. Although these countries are primarily responsible for raising the funds for environmental protection, they also depend on the help of the Western nations.

Germany is actively supporting this process. Our co-operation with most of these countries has now been put on a contractual basis (cf. Annex). The Federal Environment Ministry is also funding cooperation through concrete environmental protection projects. For Germany, there is a special significance to co-operation with our two neighbouring countries Poland and the Czech Republic with whom joint environmental protection for border areas has been agreed in contractually defined spheres. Another key area is cooperation with Russia. For example, with the financial backing of the Federal Environment Ministry exemplary monitoring centres are being set up in Volgograd and Astrakhan to record greenhouse gas emissions. In this, we are contributing to preparations for implementing the Kyoto Protocol in Russia. Other consultancy projects are being carried out with Central Asian and Caucasian Republics and with Western Balkan countries.

"Financial payments for environmental protection in 1992-2001" (in million DM)



Source: Federal Environment Ministry

From 2002, the Federal Environment Ministry's consultancy aid programme will amount to 1.84 million € per annum. It is targeted, on the one hand, at the EU candidate countries, and, on the other, at the group of New Independent States, primarily the Russian Federation and the Ukraine. In addition, cross-border cooperation projects will also be funded. The consultancy will focus on technical preparation, support for and development of twinning projects, measures for raising environmental awareness and funding preparations for investment in the field of environmental protection, primarily wastewater treatment and waste management. Another key area is providing support in building up civil service institutions, in particular at regional and local level, since, as a rule, they play a central role in implementing environmental legislation.

H. Support for developing countries

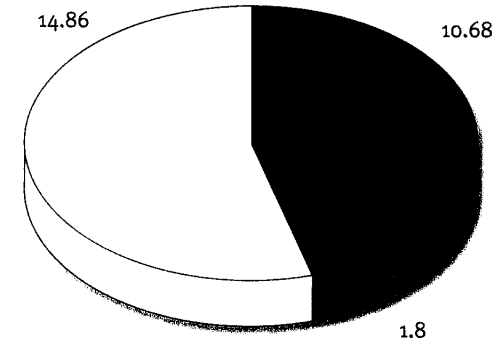
Many developing countries are exposed to grave economic, social and ecological pressures that, in some cases, threaten the very survival of their populations. That is why Germany has committed itself to pursuing active partnership with these countries. This policy stems not least from our acknowledgement that Germany, along with other industrialised countries, has in the past made disproportionate claims on the Earth's natural resources and continues to do so today. It is also based on our sense of our shared responsibility for peace and security in the world. After all, measures to combat the depletion and degradation of natural resources like freshwater or arable soils also help to abate conflicts between countries and reduce migratory movements and refugee flows.

Protection of the environment and natural resources is one of the cross-cutting tasks of German development policy. It is an important factor in our attempt to move towards sustainable development on a global level. Since the increasing destruction of natural resources is dramatically threatening the livelihoods of poor people, German development co-operation focuses on tackling the causes of the destruction of the natural environment in the recipient countries and aims at building ecologically sustainable structures. The core issue is to meet the legitimate aspirations of developing countries to share in the prosperity of this world without repeating the mistakes made by the industrialised countries.

Since 1998, the German government has been examining all instruments and areas of work in the development co-operation field to determine whether they can even more effectively promote the achievement of the objective of sustainable development. The Federal Government supports developing countries in implementing national concepts and strategies for sustainable development. This involves, for example, preparing the necessary legal foundations, establishing effective environmental institutions staffed by properly qualified personnel, transferring environmentally sound technologies, and alleviating poverty, which is both the cause and the consequence of the loss of natural resources.

In this way, environmental protection and conservation of natural resources is, like poverty alleviation, a mainstream cross-cutting task for German development policy.

Transfer of revenue from Germany to developing countries in 2000 (in billion DM)



State development-aid payments (bilateral and multilateral)

Private development aid

Private payments at normal commercial terms and conditions, e.g. loans from private banks

Source: Federal Ministry for Economic Co-operation and Development

At the same time, however, the sphere of environmental protection and resource conservation also constitutes a sectoral focus of development co-operation. In recent years, partner countries have shown an increasing willingness to carry out projects with this objective. Since 1990, between DM 800 million and over DM 1 billion (approx. 409–511 million euros) of bilateral state cooperation funding was spent each year on projects concerned with protection of the environment and natural resources. That amounts to between one-fifth and one-quarter of the total funding volume. These projects and programmes are largely designed to create sustainable structures, in the fields of waste disposal and sewage treatment, air quality control, clean generation and use of energy, nature conservation, the combating of desertification and conservation of tropical forests, for example.

The so-called *debt for nature swaps* are also important. The Federal Government has made it possible to cancel the debt repayments from the poorer developing countries provided that the money released in this way is used by the creditor countries in local currency for environmental protection schemes. From 1995-1998, debt conversions on this basis amounting to around 579 million DM were agreed with eleven countries. The Federal Budget for 2001 earmarked a total of 210 million DM for that purpose. In addition, since 1997, it is possible for up to 25 percent of state development aid to be granted as non-repayable subsidies to countries that would otherwise only be eligible for loans for projects concerned with environmental protection and conservation of resources.

Generally speaking, endeavours of this kind must be intensified. In 2001, European heads of state and government meeting in Gothenburg reaffirmed their pledge to move as quickly as possible towards the aid target agreed within the United Nations, i.e. to devote 0.7 percent of GNP to development aid and to achieve measurable progress towards reaching this target before the World Summit on Sustainable Development in 2002 in Johannesburg. In the future, the international community should also use sources of funding to finance global environmental protection that do not depend on contributions from their Member States. In this context, the idea of "green planet contributions" is being considered, e.g. by introducing fees for the use of global commons, in the shipping and aviation sector, for example. This would be an example of a global application of the polluter-pays-principle.

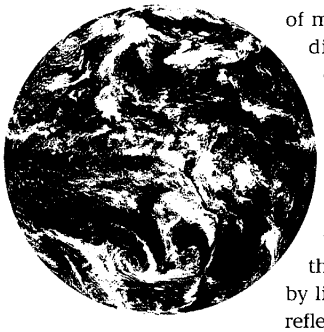
Increasing priority is also being given to non-governmental organisations and private direct investors in developing countries. In some of these countries, private schemes already have greater significance than the traditional forms of development co-operation. These activities must be encouraged and carefully designed to ensure maximum benefit to the environment. The Federal Environment Ministry has initiated a process of dialogue with industry, trade unions and NGOs that is the first of its kind. Its aim is to work out principles concerning how companies should organise their foreign investments to enable them to make a greater contribution to environmental protection. The outcome of this dialogue process will be presented as a German contribution to the World Summit on Sustainable Development in Johannesburg in August 2002 in the hope that it will trigger a similar process on an international level.

Germany is committed to fulfilling the pledge entered into at Rio to strengthen efforts in the field of technological co-operation. Developing and newly industrialising countries depend on access to modern environmental technology to solve their environmental problems and develop sustainable economic structures. This transfer must primarily take place within the private sector, since it is private businesses that normally own the relevant technologies. Germany is therefore supporting this process, in particular by promoting innovative models of co-operation between government institutions and private companies (public private partnerships) and helping the recipient countries to build appropriate legal and political frameworks.

In 1996, the Federal Government, the Government of the Land of Saxony and various science and industry institutions founded the *Internationale Transferzentrum für Umwelttechnik* (ITUT), headquartered in Leipzig, to act as a hub for information, consultancy and contact on German environmental technology. Parallel to this, "environmental area managers" have been deployed in important chambers of foreign trade to help establish close contacts between the host countries and Germany's environmental protection industry and to collaborate with the ITUT. The aim is to consolidate and expand technical, scientific and political co-operation on environmental protection between the partner countries and Germany.

II. Priorities, fields of action and actors for sustainable development

A. Climate and energy



Compared with other planets, our atmosphere is unique and must be counted among the true wonders of the world, since it is what made life on Earth possible in the first place. In terms of mass, the trace gases carbon dioxide (CO_2), water vapour (H_20), methane (CH_4), nitrous oxide (N_2O) and ozone (O_3) make up only three parts per thousand of the atmosphere, yet they are crucial to the pattern of temperature and rainfall. They cause the natural greenhouse effect by limiting the amount of heat reflected from the Earth's surface back into space and thus enable average temperatures of 15°C to prevail on our planet rather than the icy cold of space.

Since the beginning of industrialisation, the human race has been responsible for such an increase in the concentration of greenhouse gases that the change in the Earth's balance of radiation energy over these last 250 years is as great as the one that occurred over the entire period between the last ice age and the beginning of our present "warm age". The burning of fossil fuels such as oil, coal and gas, which inevitably releases CO_2, is fifty percent of the cause of this disturbance to the radiation balance. In other words, humankind has inadvertently launched the biggest geophysical experiment in the Earth's history, with all the grave risks and uncertainties that this entails. The consequences to be feared include:

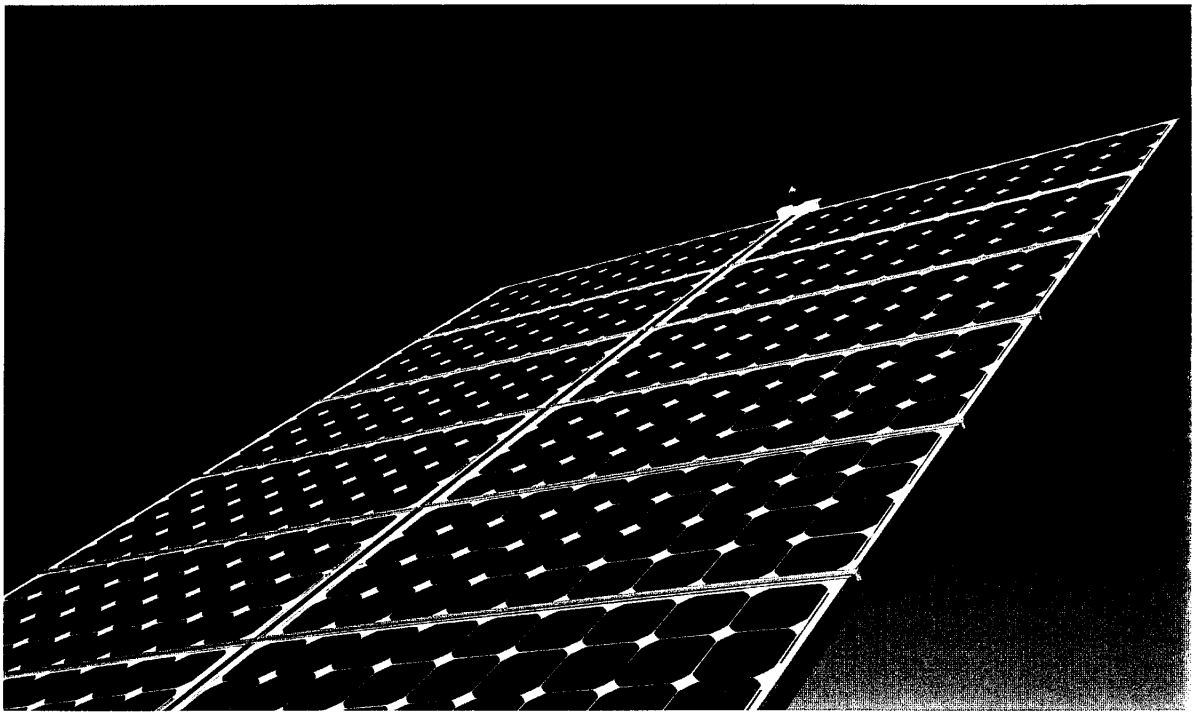
- Falling food production and declining biodiversity,
- The advance of tropical diseases into areas previously unaffected,
- Flooding of entire island nations and low-lying mainland regions
- Ever more frequent extreme weather phenomena such as hurricanes and droughts.

The Rio Earth Summit in 1992 adopted the Framework Convention on Climate Change as a global agreement to stabilise the concentration of greenhouse gases at a level that will not pose a serious threat to the world climate. Moreover, that level should be reached within a timeframe that will allow the ecosystems to adapt naturally to climate

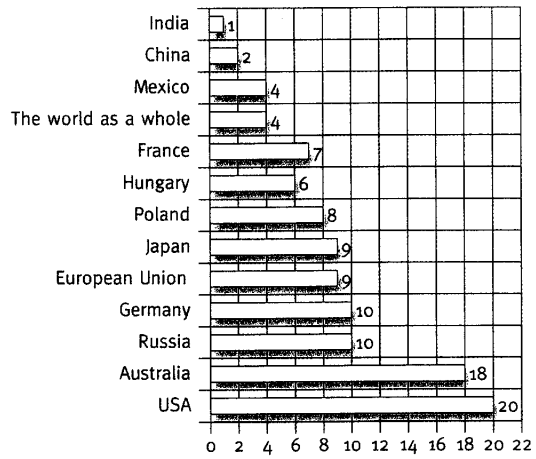
change, ensure that food production is not threatened and enable economic development to proceed in a sustainable manner. In December 1997 in the Japanese city of Kyoto, a climate change protocol was adopted which, for the first time ever, sets out a legally binding obligation on the industrialised countries, as the parties principally responsible for the enhanced greenhouse effect, to achieve specific limits or reductions in their emissions. The protocol requires that the industrialised nations reduce their emissions of the six most important greenhouse gases by at least five percent compared to 1990 levels by the period 2008-2012. To reach these targets, the individual States have agreed to varying reduction commitments. For instance, the EU countries and many Eastern European States must reduce their emissions by eight percent, Japan and Canada by six percent and Russia is obligated to confine its emissions to the 1990 level. The EU States intend to attain this goal jointly through an agreed burden sharing arrangement, under which Germany contributes the largest share with a reduction commitment of 21 percent.

Germany's national strategy against climate change is designed to reduce CO_2 emissions by 25 percent by 2005. The baseline year is 1990. We also intend to limit or significantly reduce the other greenhouse gas emissions. To reach this target, Germany has developed a comprehensive programme to combat climate change, which has now come to comprise more than 150 individual measures, such as ecological tax reform, the Renewable Energies Act, promotion of combined heat and power generation, and the Energy Saving Regulation. Some initial effects can already be seen: Germany's CO_2 emissions fell by around 16 percent between 1990 and 2000. By contrast, emissions in many other countries continued to rise (see chart).

At climate conferences held in Bonn and Marrakech in 2001, the detailed issues that needed to be answered before the Kyoto Protocol could be implemented were finally clarified. For example, it was agreed that the Parties can partially fulfil their obligations abroad. To a limited extent afforestation projects will be recognised as a contribution to fulfilment of the obligations of the Agreement. In addition, a comprehensive system of controls and sanctions was established. This is unparalleled for environmental conventions and is exemplary in character. The Kyoto Protocol must now be ratified without delay by all the States involved so that it can enter into force before the end of 2002. Since the USA has announced that it does not



An international comparison of CO_2 emissions per capita

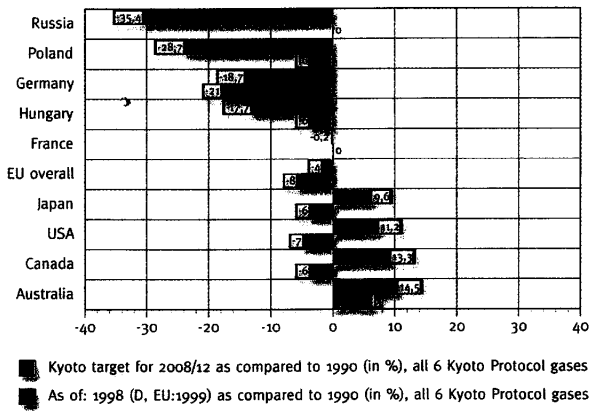


As of: 1998 or latest available year
(Sources: EIA/UNFPA).

currently intend to ratify the Protocol, it is particularly important that the other members of the international community join forces here to demonstrate that they are accepting their responsibility for the global climate. Germany and the EU are expected to ratify the Protocol by June 2002.

It is vital that efforts to combat climate change continue to progress over the next few years. It is above all the industrialised countries that are called upon to take action, as the polluter-pays principle makes clear. However, the emission-reduction efforts of highly populated newly industrialising countries, such as China, India and Indonesia, will also prove crucial in the future. That is precisely why Germany supports other countries in their efforts to develop sustainable forms of energy management and to design and implement their own national programmes to combat global warming.

A comparison of trends in greenhouse gas emissions



Sources: UNFCCC/EEA

For Germany, the following steps will be of key importance over the next few years:

- Rapid implementation of the Kyoto Protocol – if possible by the World Summit on Sustainable Development in August 2002 in Johannesburg.
- Updating the Framework Convention on Climate Change and the Kyoto Protocol. In particular, the binding reduction targets for industrialised countries must be tightened and the USA reintegrated into the international climate protection process. The developing countries must also be obliged to begin a gradual process of specific emission reductions.
- Consistent implementation of the national climate protection programme in all sectors, i.e. energy generation, industry, transport and households. Continued development of the climate protection programme beyond 2005.
- Making greater use worldwide of renewable energy sources such as solar energy, wind power, biomass, geothermics and hydropower. To this end, the World Summit on Sustainable Development in Johannesburg 2002 should adopt concrete action programmes. The Federal Government has, for exam-

ple, set itself the target of doubling the share accounted for by renewable sources of energy in German primary energy consumption by 2010.

B. Protecting the ozone layer

The depletion of the protective ozone layer has reached alarming proportions in recent years, especially over the South Pole but also across the northern hemisphere. This process is caused by a protracted and complicated chain of chemical reactions triggered primarily by the chlorine and bromine atoms of CFCs, partially halogenated chlorofluorocarbons (HCFCs) and halons, which we have been releasing for many years as aerosol propellants and refrigerants, extinguishing agents etc. As a result of the seasonal ozone "hole," which already measures more than 20 million square km in the South, the Earth is increasingly exposed the sun's harmful ultraviolet rays (UV-B).

The international community has recognised the gravity of the situation and has begun to act. A precise timetable for phasing out production and use of these substances was laid down under the 1985 Vienna Convention for the protection of the ozone layer and the 1987 Montreal Protocol based on that agreement. Since then, this timeframe has been shortened several times, the last revision being concluded in 1999 at Beijing. The agreement provided for shorter deadlines for the industrialised countries than for the developing countries. Thus, the final phase-out year for CFCs and halons was set at 2009 for developing countries, while the industrial nations had largely completed their phase-out by the end of 1995. HCFCs are to be completely banned in the industrialised countries by 2030 and in the developing countries by 2040. The obligation on the developing countries to cease CFC production took effect from 1 July 1999. The extension of the Protocol passed in Beijing will ensure that from about 2006 onwards the ozone layer will undergo a process of stabilisation and will have been completely restored by 2050-2060.

The EU countries are ahead of schedule on some of the phase-out targets. For example, they expect to have dispensed with HCFCs completely by 2014, 15 years earlier than agreed in the protocol. In Germany, the production and use of completely halogenated CFCs had essentially ceased by 1994, two years ahead of the deadline

The developing countries are being supported in their efforts to implement the Montreal Protocol by a multilateral fund which provides finance for bilateral and

The consequences of the "ozone hole" are serious:

- The health of people and animals is jeopardised: higher UV-B radiation causes skin cancer and cataracts
- Decline in agricultural crop yields
- Less plankton is formed in the oceans, which means a loss of biomass right at the beginning of the food chain

joint projects of the World Bank as well as the United Nations programmes for development (UNDP), the environment (UNEP) and industrial development (UNIDO). From 2000 to 2002, the industrialised countries provided US$ 475 million (approx. 530 million euros). After the USA and Japan, Germany is the third largest contributor, giving approximately eleven percent of the total funding, or US$ 50 million. To finance corresponding measures in the successor states to the Soviet Union (NIS/CIS) and in the Central and Eastern European countries, funds are also available from the Global Environmental Facility (GEF) and from a World Bank special programme for Russia amounting to US$ 27 million (25.3 million euros). Here, Germany contributes around DM 1.6 million (0.8 million euros).

Germany has three main concerns for the immediate future:

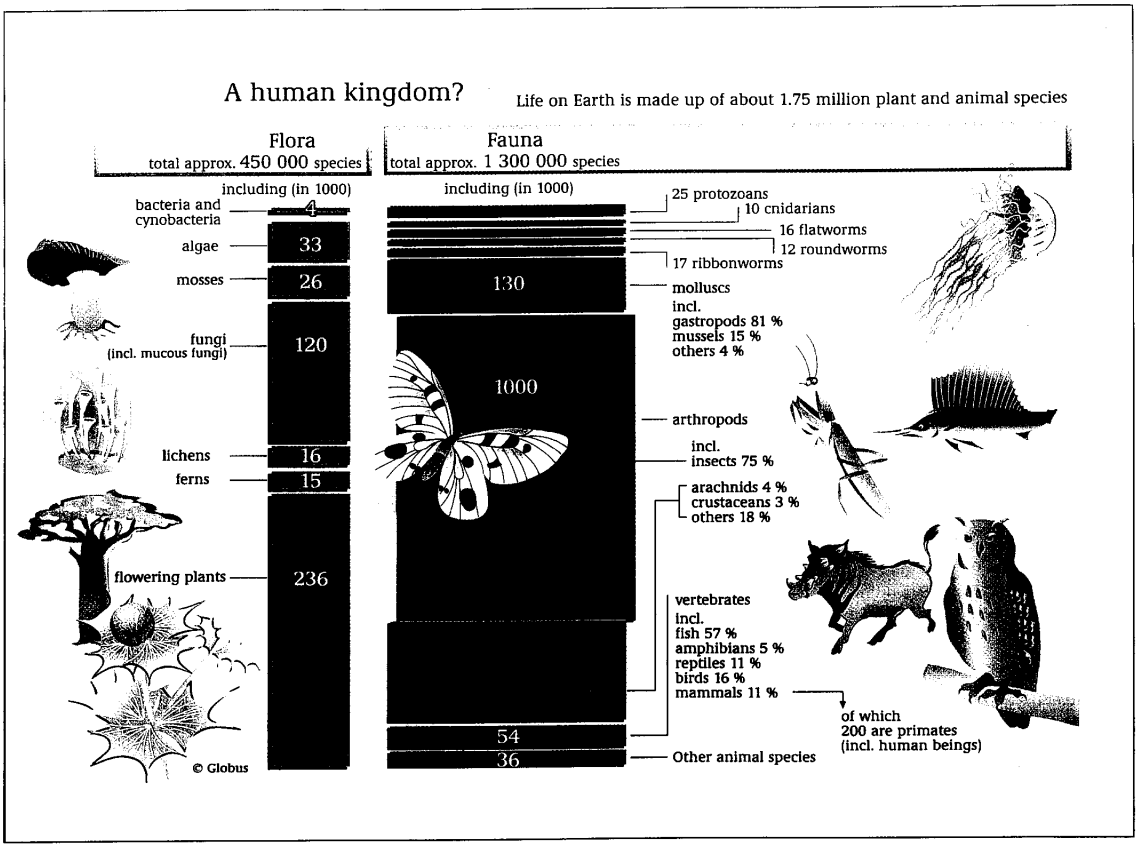
1. The financial resourcing of the Multilateral Fund created under the Montreal Protocol must be guaranteed over the coming period (2000 – 2003) so as to give adequate support to the efforts of the developing countries.

2. The existence of different regulations in developing and industrialised countries and in the former eastern bloc States has led to CFC trafficking which must be stopped.

3. The deadlines for phasing out HCFCs must be brought forward in order to rein in the use of this CFC substitute worldwide.

C. Conservation of biodiversity

Biodiversity – the totality of all living organisms, of their genetic variations and habitats – is the very basis of life itself. Its richness and the benefits it provides (such as formation of oxygen, soil fertility, drinking water, provision of raw materials or pharmaceuticals) are indispensable to humankind. Biologists estimate that there are between five and 100 million different species on Earth, of which only about 1.5 million are known and classified. In their totality, they represent a rich store of genetic information that is necessary for sustaining the ecosystems on which human life depends. Seen in this light, it is incomprehensible that we treat our natural environment so carelessly.



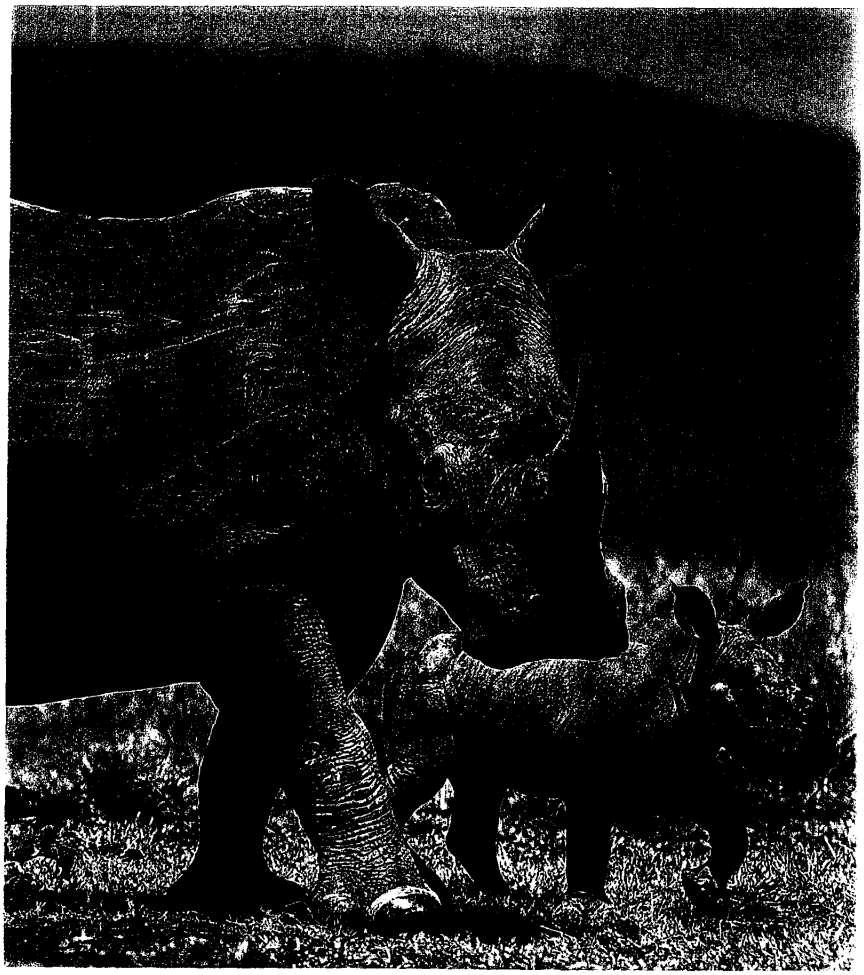
We are decimating biological diversity in four ways:

- through loss of diversity of species, i.e. by exterminating or over-exploiting certain species, such as rhinoceroses, wildcats, whales, orchids and cacti,
- through loss of diversity of habitats, i.e. by developing land, thus fragmenting and destroying natural habitats and by converting natural land into fields and pastures,
- through the loss of genetic diversity, i.e. by narrowing down the spectrum of species, breeds and varieties used,
- by environmental damage and destruction such as pollution of the air, oceans, rivers and soil.

Scientists estimate that each year 0.2 percent of all species, the equivalent of between 27 and 164 species per day, are being irretrievably lost. If we do nothing about it, in 25 years time our planet will be inhabited by up to 1.5 million fewer species. That would leave our natural environment irrevocably impoverished.

Since the early 1970s, there have been many international conventions and treaties designed to counter this worrying development. The most important of these is:

- The UN Convention on Biological Diversity. Concluded in 1992 at the Earth Summit in Rio, this international treaty was the first to regulate all aspects of the protection and utilisation of the world's entire biological heritage. It commits the international community to protect species in their natural habitats. As with the Climate Change Convention, this convention also requires the industrialised countries to provide funding and know-how to support the efforts of the developing countries. To implement the convention, the Parties draw up national strategies and joint work programmes, co-ordinating their activities at regular scientific and policy conferences. For its part, the EU has developed a joint implementation strategy. In 2002 the Federal Environment Ministry is running a broad-based campaign on biodiversity to mark the tenth anniversary of the Convention. Its motto will be "Life needs diversity."



The countries of the world with the greatest wealth of species are as a rule the developing countries. The Rio Convention on Biological Diversity therefore contains rules for the transfer of technology to species-rich developing countries, where the exploration and sustainable use of biological abundance can create alternative sources of income and thereby become an incentive for safeguarding biological diversity in general. A major UN conference, held in October 2001 in Bonn, drew up guidelines on access to "genetic resources," – such as for the manufacture of medicines – and on appropriate participation of the countries of origin of those resources in the potential

economic benefits of their utilisation. They will be submitted for decision at the next Conference of Parties to the Convention and will provide legal clarity and certainty for all involved.

The German Federal Government takes the view that, if used responsibly, biotechnology and genetic engineering can contribute to sustainable, environmentally sound development. This applies, for instance, to an integrated product policy approach to precautionary environmental protection using bioengineering processes as well as to remedial environmental biotechnology, e.g. in wastewater treatment or cleaning up degraded soils and dangerously contaminated sites. On the other hand, Germany strongly advocates a policy of avoiding any risks to people and the environment that might result from genetically modified organisms and wants to see tighter safety regulations governing their application. In addition to creating statutory instruments at national level, Germany is active internationally, for example helping to draw up the Biosafety Protocol to define global minimum standards for the transfer, marketing and application of genetically modified organisms.

Work carried out in the next few years within the context of the UN convention on biodiversity will focus primarily on:

1. Biodiversity of forests
2. Access to genetic resources and fair and equitable sharing of the economic benefits resulting from their use
3. Treatment of non-native species
4. Implementation of the Biosafety Protocol
5. Regulations for nature reserves and mountain ecosystems
6. Transfer of technology between industrialised countries and developing countries
7. Intensified interaction between the different international agreements on nature and the environment

D. Conservation of forests

Forests and woodland play an irreplaceable role in the Earth's life-support systems. They are the powerhouses of fundamental biosphere processes like photosynthesis, have a decisive influence on the carbon, nitrogen and oxygen cycles and are thus a key factor in determining the climate. They are the main producers of biomass and the habitat of most of the world's animal and plant species. Among their other functions, forests serve human beings directly as sources of wood and food and as an effective filter for our air pollution.

Yet the destruction of forests throughout the world is continuing on such a scale that it needs to be urgently halted. In the tropics alone, 16 million hectares of natural tropical forest were lost between 1990 and 2000. That is equivalent to one and a half times the entire forest cover of the Federal Republic of Germany.

Selected international agreements on biodiversity and habitat conservation

- Convention on Biological Diversity (CBD), 1992
- Convention on the International Trade in Endangered Species of Wild Fauna and Flora (CITES, 1973)
- Convention on Wetlands of International Importance as Waterfowl Habitats (Ramsar Convention, 1971)
- Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention, 1984) as well as specific regional agreements to protect seals in the Wadden Sea (1990), bats in Europe (1991), small cetaceans in the Baltic and North Sea (1992) and African-Eurasian waterfowl (1995)
- Convention on the Conservation of Antarctic Seals (CCAS, 1972)
- Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention, 1979)

There are a number of reasons why the forests are being threatened and destroyed. In the industrialised countries, the main cause is air pollution and the resulting acidification of the soil, although recently large-scale logging for industrial purposes has also had a major impact in countries like Canada and Russia. In the developing countries, forest destruction results from the development of new land for agriculture (especially by slash-and-burn clearance methods), illegal logging, inappropriate forms of timber exploitation and large-scale infrastructure and development projects.

The Statement of Forest Principles adopted at the 1992 Rio Conference represents the first global consensus on how forests should be treated and sets out principles for the management, conservation and sustainable development of forests in all climate zones. A series of important international initiatives have since been taken to implement the Rio resolutions, including the Helsinki and Montreal processes, which develop criteria and indicators for sustainable forest management.

The Convention on Biological Diversity (CBD) has particular significance for the world's forests. The Convention has three objectives: the preservation and sustainable use of genetic resources, along with the fair and equitable sharing of the economic benefits resulting from their use. At the sixth Conference of the Parties to the CBD held in April 2002 in The Hague, an implementation-oriented programme of work on the biodiversity of forests is scheduled to be passed. Germany believes that the most important elements of this would be to set up an international network of the most important forest reserves, better management of existing reserves and the consistent application of an ecosystem approach to forest management.

The recommendations for action put forward by the United Nations' ad-hoc-committees on forests (the Intergovernmental Forum on Forests (IFF) and the Intergovernmental Panel on Forests or IPF) form a good

Consequences of the destruction of forests

- Soil erosion and degradation of soil quality due to nutrient leaching,
- Desertification and irretrievable loss of biodiversity,
- Loss of natural areas that are home to indigenous peoples,
- Disappearance of vital CO_2 sinks, thus weakening a major stability factor in the world's climate system.

foundation for launching concrete measures for the protection and sustainable management of forests, in particular through national forest programmes. Our efforts in the next few years will concentrate on implementing the proposals for action. The United Nations Forum on Forests (UNFF) set up for this purpose in October 2000 is also a valuable arena for discussion and cooperation on international forest policies.

Meanwhile, the seven leading industrialised countries and Russia (G8) have drawn up a six-point action programme. It comprises the implementation of national forestry programmes, capacity building for sustainable forestry, the creation of a network of protected areas, an assessment by each State of present forestry practices, assistance for the private sector and action to prevent illegal logging.

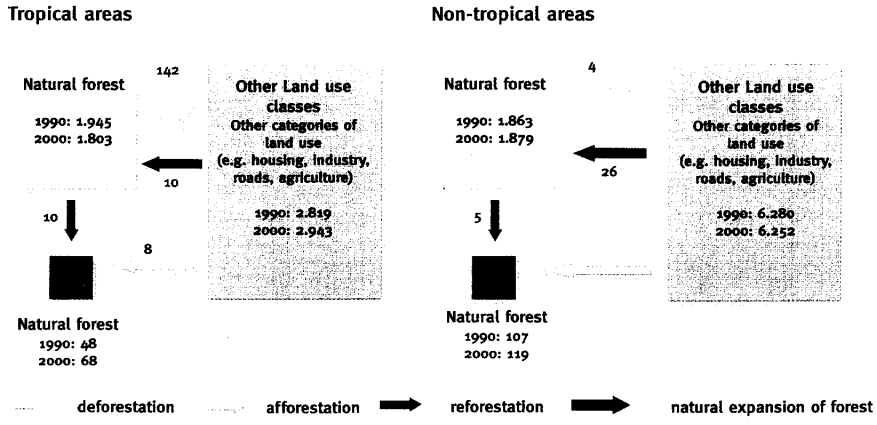
Apart from the measures we take to conserve our own forests, Germany is actively committed to safeguarding tropical forests through its development co-operation. Since 1988, 130 to 150 million € have been made available each year for programmes of this kind and, in over 180 ongoing projects, partner countries are now being supported in their efforts to conserve and sustainably manage their forests. Moreover, the German Federal Government is making a major financial contribution to multilateral initiatives to conserve tropical forests, e.g. supplying about 46 percent of the funds for the G7 States' international pilot programme to save the Brazilian rainforest.

Another way of supporting these efforts is to use credible criteria to give official recognition to forestry companies who adhere to sustainable management principles and to award eco-labels to their products to enable consumers in the industrialised countries to make

Germany believes four tasks to be central to political efforts to protect forests in the near future:

1. Concentration on concrete implementation measures for the protection and sustainable management of forests, in particular to ensure conservation of the remaining areas of ancient woodland.
2. Setting up an international network of the most important forest reserves combined with better management of existing reserves.
3. Formulating criteria for the sustainable development of forests, especially tropical forests.
4. Improving consumer information by labelling wood from sustainably managed forests, incorporating the experience gained through previous certification schemes.

Changes in forest cover between 1990 and 2000 in million hectares



As a comparison: Germany's forest cover amounts to 11 million hectares

Quelle: FAO/FRAU 2000

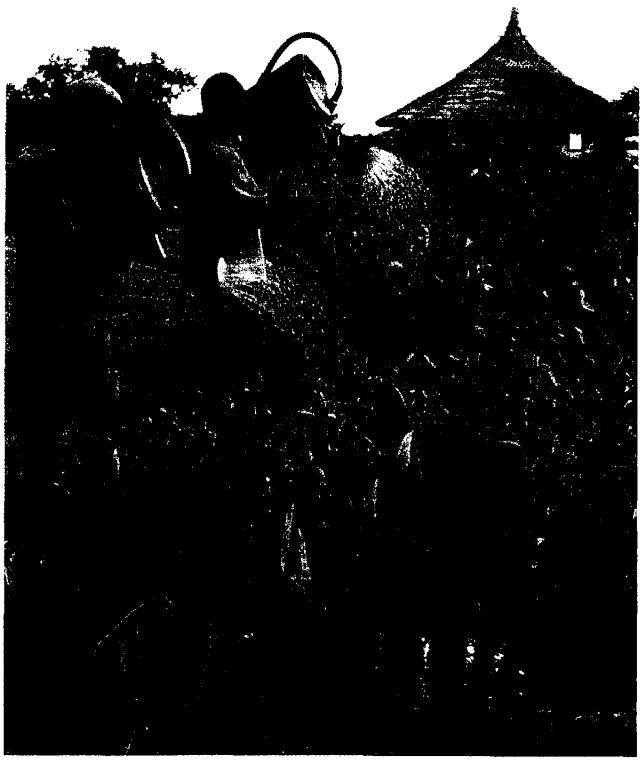
ecologically conscious purchasing decisions. A major international initiative on this that is both credible and sets high standards is the introduction of certification schemes run on principles laid down by the Forest Stewardship Council (FSC).

The Federal Government is operating two supraregional development co-operation projects that provide advice on the testing of existing certification proposals and on the development of strategies for establishing national certification systems. In April 1997, a number of German companies, mainly from the timber, building materials and furniture trade, formed an association called "Group 98" with the aim of introducing FSC-certified wood products into their product range. The public sector should also set an example in their purchasing policies for timber and recycled paper.

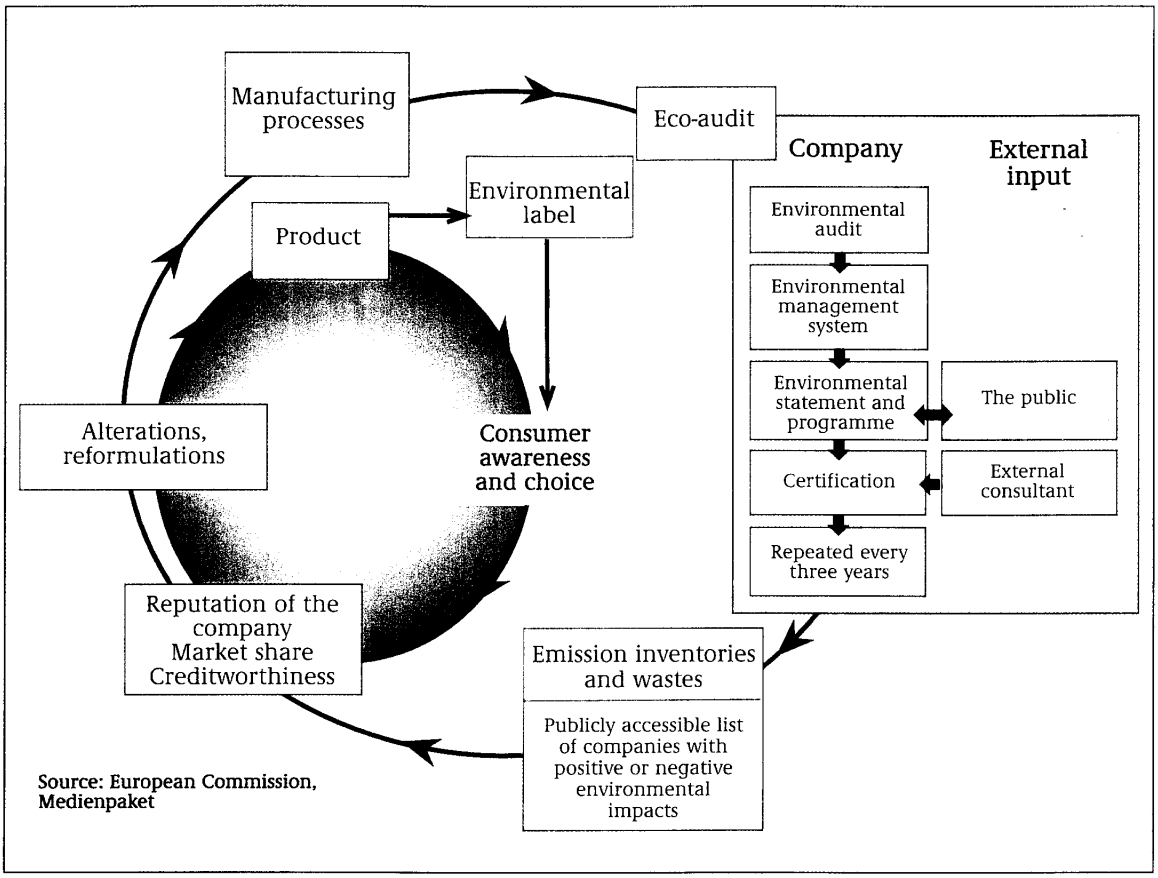
E. Sustainability in consumption and production

On the part of the globe that is home to the Europeans and North Americans, one fifth of the world's population lives in a state of prosperity of which the other four fifths living in the South can only dream. While in the South starvation is an everyday reality, we in the North live in relative luxury. To maintain our affluence we plunder the Earth's resources, which in actual fact belong to everyone. In the course of just a few generations we look set to burn most of the fossil fuels like oil, gas and coal which were formed over millions of years, while in many developing countries people all too often lack even firewood for cooking. We in Europe have, in contrast to the USA, at least declared the "throw-away society" to be a thing of the past. Yet we are still consuming raw materials at the expense of poorer countries and of future generations. For instance, half of all Germans have their own car, yet the consequences in terms of resource consumption and land needed for roads if Germany's automobile density were transferred to, say, China or India, where there is currently one car per thirty inhabitants, hardly bear thinking about.

It is in proportion to their excessive consumption of resources that the industrialised countries bear responsibility for global environmental problems. And that is why it is first and foremost the people living in these countries who are called on to make a fundamental change in their lifestyles and patterns of production and consumption. All of us, from the private consumer to the large industrial corporation, must in future gear our patterns of consumption and production strictly to the principle of sustainability. We must learn to exploit renewable natural assets like wood or fish stocks only to the extent that they are able to regenerate and will continue to be available to our children and grandchildren. As for non-renewable or virtually non-renewable natural assets, such as minerals and fossil fuels, we should only be exploiting them at the rate at which they can be replaced by other materials or energy sources. Moreover, the release of substances of any kind and of energy must not, in the long run, exceed the capacity of ecological systems like climate,



Reafforestation in Ouagadoug



Source: European Commission, Medienpaket

forests and oceans to adapt. Finally, the industrialised countries must, for their part, make additional efforts to slow down their consumption of raw materials so that the countries of the Third World can keep their fair share of the Earth's resources for their own economic development without contravening the rules of sustainability.

It will not be possible to achieve sustainable consumption and production without changes in the structure and philosophy of innovation, organisation, and management, as well as production and consumption themselves. Some of these changes have already been implemented. It is essential that the products, processes and services of the future make efficient use of energy, raw materials and land, and maintain consumption at as low a level as possible. Management run on principles of sustainability is also of benefit to companies, opening up new markets in sustainable production processes and products.

In both spheres - production and consumption - there are already promising initiatives aimed at a fundamental change of approach and a move towards sustainability. The German Federal Government believes that a concerted effort must be made to advance these initiatives:

Production: the traditional approach to emissions reduction, as practised in the past, must be enhanced by product-based forms of environmental protection. In future, the entire life cycle of a product, from manufacture through distribution and use to recycling and disposal at the end of the product's life, must be taken into account (life-cycle management). When changing production patterns, it is particularly important to achieve a substantial reduction in resource consumption by improving productivity and efficiency for each of the raw materials concerned. In discussions on resource productivity, some environmental policy experts have calculated that we need to achieve increases of a factor of four (i.e. "twice as much prosperity with half the consumption of resources") or even a factor of ten.

- *Consumption*: If consumers are to change their habits, it is vital that they be given better information. The instruments for this may be information campaigns to explain the global implications of personal choices, environmental education at school or labelling schemes for environmentally friendly products. Another key element is a pricing policy that factors in all the environmental costs. Prices would reflect above all the real disposal costs of discarded products if manufacturers were required to take back their end-of-life products and recycle the materials.

These principles have now been taken on board by both the United Nations and the European Union :

- In April 1999, the UN's Commission for Sustainable Development (CSD) passed amended UN guidelines on consumer protection, with the aim of advancing the cause of sustainable production and consumption patterns throughout the world. Governments are now required to ensure that consumers are given access to sufficient information to enable them to opt for products that comply with sustainability principles

- Meeting in Weimar in May 1999, the EU Environment Ministers agreed to develop and implement a more strongly integrated product policy, i.e. pursue a product-related environmental approach that takes account of the entire life cycle of goods and reduces resource consumption. Based on the EU's Green Paper on Integrated Product Policy published in February 2001, initial strategies were developed. In 2002, the Commission will present a White Paper on the subject.

The German Federal Government believes that to facilitate the emergence of sustainable structures of production and consumption, the following key tasks must be tackled in the near future:

1. Formulation at EU level of specific political strategies for environmental protection through integrated product policies and enhanced resource productivity.

2. Development of the EU eco-labelling scheme into an effective European system that will complement national eco-labels.

3. Extension of the obligation on suppliers to label electrical appliances with their energy consumption data to other products in the field of information and communication technology and consumer electronics.

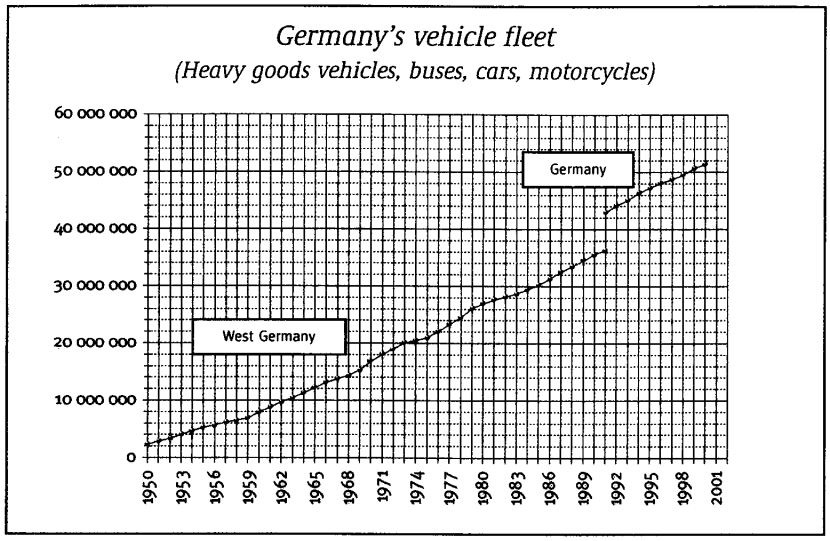
4. Increased use of cooperative tools, such as consumer information or product declaration, involving all the relevant actors (e.g. manufacturers, disposal companies, retailers, consumers, environmental associations) to increase the environmental friendliness of products and services.

F. Transport and the environment

The global increase in traffic volumes is something that causes environmental policy-makers particular concern. Although modern social and economic systems undoubtedly depend on mobility, the form this mobility generally takes today is a primary cause of environmental pollution. In Germany, for instance, transport accounts for 20 percent of the CO2 emissions threatening our climate, and the figure is rising. Moreover, road transport has led to serious depletion of the countryside and natural resources. It is also one of the major sources of air pollution, with motor vehicles pumping nitrogen oxides, hydrocarbons, carbon monoxide and particulate matter into the atmosphere. Moreover, exposure to traffic noise is also a widely felt problem.

In identifying these problems, it is not a question of demonising the transport sector as such, let alone starting a crusade against certain modes of transport. Rather, the task for a modern industrial society is to create the environmental, economic and social conditions necessary to allow transport to comply with the imperatives of sustainable development - and success here would provide an important model of clean mobility for the developing countries, where the traffic boom is yet to come.

- In the *road transport sector*, the EU has been making major strides since the early 1990s by gradually enforcing more stringent standards for motor vehicle pollution emissions and engine fuels. Stricter exhaust limits have been applied to cars and light commercial vehicles up to 3.5 tonnes in gradual stages introduced in 1996/97, 2000/2001 and 2005/2006. The currently valid standard, Euro III, means cars must comply with emission control standards that are about 70 percent lower than those in 1992. The more stringent Euro IV standard, which will come into effect from 2005, will bring the limit down by



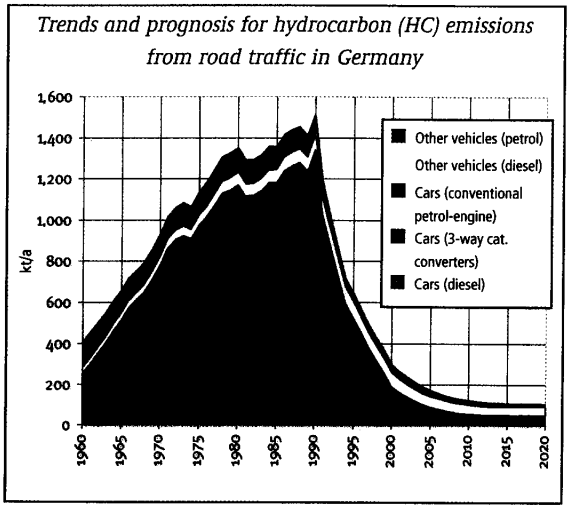
another 50 percent. Germany is also using tax incentives, even before Euro IV comes into force (2005/2006), to encourage motorists to switch to cleaner cars. About 80 % of newly registered cars with petrol engines already meet this standard.

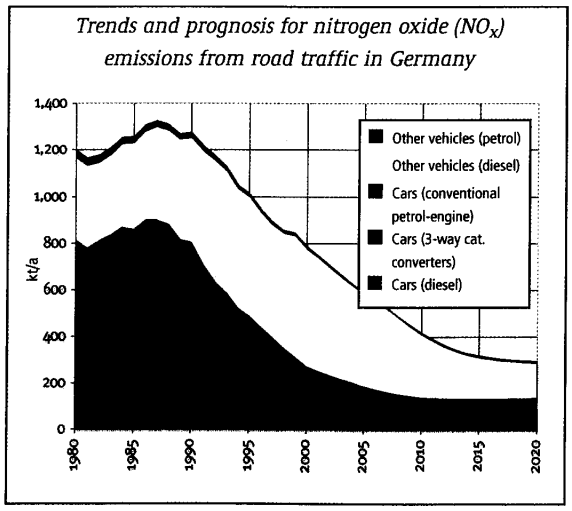
In the case of heavy commercial vehicles, i.e. lorries and buses, the EU has agreed on a similar staggered approach, with tighter exhaust emission limits coming into effect from 2000 (Euro III to Euro V). The Directive on this provides for a drastic tightening of admissible emission levels in three stages in 2001, 2006 and 2009.

- In the case of *shipping*, hardly any emission limits are in force. In September 1997, an agreement was reached within the framework of the International Maritime Organisation (IMO) to limit NOx emissions from 2000. To control sulphur dioxide emissions, the Baltic was designated a special area, which means that only marine fuels with a sulphur content of less than 1.5 percent by weight may be used there. Within the Rhine Navigation Commission, limit values for pollutants from shipping on inland waterways applicable from 2002 onwards were laid down for the first time.

- The *air transport* sector has seen a disproportionate increase in traffic in recent years, rising in Germany alone by 40 percent from 1991 to 1995. Worldwide, air traffic is expected to increase almost threefold over the next few years for passenger transport and fourfold for cargo transport. This growth will have a considerable impact on the environment. Our objective must therefore be to counter this trend through internationally coordinated regulations in the EU and the International Civil Aviation Organisation (ICAO).

Here, too, we must apply the precautionary principle and the polluter-pays principle. For it is important that the real environmental burden caused by air traffic be reflected in "ecologically honest prices." In particular, this means that environmentally cleaner modes of transport should no longer have to face





Source: TREMOD (Transport Emission Estimation Model), calculated by the Ifeu Institute, Heidelberg, using data as of 16.11.2001

tax disadvantages compared with air transport.

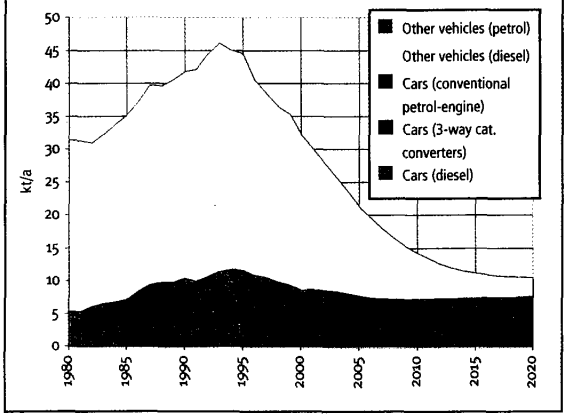
While the classic pollutants are declining dramatically, it is expected that emissions of CO_2 from road traffic will continue to grow. Further improvements in vehicle and transport technology designed to reduce fuel consumption and CO_2 emissions will not be sufficient on their own. Measures must also be taken to reduce traffic volumes, such as by creating less transport-intensive structures in industry and in urban developments and by shifting transport services to whichever cleaner transport mode is available in each case. In the medium and long term, more must be done to promote the use of new vehicle power sources, such as hydrogen produced from renewable energy, and modern propulsion technologies such as fuel cells.

The role of voluntary commitments on the part of industry in promoting cleaner mobility should not be underestimated. If their scope and timetables conform to the targets pursued by the government in its environmental policy, they can obviate the need for legislation. An example is the pledge made by the German automobile industry to reduce the average fuel consumption by cars and estate cars manufactured and sold in Germany by 25 percent of 1990 levels by 2005. This is a course that must also be pursued at European level. The European automobile industry has agreed to lower CO_2 emissions to 140 g/km by 2008 in the car fleet it distributes in the EU. This represents a 25 percent reduction against the 180 g/km in the baseline year of 1995. By 2000, the mean value had already dropped to 169 g/km.

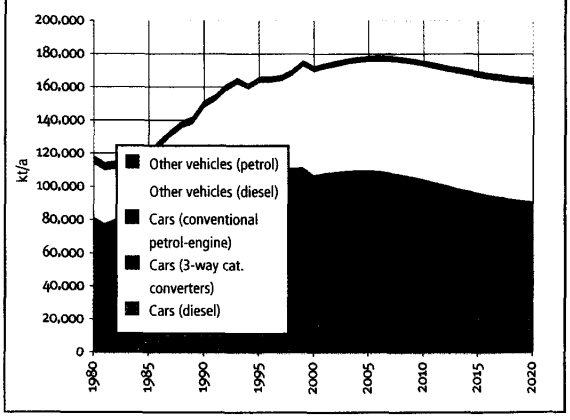
In working towards sustainable transport systems, the German Federal Government is, for the foreseeable future, pursuing a whole raft of concrete objectives:

- *Road transport in general*: compulsory introduction of on-board diagnosis systems (OBD) for cars and commercial vehicles to monitor pollutant emissions from vehicles.
- *Cars*: Europe-wide reduction in emissions of the ozone precursor substances NOx and VOCs by 70 to 80 percent of 1990 levels by 2010.
  - Implementation and monitoring of the voluntary agreement with car manufacturers at EU level to ensure a reduction in CO_2 for new cars to 140g/km by 2008 (equivalent to 6.0 l/100 km for petrol-engine vehicles and 5.3 l/100 km for diesel-engine vehicles). Continual updating of this agreement, aiming for a target of 120 g/km
  - A more stringent limit value for diesel-engine cars, to be prescribed by Euro V, and enforcement of compulsory particle traps
- *Lorries*: Framing a new standard with stricter limit values - Euro VI – and enforcement of compulsory particle traps.
- *Motorcycles*: Lowering the limit values for motorcycles to the present level applicable to cars.
- *Mobile machinery*: Introduction of limit values for small machines and adoption of a stricter limit value for larger diesel engines.
- *Fuels*: A resolution to lower sulphur levels in petrol and diesel to below 50 ppm from 2005 onwards has already been passed (Euro IV). In a further step, the sulphur level is to be lowered still further to 10 ppm. Further

Trends and prognosis for particulate emissions from road traffic in Germany



Trends and prognosis for carbon dioxide (CO_2) emissions from road traffic in Germany



Source: TREMOD (Transport Emission Estimation Model), calculated by the Ifeu Institute, Heidelberg, using data as of 16.11.2001

advantage, as well as reduction in SO_x emissions: new technology that uses up to 20 per cent less fuel will become possible for new cars.

- *Aviation*: Introduction at EU level of a CO_2 levy based on distance flown. Take steps at international level to introduce excise duties on kerosene and to abolish the exemption from value added tax on international ticket sales.

- *Aviation research programme:* running until 2010 with the following aims:

  - 25 percent reduction in fuel consumption through improvements to airframes and engines.

  - Lowering of NO_x emissions by 85 percent.

  - Lowering the sulphur content in kerosene from 0.2 to 0.01 percent by weight by adopting the ICAO recommendation and amending the relevant EU Directive.

- *Shipping*: Introduction by 2000 of the first limits on air and noise pollution applicable to pleasure craft, with a view to reducing their CH emissions by 75 percent and CO emissions by 30 percent.

  - Reducing air pollution from inland vessels by introducing limit values from 2002, with future tightening of these requirements.

G. Environmentally sound agriculture

Anyone who is concerned about preserving a healthy ecosystem, conserving soils and water resources and safeguarding biodiversity must inevitably deal with issues of agriculture and forestry. Probably civilisation's oldest economic activities, these industries have been particularly closely connected with the environment since time immemorial, being utterly dependent on fertile soil and a stable climate. Even in the highly industrialised countries, agriculture has not lost its importance: 42 percent of the surface area of the EU countries is arable land and pasture, and 28 percent is forest and woodland. In Germany, 47.9 percent of the land is farmed, and 29.4 percent given over to forest.

Since the 1950s, technological developments and economic pressures have been forcing farming into directions that have put increasing strain on the environment, with negative consequences for biodiversity, as well as groundwater, rivers, lakes and oceans. Many of these negative impacts are continuing:

- Substances deposited from fertiliser and pesticide use are impairing groundwater and surface water in many areas.

- Artificial enhancement of the fertility of low-nutrient soils transforms site conditions, reducing biodiversity.

- Site-inappropriate farming methods can lead to soil compaction and to the depletion of topsoil.

- Due to fertiliser spread on fields and methane produced by cattle, the agriculture sector is responsible for a considerable proportion of the emissions of the greenhouse gases nitrous oxide and methane.

- Intensive livestock farming produces ammonium emissions and thus contributes to forest damage and eutrophication of low-nutrient ecosystems.

Inland shipping on the River Main

- Measures such as the ploughing up of grassland, removal of landscape features or unbalanced crop rotation are degrading or destroying the habitats of numerous wild animals and plants.

In the European Community, agriculture along with its environmental impacts is largely influenced by a Community agricultural policy characterised by subsidies and sales guarantees. In recent years, however, some important steps have been taken to encourage a more environmentally sound and more sustainable direction in farming. As a result, the environmental burdens have noticeably declined and work has been done on closing substance cycles. A radical change of direction in EU agricultural policy was heralded in 1992 with the decisions on the reform of the Common Agricultural Policy. This reform includes changes in the market regime for key agricultural products, as a result of which farming intensity is being reduced. Agreement was also reached on supporting measures, which include, most importantly, grants to help farmers contribute to environmental protection and nature conservation. A particularly significant step was Regulation EEC 2078/92 on environmentally sound agricultural production methods that conserve the natural habitat. The integration of environmental protection and nature conservation aspects into the Common Agricultural Policy was taken further in 1999 by Agenda 2000. One of its consequences is that Council Regulation EEC 1257/1999 on the promotion of rural development obliges EU Member States to offer funding programmes for farmers who opt for environmentally sound farming methods.

After a long and controversial debate in Germany, an amendment to the Federal Nature Conservation Act was passed in early 2002, redefining the relationship between nature conservation and agriculture and forestry. For the first time, rules were drawn up on good professional practice to ensure that agriculture, fisheries and forestry respect the needs of nature conservation. These rules give farmers a greater role in the care and sustainable use of our diverse cultivated landscapes. A raft of other laws (including the Water Management Act, Federal Soil Protection Act, Plant Protection Act, Fertilizer Act) lay down basic conditions intended to reduce damage to the environment by

Pesticides consumption (tonnes)

	Year	Pesticides total	of which			
			insecticides	fungicides	herbicides	others
Austria	1997	3,690	389	1,688	1,601	12
Belgium	1993	9,885	1,118	2,781	5,587	383
Denmark	1997	3,675	51	794	2,726	104
Finland	1997	1,016	47	154	734	81
France	1997	109,792	6,074	64,050	33,576	6,092
Germany	1997	34,648	4,697	9,397	16,485	4,069
Greece	1997	9,034	2,436	3,104	2,116	1,378
Ireland	1997	2,325	73	679	1,261	312
Italy	1997	167,089	39,161	84,450	28,889	14,589
Netherlands	1997	10,397	1,296	4,356	2,984	1,761
Portugal	1996	12,457	727	9,746	1,584	400
Spain	1997	34,023	9,944	11,299	9,153	3,627
Sweden	1997	1,527	19	246	1.236	26

Source: OECD, Environmental Data 1999

agriculture in the areas of soil, water, air, climate, flora and fauna.

In view of the planned eastward enlargement of the EU and the new round of negotiations on agricultural products in the World Trade Organisation (WTO), further changes can be expected in European and national agricultural policy. In the wake of the BSE crisis, the Federal Government is seeking a complete reorientation of the EU's agricultural policy, in which consumer protection and precautionary health protection would be the central focus. At the same time, it would incorporate production methods that respect animal welfare as well as nature and the environment. The half-time review of the European agricultural policy, due to take place in 2002/2003, should be used as an opportunity to initiate a fundamental redesign of the EU's agricultural policy which would include abolishing subsides that are ecologically counterproductive and distort trade. The funding of the second pillar of the agricultural policy, which groups funding measures for environmental and agricultural development, should be significantly improved by reallocating money from the first pillar (traditional agricultural funding).

H. Sustainable waste management

What sustainability should mean in the waste management sector is demonstrated by nature: in nature, there is no waste at all. Whenever any product of nature, whether plant or animal, has reached the end of its life, it is broken down into elementary substances from which new life can arise. Every substance is part of the natural cycle of life.

We human beings operate quite differently. The downside of industrialized societies is symbolised by enormous mountains of rubbish. The Germans alone produce more than 390 million tonnes of waste each year. Building rubble, excavated soil, and road rubble account for the largest proportion of that total at around 57 percent, industrial waste and spoil heaps from mining contribute some 30 percent, and the remainder is household and commercial waste. Given these volumes, the widespread "throw-away" mentality is simply not sustainable, because:

- Firstly, waste consists of raw materials which should wherever possible be fed back into the production cycle. We cannot carry on simply throwing away the scarce resources of nature.
- Secondly, we currently have to use expensive procedures to prevent contamination of soil, groundwater and air caused by landfilling or incinerating waste.

Proceeding on the premise that less waste means less resource consumption and less environmental impact, we arrive at a simple and logical hierarchy of objectives for German waste management policy:

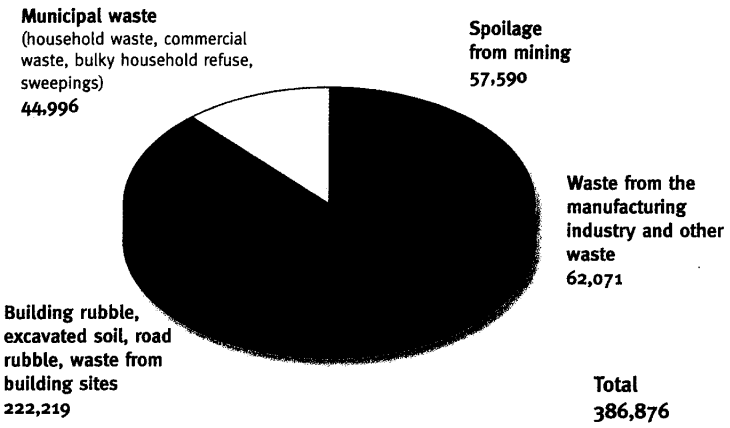
1. Preventing the generation of waste must be our top priority.
2. Unavoidable wastes must be recycled as far as possible.
3. Wastes that cannot be recycled must be disposed of in an environmentally sound manner.

In recent years, the EU has started to take steps in this direction: in February 1997, the EU Council of Environment Ministers unveiled a strategy paper for future waste management policy, focusing in particular on avoiding generation of waste and making manufacturers take greater responsibility for the

entire life cycle of their products. The aim behind this is to create an economy that produces as little waste as possible, to reduce the consumption of raw materials and energy and thus to secure sustainable development. This strategy for waste management and conservation of resources is also one of the key areas of the EU's sixth Environmental Action Programme, which runs until 2010. In recent years, the EU's policy on waste, which was established in the early 1990s, was also updated in many areas, for example through Directives on landfills, incineration of waste, on a European waste inventory and on the disposal of individual products such as cars, electronic appliances and batteries.

The introduction in Germany of the Waste Act in 1986 marked a shift from traditional waste management to closed substance cycle management aimed at conserving resources. Since the early 1990s, manufacturers and distributors have been obliged to take back and recycle packaging under the provisions of the Packaging Regulation based on this law. When the Closed Substance Cycle and Waste Management Act came into force in October 1996, it represented another logical step on this path towards sustainable substance cycles. In accordance with the three-tier hierarchy of "prevention – recycling – environmentally sound disposal," the Act's primary intention is to promote the low-waste and recycling-friendly design of products and production processes in order to close substance cycles and conserve natural resources. Since then, what has come to be known as "waste management based on material flows" has been consolidated: for example, legislation on scrap cars and used batteries is already in force, further regulations on used oil, timber and electrical appliances are being prepared. For waste paper and residues from the building trade, voluntary regulations have been concluded with industry.

Primary waste generated in 1997 in thousand tonnes*
(Preliminary results)



*Sum of all waste generated by production and consumption processes
Source: Federal Statistics Office

At international level, the export of hazardous wastes from industrialised countries to the developing world is a particular problem. With many developing countries lacking the necessary technical capacity for handling these wastes, such exports can pose a serious threat to the environment in these countries. The Basel Convention of March 1989 on the Control of Transboundary Movement of Hazardous Wastes and their Disposal, which has now been signed by more than 150 States, established globally applicable regulations on admissibility, licensing and control of exports of hazardous wastes. In the case of international waste shipments, the convention requires approvals to be given by the exporting country, all the transit countries and the importing country. In February 1998, the Conference of the Parties agreed to ban the export of hazardous wastes from industrialised countries to developing countries. However, this amendment to the Basel Convention has not yet entered into force because it has not been ratified by a sufficient number of Parties. In the EU countries, an export ban on wastes destined for disposal has been in force since as long ago as 1 February 1993. As for hazardous wastes destined for recycling, their export to non-OECD States was prohibited in January 1998.

However, a few cases of illegal shipment do still occur. Perfect border controls are not possible in view of the huge volumes of goods being transported internationally. For those cases in which the responsible parties cannot be identified and forced to pay up, a solidarity fund for the return of wastes has been set up in Germany, financed by the waste exporters, to meet the costs of returning and disposing of illegally exported waste.

In the international arena, German environmental policy agenda for the next few years will focus on:

- Developing an EU-wide closed substance cycle system
- Further development of disposal standards at OECD level,
- Assisting with the creation of sustainable waste management arrangements in Central and Eastern European countries as well as newly industrialising and developing countries."
- Concluding the harmonisation of international waste movements legislation by amending the EC Regulation on transfrontier shipments of hazardous waste.

I. Sustainable tourism

Ever increasing numbers of people want to get away from it all for a few days or weeks and recover from the stress of work in a place where nature is still relatively unspoiled, and this demand has been matched by an ever increasing variety of travel and leisure opportunities. Tourism is now one of the fastest growing sectors of the global economy. This trend also makes tourism an industry of key importance in the attainment worldwide of the goals of sustainable development.

The World Tourism Organisation estimates that global travel volumes are increasing by four percent each year and will double every 20 years. The organisation estimates that by 2020 there will be as many as 1.6 billion international tourists. Germany is the "world champion" in travel: Germans made 63.4 million holiday trips of more than five days duration in 1998, around 70 percent of them abroad, and spent some DM 91.4 billion on these vacations.

For many countries tourism offers attractive income-generating opportunities. However, it also has a wide range of implications for the environment:

- Tourism infrastructure, i.e. hotels, leisure facilities, access roads etc., frequently appropriates land in largely undisturbed areas - as any tourist can hardly fail to notice when visiting the often vast leisure and holiday complexes, like those situated along the coasts of major holiday destinations such as the Mediterranean.
- The traffic heading for holiday destinations and driving around in these areas creates air pollution, greenhouse gases (CO_2) and noise.
- Accommodation, catering and transport create a high demand for energy, water and raw materials and produce a huge amount of waste.
- Souvenir trading and leisure activities in the tourist destinations (from water sports near sensitive reed habitats to off-piste skiing) can disturb or endanger wild flora and fauna and destroy natural areas.

Seen objectively, tourism and an intact environment are natural partners. After all, tourism

depends more than almost any other sector of the economy on nature and the environment being intact. However, when local resources are used excessively and natural habitats are damaged, the economic basis of tourism itself is put at risk. It is therefore essential that the sustainability principle is put into practice in tourism. Only if we succeed in halting the decline in the biodiversity of species throughout the world, the desertification of large expanses of the world, global warming and the unbridled use of natural resources, will it be possible to safeguard not only the natural foundations of life upon which future generations depend, but also the foundations for the development of tourism.

The Federal Environment Ministry has therefore developed strategies for a sustainable tourism policy, which we hope will also advance the international process in this field and which includes national measures that involve the main actors in the tourist industry.

For example, in 2001, the environmental brand "Viabono – natural enjoyment on holiday" was launched in Germany on the initiative of the Federal Environment Ministry. The aim behind it is to make environmentally sound travel more attractive for broad sections of consumers and to motivate the tourist industry to design its products around a stronger environmental focus. With the participation of some 20 tourism, local authority, environmental and consumer associations, ambitious catalogues of criteria were developed for various sectors: tourist boards, hotel and catering trade, camp sites, holiday homes, bed and breakfast and nature reserves. They covered aspects such as waste, energy, noise, mobility, nature and the countryside, local economies and environmental management.

Since the Rio Conference in 1992, work on an international level has resulted in intensified initiatives for sustainable tourism worldwide:

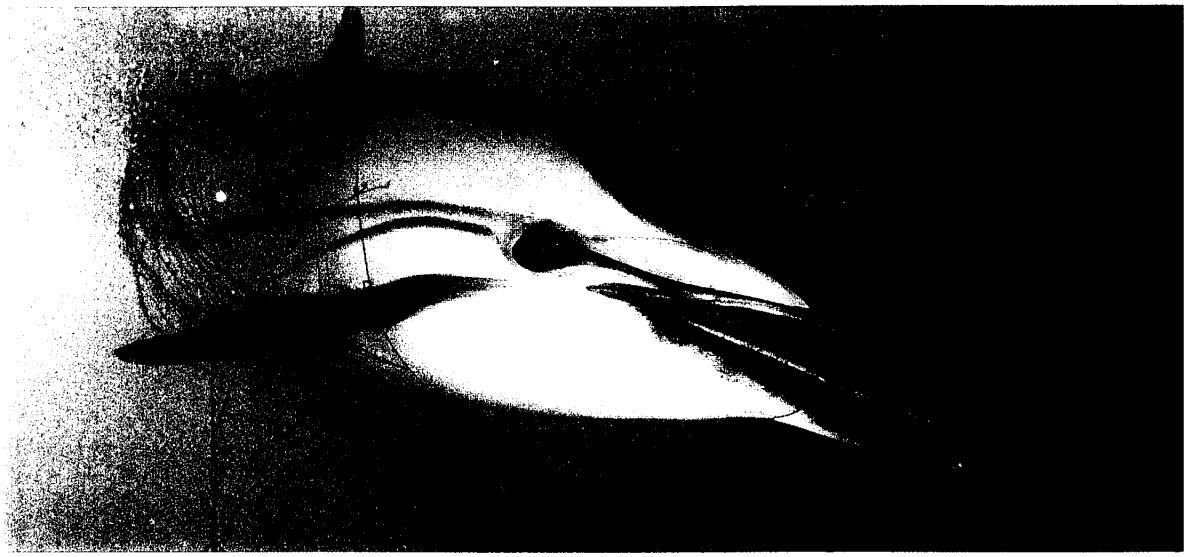
- 1995: publication of the Environmental Codes of Conduct for Tourism by UNEP
- 1995: adoption of an 18-point Charter for Sustainable Tourism at the World Conference on Sustainable Tourism in Lanzarote (Spain)
- 1997: Berlin Declaration on Biological Diversity and Sustainable Tourism, initiated by Germany's Federal Environment Ministry (BMU)
- 1997: the Special Session of the UN General Assembly included for the first time a chapter on "sustainable tourism" in the UN programme for the further implementation of Agenda 21.
- 1999: at its seventh session, the UN Commission on Sustainable Development (CSD) passed a comprehensive international working programme on sustainable tourism along with a resolution to review the activities resulting from it at the World Summit on Sustainable Development in Johannesburg in August 2002. It calls on the Convention on Biological Diversity to participate in this working programme, for example by drawing up international guidelines on sustainable tourism.
- 2001: with Germany providing financial backing along with subject expertise for the preparations, a workshop on the Convention on Biological Diversity entitled "Tourism and Biodiversity" will take place, at which Draft International Guidelines on sustainable tourism will be framed. These Guidelines will constitute a kind of basic manual for the development of tourism. They define, for example, the areas of application, the management process, the responsibilities of the relevant institutions - ranging from provision of basic information to decision-making and monitoring. Great significance is attached to public relations work and fair and equitable sharing of the benefits resulting from tourism. The Draft Directive will be submitted to the UN Commission for Sustainable Development for further work and to the World Summit for Ecotourism being organised by the World Tourism Organisation in 2002.

J. Protecting the oceans

Water is not only the origin of all life on Earth but, with a total volume estimated at 1.4 billion cubic kilometres, it is also the planet's biggest and most vital raw material. Water goes through a constant cycle of evaporation and precipitation – nothing is lost, but neither is anything added. 97 percent of water reserves consist of salt water in the world's oceans that cover 71 percent of the planet's surface.

The oceans play a central role in life on Earth. They are:

- an important climatic factor: acting as a store and sink for CO_2 and as a gigantic heat storage medium, the oceans influence atmospheric



temperature and weather and are, in turn, influenced by the climate.

- a still largely unexplored home to countless species of animals and plants ranging from single-cell algae and bacteria to whales,

- an irreplaceable food source: fish is a valuable component of the human diet. Of the 100 million tonnes of fish caught worldwide each year, about 70 million tonnes are saltwater fish,

- an important supplier of raw materials: the continental shelf areas contain nearly half of all oil and gas reserves on Earth. Seawater itself contains around 70 different elements. One cubic kilometre of seawater contains 230 million tonnes of salt, one million tonnes of magnesium and 65,000 tonnes of bromine. The potato-like nodules found in ocean floor sediment consist of up to 30 percent manganese, as well as valuable metals such as nickel, copper, cobalt, molybdenum and vanadium,

- a major transport route: the combined weight of the merchant fleets of the maritime nations transporting passengers and cargo across the world's oceans was estimated at 560 million gross registered tonnes (GRT) in the year 2000.

Despite the fact that the world's oceans play such a crucial role for life on Earth, their ecosystems are being endangered in many ways by human activities and have in part already been permanently damaged:

- Directly by use-related contamination, e.g. by industry and local authorities discharging wastewater into them, by shipping, as a result of the way raw materials are exploited, by reckless overfishing and destructive fishing methods, and by uncontrolled coastal development and land reclamation.

- Indirectly by the acceleration in the greenhouse effect and the increase in UV-B radiation from the sun caused by the depletion of the ozone layer.

Both processes influence and change the flora and fauna of the oceans.

The international community recognised at an early stage that marine environmental protection requires not only national measures but also international action. Among others, the following agreements have been concluded:

1. The 1972 Convention on the Prevention of Marine Pollution by Dumping Wastes and Other Matter, last amended by a protocol introduced on 7 November 1996 but not yet in force. The convention is designed to prevent worldwide pollution of the oceans as a result of incineration and dumping. The protocol provides for a general ban on dumping, with exemptions only in special cases. Waste incineration at sea is also generally prohibited under the protocol.

2. The Convention on the Protection of the Marine Environment of the Baltic Sea Area concluded in 1992 sets out the obligations of the

coastal states bordering the Baltic to prevent pollution from land-based and marine sources. It came into force in January 2000. As part of the Convention of the same name dating from 1974, which was the forerunner to the 1992 Convention, an International Baltic Action Programme was adopted with the aim of eliminating 132 primary sources of pollution, known as "hot spots."

3. The Convention on the Protection of the Marine Environment of the North-East Atlantic (OSPAR Convention) entered into force in March 1998 replacing earlier Conventions dating from 1972 and 1974. It also covers the North Sea and establishes the framework for international programmes and measures to accord comprehensive protection to the marine environment. The convention generally prohibits the dumping of wastes at sea and provides for a gradual tightening of the remaining exemptions. It prescribes adherence to the precautionary principle and enables decisions to become legally binding. The first decisions of that kind, for instance, were the general prohibition of the disposal of offshore installations at sea and an irrevocable blanket ban on the dumping of low and medium grade radioactive wastes. The convention was extended in 1998 to include an annex on marine nature conservation, which came into force in 2000.

4. The 1982 UN Convention on the Law of the Sea (UNCLOS), which came into force on 16 November 1994, sets out the rights and obligations of States in respect of the protection and management of the oceans.

5. The Code of Conduct for Responsible Fisheries, adopted by the Food and Agriculture Organization of the United Nations (FAO) in 1995, specifies principles for sustainable fishing practices and for minimising the adverse impacts of fisheries.

6. The Programme of Action on the Sustainable Development of Small Island Developing States, which was agreed at the 1998 global conference in Barbados, contains recommendations for measures to combat climate change and rising sea levels and to protect marine and coastal areas.

7. The UN Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks was drawn up in 1995. In terms of marine environmental protection, its most important provisions are the obligations to apply the precautionary principle and to conserve the biological diversity of the sea. The agreement entered into force in December 2001.

8. A global programme of action for the protection of the marine environment was agreed in Washington in November 1995. One of its aims is to empower developing and newly industrialising countries to take steps to protect the marine environment.

In Europe special efforts are, of course, being made to protect the North Sea and Baltic. These endeavours are reflected in a number of dedicated activities and agreements:

- The International Conferences on the Protection of the North Sea set concrete targets for reducing the pollution burdens on the North Sea caused by pollutants and human activities. The Fifth Conference on the Protection of the North Sea to be held in Bergen, Norway in March 2002 will review what has been achieved so far and continue its aims.

Special efforts have also been made to protect the Wadden Sea area. This valuable biotope is a feeding, resting, breeding and moulting ground for numerous wading birds and waterfowl, a "nursery" for many species of North Sea fishes and a habitat for marine mammals. Since 1982, the coastal states bordering on the Wadden Sea, i.e. Germany, the Netherlands and Denmark, have been co-ordinating their efforts to protect and develop this ecosystem, which is the only one of its kind in the world. The Wadden Sea Plan was adopted in 1997 at the eighth Trilateral Intergovernmental Conference on the Protection of the Wadden Sea, held in the North German town of Stade. The plan defines the concrete targets for joint conservation efforts and outlines the measures and projects needed to achieve them.

Wadden Sea

- It was decided in 1988, within the framework of the Convention on the Protection of the Marine Environment of the Baltic Sea Area (Helsinki Convention), to reduce discharges of the most hazardous substances, i.e. heavy metals, toxic and persistent organic pollutants and nutrients, by 50 percent of 1985 levels by 1995. As far as nutrients are concerned, this target was only attained for phosphorus, while nitrogen discharges remained at the same level. In June 1998, the Baltic Coastal States adopted an Agenda 21 for the Baltic area (BALTIC 21). It aims at integrating environmental protection into other policy fields and complements the activities taking place under the Helsinki Convention. The wide-ranging BALTIC 21 action programme includes measures in the agriculture, energy, forestry, industry, tourism, transport, regional planning and fisheries sectors.

Despite all these measures and activities, there is still a long way to go before the world's oceans will benefit from an integrated form of environmental management that is consistently geared to sustainability. In the coming years, Germany will focus above all on four key objectives:

1. **The protection and sustainable use of the North Sea and Baltic Sea by**

- further reductions, culminating in the complete cessation, of pollution from hazardous and radioactive substances and
- reductions in the discharge of nutrients, especially nitrogen, to levels that preclude eutrophication.

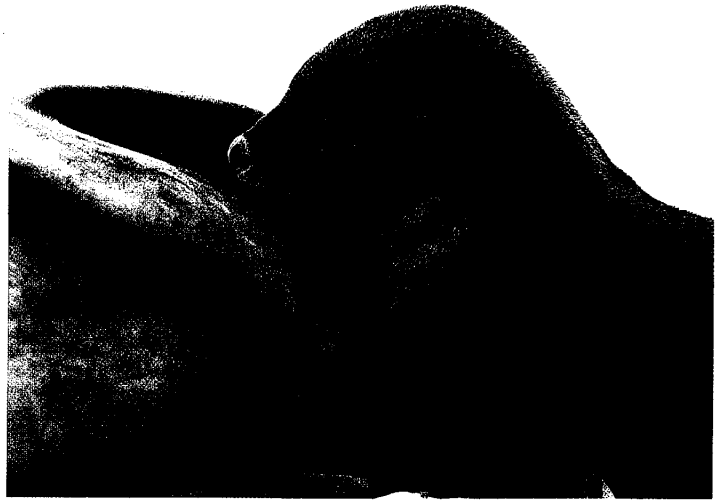
2. **Conservation of biological diversity in the North Sea and Baltic Sea by**

- establishing a network of conservation zones across the inshore and offshore waters of the Baltic (Baltic Sea Protected Areas),
- implementing the OSPAR strategy to protect and preserve ecosystems and biodiversity,
- co-ordinating and initiating coastal protection measures,
- creating a system of representative protected areas in order to safeguard ecologically valuable or endangered habitats and species in the North Sea,
- implementing and updating the Wadden Sea Plan through joint projects and measures, such as designating the Wadden Sea as a Particularly Sensitive Sea Area, as defined in the International Maritime Organisation's scheme.

3. **Sustainable use of resources and protection of the marine environment from the impact of fisheries** by the European Union's reform of its Common Fisheries Policy scheduled for 2002. This should integrate the aims of environmental protection into the EU's fisheries policy and introduce the principle of preventive action into fish stock management.

4. **Reducing pollution from shipping by**

- implementing the EU Directive of November 2000 on port reception facilities for ship-generated waste and cargo residues. When the Directive is transposed into national law, a blanket disposal fee will be levied in German harbours, regardless of whether ships actually make use of the facility or not. This will counteract the current incentive for ships to illegally dump their waste at sea without having to pay anything.
- a regulation that is legally binding worldwide to monitor and deal with ballast water from ships to prevent organisms from a different part of the world from being introduced into marine ecosystems.



K. Protection and environmentally sound use of transboundary rivers and lakes

The Rhine

Just like the oceans, rivers and lakes are also invaluable to life on Earth. As phases in the freshwater cycle, they are indispensable for human beings, since without drinking water we cannot live. But, like the oceans, rivers and lakes are also exposed to a range of different pressures:

- The constant discharge of contaminated wastewater from towns and industry, agriculture and shipping impairs water quality.
- Schemes to straighten and bank up rivers, the construction of hydropower plants, and other hydro-engineering schemes (such as dams) destroy the natural habitats of fish and other organisms. As a consequence, water meadows, with all their characteristic biodiversity, are drying up.
- As a consequence of the high water demand by industry and urban centres, a demand that is growing right across the globe, the stress on many major rivers is constantly increasing. This is leading to a shortage of drinking water and ecological damage in down-river regions and coastal zones.
- River modifications, sewer installations and surface sealing are all contributing to the growing frequency of severe flooding.

The most effective way to protect river areas is to implement a co-ordinated and monitored action programme covering the whole catchment area of the river system. Worldwide more than 200 river catchment areas extend across the territories of several States. This means that, ideally, all States with territory in the respective river catchment area must be actively involved in such a programme.

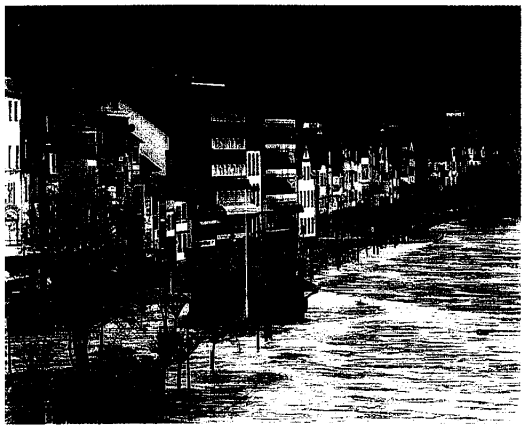
The United Nations Economic Commission for Europe (ECE) adopted a Convention on the Protection and Use of Transboundary Water Courses and International Lakes, which came into force in 1996. It contains binding provisions on the prevention, control and reduction of water pollution as well as on information exchange arrangements and warning and emergency systems.

In other parts of the world, too, there is growing recognition of the benefits of taking a joint approach to managing and conserving transboundary rivers and lakes throughout their entire catchment area. Institutionalised forms of co-operation already exist for about two-thirds of transboundary river systems worldwide. These include, for instance, the Ganges, Mekong, Senegal, Rio Grande and the Amazon.

Germany is a member of the International Commissions for the Protection of the Rhine, Elbe, Oder, Danube and Lake Constance. It is scheduled to join the International Commission for the Protection of the Maas in the near future. These Commissions – some of which have been working for many years – develop action programmes for assessing and improving the quality and structure of water bodies, for avoiding and combating accident-related pollution of water and flood protection. They also coordinate their implementation.

In December 2000, the EU's Water Framework Directive was adopted. It is designed to better coordinate the various EU Directives on water protection and develop them into a coherent single concept for water protection. By creating a framework for the protection of all forms of surface water and groundwater, the prerequisites for a uniform water

protection policy throughout the Community will be established. It thus opens up an entirely new dimension for European water protection policy. The aim is that by 2015 "good ecological status" and "good chemical status" will have been achieved in all groundwater and surface waters.



Flooding along the Mosel

The EU's Water Framework Directive also presents new challenges to the international River Basin Commissions. The provisions of the Directive make an expansion of transboundary cooperation indispensable. The idea is to make as extensive use as possible of the existing River Basin Commissions to coordinate the international management plans called for by the Water Framework Directive. In the catchment areas of the Danube and Oder, which cover not only EU Member States but also Candidate Countries, the coordination of a management plan that is as uniform as possible, as required by the EU Water Framework Directive, will also make an important contribution to preparing these Central and Eastern European Countries for EU membership.

In addition to continuing the process of reducing nutrient and contaminant inputs, Germany will focus in the next few years on safeguarding and improving river ecosystems. This will require further measures to improve regional co-operation. Flood protection endeavours must also continue. The key areas for attention in the coming years are therefore:

1. Transposing the EU Water Framework Directive into national law with the aim of achieving a single system of water protection in Germany that has a stronger ecological focus.

2. Joint development of management plans and programmes of measures to bring about a reduction in pollution and improvement in the ecology of watercourses in international river basins.

3. Implementation and continual updating of flood action plans. The most important points include renaturation projects, reactivation of flood areas, extensification of farming, afforestation and unsealing surfaces along the banks and in the catchment area of rivers.

L. Protection and sustainable use of freshwater resources

Of all the Earth's water reserves, 97 percent is saltwater and thus of no use to human beings as drinking water, two percent is locked up in glaciers and the polar caps as freshwater, and only one percent is accessible freshwater. It would be wrong, however, to say without qualification that the world is suffering from a water shortage. The total volume of this one percent that is available in the hydrological cycle is estimated to be 500,000 cubic kilometres – theoretically more than enough for the whole of humanity. The major problems that do exist stem from a huge imbalance in the regional distribution of these water reserves and the fact that an expanding world population is demanding ever more of this vital yet finite resource.

Drinking water therefore takes on central importance in the drive towards sustainable development. The growing threat to what is the basis of life and economic activity in all human societies represents one of the key problems to be solved on our planet

- While the inhabitants of the industrialised countries flush their toilets and wash their cars with the "precious liquid," about two billion people - mainly in Africa, Asia and the Middle East - have no access to clean drinking water and 2.5 billion people have no hygienic sewage system. Worldwide only five percent of wastewater is treated. Each year some 250 million people become ill from using contaminated drinking water, resulting in some five million deaths.

- Freshwater is also the most significant limiting factor on food production. An acre of land needs about 25,000 litres of water to produce 50 kg of wheat. Agriculture accounts for 70 percent of global water consumption.

- The exploitation of freshwater reserves for human use increased six-fold between 1950 and 1995, growing twice as fast as the population. Roughly two-thirds of the world's population will suffer from a shortage of

Freshwater resources in the EU

	Renewable water resources in million m³/p.a.	Consumption in million m³ p.a	Amount withdrawn per capita p.a. in l	Use intensity as a percentage
Austria	92,00	2,120	278	2
Belgium	12,500	9,030	917	72
Denmark	13,000	1,200	243	9
Finland	108,000	3,001	605	3
France	198,000	37,730	665	19
Germany	171,000	58,852	742	34
Great Britain	120,000	14,237	248	12
Greece	58,650	6,945	720	12
Ireland	50,000	793	233	2
Italy	175,000	56,200	980	32
Luxembourg	5,000	59	156	1
Netherlands	91,000	14,481	994	16
Portugal	73,000	7,288	737	10
Spain	117,000	36,900	947	32
Sweden	168,000	2,932	343	2

Source: Europe's Environment, 1995

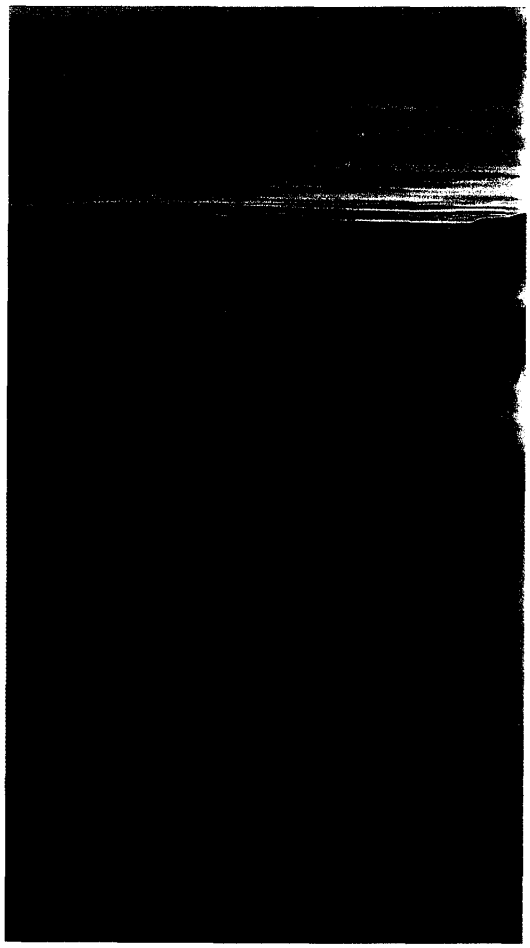
water by 2025. This also entails a growing risk of armed conflict over access to water

- Many groundwater reserves are already being exploited at rates well in excess of their natural capacity for regeneration, and their quality is being impaired by contaminants

- The depletion of water resources is causing widespread desertification and the loss of valuable land.

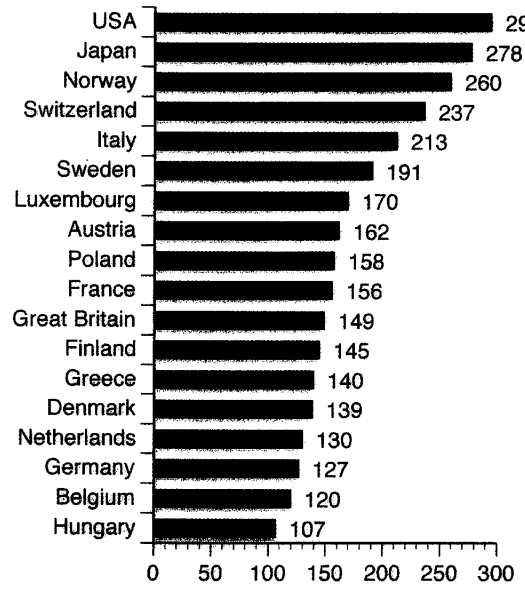
The causes of water shortage and the related problems obviously have to be tackled in the first instance by national measures. In many cases, however, it is essential that these be complemented by internationally coordinated activities. After all, around 60 percent of the world population live in transboundary river areas. It is encouraging to see how many such activities are already taking place. In addition to the co-operative action described here in section K on river systems, the United Nations has also taken a number of initiatives and declared the years 1981 to 1990 the International Drinking Water Supply and Sanitation Decade. The 1992 International Conference on Water and the Environment in Dublin was the first to lay down principles for action at local, regional and international level. In 1997, a special session of the UN General Assembly launched an international freshwater initiative and, in the spring of 1998, a strategy on freshwater was adopted at the CSD conference. In its millennium session in the year 2000, the United Nations announced its aim to cut by half the proportion of people without access to clean drinking water by 2015 and to put an end to non-sustainable use of water resources.

In the EU States, national legislation on water is strongly influenced by Community law. The EU has, for example, issued directives on the protection of groundwater, surface water and drinking water. The new Framework Water Directive has laid the foundations for a common



A day's water

Average household water consumption per inhabitant (incl. small businesses) in litres per day



Source: BGW/OECD, 1998

water protection policy throughout the Community. The aim is to achieve good quality surface water and groundwater by 2015

The German Federal Government regards the conservation of water resources as crucial to future efforts to safeguard the environment, livelihoods and peace. Germany therefore staged an international conference on freshwater from 3 to 7 December 2001 in Bonn, attended by delegations from around 120 countries and observers from a similar number of international organisations and NGOs. The conference prepared the review of progress on implementation of Agenda 21 as it relates to water, due to take place at the World Summit on Sustainable Development in 2002 in Johannesburg. The conference reaffirmed the close connection between water, alleviation of poverty and sustainable development. It achieved progress in topics such as covering the costs of water supply, involvement of the private sector, the importance of cooperation on issues concerning transboundary water bodies and the significance of decentralisation and public participation, particularly the involvement of women. It was regarded as an important step forward as we approach the World Summit in Johannesburg.

Moreover, as its contribution to safeguarding global water supplies, Germany has set itself the following major objectives for the near future:

- Provide consultancy services for developing countries engaged in administrative capacity building for water management, promote cooperation in international river basins and the transfer of water management expertise by co-ordinating and supporting training schemes run by international organisations
- Promote transboundary cooperation in river basins, including collaboration on international water management projects

M. Protection against transboundary air pollution

Like water and sunlight, air, too, is essential to human life, and yet our atmosphere is subject to alarming pollution pressures. Whilst, on a global scale, air pollutants originating from natural sources like volcanoes or processes of biological decay (rotting, decomposition) are roughly equal to the burdens generated by human beings, we should nevertheless reject the temptation to let these findings ease our conscience. For nature is palpably becoming less and less able to cope with the additional pressures. Of all the anthropogenic air pollution, about 90 percent is produced in the northern hemisphere, i.e. mainly by the industrialised countries. Most of these harmful substances – ranging from soot and dust through carbon dioxide, oxides of nitrogen, sulphur dioxide, ammonia and methane to toxic heavy metals and carcinogenic hydrocarbons – derive from energy consumption in the transport sector, households and industry, from industrial processes and agricultural production.

Air contaminants are often transported over thousands of kilometres before their harmful impact on health and the environment is even felt or seen. Not only does air pollution pose a direct risk to human health, it also has a complex influence on the global climate. Moreover, air pollutants ultimately end up in water and soil where they can directly harm people, animals and plants, including our food. Four examples illustrate these processes:

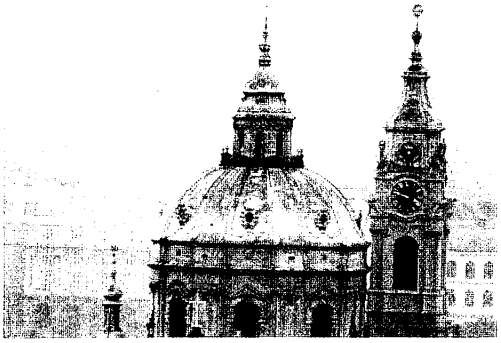
- The acidification and eutrophication of soil and water by substances such as sulphur dioxide (SO_2) and oxides of nitrogen (NO_x) from power stations and car exhausts, or ammonia (NH_3) from agriculture, damages ecosystems in a variety of ways, one of the more visible forms being the extensive damage to forests.
- NO_x and highly volatile organic compounds (VOCs) can, under the influence of the sun's rays, produce tropospheric ozone at the height of summer. This "summer smog" can cause irritation of mucous membranes and the respiratory tract and other health problems
- Under unfavourable weather conditions, when there is little movement of air, high concentrations of sulphur dioxide, carbon monoxide and dust can combine to cause what is known as "winter smog." It has a particularly adverse effect on respiratory organs. German air quality control policies mean that winter smog is virtually a thing of the past in Germany, but it remains a problem in other EU countries.

Trends in sulphur dioxide emissions in EU countries between 1990 and 1997 in kilotonnes

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
EU 15	16,362	–	–	12,342	–	10,190	8,843	–	–	–
Austria	91	82	63	60	56	56	53	51	47	42
Belgium	371	333	318	296	253	246	240	221	212	187
Denmark	182	241	188	154	156	149	180	110	77	56
Finland	259	194	140	122	114	95	105	99	90	87
France	1,279	1,388	1,213	1,053	989	933	912	766	807	682
Germany	5,323	3,995	3,307	2,945	2,472	1,993	1,403	1,126	900	832
Great Britain	3,754	3,568	3,446	3,105	2,666	2,348	2,010	1,637	1,567	1,187
Greece	506	550	555	551	526	551	542	528	541	–
Ireland	185	180	172	161	175	161	147	166	176	157
Italy	1,652	1,539	1,395	1,333	1,272	1,322	1,205	1,076	1,038	923
Luxembourg	15	–	–	15	13	9	8	6	4	4
Netherlands	203	173	172	164	146	147	135	118	107	100
Portugal	360	346	410	360	339	366	324	341	375	–
Spain	2,048	2,049	2,041	1,920	1,875	1,722	1,497	–	–	–
Sweden	132	113	102	103	–	93	83	52	52	64

Source: European Environment Agency, Internet Data Service (– no data available)

- Aggressive air pollutants also corrode buildings and cultural monuments, costing millions in repairs and restoration. "Acid rain," for example, corrodes limestone into gypsum, damaging valuable historic monuments, sometimes to the point of complete ruination.



It is obvious that internationally co-ordinated measures are essential if the environmental damage resulting from air pollution is to be combated. The UNECE laid the foundations for such measures in Europe and North America in 1979 with the adoption of the Geneva Convention on Long-Range Transboundary Pollution. This agreement, even then, was embraced by both Eastern and Western European States and helped environmental co-operation to develop between East and West in an atmosphere of mutual trust. Commitments to specific reduction targets for pollutants such as sulphur, NO_x and VOCs were then made in various individual protocols. Protocols have also been signed that deal with heavy metals and persistent organic pollutants (POPs). A "multicomponent protocol," covering not only SO2 and NOx but also NH_3 and VOCs and thus dealing with acidification, eutrophication and summer smog caused by ozone, was signed in December 1999.

In the EU, too, air quality control is gradually being harmonised:

- The 1996 Directive on integrated pollution prevention and control stipulates inter alia that certain large industrial installations must be operated in accordance with best available technology. This will help cut the emissions of air pollutants.

- The Directive on ambient air quality assessment and control, which was also adopted in 1996, sets out a timetable for the Commission to submit proposals for the amendment and harmonisation of existing air quality directives on SO_2, particulate matter, NO_2, lead and ozone as well as for the development of new directives to deal with substances such as benzene and polycyclic aromatic hydrocarbons (PAHs).

To this end, the EU has prepared a series of Directives, including, in October 2001, what is known as the NEC Directive (NEC = National Emission Ceilings), which formulates a strategy to counter acidification and eutrophication of water bodies and soils. The Directive sets individual limits for each Member State on emissions of SO_2, NO_x and NH_3 for the period up to 2010. By including VOCs, it should also help to combat tropospheric ozone. In spring 2001, the EU Commission also launched a programme entitled "Clean Air for Europe" with the aim of presenting a comprehensive long-term concept for air quality control in Europe by 2005 at the latest. During the first quarter of 2002, a new Ozone Directive is also expected to be adopted.

Germany began taking steps to combat air pollution at a very early stage. The targets set by the Geneva Convention on Long-Range Transboundary Pollution and its protocols have been achieved without exception and far exceeded in most cases. As a result of regulations governing installations, transport and vehicle technology – e.g. to ensure desulphurisation and denitrification of power plant emissions, introduce catalytic converters for engines and define pollution limits for motor vehicles – emissions of particulates, for example, fell by 76 percent, SO_2 by 84 percent and NO_x by 39 percent between 1990 and 1990. All NM-VOC emissions (NM = non-methane) were reduced by 66 percent. Germany is also supporting her eastern neighbours Poland and the Czech Republic in their efforts to combat transboundary air pollution. This will also bring further improvements to Germany's own air quality.

Germany will continue to advocate high standards in international environmental agreements. In the EU, Germany's aim is to achieve greater harmonisation of environmental regulations at a uniformly high level. The first step the Federal Government will take is to press for a Europe-wide reduction in emissions of acidifying substances into the air, until levels fall below the critical loads. We believe that four measures in particular are needed to achieve this objective:

- Give concrete form to measures needed to comply with the limit values and alert thresholds of the EU Framework Directive on air quality and its subsidiary legislation. Adoption into national law of the EU NEC Directive (strategy against acidification, eutrophication and tropospheric ozone). Interim goal: to reduce by 2010 the proportion of areas where, in 1990, the critical loads were

exceeded by 50% (in the case of acidification) and 66% (tropospheric ozone).

- Realisation of the goals of the second Sulphur Protocol of 1994, which aims to achieve a 60 percent reduction by 2010 in the gap between today's sulphur emissions into the atmosphere and the critical loads

- Prompt adoption of the Ozone Directive at EU level before the end of the first quarter of 2002 and adoption into national law.

- Ratification and implementation of the Multicomponent Protocol issued by the UNECE in 1999 which is a development of the substance-specific protocols for sulphur dioxide, NO_x and VOCs and which provides for further reductions in pollution caused by acidification, eutrophication and tropospheric ozone.

N. Protection against hazardous substances

It is hard to imagine life in the industrialised societies of the world without the many thousands of chemicals and other substances that we use. This is by no means always a blessing for people and the environment. For, in addition to their intended properties, many substances have side effects that can damage human health and ecosystems. Indeed, it is not unusual for the negative consequences to outweigh the benefits, as seen in the case of the asbestos, a material which is now prohibited since it is not only fire resistant but also carcinogenic, or pentachlorophenol, which used to be applied to protect wood and textiles from mould until the treatment was identified as a major source of highly toxic dioxin.

Particularly serious problems are now being encountered in five areas:

- Persistent organic pollutants (POPs) pose a risk to human health and the environment since they accumulate in the food chain and are capable of spreading throughout the world thanks to their physical and chemical properties.

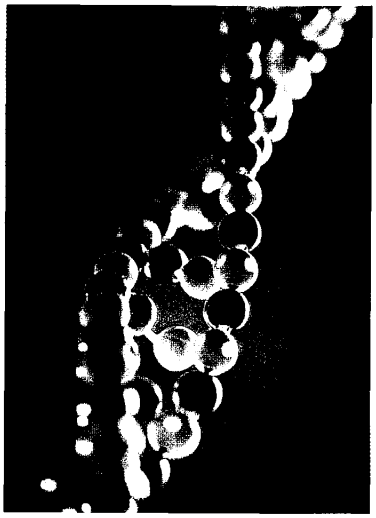
- Chemicals that upset the hormonal balance have negative effects on human and animal reproduction and health. Air pollutants, such as diesel particulates, benzene, cadmium, arsenic and nickel, can cause cancer in humans.

- Pollutants emitted by road traffic, combustion plants and from the use of solvents increase ozone concentrations at ground level during the summer. This "summer smog" presents a health hazard, e.g. affecting lung capacity, and damages ecosystems.

- Some chemicals produced in countries where their use is prohibited or severely restricted by law are nevertheless sold in developing countries. This is still the case with DDT, for instance, a pesticide that is banned in the industrialised countries. Such exports pose a threat to people and the environment, especially since some importing countries lack the infrastructure needed for properly regulated importation, distribution, storage, labelling, use and disposal of these chemicals.

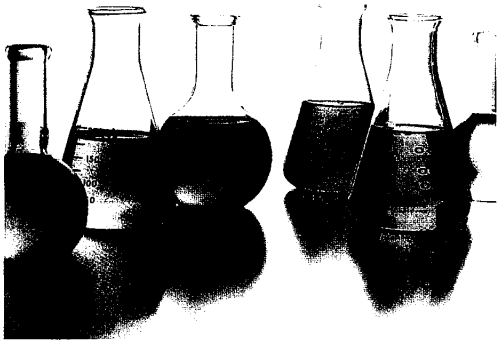
Initial attempts have been made to establish global regulations on chemical safety through numerous international agreements, such as the Montreal Protocol on Substances that Deplete the Ozone Layer (Chapter III B.), the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (PIC Convention) and the Stockholm Convention on Persistent Organic Pollutants (POP Convention).

In the EU, where chemicals legislation has largely been harmonised, there are about 100,000 "existing chemical substances," that is substances that were already on the market before 1981. Of that number, approximately 30,000 are still of commercial significance. By contrast with new chemicals, we have insufficient knowledge about the properties and effects of many of these existing chemicals. That kind of knowledge is, however, important if we are to make informed decisions on whether to prohibit or restrict chemical substances or certain applications of these substances.



The "White Paper on the Strategy for a Future Chemicals

Policy," adopted by the EC Commission in February 2001, thus proposes that in future the same data will be required for both existing and new chemicals and that the requirements for higher-volume chemicals will correspond largely those currently applicable to new chemicals. At the centre of the concept to redesign European law on chemicals on which the White Paper is based is the introduction of a uniform reg-



istration, evaluation and authorisation system (REACH = Registration, Evaluation and Authorisation of Chemicals) for existing and new chemicals. An important element of the strategy is the "reversal of responsibility" in the authorisation procedure for high-risk chemicals, i.e. the onus will now be on manufacturers to provide proof that their chemicals are safe. The EU Environment Ministers and the European Parliament have expressed basic approval of the Commission's proposals. In mid-2002 the EU Commission is due to submit Draft Directives to implement the new policy on chemicals.

The parties to the ECE Convention on the Transboundary Effects of Industrial Accidents have undertaken to take precautions to prevent industrial accidents and limit their consequences. They include the monitoring and inspection of dangerous activities and establishment of emergency and alarm plans to reduce transboundary effects of industrial accidents. The convention came into force in April 2000.

In 1989, UNEP and FAO introduced a voluntary information procedure aimed at providing better protection for people and the environment in countries importing hazardous chemical substances that are either prohibited or severely restricted in their country of origin. This "prior informed consent" (PIC) procedure is intended to ensure that recipient countries are informed in good time about the importation of such substances and about the reasons why measures have been taken to control their use in the exporting country. To make this procedure binding under international law a convention was agreed in Rotterdam in 1998 (the PIC Convention). Aware of her responsibilities as a producer and exporter of chemicals, Germany has offered to provide the necessary facilities for the Convention Secretariat to be set up in Bonn.

Many developing countries do not yet have the appropriate infrastructure for the safe handling of hazardous chemicals. They therefore need financial and technical assistance. As one of the world's largest chemical exporters, Germany has a particular responsibility to help. A number of initiatives have been launched which reflect this sense of responsibility, including a German pilot project to improve chemicals management in developing countries. Our aim is to transfer know-how and experience to developing countries and assist in its application. Overall, Germany has, in the last ten years, provided around 100 million DM for the improvement of chemicals safety in developing countries and countries in transition.

Despite all these different activities, there is still no coherent international system for the safe management of hazardous chemicals. Urgent action is therefore required on pushing forward measures to facilitate, for example, the exchange of information on toxic chemicals and chemical risks and the introduction of risk reduction programmes as described in Agenda 21.

Germany made a decisive contribution to the success of the negotiations on an international Convention on action to combat the risks posed by certain persistent organic pollutants (POP Convention) which were concluded in December 2000. Germany signed the Convention in May 2001 and will ratify it in summer 2002. The aim of this Convention is to ensure that these hazardous chemicals are withdrawn from the market and replaced by safer substances. The immediate priority is to deal with twelve substances identified by UNEP as particularly dangerous (the "dirty dozen"). They are mainly pesticides and dioxins. The Convention will severely restrict the manufacture and use of DDT, which WHO guidelines now only permit for health reasons (e.g. to combat malaria). The Federal Republic of Germany has also made an application for the secretariat of this Convention to be located in Bonn.

Considerable efforts are still required to protect people and the environment from hazardous substances. That means designing and advancing both international programmes and individual actions, such as EC regulations. From Germany's point of view, the priority tasks are:

- Implementation of the EU-wide procedure for controlling chemical pesticides through the application and

enforcement of the Biocide Directive and through a programme to review the biocides already available on the market.

- To ban the highly toxic tributyl tin (TBT) in anti-fouling paint for ship's hulls (against growth of algae and barnacles) under the auspices of the International Maritime Organisation (IMO) of the United Nations.

- International research and work programmes to improve testing methods for establishing the damage caused by potential endocrine disruptors and to examine the need to apply restrictions following the evaluation of suspicious substances such as nonylphenol, bisphenol A and phthalate in the framework of the EU programme for evaluating and controlling existing chemicals.

- Protection of human health and ecosystems against impacts from drugs for humans and animals by amending the relevant EC directives on the licensing of these medicines to ensure that the environment is taken into account as a valued asset to be protected, and by bringing the procedure for evaluating the environmental risk of pharmaceutical ingredients into line with the existing procedures for other types of chemical.

- Better protection against carcinogenic substances by issuing EC directives to establish environmental quality standards for benzene, polycyclic aromatic hydrocarbons (PAHs), cadmium, arsenic, nickel and fine particulates like soot, as well as by tightening the EU Directive on emissions from mobile machinery and extending its scope to other types of machinery.

- Europe-wide reduction, by 2010 at the latest, in emissions of ozone precursors by between 70 and 80 percent of 1988 levels, to be achieved by drawing up and implementing a protocol to the Geneva Convention on Long-Range Transboundary Pollution, and by developing an EU strategy and enforcing it through binding directives.

- Achievement of a 60 percent cut in VOC emissions from organic solvent applications by 2010 (1988 baseline) and the reduction of VOC emissions from products such as paints and varnishes by adopting appropriate European directives.

- Creation of a worldwide infrastructure for safe chemicals management through the international harmonisation of the existing labelling systems for hazardous chemicals and by implementing Chapter 19 of Agenda 21 by 2010.

- Creation of international rules for trading in certain hazardous chemicals by ratification and entry into force of the PIC Convention.

- Entry into force of the Stockholm POP Convention and ratification of the POP Protocol as part of the UNECE's Convention on Long Range Transboundary Air Pollution. The twelve substances that were the first to be regulated under the Stockholm Convention will be joined in the near future by other hazardous chemicals.

O. International nuclear safety

The German Federal Government has phased out the use of nuclear energy in Germany. It does not believe that this form of power generation can generally be justified in view of the high risks involved. Nevertheless, its policy obviously has to allow for the fact that there are as many as 444 nuclear reactors currently operating in 31 countries around the world. That is why the Federal Government also attaches great importance to improving safety standards and ensuring the international dissemination of best practice. As long as atomic power plants are in operation, the greatest possible safety must be ensured. This also applies to the handling and disposal of radioactive wastes and to measures to prevent nuclear sabotage and stop illegal trade in fissile materials.

The serious accident at Chernobyl in 1986 prompted all countries using atomic power to examine whether there were lessons to be learned with regard to improving safety. It also led to closer international co-operation to prevent such an accident from ever happening again. In particular, the accident focused international attention and action on the alarming safety situation of Soviet-design nuclear plants. Since the end of the 1980s and the opening up of the Eastern Bloc, experts have been able to take a closer look at the safety of these installations, which has largely confirmed their fears about the deficits existing there.

International criteria for assessing the safety of nuclear power plants have, since the early 1990s, been available from the International Atomic Energy

Agency (IAEA) in Vienna. It publishes safety requirements and details of nationally and internationally accepted safety practices which are regularly developed and updated to take account of new findings and technological progress.

With the exception of installations in Romania and Slovenia, Eastern Europe's nuclear power plants are of Soviet design. In all cases, experts have identified safety problems in both design and operation, although the safety implications of these deficits differ between the various models and series. There are essentially two types in use: the RBMK and the WWER reactors.

- The RBMK model was only used in the former Soviet Union. Its original design has very serious safety defects and it was these, in combination with human failure on the part of operating staff, which led to the Chernobyl meltdown. After the accident, changes were made to all the RBMK reactors to prevent the reoccurrence of similar breakdowns. However, international experts believe that there are still major deficiencies in their safety features.

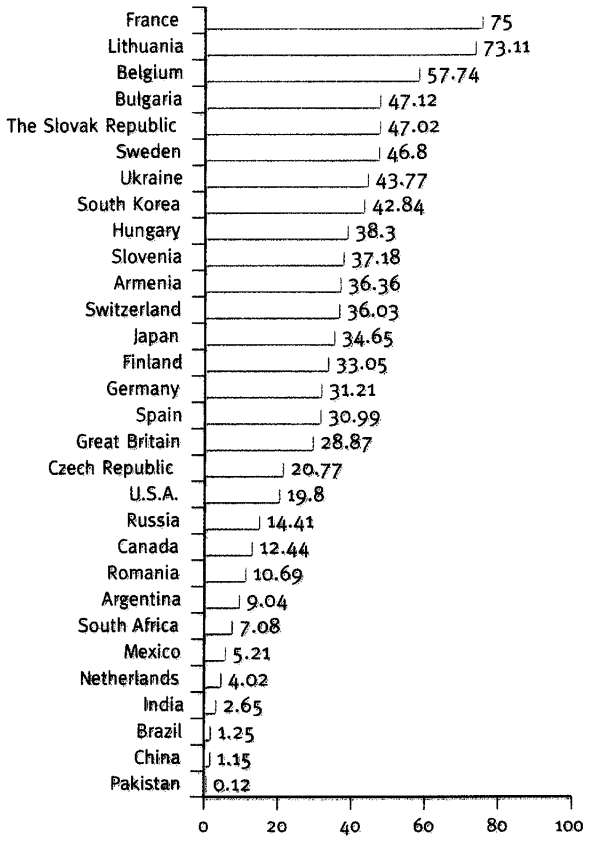
- The WWER reactors, and particularly the oldest series (WWER 440/ W-230), display considerable safety deficiencies. The later models (WWER 440/W-213) also have a number of safety problems, but they are generally considered to be rectifiable. The safety features of the WWER 1000 largely come up to the usual international standards, although here, too, there are deficits which require some retrofitting work.

The efforts made in recent years, including a substantial input by the German Federal Government, have resulted in the creation of several new international legal instruments, which represent important steps towards an enhanced international safety regime:

- The Convention on Nuclear Safety (CNS), adopted on 20 September 1994 by 38 States, grew out of an initiative by the Federal Government. It commits the Parties to observe safety standards for civil power reactors that are binding under international law and to adhere to the principle of putting safety considerations above all else when using atomic energy. Starting in April 1999, review conferences are held every three years to monitor compliance with these obligations.

- The Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management was signed by 82 States on 5 September 1997 at a diplomatic conference held

The share of nuclear energy in overall electricity generation, expressed as a percentage



Source: IAEA. As of: April 2000

under the auspices of the IAEA. The agreement defines safety requirements for the handling of spent fuel elements and radioactive wastes, including their ultimate disposal.

- The Convention on Supplementary Compensation for Nuclear Damage, of 12 September 1997, governs liability issues posed by transboundary nuclear accidents in particular and provides an international fund for compensating the victims.

In response to what are often serious safety problems with Soviet-type nuclear power plants, the G7 States at the 1992 World Economic Summit took up an initiative put forward by the German Federal Government and established a multilateral action programme to enhance nuclear safety in the Central and Eastern European States and in the successor states of the former Soviet Union (New Independent States). It still represents the conceptual basis of the global strategy to improve nuclear safety in Eastern Europe, distinguishing as it does between short-term and medium or long-term objectives. The short-term objectives include improvements in the safety of operational management, speedy technical upgrading and the updating of legislation to ensure sound approval and supervision procedures. In the medium and long term, the focus is on exploring the potential of alternative energies, while closing down unsafe plants and upgrading the safety technology used in modern plants.

The agreements concluded in the action programme are being implemented via a number of supporting programmes at various levels of international co-operation. Germany is playing a major role in four programmes and actions in particular:

1. One of the first measures was the creation in 1993 of a special fund, the Nuclear Safety Account (NSA), at the European Bank for Reconstruction and Development (EBRD). Money from this fund is used to finance work on those nuclear power plants that are to be decommissioned as quickly as possible but should at least undergo technical and operational improvements to guarantee adequate safety for their remaining operational life. Grants from this fund are only made on condition that an agreement is reached on the terms for early closure of the plants concerned.

2. In 1995 an assistance programme was agreed on between the G7 States, the European Commission and the Ukraine to close down the Chernobyl nuclear power plant. As a result of this agreement the nuclear power plant was closed down on 15 December 2000. The promised funding covers measures to reform the Ukrainian energy sector, create credit-financed alternative capacity, improve nuclear safety, solve disposal problems and alleviate social problems arising from the closure of Chernobyl. Under the agreement, US $ 1.8 billion was promised for energy sector investment. By mid-1999, 14 western donor countries had pledged more than US $ 260 million to the NSA.

3. Reactor Block IV at Chernobyl, which was totally destroyed by the accident in 1986, was only temporarily secured by the concrete envelope, known as the sarcophagus, build around it. Its stability is under threat in the long term. To finance the safe confinement of the reactor wreckage, the G7 States, the EU and 18 other countries have pledged US $ 717 million to the Ukraine, paying their contributions into the Chernobyl Shelter Fund (CSF) held by the EBRD.

4. Through its PHARE programme (targeted at CEE countries) and TACIS programme (for the New Independent States), the European Union is making a major contribution to the improvement of nuclear safety in Eastern Europe. By 2000, it had made available around DM 1,622 million (almost 830 million Euro) for PHARE and TACIS.

The G7 Action Programme had envisaged that the older Soviet-type plants (RBMK and WWER 440/W 230) be taken out of service as quickly as possible. This expectation on the part of the West has not fully materialised. Indeed, faced with economic difficulties, the countries concerned are considering plans to continue the operation of these plants right to the end of their originally planned service life and possibly even beyond. Although the reactors of the two more recent WWER construction series do now meet the international safety standards on many counts, they still have some deficiencies that demand retrofitting measures.

The Federal Government regards bilateral co-operation as an important complement to multilateral programmes. Germany has entered into bilateral co-operation in the sphere of nuclear safety with a whole series of countries:

- Joint commissions have been established with the

The German Federal Government's objectives for international co-operation in the nuclear sector

- Continued implementation of the Nuclear Safety Convention and entry into force of the Disposal Convention
- Further development of international regulations on liability, transport arrangements and security measures
- Improvement of nuclear safety in Eastern Europe by implementing the G7 Action Plan and taking complementary measures as a part of EU, IAEA and OECD programmes and via bilateral projects
- Provision of international loans for non-nuclear energy projects to facilitate decommissioning of Chernobyl and the reform of the Ukrainian power industry
- Funding and implementation of the internationally agreed programme to remediate the Chernobyl sarcophagus

neighbouring countries of France, the Netherlands, Switzerland, and, more recently, the Czech Republic, aimed at exchanging information on current issues of safety and radiation protection in installations close to common borders.

- Germany swaps experience with other major countries that are users of atomic energy, like the USA, and with countries that deploy German nuclear technology, such as Argentina, Brazil and Spain.
- The German assistance in capacity building to strengthen the safety agencies in the New Independent States and Central and Eastern European countries involves a large bilateral component as do our efforts to help them modernise plant management and safety technology.

As far as attaining the highest possible international standard of nuclear safety is concerned, co-operation is particularly important within four key international organisations:

1. The IAEA in Vienna draws up, among other things, international safety and security standards for nuclear installations, disposal facilities and transportation. The organisation contributes to improving nuclear safety throughout the world.
2. The EBRD provides loans for the reform of the energy sector in Eastern European countries as well as administering the Nuclear Safety Account, the Chernobyl Shelter Fund and the International Decommissioning Support Funds for Bohunice, Ignalina and Kozloduy. Its investment decisions have a considerable influence on the safety of nuclear power plants in Eastern Europe.
3. The International Nuclear Regulators Association (INRA), founded in January 1997, is made up of representatives from the atomic energy supervisory authorities in Canada, France, Germany, Great Britain, Japan, Spain, Sweden, and the USA. Its aim is to ensure that the highest possible safety criteria are applied to the use of atomic energy throughout the world.
4. The Western European Nuclear Regulators Association (WENRA) was founded in 1999 and its members include the atomic supervisory authorities of Belgium, France, Finland, Germany, Great Britain, Italy, the Netherlands, Spain, Sweden and Switzerland. It seeks to harmonise the safety standards enforced by its members.

The German Federal Government's main concern in the near future is to improve the safety of reactors in Central and Eastern European countries and the New Independent States. All improvements that can reasonably be expected must be made without delay, while installations where this is not feasible should be closed down as soon as possible. In the medium and long term, Germany will make every effort at all levels of international co-operation to attain the highest possible degree of nuclear safety worldwide.

P. Protection against radiation

One of the most important tasks in the field of environmental and health protection is to protect people from the dangers of ionising radiation stemming not only from artificial but also from natural sources, including radioactive material. Apart from legislation specifically designed to ensure the safety of nuclear installations and protect people who may be exposed to radiation as an occupational hazard, regulations are required to tackle two other major problems: lowering radiation exposure from medical applications and providing protection against the radioactive noble gas radon. Recently these issues have been joined by the debate about the possible effects on health from non-ionising radiation from electromagnetic fields.

Generally speaking, the "ALARA principle" is applied, ALARA standing for As Low As is Reasonably Achievable, which means that all reasonable and appropriate measures must at all times be taken to keep exposure to radiation levels as low as possible.

The average level of radiation from artificial and natural sources to which the public is exposed in Germany is approximately four millisievert per year (mSv/a). Exposure to radiation from artificial sources is largely as a result of medical applications, such as X-ray diagnostics and nuclear medicine. The main source of public exposure to natural radiation in Germany is radon.

The radiological protection strategy employed in Germany and other countries is rooted in the scientific findings of the leading international bodies of experts in this field. Germany actively participates in these bodies, whose overriding mission is to safeguard human health. The most important regulations stem from the International Commission on Radiological Protection (ICRP). Its recommendations form the basis of the European Union's Radiation Protection Directive. It is on this foundation that the Federal Government, after consulting with the Commission on Radiological Protection, issues national protection regulations.

In our efforts to reduce radiation exposure from natural sources, radon is obviously our main focus. Radon is, after smoking, considered to be the second most important potential cause of lung cancer. Radon, which is created from the natural uranium components of the Earth's crust, can under certain conditions become concentrated in indoor spaces where people will breath it in. Measurement programmes carried out nationwide have shown that the mean radon concentration indoors is about 50 Becquerels per cubic metre (Bq/m^3).

The Federal Government has commissioned numerous research projects to look at various aspects of radon occurrence in Germany, protective design features for buildings and radon-related health risks. On the basis of these findings, we are drawing up a radiation protection strategy to tackle all these problems. In regions where there is a higher radon occurrence, it is believed that improvements can be achieved by upgrading existing buildings, e.g. ground-sealing and ventilating basements in existing buildings and incorporating special design features into new buildings. The EU Commission's Recommendation on the protection of the public against indoor exposure to radon (90/143/Euratom) stipulates values of 200 Bq/m^3 for new buildings and 400 Bq/m^3 for existing buildings.

At the beginning of August 2001, the new Radiation Protection Regulation entered into force, which, in line with European legislation, stipulates significantly lower dose limit values for the protection of the public and for individuals exposed to radiation at their workplace. The radiation protection requirements in the medical field, which is the main source of radiation for the majority of the population, were also tightened up. For the first time there are explicit stipulations concerning the protection of employees and the public from naturally occurring radioactivity. They cover, for example, flight personnel, who are exposed to cosmic radiation. The X-Ray Regulation is also currently being adapted to new European standards.

We have recently seen a, to some extent, very emotional public debate on non-ionising radiation and the possible danger to health from electromagnetic fields. Many people are especially worried about the radiation given off by mobile phone base stations, but also by mobile phones themselves. The Federal Government is taking these concerns seriously. It therefore appointed the German Radiation Protection Commission (SSK) to carry out a comprehensive appraisal of scientific findings on the effects of electromagnetic fields on health. The SSK submitted its assessment in September 2001, concluding that the current state of knowledge on the subject indicates that the present limit values provide adequate protection from proven dangers to health. At the same time, the Federal Government decided to intensify research in

German legislation to protect the public against ionising radiation

- The **Atomic Energy Act**, which was passed in 1959 and has since undergone a great many amendments, contains not only the fundamental rules on the operation of nuclear installations but also detailed provisions on radiation protection and the handling of nuclear fuels and radioactive wastes.
- Under the **Act on the Precautionary Protection of the Population against Radiation Exposure**, public exposure to radiation and radioactive contamination of the environment arising from "radiologically significant events" must be kept as low as possible. To this end, the Federal authorities are empowered to set dose and contamination limit values and to prohibit or restrict the distribution of food, animal feed and drinking water where limits are exceeded. In addition, the Federal and Länder authorities are obliged to constantly monitor environmental radioactivity and report regularly.
- The **Radiation Protection Regulation** contains detailed principles for radiation protection and defines limit values for protection against ionising radiation.
- The **X-Ray Regulation** governs the application of x-rays in the medical field as well as in research, technology and industry. It is currently being amended.

this area. The mobile phone operators have drawn up a voluntary agreement, pledging better cooperation in future with local authorities when planning and building masts, shared use of mast locations, alternative locations where possible to replace sites close to nurseries and schools and warning labels for mobile phones.

Q. Soil protection and combating desertification

The Earth's soil is the direct source of life for human beings, animals and plants. It also performs a large part of the biosphere's material processes of decomposition and conversion. Soil is the filter and storage medium that maintains the water and metabolic cycles, a repository of mineral reserves and energy sources, the foundation of agriculture and forestry and, not least, an archive of natural history and civilisation. Yet the soil's ability to perform its vital functions is now under threat in many places throughout the world:

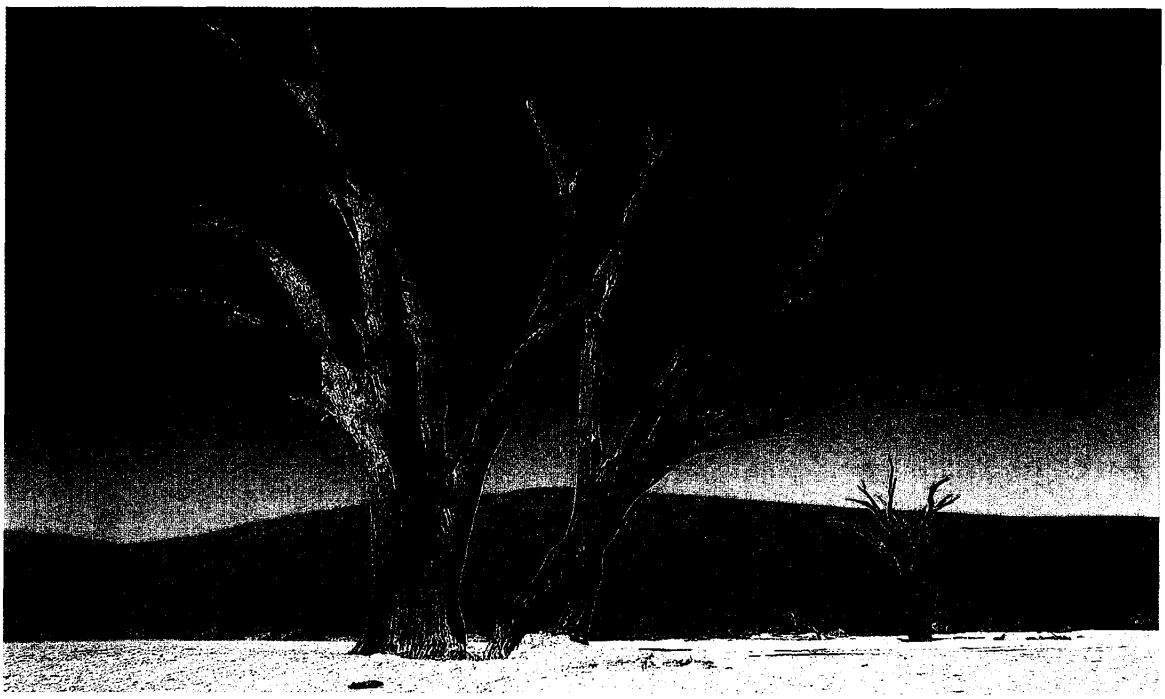
- One third of soils worldwide are now of only limited use for agriculture. A fifth of grasslands and a fifth of forest soils have either been severely degraded or completely destroyed.
- Nutrient-poor ecosystems such as lakes and forests are hardest hit by the constant input of acidifying substances and nutrients.
- The building of human settlements and roads results in large expanses of land being sealed. This limits the formation of groundwater and accelerates rainwater run-off, often causing flooding.
- Adverse soil changes and contaminated soil sites - due, for instance, to industrial installations, military training areas or improper waste storage and disposal - pose a health hazard to local residents and impair groundwater quality.
- In large parts of the world, most notably in Africa, the deserts are continuing to spread, while soils are becoming infertile and entire ecosystems are losing their capacity for natural regeneration, with the resulting adverse effects on the climate and food production.
- The loss of agricultural land is threatening the food supply and livelihoods of large sections of the population in numerous developing countries. As a result, around 135 million people will be forced to leave their homes in the coming years. Potentially, this trend poses a serious threat to international security.

Soils are very vulnerable systems, susceptible to all kinds of anthropogenic stress. As a rule, changes in soil take place very slowly and are difficult to discern. However, once the damage has occurred, it is often too late since it can only be repaired on a geological time scale – if at all. If we are to implement the sustainability principle, it must therefore be our aim in the future to use soil only in an environmentally sound way and ensure that no lasting damage is caused. We can only preserve the soil as a valuable ecological and economic asset if we do not make excessive demands of it.

As early as 1981, the UN's Food and Agriculture Organisation (FAO) adopted a World Soil Charter whose principles, set out in thirteen guidelines, are still valid today. The overriding imperative is for soils to be used sustainably so as to preserve them for future generations. Other important steps in the right direction included conventions to protect the floor of the oceans and the Antarctic, the entry into force in 1996 of the Convention to Combat Desertification (CCD), and the inclusion of soil protection as a key area in the work programme of the UN Commission on Sustainable Development (CSD) for the year 2000. To facilitate even more intensive support for measures to combat desertification, a new area of funding dealing with land degradation is to be set up in 2002 within the Global Environmental Facility (GEF), the international fund which finances environmental projects.

The Convention to Combat Desertification (CCD), the secretariat of which is in Bonn, created an internationally binding framework for active co-operation between the countries affected by desertification and the industrial nations. The aim is to stop the increasing destruction of natural ecosystems by taking concerted measures in all the relevant fields of economic and social development. It centres on the development of action plans at national and regional level and focuses on some forty countries in Africa's arid regions. In September 2001, Annex V to the Convention, which contains implementation measures for Eastern Europe and Central Asia, came into force. The partner countries concerned have undertaken to give these measures priority in national planning and in the deployment of their human and financial resources. Germany is supporting the developing countries as part of bilateral co-operation schemes through many projects designed to combat desertification.

In a move to conserve soils in the Alps, a soil protection protocol was adopted in October 1998 by the fifth Alpine Conference. Its aim is to preserve the functions and unique characteristics of Alpine soils, which are under a particular threat of erosion. Preparations to ratify the Protocol are currently underway.



R. Conservation of mountain areas

Mountains are an integral component of the global ecosystem, influencing life on Earth in many different ways. High mountain ranges, like the Sierra Nevada in the USA, the Andes in South America, the Himalayas in Asia and the Alps in Europe, exert a particularly strong influence on climate and weather patterns in many parts of the world, since they form a break against the air mass regularly circulating around the Earth, i.e. the jet stream, and can change its direction. Mountains are also an important store and source of freshwater, minerals and energy as well as being home to a unique and species-rich plant and animal world. It is, above all, the growth and concentration of traffic, the development of tourism, the spread of human settlements and the intensification of agriculture and forestry that are threatening mountain areas

The Alps are one of Europe's most important mountain ecosystems. 1,200 kilometres long and up to 250 kilometres wide, this mountain range forms the border between different European climate zones and is the main watershed between the North Sea, the Mediterranean and the Black Sea. Major European rivers such as the Rhine and the Rhône have their source in the Alps. Covering a total area of 190,000 km2 and with some twelve to thirteen million inhabitants, the Alps are the highest and most densely populated mountains in Europe and are shared by eight States: Italy, Monaco, France, Switzerland, Liechtenstein, Germany, Austria and Slovenia.

The Alps are rich in mineral deposits, and mining has played a major role in the region since the dawn of human civilisation. Today, the Alpine region's other key economic activities are livestock farming, hydroelectric power generation and year-round tourism. It is, however, these very factors that pose the threat to the region's ecosystems; for, in recent decades, large areas of the Alpine region have suffered a substantial loss of landscape features, biotopes and species.

In order to protect the vulnerable ecosystems of the Alps from further destruction, the eight States directly involved and the EU have signed and ratified the Alpine Convention of 7 November 1991. This represents a global precedent, since it is the first convention to lay down a holistic and cross-sectoral sustainable development strategy for a region comprising so many different countries. Concrete steps to implement this Convention have been agreed in protocols. Nine protocols have already been completed, dealing with regional planning and sustainable development (1994), nature conservation and landscape management (1994), mountain agriculture (1994), mountain forests (1996), tourism (1996), soil protection (1998), energy (1998), transport (2000) and conflict resolution (2000). Protocols have yet to be agreed for the fields of population and culture, air quality control, water resources and waste management. Moreover, work has begun on creating an

Alpine monitoring and information system that will form the basis for a subsequent detailed report on the state of the Alps.

The German Federal Government has been pushing, with increasing success, for the adopted protocols to be implemented before they formally enter into force. Ratification of the nine protocols implementing the Alpine Convention is currently being prepared and should have been concluded by the end of 2002. In Germany's opinion, the next steps towards protecting the Alps and other mountain regions must be:

- Implementation of the negotiated protocols on regional planning and sustainable development, nature conservation and landscape management, mountain agriculture, mountain forests, tourism, energy, soil protection and transport;
- Application of the experience acquired in connection with the Alpine Convention to the work of formulating a European strategy for sustainable development of mountain regions as part of efforts to implement Article 13 of Agenda 21.

S. Environmental protection in the Antarctic

Encompassing an area of around 14 million km2, the Antarctic is the Earth's coldest and most inhospitable continent. Its massive ice layer, which is over four kilometres thick in places, holds around three quarters of all the earth's freshwater reserves. Although, little is known about some aspects of the ecosystem in this continent at the South Pole, we are now aware of the vital role it plays in the global ecological balance. Since exploration of the Antarctic began in the early 18th century, scientists from many countries have attempted to uncover the secrets of this inhospitable continent. Even today it remains uninhabited – apart from the research stations maintained there by several countries, including Germany, which has had a research station since 1981.

The Antarctic environment is under stress from the legacy of many years of unregulated waste disposal and effluent discharge from research stations, a sharp rise in tourism in recent years with all the ensuing problems, and the incursion of alien species into the ecosystem. This environment is extremely fragile. Due to the relatively limited range of species there and the slow growth cycles, especially among the few land-based fauna, the Antarctic's biotic communities are not able to adapt to environmental changes. This means that more rigorous environmental protection measures are needed here than in more temperate climate zones.

The demilitarisation of this "sixth continent" was achieved in 1959 with the Antarctic Treaty, to which 46 States have now acceded (Germany in 1978). Since then the Antarctic has been used solely for scientific

purposes and tourism, with all territorial claims by individual States being ruled out under the Treaty. The Antarctic Treaty was supplemented in 1991 by the Protocol on Environmental Protection (Madrid Protocol), which has since been signed by 27 States. It is under this protocol that the international efforts to protect the Antarctic are now being co-ordinated. The core points in the agreement are a 50-year ban on any exploitation of mineral deposits, strict limitations on tourism and the introduction of compulsory notification and authorisation for any activity undertaken in the Antarctic. Germany ratified the Protocol in 1994 and it came into force under international law on 14 January 1998.

The Antarctic Consultative States, of which Germany is a member, meet once a year to ensure that the Treaty and the Madrid Environmental Protection Protocol are being properly implemented. It is hoped that the exchange of information in this international forum will help to harmonise conservation measures, thus achieving common and permanent standards for efforts to safeguard the Antarctic ecosystem.

T. Public participation

If we are serious about the objective of sustainable development, if we in the industrialised countries really want to bring our lifestyles and patterns of production and consumption into harmony with the natural foundations of life on our planet and, at the same time, allow the poorer countries of this world to retain their scope for development, then we need the conviction and active participation of each and every individual. It is not something that governments can simply make happen by decree. There must be a broad social consensus on the objectives and an acceptance of the measures needed to achieve them.

An important step towards improving public access to information and involving the public in decision-making in areas that will change their lives in the interests of sustainability was taken by the fourth pan-European Conference of Environment Ministers in June 1998 in Aarhus, Denmark. 34 Member States of the UN's Economic Commission for Europe (ECE) and the European Union concluded an agreement on public access to information, participation in decision-making and access to justice in environmental matters. The Convention came into force in October 2001.

In subsequently signing the Aarhus Convention at the end of 1998, the Federal Government has underlined its political backing for the goals and substance of the convention. These goals include improving transparency of actions taken by public authorities in the environmental field and giving stronger participatory rights and greater scope for legal action to the public and environmental associations. The German government attaches great importance to strengthening citizens' rights, particularly in the environmental field.

The Convention must be ratified by the signatory States before it can become binding under international law. Germany will - in close consultation with her EU partners – effect ratification as soon as German law meets the requirements of the Convention. The EU, which is also a signatory to the Aarhus Convention, is preparing necessary amendments to the directives concerned. This process must be reflected in the relevant national measures.

Ever since environmental policy established itself as a policy field in its own right, we have seen a whole series of initiatives, recommendations and declarations on environmental education at regional, national and international level. This shows that Germany, like many other countries, regards environmental education as a matter of great political importance. Environmental education comprises all measures designed to inform the public about environmentally relevant issues. It takes place both within formal education, in schools and vocational training schemes for example, and in a broad spectrum of other learning settings – the so-called informal educational processes. Environmental education aims to sensitise people to ecological problems, foster general awareness of the necessity to protect the environment and create the cognitive and emotional conditions in which environmentally friendly patterns of behaviour can take hold in our society and culture. It should also teach the skills and knowledge people need to take an active part in shaping their social environment in a way that is ecologically sound. Environmental education sees itself as one element of a more comprehensive education towards sustainable development.

The special session of the United Nations General Assembly in June 1997 called on the UNESCO as the UN body with overall responsibility for environmental education to develop a detailed programme, carefully co-ordinated between the UN Organisations, for the implementation of Chapter 36 of Agenda 21 on "promoting education in schools, raising public

awareness and initial and ongoing vocational training" and to present it to the CSD. UNESCO has not yet concluded work on this programme.

U. Actors in the field of environmental protection in Germany

The Federal Republic of Germany is a federation comprising 16 constituent states or Länder. Administrative structures vary in some cases between individual Länder. There are 14,561 local authorities in Germany, which are grouped into 323 districts and non-district municipalities, which in turn form 34 administrative regions. The functions of government in the field of environmental protection are distributed between three tiers, namely the Federal Government, the Länder or state governments, and local authorities.

Responsibility for law-making in the environmental field is divided between the Federal Government and the Länder. In the fields of nature conservation, landscape management, water resource protection and regional planning, the Federal Government may only issue outline provisions, which are then fleshed out by the Länder. The Länder, whose representatives make up the Bundesrat, also influence federal legislation via this upper chamber. The enforcement of both federal and Land legislation is almost entirely a matter for the Länder and their two or three tiers of authorities (ministries, administrative regions, districts). A number of Länder have begun the task of implementing the measures agreed at Rio, for instance by entering into dialogue with the various social groups concerned and by developing a Land-wide sustainability strategy.

The municipalities and local authorities play a particularly important role in promoting sustainable development. With their powers of self-government and planning, they assume a high degree of responsibility for environmental matters. As the bodies responsible for land use planning, local public transport, facilities for drinking water and energy supply and waste and sewage disposal, the local authorities in Germany in particular have considerable scope for action in the field of environmental protection. Setting an example in the international arena, they have made great use of their opportunities, in many cases even before Agenda 21 was adopted in 1992 at the Rio Conference. As called for in Agenda 21, numerous local authorities have, since 1992, initiated a process of dialogue with citizens, local organisations and the private sector in order to draw up and implement local Agenda 21s. The key areas are energy, climate protection, conservation of biodiversity, transport, noise abatement, and building standards.

V. Social groups

If sustainable development is to be achieved in all spheres of life and economic activity, a change in consciousness and behaviour throughout society is required that cannot be achieved unless the public is given comprehensive information and unless all social groups are involved in taking environmental policy forward.

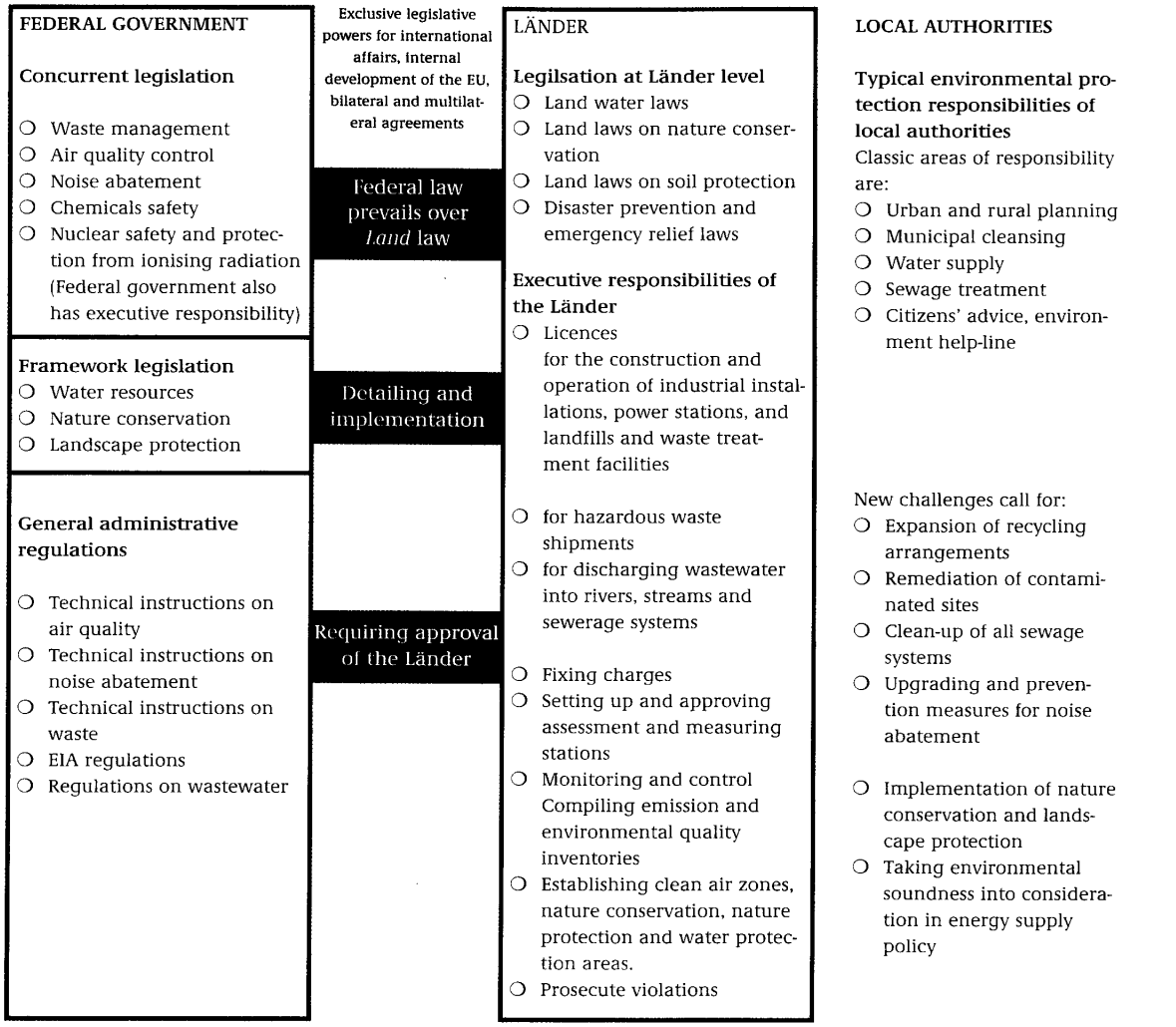
Involving all social groups in developing environmental policy plays a decisive role here. NGOs provide information and raise awareness, work on new areas of policy, organise campaigns, provide advice and education on environmental issues. Since environmental associations also enjoy a high degree of public confidence, they are able to present issues to the public in a way that is credible and effective.

This point was clearly made at the 1992 Rio Summit in the Agenda 21 action programme, which emphasises the importance of involving social groups in decision-making and the need to develop new forms of participation for these groups. Since then, NGOs have also started to take an active part in international conferences. In many cases they are also involved in producing national reports for international conferences. The European Union, too, maintains very close contacts with NGOs during all international environmental negotiations through the work of the Commission and the respective Presidency.

Germany has argued in the past, both in the domestic sphere and in the context of international co-operation, that NGOs should be more closely involved in the work of international organisations, in particular the UN Commission on Sustainable Development (CSD) and in the preparations for the World Summit on Sustainable Development in Johannesburg 2002. We shall maintain this position in the future. For the Federal Government it goes without saying that NGOs should play an active role in the Johannesburg World Summit. We have also provided non-material support and funding on a considerable scale for the work of national and international NGOs.

In Germany, NGOs have made a major contribution to the Rio follow-up process. The Forum on Environment and

Distribution of responsibilities and powers between the Federal Government, Länder and local authorities in Germany



Development co-ordinates the activities of German NGOs in the Rio follow-up process. It brings together around 60 individual organisations as well as networks of non-governmental organisations. The main function of the Forum is to review and promote implementation of Agenda 21 at national and international level. As a co-ordinating body for German environmental and development organisations, the Forum contributes significantly to the work of providing public information and implementing the Rio outcomes. In conjunction with the Federal Ministry of the Environment and the Federal Ministry for Development, the Forum organised the "Forum for Dialogue on the World Summit on Sustainable Development, Johannesburg 2002 – our responsibility for a sustainable future" in November 2001 in Berlin. Members of the public, along with numerous high-profile representatives of the world of politics and industry, trade unions, environmental and development associations and other social groups, used the opportunity of this dialogue to take stock of what has been achieved since Rio and to develop perspectives for the Johannesburg summit.

III. Strengthening environmental protection in international institutions

The needed to strengthen and intensify international co-operation is a logical consequence of the increasingly global nature of our environmental problems and their growing relevance to peace and security in the world. As at the national level, it is also crucial in the international sphere that environmental aspects be better integrated into other policy sectors, especially international trading, investment and finance activities. Germany has a vital vested interest in helping to solve the world's environmental and development problems. That is why Germany will continue to advance the cause of sustainable development by taking exemplary action at home and by displaying an active commitment within international organisations, in adherence to international environmental conventions and through our bilateral co-operation.

A. European Union

Germany attaches particular importance to the consolidation of EU environmental policy. Over the last 25 years we have seen a dynamic development of Community environmental policy, both in terms of content and institutional structures. The path leading from the first initiatives in the early 1970s through to the enshrinement of the Community's powers in environmental law pursuant to the Single European Act of 1987, the Maastricht Treaty of 1992 and the 1997 Amsterdam Treaty was a long, but successful one. Today, with over 200 directives and other regulations, some of them with far-reaching consequences, environmental policy is one of the central responsibilities of the Community.

In particular, the Amsterdam Treaty and its environmental provisions, which Germany played a key role in framing, has brought about further improvements (see box).

The new opportunities offered by the Amsterdam Treaty have already been systematically used to promote environmental protection in recent years. For example, the Council of the European Union, meeting in Cardiff in 1998, initiated the integration of environmental protection into other policy fields

The content of the Amsterdam Treaty

- Sustainable development becomes one of the key priorities of the EC and EU Treaties.
- As well as the Commission, the Council and European Parliament are now also obliged to observe a high standard of environmental protection.
- The European Parliament, which experience has shown to be progressive in its environmental policy, now has far greater decision-making powers in the legislative process for environmental issues.
- The Committee of the Regions must be regularly consulted on environmental policy measures.
- In the case of regulations that apply to the single market, it has become easier to formulate environmental protection clauses in stricter terms than envisaged under EU law.
- Of particular significance is the requirement that environmental aspects be integrated into all other areas of Community policy. This clause has been placed in a prominent position at the beginning of the Treaty and framed in precise terms.

and called upon the council formations for transport, agriculture, industry, the single market, development, fisheries, the economy and finance and international relations to develop strategies for implementing this. This process is forcing everyone concerned to systematically examine whether existing policies are compatible with the European Union's environmental policy objectives. The first positive results can already be seen, especially in the strategies of the council formations for transport, development and fisheries. The meeting of the European Council in Gothenburg in June 2000, which also set out the EU's strategy on sustainability (cf. Chapter I, section F), emphasised that these strategies should be concluded without delay and taken forward.

Progress in integrating environmental imperatives into other policies at Community level will, however, only be possible in the long run if Member States are willing to create the necessary conditions for this to happen at national level. For that reason, Germany set up in 2000 a "Secretaries of State Committee on Sustainability," with a mandate to develop a national sustainability strategy and monitor the integration of economic, ecological and social aspects.

The European Environment Agency (EEA) will have an important role to play in strengthening environmental policy in the EU by providing sound data on the state of the environment and by developing indicators that can provide the basis both for developing environmental policy priorities and objectives and for monitoring their success.

B. United Nations

As recognition of the global significance of environmental problems has grown, the United Nations has become an increasingly important actor in the field of environmental protection. 30 years after the UN Environment Conference in Stockholm, and ten years after the Rio Conference, there can be no doubting the UN's crucial role in working towards global sustainable development. However, it has also become apparent that institutional changes in the UN system are required if we are to respond adequately to the challenges of the coming years.

Alongside the United Nations Environment Programme (UNEP), which was founded in Stockholm, and the Commission on Sustainable Development (CSD), created in the wake of the Rio Conference, a whole host of other international organisations inside and outside the UN system are now active in the field of environmental protection. On the one hand, this increase in the number of institutions and the integration of environmental protection into other policy fields such as development, economic, industry or social policy must be regarded as a success. On the other hand, it places greater demands on UNEP as the only UN institution exclusively responsible for environmental protection. For that reason, it is essential that UNEP's limited financial resources be augmented. In view of the globalisation of the world economy which continues unabated, it is of decisive importance that environmental interests be consolidated and acquire a higher profile in the different sectors of international politics.

One of the main themes at the World Summit on Sustain-

able Development in August 2002 in Johannesburg will be the strengthening and development of structures for international governance in the areas of environmental protection and sustainable development. Here the Federal Government is intent on significantly strengthening environmental protection within the UN system and placing UNEP on a solid financial footing that will allow better planning. We believe that the Johannesburg summit should be the starting point for UNEP to gain a higher profile in Nairobi with the perspective of it developing into a global environment organisation.

Important elements in the strengthening of UNEP could be strategic partnerships between UNEP, the World Bank and the relevant international organisations in this field, with the aim of expanding measures to protect the environment. This could include capacity building and transfer of technology to developing countries. UNEP should make greater use of the possibility of demonstrating the tangible ecological and economic benefits of environmental policies and technologies through a number of small, handpicked pilot projects.

The future role of the UN's Commission for Sustainable Development (CSD) is important in any move to strengthen the governance structures in the field of global sustainability. The Federal Government believes that the work of UNEP and the CSD must continue to complement each other in the future. It will be of crucial importance to better coordinate the two areas of work and to develop the strengths of the CSD (holistic view of cross-cutting themes, intersectoral approach, high degree of involvement of non-governmental actors etc.) or to preserve them within a different structural framework.

UN Economic Commission for Europe

The Geneva-based Economic Commission for Europe (ECE), one of the United Nation's regional Commissions, has for over 50 years proved a valuable forum for dialogue and co-operation between the countries of North America, Western, Central and Eastern Europe and Central Asia (see box). This large group of countries accounts for 64 percent of world production, 60 percent of all exports and 65-70 percent of all patent registrations, while on the other hand it is also responsible for 60 percent of global carbon dioxide emissions (CO_2) to name just one example.

Environmental policy is an important focus of the ECE's work. Over the last two decades, legally binding international conventions and protocols have been developed on key environmental issues such as air quality control, water, environmental impact assessments and industrial accidents. These have played a pioneering role in the development of international environmental legislation.

Following the far-reaching changes that have swept through Central and Eastern Europe, interest has focused on integrating these countries into the global economy. In providing effective support for this process, it has been possible to make use of the experience and expertise accumulated by the ECE over many years. A central pillar of support for the transition process is the ECE's "environmental performance reviews," which analyse and assess environmental conditions so as to assist

The Member States of the ECE

Albania	Estonia	Latvia	San Marino
Andorra	Finland	Liechtenstein	Slovakia
Armenia	France	Lithuania	Slovenia
Austria	Georgia	Luxembourg	Spain
Azerbaijan	Germany	Macedonia	Sweden
Belarus	Great Britain	Malta	Switzerland
Belgium	Greece	Moldavia	Tajikistan
Bosnia-Herzegovina	Hungary	Monaco	Turkey
Bulgaria	Iceland	Netherlands	Turkmenistan
Canada	Ireland	Norway	Ukraine
Croatia	Israel	Poland	USA
Cyprus	Italy	Portugal	Uzbekistan
Czech Republic	Kazakhstan	Romania	Yugoslavia
Denmark	Kyrgyzstan	Russia	

progress in the environmental field, an area severely neglected in the past by the Central and Eastern European countries. Since the process of accession to the EU began for many Central and Eastern European countries, one of the ECE's main roles has been its "bridging function" for the successor states to the Soviet Union. This will be one of the key issues at the Conference of Ministers scheduled to take place in Kiev in 2003, entitled "Environment for Europe."

C. Organisation for Economic Co-operation and Development (OECD)

The Organisation for Economic Co-operation and Development (OECD) is a global forum for co-operation between industrial nations, 29 of which are currently members. The primary purpose of this co-operation is to achieve better international co-ordination in advance of decision-making processes taking place in the context of increasing globalisation. Supported by the OECD directorates, the organisation prepares and performs much of its work in numerous specialist committees and expert groups. Its most important fields of activity include economic policy, trade, capital movements, taxation, energy policy, agriculture, development aid and environmental affairs.

The OECD has opened its doors to allow other States to take part in intensive cooperation, in particular Brazil, India, Indonesia, China and Russia. This approach is apparent in the granting of observer status in certain OECD working groups in the "Environmental Action Programme" for the New Independent States, the successor states to the former Soviet Union.

Environmental protection issues have become increasingly important to the work of the OECD in recent years. In addition to issues of conventional environmental management, the organisation's work now also focuses on cross-cutting themes such as environment and trade, environment and agriculture, environment and transport and environment and fiscal policy. Within the OECD's Sustainable Development Initiative it has also been possible to link up many of the OECD's different fields of activity. Environmental policy is co-ordinated in the OECD Environment Policy Committee (EPOC). The meeting of Environment Ministers in May 2001 adopted an environmental strategy that placed great emphasis on integrated policymaking. Important environmental concerns are also addressed by the International Energy Agency (IEA) and Nuclear Energy Agency (NEA) as well as by the OECD's Development Assistance Committee (DAC).

In 1997, the OECD began to pay increasing attention to integrating the paradigm of sustainable development into its economic, social and environmental policies. The German Federal Government supports this approach both in the domestic field and by helping to develop concrete, pragmatic proposals for implementing sustainable development in the industrial nations.

The following are two examples of the OECD's work in the field of environmental protection:

- Launched in 1971, the OECD Chemicals Programme is designed to promote international harmonisation of methods for testing chemicals and plant protection agents and to set uniform criteria for good laboratory practice.
- The Environmental Performance Review project, which was started in 1991, subjects the environmental policies of all OECD Member States to comprehensive assessment. The first country it looked at in 1992 was Germany. Germany was also the pilot country for the second cycle of reviews which began in 2000.

The most important goal for the OECD's current and future work is to integrate the principle of sustainable development into all the organisation's fields of activity, including its work in the economic field where environmental aspects are to be

Member States of the OECD

Australia	**Finland**	**Iceland**	**Netherlands**	**South Korea**
Austria	France	Ireland	New Zealand	Spain
Belgium	**Germany**	**Italy**	**Norway**	**Sweden**
Canada	Great Britain	Japan	Poland	Switzerland
Czech Republic	**Greece**	**Luxembourg**	**Portugal**	**Turkey**
Denmark	Hungary	Mexico	Slovakia	USA

given far greater consideration. In concrete terms this means, for example:

- Specific projects on climate change, emissions trading, the pricing of economic goods and services to reflect their real environmental costs, on sustainable consumption patterns, new approaches to assessing ecological efficiency, the development of indicators for environmental evaluation and conservation and efficient use of resources.
- The application and updating of the OECD guidelines for multinational enterprises adopted in 2001, which also include statements on environmental conduct.
- The application and updating of the OECD guidelines on taking environmental aspects into consideration when awarding government-backed export credit guarantees.

D. G8 Economic Summit

For some years now, the environment ministers of the G8 countries (USA, Japan, France, Great Britain, Russia, Italy, Germany, Canada) and the European Commission have met in the run-up to each Economic Summit to discuss central issues of environmental policy. The purpose of these informal meetings is to co-ordinate the actions and negotiating strategies of the leading industrial nations and develop joint policy resolutions to this end. In addition to current environmental questions, such as climate change, biodiversity, forest conservation, combating environmental crime and protecting the world's oceans, the ministers have in the past given special attention to topics of immediate economic relevance. The general aim here is always to move closer to the paradigm of sustainable development.

At their meeting in Schwerin in 1999, chaired by Germany, the Environment Ministers agreed that increasing economic globalisation demands a global ecological regulatory framework for safeguarding the environment in the face of international competition. The ministers emphasised that "trade and the environment" must be a key topic on the agenda of the next round of world trade talks. At their meeting in 2001 in Trieste, Italy, the G8 Environment Ministers warned of the urgent need to step up efforts in the field of international climate protection policy. Both initiatives received the backing of the G8 heads of state and government at their meetings in 1999 in Cologne and 2001 in Genoa and proved successful: the World Trade Organisation's Conference in Doha in November 2001 agreed that separate negotiations should be held on environmental issues, and the Climate Conferences in 2001 in Bonn and Marrakech saw the breakthrough needed for the Kyoto Protocol on international climate protection to enter into force.

The main task for the future is to make concrete progress on defining the details of this ecological regulatory framework and to establish environmental standards for the individual sectors. Greater use should be made of economic and fiscal instruments so that polluters bear the burden of the real costs to the environment. It is vital to improve coherence between international financial, economic and environmental organisations and to ensure that environmental policy is recognised as an integral component of any effective approach to crisis prevention.

E. NATO

NATO is usually associated with collective military defence and political and strategic co-operation. Few people know that the North Atlantic Treaty also has a civil aspect, a "third dimension" pursuant to Article 2, which provides for the "further development of peaceful and friendly international relations" among the Parties. For about 30 years environmental protection has been part of this civil co-operation.

In 1969, NATO set up the Committee on the Challenges of Modern Society (CCMS) "in order to explore ways of making the most effective use of the experiences and resources of western nations to improve the quality of life of its peoples and to help humankind in the 20th century to learn how to live in harmony with a rapidly changing world."

Co-operation within the CCMS concentrates on an exchange of experience and information on defence- and security-related environmental problems, such as environmental protection in the military sector, hazard assessments for radioactively and chemically contaminated areas, methods and techniques for rehabilitating former military properties, and the connection between the environment and security. Germany believes that the CCMS should take on a higher profile as a body working for environmental protection as it relates to defence and to NATO, partially so as to avoid competition with other international organisations.

The environmental legacy of the Cold War and the tasks arising from that legacy are also a matter for co-operation within NATO's Euro-Atlantic Partnership Council (EAPC). Created in 1997, EAPC was formed out of the North Atlantic Co-operation Council (NACC), which was set up in 1991 by about forty countries, including the successor states to the Soviet Union. One of the key areas has been an examination of issues relevant to the environment in the catchment areas of the Black Sea and Caspian Sea. The CCMS is firmly established in this work. The attacks of 11 September 2001 have now placed terrorism and environmental security on top of the agenda. It is expected that a resolution to initiate a new programme of work on these themes will be passed.

F. International trading and financial institutions

The principle of integrating environmental protection into all policy fields applies not least to the work of the international trading and financial institutions.

The Global Environmental Facility (GEF)

The most important instrument for enabling countries, including the less developed countries, to make an effective contribution towards the achievement of internationally agreed environmental protection targets is the Global Environmental Facility (GEF), which was founded in 1991. It is a multilateral financing mechanism, jointly operated by UNDP, UNEP and the World Bank, and financed by the contributions of the industrialised countries. Its remit is to provide Third World countries and the countries of Central and Eastern Europe with financing, in the form of grants or concessionary loans, for projects and measures designed to protect the global environment. Since 1994, the GEF has been the financing instrument for the Framework Convention on Climate Change and the Convention on Biological Diversity. It administrates the financial aid measures connected with these two conventions.

The key areas of its work are climate protection, conserving biodiversity, protecting the ozone layer and international water resource protection. Measures to counter soil degradation and, in particular, to combat desertification and deforestation are earmarked for increased funding in the future. There are also plans to set up a new area of funding in 2002 for persistent organic pollutants (POP).

From its launch in 1991 to the end of the current phase of financing in 2002, the GEF will have received funds totalling 5.6 billion US dollars. Germany has contributed about US $ 600 million in all. Germany's concern for the fund's third phase of financing (2002-2006) is to reaffirm the GEF as the central financing mechanism for global environmental protection and to strengthen the GEF through a significant replenishment that will match its new areas of responsibility.

The World Trade Organisation (WTO)

The World Trade Organisation (WTO) plays a central role in promoting global economic development. It has created a comprehensive body of rules to safeguard free international trade. As far as environmental protection is concerned, the main way that governments come into conflict with WTO rules is when they intervene not only to protect their national environment but as a response to global and transboundary environmental problems by taking measures that also affect trade. It is for this reason the Committee on Environment and Trade was set up by the WTO in 1995. Its remit is to identify the relationships between trade and environmental measures in order to promote sustainable development and issue recommendations for any adjustments that need to be made to the rules governing the multilateral trading system. There are also new challenges to be faced as a result of the new round of world trade talks agreed at the Fourth WTO Conference of Ministers in Doha in November 2001. For the first time there will be separate negotiations on environmental issues, and environmental aspects will be taken into consideration in all other relevant areas of negotiation. The aim is the comprehensive integration of environmental aspects into WTO rules.

International financial institutions

Another important starting point for environmental protection activities in the financial services sector is to be found in the international financing institutions. The most important are:

- The World Bank group, especially the International Bank for Reconstruction and Development (IBRD),
- Regional development banks, such as the European Bank

for Reconstruction and Development (EBRD) and the European Investment Bank, and

- The International Monetary Fund (IMF).

The aim is to ensure that the environmental impact of projects that are funded by these institutions is given greater consideration. It is hoped that they will, in this way, act as a model for the private-sector banking and insurance industry. Individual institutions like the World Bank are already operating in accordance with stringent internal review guidelines for project appraisal. Environmental concerns should be better integrated even into the far-reaching strategic decisions of the finance institutions (e.g. country- or sector-specific programmes).

Export credit guarantees

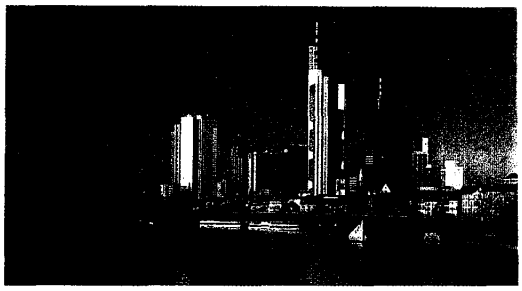
The state-backed export credit guarantee systems of the industrialised countries play a key role in international investment and financing activities. In the arrangements for granting guarantees against non-payment on exports, increasing importance is being attached to environmental impact and sustainability as criteria for assessing the projects being underwritten or funded. On the national level, the Federal Government issued a set of guidelines in 2001, to be used when granting export credit guarantees to ensure that ecological, social and development concerns are taken into account. At OECD level, also in 2001, the Member States agreed to follow Environmental Guidelines when issuing export credit guarantees. The Federal Environment Ministry's intends to press for adherence to these guidelines and to update them to include high ecological standards.

Commercial banks and insurance companies

In the economic sphere, the commercial banks and insurance companies are very important players in terms of environmental policy. As long ago as 1992, and again in 1995, the international banking and insurance industry, responding to an initiative of the United Nations Environment Programme, drew up a code of conduct aimed at consolidating the environment policy activities of individual financial service providers. The statements of the banking and insurance industries on environment and sustainable development made in 1992 at the Rio Earth Summit have since been updated and signed by more than 100 institutions. In many cases, it was consideration of these UNEP commitments that led financial service providers to introduce internal environmental management systems.

To ensure that environmental protection requirements are given greater consideration in international trading, investment and financing activities, a series of measures must, in the opinion of the German Federal Government, be taken in the immediate future:

- Greater dissemination and implementation of the commitments by the banking and insurance industry made in their statements on the environment and sustainable development;
- Application and implementation of environmental guidelines at OECD level to state-backed export credit guarantees;
- Higher profile for environmental protection in the negotiations in the new world trade round with the aim of integrating environmental aspects into WTO activities,
- Greater attention to environmental aspects in the imminent negotiations on economic co-operation between the EU and the ACP states as part of the Cotonou Agreement;



Frankfurt

- Introduction of preferential tariffs for imports of products from sustainably managed tropical forests by amending the regulation on the generalised system of preferences, then extending this to other product categories;
- Application of the OECD Guidelines for multinational companies to companies' environmental practices;
- Organisation of a workshop with the UN Conference on Trade and Development (UNCTAD) on options for integrating environmental aspects into investment agreements;
- Introduction of environmental clauses into global investment agreements.

Regional and bilateral co-operation

Bilateral co-operation with other industrialised and developing countries as well as with Central and Eastern Europe (CEE) countries is an important component of international environmental co-operation. Co-operation with many of these countries has been placed on a contractual basis with the conclusion of bilateral environmental agreements, while other co-operation arrangements are governed by multilateral agreements and programmes. The co-operation focuses mainly on the exchange of information, the resolution of bilateral questions and the transfer of environmental protection technology. Given the importance of this type of bilateral co-operation, Germany intends to strengthen it further in future. Indeed, the dialogue with our partner countries will increasingly move beyond bilateral topics to embrace efforts to tackle global environmental problems.

A. Countries of Central and Eastern Europe

The countries of countries of Central and Eastern Europe (CEE) continue to face major environmental problems. In some of the successor states to the Soviet Union, these problems have taken on disastrous dimensions. In particular the CEE States wishing to join the European Union will have to undertake enormous efforts to reach the level of environmental protection that prevails in the EU. There are two particular reasons why Germany has a direct interest in seeing improvements in the environmental situation in Central and Eastern Europe:

- Due to our geographical position as a neighbour of these countries, Germany is also affected by their environmental pollution.
- Environmental dumping, i.e. the relocation of industrial production to countries with lower environmental standards, must be prevented if we are to safeguard our industries and jobs.

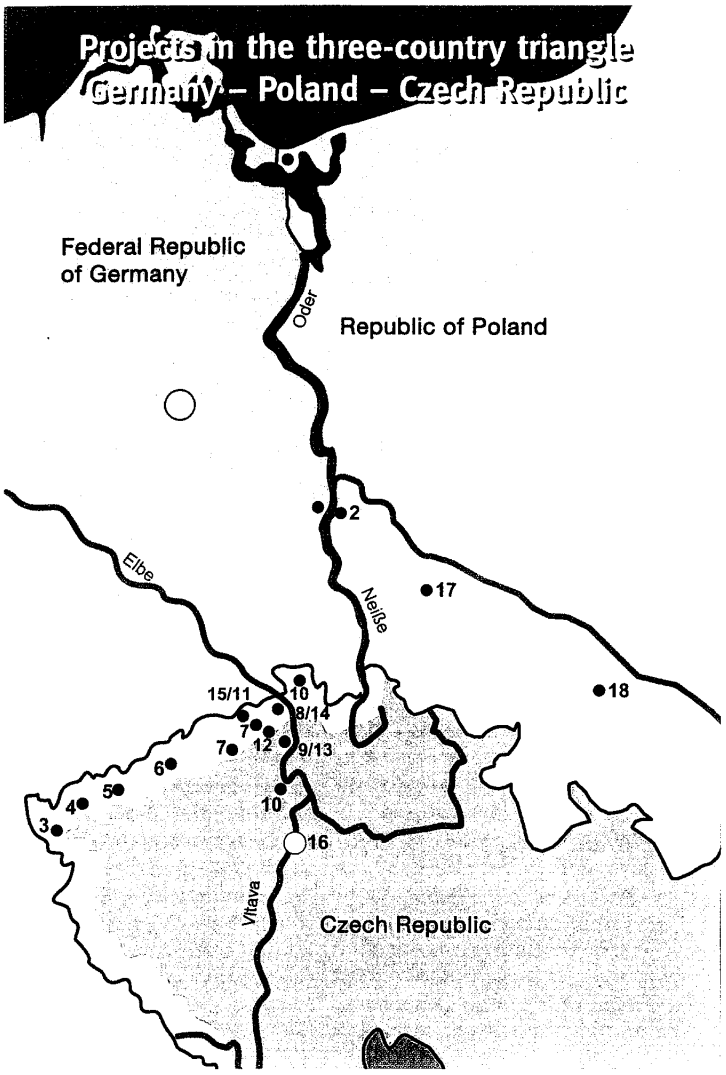
Germany took an early lead in supporting modernisation in these countries by launching, in 1992, a programme of "advisory assistance for establishing democracy and a social market economy," which includes measures to help them catch up with the environmental standards of Western Europe. Known simply as the Transfer Programme, it enabled 84 projects in the field of environmental protection to be implemented between 1992 and 1998 in Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland and Slovakia, as well as in Russia and the Ukraine. Since 2000, the

Federal Environment Ministry has run its own consultancy programme for Central and Eastern European countries, through which it funded 36 environmental projects in 2001 alone. The key areas of the programme are to prepare accession candidates for EU membership and to support flagship projects to improve the environmental situation in Russia and the Ukraine.

As part of this accession strategy, Germany is closely involved in the EU programme to develop effective institutions in the candidate countries.

However, looking beyond the EU accession candidates, it is also vital that the other CEE States be integrated into a European environmental partnership. Germany is, to this end, actively committed to the following measures in particular:

- Taking forward the "Environment for Europe" process in the UNECE framework, with a stronger focus on the New Independent States (NIS)
- Institutional capacity building as a prerequisite for environmental protection, by adopting a similar approach

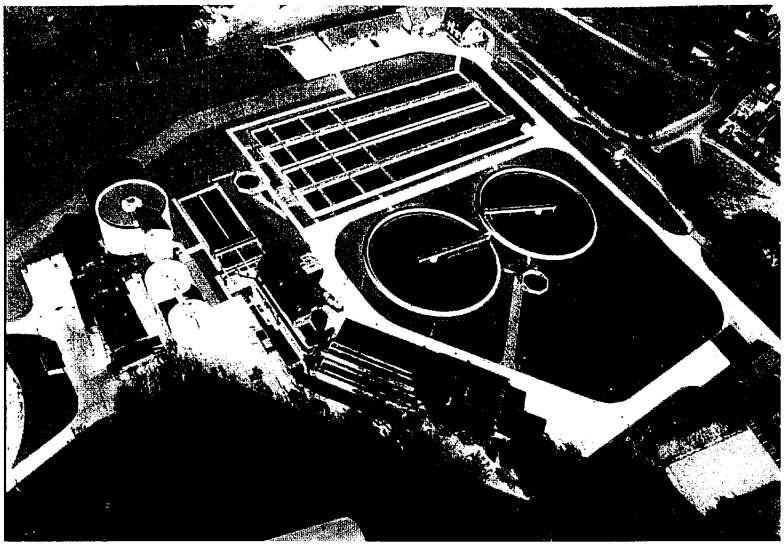


LEGEND

1 Sewage treatment plant, Swinemünde
2 Sewage treatment plant, Gubin - Guben
3 Environmentally friendly combined heat and electricity supply, Cheb/Eger
4 Tisova I power station in Sokolov
5 Flue gas scrubbing system for four blocks in the Prunerov I power station
6 Power station T 700 Chemopetrol Litvinov
7 Rehabilitating and upgrading the sewage treatment plant Most-Chanov and Teplice – Bystrany
8 Sewage treatment plant, Decin
9 Reduction in the level of organically bound halogens in the wastewater of Spolchemie in Usti nad Labem
10 Municipal sewage treatment plants for North Bohemia in Ceska Kamenice and Roudnice nad Labem
11 Installation and operation of 10 wind turbines ("U Tri Panu Wind Farm") in Olris/Moldava
12 Reduction in transboundary emissions of pollutants - measures for treatment of wastewater from the production of multi-nutrient fertilizers (NPK) at Lovochemie a.s.
13 Reduction in transboundary emissions of pollutants from production processes and measures to clean up a canal and contaminated site at Spolchemie a.s.
14 Environmentally friendly combined heat and electricity supply for the town of Decin
15 Installation and operation of 34 wind turbines - "Oldris/Moldava Wind Farm"
16 Article 35 – mobile system for remote air pollution monitoring (Lidar)
17 Reconstruction of the municipal wastewater treatment plant, Szprotawa
18 Modernisation of two tramlines in the city of Wroclaw as part of a scheme to reduce air pollution and noise emissions

Area covered by the pilot project in environmental protection, the "Air Quality Control Fund"

Source: Federal Environment Ministry



Sewage treatment plant, Gubin-Guben

to the twinning programme and strengthening the environment authorities,

- Promoting environmentally aware management in industry
- Improving the framework for financing environmental investments
- Funding other selected projects and measures to prepare the way for investment

Co-operation with Poland and the Czech Republic

Germany's position as a direct neighbour of the Republic of Poland and the Czech Republic makes co-operation with them in the field of environmental protection essential. Our common borders demand close co-operation on such matters as the protection of transborder watercourses from contamination, accident and disaster control, and environmental impact assessment of planned developments near the border. They also offer opportunities for environmental protection schemes along the border that are beneficial to both countries. For instance, in recent years several German-Polish and German-Czech projects have been carried out in the field of transboundary wastewater treatment (cf. map). Sewage treatment plants in Gubin and Swinemünde (in the Republic of Poland) and in Raudnitz on the Elbe, Böhmisch Kamnitz and Tetschen (in the Czech Republic) were built as joint environmental protection pilot projects, for which the German Federal Government provided funding of around DM 45 million.

Transboundary nature conservation is another area in which countries can successfully work together. The Internationalpark Unteres Odertal, a German-Polish nature reserve in the Lower Oder valley, is a model for other joint nature conservation areas now being established.

Since they occur primarily in the triangle where the three countries meet, air pollution problems have been tackled through trilateral co-operation. Due to the colossal air pollution, largely caused by the lignite processing industry, the area has become infamous as the "Black Triangle." In Northern and Western Bohemia, for example, some 56 tonnes of sulphur dioxide per square kilometre were, as recently as 1990, being pumped into the air, largely from filthy smokestack industries – a rate much higher than in the rest of Europe. In Saxony and in the (former) Polish voivodeships of Jelenia Góra (Hirschberg) and Walbrzych (Waldenburg), air pollution levels were also horrendously high, causing severe forest damage in the Erzgebirge and Riesengebirge mountains.

After just ten years of co-operation, a significant reduction in air pollution has been achieved, bringing a palpable improvement for everyone in the region. This has been achieved above all by ecological remediation and closure of large power plants in Northern Bohemia and Saxony (partly funded by the German Government) and the remediation of the Polish power plant at Turów. Today, the air quality situation in the "Black Triangle" is constantly monitored by a network of 43 measuring stations. The data recorded are shared and evaluated by all sides.

It is not only the large-scale power plants but also small and medium-scale facilities that are responsible for air pollution in the region, which is why EU funding has been provided for local authority infrastructure on the Polish and Czech sides of the border, thus further easing the transboundary pressures on the environment.

The specific problem of air pollution in the Erzgebirge mountain region was addressed

at the end 1996 by another German–Czech co-operation initiative. A report on the air quality of the Erzgebirge region, jointly published by the two countries in October 1998, traces trends in emissions and pollution levels and details the measures taken to reduce pollution. The "Programme of action for the Erzgebirge/Fichtelgebirge" published in November 2001, puts forward proposals for concrete measures to further reduce emissions. The Federal Environment Ministry and the Czech Environment Ministry intend to continue their collaboration in this field.

Beyond the question of the areas close to the borders, Poland and the Czech Republic have also increasingly benefited from the transfer of German experience acquired in ecological remediation efforts in the new Länder (formerly East Germany), which is especially relevant to these countries' preparation for EU membership.

To ensure close and comprehensive co-operation, joint environmental management and coordination bodies - the German-Polish Environment Council, the German-Polish Commission for Neighbourly Cooperation and the German-Czech Environment Commission – were set up. These bodies are founded on the environmental agreements which Germany signed with the Republic of Poland on 7 April 1994 and with the Czech Republic on 24 October 1996.

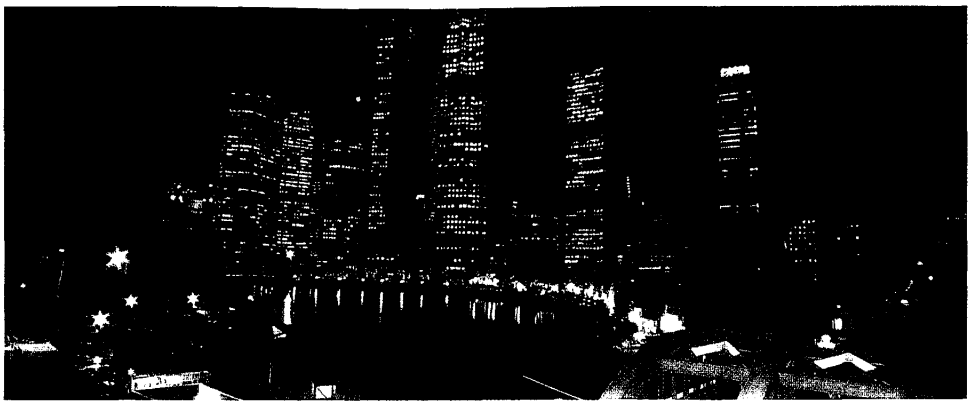
Stability Pact for South Eastern Europe

The stability pact for South Eastern Europe, adopted by the heads of state and government at the South Eastern Europe Conference in Sarajevo on 30 July 1999, forms the political basis for future co-operation in a region which, in addition to Albania and the successor states to Yugoslavia, includes Bulgaria and Romania, both candidate countries for accession to the EU. The Kosovo conflict and its ramifications also pose a major challenge for environmental protection in South Eastern Europe

On the initiative of the Environment Ministers of the countries of South Eastern Europe, the "Regional Environmental Reconstruction Programme REReP" was developed in March 2000 within the framework of the Stability Pact. The Environment Ministers agreed a list of priority environmental projects and approved the setting up of a REReP Task Force, which would be based in the Regional Environment Centre for Central and Eastern Europe. The programme comprises around 75 projects with a financing volume of 70 million euros for a period of five years. The balance sheet for the first two years of the programme can, with four completed projects and 30 still running, be said to be positive. Funds have already been allocated to 80 percent of the so-called "quick start projects" that were planned for the first two years, with a funding volume of 30 million euros.

The belief that environmental protection is particularly suited to making an important contribution to stabilising the region has stood the test of time. Since November 2000, the Federal Republic of Yugoslavia has also been part of the programme. Even now, through the regular cooperation between the countries of South Eastern Europe and the joint realisation of transborder environmental projects, a long-term cooperation is beginning to develop which is helping to create a climate of trust. In future the programme will play a more prominent role within the process of rapprochement between the countries of South Eastern Europe and the EU. This is also reflected in the Stabilisation and Association Agreements between the EU and Albania, Bosnia-Herzegovina, the Federal Republic of Yugoslavia, Croatia and Macedonia that have already been concluded or are currently being negotiated.

Very early on, the Federal Environment Ministry attached great importance to the activities in the field of environmental protection within the framework of the Stability Pact. For example, in 2000, it made funds available at short notice to guarantee start-up financing for the Secretariat of the REReP Task Force in Szentendre. The Federal Government, in collaboration with the Secretariat of the Task Force, is also implementing three projects with a financing volume of 3.6 million DM. The projects, which run from September 2000 to February 2004, concentrate on developing sustainable financing mechanisms for measures connected with the environment, developing a strategy for harmonisation with EU environmental standards and increasing the role of NGOs in environmental protection and nature conservation.



Singapore

B. Developing and newly industrialising countries

The global environmental problems demonstrate particularly clearly that if the whole world were to adopt resource-intensive modes of production and consumption whilst failing to pursue rigorous environmental policies, there would be little or no chance of achieving genuinely sustainable development in industrialised, newly industrialising and developing countries. Consequently, one of the aims of German co-operation on environmental policy with the developing and newly industrialised countries, both in multilateral forums and in bilateral relations, is to heighten awareness of the problems, identify appropriate ways forward, including technological co-operation, and – in collaboration above all with the Federal Ministry for Economic Co-operation and Development – to initiate appropriate projects and follow up with implementation support.

A scheme that has proved extremely useful in this area is the advanced environmental training programme for experts from developing and newly industrialised countries which is offered at the Centre for International Postgraduate Studies of Environmental Management at Dresden Technical University and co-funded by the Federal Environment Ministry, along with UNEP and UNESCO. The courses, which were first organised as far back as 1977, enjoy an excellent international reputation and are becoming increasingly popular. Over 1,000 participants from 120 developing and newly industrialising countries have taken advantage of this scheme to date.

Environmental cooperation with developing countries is taking place on a wide range of different levels. Examples of these levels include the ASEM process, the German-Singapore Environmental Technology Agency and collaboration with countries as varied as China, Mexico and South Africa.

The ASEM process

An example of this is the ASEM process, which came into being in March 1996 at the first Asia Europe Meeting (ASEM) in Bangkok. The 25 States participating in this process – 15 EU States, seven members of the Association of South East Asian Nations (ASEAN), the People's Republic of China, Japan and South Korea as well as the European Commission – have from the outset attached very great importance not only to economic affairs and cultural exchange but also to environmental questions. In January 2002, the first meeting of ASEM Environment Ministers took place in Beijing at which key areas of cooperation were identified and a contribution to preparations for the World Summit on Sustainable Development in Johannesburg 2002 was made.

Germany-Singapore Environmental Technology Agency

An example of successful regional co-operation is the Germany-Singapore Environmental Technology Agency (GSETA), which is based on an agreement signed in November 1991 between the environment ministries of the two countries. The GSETA primarily supports the transfer of environmental protection know-how and technology to the Asia-Pacific region by holding joint events organised by the two ministries. These seminars, workshops and conferences discuss environmental management and environmental technology and are aimed at senior experts from the

environmental authorities of the entire region. Since 1992, the GSETA has been arranging seminars on all important aspects of environmental protection. Almost 700 experts from the environmental authorities of 17 States in the Asian Pacific region had taken part in the thirteen events held by mid-2001. Private industry will be more closely involved in future to intensify the transfer of knowledge and technology.

China

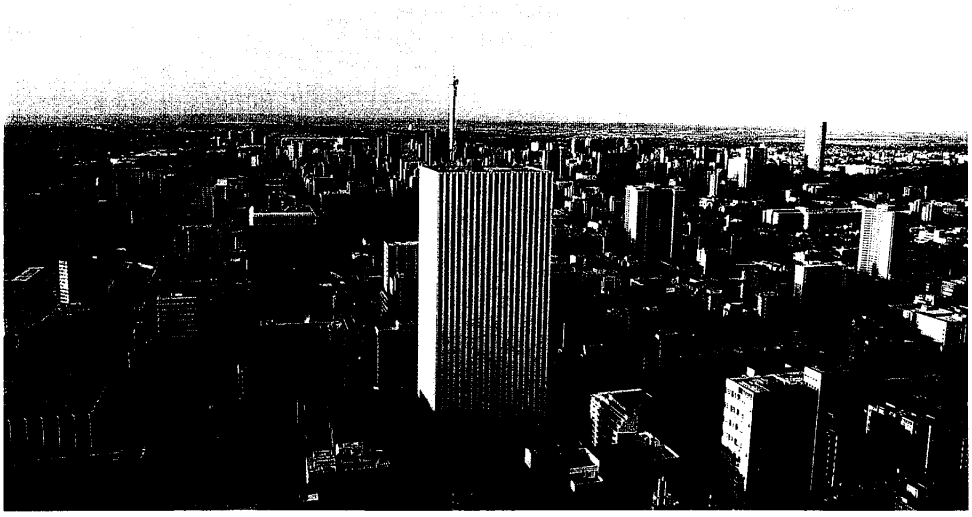
Given the potential global impact of the environmental problems of the world's most densely populated nation, tackling them is a matter of particular urgency. Sino-German cooperation in the field of the environment and development has made great progress. Since the 1980s, the two countries have been successfully working together in many areas, for example in increasing energy efficiency, renewable energy, reducing emissions of pollutants, waste disposal and sewage treatment, water supply, the protection of natural forests and the development and manufacture of CFC-free refrigerators. This cooperation has also specifically worked to improve the efficiency of the Chinese institutions involved.

Initiated by the two heads of government, Chancellor Gerhard Schröder and Prime Minister Zhu Rongji, a Sino-German environment conference was held in Beijing on 12./13. December 2000. The conference was by far the largest and most comprehensive bilateral event of its kind to date. At the conference, an agreement was reached to intensify cooperation on environmental matters, such as drafting and enforcing environmental legislation, environmental management, energy efficiency, renewable energy, protection of soil and water, and preservation of biodiversity. The two countries also stressed the importance of free-market instruments in environmental protection, such as wastewater and waste charges. Building on the bilateral environmental agreement of 1994, Germany and China expressed their intention to hold regular environment forums, the industry segment of which will be organised by the industry associations of the two countries.

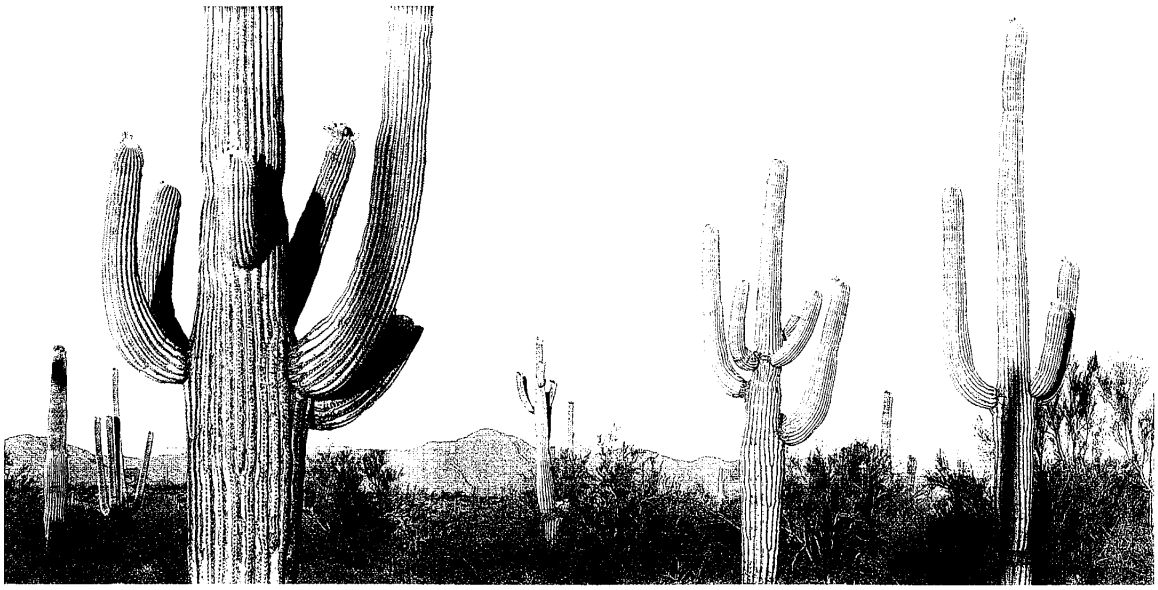
South Africa

South Africa is not only one of the most important countries on the African continent, in recent years it has also become one of the principal representatives of the developing countries in international politics. This is also reflected in the fact that South Africa is hosting the World Summit on Sustainable Development which will be held in August/September 2002 in Johannesburg and which is expected to inject new impetus into global environment and development politics. In 1998, the Environment Ministries of Germany and South Africa signed an environmental agreement which forms the basis for the bilateral cooperation between the two counties in environmental matters.

As a result of this, a delegation led by Federal Environment Minister Jürgen Trittin visited South Africa in December 1999, and the two countries agreed a work programme for their cooperation. In June 2000, the two ministers made a joint visit to the World Exposition EXPO and looked at questions of sustainable tourism and international climate protection. In 2000,



Johannesburg



there were also a number of visits to Germany by South African experts, and in 2001 German waste management experts took part in a conference on waste management issues in South Africa. With the imminent World Summit in view, the two countries also intend to intensify their bilateral cooperation still further.

Mexico

With its rapidly expanding population and high rate of economic growth, Mexico faces immense challenges in terms of protecting the environment and managing its natural resources. Although Mexico is an OECD member, it has extensive rural regions that still have the character of a developing country and it therefore has a special role to play in international environmental protection initiatives as an interface between industrialised and developing countries. An environmental co-operation agreement was signed in 1993 between the environment ministries of Germany and Mexico. Its main objective is to consolidate our co-operation in all environmental policy matters by strengthening dialogue and improving the exchange of information. As part of this agreement, the Federal Environment Ministry has been taking part in TECOMEX, Mexico's most important trade fair in the environmental sector, which focuses on different topics each year. The theme of the 2000 show was solar energy, of the 2001 show renewable energies and water supply. Parallel events taking place in connection with TECOMEX, in which the German-Mexican Chamber of Commerce and German industry had a decisive involvement, were greeted with great interest on the part of Mexican industry.

C. Industrialised countries

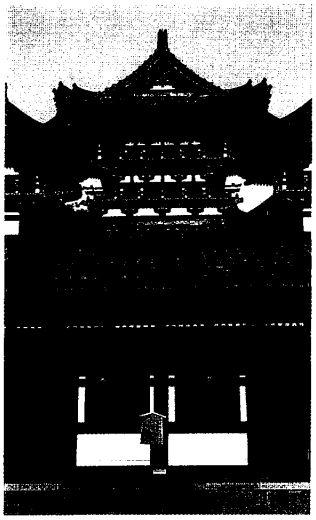
Since the industrialised countries have similar economic and social conditions but also bear similar degrees of responsibility for global environmental problems, their ongoing dialogue on environmental policy helps them to achieve a better understanding of environmental problems and prepare the ground for common solutions.

USA

Germany's bilateral environmental dialogue with the USA has a particularly long tradition. It began back in 1974 with an intergovernmental agreement on co-operation on environmental affairs. US-German co-operation intensified in 2000 when Germany organised a workshop on climate protection which brought together senior representatives of both governments, industry and non-governmental organisations and resulted in regular German-American environment forums and environmental policy consultations.

Japan

An intergovernmental agreement on co-operation in the field of environmental protection was signed by Germany and Japan in 1997. For Japan, the agreement with Germany was the first of its kind with an EU country. Its primary aim is to foster a reciprocal exchange of information on environmental protection. In particular, the agreement will encourage an exchange of experience and closer dialogue on



possible joint strategies in the fields of waste management, wastewater treatment, noise abatement, soil protection, the ozone problem and the greenhouse effect. The agreement provided for the establishment of a joint committee which, at its first meeting in December 1998, agreed on a series of joint activities for 1999/2000. In 2000, workshops were held in Berlin on dioxin and hazardous waste.

France

The special relationship between France and Germany is also reflected in the field of environmental policy. In addition to co-operation in the multilateral arena, especially within the European Union, the two countries also have a variety of bilateral contacts at national and regional level. Particular mention should be made in this context of the Franco-German Environment Council, which was founded at the Franco-German summit of 2/3 November 1989 on the basis of an exchange of notes. The Council's annual meetings alternate between Germany and France, with the participation of representatives of both environment ministries as well as Germany's Länder and France's regions and départements. Depending on the current situation, the agenda covers not only purely bilateral issues but also European and global topics. Apart from facilitating the co-ordination and development of bilateral initiatives, the Franco-German Environment Council also provides a forum for cultivating contacts between the relevant actors on both sides. The Franco-German Environment Council is at the same time a symbol and a catalyst for the common Franco-German commitment that also extends to the environment sector.

South Korea

The Federal Republic of Germany and the Republic of Korea – one of the twelve most important industrialised countries – intend to work together more closely in the future in the field of environmental protection and to put their work on a more formal footing. An agreement to this effect was signed by the Federal Environment Minister Jürgen Trittin and his South Korean counterpart Myung-Ja Kim on 6 July 2001 in Berlin. As future areas of cooperation, the agreement lists waste management (particularly waste incineration and recycling), along with the transfer of environmental technology, renewable sources of energy, environmental impact assessments, nature conservation and environmental education. The experienced gained in the field of environmental protection during the process of German reunification may also be of interest to Korea.

Vosges du Nord/Pfälzerwald biosphere reserve

V. Annex

A. Bilateral environmental agreements

I. Intergovernmental agreements

Brazil
- Joint Declaration on the environment of 20.11.1996

Bulgaria
- Intergovernmental Agreement on co-operation in the field of environmental protection of 11.06.1993

Czech Republic
- Intergovernmental Agreement of 12.12.1995 on co-operation in the field of water management for transboundary watercourses (ratified)
- Intergovernmental Agreement of 24.10.1996 on co-operation in the field of environmental protection (ratified)

Hungary
- Intergovernmental Agreement of 09.05.1993 on co-operation in the field of environmental protection

Israel
- Intergovernmental Agreement of 11.12.1991 on a co-operation project in the field of nature conservation and landscape management
  Intergovernmental Agreement of 17.03.1993 on co-operation on environmental protection and nature conservation

Japan
- Intergovernmental Agreement of 26.08.1997 on co-operation in the field of environmental protection

Malaysia
- Intergovernmental Agreement of 18.11.1995 on co-operation on environmental protection

Poland
- Agreement between the German and Polish government on the formation of the German-Polish Environment Council of 17.06.1991
- Treaty on co-operation in the field of management of border watercourses of 19.05.1992 (ratified)
- Intergovernmental Agreement of 07.04.1994 on co-operation in the field of environmental protection (ratified)

Romania
- Intergovernmental Agreement of 05.04.1993 on co-operation in the field of environmental protection

Russian Federation
- Intergovernmental Agreement of 28.05.1992 on co-operation in the field of environmental protection

Slovak Republic
- Intergovernmental Agreement of 14.07.1997 on co-operation in the field of environmental protection

Turkey
- Intergovernmental Agreement of 05.10.1992 on co-operation in the field of environmental protection

Ukraine
- Intergovernmental Agreement of 10.06.1993 on co-operation in the field of environmental protection

USA
- Intergovernmental Agreement of 09.05.1974 on co-operation in environmental affairs

II. Interdepartmental Agreements with the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

Albania
- Interdepartmental Agreement of 13.10.1992 on co-operation in the field of environmental protection

Australia
- Interdepartmental Agreement of 11.06.1992 on co-operation in the field of environmental protection

Canada
- Interdepartmental Agreement of 17.09.1990 on co-operation in the field of environmental protection

China
- Interdepartmental Agreement of 26.09.1994 on co-operation on environmental protection

Czech Republic
- Interdepartmental Agreements of 27.11.1992, 19.12.1994, 24.10.1996, 09.07.1997, 08.12.1999, 23.10.2000 und 21.11.2000 on the implementation of environmental pilot projects (including flue gas treatment systems in Prunerov I power station, wastewater treatment plants in Decin, in Northern Bohemia, and in Most/Teplice, a fund for air quality control, environmentally friendly heat and electricity supply for Cheb/Eger, and U tri Panu wind farm)

Estonia
- Interdepartmental Agreement of 25.05.1992 on co-operation in the field of environmental protection

Hungary
- Interdepartmental Agreement of 27.11.1990 on the provision of an air quality measurement network for the city of Budapest (technical co-operation)

India
- Memorandum of Understanding of 08.09.1998

Indonesia
- Interdepartmental Agreement of 25.02.1993 on co-operation on environmental protection

Iran
- Interdepartmental Agreement of 04.10.1992 on co-operation on environmental protection

Latvia
- Interdepartmental Agreement of 14.04.1993 on co-operation in the field of environmental protection

Lithuania
- Interdepartmental Agreement of 16.04.1993 on co-operation in the field of environmental protection

Mexico
- Interdepartmental Agreement of 25.10.1993 on co-operation in the field of environmental protection

Poland
- Interdepartmental Agreements of 21.04.1994, 11.04.1995 and 18.6.2001 on the implementation of the joint environmental protection pilot projects (including the Swinemünde sewage treatment plant and the Gubin-Guben waste-water treatment plant)

Poland/Czech Republic
- Agreement between the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety of the Federal Republic of Germany, the Minister for Environmental Protection, Natural Resources and Forestry of the Republic of Poland and the Minister for the Environment of the Czech Republic of 17.09.1996 on the exchange of data on air pollution in the "Black Triangle" area.

Singapore
- Interdepartmental Agreement of 26.11.1991 on co-operation on environmental protection

South Africa
- Interdepartmental Agreement of 10.03.1998 on co-operation in the field of the environment

South Korea
- Memorandum of Understanding on Environmental Cooperation of 6 July 2001

Uruguay
- Interdepartmental Agreement of 20.5.1998 on co-operation in the field of environmental protection

B. International environmental agreements

I. Rio agreements

The most important results of the United Nations Conference on Environment and Development held in Rio de Janeiro in June 1992 are:

1. CONVENTIONS

a) United Nations Framework Convention on Climate Change (Climate Change Convention) (the foundation in international law for international co-operation to prevent adverse changes to the climate and their potential consequences)
b) Convention on Biological Diversity (the basis for international co-operation to protect biodiversity)
c) United Nations Convention to Combat Desertification of 17 June 1994 (entered into force in 1996)

2. DECLARATIONS

a) Rio Declaration
The Rio Declaration lays down the basic principles which are to govern the future behaviour of States towards each other, and of States towards their citizens, in the field of environment and development.

b) Statement of Forest Principles
The Statement of Forest Principles lays down principles for the management, conservation and sustainable development of forests in all climate zones

c) AGENDA 21
Agenda 21 is a comprehensive action programme to achieve sustainable development through new forms of co-operation throughout the world in the field of environmental and development policy.

II. Other multilateral treaties and programmes in the environmental protection field

1. Protection of the stratospheric ozone layer:

- Vienna Convention for the Protection of the Ozone Layer of 22 March 1985
- Montreal Protocol on the Protection of the Ozone Layer of 16 September 1987

2. Water protection:

- Convention on the Protection of the Marine Environment of the North East Atlantic of 22 September 1992 (OSPAR Conventions)
- Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Convention) of 29 December 1992, with global application, provisions extended by supplementary protocol of 7 November 1996
- Agreement for Co-operation in Dealing with Pollution of the North Sea by Oil and Pollutants (Bonn Agreement) of 13 September 1983, as amended on 22 September 1989
- International Conferences on the Protection of the North Sea, which take far-reaching landmark decisions on policy to protect the North Sea
- Convention on the Protection of the Marine Environment of the Baltic Sea Area of 22 March 1974 and of 9 April 1992 (Helsinki Convention)
- Convention for the Prevention of Marine Pollution from Ships of 1973, as amended by the Protocol of 1978 (MARPOL 73/78), with global application
- Convention on the Protection and Use of Transboundary Watercourses and International Lakes of 17 March 1992
- Washington Declaration and Global Action Programme to Prevent Marine Pollution from Land-based Sources (Washington, November 1995)

3. Waste management legislation:

- Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal of 22 March 1989

4. Nature and species conservation:

- Convention on the International Trade in Endangered Species of Wild Flora and Fauna of 3 March 1973 (CITES)
- Convention on Wetlands of International Importance of 2 February 1971 – RAMSAR Convention
- Convention on the Conservation of Migratory Species of Wild Animals of 22 June 1979 (Bonn Convention; CMS), and specific regional agreements under the Convention to protect seals, small cetaceans, bats and waterfowl

- Agreement on the Conservation of Antarctic Seals of 1 June 1972 (CCAS)

5. Air quality control:

- Geneva Convention on Long-Range Transboundary Air Pollution of 13 November 1979, including the protocols dealing with sulphur, nitrogen oxide and volatile organic compounds (VOCs)

6. Chemicals safety

- Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (Rotterdam Convention on PIC) 10 September 1998 (PIC Convention)
- Stockholm Convention on Persistent Organic Pollutants of 23 May 2001 (POP Convention)

7. Cross-sectoral agreements

- Convention on Environmental Impact Assessment in a Transboundary Context (Espoo Convention) of 25 February 1991
- Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (Aarhus Convention) of 25 June 1998.

8. Regional treaties and programmes

- Protocol of Environmental Protection of 4 October 1991 to the Antarctic Treaty
- Convention on the Protection of the Alps of 7 November 1991 (Alpine Convention)
- Environmental Action Plan for Central and Eastern Europe (EAP), concluded in May 1993 in Lucerne by the second conference of Ministers of Environmental Affairs
- Agenda 21 for the Baltic Sea Area (Baltic 21)

C. Abbreviations and acronyms

Bq	Becquerel
C_2F_6	Hexafluorethane
CBD	Convention on Biodiversity
CCD	Convention to Combat Desertification
Cd	Cadmium
CEE	Central and Eastern Europe
CEN	Comité Européen de Normalisation (European Committee on Standardisation)
CF_4	Tetrafluormethane
CFCs	Chlorofluorocarbons
CH_4	Methane
CHCs	Chlorinated hydrocarbons
CO	Carbon monoxide
CO_2	Carbon dioxide
CSD	Commission on Sustainable Development
DDT	Dichlordiphenyltrichlorethene
EBRD	European Bank for Recovery and Development
EC	European Communities
ECE	Economic Commission for Europe (UN)
ECNC	European Center for Nature Conservation
EDTA	Ethylene diamine tetra-acetic acid
EEC	European Economic Community
EIB	European Investment Bank
ERP	European Recovery Program
EU	European Union
EURATOM	European Atomic Energy Community
FAO	Food and Agriculture Organization of the United Nations
G	Gramme
G 7	Group of seven leading economic powers (USA, Canada, Japan, Great Britain, France, Italy, Germany)
G 8	G7 States plus Russia
G 24	Group of 24 Western industrial nations (OECD Member States)
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GGEs	Greenhouse gas emissions
GJ	Giga-joule
GLP	Good Laboratory Practice
GRT	Gross registered tonnes
GSETA	Germany-Singapore Environmental Technology Agency
H_2	Hydrogen
Ha	Hectare
HC	Hydrocarbon
HCB	Hexachlorobenzene
HCFCs	Partially halogenated CFCs, hydrochlorofluorocarbons
HCH	Hexachlorocyclohexane

HELCOM	Helsinki Commission (Baltic Marine Environment Protection Commission)
HFCs	Hydrofluorocarbons
Hg	Mercury
IAEA	International Atomic Energy Agency
ICAO	International Civil Aviation Organization
ICLEI	International Council for Local Environmental Initiatives
ICN	International Conference on the Protection of the North Sea
ICPDP	International Commission for the Protection of the Danube against Pollution
ICPEP	International Commission for the Protection of the Elbe against Pollution
ICPOP	International Commission for the Protection of the Oder against Pollution
ICPRP	International Commission for the Protection of the Rhine against Pollution
IEA	International Energy Agency
IFCS	Inter-Governmental Forum on Chemical Safety
IMO	International Maritime Organisation
INC	International North Sea Conference (International Conference on the Protection of the North Sea)
ISO	International Organisation for Standardisation
ITTO	International Tropical Timber Organization
ITUT	Internationales Transferzentrum für Umwelttechnik (International Transfer Centre for Environmental Technology)
IUCN	International Union for the Conservation of Nature
KfW	Kreditanstalt für Wiederaufbau (Reconstruction Loan Corporation)
MAI	Multilateral Agreement on Investment
MEA	Multilateral Environmental Agreement
N or N_2	Nitrogen
N_2O	Nitrous oxide, laughing gas
ng	Nanogramme
NGOs	Non-governmental organisations (e.g. associations)
NH_3	Ammonia
NH_4	Ammonium
NIS	New Independent States (successor states to the former Soviet Union)
NO_3	Nitrate
NO_x	Oxides of nitrogen
O_2	Oxygen
O_3	Ozone
ODS	Ozone depletion substances
OECD	Organisation for Economic Co-operation and Development
OSPAR	Oslo-Paris Commission - Convention for the Protection of the Marine Environment of the North-East Atlantic
P	Phosphorous
PACs	Polycyclic aromatic carbons
Pb	Lead
PCB	Polychlorinated biphenyl
PCDD/F	Polychlorinated dibenzodioxins and dibenzofurans ("sum parameters" for dioxin)
PCP	Pentachlorophenol
PFC	Perfluorocarbons
PHARE	Poland and Hungary Action for Restructuring of the Economy (EU assistance programme extended to promote the process of scientific and social reform and to develop market economies in CEE countries)
PIC	Prior Informed Consent (by countries receiving imports of certain chemicals)
PJ	Petajoule
PM	Particulate matter
POP	Persistent Organic Pollutants
ppb	Parts per billion
ppbv	Parts per billion by volume
ppm	Parts per million
R22	Chlorodifluoromethane
SF_6	Sulphur hexafluoride
SO_2	Sulphur dioxide
TACIS	Technical Assistance for the Commonwealth of Independent States
TBT	Tributyl tin
TCDD	2,3,7,8 tetrachlorodibenzo-p-dioxin
UBA	Umweltbundesamt (Federal Environmental Agency)
UN	United Nations
UNCED	United Nations Conference on Environment and Development (June 1992 in Rio de Janeiro)
UNCLOS	United Nations Convention on the Law of the Sea of 1982
UNCTAD	United Nations Conference on Trade and Development
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UVB	Ultraviolet type B radiation
VOCs	Volatile organic compounds
WBGU	Wissenschaftlicher Beirat für globale Umweltveränderungen (German Advisory Council on Global Change)
WHO	World Health Organization
WTO	World Trade Organization

A selection of links to institutions working in the field of international environmental policy

Institutions in Germany

http://www.bmu.de
The Federal Environment Ministry's website contains information on all important aspects of the environment and includes links to topics of further interest

http://www.umweltbundesamt.de
The Federal Environmental Agency's website includes one of Germany's most comprehensive environmental databases.

http://www.bfn.de
One of the key areas the Federal Nature Conservation Agency's website focuses on is international nature conservation

http://www.bfs.de
The Federal Radiation Protection Agency has information on a range of topics, including radiation protection and disposal and transport of nuclear waste.

Institutions in Europe

http://europa.eu.int/comm/environment/"
The website of the European Commission's Environment Directorate General contains a wealth of information on the EU's environmental policy.

http://www.eea.eu.int
The European Environment Agency gathers information about the environmental situation in Europe and has extensive data on European environmental policy.

Global institutions

http://www.unep.org
The website of the United Nations Environment Programme (UNEP) provides information on global environmental policy and includes links to many of the secretariats for UN conventions on the environment.

http://www.unece.org/env/welcome.html
The UN's Economic Commission for Europe (UNECE) is active in many areas of environmental policy and was the driving force behind many conventions on the environment.

http://www.un.org/esa/sustdev/csd.htm
The UN Commission for Sustainable Development provides a wealth of information in the run-up to the World Summit on Sustainable Development to be held in August 2002 in Johannesburg.

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Printed on paper composed entirely of recycled materials.

It's our Future.

hamos

Solutions for Recycling

Electrostatic Separation Technologies Made in Germany by Hamos GmbH

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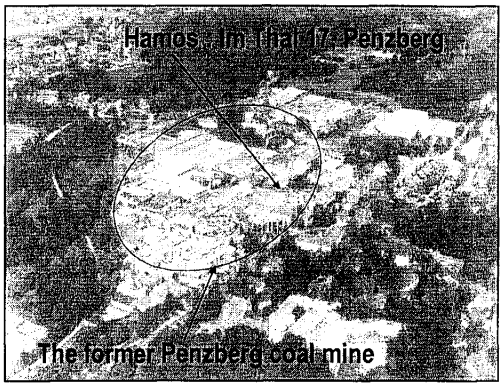
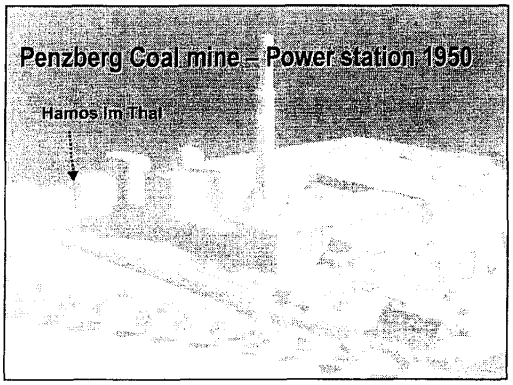
Solutions for Recycling

Electrostatic Separation Technologies made by Hamos / Penzberg

Penzberg, Sept. 3, 2003

hamos

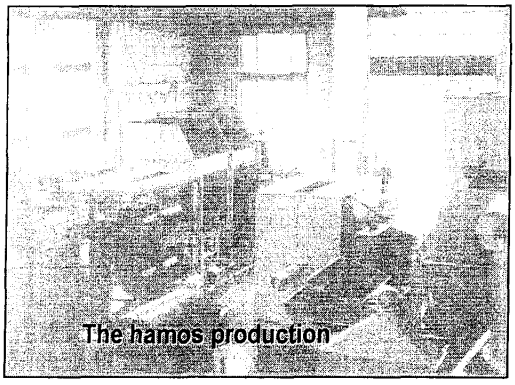




hamos -the Company

- Hamos was founded in 1981
- **hamos** = **Ha**rro **M**üller-**S**türcken (the founder)
- 20 full- and half-time employees.
- All staff members are highly qualified engineers, technicians and administrators.
- We focus on R&D, tests and sales
- we assemble, production is made at local suppliers or manufacturers

hamos



The know-how

- working on electrostatic separation for metals and plastics since 1993
- know-how in R & D, engineering, "prototyping" and production
- even complete systems including hardware are designed
- 16 patents or patent claims
- hamos is a partner for many recyclers and well known in the industry

hamos

The Product Range

hamos offers separation systems for the industry:

- electrostatic metal separators
- electrostatic plastic separators
- electrostatic separators for special purposes (minerals etc.)
- electronic all metal separators
- complete recycling systems
- others

hamos

7

Electrostatic Separation Technologies made by hamos

- KWS electrostatic metal separators
  - Separation of non-ferrous metals
- EKS electrostatic plastic separators
  - Separation of plastic mixtures

hamos

8

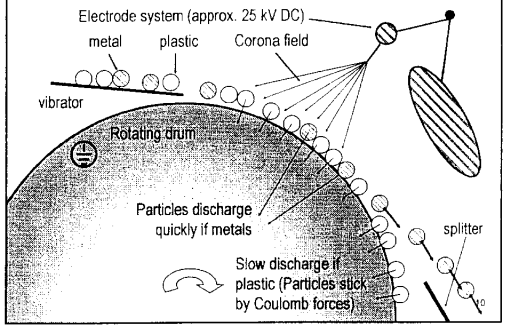
Separation of Non Ferrous Metals

Coarse Metallic Particles	▪ Eddy current separators ▪ Shaker tables (gravity separators) ▪ Air separators (zig-zag) ▪ (Heavy media wet separation)
Fine Metallic Particles	▪ **Electrostatic separators** ▪ Water tables ▪ (Shaker tables) ▪ (Air separators)

hamos

9

Physics of a KWS Electrostatic Separator



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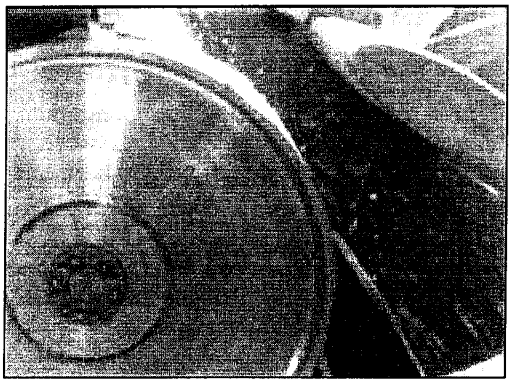
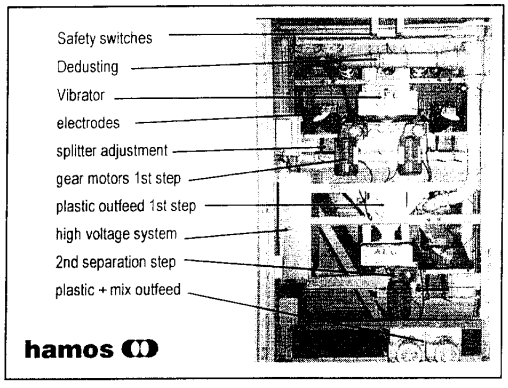
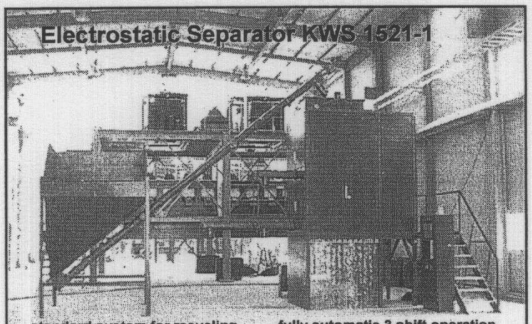




Electrostatic Separator KWS 1521-1



- standard system for recycling
- 3/4 drums 1.500 mm
- throughput up to 1000 kg/hr
- fully automatic 3 shift operation
- low energy / manpower
- +145 machines in 26 countries

Electrostatic Separation Technologies made by hamos

- KWS electrostatic metal separators
  - Separation of non-ferrous metals
- EKS electrostatic plastic separators
  - Separation of plastic mixtures

hamos 14

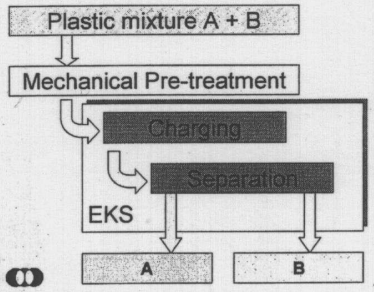
Possible physical effects for plastic separation

Plastic	Specific weight [g/cm³]	Di-electric Constant (at 800 Hz)	Surface resistance [Ω]
PP	0,91	2,3	1×10^{13}
PE	0,92 ÷ 0,96	2,28	5×10^{13}
PS	1,13	2,5	5×10^{14}
ABS	1,04 ÷ 1,06	3,2 ÷ 4,6	5×10^{13}
PVC	1,39	2,8 ÷ 4,5	5×10^{13}
PET	1,35	3 ÷ 4	5×10^{14}

We use tribo-electric effects (Di-electric Constant)

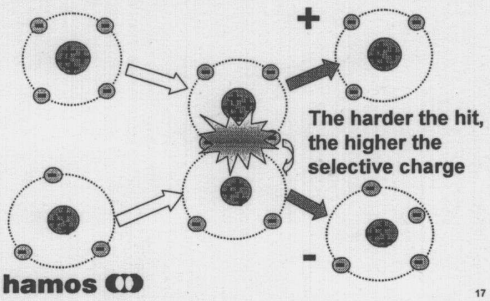
hamos 15

Tribo-electric separation



hamos 16

Hamos tribo-electric Charging

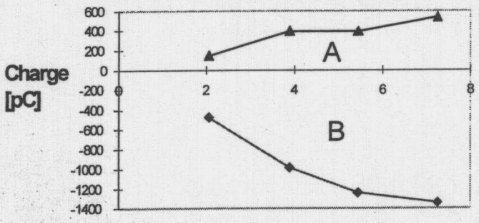


The harder the hit, the higher the selective charge

hamos 17

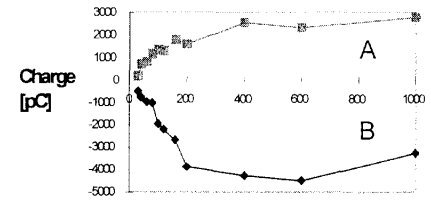
Influence of Acceleration on charge

"We hit harder" for best results



hamos Max. Acceleration [m/s^2] 18

Influence of number of contacts "We hit a lot" for best results



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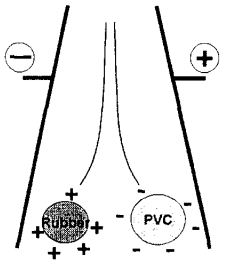
Separation of charged particles in a high voltage field

Selectively charged particles are attracted by high voltage electrodes (± 35 kV)



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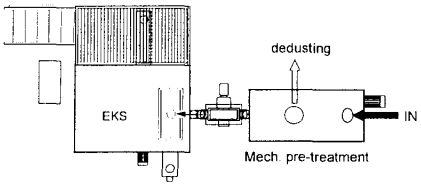
EKS 1021-0 standard design

for one-step separation

Throughput 500...750 kg/hr



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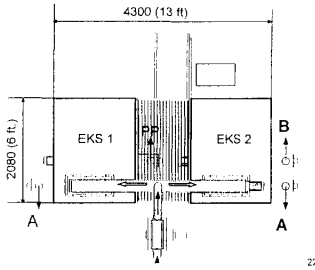
EKS-Twin design

Parallel operation of 2 units - double throughput

- throughput ~ 1.500 kg/hr



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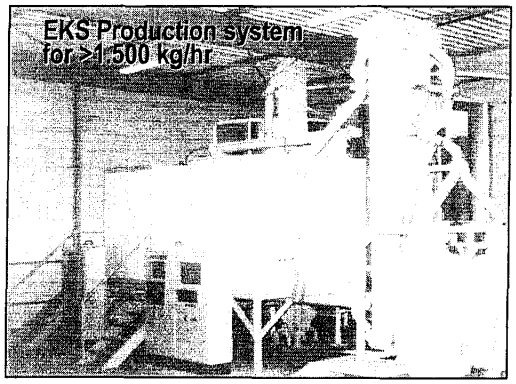

Benefits of EKS electrostatic separators

- Universal application (1 machine, many different plastic mixtures)
- DRY separation process
  - no liquids or chemicals required
- Separation independent from
  - specific weight (HDPE from PP)
  - colors (grey HIPS from grey ABS)
  - shape (pellets from pellets)

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The hamos EKS

- typical product purities > 99,5%!
- additional polarization effects separate metals, wood, glass etc. as well
- production scale machines run 24 / 7
- stand alone system
- practically no manpower required
- low sorting costs (typically 20$/ton.)
- no direct wear parts
- easy to adjust to new plastic mixtures
- many different plastic mixtures can be separated
- well proven design- >30 sold machines
- Patented design

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Metal separation with hamos KWS electrostatic separators

Examples

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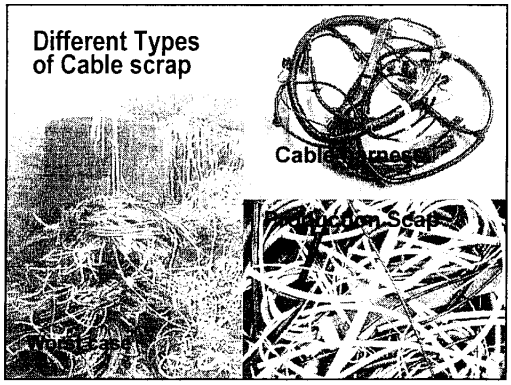
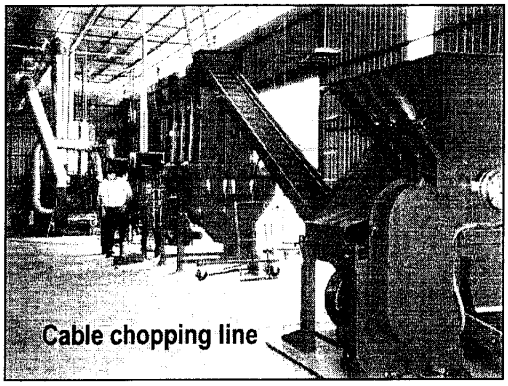
Different Types of Cable scrap





Cable Recycling/Chopping line

Shredding / Granulation for mechanical liberation of metal and plastics

sorting of metal and plastic with shaker table/air table

clean metal | metal containing plastics

?

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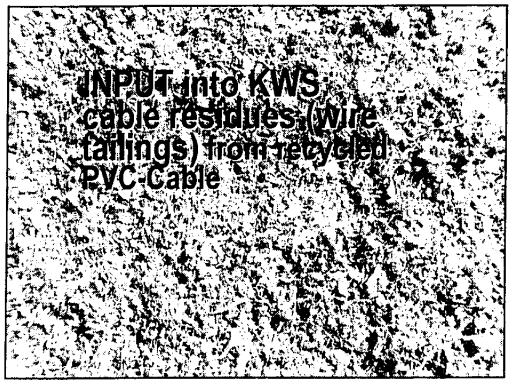

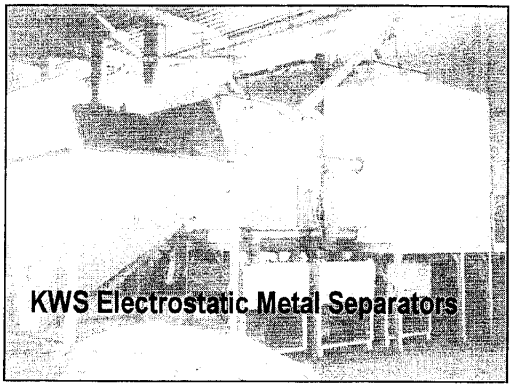

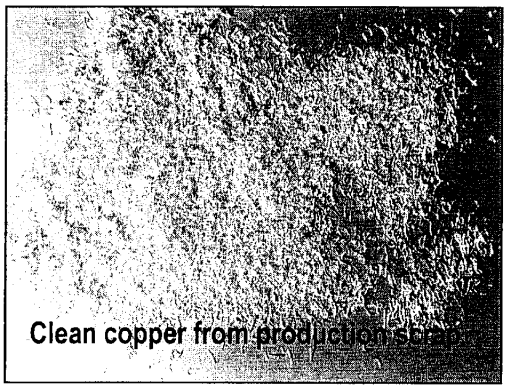

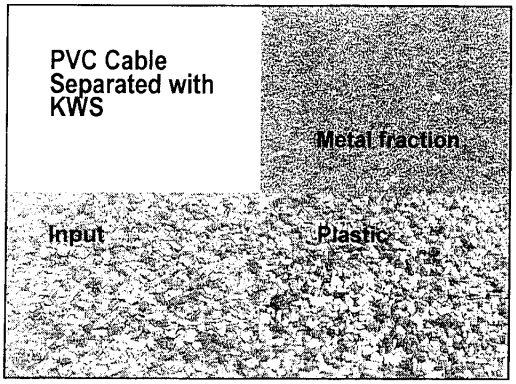

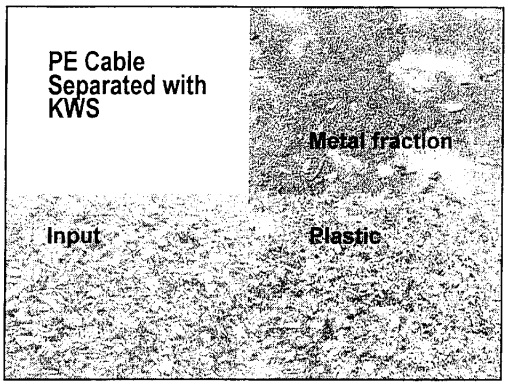

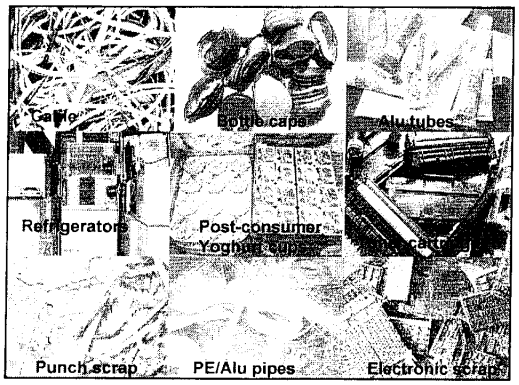

What makes the KWS system pay back so shortly ?

- **KWS recovers even finest NF-metals**
- **Dry** separation process - no water is used.
- Separation efficiency 90 ...99%
- cleans plastics in seconds
- separates up to 2.000 kg/4,400 lbs/hr
- no wear costs / practically no manpower
- low separation costs (< 15 US$/ton, incl. energy, manpower, financing etc.)
- fully automatic 3 shift operation (7/24)
- Cable recycling: 5% copper loss - NET profit $ 60 / hr!
- **typical ROI in < 6 months**

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> 145 worldwide References

Analysis, APU GmbH, ABC Apparatebau Caputh GmbH, A. T. I. s.r.l., AWATA Metals SDN BHD, Barrie Metals Inc., Baumann Recycling GmbH,Bay Metal Inc., Baytec GmbH, Behrendt Recycling GmbH, Berger Recycling, Bifa GmbH, Bögner Kabelverarbeitung KG, Bollow GmbH, Booth Ltd., Boxstrong Ltd., Bühlmann Alteisen AG, Cablo, Chang Pwu, Citiraya Industries, CNS, Correns&Co.LTD., Cupral, C.V. Suma, Daimler Benz, David J. Joseph Inc., Drusetal Kabelrecycling, EBS, Engineering Services, Envitronic GmbH, EVB Entsorgungs GmbH, Exner-Werth Recycling GmbH, Flinsch Recycling, Fournier Metaux, Franzefoss, Fuba Elektronik, Fullypak, Görgens Engineering, Gotthard Nilson, GS Recycling AB, Hämmerle GmbH, Harig, Henting Kabelrecycling GmbH, HSB GmbH, ISOSPORT GmbH, Jäger Kunststoffrecycling, Kabelmetall Elektro GmbH, Kanemura, KJK Trading, KLUTON GmbH, KME Kunststoffwerk, Laakmann&Zahn, Lirec, Löchner GmbH, LO-ZAN Plastik S.P.A., Martens Kabelrecycling, Mereco, Metalcavi SRL, Metalfill , Metallkontor Kurth KG, Metallschmelze Tattendorf GmbH, Metallverwertung München GmbH, MRT, MTN, MUDI Applied Technologies, Nakajima Shoten Co. Ltd., Nico-Metall GmbH, NOBA Kabelverwertung GmbH, Oxanna, OVG Universität Magdeburg, Pape, Placucci Alessandro, Pogoda Recycling, RANK Research Sdn Bhd, RASA Industries, Recycling Dr - Sickert GmbH, Remet A.G., Replast spol. s.r.o., Result AG, RETEC GmbH, RETECH GmbH, REPA GmbH, Reto Recycling, Rips Alcatel, Rips Alcatel, S.A.G. Straßburger, SAMBO METALS Co. Ltd., Schmoll AG, Schwalger GmbH, Shred Tech, Sewon Metals, Simons B.V., Simsmetal Ltd., Sirec S.A., SKY Plastic mbH , Salzburger Metall & Kabel GmbH, SOLVAY S.A., Straub Metallhandelsgesellschaft mbH, SUBRA METAL BHD, SUPERDRAGON Ltd, Teigen Hellik, Teik Siang Industries Sdn Bhd, Terlouw Recycling, Timmermanns Kabelrecycling B.V., TKM Verbundwerkstofftrennung GmbH, TNO Environemental and Energy, Toshiba, Totaal Recycling, Trentech AG, Trienekens Entsorgung, Trigo Recycling, TRH Trading BV, Türk PIRELLI A.S., USEG GmbH, VOKA, Weber Kabelrecycling, WER GmbH, Xaver Wiederkehr, XBK Kabel, WTG, Yeon Hung Packing, Zipkat & Speer GmbH & Co. KG, Zirec Kabelzerlegung GmbH, Zoffoli, Zohar S.B.A., ... and many more

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KWS references in Asia (8 KWS in Taiwan)

- **AWATA Metals SDN BHD,** MY-Johor Bahru (Cable)
- **CHANG PWU,** TW-Taipeh (Electronic scrap)
- **CITIRAYA INDUSTRIES,** TW-Lung Shen*** (Electronic scrap)
- **Correns&Co.LTD.,** JP-Tokio (Electronic scrap)
- **C.V. Suma,** ID-Surabaja (Cable)
- **Fullypak,** MY-Selangor (Cable)
- **MUCH FORTUNE TECHNOLOGY,** TW-Taipeh (Electronic scrap)
- **Kanemura,** JP-Kumamoto (Cable)
- **KJK Trading,** SG-Singapur (Electronic scrap)
- **Nakajima Shoten Co. Ltd.,** JP-Tokyo (Electronic scrap)
- **NAN YA PLASTICS Corp,** TW-Hsinkang Village (Electronic scrap)
- **RANK Research Sdn Bhd,** MY-Prai (Electronic scrap)
- **RASA Industries,** JP-Tokyo (Electronic scrap)
- **SAMBO Metals Co.,Ltd.,** KR-Chungchongnam-Do (Electronic scrap)
- **SEWON Metals,** KR-Seoul (Electronic scrap)
- **SUBRA METAL BHD,** MY-Kuala Lumpur (Electronic scrap)
- **SUPERDRAGON Ltd,** TW-Taipeh (Electronic scrap)**
- **Teik Siang Industries Sdn Bhd,** MY-Butterworth (Electronic scrap)
- **Toshiba,** JP-Tokyo (Electronic scrap)
- **Yeon Hung Packing,** KR-Seoul (Plastic/Aluminium)

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Recycling of electronic scrap with hamos KWS and ERP system

Examples

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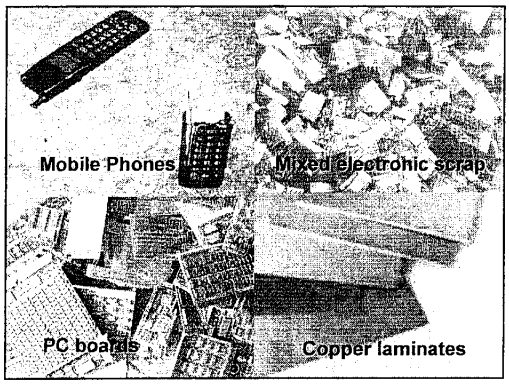

PC board recycling (principle)

Coarse Shredding for mechanical liberation

Pulverisation for metal/non-metal liberation

Separation of metal and non-metal with KWS electrostatic separators

clean metal | Non metallic fraction

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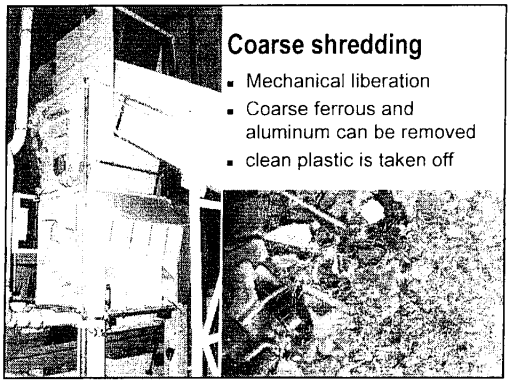
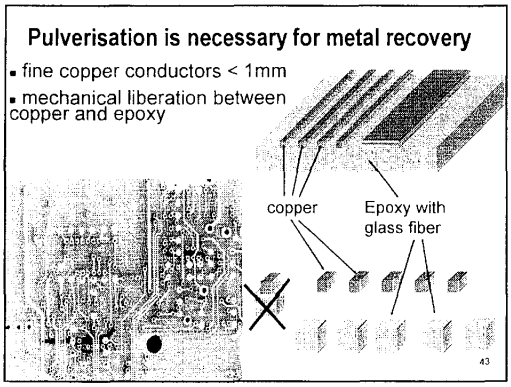
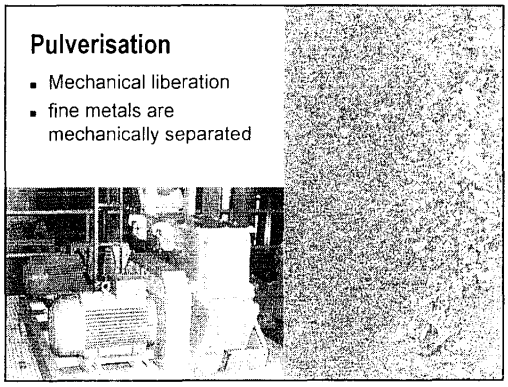
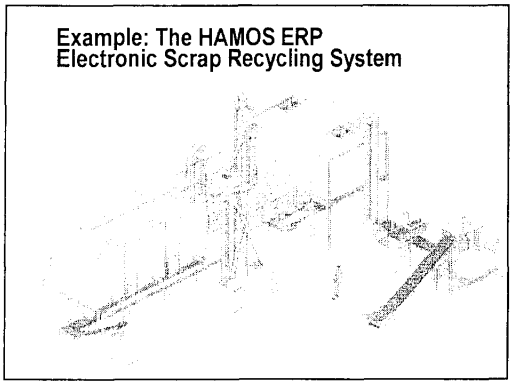


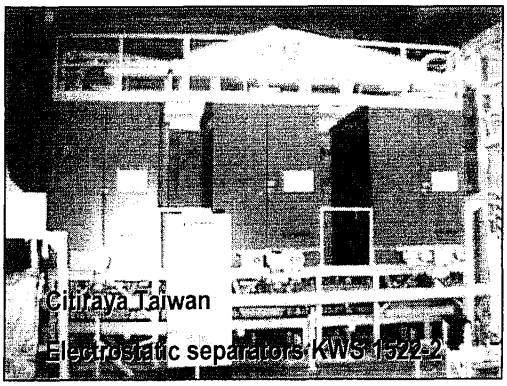
Coarse shredding

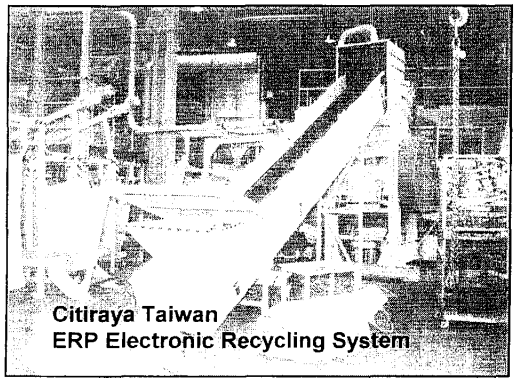
- Mechanical liberation
- Coarse ferrous and aluminum can be removed
- clean plastic is taken off

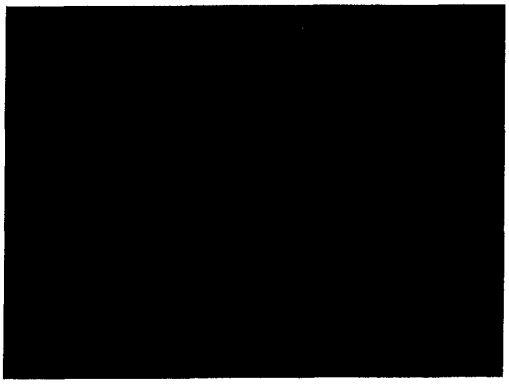

Pulverisation is necessary for metal recovery
▪ fine copper conductors < 1mm
▪ mechanical liberation between copper and epoxy
copper
Epoxy with glass fiber
43

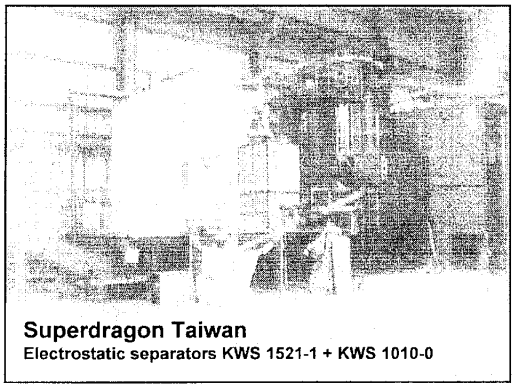

Pulverisation
▪ Mechanical liberation
▪ fine metals are mechanically separated


Example: The HAMOS ERP Electronic Scrap Recycling System


Citiraya Taiwan
Electrostatic separators KWS 1522-2


Citiraya Taiwan
ERP Electronic Recycling System

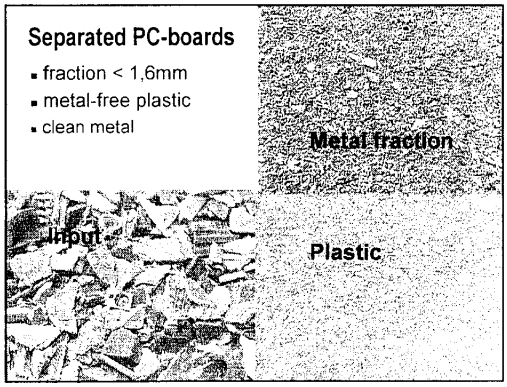




Superdragon Taiwan
Electrostatic separators KWS 1521-1 + KWS 1010-0

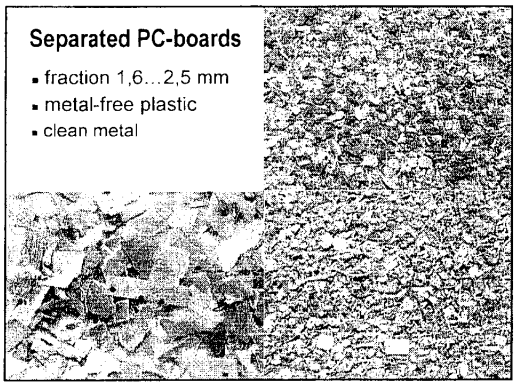
Separated PC-boards

- fraction < 1,6mm
- metal-free plastic
- clean metal



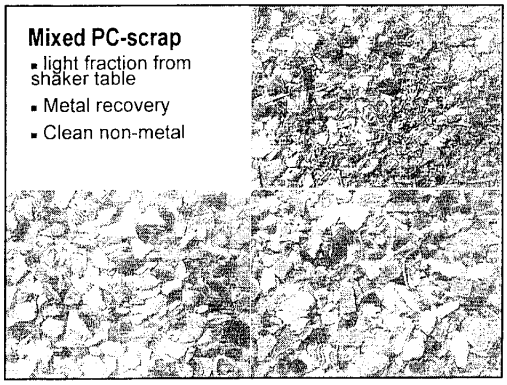
Separated PC-boards

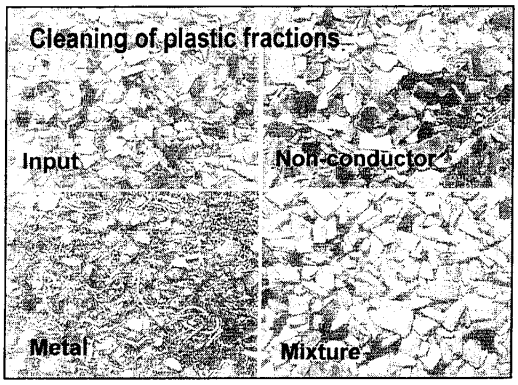
- fraction 1,6...2,5 mm
- metal-free plastic
- clean metal



Mixed PC-scrap

- light fraction from shaker table
- Metal recovery
- Clean non-metal





The Final Products:

- Metal product containing precious metals (copper with gold, silver, platinum, palladium etc.)
- Non-metallic product (metal-free plastics, epoxy, glass fibre etc.)
- Mixture product (to be put back for further liberation)
- The Hamos KWS + ERP System is designed to achieve a maximum recovery of metals.

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Separation of different plastics with hamos EKS electrostatic separators

Examples

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PET bottle recycling

- PET is contaminated with PVC (between 50 and 3.000 ppm)
- Melting points:
  - PET 250 °C
  - PVC 160 °C („burns" and produces HCl, depolimerizes PET)
- PVC separation is a must
- PET and PVC
  - Same colour
  - Same specific weight
- **Hamos has the solution: EKS for electrostatic flake sorting**

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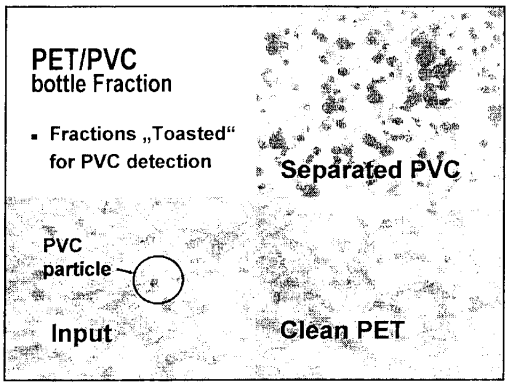

What purities are possible with EKS electrostatic separation? Separation of PVC from PET

- **Results with electrostatic separation:**
  - **PVC separation > 95%**
  - Aluminium, glass and other impurities are mostly separated due to polarization effects
  - **Production > 1,5 tons/hr with 24 / 7**

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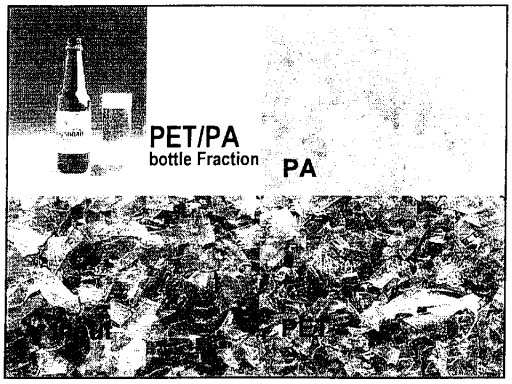

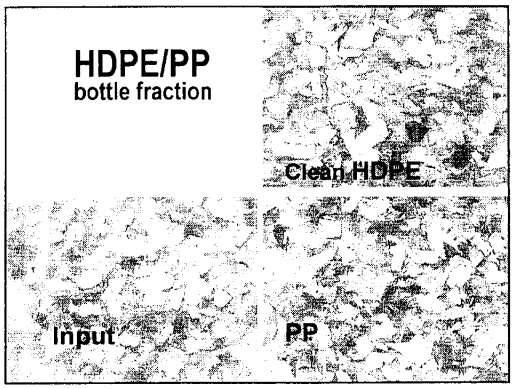

What maximum purities are possible with EKS electrostatic separation? Separation of PVC window profiles

- PVC-rubber separation (formerly by hand)
  - PVC-content approx. 93%
  - Rubber/EPDM 7%
- Results with electrostatic separation
  - PVC x > 99,6% (typical purity 99,9%)
  - with add. colour sorting >99,995%
  - with additional final control > 99,9995 %
- Production > 1,5 tons/hr with 24 / 7

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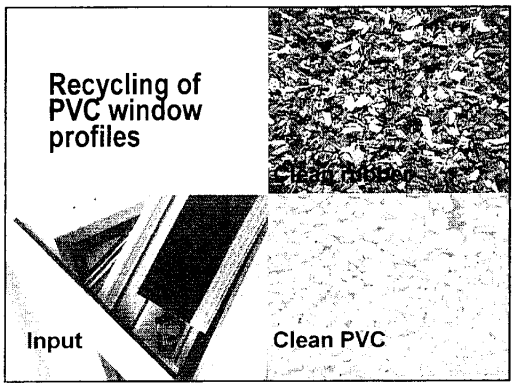

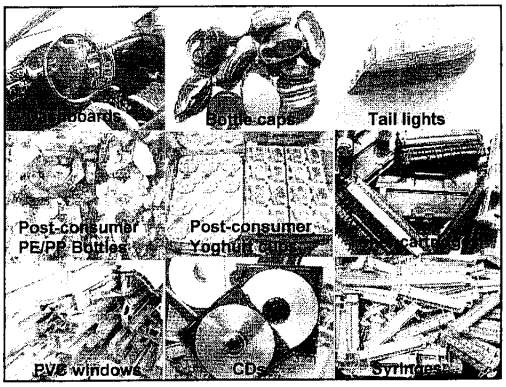

Advantages of the hamos EKS

- needs practically no manpower
- very clean plastics
- stand alone production system
- no direct wear parts
- easy to adjust
- designed for 24 hour operation
- separates many different plastic mixtures
- well proven, flexible design
- throughputs up to 1500 kg/hr

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EKS Reference list

- **ARCC** F-Bayonne**
- **Baumann** D-Donnersdorf**
- **Bögner** D- Ringelheim
- **Butler-MacDonald** USA-Indiana*
- **Cité +** F-Pervenchères**
- **Dekura** GB_Peterlee**
- **Tönsmeier-Dekura** D-Rahden**
- **Tönsmeier- Dekura** D-Söllichau**
- **Tönsmeier- Dekura** F-Steinbourg**
- **Tönsmeier- HÖKU** D-Höxter**
- **ERA**, England
- **GAIKER**, Spain
- **Henley Burrows**, England
- **KEMA**, Netherlands
- **POLYCON**, D-Oranienburg
- **PT Bas Murni**, IND-Jakarta**
- **RAGN SELLS**, Sweden
- **REPA** D-Kassel**
- **SchuRec** D-Freiburg**
- **SOLVAY S.A.**, B-Brussels**
- **SOLVAY Vinyloop**, I-Ferrara**
- **VEKA Umwelttechnik**, D-Behringen*****
- **VISTEON /Autopal.**, CZ- Nový Jicín*
- **VOGT Plastik**, D-Rickenbach***

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Separation of Complex materials
with hamos KWS and EKS electrostatic separators

Metal + Plastic Separation

Examples

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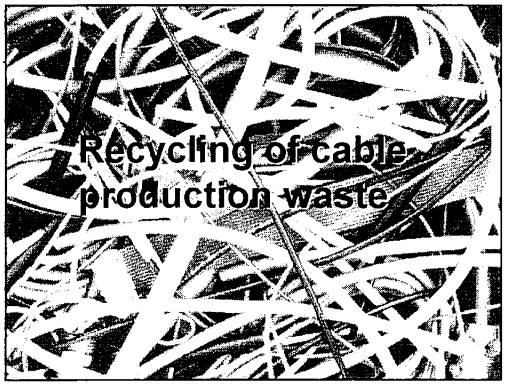
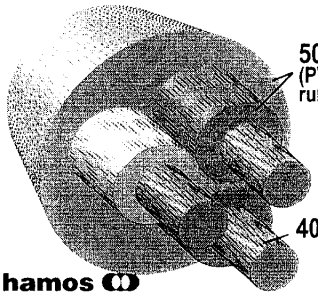


Average composition of Cable



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The metal and PVC of cable residues are valuable materials

- Cable residues contain 3...15 % of fine copper
  - average value of lost copper: US$ 88 /ton*
- The cable plastics can contain 50...80 % of PVC
  - average value of lost PVC: US$ 500 /ton*
- **With hamos separation technologies it is possible to recover both metal and PVC**
- **Theoretical gross profit could be US$ 588/ton**

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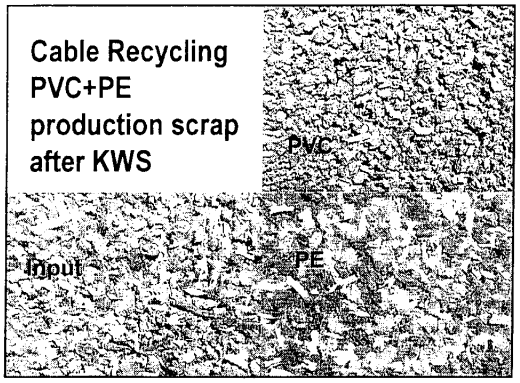
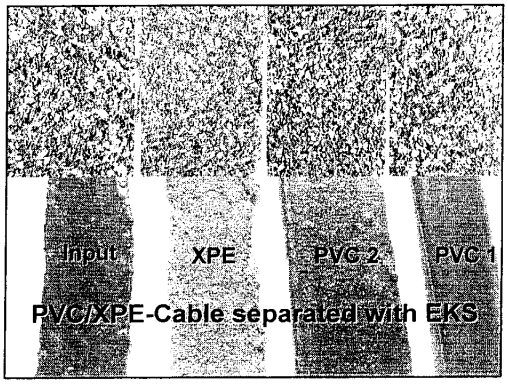
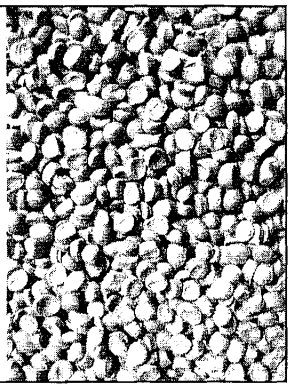
Cable Recycling
PVC+PE
production scrap
after KWS





Final
PVC product
made of
PVC/PE cable
Separated
with EKS
and
extruded

hamos



Reuse of recycled cable PVC

Clean PVC can replace virgin PVC :

- cable harness (jacket)
- shoe soles/shoes
- flexible garden hoses
- automotive applications
- PVC foils etc.

"Dirty" PVC (mixed with others):

- traffic systems (PVC >80%)
- floor tiles (PVC >98%)
- noise protection elements etc.

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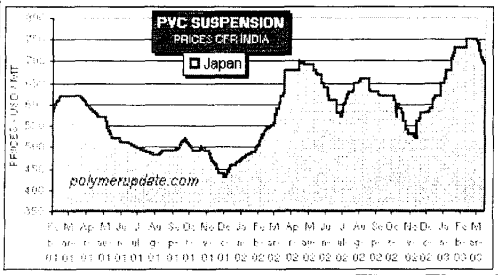
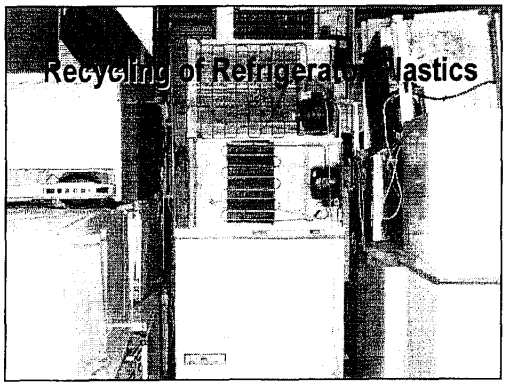
PVC prices (we replace virgin PVC)

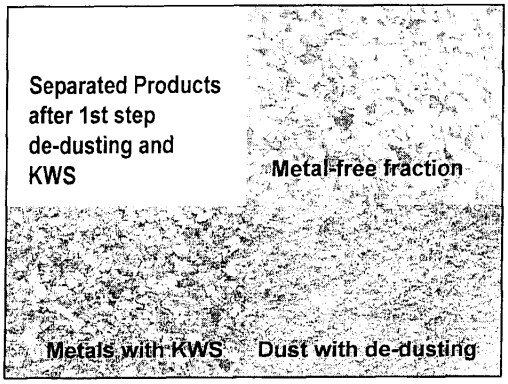


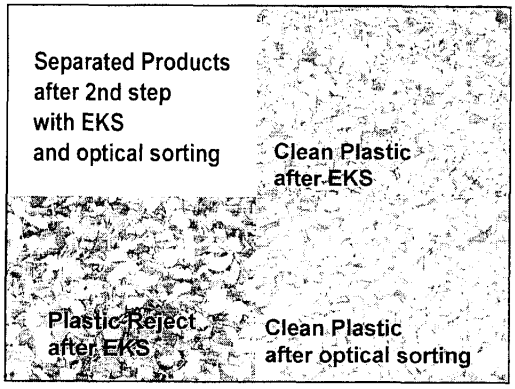
Recycling of Refrigerator Plastics

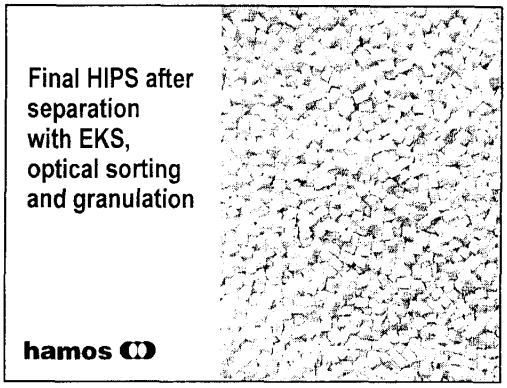


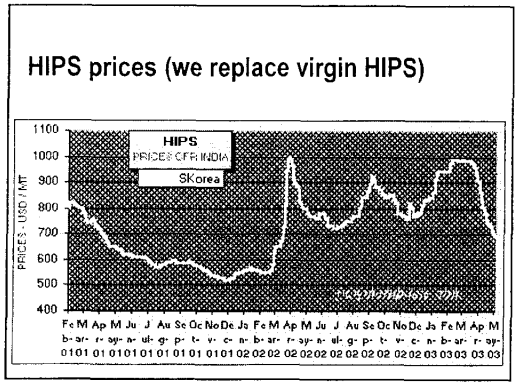
Refrigerator Plastics after shredding and separation of PU foam and coarse metal

Separated Products
after 1st step
de-dusting and
KWS









Advantages

- Waste refrigerator plastics is turned into valuable HIPS
- Dry system
- High recovery rate for metals and plastics
- Quick return on Investment
- Flexible system (works with other scraps as well)

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Summary

- Electrostatic separators KWS and EKS solve many sorting problems
- Dry separation technologies have big advantages
- Hamos KWS and EKS machines pay back within short time

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Thanks for your attention!

For further questions just contact us:

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  Im Thal 17,
  82377 Penzberg/Germany
- **Telephone:** ++49-8856-9261-0
- **Fax:** ++49-8856-9261-99
- **Email:** dr.k@hamos.com

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Solutions for Recycling

Electrostatic Separation Technologies Made in Germany by Hamos GmbH

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Managing Director

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dr.k@hamos.com

LEADING IN ELECTROSTATIC SEPARATION

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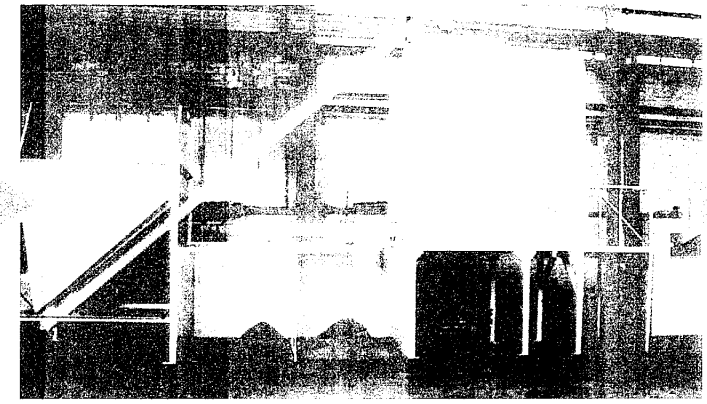
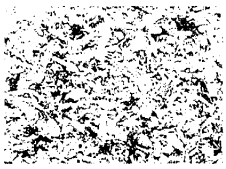
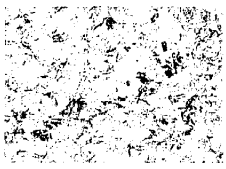
Electrostatic Metal Separators

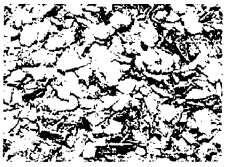
hamos KWS

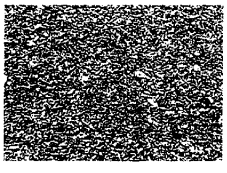


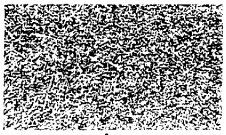
hamos KWS 1521-1 with accessories











If you recycle
- Metal / Non Metal Mixtures
- Cable Scrap
- Electronic Scrap
- Shredder Dust / Grinding Dust
- Alu-plastic-compounds

The **hamos** KWS Electrostatic Separators recovers the finest metallic particles with a dry separation process at lowest cost. So make more money with your materials!

Electrostatic Separators hamos KWS enable:
- Additional profits due to higher metal recovery rate (a typical return on your investment is < 100 days!)
- Transforming waste to valuable material
- Recovery of finest metallic particles
- Cleaning of non-metallic materials
- Dry metal separation without lavish drying processes

Your Advantages
- Dry separation process
- Optimum for finest metallic particles
- Easy to operate
- Over 150 units in operation
- Low energy consumption
- High product purities
- Quick return on investment
- Low staff requirements

The Function

Conductive metals and non-conductive materials are electrostatically charged by a high voltage Corona electrode. The metal is discharged on a separation drum and is thrown off. Non-conductors stick on the drum and are brushed off.

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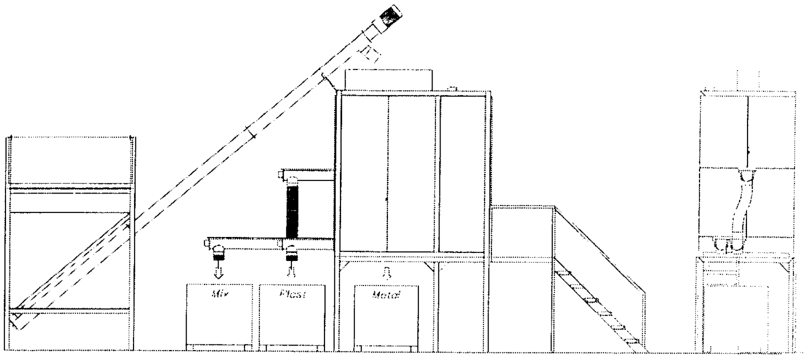
The Product Range

We deliver **hamos** KWS Electrostatic Separators with one, two, three or four drums and drum lengths up to 2.500 mm as turn-key systems. All production machines have integrated material transport systems (screw conveyors), dust pipes, electrode cleaning and PLC control as standard specifications.

By the use of the **hamos** material container with infeed screw feeder we can offer a fully automatic system, designed for 3-shift operation. This installation requires a total space of approx:

- Length: 10.000 mm
- Width: 2.500 mm
- Height: 5.750 mm



The Models

Model	Stages	Drum Length	Capacity (approx.)*	Main Application
KWS 1010-0	1	1 x 1000 mm	300 kg/h	Low Throughput
KWS 1521-1	2	3 x 1500 mm	1000 kg/h	Cable
KWS 1522-2	2	4 x 1500 mm	1000 kg/h	Electronic Scrap
KWS 2521-1	2	3 x 2500 mm	1800 kg/h	Cable
KWS 2522-2	2	4 x 2500 mm	1800 kg/h	Electronic Scrap

*Product capacity is material dependent

Our Offer

We have made hundreds of separation tests with different types of material . Please contact us if you are interested in a separation test in our laboratory. We will show you how much metal can be recovered from your material.

hamos supplies the following systems:

- **ERP** Electronic Scrap Recycling Plant.
- **EKS** Electrostatic Separators for plastic-plastic-separation
- **ECS** Eddy Current Separators
- **HS, FFS, LCS** Electronic All-Metal Separators for protection of machines and products
- **SEA** Colour Sorting Machines
- **Magnets**

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Your local agent / representative:

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LEADING IN ELECTROSTATIC SEPARATION

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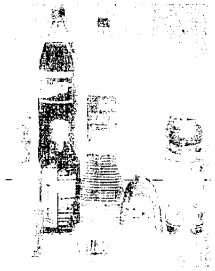
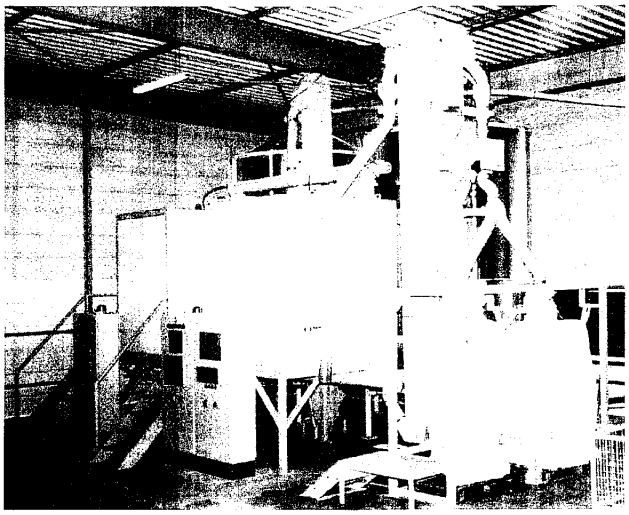
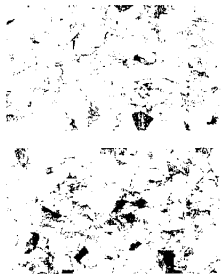
Electrostatic Plastic Separators

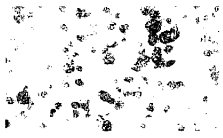
hamos EKS

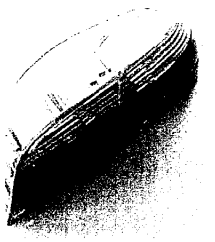


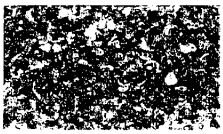


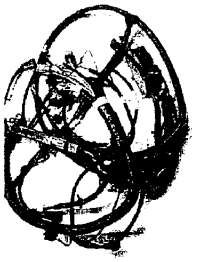
hamos EKS 1022-2 with accessories











You recycle:

- Plastic bottles
- Plastic window-frames
- Cable residues
- Plastic production waste
- Technical polymers
- Automotive residues
- Post consumer plastic waste
- Refrigerators and many more

With the dry working **hamos** EKS Electrostatic separator you can separate your plastic mixtures with the lowest cost, like many other recyclers do! The EKS separates HDPE/PP, PET/PVC, PVC/Gummi, PP/PS, ABS/PMMA, HIPS/ABS, PVC/PE and many more.

hamos EKS Electrostatic Separators enable:

- Dry plastic separation without separation liquids
- Change of plastic waste into valuable material
- Re-use of separarated plastic materials
- Reduction of the scrap quantity to be dumped.
- High product purities
- Low product loss
- Modular system for any production requirements

Your advantage

- Dry separation process
- No separation liquids necessary
- Independent from specific weight
- Independent from colour
- Efficient technology
- High purity of the products
- Well proven, turn-key system
- Quick return on investment
- Low manpower, easy operation
- Low power consumption
- Even highest throughputs possible
- High flexibility - one machine separates many plastics

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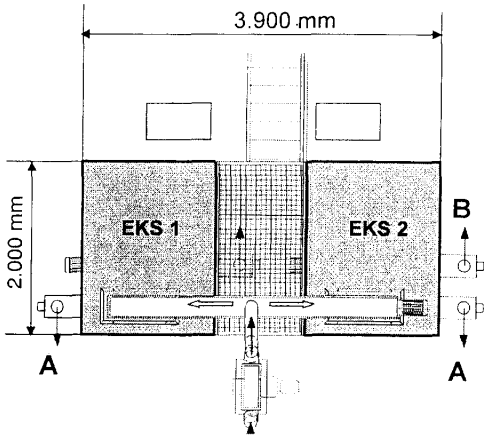
The function

A mixture of different plastics is tribo electrically charged in a special charging unit. Plastic particles are charged positively or negatively on mutual contact. This effect happens by changing electrons from one plastic tc the other. After charging the particles are separated in a high voltage field.

The product range

hamos delivers EKS tribo electrical separators with different throughputs and specifications especially for your application with one or two separation steps. All machines can be equipped with integrated screw conveyors for material output. With our infeed silos and the automatic material logistics we can deliver a complete turn-key system, designed for fully automatic operation in 3 shifts. The highly flexible **hamos** EKS separators can be used "in parallel" with two or more machines for maximum production or "in line" for re-separation of the reject.



Standard specifications

EKS electrostatic separators are equipped with the following standard specifications, which are all included in our price without extra charge:

- Complete EKS separator system, ready to use
- Fully automatic operation in three shifts by microprocessor controlled Siemens S7 PLC system (2 button operation: START and STOP)
- Fully automatic logistics for material infeed by silo (optional) allows 24 hr continuous operation without manpower
- Individual adjustment of parameters by frequency controlled motors
- Fully automatic electrode cleaning system
- Fail safe operation
- Separator housing, framework, operation platform
- Easy access for cleaning through huge doors on the sides of the machine
- Electronic high voltage supply avoids toxic transformer oils
- Practically no wear

Our Offer

We have made hundreds of separation tests with different types of material . Please contact us if you are interested in a separation test in our laboratory. We will show you which value your material could have.

hamos supplies the following systems:

- **ERP** Electronic Scrap Recycling Plant.
- **KWS** Electrostatic Separators for recovery of fine metallic particles
- **ECS** Eddy Current Separators
- **HS, FFS, LCS** Electronic All-Metal Separators for protection of machines and products
- **SEA** Colour Sorting Machines
- **Magnets**

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e-mail: hamos@hamos.com
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Your local agent / representative:

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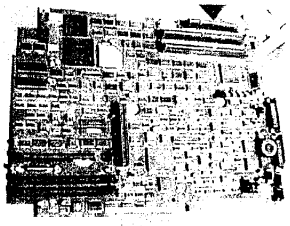
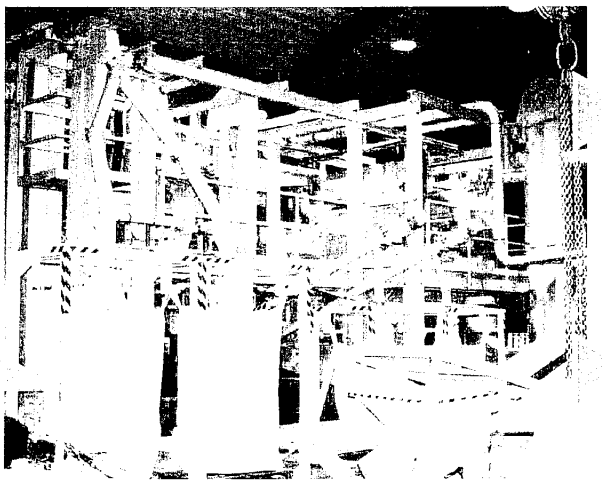
Printed Circuit Board Recycling Plant

hamos ERP 250

Printed circuit boards

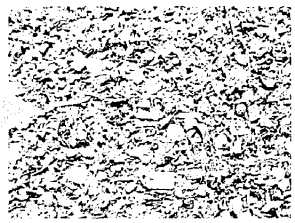


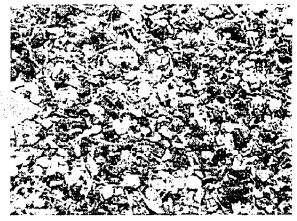
Input (electronic scrap)



Electronic Scrap Recycling Plant hamos ERP

Metal fraction





Non-metallic fraction

You need to recycle 200 ... 300kg/hr of

- Populated PC-boards with digital or analogue components
- PC-board base material without components like laminates and trim waste (Phenolic / FR4 Epoxy)
- PC-board production scrap (single, double or multi-layer)
- Electronic components, chips and production waste from chip manufacturing

With the Hamos ERP 250 you will achieve a

- Highly concentrated non- ferrous fraction (containing copper, aluminium and precious metals like gold, silver, platinum, palladium etc.)
- Ferrous product
- Non-metallic product (mostly metal-free fine plastic, epoxy, glass fibre, ceramics, dust etc.)

The ERP 250 will give you a maximum recovery of marketable metal concentrates

The Hamos ERP 250 PC-board scrap recycling system will process these materials into highly concentrated metallic and non-metallic fractions.

Please note: Heavy steel parts, relays, coils, transformers etc. have to be removed from the PC-boards prior to processing.

The ERP 250 PC Board recycling plant is especially designed for the low cost recycling of approx. 200 ...300 kg/hr of bare and populated PC-boards (production scrap and post-consumer waste) into clean metal and non-metallic fractions.
In the first step the bare and populated PC-boards are shredded. (Heavy items like transformers etc. and toxic components have to be manually disassembled before). Then a heavy duty hammer-mill pulverizes the material to achieve liberation between epoxy/glass-fibre base material and metal. The ground material is then screened and de-dusted subsequently. From the fine fraction the valuable metal fraction is separated, using electrostatic and gravimetric separation technologies.

Advantages of the ERP 250
- High recovery rate for precious metals (gold, palladium, silver etc.)
- Recuperation of copper and aluminium
- Certified destruction of electronic production waste
- Clean non-metallic fraction
- Heavy duty system, easy to operate
- Economic solution with low recycling costs
- No environmental hazards
- Dry recycling process
- Reduced material size saves shipping costs
- Reduction of the scrap quantity to be dumped.

Products, which can not be recycled:
- Heavy electric scrap
- PC-boards with coils and transformers
- Glass
- Paper
- Cable
- Electronic products with toxic contents
- Products with wet and oily fluids

Necessary material pre-treatment:
All toxic or harmful substances which can cause environmental or health problems must be removed from the PC-Boards prior to the recycling process.

Plastic housings, cable, heavy materials like coils and transformers, stainless steel parts etc. can not be treated in the ERP 250 system and have to be removed as well.

Technical data:

Energy consumption
400 Volt 3-phase, approx. 130 kW

Possible throughput
Approximately 200 ... 300 kg of PC boards per hour

Required personnel
- 0,2 Forklift-driver
- 0,5 Machine-foreman
- 1 Helper for material feed and control

Required space
The complete plant (without stock for raw and finished products) requires a minimum space of 10 x 15 m. The required minimum building height (ceiling) is 6 m.

Other Equipment
hamos can also supply the following systems

- **ERP 1500** with throughputs of >1.500 kg/hr, including disassembly, sampling etc.
- **CSS** for TV tube and monitor recycling
- **RRP** for recycling of refrigerators
- **CRP** for cable recycling
- **KWS** electrostatic separators for fine metal recovery
- **EKS** electrostatic separators for plastic- plastic sorting
- **ECS** eddy current separators
- **Magnets**

Please contact hamos if you have any other specific separation problem.

The Company

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e-mail: hamos@hamos.com
Internet: www.hamos.com

Your local agent / representative:

LEADING IN ELECTROSTATIC SEPARATION

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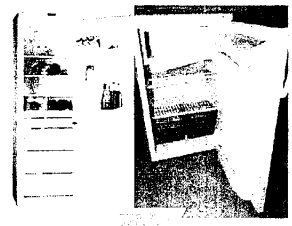
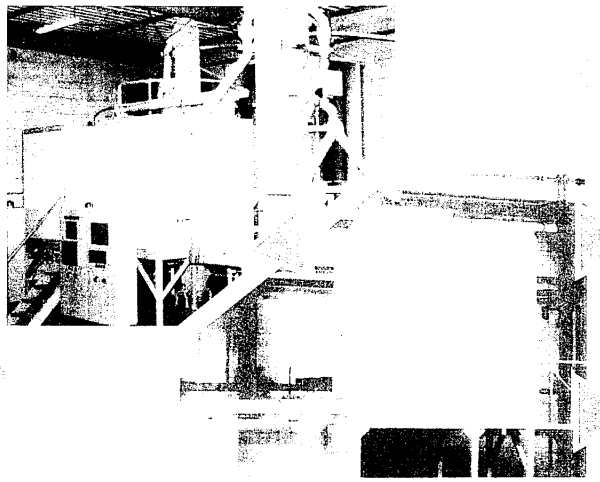
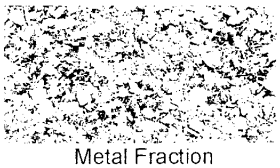
Recycling System for Plastics from Refrigerator Recycling

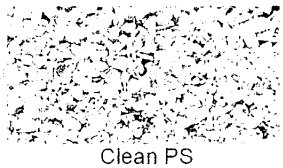
hamos PRS







Metal Fraction



Clean PS

Plastic Waste

Electrostatic Separators **hamos** KWS and EKS

PS Regrind

Problem
If refrigerator bodies are shredded, a great amount of residual plastic (mainly polystyrene, polluted with residual metals, wood, other plasics like ABS, PP, PU, cable and other materials) is generated. Due to the high content of impurities, such plastics can not be used without further treatment. They are normally incinerated.

The hamos solution
The **hamos** PRS recycling system can convert such plastic residues, coming from the recycling of refrigerator bodies, to a highly valuable HIPS plastic fraction.

For that we offer a turn-key system including the necessary material logistics etc.

The hamos PRS separations system enable:
- Clean polystyrene
- Concentrated wastes
- Minimisation of PU-foam contents
- Complete recovery of the residual metals
- Separation of PVC
- Separation of other plastics

Your advantages
- Dry separation process
- High purity of the finished product
- Well proven separation technology
- Reduction of the scrap quantity to be dumped
- Fully automatic function
- Quick return on investment
- Low wear
- Economic solution with low recycling costs
- Modular solution, will separate other plastics as well
- Heavy duty system, easy to operate

What we can supply:
hamos supplies a turn-key system to produce a highly valuable PS from plastics, coming from the recycling of refrigerators. Depending on the prior separation steps and already installed shredder / grinder capacity we can offer this recycling system to your needs.
With the supplied systems and units for material storage, dosing and material transport the PRS system works fully automatically. The complete PRS system is very flexible, so other plastic mixtures can be separated as well.

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Pre-treatment
To protect the following machines the material must be free of coarse metallic particles. On request we can offer powerful magnets and eddy current systems for removal of large ferrous and non-ferrous particles.
Please take care that the material is kept dry.

Function
- In the first step the refrigerator plastic is granulated to a suitable size. During granulation additional liberation between material composites takes place.
- The light fraction (PU, other foams, paper, cardboard, wood etc.) is separated by using a wind screen process.
- The **hamos** KWS electrostatic separator separates practically all residual metals (Cu, Alu, brass etc.).
  With an optimum machine adjustment also other undesireable particles like rubber, wood, etc. can be removed.
- In the following step the plastics are separated. The **hamos** EKS electrostatic separation system takes out most of the plastics which are not polystyrene. The result is a PS granulate practically free of other plastics.
- If necessary the quality of the finished fraction can be improved using an optical sorter.
- The separated product can be filled in big-bags, containers etc.
- The best plastic quality can be achieved, if the clean granulates are extruded. If a melt filtration system is used, all non-melting impurities can be taken out.

Performance data
- Plastics, coming from refrigerator recycling, with mostly HIPS contents
- Particle size < 80 mm, without coarse metallic paricles
- Max. moisture < 0,5 %
- Throughput Small system approx. 200 ... 300 kg/hr
  Large system approx. 800 ... 1.000 kg/hr

Standard specifications
The **hamos** PRS recycling system can be "tailor-made" to meet the customers requirements:
- Turn-key system
- Fully automatic function by Siemens S7 PLC
- Fully automatic material logistics with infeed silo and transport systems for fully automatic production in 3 shifts
- Individual adjustment of the separation parameters
- Fully automatic electrode cleaning system
- Separator with platform, stair etc. for optimum access
- Easy cleaning through huge doors on the sides of the machine
- Low wear

hamos supplies the following systems:

- **ERP** Electronic Scrap Recycling Plant
- **EKS** Electrostatic Separators for plastic-plastic separation
- **KWS** Electrostatic Separators for recovery of fine metallic particles
- **ECS** Eddy Current Separators
- **HS, FFS, LCS** Electronic All-Metal Separators for protection of machines and products
- **SEA** Colour Sorting Machines
- **Magnets**

Our Offer

We have made hundreds of separation tests with different types of material . Please contact us if you are interested in a separation test in our laboratory. We will show you which value your material could have.

The Company:

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Your local agent / representative:

LEADING IN ELECTROSTATIC SEPARATION

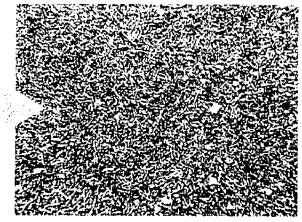
hamos

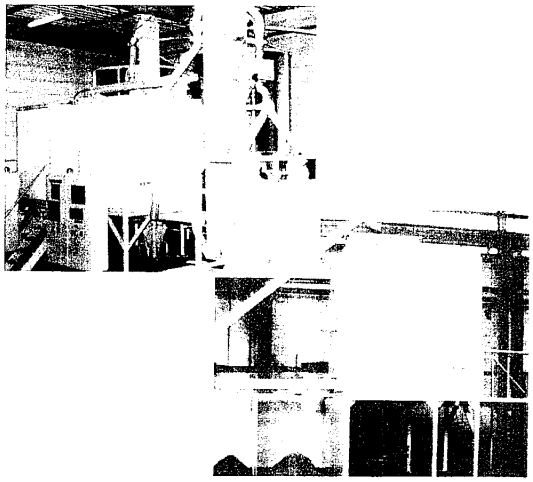
Production of clean PVC granules from mixed cable

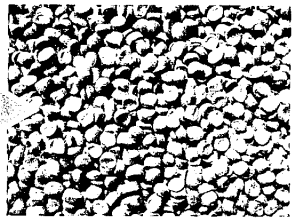
hamos KWS & EKS

Cable Production Scrap

Separated Metal







Granulated Cable

Electrostatic Separators EKS and KWS

PVC Granules

Problem
Higher production costs and more competition make it difficult for cable manufacturers to sell their products with good profits. Due to cost reduction in production and logistic, the potentials for savings have been widely used. New possibilities for cost reduction have to be found ...

This is the savings potential!
Material costs are responsible for up to 80 % of the production cost of an "average" PVC cable. While copper prices, depending on the stock market index, can not be decreased, the second largest cost factor "plastic insulation" has a lot of potential for cost savings.

The new dry separation system of **hamos** is using the high amounts of production scrap originating from cable production and converts these to clean flexible PVC. This PVC can be re-used in cable production and can be added to cable-harnesses, fillers etc. The result saves a lot of material costs! Also many other applications for this PVC are possible.

Solution
Starting from PVC cable production scrap, a PVC fraction with > 99,9 % purity can be achieved by electrostatic separation. This PVC fraction can be easily re-used in cable products, but other applications like shoe-soles, garden hoses, floor tiles and other products are possible as well.

Your advantages
- Production of valuable PVC
- Material cost reduction in cable production
- Reduction of waste
- High recovery rate for metals
- Short return on investment
- Dry separation process (no water with following drying necessary)
- Low energy consumption
- High degree of separation, especially for small metallic particles
- Material change without problems
- Lowest staff costs
- Easy operation
- Fully automatic, continuous process
- Highly economic solution

hamos

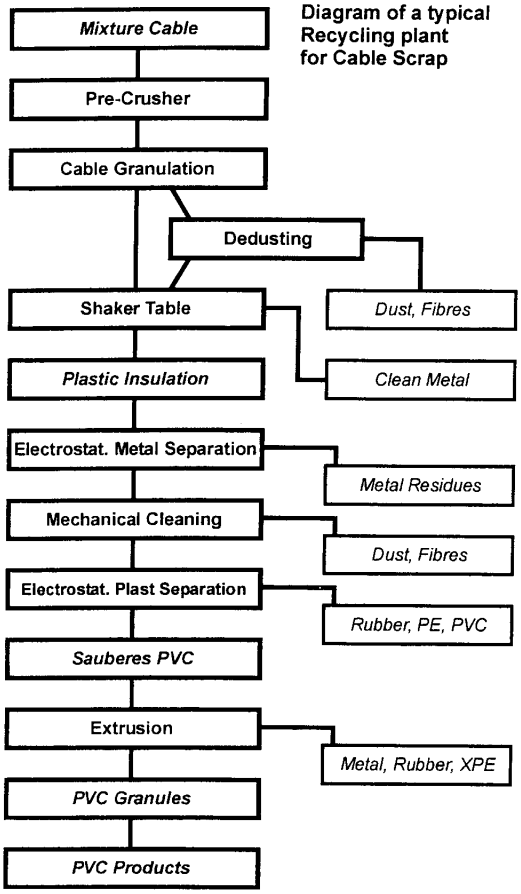


Diagram of a typical Recycling plant for Cable Scrap

Equipment

hamos electrostatic separators are delivered as fully automatic systems with mircoprocessor PLC, integrated material logistics, de-dusting system, and easy and precise adjustment of all separation parameters. Throughput capacities of more than 1.500 kg/hr are possible with standard equipment! Of course we deliver such systems including material logistic and infeed hoppers.

The hamos solution

Cable shredding

The pre-sorted cable residues are granulated in a standard, mechanically working cable recycling unit, using shredders, grinders etc. After shredding, the valuable copper is recovered using shaker tables. The residual plastic insulation still contains a small amount of metal.

Separation of metall dust and wires

The plastic cable insulation, still containing copper dust, small wires or aluminium foils is electrostatically separated, using a **hamos** KWS system. The KWS separates the fine metals from the cable insulation. Only electrostatic corona drum separators can separate such high amounts of very fine metallic particles like copper dust etc. The dry function is very important.

PVC separation with tribo-electric plastic separators

From the mixed cable insulation, consisting of flexible PVC, PE or X-PE, the **hamos** EKS tribo-electric separator can make a clean PVC fraction. For that the plastic particles are brought into contact with each other and are tribo-electrically charged (PVC takes negative charge,PE or rubber positive charge). This effect is called "tribo-electric charging".

Granulation

To achieve maximum purity of the recovered PVC we recommend to use an extruder system. Small amounts of impurities of metals and non melting plastics can be separated using melt filtration systems. The result is a perfect, metal free PVC fraction.

More information and technical details can be found in our special **KWS** and **EKS** leaflets.

The company

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Your local agent / representative:

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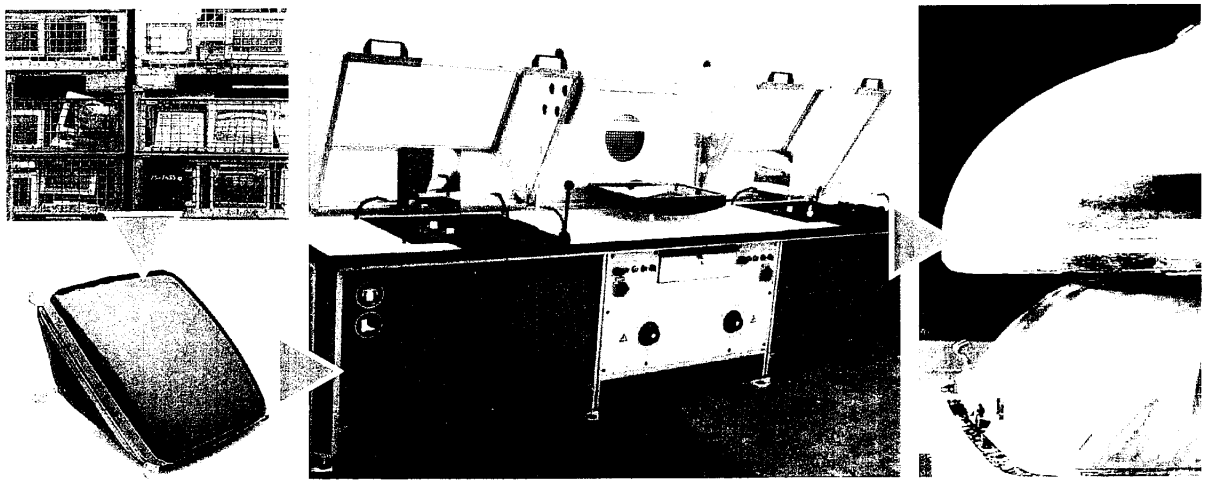
CSS Separation and Cleaning Line for CRTs

hamos CSS



Pre-disassembled CRTs **CRT Recycling System hamos CSS** Separated CRT

CRTs and monitors have created a recycling dilemma. Because of their size, materials composition (leaded glass, plastic, etc.) and non-biodegradability, cost-effective recycling methods for these products are necessary. hamos unique solution involves reduction and separation of the CRTs into materials fit for recycling. This allows you to cost-effectively recycle your monitors in large volumes thus eliminating the need to landfill

You recycle
- TV's,
- Computer monitors
- Other CRT's (cathode ray tubes)

and need a recycling line for disassembly?

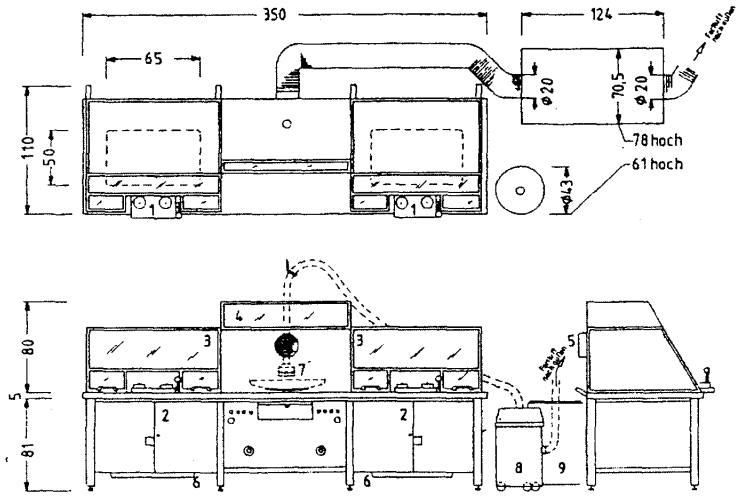
The CSS picture-tube separation and cleaning system will separate such dismantled CRTs (cathode ray tubes) into two parts: The front screen glass and the rear cone.

With the CSS you will achieve:
- A clean front glass without polluting fluorescent layers
- Two recyclable glasses (front glass barium-oxide, backward cone lead-glass) can be recycled into materials of high quality.
- A clean metallic fraction (TV screen, mask etc.)
- A concentrate of fluorescent dye powder

Recyclable Materials:
- Dismantled, ventilated and undamaged CRT picture tubes (according to German waste disposal regulations
- The CSS fits for any size of CRTs (pre-sorting recommended)
- CRTs with synthetic layer on screen or acrylic-resinated tension ring can not be separated.

Advantages
- **Two recyclable glasses instead of mixed waste**
- Well proven technology
- Low capital expenditure
- Minimum running costs
- Dry recycling process
- Reduced material size saves shipping costs
- Heavy duty system, easy to operate
- Takes out toxic fluorescent layers

hamos



1. Separating device and hot wire system
2. CRT lifting table
3. Telescopic hood
4. Stationary protective hood
5. Switch box
6. Container for collecting pieces of glass
7. Brush head for extracting the fluorescent coating
8. suction unit
9. vacuum holding device for the 3 hoods

Function of the basic CSS system:
The first step is the separation of the two glass parts. In the second step the internal metal parts (masks etc.) are removed. The third step is the removal of the fluorescent layer from the front glass:

Required manpower
For the dismantling of 25 - 30 CRTs per hour a CSS double machine (as in the drawing) is recommended. The operator will switch between the two CRT - dismantling plants and the de-dusting system for removing the fluorescent powder in the middle. With only one operator a maximum annual capacity of 40,000 CRTs can be recycled.

Technical Data

Approx. capacity
(in CRTs per hour and kg with 20 kg/per CRT)

- Type CSS single: 15 pcs/hr (300 kg)
- Type CSS double: 30 pcs/hr (600 kg)

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General requirements
The CSS Picture-tube separation and cleaning system is installed on a table.

- Table L x W x H 2.500/3.500 mm x 1.000 mm x 860 mm,
- Required space 2 m² for type CSS single, 4 m² for type CSS double
- Additional 2 m² are required for auxiliary equipment (small compressor, ventilation device, suction device)

Power supply

- 400V/32 A 50 / 60Hz

References
We have installations in many countries worldwide. The first CSS installation has been successfully running since 8 years. Our reference list includes even small companies as well as the market leaders in electronics recycling. The total installed separation capacity can deal with the used CRT tubes of more than 80 million people.

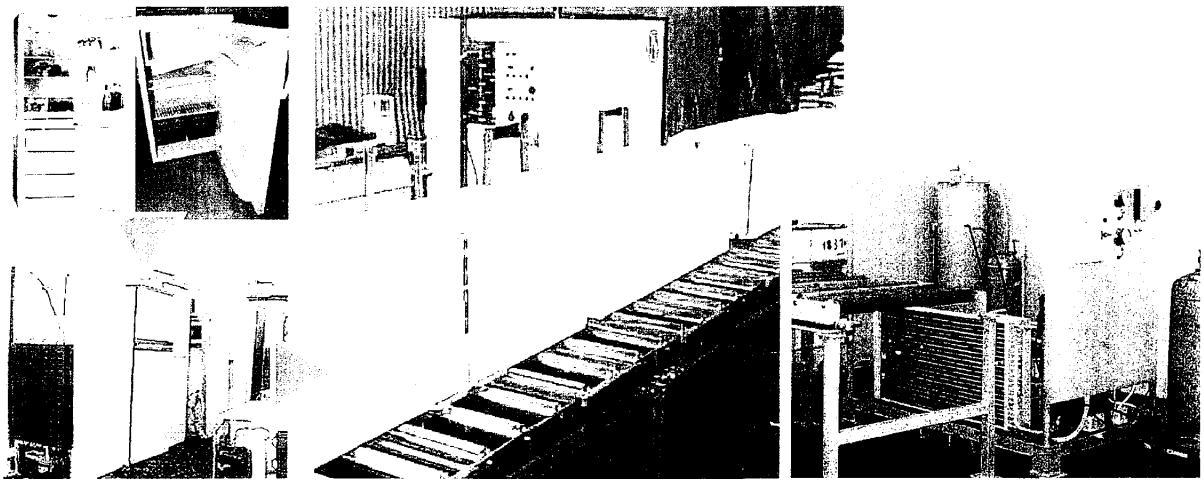
Please contact hamos if you have any other specific separation problem.

Your local agent / representative:

hamos

Refrigerator CFC Separation Equipment

hamos RRS



Collected units

Refrigerator CFC Separation Equipment hamos RRS

The RRS system is used to take out the CFC cooling medium and the motor oil from refrigerators and air conditioners. Only DRY equipment without the undesirable CFC cooling medium can be shredded in an environmentally safe way.

We can offer a turn-key, fully encapsulated recycling system for the bodies/empty refrigerators as well. Please contact us if you are interested.

You recycle

- Refrigerators
- Food freezers
- Air conditioners
- Bottle vending machines etc.

and need a recycling line to take out the CFC cooling medium?

The RRS Refrigerator recycling system will take out the undesirable CFC cooling medium and leaves a DRY Refrigerator. This step is important prior to any other recycling step.

Advantages:

- **Environmentally safe removing of CFC cooling medium**
- **Production of >30 refrigerators or air conditioners per hour (60 units upon request)**
- **Only 1 operator required**
- **Undestroyed compressors can be easily sold on special markets.**
- **Complete separation of CFC cooling medium from compressor oil**
- **Compressor oil free of CFC**
- **Low operation cost**
- **Easy to handle**
- **10+ world-wide references**

hamos

Function of the basic RRS system:

Pre-Treatment
In the first step plastic drawers, glass shelves, chip wood plates, rubber door sealings and other loose materials are removed from the cooling equipments.

Environmentally safe removing of cooling medium:

- The refrigerators or air conditioners are put by hand on a roller conveyor with the compressor facing the operator. It is important that the compressor is at the lowest point possible.
- A pair of special tongs is now fixed at the pipe at the compressor. The pressure tight piercing pin opens the pipe.
- The tongs are connected to the vacuum compressor by a tube system.
- A vacuum pump sucks the mixture of oil and gas into a vessel. The CFC cooling medium and the oil are completely removed from the refrigerator or air conditioner.
- The compressor of the refrigerator or air conditioner is now carefully disassembled and removed. The compressors can be easily sold.
- The **dry** refrigerators / air conditioners are now ready for further processing in a shredder system.

CFC separation and oil reconditioning

- The mixture of oil and CFC gas is continuously de-gassed by a integrated, fully automatic oil-degasifying unit.
- The CFC cooling medium is completely separated from the oil.
- The CFC is pumped into standard 90 litre CFC pressure bottles, standing on a scale. A visible and optical signal appears as soon as the bottle is filled up. The bottle is then changed by hand into a new empty one.
- The oil taken out of the de-gassing installation is free of CFC and has a quality corresponding to "used oil"
- The oil is pumped into a oil barrel or similar vessel.

Technical Data

Required manpower:
For the CFC separation of 25 ... 30 refrigerators or air conditioners per hour a RRS system for parallel treatment of 6 systems is recommended The only operator will switch between the 6 suction points.
Suction unit and Gas Removal:
L x W x H 1600 mm x 1000 mm x 1600 mm
Power supply:
16A CE, 400 Volt; 50 Hz. Standard
Conveyor Line:
L x W x H 6000mm x 1100 mm x 800mm
Number of sledges:
6 pcs.

Please contact hamos if you have any other specific separation problem.

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Your local agent / representative:

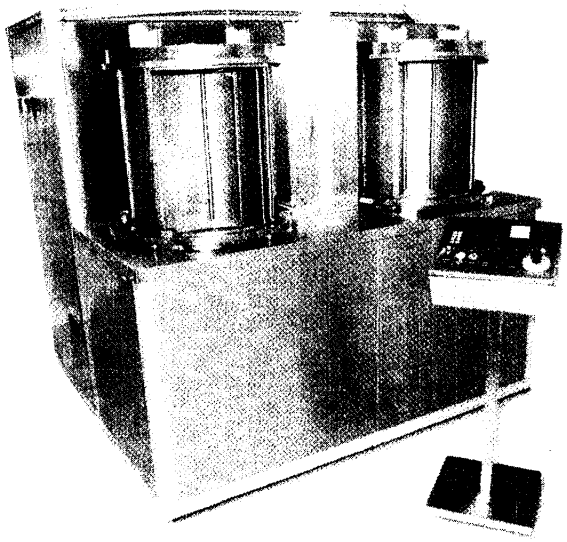
VALIDES
Modular Designed Disinfection System for Medical Waste

VALIDES

Modulare Desinfektionsanlagen für infektiöse Abfälle

VALIDES

Modular Designed Disinfection System for Medical Waste



VALIDES

Dispositifs modulaires de désinfection pour déchets infectieux

VALIDES

Impianti modulare per la disinfezione di refiuti infetti

VALIDES

Installaciones modulares de desinfección de desperdiciosos infecciosos

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Tel: 06897-972934 Fax: 06897-972935 E-Mail: ha-international@t-online.de

德國 VALIDES　醫療廢棄物處理設備

<目前的醫療廢棄物問題>

隨著環境污染問題日益嚴重，與民間之環保意識的抬頭，對于醫療單位所排放之廢棄物已成為敏感的問題。因為醫院收容的是病患，一有疏忽，可能是聚合各種病菌，甚至讓醫院成為繁衍的溫床。不單是在治療過程中所產生的醫療廢棄物有可能具有傳染性，如使用過的器材及治療用棉花、紗布等材料。特別的是在醫療廢棄物貯存、運輸、處理過程中亦可能將病菌或病毒等污染帶到醫院外，而造成公害。 若能斷絕這些醫療廢棄物“周遊全國各地”的途境，自然能讓其傳染的可能性降低。 在最近的實例中- 非典肺炎 SARS 施虐全亞洲及加拿大，我們更可以瞭解到疾病預防及傳染源與民眾完全 隔離的重要性。

<解決方案>

德國原設計公司及制造廠 B.I.M.E. GmbH 擁有 十年專業經營醫療廢棄物處理的經驗並在其間成功的研發設計完成專門消毒醫療廢棄物的 VALIDES-System。醫療廢棄物處理的問題是具有不分地域、不分人種及全球性的特性。 台資 HA International Envitech(HA 國際環保開發公司) 在與該原廠達成合作協議後參與其產品改進及負責在亞洲市場的開發工作。

VALIDES 醫療廢棄物處理的原理簡而言之就是在可能的污染源/醫療廢棄物 離開醫院前施以有效的 預抽真空蒸氣滅菌處理。VALIDES 處理流程經由 德國衛生署及 Robert Koch Institute 認可及產品經德國 TÜV 認証，在全程監控下，以攝氏 121 度 30 分鐘施以蒸氣消毒為標準。 其操作流程及時間當然亦可藉 PLC 隨需要更改。

Fa. HA International Envitech, Saarbrücker Str. 292, 66125 Saarbrücken, Germany Tel:06897-972934 ha-international@t-online.de

VALIDES 設備特點：

- 單元式組合使我們的 VALIDES 消毒滅菌設備可依需求靈活選用
- 顧客可依現地何種制造蒸氣的能源較價廉或保養及操作費高低自行決定是由 廢熱、瓦斯或電力來操作
- 同時適用于可燃性及不可燃燒性、金屬及非金屬的醫療廢棄物處理(德國 A+B+C 型及台灣 黃色容器感染性事業醫療廢棄物)
- 以飽合水蒸氣加熱，無爆炸的危險
- 設備經由德國 TÜV 及德國流行病防疫所 Robert Koch Institute 認可且經多年實際操作驗証產品可靠性
- 產品採 316 SS/DIN 1.4571 不銹鋼材質，經久耐用
- 操作安全，全程監控並有計錄備查
- 以標準式測試片供消毒結果証明
- 處理後之醫療廢棄物無再污染之虞（依德國醫療廢棄物處理法可當一般廢棄物處理）
- 操作及單位處理費用低廉

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VALIDES 消毒處理流程

1. 操作人員在操作面板上選擇出理想的處理流程。選擇了固定流程或自訂流程後反應箱須由雙手操動上昇並打開反應箱(安全裝置)。此時可將待處理消毒物置入反應箱內。關箱時亦須雙手操動以免發生操作意外。藉由開關啟動 PLC 自動操作已設訂之流程

2. 一般流程如下：反應箱抽真空至 65mbar(1 psi) 並啟動穿孔裝置讓待處理物能無礙的接受蒸氣加溫。所有氣體排出前均經過無菌過濾。噴入飽合蒸氣至系統達 1000mbar(15 psi)。反應箱再次抽真空至 200mbar(3.5 psi)。此[抽真空至 200mbar-再加壓(1000mbar)加熱]之動作將重複 4 次

3. 加壓反應箱至 2050mbar(31psi)及加熱至 121 度 C(250 度 F) 此時進行正式的 Sterilization 。

4. 完成消毒後進行 乾燥。此時反應箱抽真空至 450mbar(7 psi) 以減少濕度及臭味。系統中可另加裝除臭裝置減少惡臭程度

5. 待 面板 LED 燈號閃爍 通知操作人員，可將已消毒處理完成廢棄物取出，並進行下一批次的處理。

附件: 德國醫療廢棄物分類(english)

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VALIDES
Modular Designed Disinfection System for Medical Waste

The Company

Originally, B.I.M.E. is in the business of treating infectious waste since 10 years, who decided to develop and produce a new system for disinfecting medical waste successfully. The company HA International Envitech Co. in Saarbrücken Germany take over the improvement of the whole system and begin in 2002 the dialog with the customer and the work of marketing in Asia, where has the similar problem and danger of infecting through medical waste as in Europe- especially after the suffering of SARS-disease in China, Hong-Kong, Singapore and Taiwan.

Disposal of hospital-produced waste

The problems associated with the handling and disposal of hospital waste, especially where group B and C infectious waste is involved, are of ever greater concern to those responsible for running health systems and waste disposal services, as well as to politicians and members of the medical profession. A great number of laws and regulations have to be observed, along with such aspects as efficiency, methods of transport, convenience for users etc. The disposal of infectious waste thus requires processing techniques that are made to suit special local circumstances, and which nevertheless manage to guarantee efficient and economic disposal, despite the demands exacted by environmental legislation. Disinfecting of waste on site is the most economically efficient and ecologically sound way to avoid both the transporting of infectious waste and its associated costs. The addition of shredding and liquid separation processes saves increased extra costs by permitting waste disposal alongside normal refuse.

Individual Uses

Just as there are many areas of use – waste from microbiology labs, hospitals, industry or research establishments – so there are as many made-to-measure sterlising units. Flexible modular fabrication means that one line of products can cover the entire range of waste disposal requirements.
The assembly configuration is made to fit exactly the task for which the unit is required. Possible alterations to requirements are also catered for, by the addition of modules to optimise the unit according to its new mission – avoiding unnecessary spare container capacity and the increased energy consumption that this entails.

Collecting the infectious waste

Infectious waste can be brought in for processing both in sacks that can be sterilised in an autoclave for re-use and is strong disposable containers. The containers are automatically opened once the chambers close, thus eliminating any danger to the persons operating the unit. Once the disinfecting process is over, the disinfected waste matter can be remove manually or, according to the configuration of the unit, automatically shredded or sent for further processing.

TECHNOLOGY

The idea was to build a system that is adaptable to the needs of the customer. Not the one size fitts all approach. The solution is the present modular designed ***VALIDES*** system.

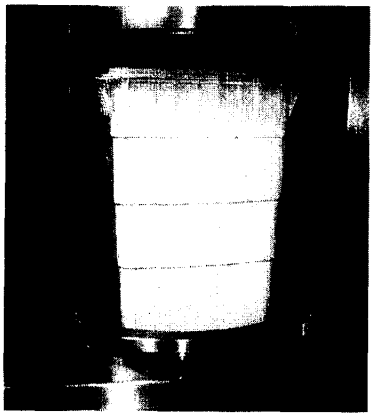
The basic unit of the ***VALIDES*** system is a one single disinfection chamber. By adding several basic units, the system can be adapted to the needs of the customer. There are 1-, 2-, and 4- disinfection chamber units produced.

Energy efficiency and simplicity of design, where possible, is carried out on every aspect with the ***VALIDES*** system, i.e.

- The disinfection process is solely done by pulsed vacuum and saturated steam according to the Federal Epidemic Act for medical waste class A, B, C and D. No chemicals are necessary.

- The customer has the option, how the steam is generated either by electricity or connected to the customer's in house steam system (optional).
  There is no so called new " state of the art " technology used, as Induction- or Microwave systems, for simply heating water.

- There are no moving parts in the pressurized disinfection/sterilization chamber, to open hermetically closed plastic waste containers.



VALIDES
Modular Designed Disinfection System for Medical Waste

As waste containers, either plastic containers or autoclaveable plastic begs, can be used with the ***VALIDES*** system. The plastic containers are opened by focused infra-red light during the first step of the disinfection process. The disinfection process is fully computer controlled. Once the process is started it cannot be interrupted.

Treatment procedure generally

Operation	Selection of the disinfection chamber group at the control panel. By operating the two hand safety switches, the chambers open and the chamber floor is lowered for loading.
	Closing of the chambers also by operating the two hand safety switches.
	Starting the fully computer controlled disinfection process by pressing the start button.
Process	Evacuation of the disinfection chambers to 65 mbar (approx. 1 psi) and applying the heating-element to open the plastic waste containers.
	The exhaust air is cleaned by sterilizing filters.
	Pressurizing the disinfection chambers by saturated demineralized steam to 1000 mbar (approx. 15 psi)
	Evacuation of the disinfection chambers to 200 mbar (approx. 3,5 psi).
	Repeating 4 times pressurization an evacuation between 200 mbar and 1000 mbar.
Sterilization	Pressurizing the disinfection chambers by steam to 2050 mbar (approx. 31psi) and a temperature of 121°C = 250 F
	Holding the pressure and the temperature for 8 minutes.
Drying	Evacuation of the disinfection chambers to 450 mbar (approx. 7 psi) to minimize the humidity and offensive odors.
	A blinking LED located at the control panel, indicates the end of the treatmen. The chamber floors can be lowered. The floors tip and the disinfected waste is ejected into a shredder, or a trolley (optional).

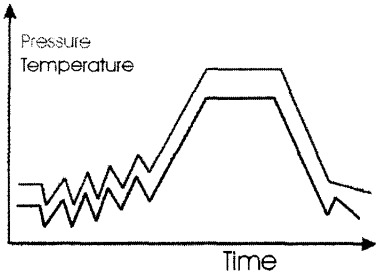


Fig.: Valides Vacuum-Steam Process

VALIDES
Modular Designed Disinfection System for Medical Waste

TECHNICAL DATA

TECHNOLOGY :	Fractional steam and vacuum process	
STERILISATION TEMPERATURE :	95°C, 105°C, 121°C at choice	
ELECTRONIC :	SPS-control with special system related software	
PROCESS CONTROL :	System- and disturb notifications are indicated on the display in plain text. Recording printer with protocol print-out.	
POWER SUPPLY :		
Mechanical use	5 kW	
Heating system and steam generator	12 kW	
Air compressor	2 kW	
Average consumption	9,2 kW /h	
Connection	3/N/PE AC 400V 32A 50Hz	
WATER SUPPLY :		
Temperature max.	15°C	
Hardness	3 – 5 °dH	
Pressure	3 – 5 bar	
Connection	DN 20 ¾"	
Consumption	80 l/h	
WASTE WATER :		
Temperature max	55°C	treatment not necessary
Pressure	pressureless	
Connection	DN 50	
Output max.	50 l/min	
NOISE CHARGE :		
Noise level	50 dBA	by compressor operating
MODULE MEASURES AND WEIGHT :		
Height	2100 mm	
Depth	1800 mm	
Width	950 mm	
Weight approx.	400 kg	
CAPACITY :	192 kg	12 kg loading per chamber (shift of 8 hours)
CYCLE TIME :	30 min (adjustable i.e. 60 min. or more)	

VALIDES
Modular Designed Disinfection System for Medical Waste

Technical description *VALIDES* 1.1

Unit:
Permanently installed 1- chamber unit to disinfect infectious substances.

Mechanical Design:
The complete unit is mounted on a self-supporting frame. For outdoor use the unit is installed into a foam insulated container. For indoors the unit is enclosed by removable chrome-nickel steel (DIN 1.4301 equivalent to AISI 304 and BS 304 S 15) panels. The loading area is covered with chrome-nickel 1.4301 sheets. The pressure vessel (PV) is mounted onto a stable pipe frame, all joints are either welded or screwed. For loading the bottom of the PV is lowered. The different components as there are the el. controls, the compressor, the water treatment and the steam generator are installed inside the container.

Pressure vessel:
The PV, is a single wall, standing cylinder. The bottom and the upper part are bell-shaped. The upper and lower part are connected by a slant joint. The upper part of the PV contains a silicon seal hose. A central turning ring system with an integrated pneumatic seal is locking the joint. A pneumatic actuator locks and unlocks the central locking system. To balance the PV pressure before opening the PV, computer controlled forced air is provided. The max datas of the PV are:

pi = 2.5 bar (36.6 psi)
pi = -1.0 bar (-14.4 psi)
t = 135°C (275 F)
v = 170 L (45 gallons)

The PV is completely manufactured of chrome-nickel steel (DIN 1.4571 equivalent to AISI 316 Ti and BS 320 S 31) according to the German-DIN standards for pressure vessels. The PV is secured by a safety valve.

Piping:
The pressurized part is welded or screwed, material chrome-nickel 1.4310. All temperature sensitive piping is insulated by mineral fibre with an aluminium outer skin. All other piping is chrome-nickel pipes with stainless steel fittings.

Valves:
Process valves are pre controlled and screwed into the piping system. The pneumatic valves are also pre controlled and installed in blocks in the control box. Valves that are in contact of the process are bronze or brass.

Filters:
All exhaust air is cleaned by filters of 0.2°µm according to HIMA Guidelines (Food and Drug Administration, Drug Master File No. 5967). The filters are approved for sterilization of contaminated air. The sterilization filters are produced of polypropylen and teflon. The filters are contained in chrome-nickel 1.4301 housing. The filters are also decontaminated during the disinfection process.

Pneumatic:
All movements of the system are controlled by pneumatic actuators. A compressor generates the pressure. The pneumatic system is oil less. All actuators are standarized and can be replaced by any other standardized product.

Vacuum generation:
A liquid-ring vacuum pump produces the preset vacuum. The pump needs for the optimal operation cool water with max. 15°C (59 F) . To minimize the use of water, the water is circulated.

VALIDES
Modular Designed Disinfektion System for Medical Waste

Computer control:
The system is computer controlled by a Siemens SPS (memory controlled system). The process is operated from a control panel. The programme cannot be changed or lost. The disinfection process cannot be interrupted. The process parameters such as pressure, vacuum, temperature, number of cycles are documented by a print out. In case of a failure, the failure is indicated at a display of the control panel and documented by a print out.

Programmes:
All ***VALIDES*** units are equipped with these programmes:

- Disinfection of contaminated, dry waste at 121°C, 8 minutes, in disposable plastic containers
- Disinfection of contaminated, dry waste at 121°C, 8 minutes, in autoclavable plastic bags
- Disinfection of contaminated, moist waste at 121°C, 8 minutes, in disposable plastic containers
- Disinfection of contaminated, moist waste at 121°C, 8 minutes, in autoclavable plastic bags
- Vacuum test programme
- Preheat programme
- Night preheat programme
- Optional programmes are available, i.e. for liquids, or food.

Steam generation:
The process steam is generated by an electrical steam generator. The water is treated by filters and a softening unit, and preheated to 80°C (176 F) in a supply container. A high pressure pump transfers the hot water into the steam generator. The process is controlled to avoid dry run or overheating and an additional safety valve.

Sensors:
The operational temperature is measured by a PT 100 (platinum) temperature gauge, range 0 – 150°C . The range of the pressure sensor is 0 – 2500 mbar. Both parameters are indicated on the display of the control panel during the process.

Documentation:
With each unit the following documents are enclosed:

- Operating manual including wiring schemes,
- Maintenance manual,
- Test documents of pressure vessel,
- Operating and maintenance manuals for the water treatment unit, the vacuum pump, and the compressor (optional)

Remark:
The ***VALIDES*** complies with German standards, laws, and regulations and can be modified to comply with other standards.

Vacuum - steam process -Why is a vacuum necessary?

The VALIDES system works on the vacuum-steam principle. This process is in widespread international use and is regarded as being both reliable and economically sound. Only those processes recognised by the RKI, in accordance with par. 10c of BeseuchG may be used for the heat-disinfecting of group C waste.

Correct disinfecting or sterilisation can only be guaranteed if the saturated steam atmosphere used contains no residual air. The sterilisation of porous objects, e.g. surgical dressings, or objects with hollow areas (tubes, petri dishes, etc.) requires an extremely low presence of residual air to ensure that the hot steam works both rapidly and correctly. Other processes are available for use as required when different objects are involved.

Appendix:

GERMAN HEALTH MINISTRY : DIVISION OF WASTE

CATEGORY A (German Waste keys 911 01, 971 03, 912 01, 912 02):

Waste which, from the point of view of the prevention of infections and of the environmental hygiene, does not need to be disposed of according to particular conditions:

- domestic waste
- disinfected waste of the category C
- kitchen and canteen scraps

CATEGORY B (German Waste Key 971 03):

Waste, which must be disposed of according to particular conditions to prevent the infection of installations and equipment in public health services:

- waste marred by blood, secretions, excretions i.e. scar bandages, plaster castes, one-way linen, liners and one-way material including syringes, canulas, scalpels

CATEGORY C (German Waste Keys 971 01, 137 05. After disinfection 971 03): **

Waste, which must be disposed of according to particular conditions to prevent the infection of installations and equipment in and outside public health services (so called infectious waste, or waste risking to infect or highly infect):

- waste, which must be treated as decribed in § 10 of the German Government Law against Epidemics. This is the case, if waste is marred by germs of notifiable, contagious diseases and the spreading of this kind of diseases is expected.

i.e.

cholera	typhoid abdominalis
lepra	haemorrhagic fever caused by a virus
anthrax	brucellose
paratyphoid A,B,C,	diphteria
plague	meningitis/encephalitis
smallpox	Q-Fever
poliomyelitis	glanders
dysentery	tuberculosis
rabies	virus-hepatitis
tularenses	

Futher more, microbiological cultures, which come up in instisutes of Hygiene, Microbiology and Virology, as also in laboratories and medical practices having an equivalent activity, are considered as waste of the category C.

** **The minumum disinfection temperature demanded by German law to destroy germs of this category is 105°C.**

1. 企业基本情况		
企业名称	ETLog EnviroTech & Logistics GmbH 德国 ETLog 环境技术&后勤股份有限公司 (简称 ETLog)	
企业地址	Brunnenstrasse 164 – 10119 Berlin – Germany(德国)	
联系人	Jan-Gerd Kühling	电话: +49/30/443187-30
E-mail: Kuehling@etlog.com		传真: +49/30/443187-49

2. 企业简介(500 字以内)

ETLog 专长于医疗废物的综合处置、后勤运输和管理咨询，总部在德国柏林。ETLog 是德国医疗废物处置与管理领域的主要公司之一，同时也在世界范围内享有很高竞争优势，能够提供环境友好又经济可行的医疗废物综合处置方案：包括医疗废物的产生一直到最后的处置。公司业务主要有：

- ***医疗废物处置技术***
  危险和无危险医疗废物的安全运输，循环再利用及高效处置设备；...
- ***医疗废物管理***
  医疗废物物流分析（包括单个医院或整个区域乃至全国范围）；建立和实施医疗废物管理体系；为 100 到 100.000 床位的容量建立医疗废物内部管理系统或规划医疗废物处置中心；准备环境质量管理体系 ISO 14000 和 EMAS 认证；...
- ***医疗废物的内、外部后勤管理***
  建立医院内部、外部后勤体系，高效收集和运输的医疗废物；建立废物跟踪记录程序；实施经济、有效的后勤方案，如“处置链”式后勤系统；...
- ***医疗废物培训***
  为客户设计专门的医疗废物内部管理培训课程；培训培训者；开发医疗废物管理的各类课程，从初级的意识培训到给决策者的提供的高级管理培训；直接责任人的培训，如：医院废物收集和管理员；...

ETLog 提供的全套技术与服务，能够使客户方便地获得完整的医疗废物解决方案。此外，在传染性医疗废物的处置技术方面，ETLog 与著名的 Tuttnauer 公司密切合作。Tuttnauer 公司是高压杀菌技术领域的国际龙头公司。

ETLog 的业务遍及全球，重点在欧洲、亚洲和中东地区。ETLog 在沙特阿拉伯、中国、乌兹别克斯坦和土耳其等国提供的服务和产品赢得了客户的信任和满意。更多的信息请访问 www.etlog.com.

(2)

3. 从事同类项目国际或国内经验和业绩

ETLog 有丰富的国内和国际项目经验，曾作为独立咨询公司给私人客户和德国发展组织 GTZ 的项目提供服务和技术，也作为项目子合同公司参与由世界银行和欧洲重建与发展银行融资的医疗废物项目。ETLog 还与国内和国际的相关组织建立了密切的合作关系，ETLog 是国际固体废物协会医疗废物分委会的德国代表。(详细资料备索)

国际经验节选 – 医疗废物:

沙特阿拉伯： 沙特首都利雅得医疗废物集中处置厂的可研及规划。实施医疗废物微观、宏观管理培训。

乌兹别克斯坦： 设计医疗废物临时收集和存储系统，包括收集箱和运输车的技术说明。设计医疗废物卫生填埋场和操作流程，完成运行操作培训。

土耳其： Antalya 镇医疗废物集中处置场的可行性研究及规划。指导实施 Bursa 镇医疗废物处置总体规划。

此外，ETLog 还已经或正在爱沙尼亚,波兰，马其顿，塞浦路斯,埃及，印度和韩国等国家开展业务。

国内经验节选（中国）–医疗废物:

ETLog 于 2000 年进入中国市场，主要在湖南省开展业务。已经进行的业务包括：

湖南长沙:

- 医疗废物管理系统的快速分析
- 研究和分析长沙医院废物的总量及构成（与湖南大学合作）
- 制定长沙医疗废物管理与处置的总体规划
- 为持有上岗证的医院医疗废物管理员开发和实施培训课程（与湖南省卫生局合作）
- 建立和实施医院废物内部管理体系（Xingya 医院，肿瘤医院和红十字儿童医院）
- 医疗废物集中处置场可行性研究和设计（处理能力为 22.000 床位，于 2003 年实施）

浙江杭州:

- 实施医疗废物管理的培训（与浙江环保局合作）

湖南省卫生厅

证 明 信

_____:

2002 年 8 月,德国 ETLog 公司与湖南省卫生厅合作在湖南省长沙市举办了医院废物管理员培训班。此项目负责人 Kuehling 先生请求我们写一封有关的工作证明，情况如下:

为在我省医院引进新的医疗废物管理体系，我省卫生厅与德国 ETLog 公司合作，选择了长沙城区 20 家医院 40 名中高级管理人员举办了为期一个月的医院废物管理理论知识培训班。培训班分初级班和提高班各一期，每期两个班，每班 5 天。初级培训班主要介绍有关医疗废物管理的基础知识包括处理的物流管理，劳动安全等,即从废物的产生到最终处置，也包括了如何在医院实施废物审核。提高班学员接受了一些特殊性废物管理的学习（如细胞毒素废物，实验室废物），学习如何制定不同废物流的管理计划，建立监控和文件管理体系，如何培训医院职工和具体实施医疗废物管理体系。学员通过培训达到具备医院废物管理员的资格。每个学员在两期培训学习之间的一个月时间是回医院实习，将所学的管理知识应用于临床实践。同时，在两期培训班之间，学员通过邮寄收到更多的学习资料。第二期培训班结束后也会有这样的函授课程，理论学习和实践阶段加起来共 8 个培训单元。

湖南省卫生厅和湖南大学对培训课程进行了评估。结果是：97.5%的学员非常满意培训课程及培训专家，并在“很好”一栏上划勾，87.5%的学员认为对自己的工作有启发，95%的认为讲座准备充分，90%认为培训材料对今后还有用处。

我们非常高兴写下此信来感谢 ETLog 公司员工的辛勤工作和付出的努力。ETLog 的职员非常敬业,并具有医疗方面的基本知识。培训材料(约 200 页)质量高并有助于学员的日常工作。培训班的成功实施也表明 ETLog 公司在这一领域经验丰富。我们认为 ETLog 公司可承担医疗废物领域的其他所有项目。

此致

敬礼!

湖南省卫生厅医政处处长:

二〇〇二年十月三十日

湖南省卫生厅 医政处

湖南省肿瘤医院

推荐信

尊敬的 Kuehling 先生：

我们非常高兴呈交关于在中国长沙湖南省肿瘤医院的废物管理项目的推荐信。

2002 年秋，德国 ETLog 公司帮助我们湖南省肿瘤医院实施先进的废物管理，其中 ETLog 公司的 2 名工程师参与了项目。

项目包括：

废物审核：

在医院内进行了医疗废物实际操作的调查和废物流的分析，结果由 ETLog 公司进行评估。基于这一调查结果确定了针对现代废物管理体系需改进的地方。

废物管理体系的实施：

开发出了针对医院废物管理实际的废物管理计划，行动计划和废物政策等概念。这一概念包括了改进分类质量在医院内集中回收，改进回收质量和数量，设计和详细规划储存点，改善废物产生者和垃圾工人的安全。ETLog 公司的员工在三个星期内给医院废物管理系统的实施提供大量帮助。

为引进新的管理方法，医院的 120 名职工、管理人员在分类和废物管理方面得到了培训。

湖南省肿瘤医院

ETLog 公司按时地完成该项目，我们非常满意基本达到我们的期望。公司员工也表现出丰富的经验和极大的工作热情并和政府权威机构合作良好。我们毫不质疑地推荐 ETLog 公司承担医疗废物领域的各种项目。

我们希望

我们非常感谢 ETLog 公司在项目中的良好合作并期望在以后的项目中能继续和 ETLog 公司合作。

此致

敬礼

湖南省肿瘤医院

周晓

2003.2.17.

湘雅醫院

Xiang Ya Hospital of Central South University

141 Xiang Ya Road, Changs
Hunan 410008, P.R.China
Tel :(0731)4328888
Fax:(0731)4327332

致：ETLog 环境技术和物流管理有限公司
Brunnenstraß 大街 164 号
10119 柏林
德国

推荐信
项目：医院废物管理

各位先生，女士：

受到德国 ETLog 公司的请求，我们非常高兴为他们在中国长沙中南大学湘雅医院实施了一套先进的医院废物管理提供该推荐信。

2002 年秋，德国 ETLog 公司帮助我们医院重新组织了废物管理，因此我们实施了全部的废物审核，包括废物流的分析。

开发和建立了一些必要的文件化管理，如废物管理计划，废物指南和标准操作程序、表格等。

ETLog 公司的员工连续三个星期在医院跟踪新的医院废物管理系统的实施。在此期间废物分类和回收的方案得以实施。这些方案是根据长沙的实际情况调整，并适合我们医院，且在实际操作中不断地调整。为加强回收物质的管理，ETLog 公司为临时储存点和回收物质的集中储存点的选址和调整提供咨询。

在医疗废物方面的培训也得到了医院们管理人员的赞同。给我门留下深刻印象的是 ETLog 公司向我们展示了一个医院能够如何以成本有效的方式来实施一个医院废物管理体系。

ETLog 公司按时地完成该项目，我们非常满意。它的员工也表现出了极高水平的专业知识和技能和极大的工作热情。 有了这次良好的团队合作，我们希望在以后的项目中能继续和 ETLog 公司合作。

我们非常高兴写下这封信来感谢 ETLog 公司的工作并借此信祝愿 ETLog 公司将来更加成功。

此致

敬礼

中南大学湘雅医院

CETH
Sino-German Center
for Environmental Technology

Hunan University, Changsha, Hunan
410082 China
Tel.: ++86 731 8822778
Fax: ++86 731 8822778

Letter of recommendation

Mr. Kühling of the company ETLog GmbH, Berlin (Germany) asked us to write a recommendation about the work of his company, carried out in the past for the CETH, Hunan (P.R.China). This whish, we would like to fulfil with this letter.

The CETH is a Sino-German cooperation for knowledge transfer and technology transfer from Germany to China in the fields of waste water handling and treatment, solid wastes handling and treatment and air pollution control. It is based at the Environmental Department of Hunan University
The company ETLog GmbH has worked for the CETH as expert company for healthcare waste management and treatment. Contains of the work in the different projects have been:

- ✓ Momentary analysis of the current situation of hospital waste management and treatment in the Province Hunan, P.R. China
- ✓ Support and analysis of a waste audit, carried out in five different hospitals in Changsha
- ✓ Research and development of regional concepts for the ecological and economical handling and treatment of different waste streams from the healthcare sector. (Scope: waste generated from 22.000 hospital beds – to be implemented in the end of 2002)
- ✓ Set up of a concept, master plan and implementation plan for the introduction of a training of the trainer program: "Hospital waste officer" (Will be implement in 2002)
- ✓ Set up of model regulations for the management of hospital waste
- ✓ Training on the monitoring of hospital waste by authorities

The drawn up plans, concepts, trainings, etc. proved to be sound and practice-oriented in every aspect and are based on the local legal laws, latest standards by the WHO and on the new technical guidelines issued by the Basel Convention.

The results of the work of ETLog GmbH were presented in detailed workshops and reports to the responsible governmental authorities. During these workshops, fundamental decisions on next steps for the lasting improvement of the hospital waste situation in Hunan could be taken. Next to this, ETLog gave different lectures on advanced hospital waste management and treatment to post-graduated students of the Hunan University, P.R. China and other.

We are glad to have the possibility to certify with this letter the excellent work and the extensive know-ledge of the ETLog GmbH as experts on healthcare waste. The CETH was impressed with the adroit way of working during the projects, the workshops and the lectures. We are totally satisfied with the results of the carried out work and are sure, ETLog GmbH will have a successful future.

29. April 2002

Dr. Horst Schüssler
-Project Advisor-

/ خ / ٠٠٠٦٧٥ /
الرقم:
الاثنين، ١٣ مايو، ٢٠٠٢م
التاريخ:
المشمولات:

رأي للتدريب والاستشارات البيئية
RAE Training and Environmental Consul.

ETLog GmbH
M.Sc. Jan-Gerd Kuhling
Brunnenstr. 164
Berlin, Germany

Wednesday, 08 May 2002

Letter of recommendation

The company RAE Training and Environmental Consul., Riyadh, Saudi Arabia is specialized in training and awareness programs for the environmental sector. In the frame of this, RAE is giving training for the private and public healthcare sector to improve the momentary situation of hospital waste management in the Saudi Arabian hospitals.

On recommendation of the Ministry of Health, Saudi Arabia, M.Sc. Jan-Gerd Kuhling was invited in 2001 for the first time, to give several lectures and workshops on hospital waste as expert in this field. Target group was the middle and higher management of several hospitals.

During the training, the company ETLog trained and informed the participants in the potential hazards created by hospital waste for the environment, the public, and the healthcare staff. Also they explained strategies and management methods to improve the complete disposal chain of hospital waste (segregation, collection, internal transportation, interim storage, external transportation and final treatment). Further they introduced internal and external monitoring, waste tracing and record keeping methods. By case studies and workshops, the participants could recapitulate the contains of the lectures. For the training package, ETLog set up a detailed and practice orientated handout.

> The company RAE and the participants were impressed and totally satisfied by the training. The training units of ETLog proved to be sound and practice-oriented in every aspect. They showed a very high degree of motivation, demonstrated a high technical competence and a very good professional competence. Out of this, RAE decided that ETLog became the permanent speakers for trainings in the sector of hospital waste given by RAE. Since that time, ETLog carried out several trainings on hospital waste in Saudi Arabia.

We are pleased to be able to confirm the excellent work, carried out by the company ETLog during the training. We hope to involve ETLog also in future in our training program and we are sure, Mr. Kuhling and his company will have also much success in other countries.

RAE Training and environmental Consul., Riyadh, Saudi Arabia

Faiz Al Yousef
General Manager

رأي للتدريب والإستشارات البيئية

rae-tec@awalnet.net.sa

المملكة العربية السعودية – ص.ب: ٨٦٩٠٢ – الرياض: ١١٦٣٢ - تليفون: ٢٩٣١١٢٠ – فاكس: ٢٩٣١١٥٠
Saudi Arabia - P.O.Box: 86902 - Riyadh: 11632 - Tel. 2931120 - Fax: 2931150

Project Implementation Unit *of Hokimyat of Tashkent City*

700027, 1 a, Halqlar Dustligy sq., Tashkent, Uzbekistan.
Tel: (+998-71) 144-48-49, 144-48-46
Fax: (+998-71) 133-25-07

ETLog EnviroTech & Logistics GmbH
Brunnenstrasse 164

10119 Berlin
GERMANY

October 2, 2002

Dear Sir or Madam

Recommendation Letter

With pleasure we confirm that the ETLog EnviroTech & Logistics GmbH supported the Municipal of Tashkent, Uzbekistan as a competent consultant in 2002.

The consultation of the company represented by the project leadership of the graduated engineer Mr. J.-G. Kuehling, concerning the biomedical waste management and operational technical assistance was always competent and of high technical standard.

In detail, the ETLog GmbH was contracted for the following tasks:

- Characterization of the current practices respecting biomedical waste generation and its management including identification of sources, types and volume of wastes;
- Design of temporary storage and collection system including technical specification of containers and vehicles required and input of this information into procurement documents;
- Select and design of secure landfill cell for biomedical waste disposal within the Achangaranskoe Highway disposal site;
- Development of operating procedures
- Development and delivery of necessary training to support the efficient operation of the system;
- Recommend a longer-term development plan for introduction of biomedical waste management

The whole work carried out by the ETLog GmbH is characterised by high technical quality, which meets all technical requirements and in addition the standards regarding the specific existing conditions of Uzbekistan.

The ETLog GmbH has always corresponded to both the technical and ecological requirements of renovation and the requirement of economical solutions at this. For that reason we confirm that the company has an excellent reputation, always acted loyally and has our complete confidence.

Yours faithfully

Rustamov G.D.
PIU Director

湖南省卫生厅　　德国技术合作公司　　中德环境技术中心　　德国 ETLOG 公司

医院废物管理员培训班 (Hospital Waste Officer Training Courses)

结业证书(Certificate)

兹证明
This to certify that

李妍

Ms. Li Yan

参加了为期 5 天的医院废物管理的基础培训班和 5 天的高级培训班并通过结业考试合格。该学员能够运用所学知识在医院担任

医院废物管理员

特发此证。

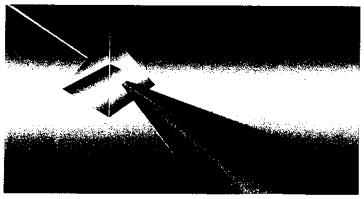
participated in a 5-day basic course and a 5-day advanced training course on hospital waste management. By successfully passing the test, the participant showed that he/she is able to act in his/her hospital as

Hospital Waste Officer

刘家望 副厅长
Liu Jiawang
湖南省卫生厅
Hunan Provincial Health Bureau
2003.2.24

曾光明 主任
Zeng Guangming
湖南大学中德环境技术中心
Sino-German Center for Environmental Technology, Hunan University
2003.2.24

杨·吉尔德 库林
Jan-Gerd Kühling
德国 Etlog 公司
ETLog EnviroTech & Logistics GmbH
2003.2.24



K U M A S

Kompetenzzentrum Umwelt

The Environmental Network

(下)

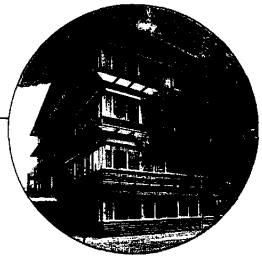
A Centre of Competence ...

KUMAS stands for "Kompetenzzentrum Umwelt," which means Centre of Competence for Environmental Technologies and Affairs.

Based on the belief that environmental technologies will be among the key technologies of the 21st century, KUMAS – supported by the Bavarian State Government – was established in Bavaria with the aim of developing one of Europe's leading environmental centres.

The KUMAS network effectively links and promotes the specific environmental know-how of companies, universities, universities for applied sciences and other educational institutions as well as chambers of commerce and governmental authorities, thereby permanently improving the competitiveness of all partners.

... for Environmental Technologies and Affairs



The result of this work is evident in the diversity of the fields of expertise in the KUMAS network:

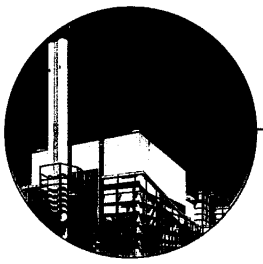
- Establishing a new business
- Environmental education
- Sustainable management
- Environmental economy
- Renewable energies
- Environmental medicine
- Environmental biotechnology
- Environment & traffic / logistics

Your Gateway ...

Bavaria is not only attractive as a holiday resort but also as a high-tech location where innovative technologies such as environmental technology are promoted in many different ways.

In addition to economic promotion, the existing innovative potential of local companies and service providers also helps make Bavaria-Swabia such an attractive location.

KUMAS draws on this potential on your behalf and helps you find appropriate partners, products and services.



... to Innovation

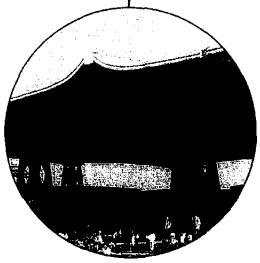
From the network of specialized expertise and the proximity of the individual players in the Centre of Competence, environmentally oriented companies reap vital benefits:

- Investment and planning security via accelerated licensing procedures
- Short innovation cycles through cooperation and knowledge transfer
- High potential of qualified junior and technical employees and executives through specific environmental training
- Knowledge head-start by sharing experiences and by cooperation with partners in the KUMAS network
- Financial support through attractive promotional programmes and advice on submitting proposals
- New market opportunities through joint marketing

K U M A S
Kompetenzzentrum Umwelt

Leadership ...

KUMAS' objective is to develop one of the leading environmental centres in Europe through the close cooperation of companies, agencies and institutions in Bavaria.



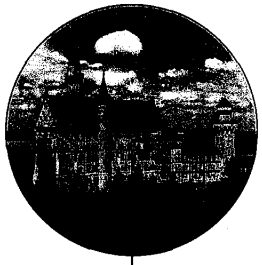
... follows Partnership

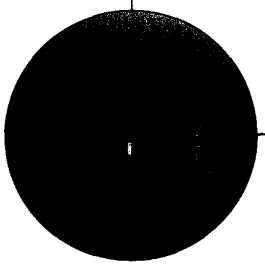
An important factor for success is the high degree of partnership and willingness to cooperate of all KUMAS network members.

KUMAS network membership provides optimum conditions for successful positioning in the new environmental market, in particular for start-ups or companies wishing to set foot in the European environmental sector.

A Location ...

... in the Heart of Europe





KUMAS is situated in Bavaria – one of the most beautiful regions in the world.

Located in Augsburg, Germany, KUMAS is very close to Munich and Nuremberg, right at the very heart of Europe. This central location affords many excellent advantages:

- First-rate transportation infrastructure with road, railway and air-traffic links to other European economic centres
- Central location in particular for emerging Eastern European markets of the future (especially EU membership candidates)
- Highly motivated and qualified technical employees and executives
- Solid trade, industry and service structures
- Well-developed research and educational infrastructure
- Attractive surroundings with high quality of life and intact environment

Your link to ...

K U M A S
Kompetenzzentrum Umwelt

Your main contact partner for the KUMAS network is "Förderverein Kompetenzzentrum Umwelt Augsburg-Schwaben e.V." (Augsburg-Swabia Centre of Competence for Environmental Technologies and Affairs) in Augsburg, Germany.

All important KUMAS members (from industry, service, trade, research and development, management and politics) work together closely to achieve favourable basic conditions for companies in the environmental sector.

Active support from partnerships and knowledge transfer, advice on obtaining promotional funding together with the organization of seminars and conferences are also part of the effective public relations work undertaken for members via joint national and international trade fairs, for instance.

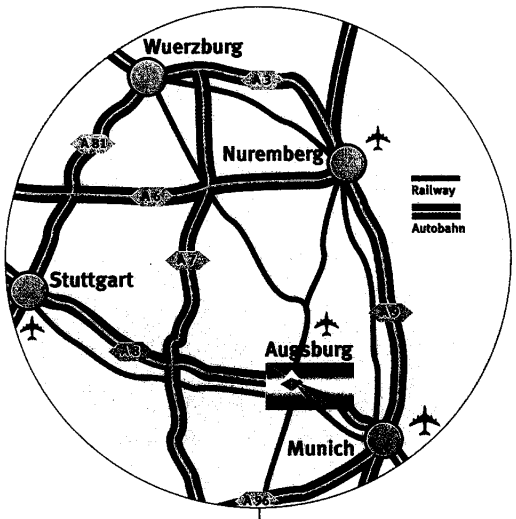
... the Environmental Network

For more information, please contact the KUMAS office listed below.

Our staff will be glad to help you identify possible partners, official contacts and any services you may require.

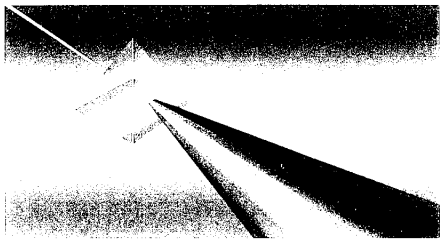
If travelling from abroad, Munich is your nearest airport. Augsburg is only 70 kilometres west of Munich and can be easily reached by public transport.

Augsburg Airport has air connections to several German destinations such as Berlin, Düsseldorf, Frankfurt and Dresden.



UMWELT BAYERN

KUMAS Förderverein Kompetenzzentrum Umwelt Augsburg-Schwaben e.V.
Am Mittleren Moos 48
D-86167 Augsburg
Phone: 00 49 /8 21/74 93-194
Fax: 00 49 /8 21/74 93-166
E-mail: info@kumas.de
Internet: www.kumas.de



K U M A S
Kompetenzzentrum Umwelt

Centre of Competence
for Environmental Technologies
and Affairs

LIST OF MEMBERS

- Business and Services Trade
- Research and Educational Institutions
- Authorities and Scientific Institutions

KUMAS
Förderverein Kompetenzzentrum Umwelt Augsburg-Schwaben e.V.
Am Mittleren Moos 48
D-86167 Augsburg
Telefon 08 21/74 93-194
Telefax 08 21/74 93-166
E-Mail: info@kumas.de
Internet: www.kumas.de

2003

KUMAS Members

List of Members of the Centre of Competence in Environmental Technologies and Affairs
Förderverein Kompetenzzentrum Umwelt Augsburg-Schwaben (KUMAS) e.V.
Am Mittleren Moos 48, 86167 Augsburg Phone: +49/821/7493-194; Email: info@kumas.de,
Please find full informations on our members at our homepage www.kumas.de, section „Mitglieder".

K U M A S
Kompetenzzentrum Umwelt

	Bussiness / Institution	Phone	Internet
1	A&U Abfallwirtschaft & Umwelttechnik GmbH, Augsburg	0821/26199-0	www.au-gmbh.de
2	AAC Opel Sigg, Augsburg	0821/7479-0	www.opel-sigg.de
3	Abwasserbetrieb Stadt Augsburg	0821/324-7750	klaerwerk.stadt@augaburg.de
4	ACCON-IMTEC Gesellschaft für immissions-technische Beratung mbH, Augsburg	0821/90630-63	www.accon.de
5	AFAG Messen und Ausstellungen GmbH, Augsburg	0821/25769-0	www.afag.de
6	AL-KO KOBER AG, Kötz	08221/97-0	www.al-ko.de
7	Allgäu-Initiative GbR, Kempten	0831/575860	www.allgaeu-initiative.de
8	Allgäuer Überlandwerk GmbH, Kempten	0831/2521-0	www.auew.de
9	Anwenderzentrum Material- und Umweltforschung der Universität Augsburg	0821/598-3403	www.amu-augsburg.de
10	APA GmbH, Augsburger Pumpen und Anlagen	0821/24078-0	www.apa-pumpen.de
11	ARNOLD CONSULT AG, Kissing	08233/7915-0	www.arnold-consult.de
12	ATOFINA Deutschland GmbH, Günzburg	08221/98-0	www.atofina.de
13	ATZ-EVUS, Entwicklungszentrum für Verfahrens-technik, Sulzbach-Rosenberg	09661/908-400	www.atz-evus.de
14	Augsburger Flughafen GmbH, Augsburg	0821/27081-0	www.augsburg-airport.de
15	Augsburger Schwabenhallen Messe- und Veranstaltungs GmbH, Augsburg	0821/2572-0	www.messeaugsburg.de
16	autohaus augsburg KUMMER + KLOSTERMAIR GmbH & Co. KG, Augsburg	0821/9009-0	www.autohaus-augsburg.de
17	AVA Abfallverwertung Augsburg GmbH, Augsburg	0821/7409-0	www.ava-augsburg.de
18	AxynTec Dünnschichttechnik GmbH, Augsburg	0821/74999140	www.axyntec.de
19	BAUFRITZ GmbH & Co. seit 1896, Erkheim	08336/900-0	www.BAUFRITZ.com
20	Bayerische Ingenieurekammer-Bau, München	089/419434-0	www.bayika.de
21	Bayerisches Institut für Angewandte Umweltforschung und -technik GmbH, Augsburg	0821/7000-0	www.BIfA.de
22	Bayerisches Landesamt für Umweltschutz, Augsburg	0821/9071-0	www.bayern.de/lfu
23	Bayern-Fass GmbH, Aichach	08251/8899-0	www.bayern-fass.de
24	BAYOSAN Wachter GmbH & Co. KG, Bad Hindelang	08324/921-0	www.bayosan.de
25	BEKON Lärmschutz & Akustik GmbH, Augsburg	0821/34779-0	www.bekon-d.de

as at 2003-09-03

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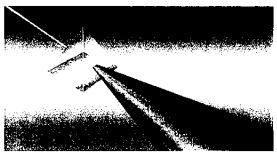

K U M A S
Kompetenzzentrum Umwelt

	Bussiness / Institution	Phone	Internet
26	BEKON Umweltschutz & Energietechnik GmbH, Augsburg	0821/34779-0	www.bekon-d.de
27	Bezirk Schwaben	0821/3101-0	www.bezirk-schwaben.de
28	bfm umwelt - beratung forschung management gmbh, Augsburg	0821/7493-123	www.bfm-umwelt.de
29	Bildungszentrum für Umweltschutz, Lauingen	09072/71-0	www.bzu.de
30	Bio Energie Centrum - BENC KG, Mertingen	09078/968550	www.benc-kg.de
31	BIO-Energie Schwaben GmbH, Erkheim	08336/8055-0	www.bio-energie-schwaben.de
32	Brinker – Umwelt- und Managementberatung, Oberstdorf	08321/780484	www.umweltonline24.de
33	BSH BOSCH UND SIEMENS HAUSGERÄTE GmbH, Dillingen	09071/52-0	www.bsh-group.com
34	bvek Bundesverband Emissionshandel und Klimaschutz e.V., Augsburg	0171/7557480	www.emissions.de
35	BWF Offermann, Schmid & Co. KG, Offingen	08224/71-0	www.bwf-group.de
36	CABB - Clariant (Acetyl Building Blocks) GmbH & Co. KG., Gersthofen	0821-479-2432	www.cabb.clariant.com
37	CheMin – Chemische und mineralische Untersuchungen GmbH, Augsburg	0821/74839-0	www.chemin.de
38	Ciba Spezialitätenchemie Pfersee GmbH, Langweid	08230/41-0	www.cibasc.de
39	Clariant GmbH, Werk Gersthofen	0821/479-0	www.clariant.de
40	DALOG GmbH, Diagnosesysteme, Augsburg	0821/7477-710	www.dalog.net
41	Dehner Garten Center GmbH, Rain am Lech	09090/770	www.dehner.de
42	Deutsche Bank AG, Filiale Augsburg	0821/3157-0	www.db-innovation.de
43	Deutscher Gewerkschaftsbund, Landesbezirk Schwaben	0821/420797-0	www.dgb-bayern.de
44	Dr. J. Bruggey – GEOTEC, Geotechnik und Umweltschutz GmbH, Augsburg	0821/90603-0	Bruggey-GEOTEC@t-online.de
45	DR. GRANDEL GmbH, Augsburg	0821/3202-0	www.grandel.de
46	EADS Deutschland GmbH, Werk Augsburg	0821/801-0	www.eads.net
47	ECOSOIL Sanierung GmbH, Niederlassung Ulm	0731/97982-0	www.ecosoil.de
48	EnviComCenter AG, Augsburg	0821/56081-0	www.envicom.de
49	EnviroTex GmbH, Augsburg	0821/569796-0	www.envirotex.de
50	ERDGAS SCHWABEN GmbH, Augsburg	0821/9002-0	www.erdgas-schwaben.de

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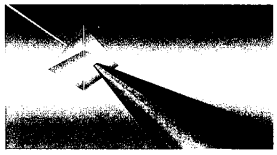

K U M A S
Kompetenzzentrum Umwelt

	Bussiness / Institution	Phone	Internet
51	Erhardt + Leimer Elektroanlagen GmbH, Augsburg	0821/2435-0	www.el-elektroanlagen.de
52	erneuerbare energien Kommunikations- und Informationsservice GmbH, Reutlingen	07121/3016-0	www.energie-server.de
53	ESS Energie Systeme & Service GmbH, Landsberg am Lech	08191/9279-0	www.ess-elektroservice.de
54	eza! Energie- und Umweltzentrum Allgäu gGmbH, Kempten	0831/96028610	www.eza-allgaeu.de
55	Fachhochschule Augsburg	0821/5586-0	www.fh-augsburg.de
56	Fachhochschule Kempten	0831/2523-0	www.fh-kempten.de
57	Fachhochschule Neu-Ulm	0731/9762-0	www.fh-neu-ulm.de
58	FAIST Anlagenbau GmbH, Krumbach	08282/8880-0	www.faist-group.de
59	Federal-Mogul Friedberg GmbH	0821/6001-0	www.federal-mogul.de
60	Freistaat Bayern (vertreten durch die Regierung von Schwaben)	0821/327-0	www.regierung.schwaben.bayern.de
61	Fujitsu Siemens Computers GmbH, Augsburg	0821/804-0	www.fujitsu-siemens.de
62	Gebr. Lang GmbH Papierfabrik, Ettringen	08249/802-0	www.langpapier.com
63	geoinform AG, Würzburg	0931/270050-0	www.geoinform.de
64	GEO RISK Planungsgesellschaft mbH, Augsburg	0821/7493-115	www.georisk.de
65	Georg-Haindl-Wissenschaftsstiftung, Augsburg	0821/3109-600	Hans-Ulrich.Embacher@upm-kymmene.com
66	Grünbeck Wasseraufbereitung GmbH, Höchstädt	09074/41-0	www.gruenbeck.de
67	Handwerkskammer für Schwaben, Augsburg	0821/56006-0	www.hwk-schwaben.de
68	HAPPLE Maschinenfabrik Anlagenbau GmbH, Weißenhorn	07309/81-101	www.happle.de
69	Hielscher & Besser Steuerberatungsges. mbH, Augsburg	0821/50901-0	www.hielscher-besser.de
70	HOSOKAWA ALPINE Aktiengesellschaft, Augsburg	0821/5906-0	www.alpinehosokawa.com
71	HPC HARRESS PICKEL CONSULT AG, Harburg	09080/999-0	www.HPC-AG.de
72	Hubert Schmid Recycling und Umweltschutz GmbH, Marktoberdorf	08342/961071	www.schmid-umweltschutz.de
73	Hygiene-Technik, Röfingen	08222/42942	www.system-ernst.de
74	IGS Industriepark Gersthofen Servicegesellschaft mbH & Co. KG, Gersthofen	0821/479-0	www.industriepark-gersthofen.de
75	IFE Gesellschaft mbH, Ingenieurbüro, Augsburg	0821/409450	www.ibp-ife.de

as at 2003-09-03

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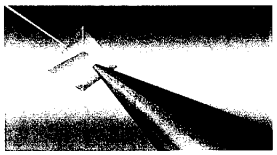

K U M A S
Kompetenzzentrum Umwelt

	Bussiness / Institution	Phone	Internet
76	Industrie- und Handelsgremium Aichach-Friedberg	0821/3162-0	---
77	Industrie- und Handelsgremium Augsburg-Land	0821/3162-0	---
78	Industrie- und Handelsgremium Augsburg-Stadt	0821/3162-0	---
79	Industrie- und Handelskammer für Augsburg und Schwaben	0821/3162-0	www.augsburg.ihk.de
80	Ingenieurbüro Herbert Scheel VDI, Friedberg	0821/262898-0	www.scheel-net.de
81	Ingenieurgesellschaft für Umwelttechnik und Bauwesen Dr. Eisele mbH (IUB), NL Kempten	0831/704964-0	www.dr-eisele.de
82	INNOLAB GMBH, Harburg	09080/999-284	www.innolab.de
83	Institut für angewandte Forschung Memmingen (IAFM) e.V.	08331/3099	www.fh-kempten.de/htt/iafm.htm
84	Institut für Geographie an der Universität Augsburg	0821/598-2268	www.geo.uni-augsburg.de
85	Institut für Laboratoriumsmedizin, Mikrobiologie und Umwelthygiene am Zentralklinikum Augsburg	0821/400-3200	www.umweltmedizin-klinikum-augsburg.de
86	Institut für Management und Umwelt, Augsburg	0821/34366-0	www.imu-augsburg.de
87	Institut für Meteorologie und Klimaforschung - Atmosphärische Klimaforschung (IMK-IFU), Forschungszentrum Karlsruhe, Garmisch-Partenkirchen	08221/183100	www-imk.fzk.de
88	Institut für Umweltrecht an der Universität Augsburg	0821/598-4551	www.jura.uni-augsburg.de/Fakultaet/Umweltrecht
89	ipu – Institut für Praktische Unternehmensführung, Sulzberg	08376/975-35	www.ipuonline.de
90	KARAT GmbH, Mülltrennung mit System, Augsburg	0821/2670808	www.2000karat.de
91	Kernkraftwerk Gundremmingen GmbH	08224/78-1	www.kkw-gundremmingen.de
92	Kling Consult Planungs- u. Ingenieurgesellschaft für Bauwesen mbH, Krumbach	08282/994-0	www.klingconsult.de
93	Kloster Roggenburg, Zentrum für Familie, Umwelt und Kultur	07300/9611-0	www.kloster-roggenburg.de
94	Knittel GmbH Abfallentsorgung, Vöhringen	07306/9616-0	www.knittel-entsorgung.de
95	Kreishandwerkerschaft Aichach-Friedberg	0821/601405	www.hwk-schwaben.de
96	Kreishandwerkerschaft Augsburg	0821/3259-0	www.kh-augsburg.de
97	Labor Dr. Scheller GmbH, Augsburg	0821/450733-0	www.labor-dr-scheller.de
98	Landkreis Aichach-Friedberg	08251/92-0	www.lra-aic-fdb.de
99	Landkreis Augsburg	0821/3102-0	www.landkreis-augsburg.de
100	Landkreis Dillingen	09071/51-0	www.landkreis.dillingen.de

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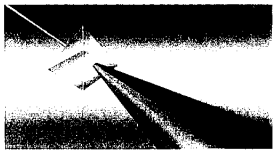

K U M A S
Kompetenzzentrum Umwelt

	Bussiness / Institution	Phone	Internet
101	Landkreis Donau-Ries	0906/74-0	www.donau-ries.de
102	Landkreis Günzburg	08221/95-0	www.landkreis-guenzburg.de
103	Landkreis Neu-Ulm	0731/7040-0	www.landkreis.neu-ulm.de
104	Lechwerke AG, Augsburg	0821/328-0	www.lew.de
105	Leop. Siegle GmbH & Co. KG, Augsburg	0821/7905-0	www.siegle.de
106	Lech-Stahlwerke GmbH, Meitingen	08271/82-0	www.lech-stahlwerke.de
107	LGA Landesgewerbeanstalt Bayern, Nürnberg	0911/655-50	www.lga.de
108	MAN Roland Druckmaschinen AG, Augsburg	0821/424-0	www.man-roland.de
109	M·A·R Max Aicher Recycling GmbH, Nürnberg	0911/64292-0	www.mar.de
110	Märker Zementwerk GmbH, Harburg	09080/8-0	www.maerker-gruppe.de
111	Mattfeldt & Sänger Marketing und Messe AG, Kempten	0831/540633-0	www.ms-marketing.de
112	mayr Antriebstechnik, Mauerstetten	08341/804-0	www.mayr.de
113	MDE Dezentrale Energiesysteme GmbH, Augsburg	0821/7480-0	www.mde-augsburg.de
114	MEBA - Metallbau Bachmann, Balgheim	09083/809-0	www.meba-bachmann.de
115	Meidert & Prof. Versteyl Rechtsanwälte, Augsburg	0821/90630-0	www.meidert-kollegen.de
116	Merk-Holzbau GmbH & Co. KG, Aichach	08251/9080	www.merk.de
117	Möhler + Partner, Beratende Ingenieure für Schall-schutz, Augsburg	0821/3199533	www.mopa.de
118	Molkerei Alois Müller GmbH & Co., Aretsried	08236/999-0	www.muellermilch.de
119	muva kempten Qualitäts- und Laborzentrum	0831/5290-0	www.muva.de
120	Pfister GmbH, Augsburg	0821/7949-0	www.pfister.de
121	PRESSE-DRUCK- UND VERLAGS-GMBH, Augsburg	0821/777-0	www.augsburger-allgemeine.de
122	Private Technikerschule Augsburg	0821/25768-30	www.bbz-augsburg.de
123	RS Umwelttechnik KG, Neusäß	0821/24648-0	www.rohrleitungsbausued.de
124	RWE Umwelt Augsburg GmbH, Gersthofen	0821/49003-0	www.rweumwelt.com
125	Seitz - Weckbach - Fent & Fackler Rechtanwälte Steuerberater, Augsburg	0821/34585-0	www.swff.de

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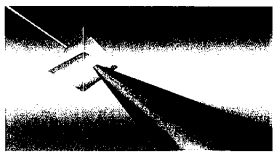

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Kompetenzzentrum Umwelt

	Bussiness / Institution	Phone	Internet
126	Sension GmbH – Biologische Detektions- und Schnelltest-Systeme, Augsburg	0821/7493-173	www.sension-gmbh.de
127	SGL ACOTEC GmbH, Meitingen	08271/83-0	www.sglcarbon.de
128	SINUS CONSULT GmbH, Augsburg	0821/74775-80	www.sinus-consult.de
129	Sparkassen-Bezirksverband Schwaben, Augsburg	0821/3255-0	www.stadtsparkasse-augsburg.de
130	Spechtenhauser Pumpen GmbH, Waal	08246/9695-0	www.spechtenhauser.de
131	Stadt Augsburg	0821/324-0	www.augsburg.de
132	Stadt Friedberg	0821/6002-0	www.stadt-friedberg.de
133	Stadt Landsberg am Lech	08191/128-0	www.landsberg.de
134	Stadt Lauingen an der Donau	09072/998-0	www.lauingen.de
135	Stadtwerke Augsburg Holding GmbH, Augsburg	0821/324-0	www.stawa.de
136	Steinbacher - Consult, Neusäß	0821/46059-0	www.steinbacher-consult.com
137	Techniker Krankenkasse, Geschäftsstelle Augsburg	0821/5583-0	www.tk-online.de/augsburg
138	TrennSo-Technik, Weißenhorn	07309/9620-0	www.trennso-technik.de
139	Trevira GmbH, Werk Bobingen	08234/82-0	www.trevira.com
140	TTW – Projekt Technologietransfer Wasser, Hof	09281/891-0	www.bayern.de/wwa-ho/ttw
141	TÜV Süddeutschland Bau und Betrieb GmbH, München	089/5791-0	www.tuev-sued.de
142	UTG - Umwelt-Technologisches Gründerzentrum GmbH, Augsburg	0821/7493-0	www.u-t-g.de
143	UPM-Kymmene Papier GmbH & Co. KG, Augsburg	0821/3109-0	www.upm-kymmene.com
144	Universität Augsburg	0821/598-0	www.uni-augsburg.de
145	vbw Vereinigung der Bayerischen Wirtschaft e.V.	089/55178-100	www.vbw-bayern.de
146	Verlagsgruppe Weltbild, Augsburg	0821/7004-0	www.weltbild.de
147	VCI - Landesverband Bayern, München	089/92691-0	www.chemie-kvi-bayern.de
148	VÖWA-Wertstofftechnik GmbH, Bobingen	08234/9656-0	www.voewa.de
149	WashTec AG, Augsburg	0821/5584-0	www.washtec.de
150	Wirtschaftsjunioren Augsburg (im Namen der WJ Bayerisch-Schwaben)	0821/3162-373	homes.augsburg.ihk.de/wj/index.htm

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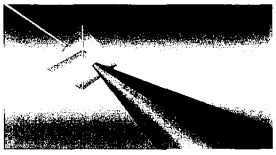

K U M A S
Kompetenzzentrum Umwelt

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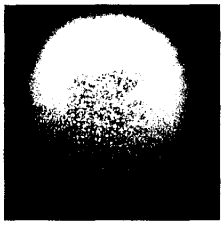
151	WissenschaftsZentrum Umwelt (WZU), Universität Augsburg	0821/598-3000	www.uni-augsburg.de/wzu
152	ZAK Energie GmbH, Kempten	0831/25282-0	www.zak-kempten.de
153	Zentralklinikum Augsburg und Krankenhaus Haunstetten	0821/400-0	www.klinikum-augsburg.de
154	Zeuna Stärker GmbH & Co. KG, Augsburg	0821/4103-0	www.zeunastaerker.de

as at 2003-09-03

BIfA

Bavarian Institute of
Applied Environmental
Research and
Technology

Waste, Environment, Industry: Practical Solutions

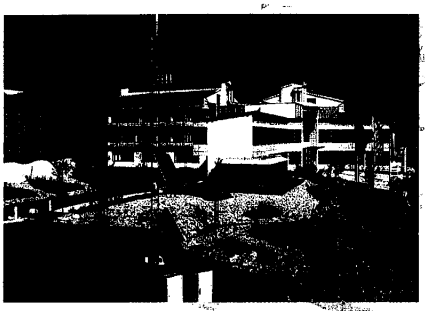


Waste, Environment, Industry: Practical Solutions

BIfA GmbH
Bavarian Institute
for Waste Research

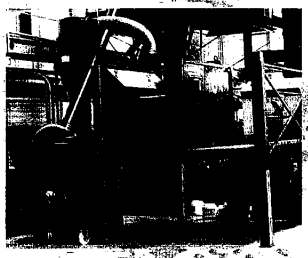
Specialists of multi disciplines work for realistic and useroriented solutions

- Environmental technology
- Innovations in waste management
- Recycling and handling of residuals
- Concepts for waste-avoidance
- Ecological and economical requirements



Engineering

- Process development
- Optimisation of products and processes
- Life-cycle assessment
- Process simulation and modelling
- Engineering



Technical Chemistry

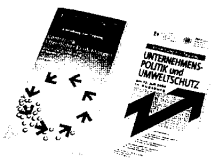
- High-quality analysis
- Air pollution control
- Quality management
- Dioxin analysis

Toxicology/Microbiology

- Hygienic assessment
- Biological monitoring
- Quality control
- Test of bio-degradability of pollutants
- Toxicological assessment

Economy

- Environmental economics
- Pricing in waste sector
- Tax harmonisation
- Financial controlling
- Management training



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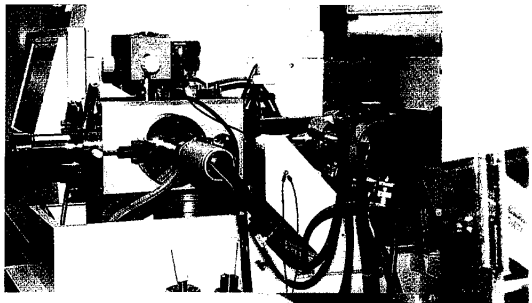
Fax: +49 821/70 00-100
e-mail: marketing@bifa.de

Waste, Environment, Industry: Practical Solutions

BIfA GmbH
Bavarian Institute
for Waste Research

International activities

- **Detailed knowledge**
- **Broad experience**
- **Good contacts**
- **Customers all over the world**



Practical solutions

- Feasibility studies
- Market studies
- Technology survey
- Support for technology implementation
- Waste management concepts

Different countries – different needs

- Economic conditions
- Technological basis
- Natural resources
- Staff cost
- Climate

Adapted technology for international markets

Environmental issues require adapted technologies for practical solutions

- Technology transfer
- Know-how transfer

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Waste, Environment, Industry: Practical Solutions

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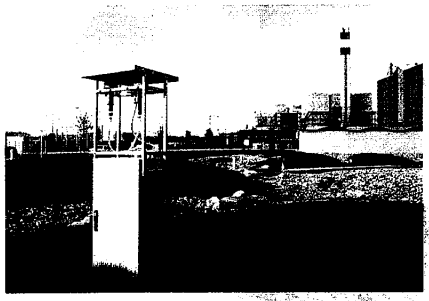
Technical Chemistry

- Dioxin analysis
- High quality analysis
- Air pollution control
- Quality management

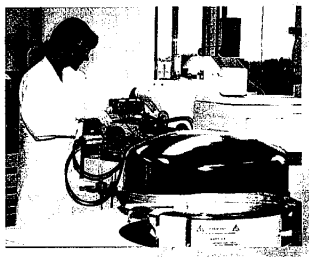


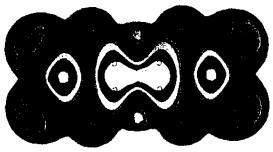
Waste- and environmental Analysis

- Sampling
- Analysis
- Study of pollutants release
- Assessment of hazards

Dioxin Analysis

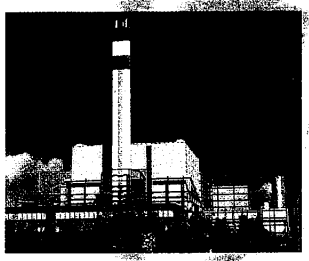
- Sample preparation
- Mass spectrometry
- Evaluation

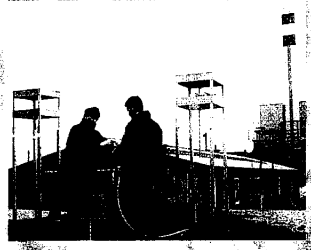




Air pollution Control

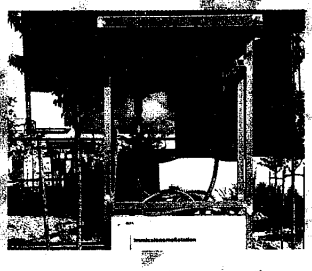
- Emission measurements
- Plant optimisation
- Plant monitoring

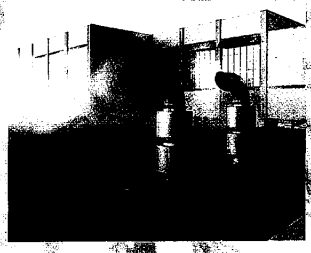




Environmental chemistry

- Environmental monitoring
- Emission measurements
- Impact assessment of pollutants





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e-mail: marketing@bifa.de

Waste, Environment, Industry: Practical Solutions

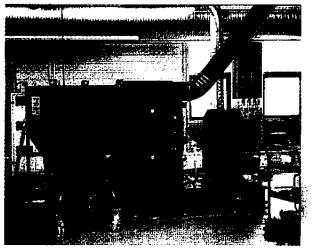
BIfA GmbH
Bavarian Institute
for Waste Research

Research and Development in laboratories, pilot plant hall and outdoor experimental site

- Laboratories: 1500 m²
- Pilot Hall: 600 m²
- Outdoor Experimental Site: 1000 m²

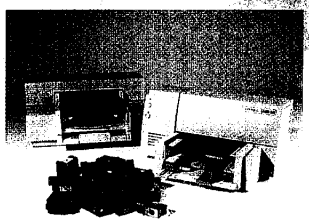
Development of Recycling-Technologies

- Processing of complex residues
- Recovery of valuable materials
- Removal of hazardous substances
- Closing of material cycles



Optimisation of Products and Processes

- Reduction of solid waste, waste water and waste air
- Improvement of material and energy efficiency
- Improvement of practicability
- Live-cycle assessment
- Process simulation and modelling



Engineering

- Waste management concepts
- Technology transfer
- Environmental technology

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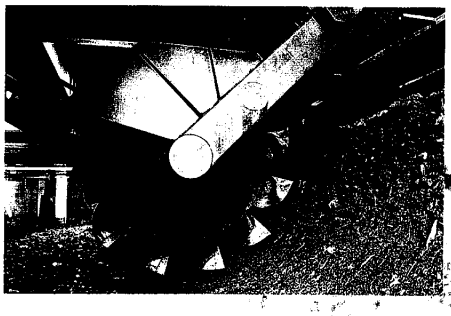
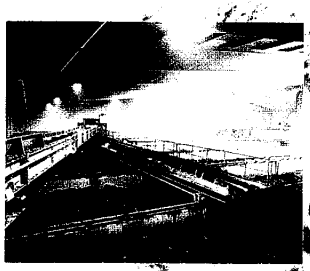
Toxicology/Microbiology

- **Environmental/industrial hygiene**
- **Environmental biotechnology**
- **Environmental toxicology**
- **Quality assurance**



Environmental Hygiene

- Occupational safety provisions
- Determination and evaluation of germ emission
- Working out of hygiene plans
- Prevention of microbial material destruction

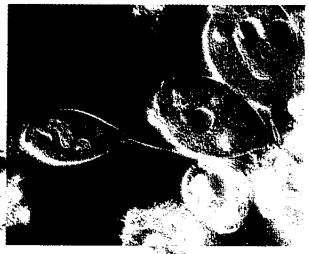


Environmental Biotechnology

- Biological waste treatment
- Biological scrubbed gas cleaning
- Biological soil and ground water purification
- Biological water and waste water recycling

Environmental Toxicology

- Toxicological evaluations
- Recording of environmental impacts
- Bio-Monitoring



Quality Assurance

- Quality surveillance
- Plant optimization
- Support with product marketing

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Bayerisches Institut für Abfallforschung

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Waste, Environment, Industry: Practical Solutions

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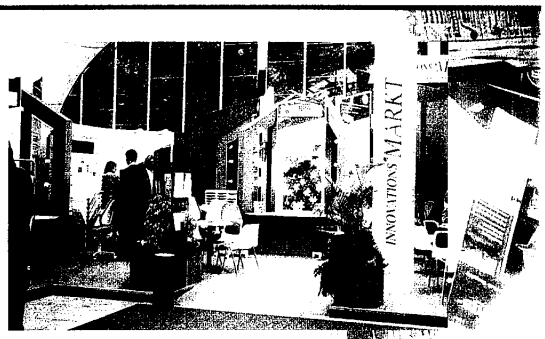
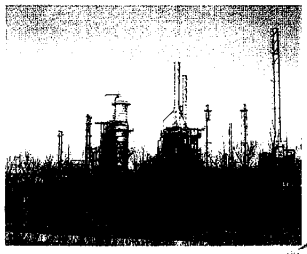
Economy

- **Economically modivated environmental research**
- **Individual consultancy at private and public sector**
- **Political decisions support**
- **Economical analysis and decision models**



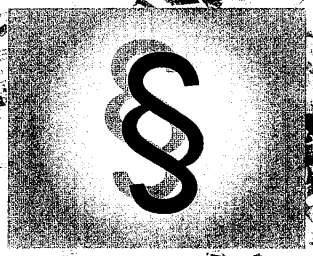
Management

- Consultancy on ecologically orien-ted management
- Solutions to ecological problems in the environment area



Consulting

- Technical advise for public agen cies, communities and enterprises
- Consultancy on legal and organiza tional form at public sector
- Decision on investment and funding



Controlling/Costs

- Development of controlling con cepts
- Calculation and design of waste disposal fees
- Costs optimization at public institu tions (bench marking)

Management-Training

- Cost optimization
- Management politics
- New controlling models

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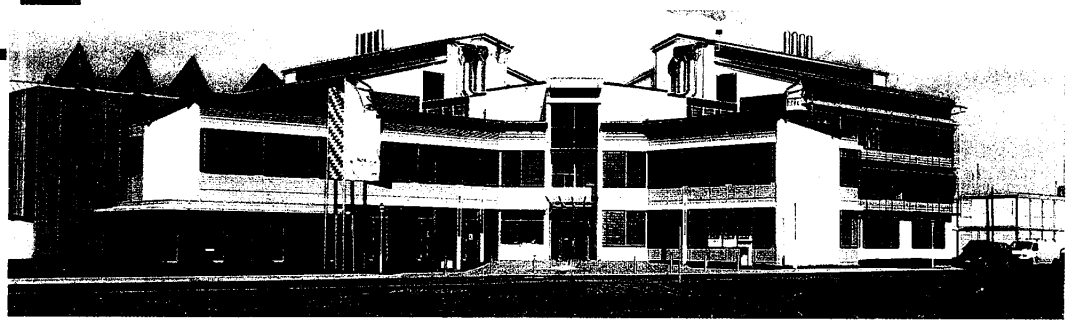
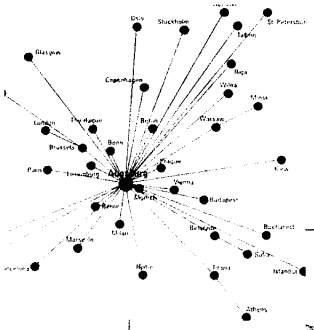
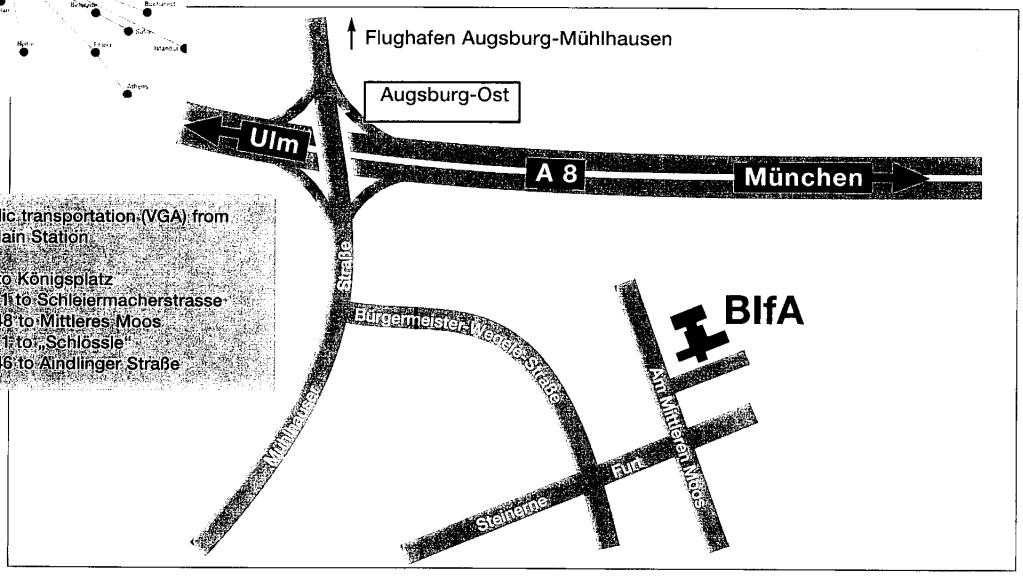




How to find us...



...using public transportation (VGA) from Augsburg Main Station

Tram No. 2 to Königsplatz
a) Tram No. 1 to Schlejermacherstrasse
Bus No. 48 to Mittleres Moos
b) Tram No. 1 to „Schlössle"
Bus No. 46 to Andlinger Straße

Shareholders:

The Free State of Bavaria, City of Augsburg
The Chamber of Industry and Commerce for
Augsburg and Swabia

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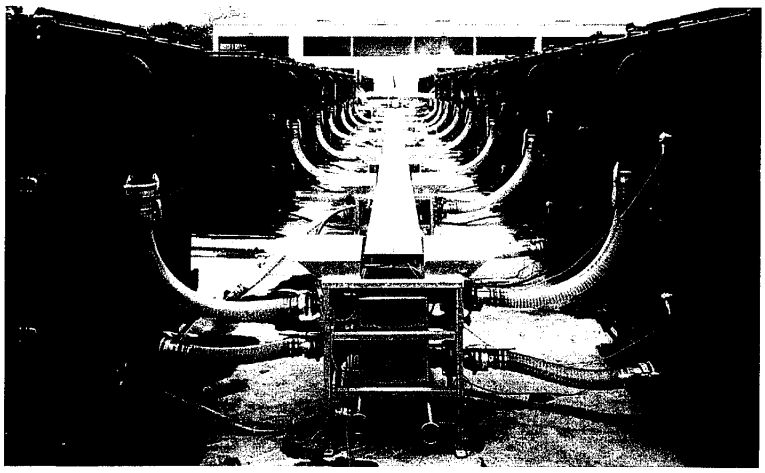
RETHMANN Entsorgungs AG & Co.

www.rethmann.com



Container composting plant (Kneer system) in Altenberge (Germany)

The company

von Ludowig GmbH is a subsidiary of the world's biggest family-owned waste management company **RETHMANN AG & Co** with its branches

- **RETHMANN Entsorgungs-AG** (waste management and recycling),
- **SARIA Bio-Industries** (animal waste processing)
- **RHENUS AG** (logistics).

In 2002, the RETHMANN group achieved a total turnover of 1,81 billion € with 15,670 employees in more than 500 companies, subsidiaries and joint ventures in 17 countries.

The waste management branch (RETHMANN Entsorgungs-AG) is working in Germany, Poland, The Czech Republic, Hungary, Australia, Taiwan and other countries.

von Ludowig GmbH is your partner, whenever you want to use the know-how of RETHMANN.

Products and technologies

- Treatment of domestic and commercial wastes
- Bio-waste composting and fermentation
- Mechanical-biological waste treatment
- Operation of incineration plants
- Treatment of industrial waste
- Treatment of sewage sludge
- Treatment of hazardous waste
- Plastic recycling
- Paper recycling
- Wood recycling
- Collection of used textiles
- Construction waste recycling
- Photo chemical recycling
- Destruction of data carriers
- Electrical appliance recycling
- Treatment of contaminated soils
- Recycling of scrap material
- Production of substitute fuels
- Production of chemicals
- Treatment of gypsum
- Treatment of spent pot liner
- Operation of waste water treatment plants
- Engineering, design, building and operation of plants for sorting, treatment and recycling of domestic and industrial waste

(A) 1.

von LUDOWIG
Process Technology

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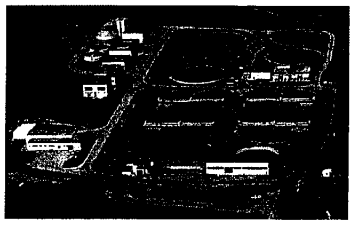
RETHMANN®

PET-Recycling plant in Taiwan



Central waste water treatment plant for industrial process waste water in Germany

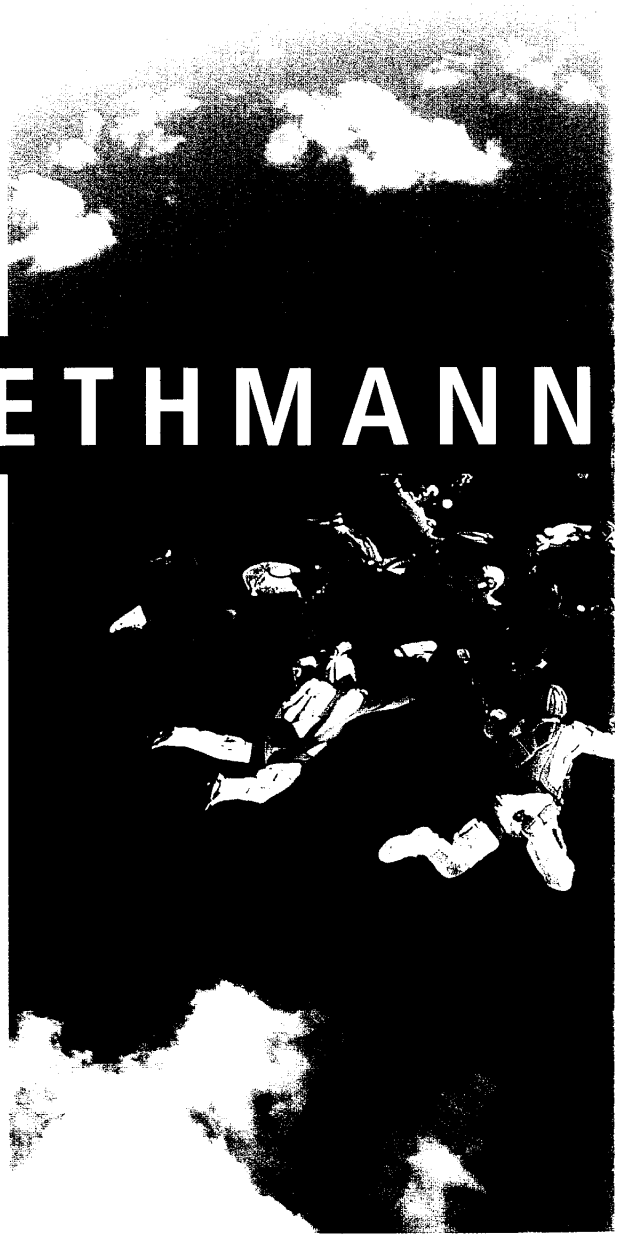
Frontlift collection vehicle operating in the Sydney markets

RETHMANN®
Entsorgung

www.rethmann.com

Customised concepts. Integral solutions. That's how we create space for our customers

Nowadays it is no longer sufficient to take a fixed range of products and pick out the one that will more or less meet the customer's requirements. If success is to continue in the face of competition, a responsive service must become pro-active and take an integral approach.



At the centre of it all is the task in hand. Whatever is necessary to solve a problem, that is what the service company has to provide – no matter whether the customer requests it explicitly or not. Only this kind of systematic policy will create the desired added value – so that we can relieve our customers all round and they can concentrate on their own activities and areas of expertise.

What we have to offer is security. You can rely on our services meeting all your requirements. They are appropriate and state-of-the-art so they guarantee all possible security:

- The security of flexible, future-oriented solutions
- The security of maximum utility at minimum cost
- The security of a competent, reliable partner accepting and bearing responsibility.

From A to Z:
The entire range of our services, process technologies and products

Alpha-semihydrate production
Analysis and substance assessment
Anhydrite production
Archive management
Area management
Area recycling
Biological clean-up
Brikollare composting
Building cleaning
Building management
Bulky waste collection
Central purchasing
Chemical/physical waste treatment

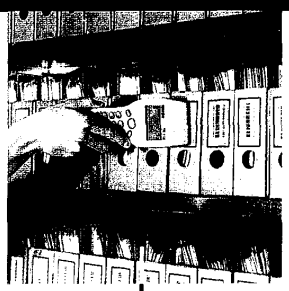
Analysis and substance assessment:
We have reputable accredited laboratories which mainly do work for other clients. State-of-the-art equipment means that even the most complex tests are possible.

Facade cleaning
Facility management
Factory logistics
Fermentation processes
Filtering systems
Financing models
Fleet service and management
Flue gas cleaning
Fluorescent tube recycling
Fuel substitute generation
Glass treatment
Green area management
Ground water cleaning

Leaves disposal
Legal reviews
Logistics
Maintenance services
Marketing

Planning advice for architects:
The larger the project in hand, the more important it is for architects to be given sound advice when planning utility and waste disposal logistics. For example, for the construction and alteration of 26 German railway stations it was we who developed the appropriate concepts.

SERVICES



Archiving, digitising and restoring data:
Apart from the destruction of information and data media in accordance with the law we also offer conventional and digital archiving. The range of services covers all the items necessary including just-in-time delivery of data/data media you require.

Citizens advice telephone
Clean-up concepts
Collection of charges for local authorities
Commercial cleaning services
Company Partnership
Composting
Composting organic waste
Construction materials production
Construction rubble treatment
Construction site sanitation service
Container composting
Contaminated site clean-up
Cooperation models
Crop protection
Crop protection analysis
Data medium destruction
Digital document management
Disinfection plants for hospital waste
Dismantling centres for electrical and electronic scrap
Dispatch services
Disposal consultancy
Disposal documentation
Disposal logistics
DSD sorting
Electronic scrap recycling
Electrorecycling
Energy management
Engineering services
Environmental laboratories
Heap composting
Highway construction
Industrial waste water cleaning
Information media destruction
Interim storage
Janitor service
Landfill operation

Collection of charges for local authorities:
Wherever we handle the water supply or domestic waste disposal on behalf of local authorities, for example, in more and more cases we also collect the relevant charges.

Material flow documentation
Materials supply
Mechanical-biological treatment
Medical waste disposal
Medical-biological treatment
Mercury recovery
Messenger services
Metal cinder treatment
Municipal waste water cleaning
Near-household collection
Office logistics
Office waste disposal
Oil recycling
Ondesk deliveries
Operator models
Packaging handling

Paper recycling

Paper sorting

Personnel administration

Personnel services

Photographic chemicals recycling

Pit cleaning

Pit drainage

Planning consultancy for architects

Planning services

Plant construction

Plant financing

Plant operation

Plant planning

Supply logistics: One step towards integral service is the linking of waste disposal and the supply of components, raw materials and consumables. If, for example, we pick up photographic chemicals for disposal, we can bring new process chemicals with us.

Sewer cleaning

Sewer network maintenance

Sewer service

Sludge dewatering

Soil washing

Solvents production

Solvents recovery

Sorting equipment

Sorting mixed construction waste

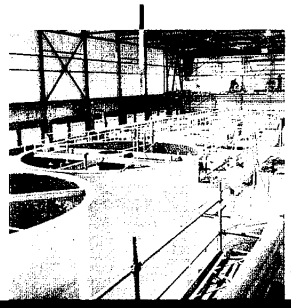
Spare parts supply

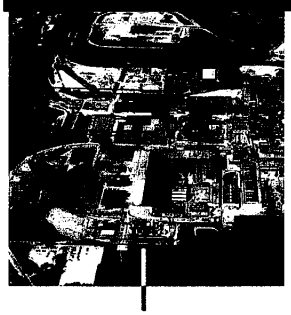
Special waste disposal

Supply logistics

Taking back packaging

Water management: Under Public Private Partnerships and Company Partnerships we handle not only planning, construction and operation of water cleaning and treatment plants but also provide supplies of drinking water and process water.





Recycling: The RETHMANN Lippe plant is the largest recycling centre in Europe and one of the numerous RETHMANN production locations for high-quality secondary raw materials, primary materials, special products and capital investment goods.

Planting work

Plaster recycling

Plasterboard treatment

Plastic granules

Plastics recycling

Pollutant analysis

Pollutant collection

Pollutant collection vans

Post-mount service

Process optimisation

Process technology concepts

Product recycling

Project control

Property management

Public Private Partnership

Quality analysis

Quality compost

Raw materials management

Recycling

Recycling yards

Regranulation

Residual waste treatment

Residue incineration plants

Returnable product systems

Rehabilitation plants

Safety management

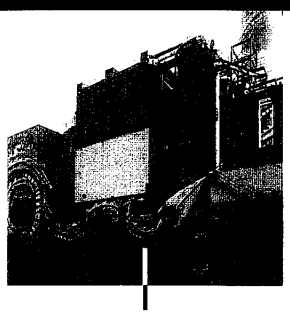
Sand trap

Scrap collection transport services

Scrap metal recycling

Solutions

Sewage sludge utilisation



Waste incineration plants: Thermal utilisation at our incineration plants reduces the quantity of waste to be disposed of and there is the added benefit of generating power and heat.

Tank systems

Traffic sign cleaning

Treatment technology

Tree cuttings disposal

Waste analysis

Waste barantes

Waste incineration plants

Waste management

Waste management concepts

Waste shredding stations

Waste transportation

Waste water treatment

Waste water treatment plant construction

Waste water treatment plant operation

Waste water treatment plant planning

Water management

Window cleaning

Winter services

Wood treatment

Work wear analysis

Workshop disposal

We do a lot more than you may think:

TRADITION MOTIVATION INNOVATION

PROFILE

Always ahead of its time.
Innovations are a matter of tradition at RETHMANN

RETHMANN's innovative strength lies in the systematic development of future-oriented recycling processes and services. The company has a tradition of lateral thinking that has always characterized the success of the family company. Only those who recognize the signs of the times and use the resulting challenges as an opportunity are able repeatedly to redefine the state of the art, rather than simply follow it.

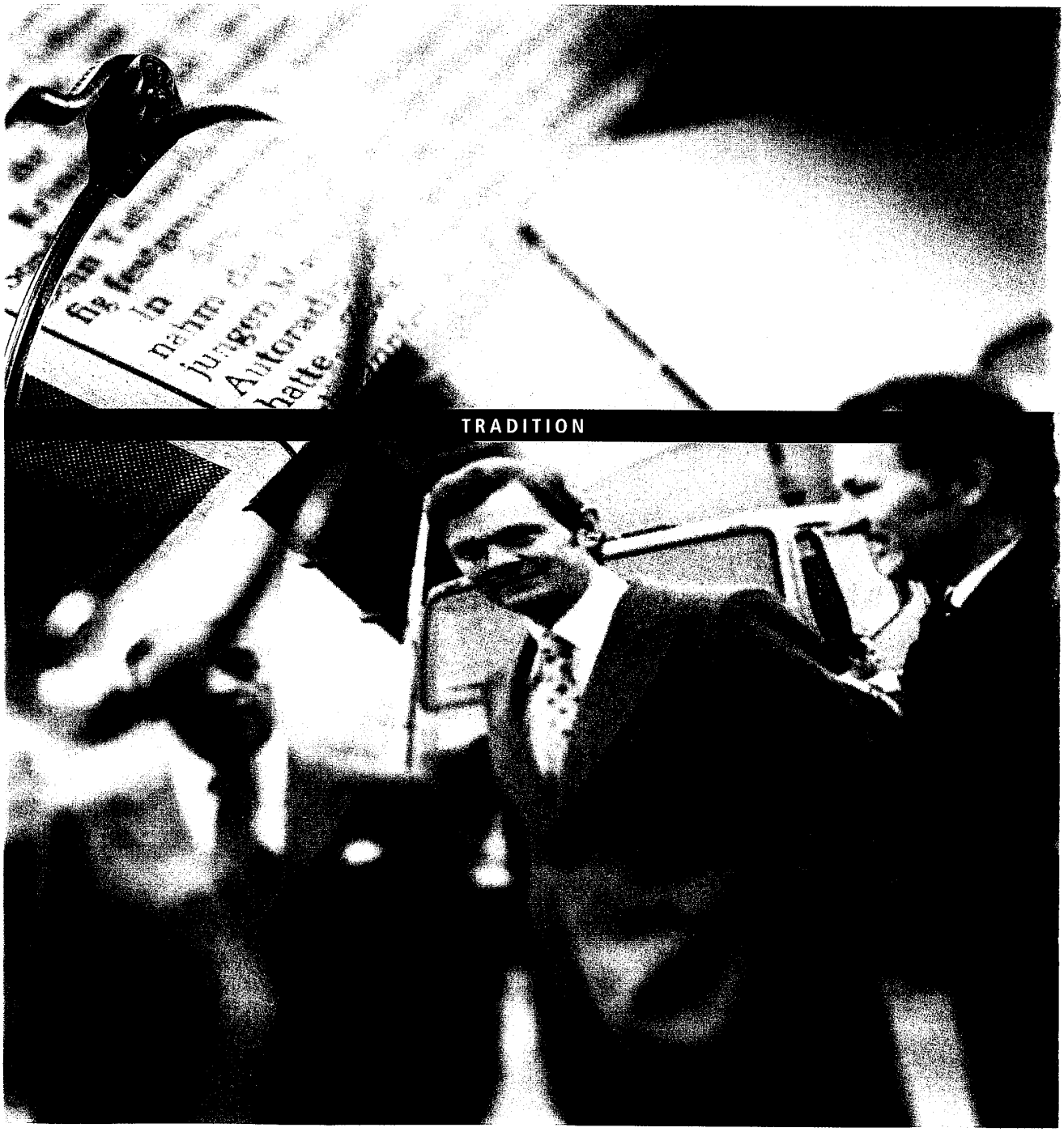
»We were already thinking in terms of material recycling at a time when hardly anyone else recognized the need. In the field of high-grade plastics recycling, for instance, we have almost twenty years' experience.«
– Norbert Rethmann –

RETHMANN was involved in recycling long before the Recycling Law was passed. Even in the early Seventies we could see enormous opportunities opening up in the separate collection and processing of refuse to make secondary raw materials. We grasped these opportunities and are today happy about our many years' experience and the leadership we have gained.

Our base is the solid foundation of a family company steeped in tradition. This is how we began in 1934 and how we intend to continue. We know the way

From the RETHMANN chronicle:

- 1934: Josef Rethmann founds the company
- 1959: The first disposal contract for »dust-free refuse disposal« in Selm
- 1963: Norbert Rethmann takes over the company
- 1977: Founding business of the abattoir waste division – today, RETHMANN's »SARIA Bio-Industries« division is the European leader in this field
- 1982: The first overseas subsidiary begins its disposal activities in Penrith, Australia
- 1993: Takeover of the Lippe plant. Today it is Europe's largest recycling centre
- 1998: With the acquisition of RHENUS, RETHMANN adds a logistical division to the waste management and bio-industries divisions
- 2000: Public Private Partnership and Company Partnership are becoming more and more important

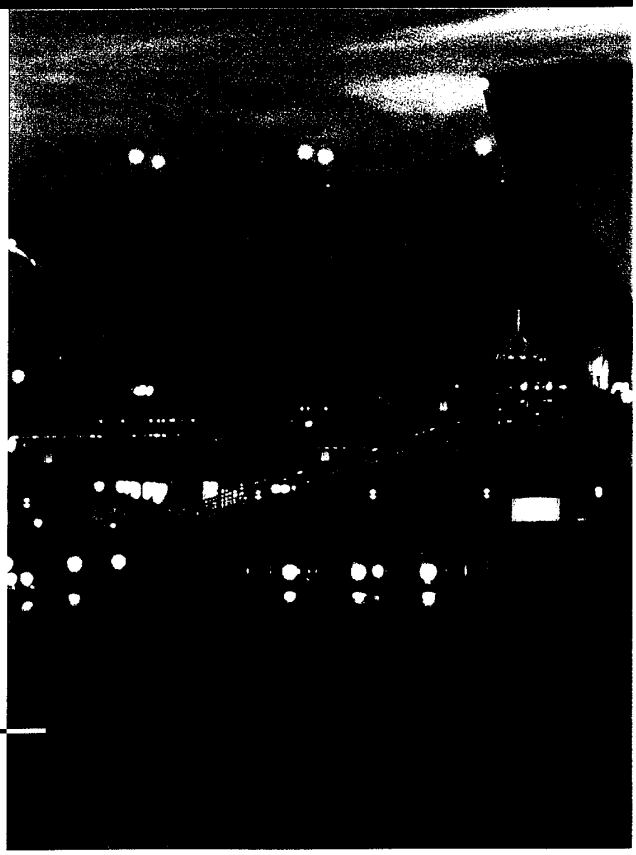


There are many opportunities beyond the obvious. We're completely open to them

Joint venture, Public Private Partnership or full service – we are flexible in relation to the organizational form of the collaboration, the commission itself or the country in which we operate.

RETHMANN runs PET recycling plant in Taiwan

As an integrated, full service provider, we take up every challenge. And whichever route we ultimately take, our aim is always the most effective, reliable and economical solution.



We seize opportunities – nationally and internationally. We have been operating in Australia, for example, since 1982. In the meantime we provide services at several locations in Melbourne, Newcastle, Sydney, St. Marys, Liverpool, Dural and St. Peters.

We are now represented by numerous branches in central and eastern Europe where we dispose of commercial and domestic waste, as shown here in Poznan, Poland

Examples of international RETHMANN activities:

- In Europe, especially Poland, the Czech Republic, Slovakia, Hungary, France and Great Britain, our services include the disposal of domestic and industrial waste
- In South East Asia, particularly in Taiwan, Malaysia, Japan and Indonesia, we are constantly expanding our activities and transferring our know-how in the field of facility planning and construction

INTERNATIONAL PRESENCE

Our network offers every possibility. For the benefit of our customers

Over the space of sixty years RETHMANN has built up a comprehensive combined network of logistics and plant operation – providing reliability and offering every opportunity. It is a professional set-up enabling us to act and respond both quickly and reliably.

Over 270 interlinked business units, subsidiaries and holding companies at home and abroad. Many others will follow

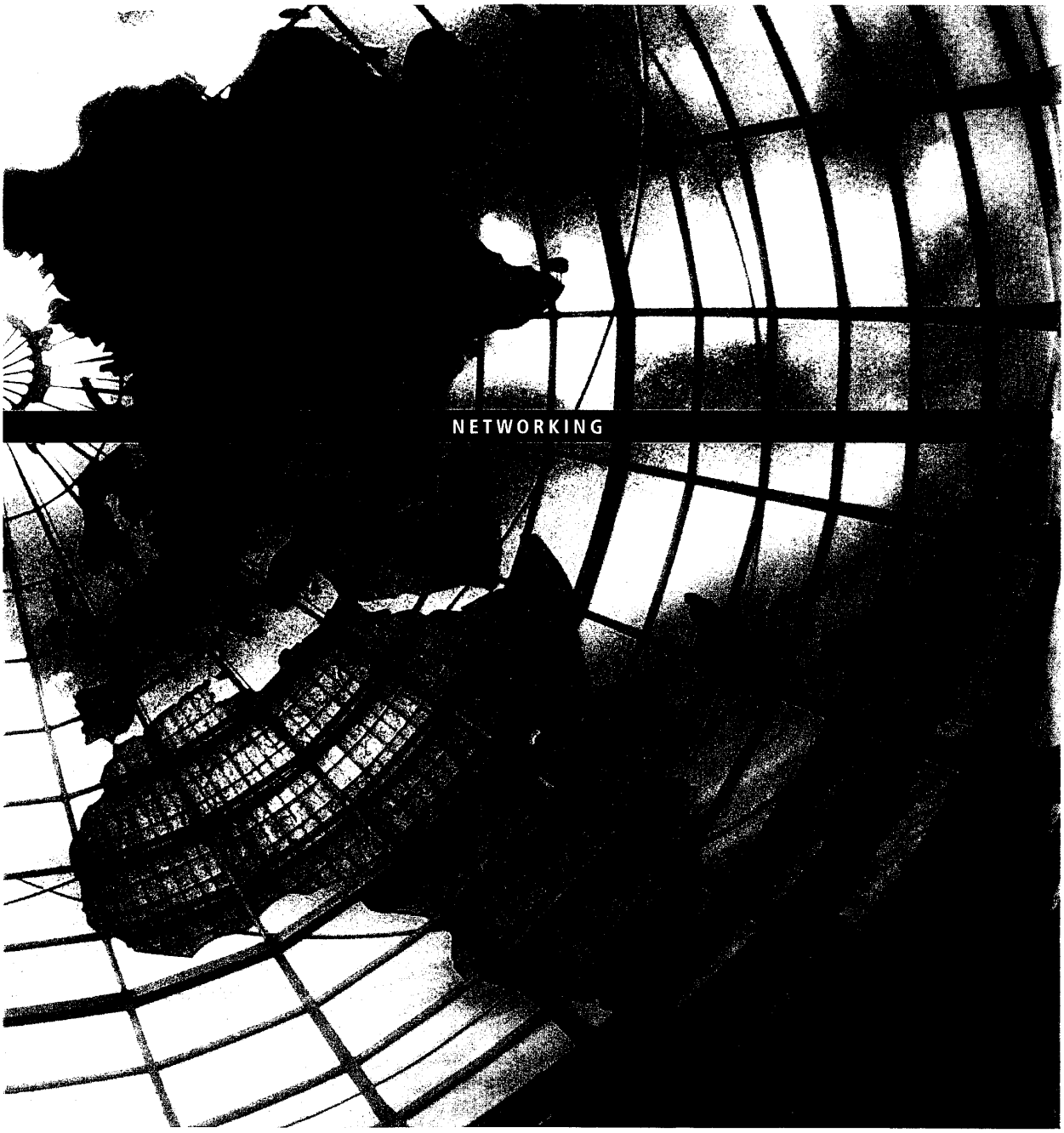
RETHMANN offers a full, international service – all from one provider:

- logistical organisation, coordination and optimisation
- material consolidation, processing and recycling
- plant financing, construction and operation
- product development, manufacturing and marketing
- assumption of responsibility and guarantees of reliability

An efficient, extensive infrastructure as defined by modern branches, collection systems and plants is perhaps not everything ...
... but it makes a lot of things much easier

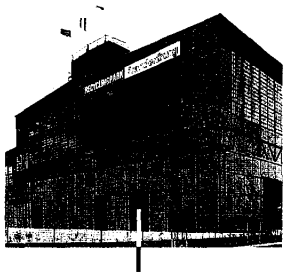
**We have the know-how,
experience and technology.
RETHMANN Entsorgungs AG & Co. has:**

- 8,900 members of staff
- 370 locations
- a fleet of over 2,800 vehicles



Natural resources are finite.
We use the resources of the future

From waste to product. With commitment and know-how we utilize all available technologies, find economic solutions and tap the raw material sources of the future.



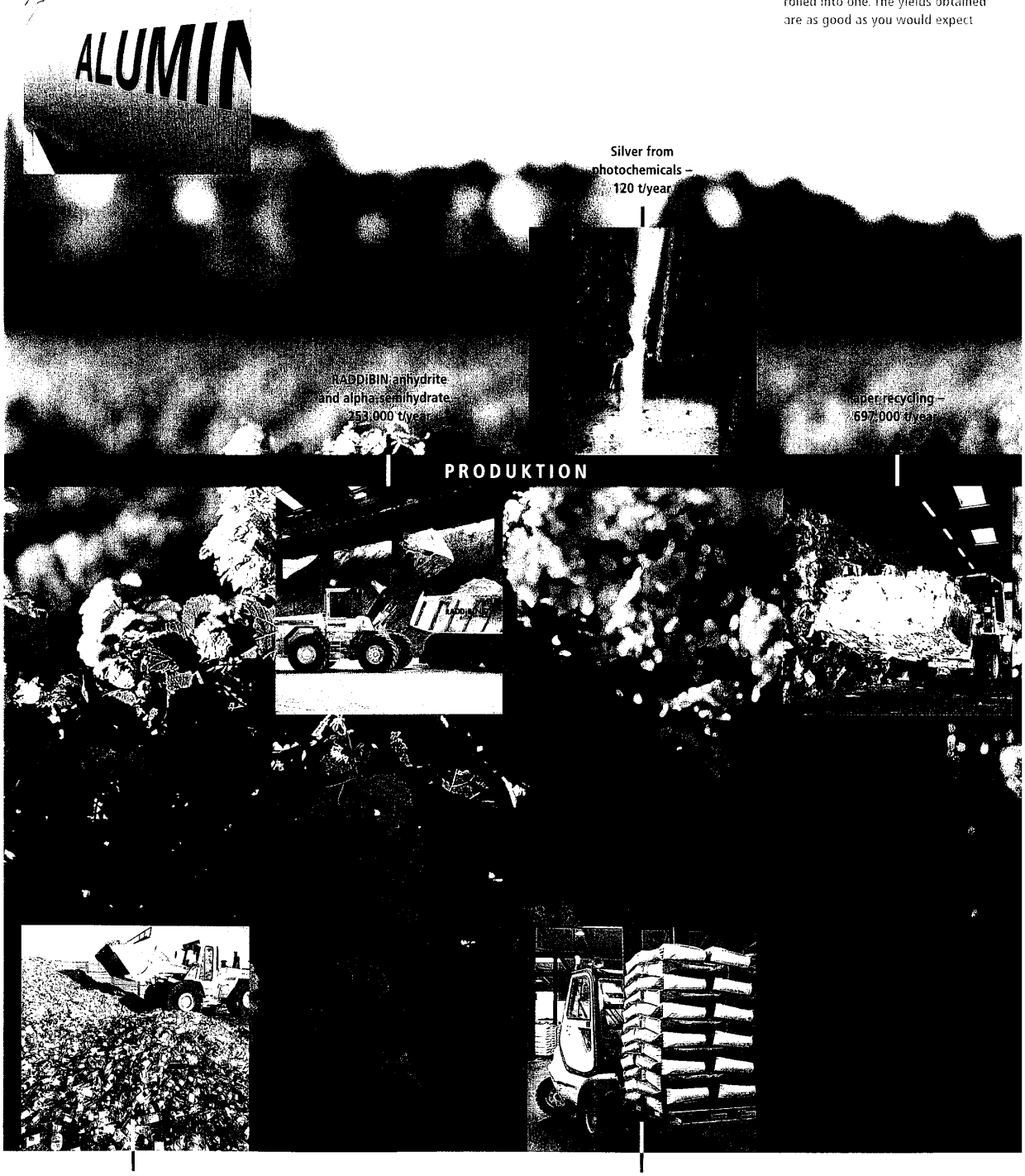
Brandenburg Recycling Park:
Substitute tuels 20,000 t/a

Through intensive research and development work, we have developed sensible applications and opened up reliable future sales areas for the primary materials processed by us.
RETHMANN branded products are in demand worldwide in many different industries: construction industry, the food industry, landscaping, paper, wood and plastics processing, medicine, aluminium production, the chemical industry ...

Our customers demand quality – even when it comes to compost. It is not without good reason that we put great efforts into field tests and quality assurance. The results speak for themselves: an annual 380,000 t RETERRA topquality soil and compost

ALUMIN, high-grade sodium aluminate for chemical applications and waste water treatment – 25,000 t/year

Good ground has to be productive. This is why our customers have opted for RETERRA. RETERRA is a biotope, a nutrient supply and water reservoir rolled into one. The yields obtained are as good as you would expect



Glass recycling – 1,022,000 t/year

PLANO plastic granules – 53,000 t/year

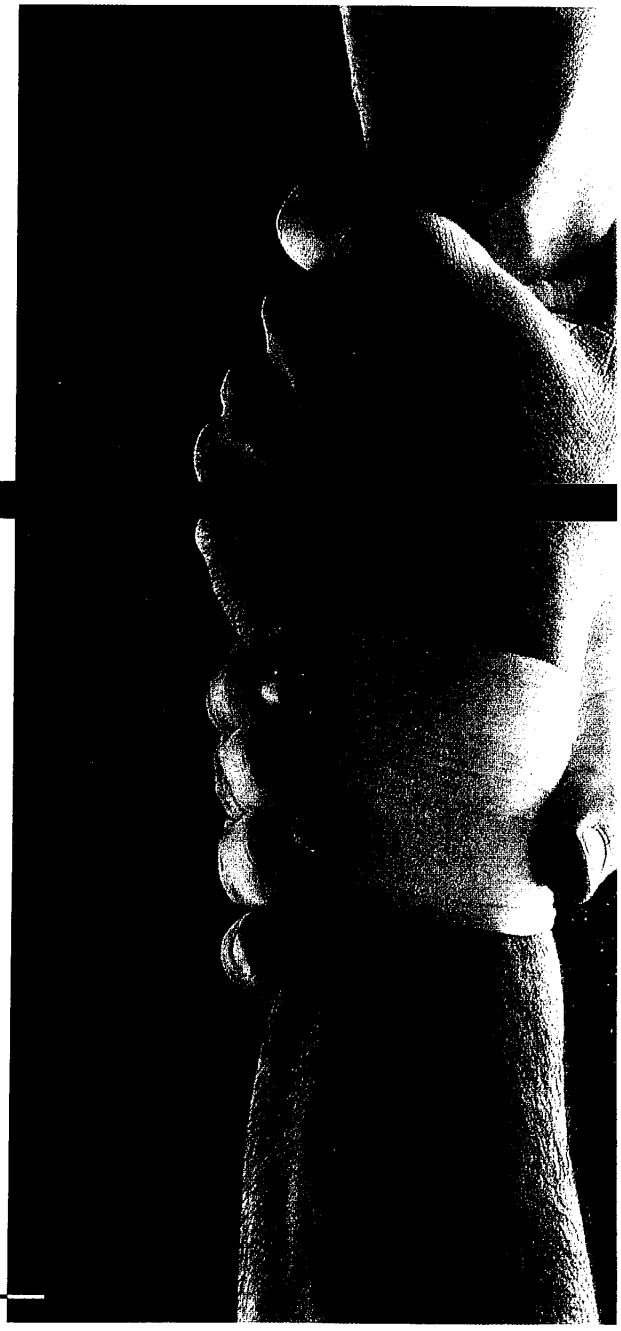
Supervision is good but trust is better. There are certain things you just have to be able to rely on

More than any other business, services are a matter of trust. Trust is something the Rethmann family name has stood for since its company was founded in 1934.

Our customers can rely on the quality of our services and products

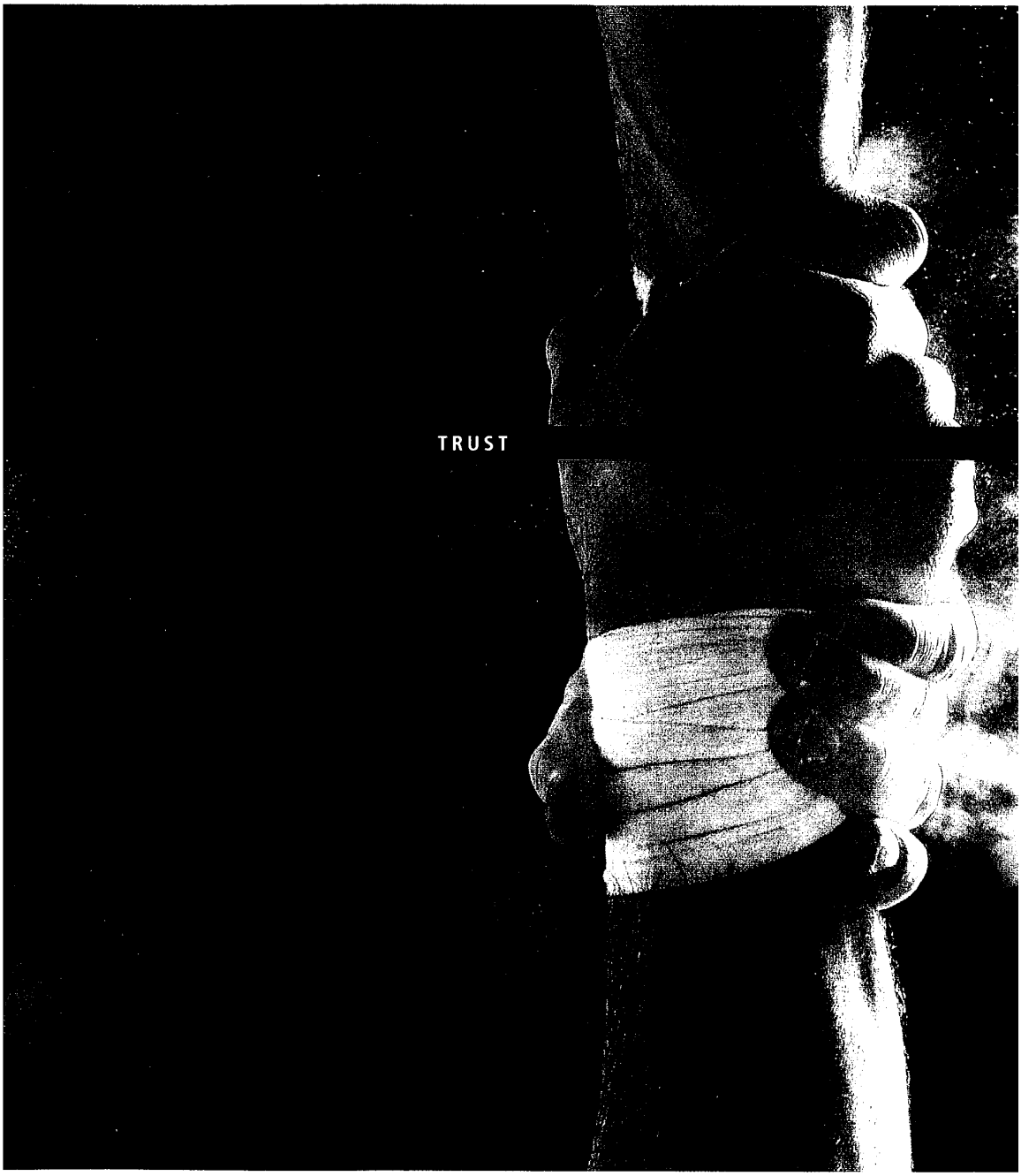
Our customers' trust is based on essential factors:

1. Cost transparency. We conclude unambiguous contracts, guarantee long-term price stability and have clear accounts.
2. Service transparency. We provide our customers with comprehensive advice, we define with them the full scope of the service and we can always be checked out anywhere.
3. Our employees. They are motivated to offer our customers the best service.



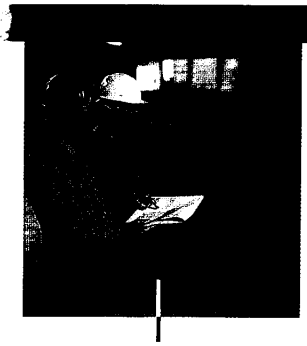
Winning the trust of our customers is our number one aim

So much for control:
Our customers' trust in the quality of our service results from a number of things. Our operations are certified. Our application and disposal channels are clearly defined. And our products are subject to rigorous quality assurance



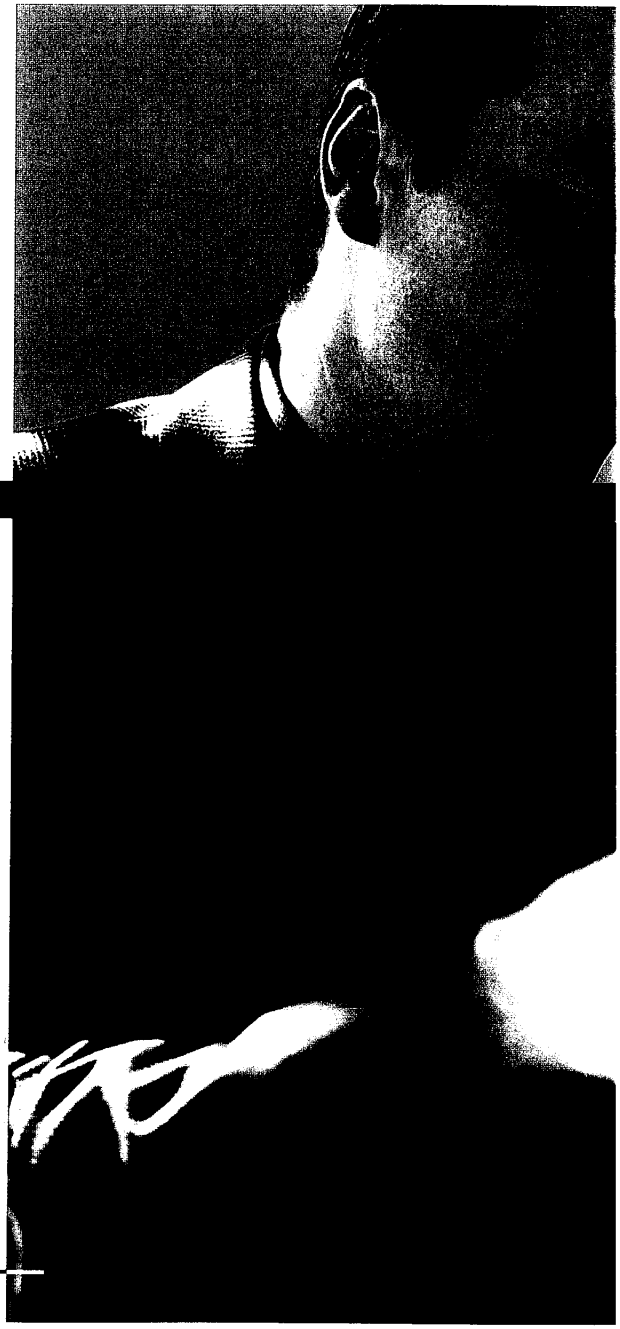
Our customers want to be able to speak to people who know what it's all about and what matters. We train them

For success in business a committed and reliable workforce is the greatest asset. We at RETHMANN have achieved a high standard of technical expertise. And because we want it to stay like this in the future, we do something about it.



Anyone who takes on responsibility position must know what he's doing

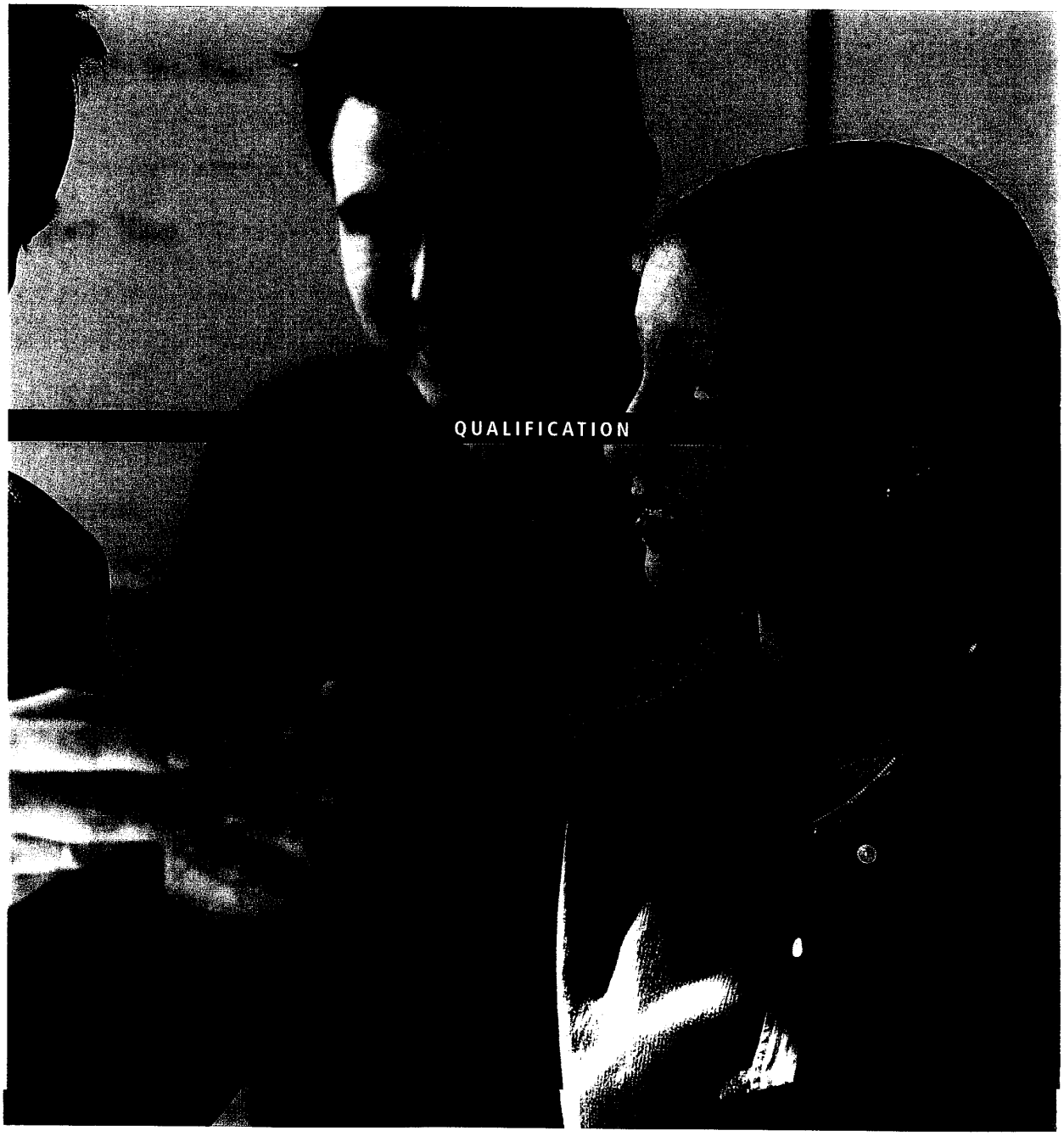
- Training: 240 trainees in 15 careers. Many of our managers were trained by us ...
- Personnel development: RETHMANN employees receive training through seminars and courses
- Sponsorship: We sponsor students during their doctorates and degree courses
- Motivation: Our employees have many good ideas, which we greatly value



Know-how is acquired, experience gained. What is best in the long term is to be able to pass on both

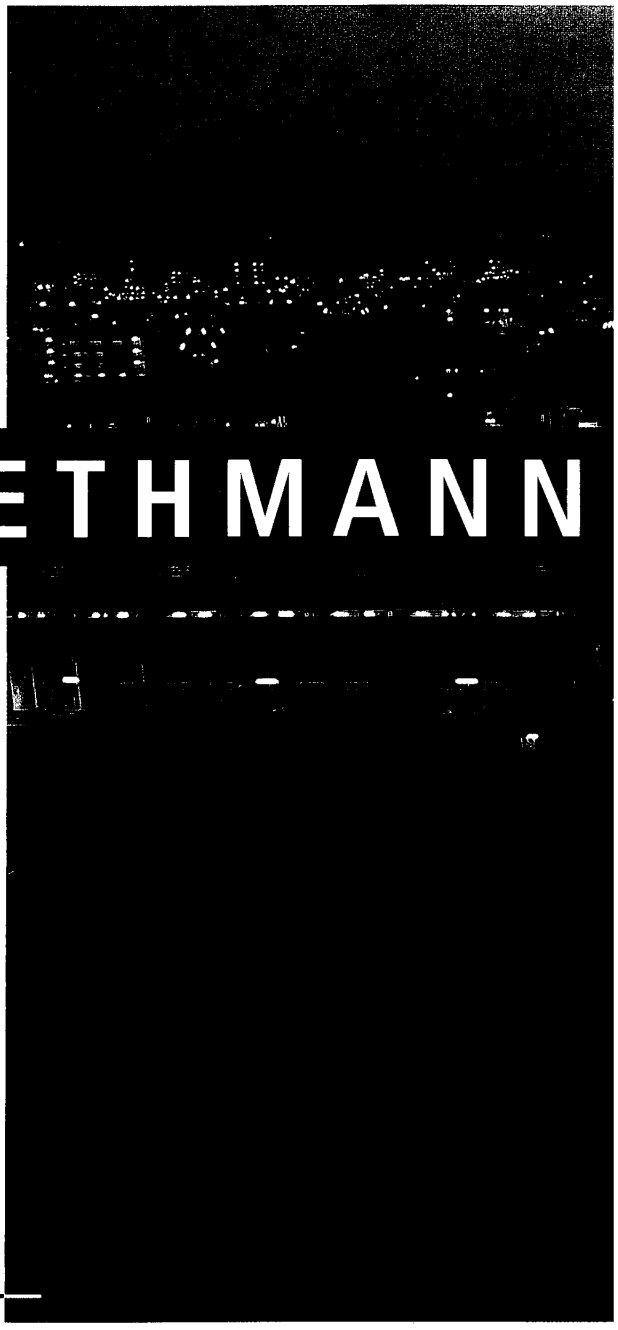
Some of the research projects in which we are involved:

- Study »Evaluation of the use of alternative fuels (SBS) from an environmental and health point of view«, in conjunction with the EPEA International Environmental Research and the INFA Institute
- Study »Waste avoidance comes before incineration«, in conjunction with the EPEA Environmental Institute in Tübingen
- Research project »High-grade material recycling – office furniture« – supported by the Federal Ministry for Research and Technology
- Project entitled »Refuse-free operations«, in conjunction with the Lower Saxony Technical University and the Lüneburg-Stade Chamber of Commerce



Successful cooperation depends on many factors. We have first-class references

Time after time, our customers do their utmost to surprise us with new challenges. We enjoy finding solutions. Yet that is not the only reason why many large and small customers have opted for RETHMANN ...

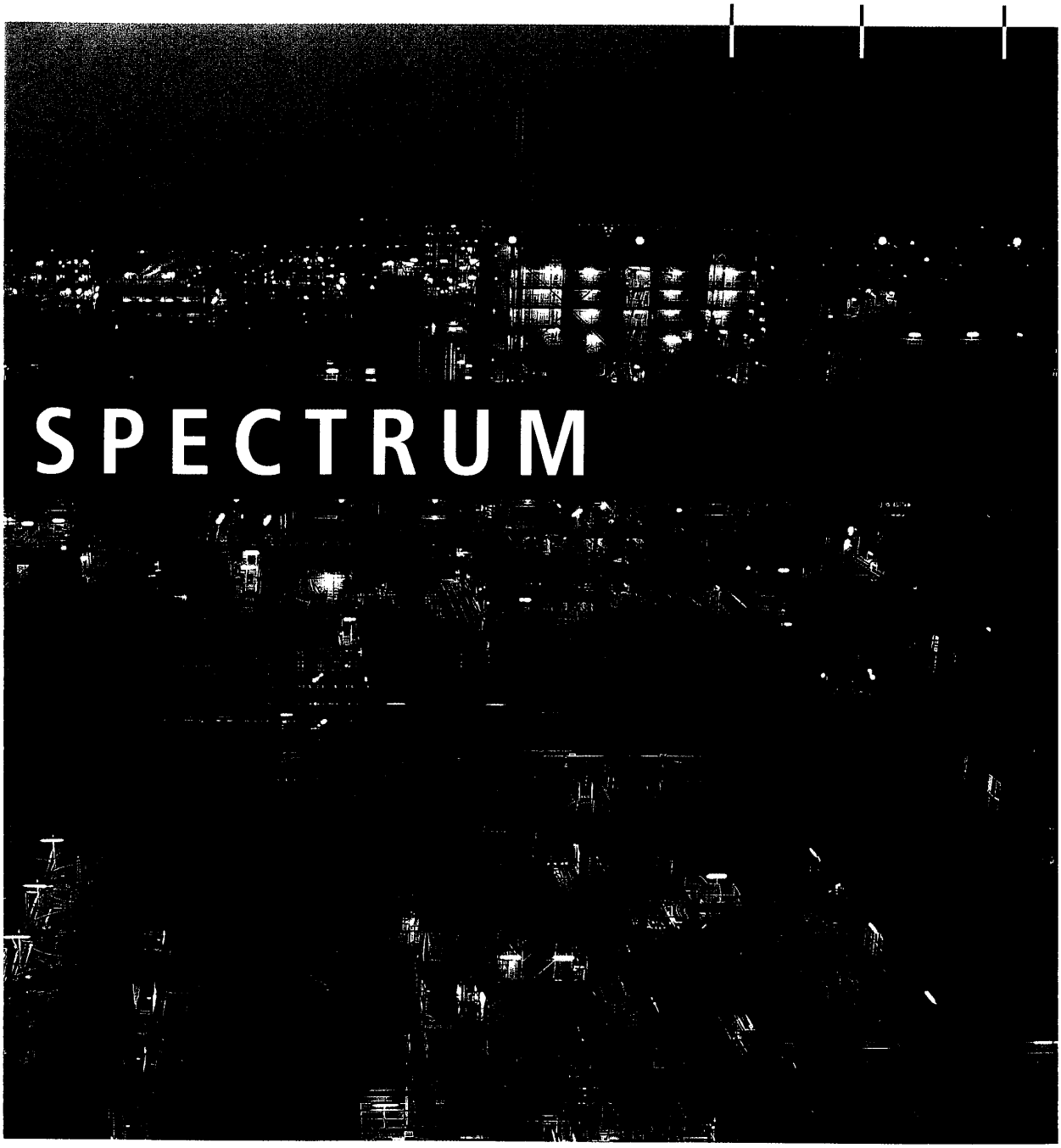


We listen before getting to work. And we offer each customer a central contact who will take care of everything, is conversant with the legal requirements, knows what is best and will provide the most favourable solution for the customer.

Degussa-Hüls, Marl

The customers
for whom we work:

QUALITY EFFICIENCY SECURITY



Budget relief. Stable charges. Reliable waste disposal. With us as partners – no problem

RETHMANN guarantees reliable waste disposal in the local authority sector for more than 6 million people in Germany and about 2.6 million abroad. For more than 60 % of them within the framework of integrated Public Private Partnership solutions.

City of Gotha: We have been commissioned to handle the entire water management for supply and disposal: from operation of the treatment plants and pipe networks, cleaning and maintenance through to invoicing.

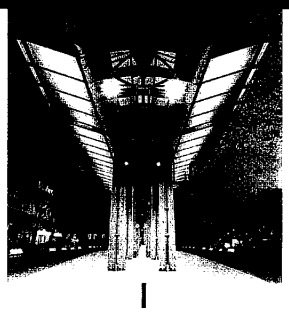
With RETHMANN joining FES Frankfurt it means that the full scope of private financing can be exploited

Regardless of the organisational form of cooperation, our services can be as comprehensive as the local authorities require. From classic waste disposal and retrieval, through financing, constructing and operating the sorting and processing systems down to the marketing of products from recycling.

Full Service – better than traditional waste disposal:

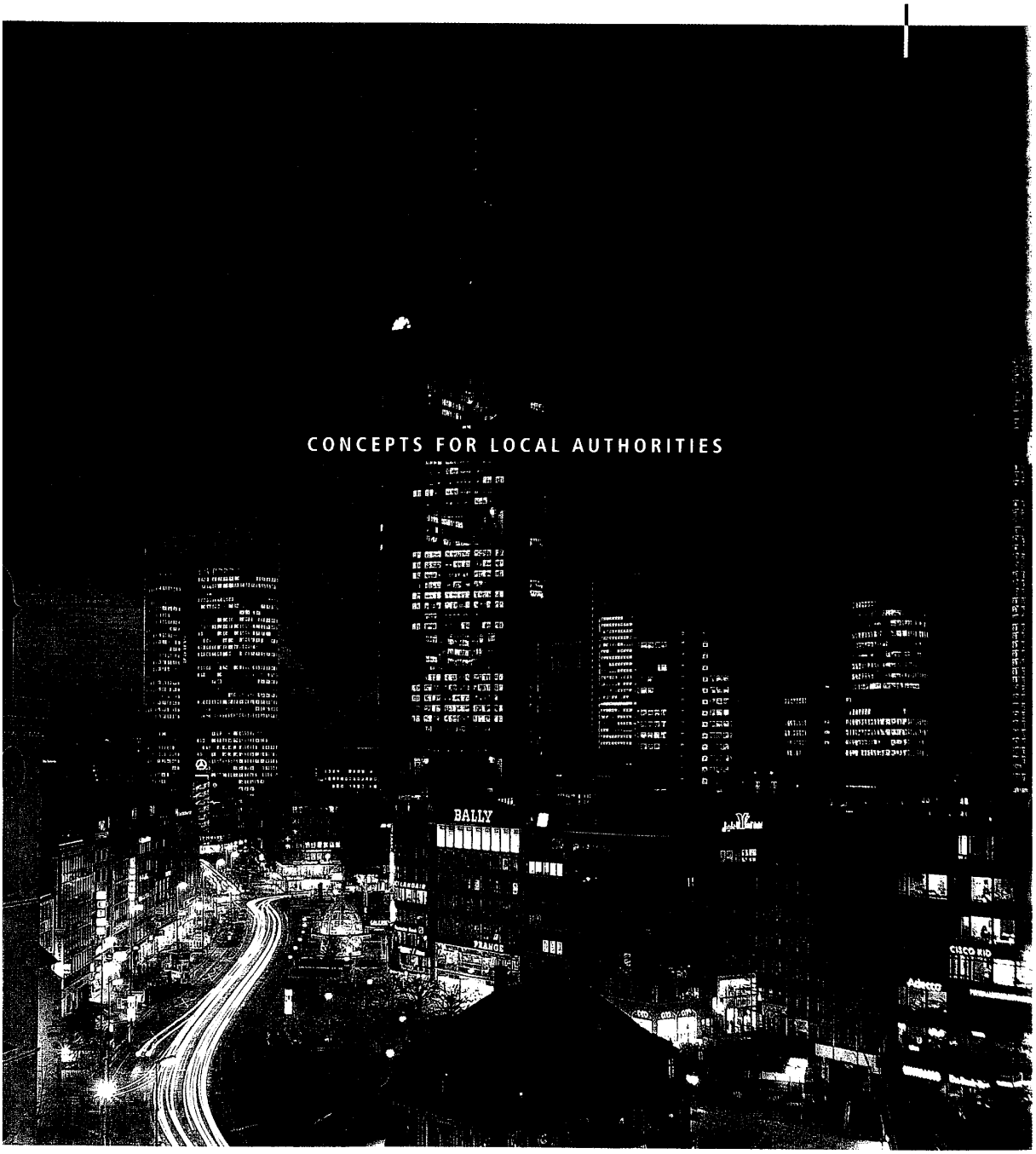
- We are able to operate recycling yards, manage landfills and make full use of incineration plants – sometimes in conjunction with other local authorities
- We can take on the collection of individual charges, the disposal of bulky refuse and the manning of waste disposal help-lines
- We can carry out the work of Green Space Offices and those of the public transport companies

... and much more.



The town of Oberhausen: Taking care of green areas and open spaces, disposal of biowaste, domestic, trade and special waste, secure destruction of data media, cleaning of buildings, maintenance of roads and canals, street cleaning, maintenance of the sports facilities and swimming pools, winter service

The city of Frankfurt: RETHMANN has a stake in the Frankfurter Entsorgungs- und Service GmbH (FES) [= Frankfurt waste disposal and service company]. Among its tasks, in addition to a full waste disposal and re-use service, are the cleaning of 1,433 km of roads, winter service and school pupil transport, plus also the operation of its compost centre, the waste incineration plant, the public amenities and a special workshop for local authority service vehicles



It is our policy to take care down to the last detail. Our customers wouldn't be satisfied with anything less

Whether it is the army, the national railways or telecommunication. We are to be found wherever care, reliability, security and integrity are of prime importance. Sometimes we take on all the work for our customers and sometimes only some of it, sometimes just here and there. You will find some examples of our diversified range of services on this page.

Hessische Landesbank, Frankfurt: Night-time waste disposal – from 23.00 hours to the early morning. So that the employees are not disturbed during the day, we have taken this customer requirement on board without compromise

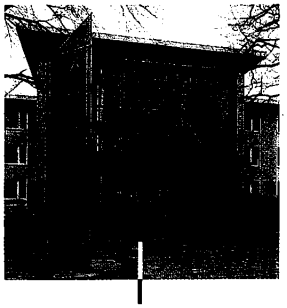
DeTeMedien, Frankfurt: From Sylt to Berchtesgaden – on the instructions of DeTeMedien RETHMANN takes back old telephone directories collected at post offices nationwide and moves them on to paper recycling. That way the old telephone directories can be made into new ones again – precisely in tune with a recycling economy

Nürnberger Lebensversicherung (insurance), Nuremberg: RETHMANN handles the destruction of information media and the disposal of electronic scrap for 100 branch offices.

DAK, Hamburg
RETHMANN carries out the destruction of data media for over 200 offices nationwide.

Münster customs
Under the supervision of the customs office RETHMANN destroys pirated products and smuggled cigarettes, which the customs have seized to protect German trade and which are to be destroyed by order of the courts.

Munich trade fair
We have built a sorting plant on the actual trade fair premises – and hence in the direct vicinity of where the waste occurs – and we operate it with our own personnel. That way we have been ensuring smooth comprehensive waste disposal for the entire trade fair site for over 15 years now.



Essen University Hospital: A town in itself. Disposal of waste – from leftover food to hospital waste

Postbank, Bonn: RETHMANN has been working for the Postbank nationwide since 1998 and takes care of the destruction of data carriers. Our service ranges from providing a variety of secure containers to the reliable destruction of the data media in our plants and subsequent recycling

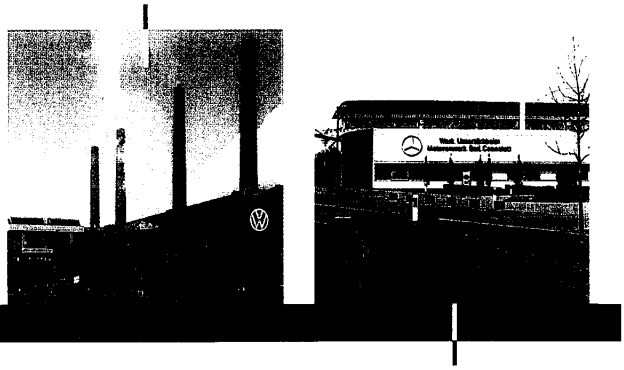
»It was quite simply the high standard of security which RETHMANN guarantees in data destruction which persuaded us.«

– Dr. Michael Nießen, Postbank –

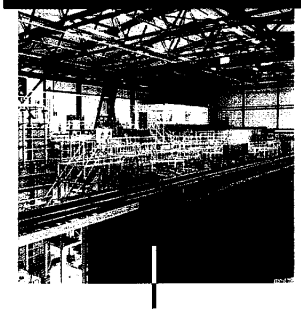
CONCEPTS FOR SERVICE PROVIDERS

If you want to conquer industry, you have to come up with something special. We decided on quality

VW, Wolfsburg: A location with many different and demanding waste disposal problems. VW places confidence in RETHMANN for factory waste disposal.



In winter the snow. In spring the green spaces. In summer the drinks supply. In autumn the leaves. And all through the year the full industrial service. RETHMANN offers – far beyond the classic waste disposal service – highly diverse, freely selected individual services or a convenient full service.

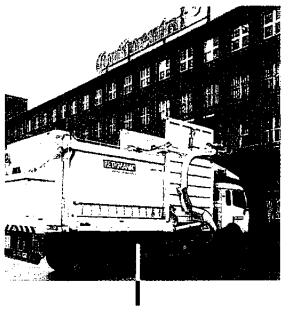


Ruhr-Zink, Datteln: Within a very short space of time we built a new waste water treatment plant for the subsidiary of Metallgesellschaft within the scope of a Company Partnership.

From our range of services:

- All the tasks of the works logistics management – collection at appointed waste locations, through in-house transport to just-in-time parts supply
- Maintenance and cleaning of power, production and filter plants
- Integration of waste disposal into operating procedures. Financing of waste disposal facilities
- Training of workers aimed at increasing their motivation and ensuring maximum waste disposal security
- Performance data capture for waste material accounts and attribution to originators

... genuine full service. Secure, economical and convenient.



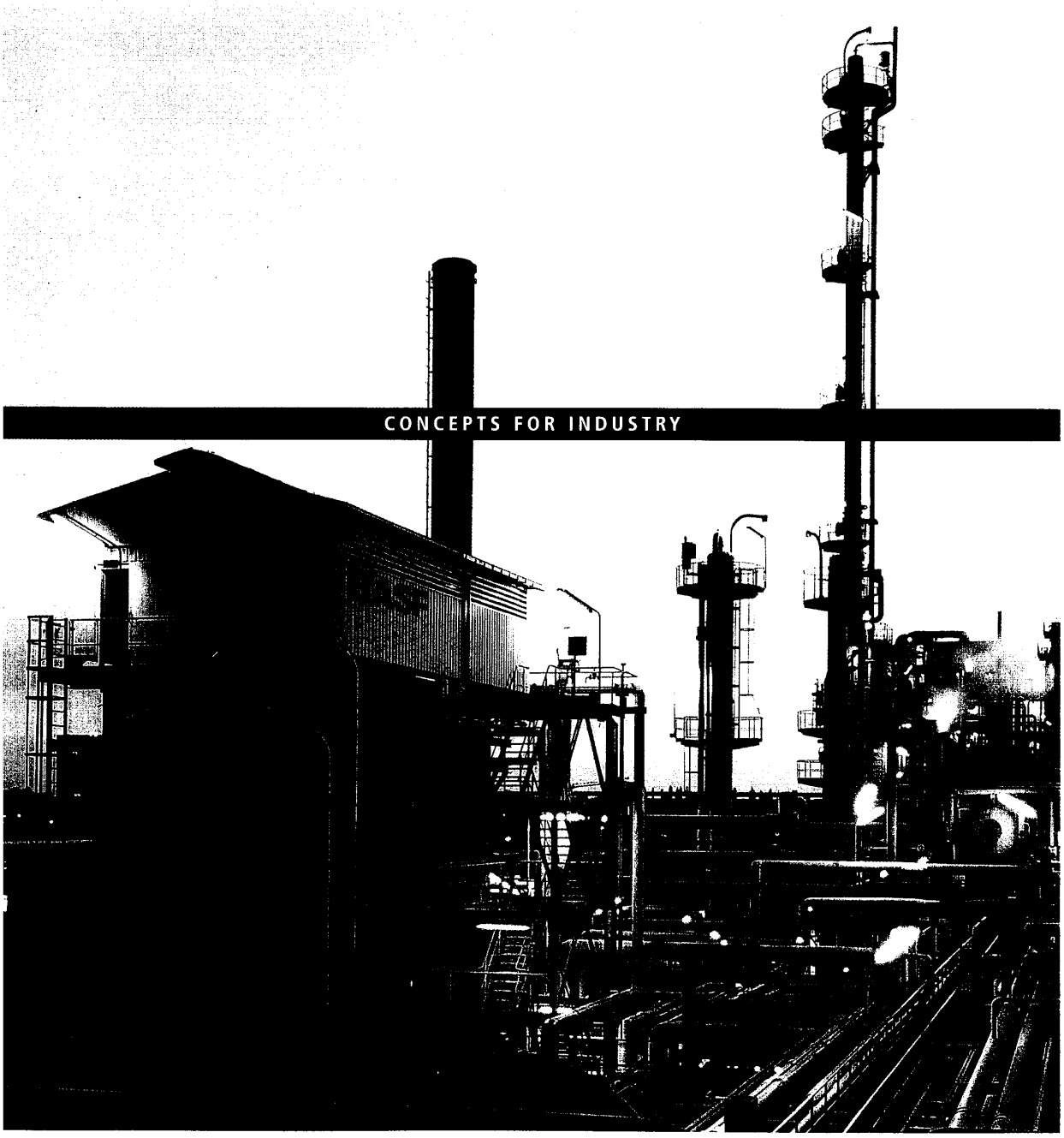
Continental, Hanover: Implementation of a comprehensive scheme for works waste disposal. By switching to the collection by front loaders considerable costs have been saved

DaimlerChrysler, Stuttgart: RETHMANN has been the waste disposal partner for the factories in Untertürckheim and Bad Cannstatt for many years now.

BASF, Schwarzheide: Among other things RETHMANN operates a plant on the BASF site for the pre-processing and interim storage of special waste which is subsequently disposed of in the BASF residue incineration plant. Optimum use of the system is ensured by taking additional waste from the numerous regional and supra-regional trades and industries

»With RETHMANN we have a competent partner, who provides backup in the preliminary processing of waste and ensures that our disposal plant is well utilised. There are advantages in the close proximity of the RETHMANN workshops to our incineration plant and the utilization of the existing infrastructure and services on offer in our industrial park.«

– Joachim Diener, BASF –

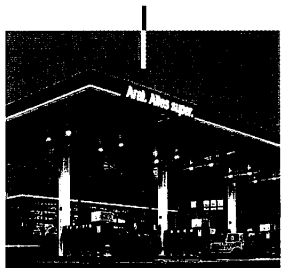


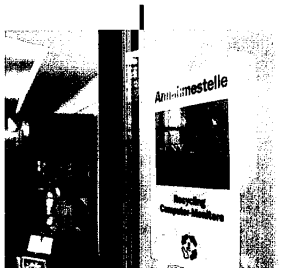
CONCEPTS FOR INDUSTRY

Many of our customers have branches throughout the whole of Germany. We do too

ARAL, Bochum: At 2,700 filling stations throughout Germany nearly 5 million empty oil tins are collected every year. Why did ARAL choose RETHMANN? Because we were flexible enough to be able to guarantee geographic coverage immediately.

SONY, Cologne: For worn out computer monitors SONY Germany has built up, together with RETHMANN, a national take-back system with collection points in shops

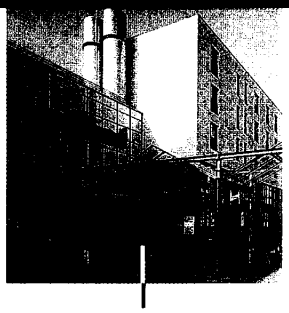




Production or distribution, industry solution or company solution - RETHMANN provides customised, low-cost and reliable system services for supplies, waste disposal, service and recycling.

Three system packages:

1. Manufacturer-financed returnable product concepts: recycling systems for packaging and products – with guaranteed geographic coverage. Not only in Germany!
2. Company full-range disposal packages: all waste is handled by a single contractor – from recyclable materials to special waste.
3. Comprehensive full service: for services beyond waste disposal we are available wherever you need us.



Kaufland, Lidl & Schwarz, Neckarsulm: RETHMANN has been commissioned with the waste disposal for supermarkets and superstores, including Kaufland. The advantages are evident: one partner to consult, standardised invoicing and, last but not least, integral waste balances increase transparency and flexibility.

Take-back systems for paints and lacquers

Since 1993 RETHMANN has been operating a system which is free of charge for over 8,000 paint shops. The clients are 33 leading paint manufacturers such as Akzo Nobel Coatings with the sales companies Sikkens and Lesonal, BASF Coatings, ICI Lacke Farben, Spies Hecker, Standox ...

Karstadt AG, Essen

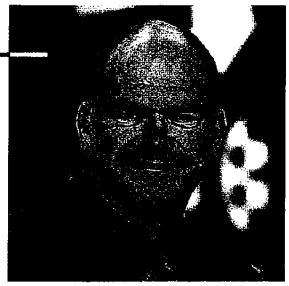
For Karstadt and Hertie RETHMANN maintains a national take-back system for refrigerators and large domestic appliances. Recyclable materials from around 40,000 appliances are returned to the production cycle every year.

3M Deutschland, Neuss

Sensible cycle economy begins at the product development stage. 3M consulted us on the development of a new paint application system. So when it was launched there was a recycling system already in place for consumables.

Media Markt/Saturn, Ingolstadt: Since 1999 we have been handling the taking back of old appliances, particularly "white goods", with a volume of approx. 15,000 appliances per year for Media Markt and Saturn. The system operates nationally and at the moment covers approx. 70 affiliated stores.

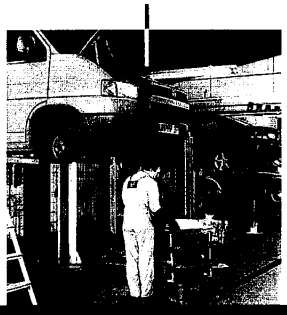
"We take back old appliances from our customers voluntarily. We chose RETHMANN because their strategy and commitment was in line with our requirements."
– Hans-Peter Alkert, MediaMarkt/Saturn –



STRATEGIES FOR MANUFACTURERS, WHOLESALERS AND CHAIN STORE ORGANISATIONS

Anyone who wants to become big must never overlook the smaller items. We'll pick up any volume of waste, no matter how small

Garage service: Used oil, oil cans, spare parts and exchange parts – whatever is left over in the car repair shop is picked up by RETHMANN – for safe state-of-the-art disposal and reutilisation in accordance with the law. RETHMANN, take it!



Photographic laboratory service: Used process chemicals from the photographic laboratory have to be disposed of ecologically. The recyclable substances contained in them, mainly silver, are returned to the cycle of materials – a job for RETHMANN!

Chemicals from the photographic laboratory, oily substances from the workshop, left-overs from the restaurant. Paper from the printing works, packaging from retailers ... although we are one of the largest environmental service providers in Germany (or maybe precisely for that reason) we also pick up very small quantities. We don't mind how far we travel or if there is not much time available. As with any other contract.

Printing works service: Paper and ink – the consumables at a printing works are also their waste. RETHMANN disposes of them on time and ecologically. The latter is particularly important for printing ink: it can contain oil and heavy metals – which are no problem for RETHMANN!

A full service from a single source

When you choose RETHMANN you get not only one of the most efficient methods of waste disposal but also one of the most convenient:

1. A flexible waste disposal partner for all waste, no matter how small or large the volume
2. A central partner to contact for all the questions to which you require answers quickly and reliably

Some good reasons why many large and particularly tens of thousands of small customers, all over the world have already chosen RETHMANN system services. To put it in a nutshell, they have chosen the best possible terms.
Maximum security. Optimal service. All this is typical of RETHMANN!

Nordwest-Zentrum, Frankfurt

One example of many: a large commercial centre with 120 tenants, a hotel and a technical college – our local staff organise and optimise all the flows of material.

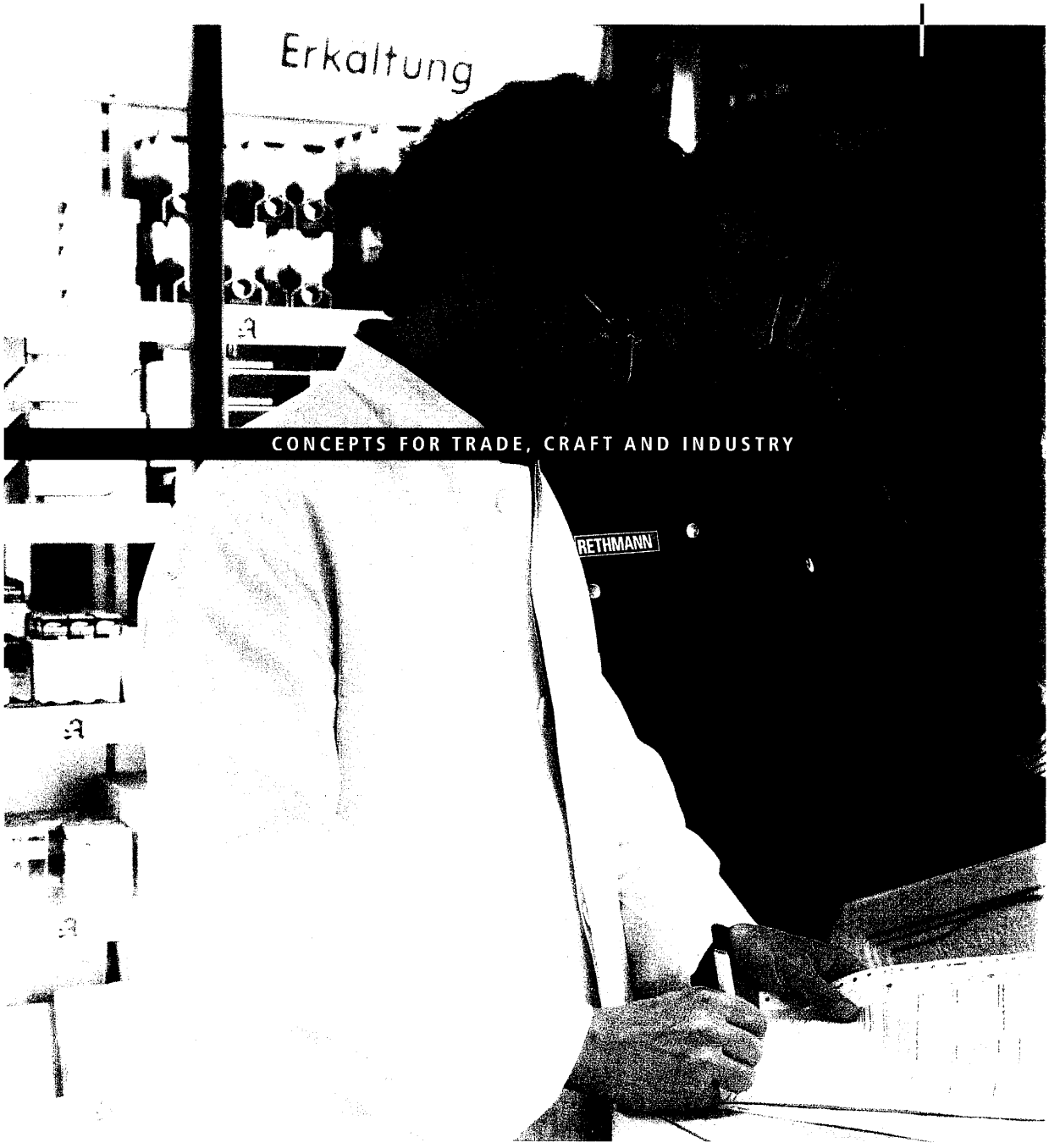
SPAR-Zentrallager, Langenfeld

We empty the roll-on-off containers coming back from the branches, sort the empties, segregate waste packaging from other remaining materials and prepare returnable transport packaging for reuse.

Aldi, Datteln

RETHMANN guarantees a 24 hour service for pick-up, unpacking and reutilisation of spoiled goods from faulty deep-freeze systems.

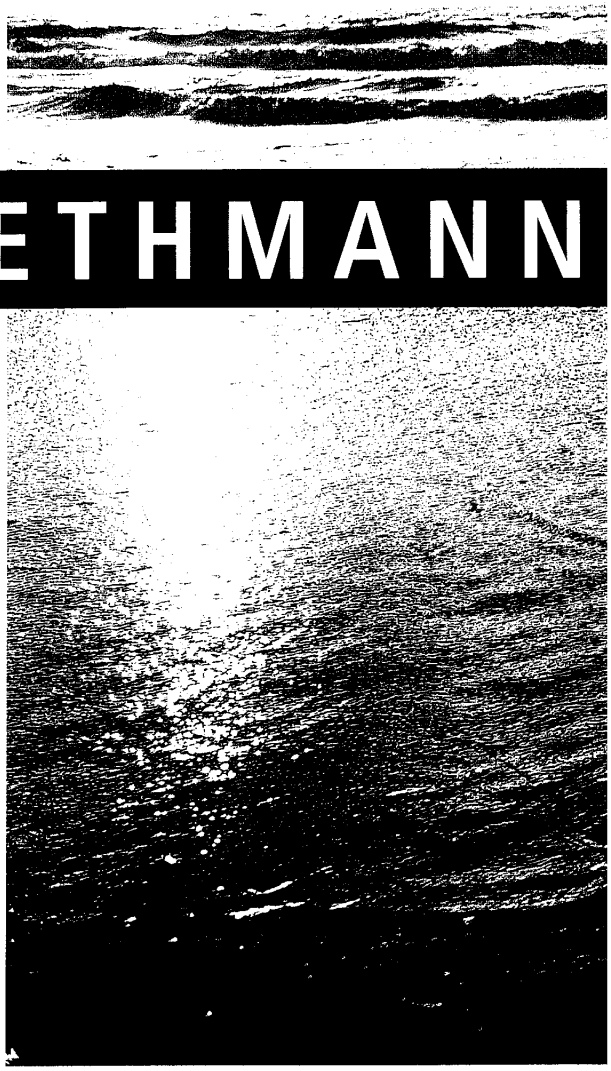
Quick, reliable and safe. RETHMANN disposes of small quantities flexibly and at reasonable cost. Recyclable materials, pollutants and special waste – as here for example, medicines which have been handed in because the expiry date has elapsed. Give us a call, and we're on our way. Full service, full responsibility –even for small and very small quantities!



CONCEPTS FOR TRADE, CRAFT AND INDUSTRY

And tomorrow?
A glimpse of the future

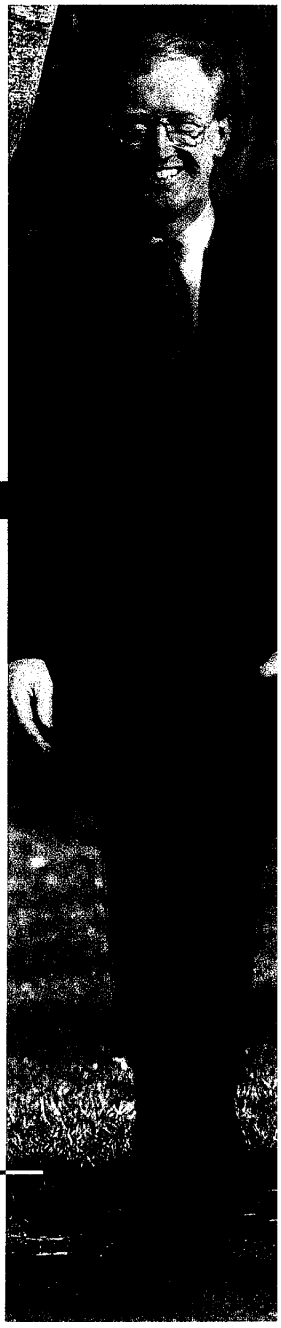
Anyone who wants to design the future has to utilise the experience of the past, grasp the opportunities of the present and cater for the expectations of the next generation.



TRADITION SUCCESS VISIONS

PROSPECTS

Visions are the true source of progress. We carry on thinking



Most visions seemed inconceivable to start with. And today? At RETHMANN we can imagine lots of things for the future.

»We have to think even more in terms of comprehensive solutions. That is where the future of our business lies. Everything under one roof – with the intelligent use of all the existing components of our logistics, our collection systems, systems structure, financing possibilities and our marketing channels.«

– Dr. Hermann Niehues, Chairman of the Supervisory Board –

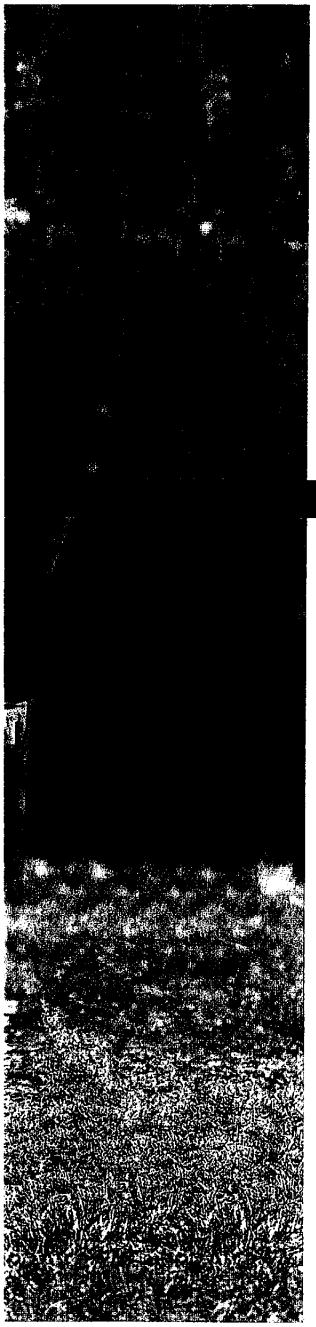
We shall continue to use our diverse ideas, contacts and technical possibilities ever more widely in the service of our customers. In so doing we shall increasingly perform tasks which go beyond traditional waste disposal.

Tasks with a future:

- Providing complex system services
- Implementation of integral Public Private Partnership solutions
- Concepts for innovative water management
- Interlinking waste disposal and supplies
- Development of high-quality products and closed product life cycles
- Development of alternative raw material and energy resources
- Promoting cooperative agreements
- Use of innovative technologies
- Penetrating new markets

From the left: Dr. Hermann Niehues (Chairman of the Supervisory Board), Ludger Rethmann (Member of the Board), Reinhard Lohmann (Member of the Supervisory Board), Klemens Rethmann (Member of the Supervisory Board), Norbert Rethmann, Egbert Tölle (Member of the Board)

Our approach to reaching the target is systematic. The philosophy of our work



- Our speciality is providing waste disposal services for industry, commerce, the trades and public authorities.
- We determine new possibilities for efficient recycling and open up new marketing channels for recyclable materials.
- Disposal of waste depends primarily on reliable long-term waste disposal, not on short-term cost considerations.

PHILOSOPHY

- For linking the place where the waste occurs and where it is recycled or disposed of we have an optimised logistic system in place. That means a demand-oriented, user-friendly recording system at the source, separate collection of materials and controlled supraregional transportation to the various recycling and disposal centres.
- We apply waste disposal processes which neutralise pollutant potential and reduce the bulk.
- We meet the challenge of new problems by maintaining a constant dialogue with customers, researchers, engineers and politicians.
- As far as we are concerned, efficient recycling takes priority over waste disposal.
- Further training for our members of staff is an important policy and for us it begins with comprehensive basic training.
- We will be tackling the development processes necessary in the future in the waste disposal industry by making capital investments and constantly increasing our workforce. The main requirement is the continuous endeavour to achieve a good-quality return on capital invested.

For us today is already yesterday ...
Developments are moving fast and requirements are ever more stringent. We are flexible

RETHMANN®
Full Service. No Limits!

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RE

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Solutions for Waste Disposal and Recycling

COLLECTION PROCESSING UTILIZATION

PET-Recycling, Taiwan

Internet: www.rethmann.com

Waste Collection, Sorting and Processing. We Open Up Raw Material Sources

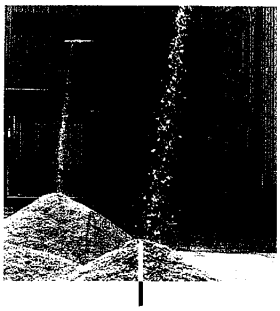
There is one thing we are convinced of – waste is the raw material source of the future. Our experts and engineers already thought about recycling when nobody imagined the need for it. Hence our comprehensive experience with the implementation of disposal methods that are sensible, feasible and consistently in line with recycling objectives. RETHMANN has been building and operating processing and recycling plants for more than 30 years. Today, our plants can be found at over 350 locations around the world.

"We at RETHMANN have been working hard for years to make the technical recycling of an ever larger number of waste fractions possible and economically viable. The portion of recyclables used as input for manufacturing must be continuously raised to reduce the use of natural resources as much as possible"

– Egbert Tölle, Ludger Rethmann, directors of RETHMANN Entsorgungs AG & Co. –

Concepts, Technology and Operations for Waste and Recycling Management

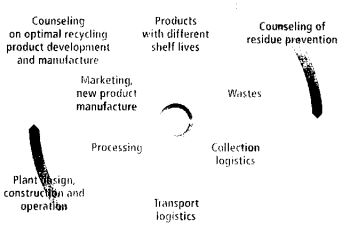
RETHMANN is one of the largest privately owned waste disposal and recycling operators in Europe – represented in fifteen countries of the world with a workforce of 9 thousand to collect the disposable waste of over 8 million people and of some 100,000 industrial and commercial customers. But even when waste travels a long way, our comprehensive know-how and the experience of decades accompanies it. Whether sorting, processing, recycling, landfilling or incineration – RETHMANN knows how it is done.



Looking at glass alone, RETHMANN recycles 900,000 tons a years

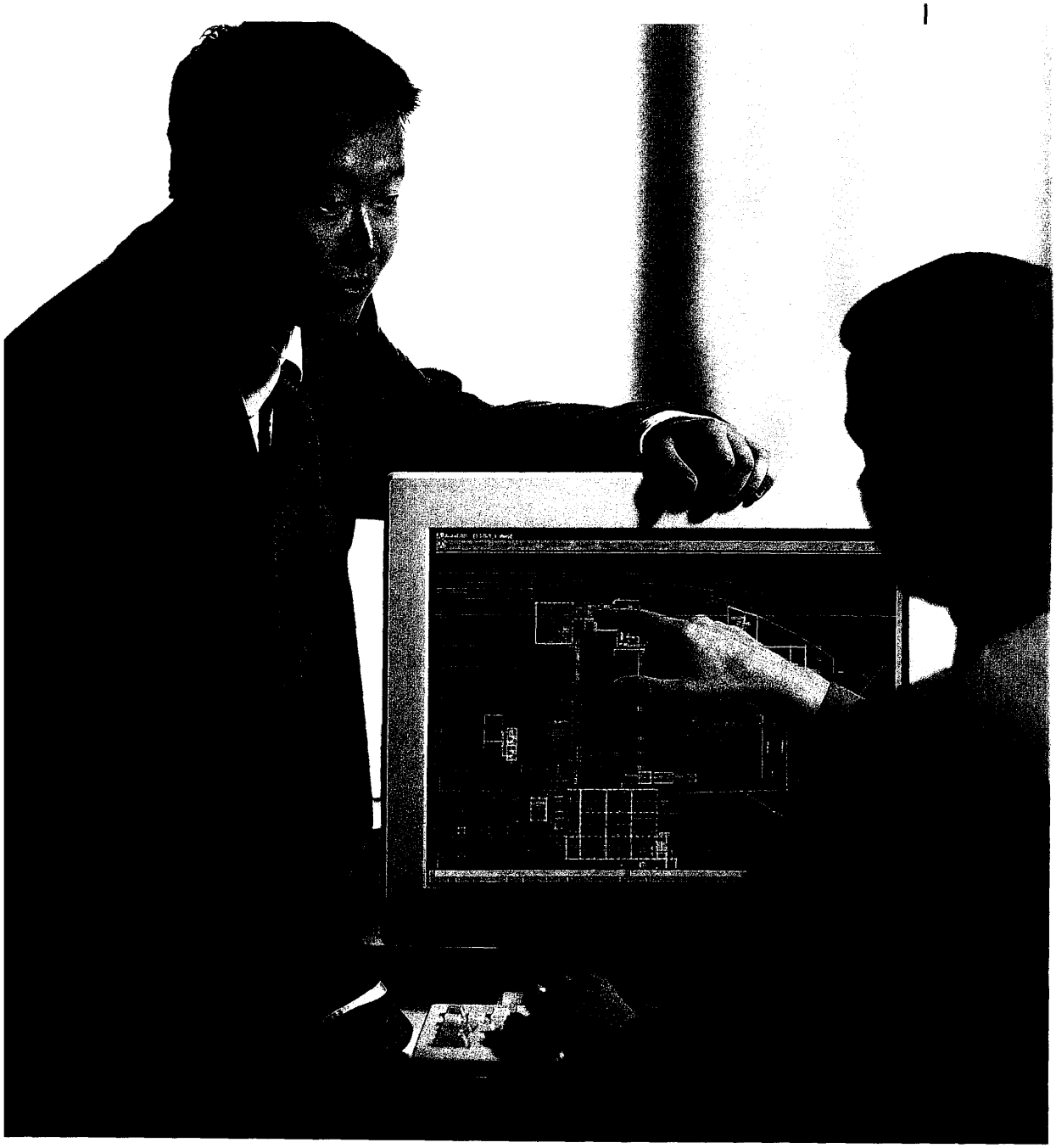
Our range of services is extensive:

- Organizing, coordinating and optimizing disposal logistics
- Channeling, processing and recycling material flows
- Design, construction, financing and operating plants
- Developing, producing and marketing products
- Performing quality checks and assurance programmes
- Taking over responsibility and assuring safety



Our objective are closed material streams

From waste to product: with know-how and commitment, our personnel designs, builds and operates plants for efficient state-of-the-art recycling



We Provide the Know-How.
You Make Use of it. Anywhere in the World

Whoever opts for a cooperation with RETHMANN, surely selects one of the most experienced waste disposal and recycling operators in the world.

In Australia, we have been active for over 17 years. Meanwhile, a force of over 140 works in Sydney, Melbourne and Newcastle

In Central and Eastern Europe, we are represented at numerous locations and our own sorting and recycling plants

Where You Want It, How You Want It ...

Know-how transfer, joint venture or full service – we are open to all forms of cooperation. And at all times guided by the needs of our customers and by local conditions. And that may be at any location in the world – whether we are already represented or not. We are flexible to build a base for waste disposal and recycling of the highest standard anywhere in the world.

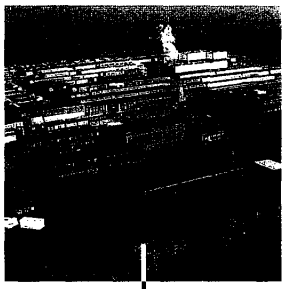
... and What You Want

As an integrated, full-service provider we accept any challenge – regardless of whether the choice is for our technical or organizational know-how. And whichever operating method we may recommend in the end, our goal is always the most effective, safest and economical concept – that our clients can be sure of.

Good Reasons that Speak for RETHMANN

Our success is based on two essential principles backed up by the good name of the RETHMANN family:

1. Transparency of performance – or the certainty that comprehensive counseling precedes the selected implementation method – verifiable at any point and under any aspect.
2. Transparency of cost – meaning the safety of clear contract clauses and long-term cost stability.



In Germany, RETHMANN operates Europe's largest recycling plant – a modern production site for valuable secondary raw materials, base materials and specialty products

Other arguments in support of a cooperation with RETHMANN:

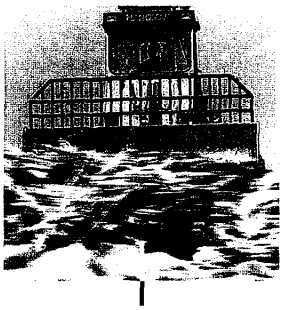
- Collection of all generated waste
- Minimizing the volume of landfilled portions
- Eliminating the hazard potential of special waste
- Proven recycling concepts
- Safe incineration or landfill methods

Our teams are flexible and available for tasks at any place in the world

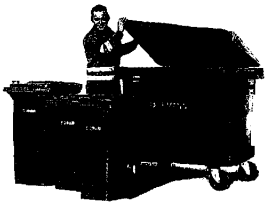
In Asia, we operate one of the most modern recycling plants of the continent which sets standards, also with regard to the cleaning of the waste water generated

Bins, vehicles and facilities. Everything you need

Make use of the safety, convenience and efficiency of professional system solutions: qualified counseling, flexible logistic systems, disposal services and efficient processing and recycling, RETHMANN offers integrated solutions.



Where recycling is economically not sensible or technically not feasible, we assure the required disposal safety on the transport to incineration plants or landfill, which we are also pleased to construct



RETHMANN's Waste Management

When it's a matter of developing or introducing systems for the disposal of household, commercial or industrial waste, call on us with our field-proven technology and concepts. The major areas of our service range is shown below:

- Concepts for municipalities: disposal of urban waste, collection of recyclables, street sweeping, plant construction and operation
- Concepts for health services: disposal of waste from hospital and medical practioners (medical waste, photochemicals)

We dispose of a comprehensive range in the highly specialized vehicles

- Concepts for industry, administration, business and trades: disposal of wastes of all kinds, collection of recyclables (in particular of packaging materials), waste water treatment and sludge drying, industrial cleaning

At all times, we are able to offer our clients an exhaustive range of services: clean and hygienic collection in closed container systems, safe and economic pick-up in modern vehicles, ecologically sound processing, recycling or disposal.
We are guided uncompromisingly by the needs of our clients.
We are also open for the gradual establishment or extension of a cooperation.

Recycling and Production at Maximum Rate

To gain secondary raw materials, RETHMANN constructs and operates plants that are so varied as are the residues themselves. In the last 30 years, RETHMANN has built countless major technical production facilities for the recovery of raw materials.

To simplify disposal and recycling, we separate the various materials by grade already during collection at source

Effective Recycling is Mainly a Question of Technology. We Have the Complete Program

Glass recycling

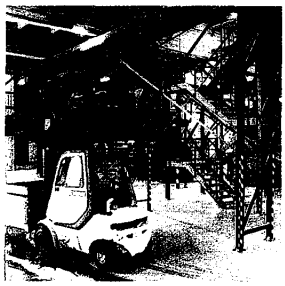
Like no other raw material, glass symbolizes perfect recycling efficiency. You can melt it and convert it into new products as often as you like without changing its specific properties. And the melting of used glass requires much less energy than the production of new glass from primary raw materials.

From pure-grade glass breakage, any type of glass can be made – from sheet glass to bottles

Paper recycling

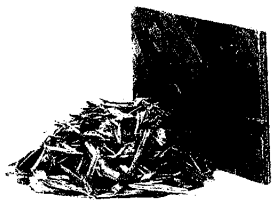
If you really want to sensibly recycle old paper, it is not sufficient to collect a large quantity and press it into colourful mixed bales. That is why we build and operate plants in which the paper is presorted the way the market wants it – presorted and free from contaminants.

The result of compounding is up to 12 pure-grade paper qualities from which the most varied products can be manufactured



Timber recycling

Modern wood recycling plants from RETHMANN not only cut up the material but also sort it into four grades – from untreated, solid timber for the chipboard industry to pretreated mixed-type firewood to be used as alternative fuel in thermal power plants.



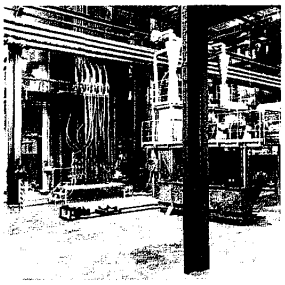
Colourful mixed output materials are sorted into various qualities after shredding. The best grades are used for particle boards

Plastic PET recycling

The advantage of RETHMANN's PET recycling lies in its low energy consumption. The material is not melted at a high cost in energy but is merely shredded and cleaned using state-of-the-art technology. The purity level of our PET flakes is in the parts-per-million range.

Clean and pure-grade PET flakes are ideal for the production of new bottles, cups and fibres

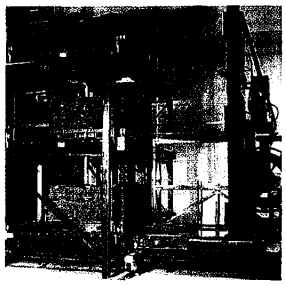
Besides from the systems shown here, we also build and operate plants for recycling chemicals, electrical and electronic scrap, plaster, fluorescent tubes, solvents, scrap metal, textiles and many more



Plastic PE/PP recycling

Regranulation allows production of high-value recycling grades which are equal to new products in every way. Typical uses for recyclates are not only in the manufacture of containers and vessels but almost everywhere in plastics manufacturing.

Recyclates are every bit as good as granulates made from primary raw materials. The products which can be made from recycled materials are correspondingly high in value



Composting

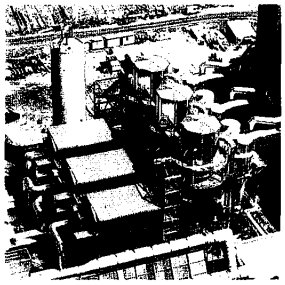
RETHMANN has meanwhile built numerous composting plants which, depending on the yearly throughput and the desired grade, operate on the open tunnel, Bricollare or container composting principles. In addition, the Bricollare Process patented by RETHMANN is economical and especially safe for the environment.

We produce high-value soils and compost from bio and green wastes

Demolition waste

RETHMANN supplies plants which allow the processing of construction rubble and also of mixed building waste by sorting and fractionation. The materials find new uses mostly in road building.

Construction debris is turned into recycled construction materials for road building



Mechano-Biological processing of mixed waste

Substitute fuels are made from residual waste which is matched to the needs of the user. Incoming waste is shredded, fractionated into predominantly organic matter, combustable matter and a mineral fraction and then processed into compost and secondary fuel. The volume of the original waste is reduced, dramatically leaving only a small fraction of the original for landfilling.

The days when residual waste was dumped without further processing are gone. We extract high-quality components and process them into substitute fuels

We do not only have the facilities but the logistics, too: RETHMANN vehicles are on the road all over the world collecting recyclable materials. Built to the latest technical standard, these vehicles can ensure optimal efficiency of logistics processes

RETHMANN®

Full Service. No Limits!

Still have any questions?

We have the answers.

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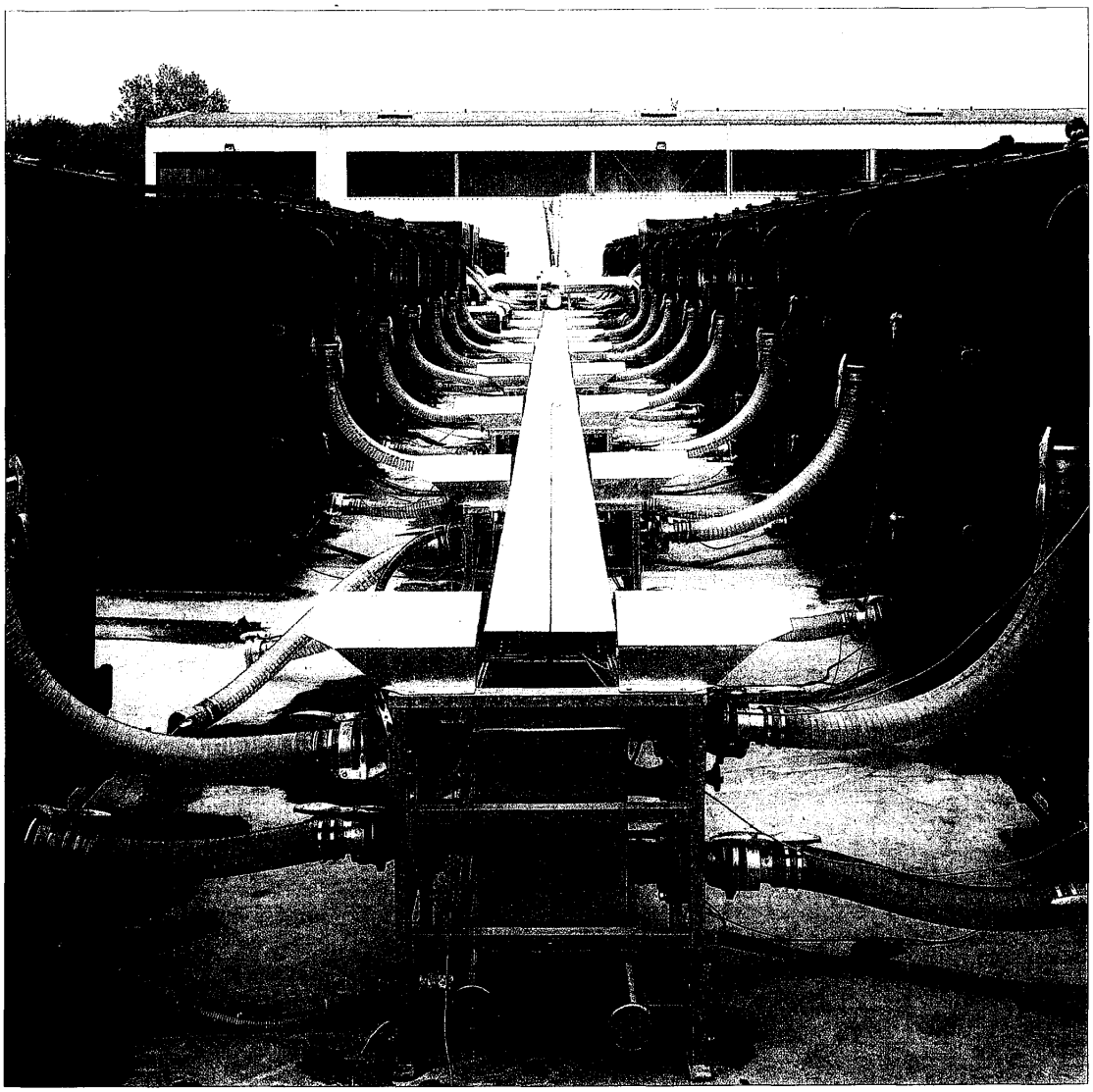
von LUDOWIG
Kompostierungsverfahren

How to win earth.
Container composting
according to the Kneer system.



(九)

We give life to the earth, and that in a very short time.

First of all, there is the conversion of waste, followed by its disposal. These are the criteria laid down in the legislation governing waste disposal. These are also the objectives of von Ludowig GmbH. The most important objective, in the economics of waste disposal, is to utilise organic waste materials to form high quality compost. This waste disposal system economises on valuable dump space, utilising minimum energy and it also relieves the environment. The container compost plant, according to the Kneer system, as propagated by von Ludowig GmbH and their licencees, possesses a method which offers great advantages; from the economical and ecological points of view, and this method is in use, both domestically and abroad.

Container composting reduces time requirements to a fraction.

The aerobic rotting process can only take place under the introduction of oxygen. It is necessary for air to flow freely through the material which is to be composted. The conventional rotting process, outdoors, occurs in an uncontrolled manner and requires a relatively long time period. This is quite different with container composting according to Kneer:

- Forced aeriation, within an enclosed system, reduces rotting to a technically controllable process.
- Time requirements are reduced to a fraction! The results of a conventional composting system require at least a year – this result can be achieved in a mere two weeks by utilisation of the heat-insulated containers.

Also there is a remaining rotting period outdoors which requires four to six weeks.

Apart from this, rotting in the closed containers – with the regulated introduction of air – achieves temperatures of up to 72 degrees C. This is reached by means of the accelerated metabolism of micro-organisms and bacteria. The rotting material is thus reduced to a hygenic condition which can always be guaranteed by use of this method. A valuable final product is therefore created which can be well employed for many purposes.

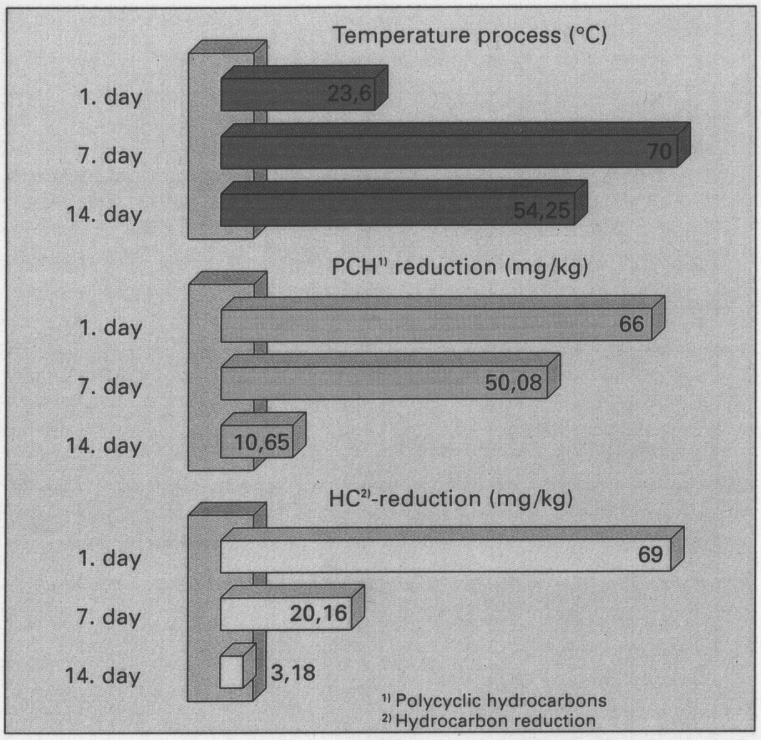
Further advantages which can be obtained only by composting in containers, by means of the enclosed introduction of air:

- There is no requirement for cost-intensive rotting halls – a firm concrete surface for the containers is quite sufficient.
- There is no odious emission of gases.
- There is an absolute minimum of leakage water and condensation, and therefore no drainage problems.
- Optimal functioning, even in cold weather, as the inflowing air is heated. (Utilisation of the warm exhaust air is possible, by means of a heat-exchanger).

The basic materials for rotting: everything which is organic in nature.

Especially suitable materials are:

- Garden and household waste-which has been collected and sorted.
- Organic commercial waste, e.g., organic waste from wholesale markets and the organic waste from the weekly local markets.



By means of the interrupted aeration – controlled by both the parametres O2 in the exhaust air, and the contents of the container – the Kneer system achieves a rotting cycle of a mere 14 days.

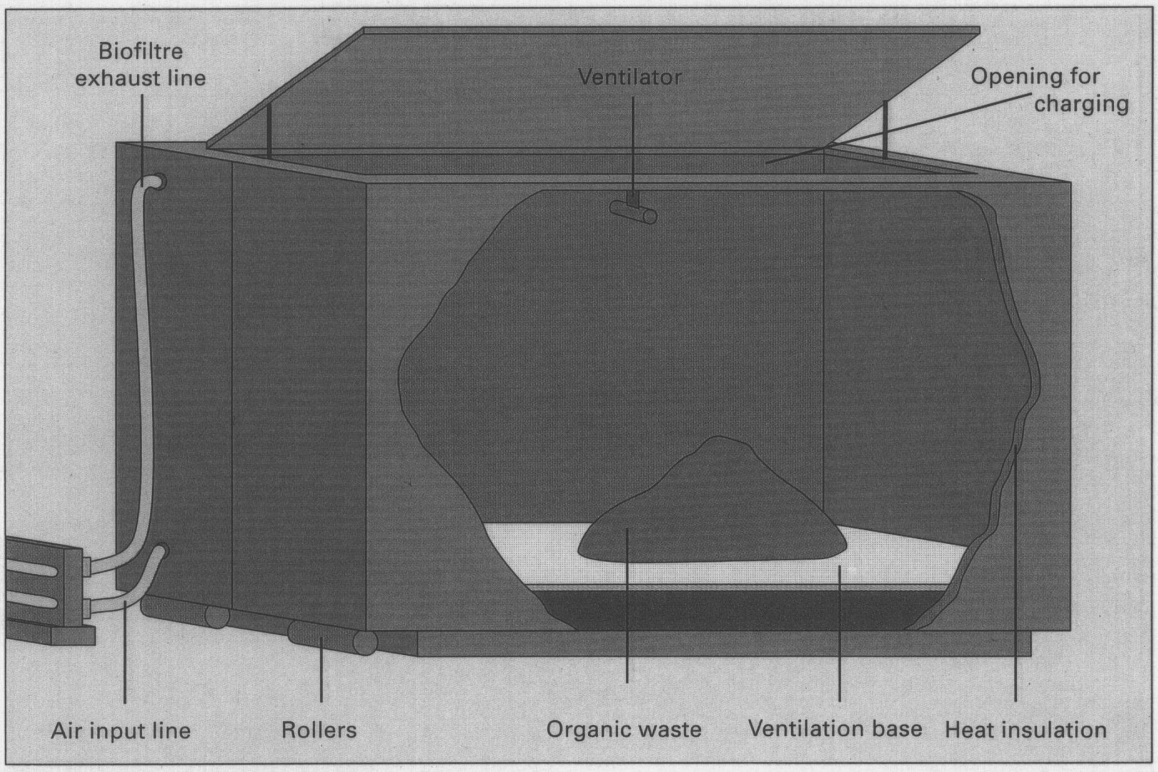
- Low toxic sewage sludge from communal sewage treatment plants.
- Paper and cardboard
- Wood residue
- Liquid dung and other fluid-organic waste.
- Animal dung.
- Organic waste from breweries and fruit juice processing plants, as well as organic waste from sugar refineries.

The system, the system-components and its functioning

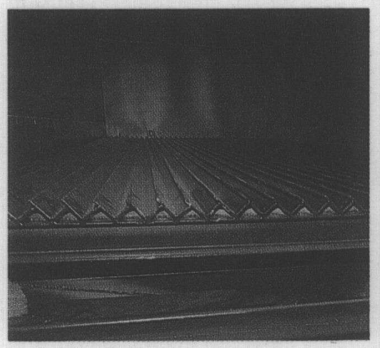
Biological waste is composted in charges in the containers. The containers are combined, in their constructional principle, to modules and plants, in order to correspond to individual demands.

A module consists of the undermentioned components:

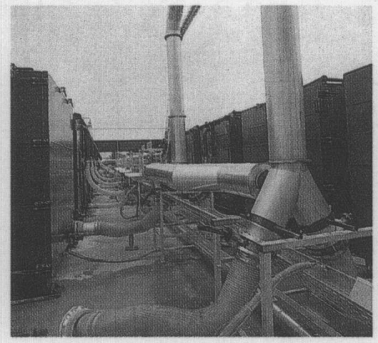
8 rotting containers with an integrated air-inflow unit.
1 biological filtre, situated in a further container.
1 controll unit.
The capacity of each module consists of approx., 3,000 tonnes per annum. The most convenient annual tonnage , of organic material for rotting, lies around 1,500 to 30,000 tonnes input per annum.



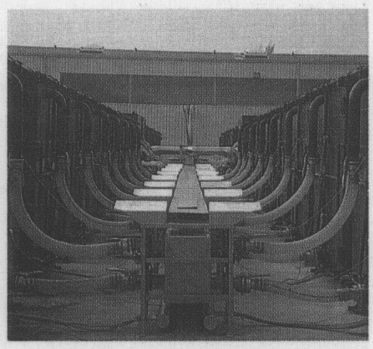
Rotting container with an integrated air-inflow unit in section



Forced ventilation under low pressure via the ventilation base



The patented biofiltre system purifies the exhaust air perfectly.



A contained air ventilation system reliably retards the emission of odious gases.

Forced ventilation is effected under low pressure from below, through the perforated ventilation base of the container.

An exhaust ventilator sucks the exhaust air out and leads it directly to the biofiltre. The odious gases, dust and toxic materials are filtered here; only pure air is expelled. The biofiltre system has been patented, as well as the container composting system.

The final result of container composting is valuable compost.

In the case of a critical condition being reached, in connection with the biological balance, in one of the biofiltres; the system will automatically switch to a different filtre, until that point in the process where the biological balance has again been reached.

The air-volume controll is in direct connection with the temperature of the rotting material and with the oxygen content of the exhaust air. Each container is equipped with an individual control unit to ensure optimal air-volume dosage. The individual control units are controlled by means of a central computer control system.

The walls and the roofs of the containers are covered by heat-insulating material. This enables a build-up to the ideal temperature of the rotting organic material, quite independently from external, ambient weather conditions.

Subsequent to the completion of the rotting cycle, the container can be tipped and emptied in a very short time, and is then ready to be refilled with organic material to again be rotted in the next cycle.

Subsequent to the intensive rotting process in the containers, the sorting of foreign, inorganic bodies can be effected; such as: glass, plastics etc. At this point in time of the process, the materials have a strongly reduced moisture content and is also without odour.

The compost, which has been won by this process, can be sorted into varying qualities, depending on the length of the rotting periods and by careful screening.

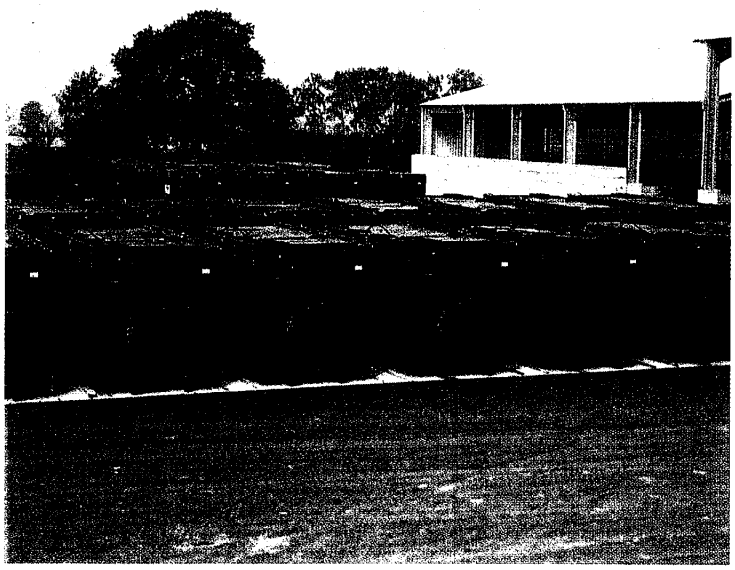
The result is convincing:

The result of this process is a high quality compost with excellent properties for improving the quality of the earth.
The compost has:

- High porosity, (surface area).
- High properties for containing moisture.
- A water content of 40 - 50 %, and
- a pleasant , natural odour.

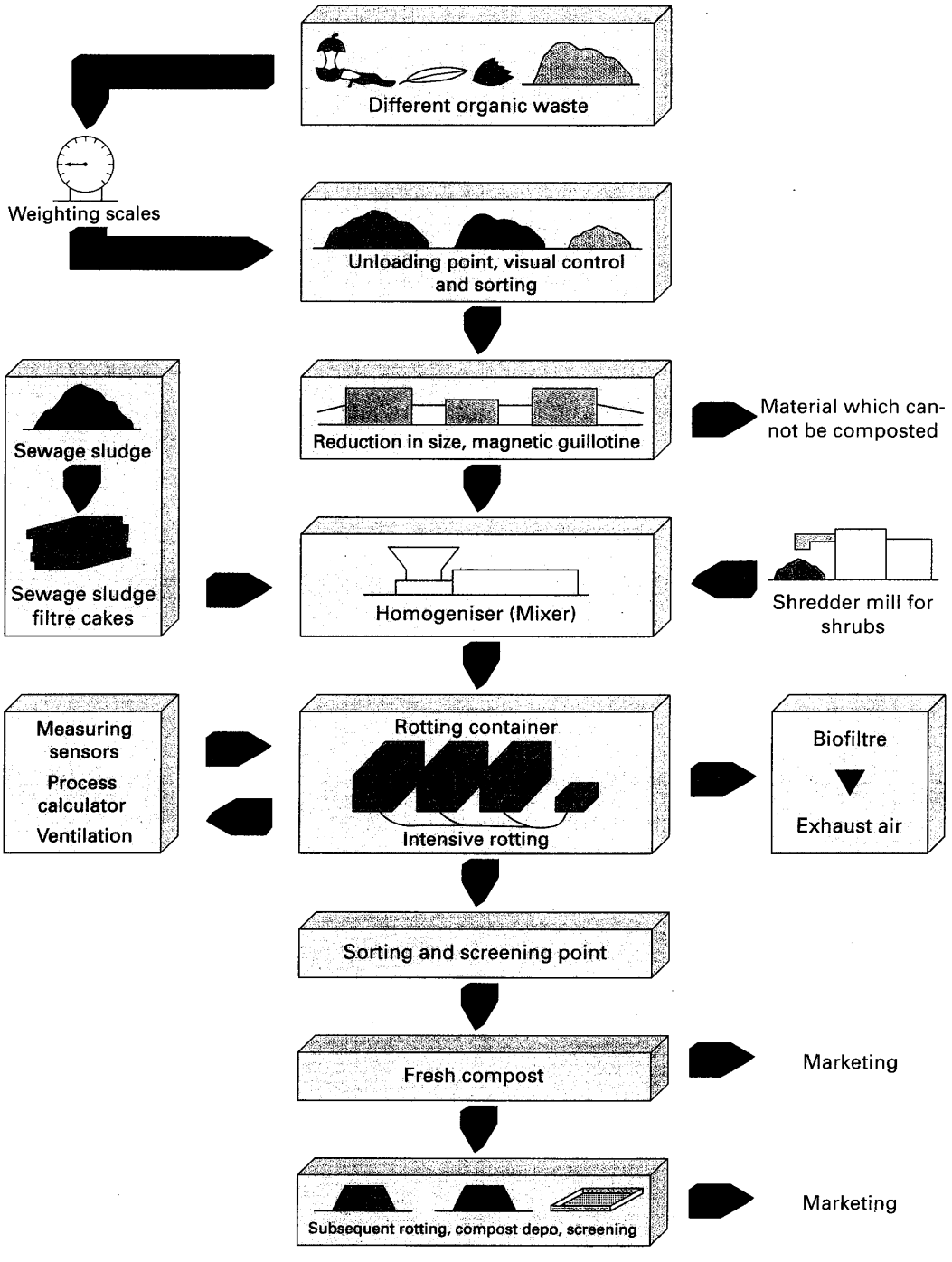
In comparison with other known conventional methods, we can say:

Typical of this system of composting, is the simple technical controll. Low investement costs, low labour intensitivity, easy controlling and surveillance, as well as high flexibility in adapting to various materials and volumes.



8 rotting containers, together with a biofiltre and a controll unit make up a module.

Process scheme related to the container composting system according to Kneer:



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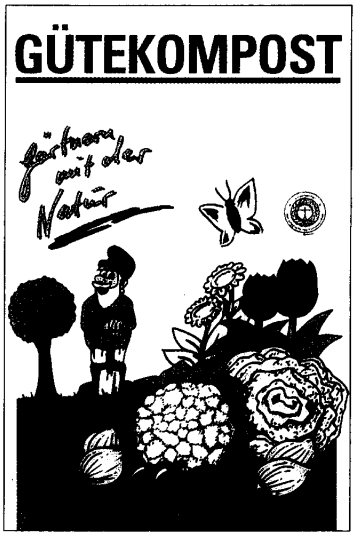

...for a cleaner environment.

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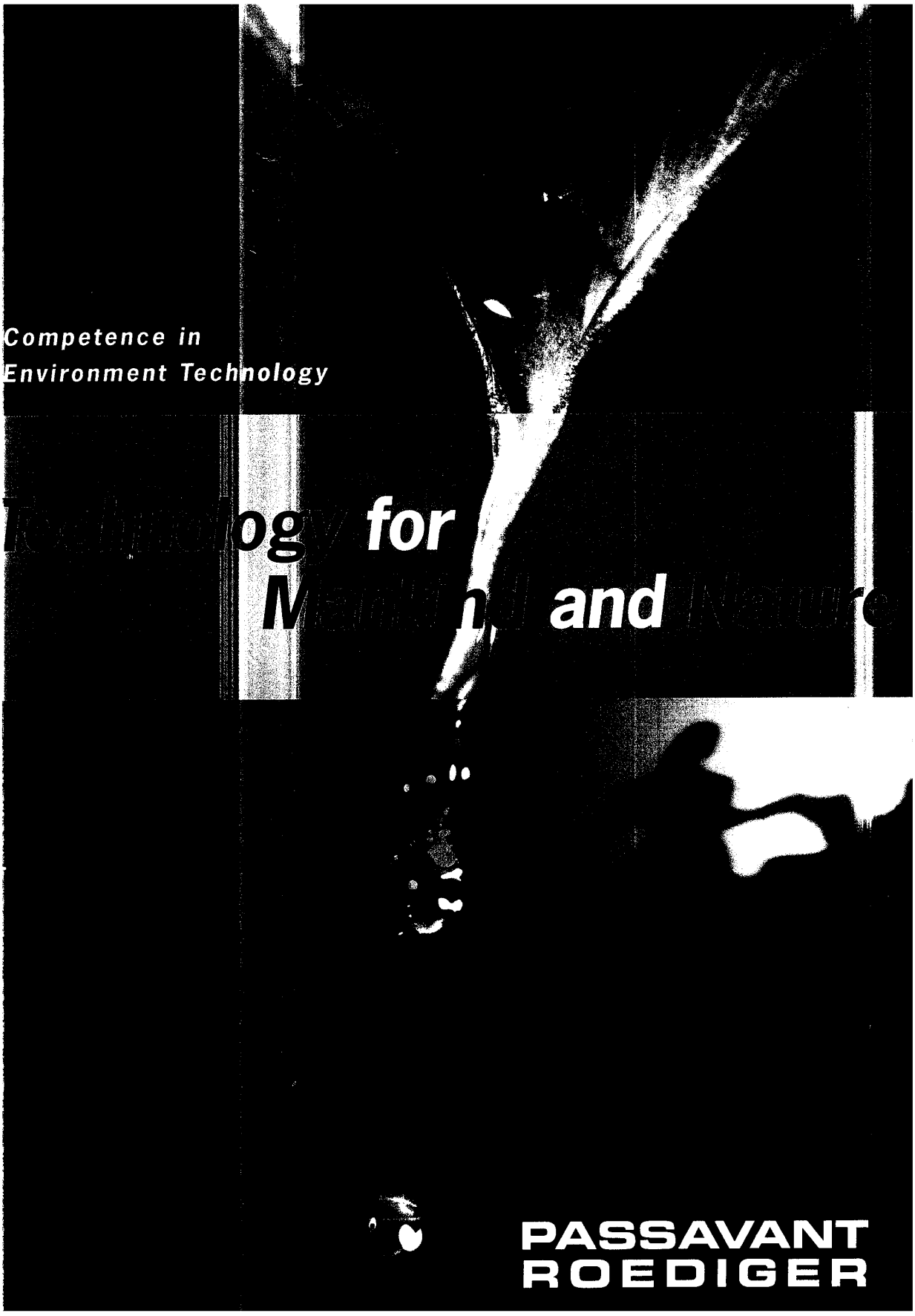
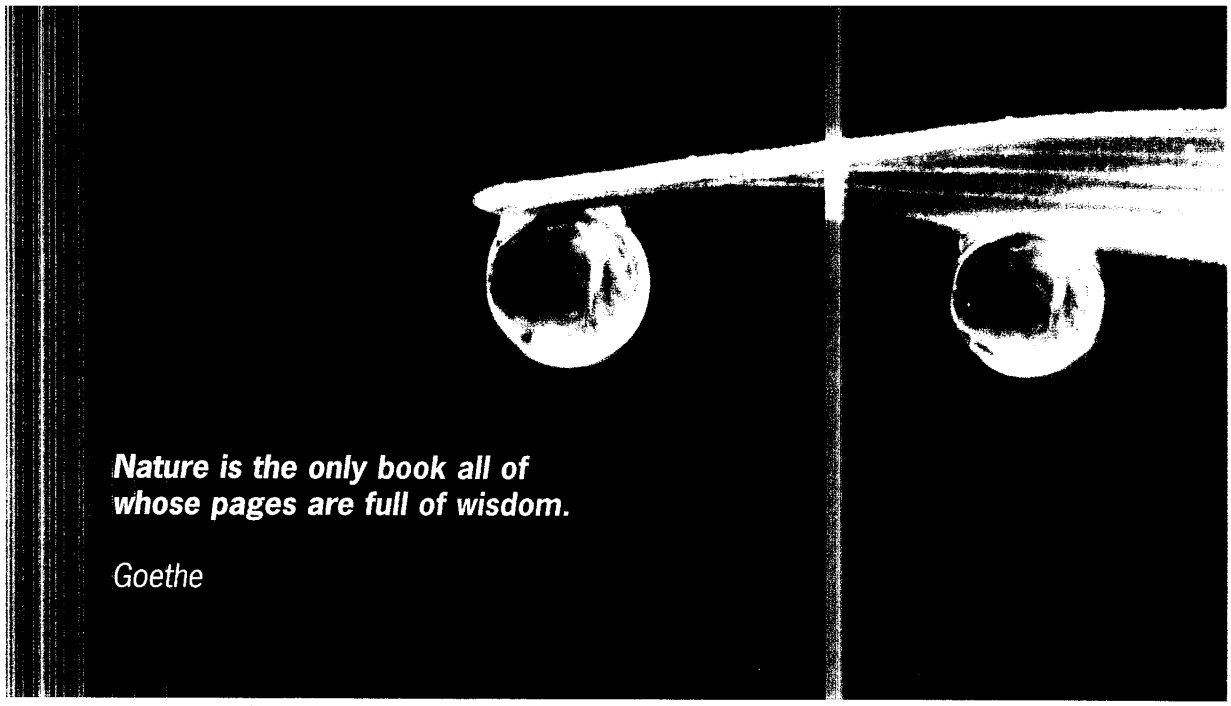

Competence in
Environment Technology
for
and
PASSAVANT
ROEDIGER

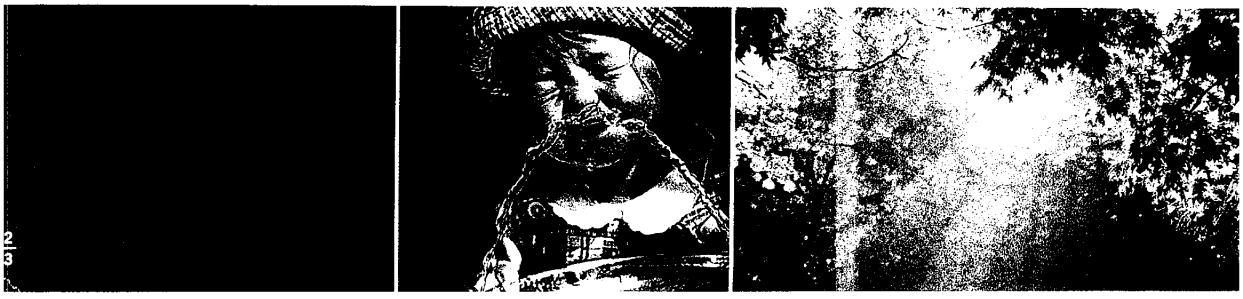


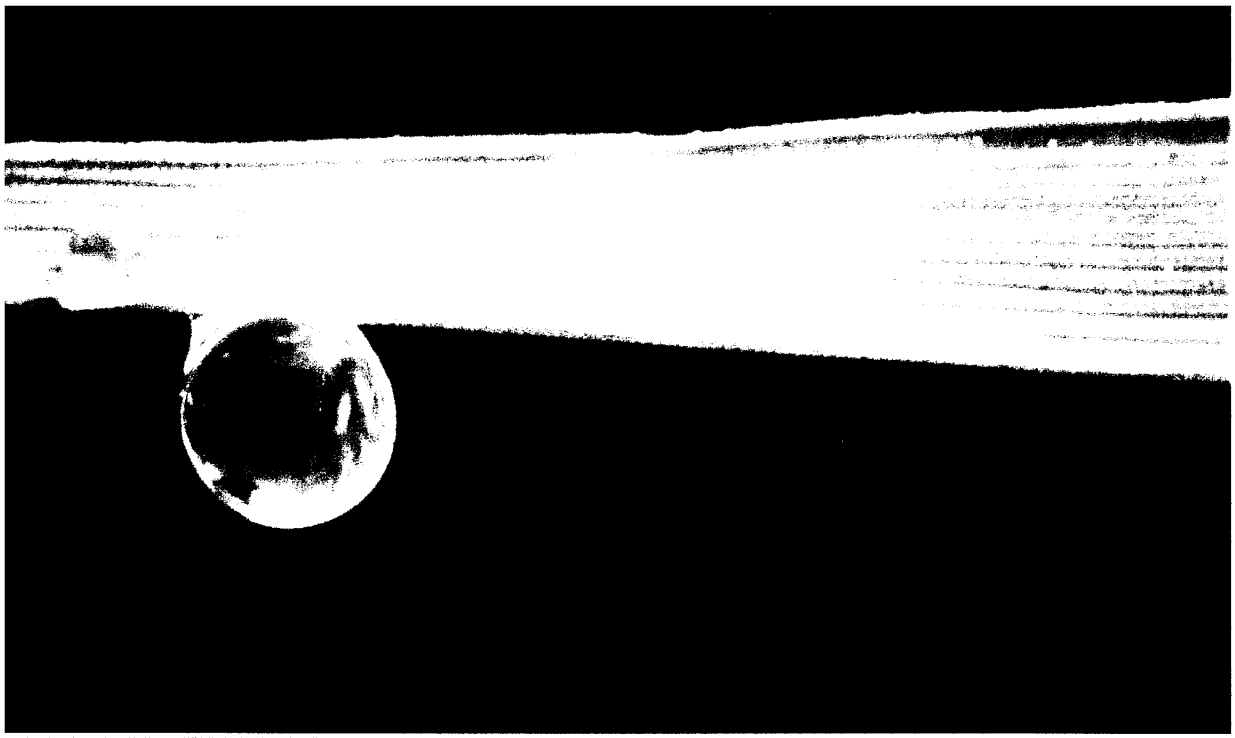
The Driving Force in Environmental Technology

Forests, pastures, water – man in harmony with nature. A picture of perfection – but appearances are deceptive. The natural cycle has become unbalanced long ago almost all over the world.

The more man interferes with the natural processes, the more he has to contribute to the speedy regeneration of the environment. The more we require natural raw materials and mineral resources, the more we have to do with a view to reclaiming these worthy goods available in limited quantities and to handling valuable resources sparingly.

This is the reason why today, more than ever, innovative technologies are called for which are capable of contributing to ecologically and economically meaningful solutions for active protection of the environment. We have constantly stimulated the development of these technologies for more than 100 years. And we intend also to do so in future. In the interests of mankind and nature. Today and tomorrow – worldwide.





Contents

PASSAVANT
ROEDIGER

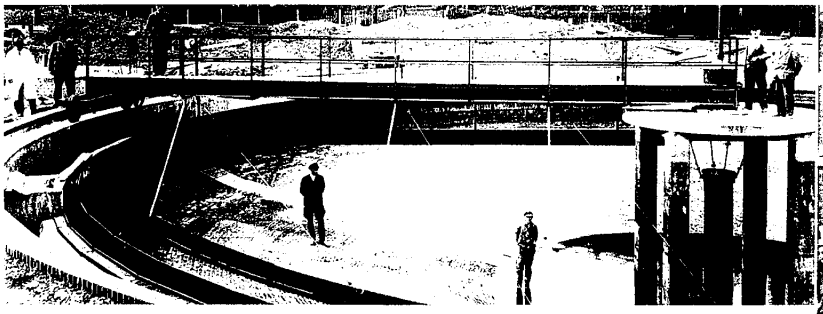
From the Ironworks to the Technological Group

Samuel Adolf Passavant, architect from Frankfurt, acquired in 1884 the Michelbacher Hütte. Together with the English engineer, Sir William Lindley, he worked resolutely towards the manufacture of cast iron components for the controlled drainage of roads and buildings.

Chief Guild Warden Peter Roediger set up in 1842 the Roediger plumbing shop and began as one of the first to drill filter wells, to set up pumping stations, as well as to install water under pressure and lighting gas network systems.

The PASSAVANT-ROEDIGER-Story

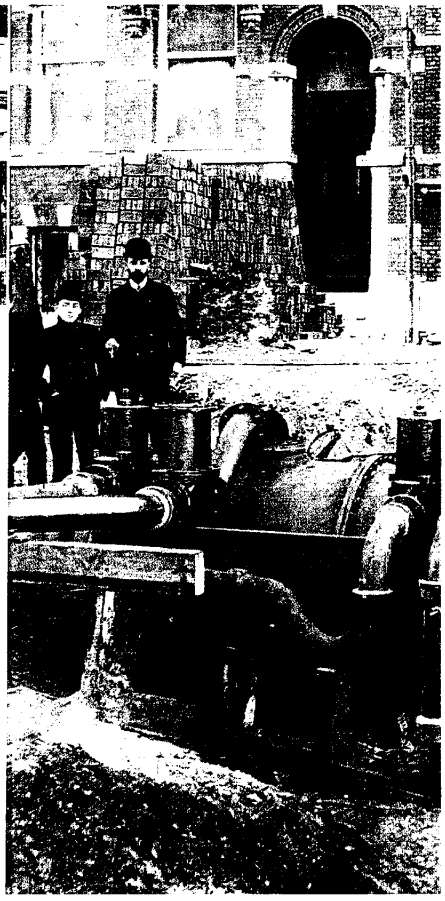
The Century Catalogue was published for the first time by PASSAVANT in 1890 and is still today considered to be the "Bible" of drainage engineering among plumbers and architects in the up-to-date version in force.



PASSAVANT's first circular sewage scraper for the treatment of municipal effluent was commissioned at Sigmar-Schönau in 1938.

PASSAVANT and ROEDIGER – names which, in the development and production of innovative environmental technology, stand for tradition, expertise and experience. Ever since the 30s of the last century, PASSAVANT concentrated on the development and production of components and complete solutions for the purification of municipal and industrial effluents.

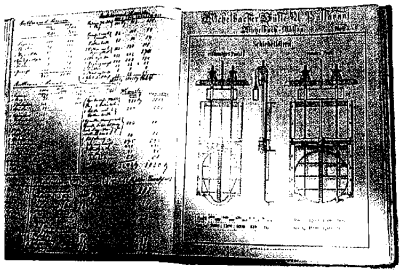
ROEDIGER's success story began with the drilling of filter wells, the setting up of pumping stations, as well as the installation of water under pressure and lighting gas network systems. New technologies in the field of effluent and sludge treatment have been developed since the middle of the last century and which made ROEDIGER one of the worldwide leading establishments in the field of municipal effluent engineering, sludge digestion and vacuum drainage engineering.

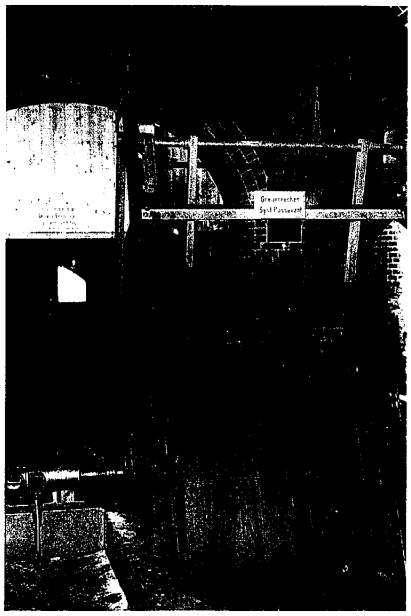


As long as ago as 1873, ROEDIGER set up a vacuum drainage system in Amsterdam.

Combined strength

The two traditional enterprises PASSAVANT and ROEDIGER merged in 1998 under the parent company Bilfinger Berger AG, Mannheim, to form PASSAVANT-ROEDIGER UMWELTTECHNIK. This merger was a logical reaction to changes in the international market for environmental products. This combination resulted not only in joint know-how and expertise, but chiefly also in synergy effects in the fields of development, production and sales. Essential prerequisites with a view to continuing the tradition of both companies and to combining in future success in the field of environmental technology.





The grab bar screen developed by PASSAVANT represents a milestone in effluent treatment. One of the first grab bar screens was already set up by PASSAVANT in 1940.

PASSAVANT
ROEDIGER

Michelbacher Hütte PASSAVANT's production site at the turn of the century

The large and well equipped fleet of vehicles forms an essential part of the speedy and comprehensive service organisation.

Success in technology-orientated markets presupposes a maximum of expertise and efficiency. Excellent quality in development, production and service are the criteria which are our yardstick. The name PASSAVANT-ROEDIGER and the tradition covering more than 100 years in the field of environmental technology impose on us an obligation and, at the same time, form a challenge not only to achieve, but also continuously to improve, the quality standards defined by ourselves and our clients.

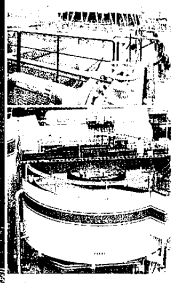
This is ensured by skilled male and female staff, modern planning, design and production techniques, as well as by a qualified quality management which guarantee the quality of our products and services – at every level of the company – ranging from development and design via production to service. Because solely excellent quality guarantees absolute safety, satisfied clients and long term success.

In the dialogue with our clients, we will also in future face new tasks and challenges in the field of environmental technology. With the aid of our comprehensive know-how, trend-setting developments and intelligent, efficient products which provide ecologically as well as economically future-orientated solutions worldwide in the field of environmental technology.

Already at the beginning of the 80s, PASSAVANT-ROEDIGER developed concepts for the use of energy generated by wind power for the energy, measuring and control system of sewage plants. The Husum sewage plant (illustration on the right) is an example of this.

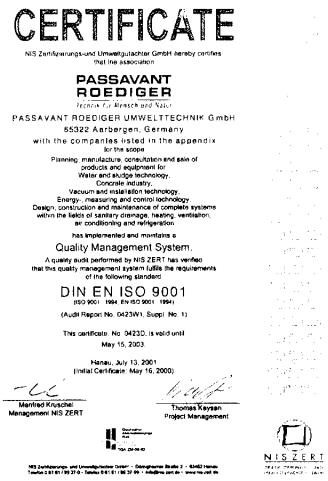
Modern design, construction, and production techniques ensure the excellent quality of our products and services.

Competence in Environmental Technology



Quality without compromise

We are at all times conscious of the special importance of quality to and the thus related requirements of our clients because, in addition to the standard and our clients' quality requirements, our machinery and plant also have to conform to safety-relevant functions in most sensitive fields of application. For example, in drinking water treatment which forms the basis of a safe supply without any risk to health to municipality and other drinking water suppliers. Or the use of plant and machinery for cooling water treatment at nuclear power stations and conventional energy generating plants, in which case quality and safety assume absolute priority.



CERTIFICATE

NIS Zertifizierungs-und Umweltgutachter GmbH hereby certifies that the association

PASSAVANT ROEDIGER

Technik für Abwasser und Natur

PASSAVANT ROEDIGER UMWELTTECHNIK GmbH
65322 Aarbergen, Germany
with the companies listed in the appendix
for the scope
Planning, manufacture, consultation and sale of products and equipment for:
Water and sludge technology,
Concrete industry,
Vacuum and installation technology,
Energy-, measuring and control technology,
Design, construction and maintenance of complete systems within the fields of sanitary drainage, heating, ventilation, air conditioning and refrigeration

has implemented and maintains a

Quality Management System.

A quality audit performed by NIS ZERT has verified that this quality management system fulfils the requirements of the following standard

DIN EN ISO 9001
(ISO 9001 : 1994 /EN ISO 9001 : 1994)

(Audit Report No. 0423/W1, Suppl. No. 1)

This certificate, No. 0423D, is valid until
May 15, 2003.

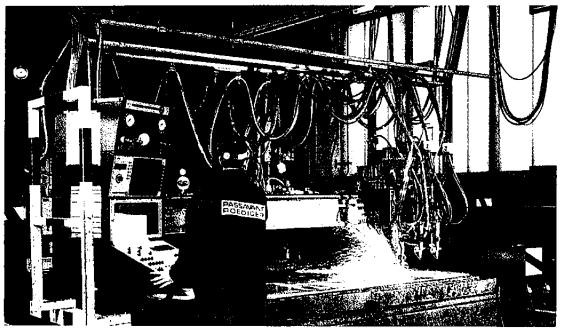
Hanau, July 13, 2001
(Initial Certificate: May 16, 2000)

Manfred Kruschel
Management NIS ZERT

Thomas Kaysan
Project Management

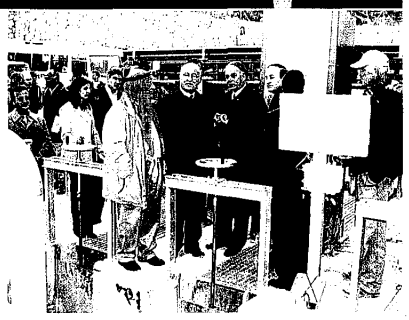
NIS ZERT

In 1994 PASSAVANT has been certified by DQS according to DIN EN ISO 9001 for the first time – and further certifications by NISZERT have confirmed in regular intervals that PASSAVANT-ROEDIGER operate a functioning quality management system.



PASSAVANT ROEDIGER

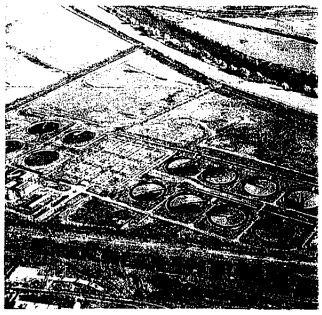
Thinking Globally – Acting Locally



Handing over of the keys of the Al-Bireh, Palestine, sewage plant by Federal President Johannes Rau. The turnkey plant set up by PASSAVANT-ROEDIGER has been financed by the "Financial Collaboration" promotion fund of the Federal Republic of Germany

Protection of the climate, environment, water. All these are subjects which assume increasing importance worldwide and which characterise the market for exacting environmental technology. This development has also considerably affected the activities of PASSAVANT-ROEDIGER who have been acting on an international level in this field for a number of decades. Whether in America, Africa, Asia, Australia or in Europe – PASSAVANT-ROEDIGER have contributed with the aid of innovative technology in almost all regions of the world to improving decisively the situation of man and his environment in the region concerned. This concentrated chiefly on projects for the treatment of drinking water and effluent – a central task assuming increasing importance worldwide.

With the aid of functional, reliable and service-friendly systems and plants, PASSAVANT-ROEDIGER provide cost-effective solutions which, making due allowance for the resources available, render the realisation of the project possible in many places. PASSAVANT-ROEDIGER's concepts meet a high degree of acceptance also in regions which are on the threshold of industrialisation and whose financial resources are limited.



Modern waste water technology of PASSAVANT-ROEDIGER ensures clear terms all over the world
Picture above: Sewage Treatment Plant Rome South, Italy

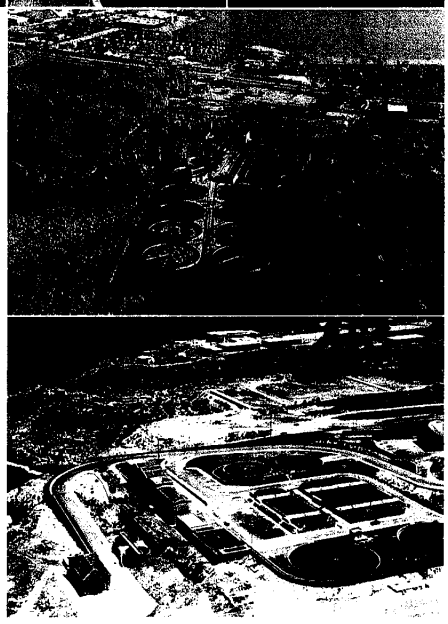
PASSAVANT ROEDIGER

In clients' vicinity all over the world

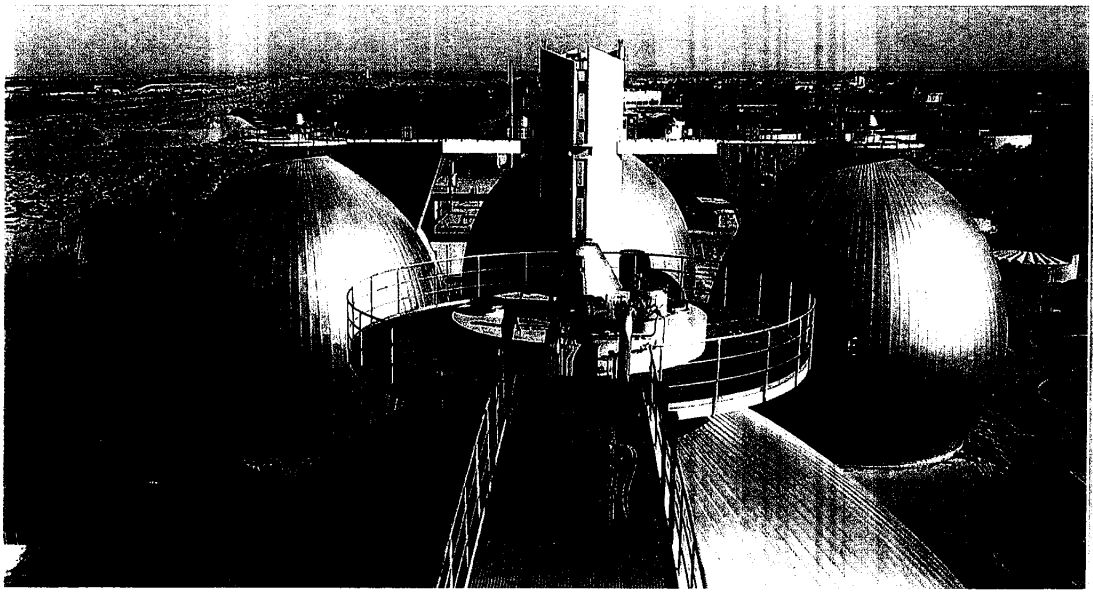
We are represented in almost all countries of the world in the form of branches, subsidiaries, agencies and representatives. An indication of the proverbial clients' vicinity. Because the different requirements to be met by the solution of environmental tasks call for a wide knowledge of the local and regional situation.

Substantial technical expertise, long standing experience, comprehensive know-how and high reliability of PASSAVANT-ROEDIGER's male and female employees are attributes very much appreciated by our clients. In Germany, in Europe. Everywhere.

You will find the addresses of our branches and sales organisation worldwide in the Internet under **http://www.passavant-roediger.de**.

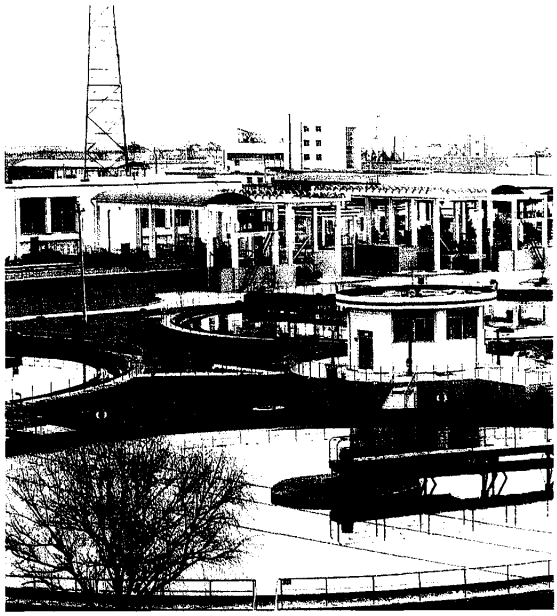


Projects which emphasise PASSAVANT-ROEDIGER's international expertise.
Illustration top: Frederika, Denmark, sewage plant
Illustration middle: Rethymnon, Greece, sewage plant
Illustration bottom: Digesters of the Dubai sewage treatment plant



Plants and System Solutions for Municipal and Industrial Effluent Treatment.

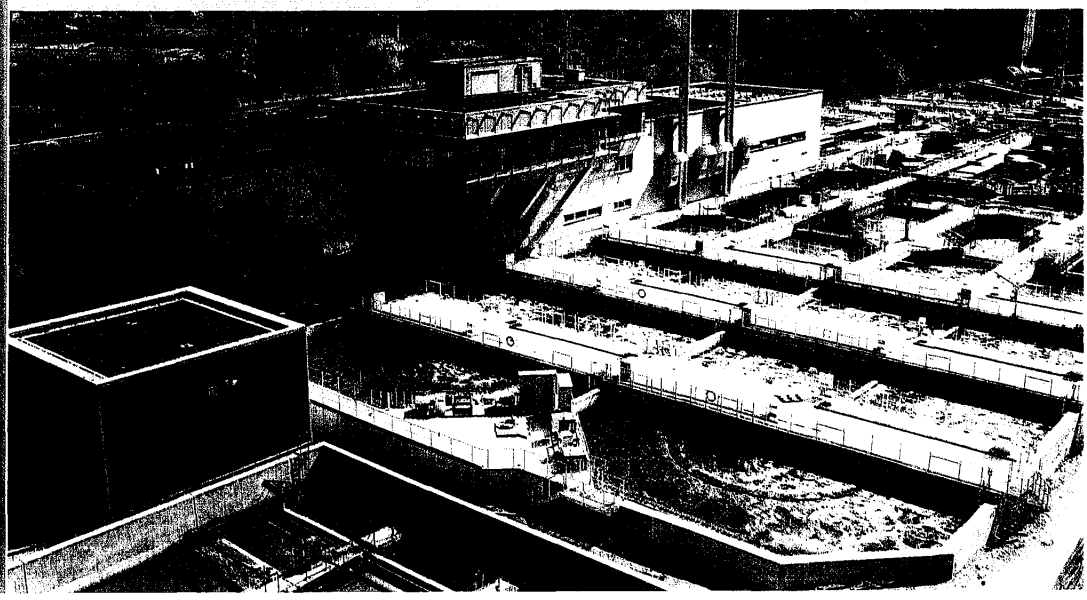
In addition to private households, industry and trade generate ever increasing volumes of effluent. To this must be added surface water which takes to the drains the dirt accumulated on roofs, roads and sites. The thus resulting incidence of effluent and the concentration of organic pollution amount to a multiple of what the self-cleaning forces of our waters are able to deal with. It follows that the treatment of effluent before taking it back to the natural water cycle is indispensable. A task which is being solved by the most modern sewage technology and turnkey sewage plants of PASSAVANT-ROEDIGER.

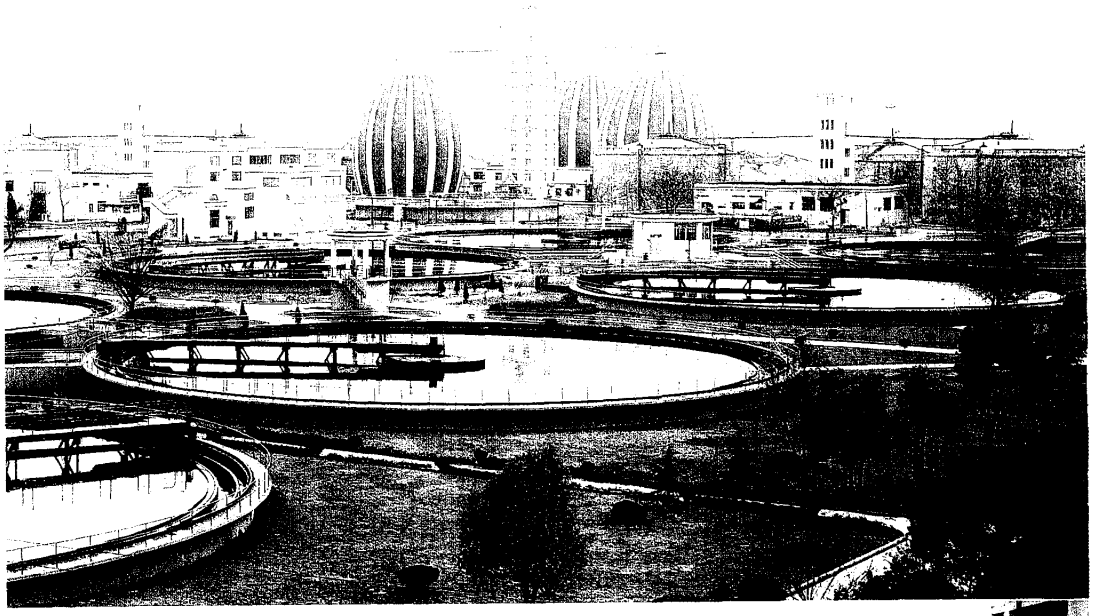


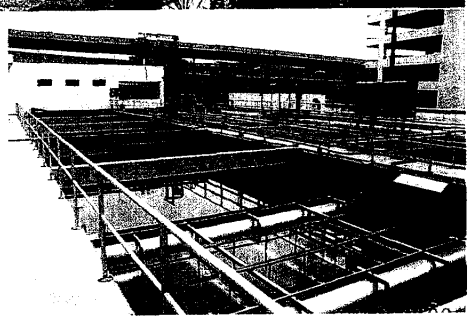
An imposing picture:
The turnkey sewage plant at Hangzhou, People's Chinese Republic, built by PASSAVANT-ROEDIGER.

Plant Construction

Switch board gallery of most transparent design on the main sewage treatment works Wiesbaden for 350,000 P.E.







Sewage treatment plant with Sequence Batch Reactor (SRB Technology) for 20,000 P.E. in Phramongkutklao, Thailand

The treatment of municipal and industrial effluent has been for more than 100 years a special domain of PASSAVANT and ROEDIGER. Both names stand, on a national and international level, for excellent know-how and efficient process technology in this field. We provide individual and made-to-measure solutions – ranging from delivery and assembly to the complete realisation of turnkey plants. We are thus the competent partner for all questions of effluent treatment – ranging from planning and design via construction and installation up to commissioning, maintenance and operation – exactly as required by investors and operators.

The total capability of the business sector Plant Construction in an overview:

- **Design, construction and commissioning of domestic and industrial waste water treatment plants**
- **Design, construction and commissioning of plants for treatment of potable, service and process water**
- **Treatment of urban solid waste**
- **Rehabilitation of hydro power plants**

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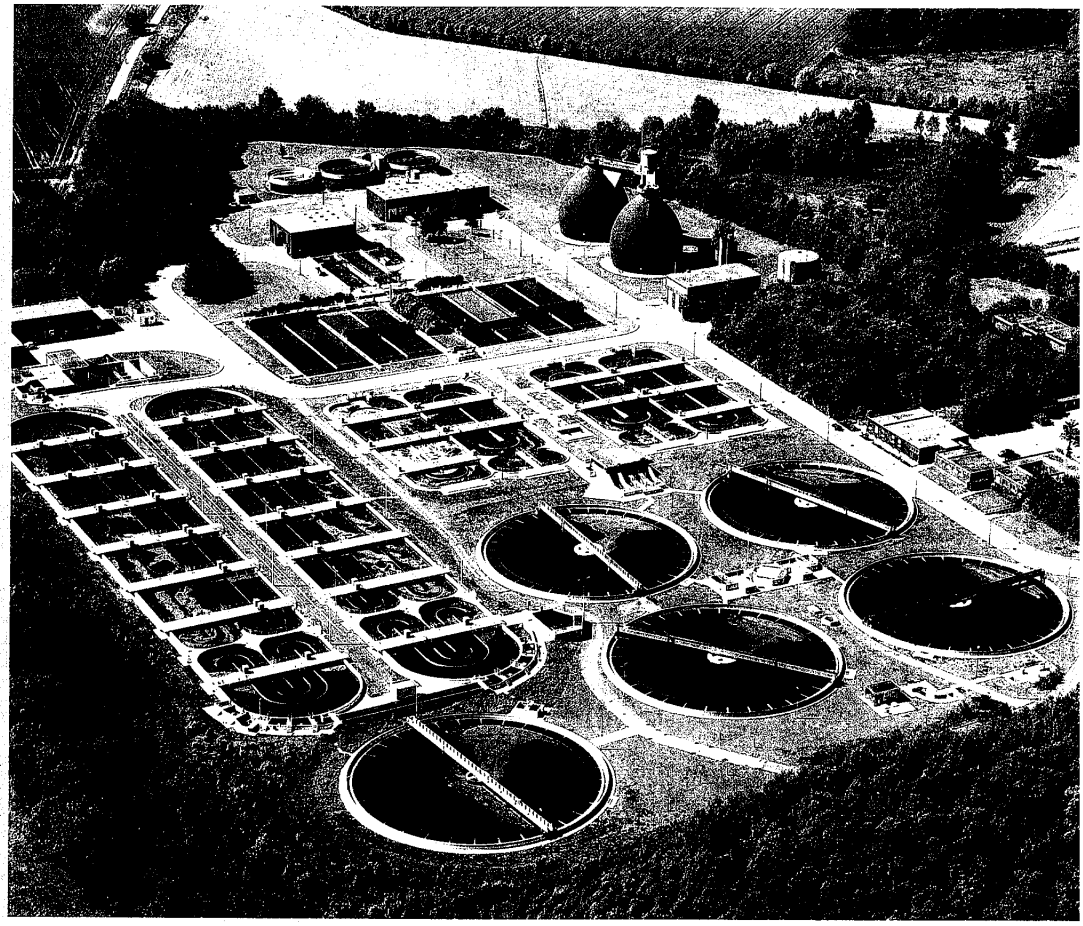
Plants and System Solutions for Municipal and Industrial Effluent Treatment



Ever since dealing with effluent treatment, PASSAVANT-ROEDIGER continuously adapted their range of services to the individual tasks to be performed by municipalities and industry. With the aid of trend-setting product innovations and efficient process technology, decisive contributions to the rationalisation and optimisation of treatment processes in effluent treatment were made. A substantial proportion of machines and system components developed and produced by the Group are used for the planning and realisation of partial and complete solutions up to turnkey plants. This ensures a superior quality and functional reliability – a benefit which considerably differentiates PASSAVANT-ROEDIGER from other suppliers who either concentrate on planning and consultancy, or exclusively supply machinery and equipment for effluent treatment.

PASSAVANT-ROEDIGER's modern and highly efficient technology can be found in municipal and industrial sewage plants all over the world. Whether in Germany, Europe or at the other end of the world – use is made everywhere of PASSAVANT-ROEDIGER's experience and know-how with a view to realising local, regional or corporate specific projects of effluent treatment in a modern and economic manner. This also includes, in addition to the functional and technical aspects, the mentality, infrastructure, geography and architecture of the relevant region as far as planning of the overall concept is concerned.

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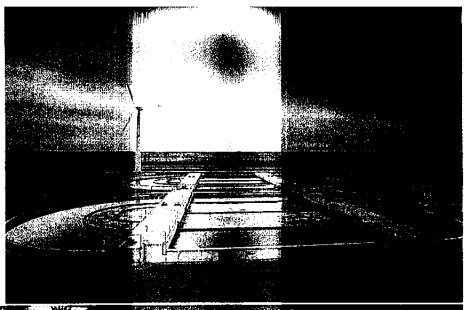
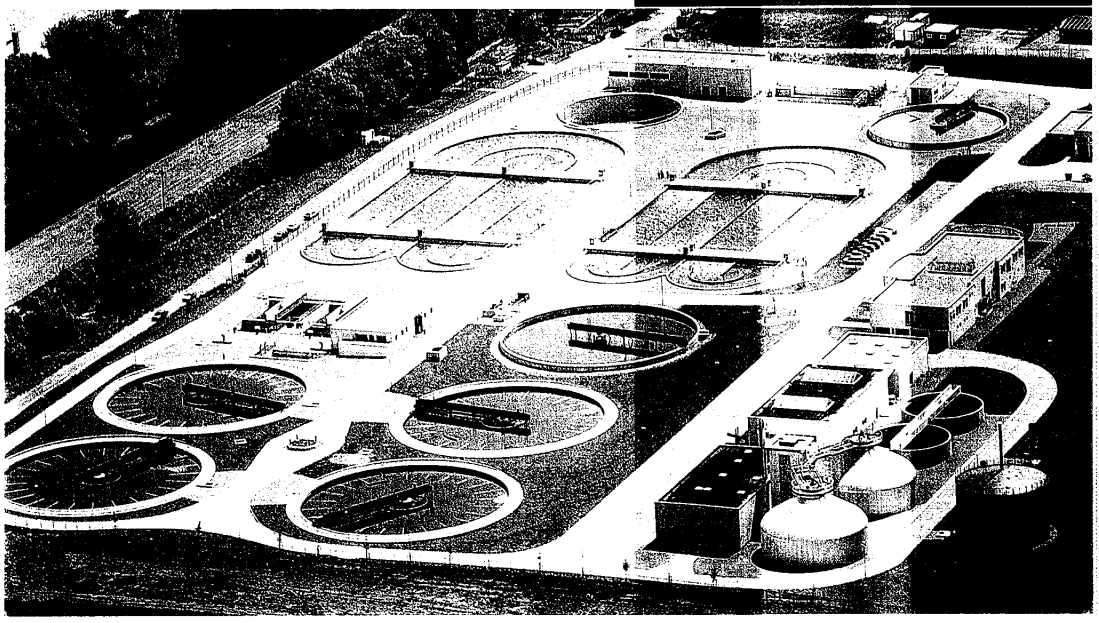
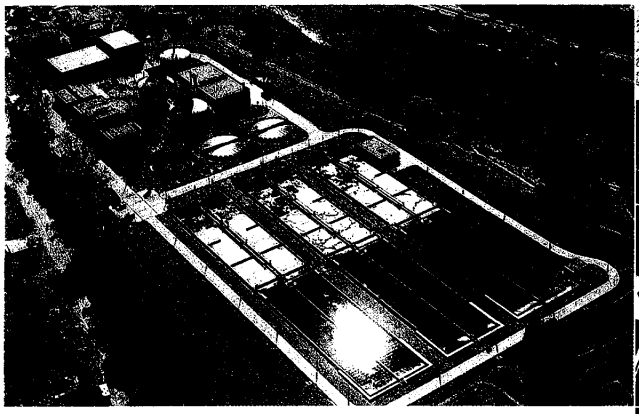


Ideal blending in with the landscape: Husum sewage plant.



The Gotha central sewage plant (picture above) for 150,000 P.E. set up by PASSAVANT-ROEDIGER as turnkey complete solution in only 24 months.

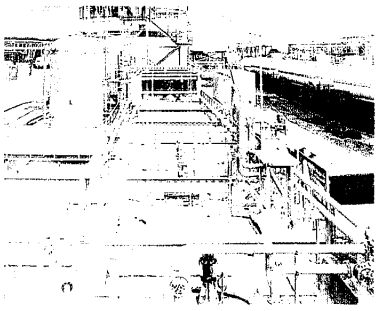
PASSAVANT-ROEDIGER's Mammoth Rotors were installed for the first time in deep basins at the Münster main sewage plant. This technology is nowadays used for water depths in excess of 7 metres.



Aerial photograph of the Saarbrücken-Burbach sewage plant.

Proof of the fact that modern purification technology and contemporary architecture do not clash: The Saarbrücken-Burbach sewage plant.

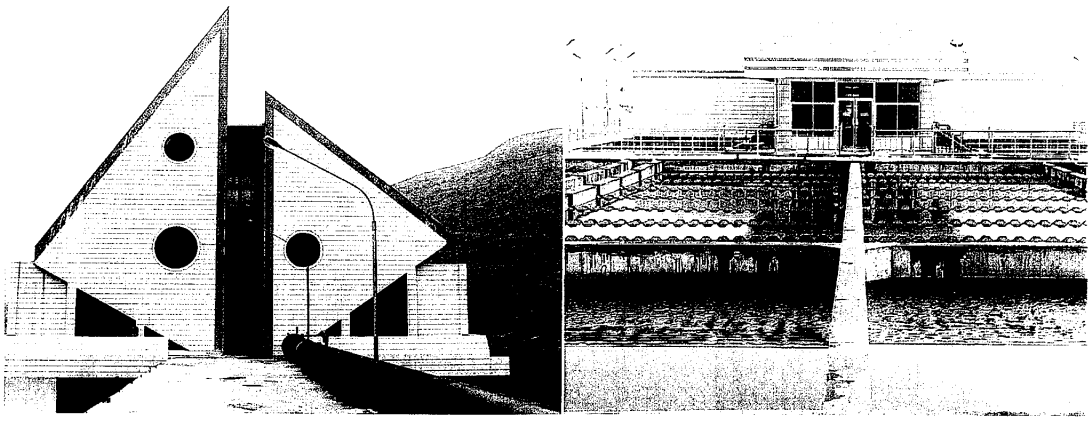
Plants and System Solutions for the Treatment of Drinking, Industrial and Process Water



Plant for the treatment of process water in the chemical industry

The water used to give ICE trains a high gloss is treated with the aid of PASSAVANT-ROEDIGER's technology.

The drinking water supply in the People's Chinese Republic (Anshun) is also ensured with the aid of PASSAVANT-ROEDIGER's most modern technology.

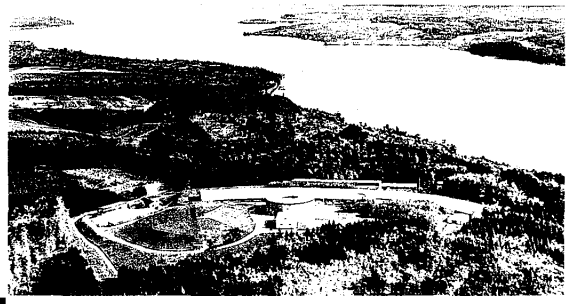


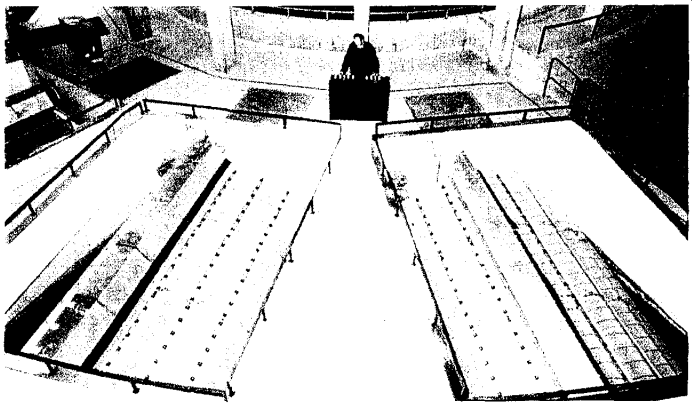
Increasing industrialisation and rising population figures result in increasing water requirements. The existing ground and surface water is not only required in the form of drinking water, but in large quantities also as industrial and process water for industrial and trade purposes.

Before ground and surface water can be used as drinking, industrial and process water, a systematic water treatment is in most cases called for. PASSAVANT-ROEDIGER supply the entire know-how and complete equipment for the realisation of individual projects, ranging from planning and design up to commissioning and maintenance.

PASSAVANT-ROEDIGER are able to avail themselves at the various stages of water treatment within the framework of the overall concept of a wide range of efficient components and products developed and produced within the Group. A benefit which is highly appreciated not only by planners and designers of the complete solutions, but chiefly also by the clients and operators of the plants. PASSAVANT-ROEDIGER provide for the many differing tasks of municipalities and industry not only convincing concepts, but complete solutions of efficient technology, high degree of effectiveness and lasting reliability.

With a yearly quantity of 130 million m³ 3,500,000 people are supplied with potable water from Lake Constance. The technology has been provided by PASSAVANT-ROEDIGER.



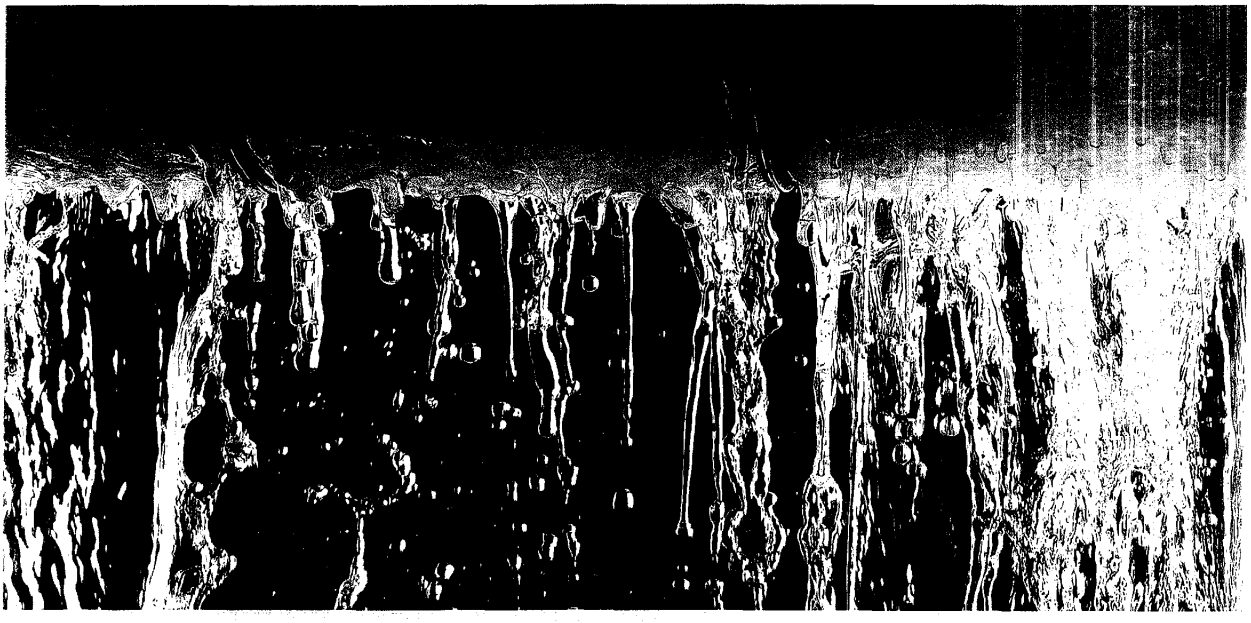


Distribution well and micro-screen installation of the Lake Constance "Sipplinger Berg" drinking water supply.

Clear, pure water

Water is our elixir of life. This is the reason why the quality of drinking water has to meet stringent requirements. In addition to quality, the functionality and economic efficiency of the treatment processes play a decisive role.

PASSAVANT-ROEDIGER provide with the aid of process technical know-how and first class products functional and efficient system solutions which have established themselves in the treatment of drinking water and contribute to ensuring the supply of clear, pure drinking water in the face of growing requirements and increasingly rising quality specifications also in future.



Impressions from the world of water treatment technology: Screening basket of a micro drum screening machine.

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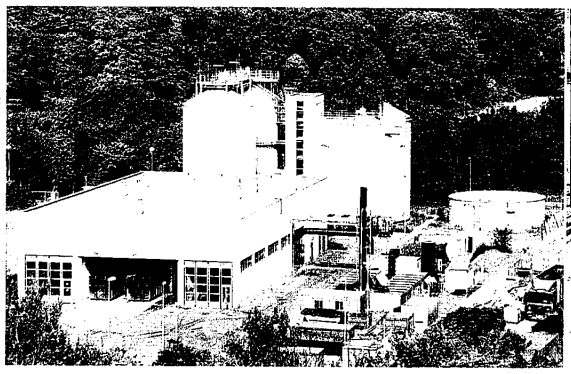
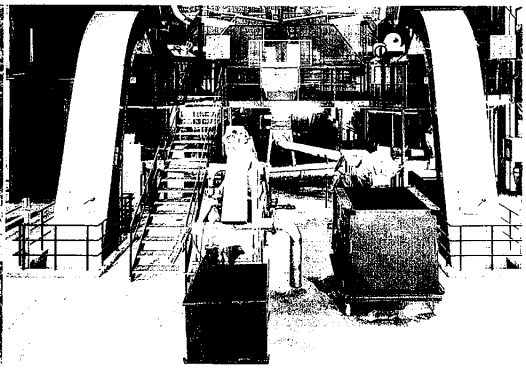
Plants and System Solutions for Waste Treatment



Plant for fermentation of bio-waste (Picture: Biowaste Fermentation Plant in Münster)



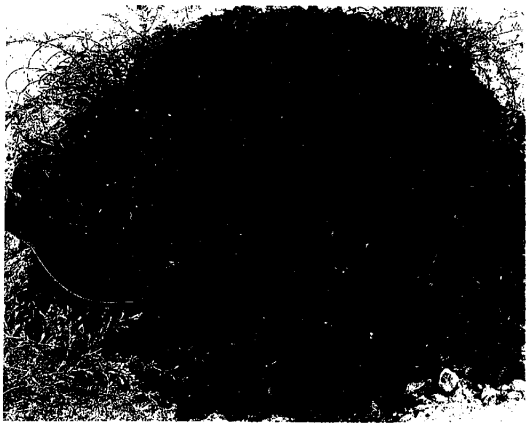
A look into the "inner life" of the Münster bio-waste fermentation plant shows the mechanical pre-treatment of waste.

Biowaste fermentation

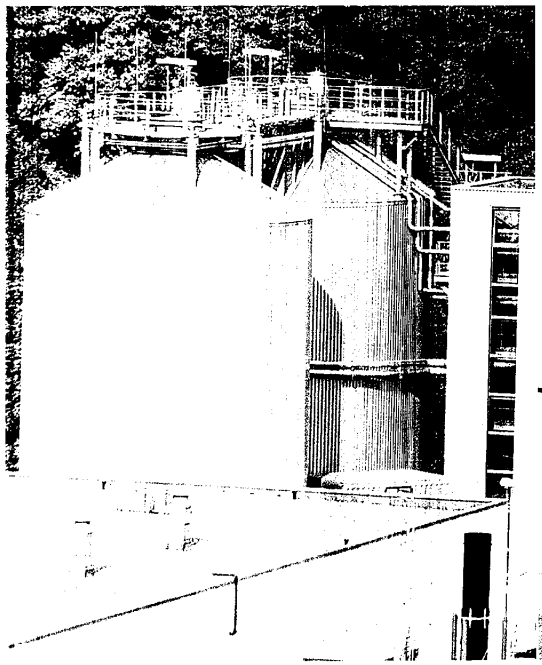
Waste, useful material, raw material. The boundaries between these terms are fluid. What we call disparagingly waste is being used increasingly as basis for the generation and recycling of raw and other useful materials. This is without a doubt a step in the right direction in view of a rising waste mountain worldwide. PASSAVANT-ROEDIGER also play an important part in this future-orientated development with the aid of innovative technology.

Already since the middle of the last century, and based on the activities in municipal water treatment, ROEDIGER pushed ahead with the development of sludge digestion. Based on this digestion technology, a process for the fermentation of biological waste was developed which closes the cycle between the use of raw materials and the recycling of still usable materials.

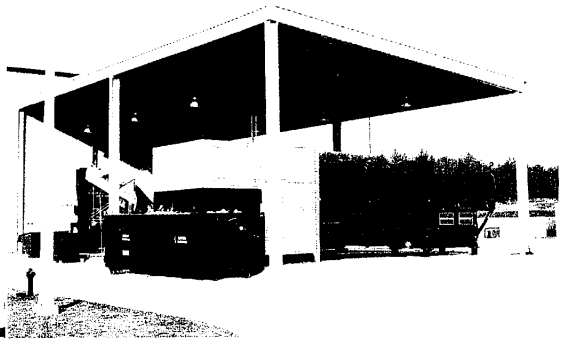
The end product of this biological fermentation process consists of compost rich in nutrients which can be used as a valuable and biological fertiliser in agriculture. In addition, the fermentation process generates digestion gas respectively biogas which is used as a secondary product of biowaste fermentation for the generation of heat and energy. In addition to the conservation of raw materials for the generation of energy, utilisation of this energy results in a reduction of costs incurred by the recovery process.



The object of the fermentation of biological waste is the production of compost which is used as a valuable fertiliser in horticulture, as well as in agriculture and forestry.



The "heart" of waste treatment: Intensified fermentation for the stablisation of organic substances.

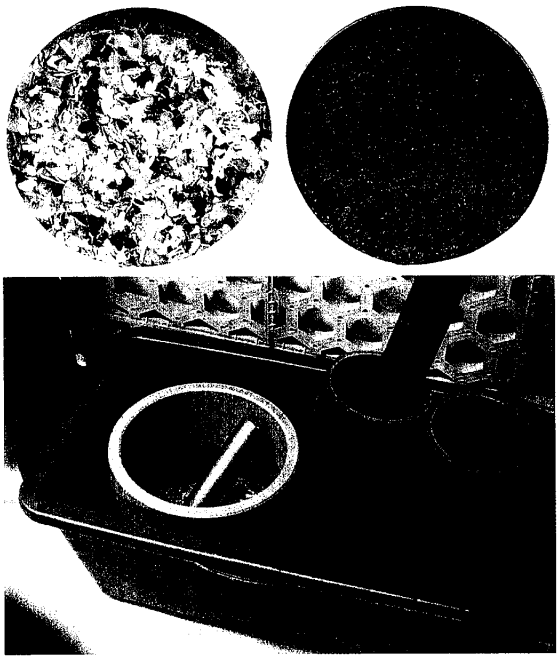


Mechanical-biological waste treatment for recycling and stabilisation of valuable substances from urban solid waste.
(Picture: Residual Waste Treatment Plant Zgorzelec/Poland)

Residual waste treatment

The mechanical biological waste treatment (WTP) renders possible the comprehensive recycling of solid domestic refuse. As in the case of biological waste treatment, the core of this process consists of the intensive fermentation resulting in stabilising the organic waste fraction and in the generation of biogas.

This technology enables substances such as paper, plastics, metal or wood to he recycled and treated for re-use. In addition, it is possible to produce selected quality-tested mixed fractions which can be used for example as substitute fuel, or waste dump fractions of low calorific value which, in accordance with the guidelines of the Waste Decree, can be taken to low emission waste dumps not calling for any post-treatment. This technology of PASSAVANT-ROEDIGER thus makes a decisive contribution to a modern and environment-orientated utilisation of residual waste.



Steps of the mechanical-biological waste treatment (WTP)
Picture above, left: cleaned plastic waste fraction
Picture above, right: plastic granulate of cleaned fraction
Picture below: products made from plastic granulate

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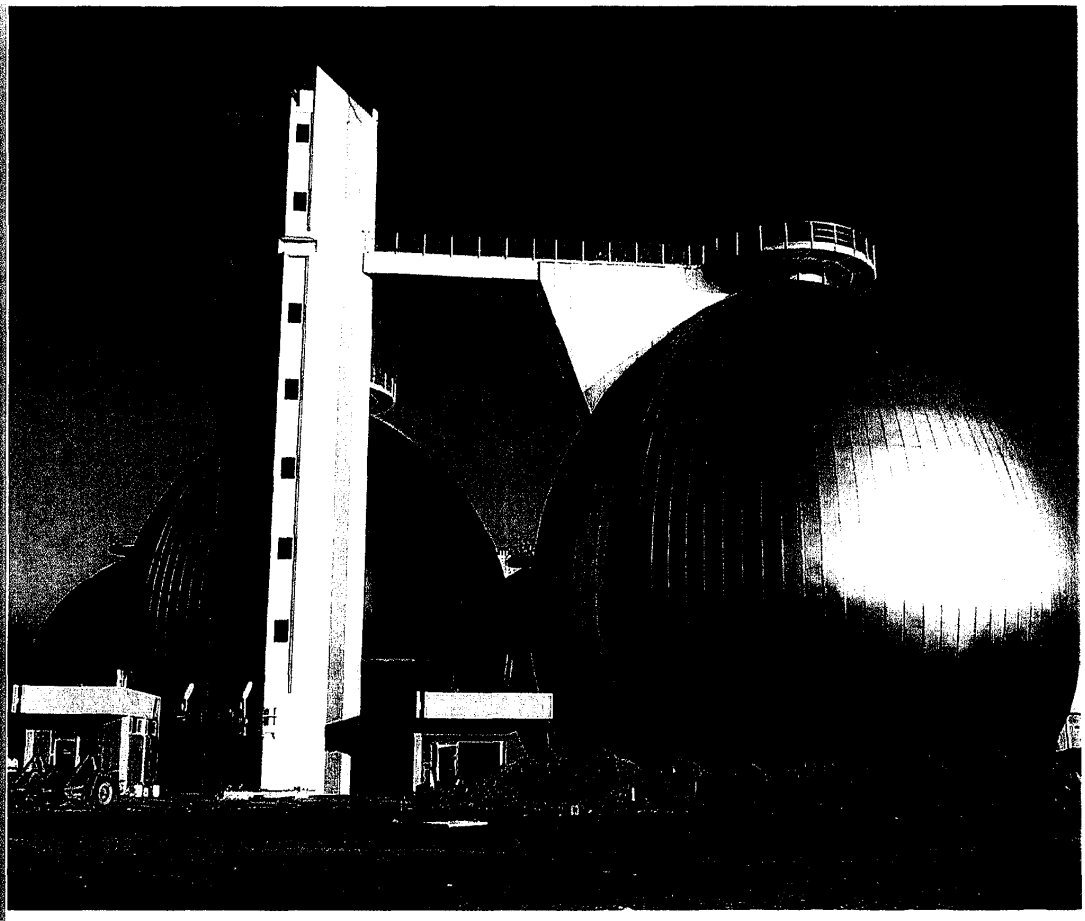
Plants and System Solutions for Sludge Digestion



Digesters (of 9,000 m³ capacity each) of the sewage treatment plant Al-Awir, Dubai for 1,700,000 pop. equiv.

Sludge digestion

PASSAVANT-ROEDIGER developed the process of intensive sludge digestion for the recovery of usable materials from sewage sludge. This consists of stabilising the sludge in the digestion containers anaerobically and converting the organic mass into methane gas and water.

This method of sludge digestion provides a large number of technical benefits, among others the volume reduction and improved dewatering of the sludge, as well as the reduction of the activated sludge basin volume. This digestion process supplies biogas for the generation of electricity and, on the other hand, valuable fertiliser for agriculture and forestry. An excellent example illustrating how ecological and economic aspects can be harmonised with the aid of progressive environmental technology.

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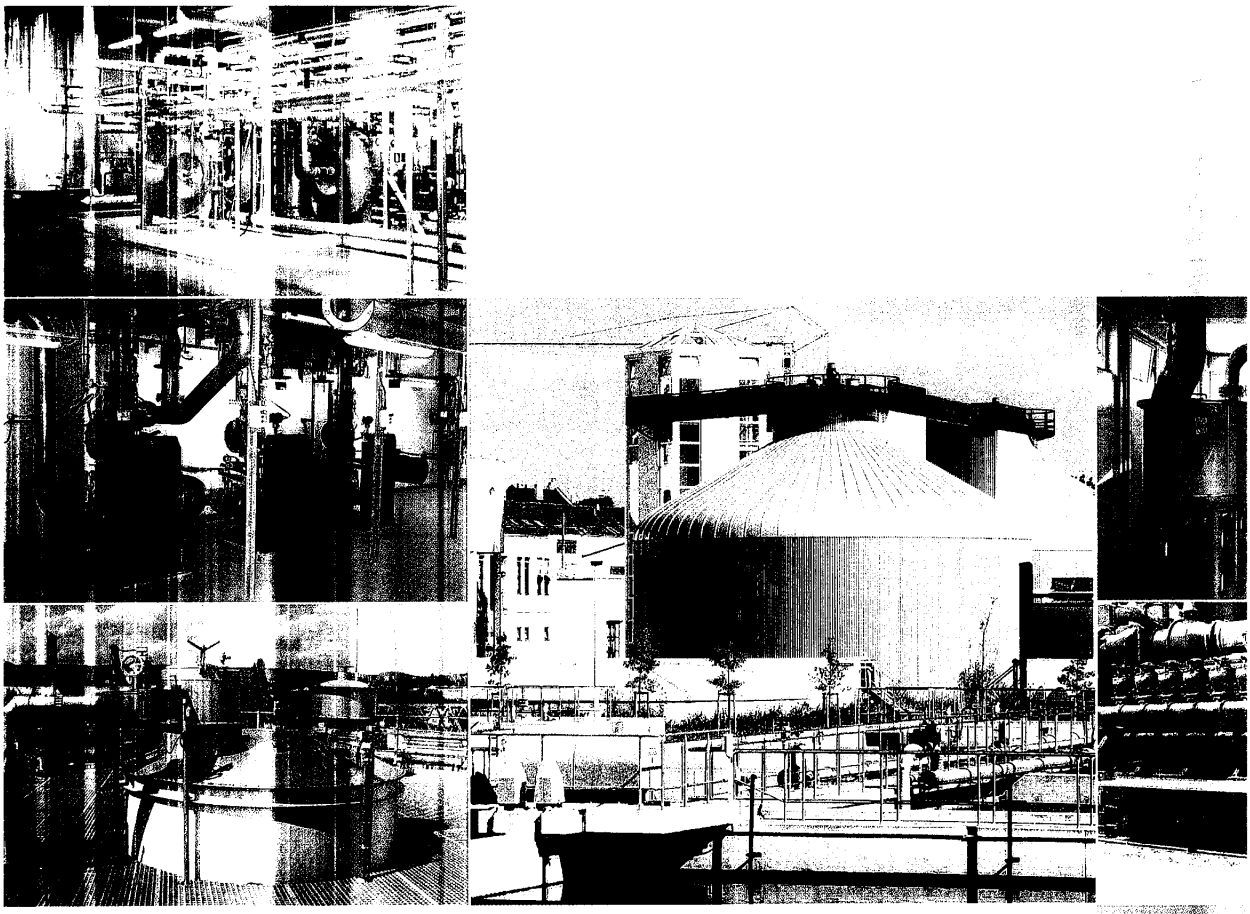
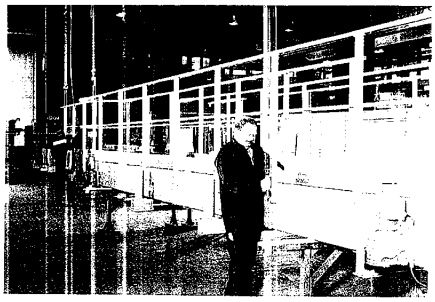


Picture above: pasteurisation plant for hygienisation of the sludge preceeding digestion.
Picture middle: Circulation pumps for heating and pre-heating of the sludge
Picture below: Gas dome of the digesters to collect and pass on the bio-gas, with safety and observation facilities

Digesters at Saarbrücken-Burbach.

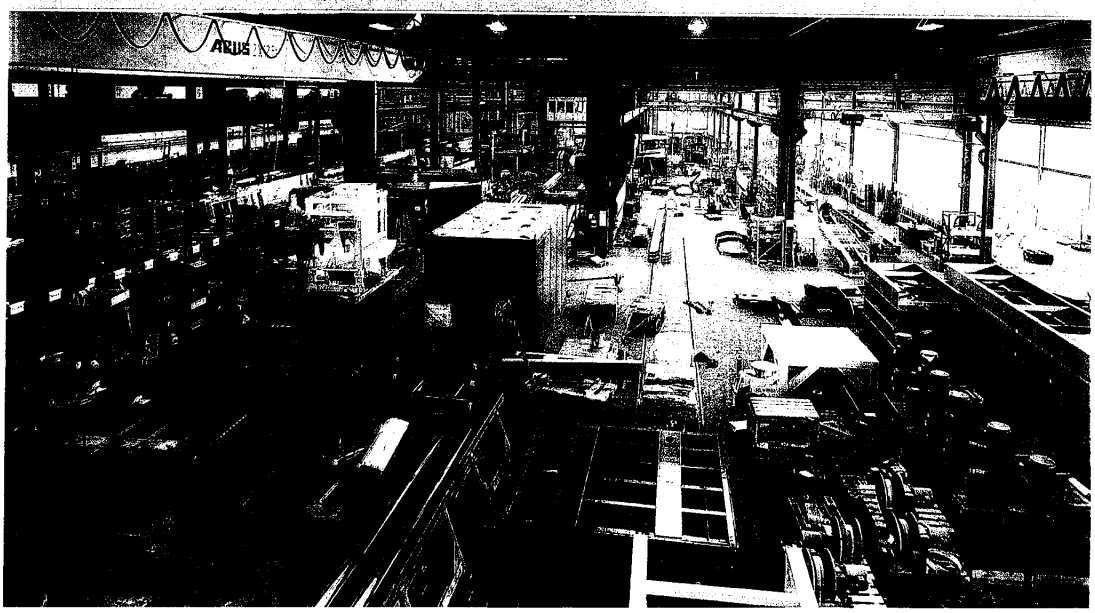
Digesters on the Main Treatment Plant Wiesbaden



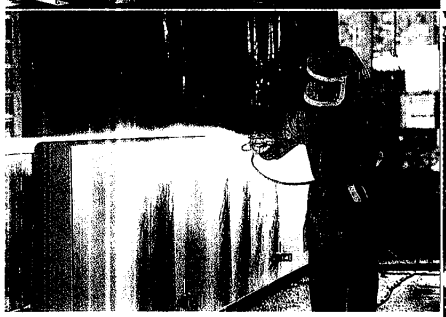
Modern production techniques, computer-controlled machines and thoroughly trained male and female personnel are the prerequisites of high precision and efficiency of industrial production. Machinery construction within the PASSAVANT-ROEDIGER Group not only looks back on a long tradition, but also continues to occupy a very high position. This is where we manufacture our own products developed by our design engineers for the solution of environmental tasks. With the complete experience and the required care which guarantee the positive image of our quality products on the occasion of the production of sturdy components as well as the installation of filigree technology.

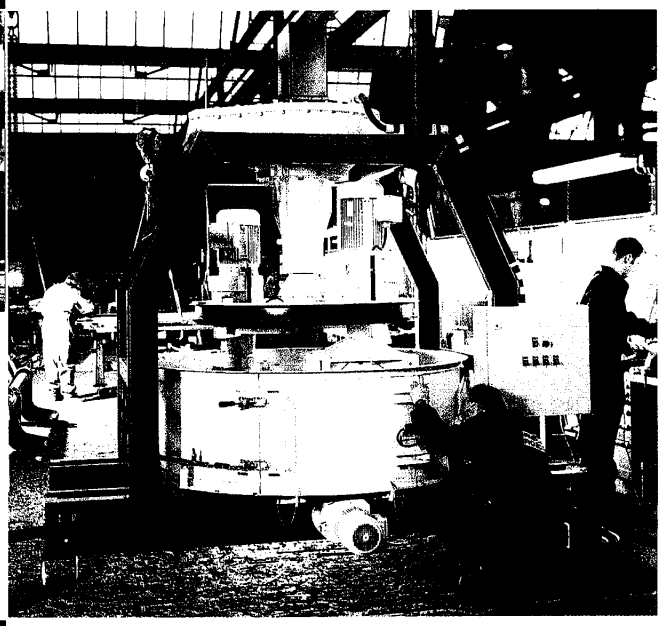
The view of the production floor is characterised not only by production techniques and computer-controlled machinery. It is mainly the male and female personnel who know their trades and who produce quality down to the last detail. The knowledge of the link between qualification and quality has always caused us to train our technical personnel ourselves and to secure the quality and continuity of the manufacture of our products in the long term with the aid of trainees.

Excellent Products of Our Own Manufacture



Bridge constructions up to 60 metres long are produced in all usual materials and their combinations.





An efficient paint shop comprising shot blasting facilities makes it possible to meet clients' individual requirements and guarantees perfect protection of the material of our machines and plants.

Heavy duty mixers for the concrete processing industry are "rounded off" in every respect. The combination of steel construction, transmission gear, drive and control systems calls for maximum precision in production.

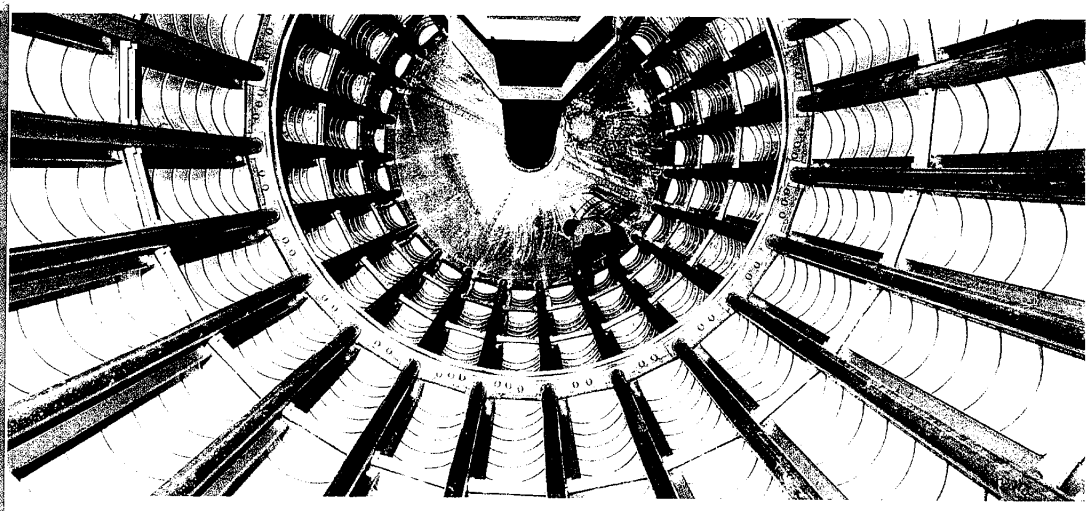
Technicians and specialists for all working processes ensure the quality of our products down to the smallest detail.

Complex machinery, such as for the moulding of stone, is fully assembled and tested before delivery to the client with a view to ensuring proper function and performance of the machine following installation at the client.

Modern production techniques and computer-controlled machines form the picture on the production floors of PASSAVANT-ROEDIGER. Machinery for the treatment of effluent, building material machines, as well as individual components for environmental technology on an area of approximately 10,000 m².

PASSAVANT ROEDIGER

Components for the Treatment of Drinking, Industrial and Process Water



Distribution well and micro-screen unit of a municipal drinking water supply plant. (Sipplinger Berg/Lake Constance drinking water supply).

Machinery Engineering

Micro-screen drum for the efficient separation of solids during the treatment of drinking water from ground and surface water.

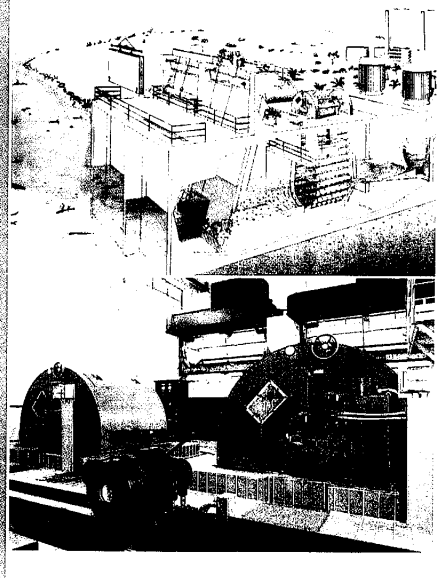
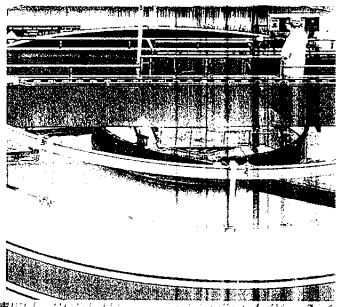


Illustration of inlet works for the generation of cooling water from surface water (top illustration). Travelling band screens for removal of solids (bottom illustration).

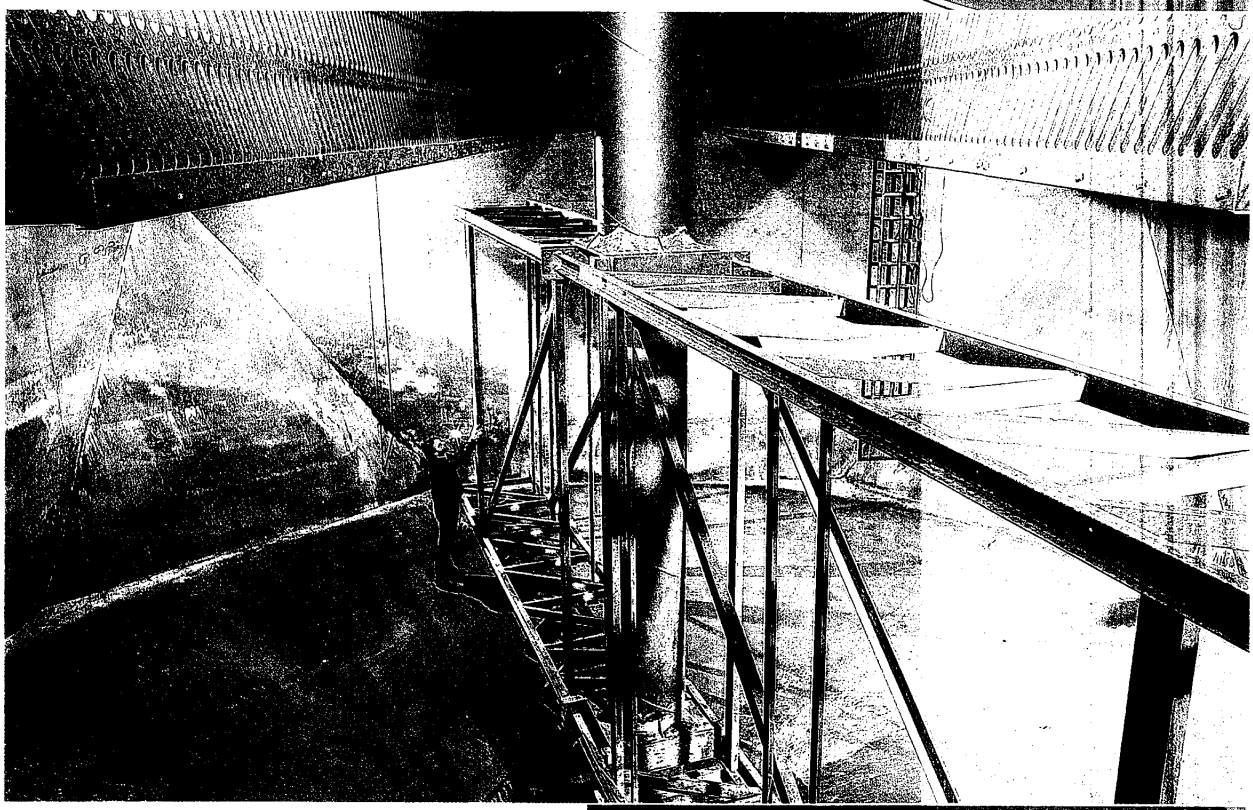
The effective and economic treatment of drinking, industrial and process water calls for efficient, reliable products and components. For example, in order to remove polluting particles from ground and surface water before it is converted into drinking water or used in the form of industrial and process water for industrial and trade purposes.

Regardless of whether travelling band screens, drum screens or grab bar screens, the products and system components developed by PASSAVANT-ROEDIGER have thoroughly proved themselves in actual practice for the removal of solids, turbid and suspended substances and provide optimum conditions for subsequent treatment stages to attain the ultimate water quality required.

Components for Chemical Water Treatment

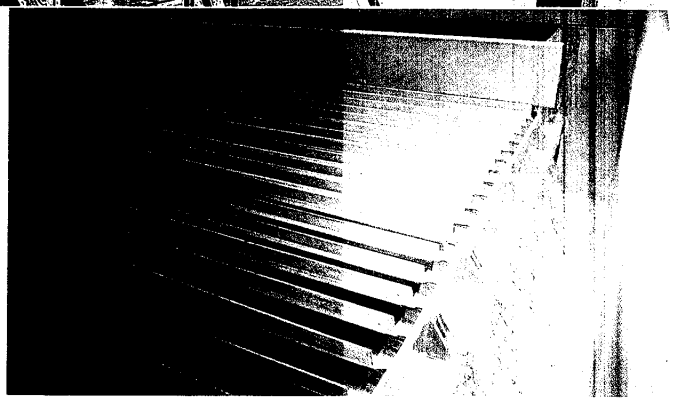


PASSAVANT-ROEDIGER's Turbo-Koagulator provides many possibilities for the pre-treatment of ground and surface water, as well as for the treatment of industrial and municipal effluents.



The utilisation of ground and surface water as drinking and industrial water confronts the products and components for chemical water treatment partly with similar requirements as those to be met by the treatment of industrial and municipal effluents. An example of this is the Turbo-Koagulator which provides ideal possibilities for the flocculation, precipitation, sludge separation and thickening and which is used for the treatment of drinking and industrial water from ground and surface water, as well as for the treatment of industrial and municipal effluents.

For the physical-chemical pre-treatment, as well as for decarbonization, deferrization and demanganization, PASSAVANT-ROEDIGER have developed a lamella separator with integrated sludge thickening mechanism for high performance sedimentation. Thanks to the variation of the treatment stages, this process can be used for multi-purposes, for example, to prevent scale deposits in the distribution network, to produce highly pure lime water for water treatment, as make-up water for cooling towers, as a third cleaning stage for the elimination of phosphates and solids, as well as a pre-treatment stage for reverse osmosis plants.



The process of high performance sedimentation developed by PASSAVANT-ROEDIGER (Turbo-Lamella Separator) can be used for the physical-chemical water treatment in an extremely versatile manner.

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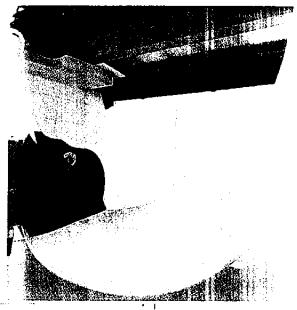
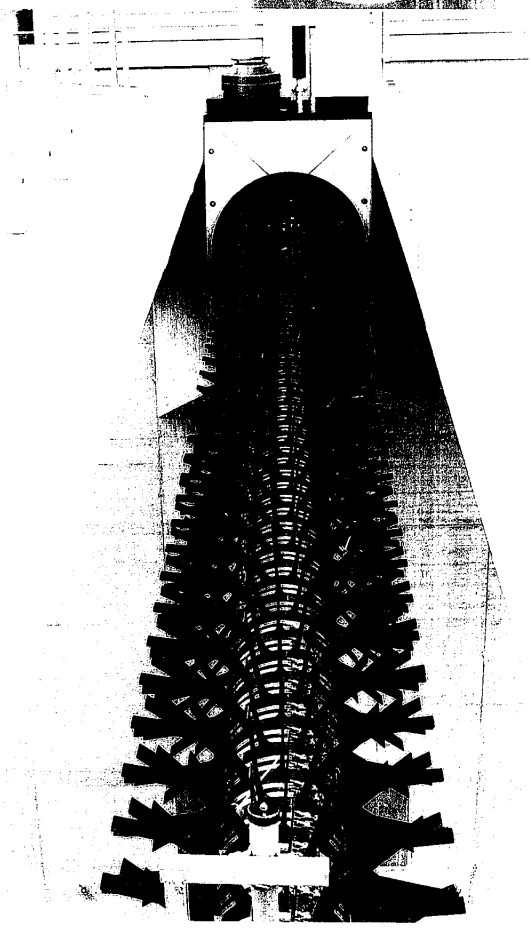
Components for Effluent Treatment



Clear conditions

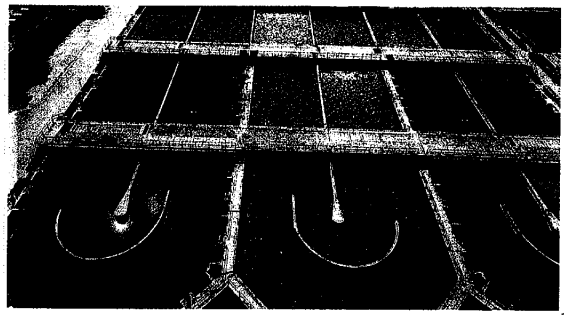
PASSAVANT-ROEDIGER's commitment in the field of effluent treatment began in about 1900 with the construction of the first mechanical screens and rotary distributors for filters operating biologically. Ever since this beginning, PASSAVANT-ROEDIGER's modern sewage technology ensures clear conditions all over the world.

With the aid of trend-setting product innovations, PASSAVANT-ROEDIGER continue as before to contribute decisively to the rationalisation and optimisation of effluent treatment processes. An example of this is the development of the Mammoth Rotor. These high performance aeration rotors render possible the conversion from the oxidation ditch to modern activated sludge plants with nutrient elimination. This technology resulted in a worldwide revolution in the field of biological effluent treatment.

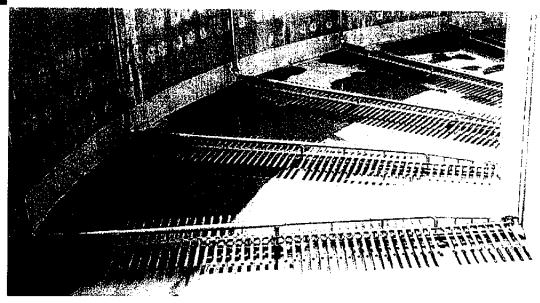


Mammoth Rotors up to 9 metres long ensure the economic oxygen supply in large sewage plants.

PASSAVANT-ROEDIGER's technology in the Far East:
The biostage of the Binhe, People's Chinese Republic, sewage plant.

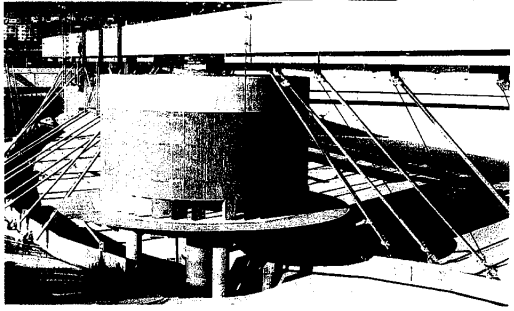


Bioflex® and Roeflex® membrane diffusers for the intermittent nitrification and denitrification.



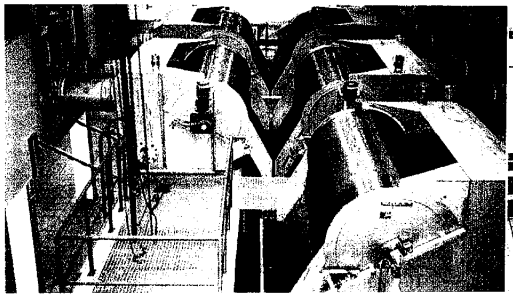
PASSAVANT
ROEDIGER

PASSAVANT's first "circular" scraper bridge was commissioned already in 1938. What was considered a milestone of effluent treatment at the time has meanwhile been perfected by consistent further development and adapted to increasingly stringent requirements. The success is unmistakable: the picture of a large number of municipal and industrial sewage plants is characterised by PASSAVANT-ROEDIGER's scum removal systems of the most recent generation.

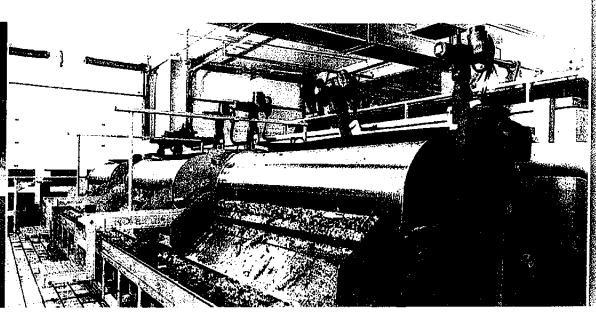


The provision of large diameter sedimentation basins – a speciality of PASSAVANT-ROEDIGER in the field of sludge collection.

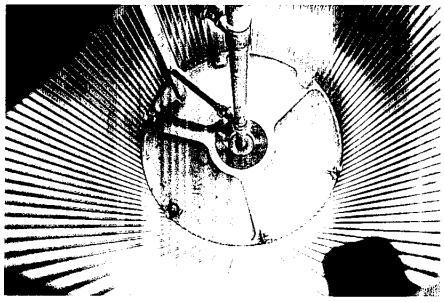
Rotopass wedge wire rotary screen for the mechanical pre-treatment at the sewage plant inlet.

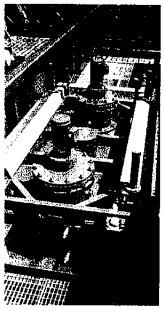


With gap widths of up to 1 mm, Rotopass® succeeds in relieving the sewage plant already at the first stage.



Components for Effluent Treatment



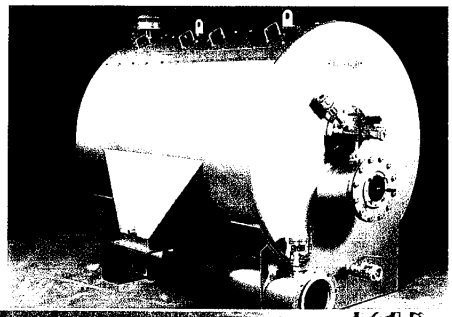


Separation of solids

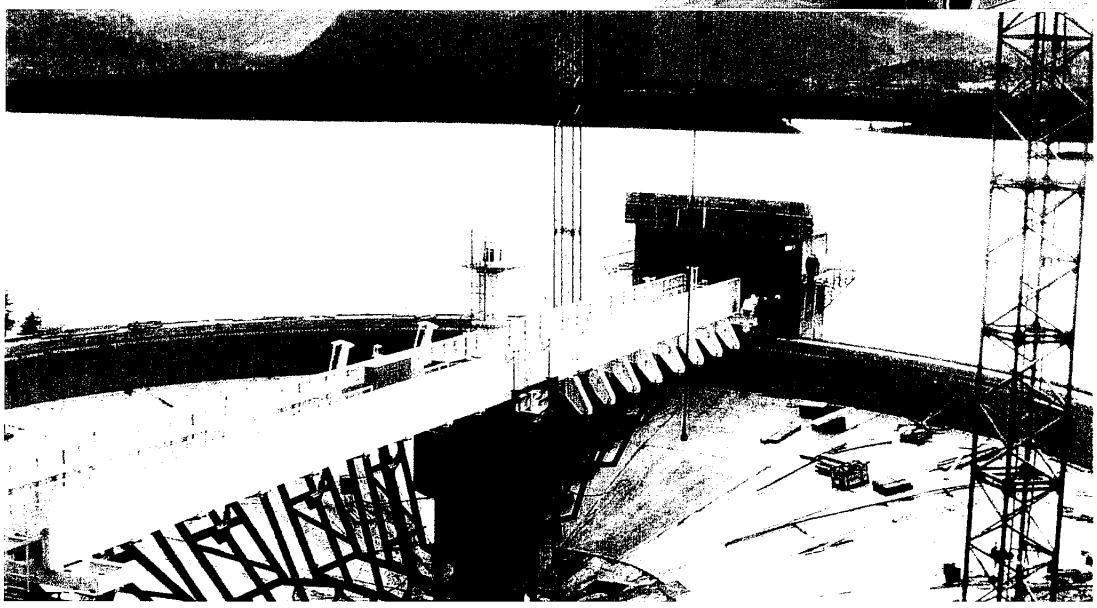
The treatment of effluent is an extremely wide and complex field. The separation and thickening of solids is one of these special disciplines for which PASSAVANT-ROEDIGER provide made-to-measure problem solutions. The wide range of machines and plants begins with the Rotopass wedge wire rotary screen units for the separation of solids during the mechanical cleaning process. Lamella separators for the high performance sedimentation, as well as Turbo-Koagulators and sewage thickeners are designed on a large industrial scale and used in the municipal as well as industrial sectors for the treatment of effluent, separation of solids and sludge thickening.

The sludge produced by municipal and industrial sewage plants has to be thickened and drained before its treatment or disposal. With the aid of PASSAVANT-ROEDIGER's chamber filter or belt filter presses, sludge is compressed in such a manner as to attain a solids contents of up to 50% and, in view of its consistency, is eminently suitable for further utilisation, tipping, drying, incineration, composting or as fertiliser. In addition, PASSAVANT-ROEDIGER's range of products provides a number of further process techniques for sludge thickening and draining which, as a function of the field of use and problem to be solved, provide optimum solutions.

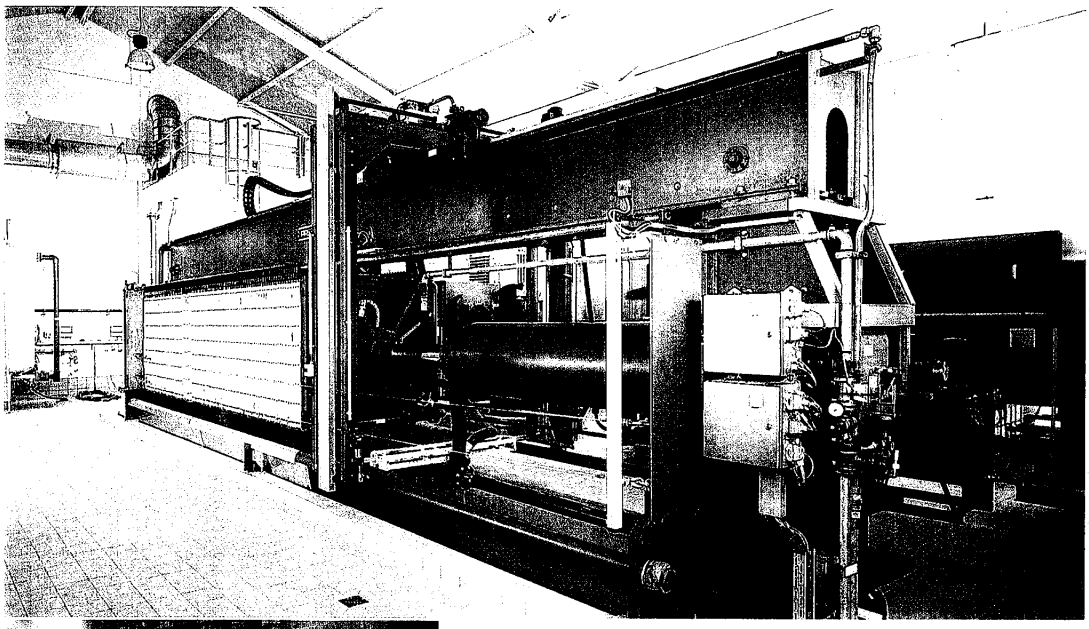
PASSAVANT-ROEDIGER's pressure Rotopass: a wedge wire rotary screen concentrator for the dewatering of surplus sludge.



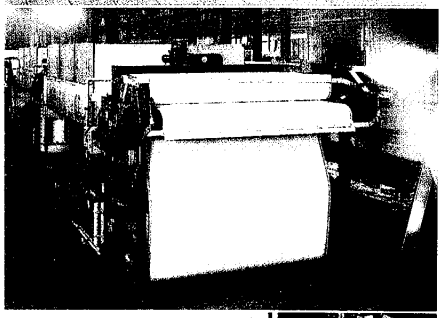
PASSAVANT-ROEDIGER's heavy load thickener for the treatment of industrial sediments. The picture illustrates a heavy load thickener of 45 m basin diameter built for a marble unit at Hustadt, Norway.



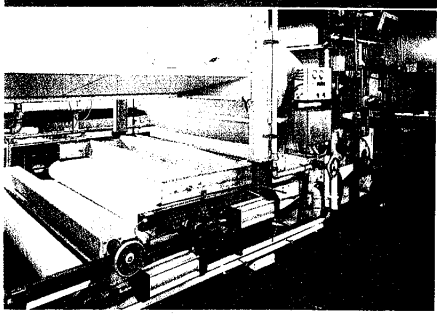
Components for the Drainage of Sludge



PASSAVANT-ROEDIGER's chamber filter press method combines a high degree of efficiency with long service life.



The belt filter presses of the ROEPRESS® series ensure a throughput performance from 5 to 40 m³/h.



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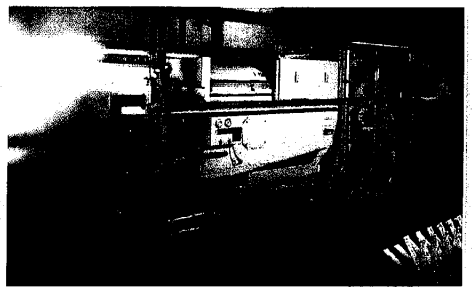
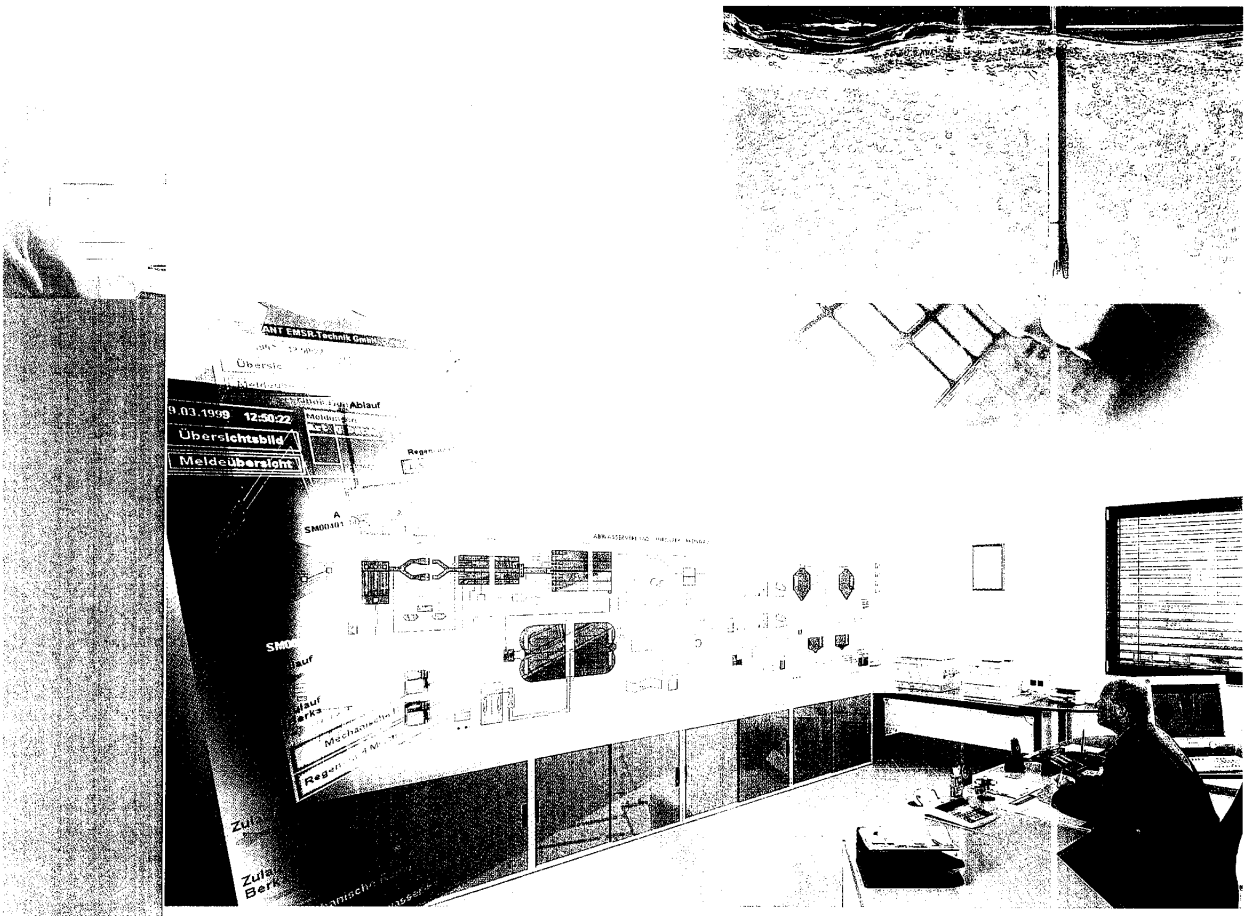


The Duodrain technology distinguishes itself by maximum efficiency for minimal space requirement.



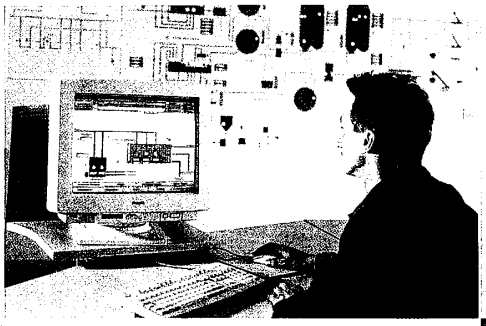
Energy, Measuring and Control Engineering

Economic efficiency, reliability, safety and operator-friendly. In the case of new constructions, extensions and modernisation of industrial and municipal installations, these criteria form now more than ever before the basis of investment decisions. Electric engineering appliances, electronic controls and exacting, operator-friendly software are indispensable to meet these stringent requirements.

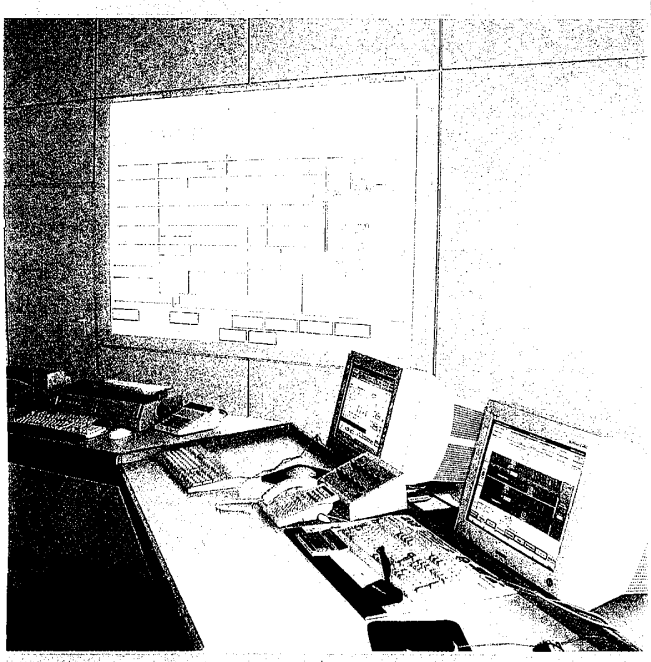
PASSAVANT-ROEDIGER solve client-specific problems with the aid of intelligent technology, technical expertise and practice-orientated know-how. This combination has for many years been the recipe of success for the realisation of exacting projects – ranging from electric equipment of individual machines up to turn-key installations for municipalities and industry.

The range of services of EMSR technology:

- **Analysis, consultancy, planning**
- **Energy distribution**
  - Medium high voltage installations
  - Transformers
  - Low voltage distribution systems
  - Emergency generating sets
- **Automation technology**
- **Process control technology**
- **Remote control technology**
- **Measuring technology**
- **Assembly, commissioning, service**



Control room
Visualised mimic diagram and screen working position at the Zeitz sewage plant

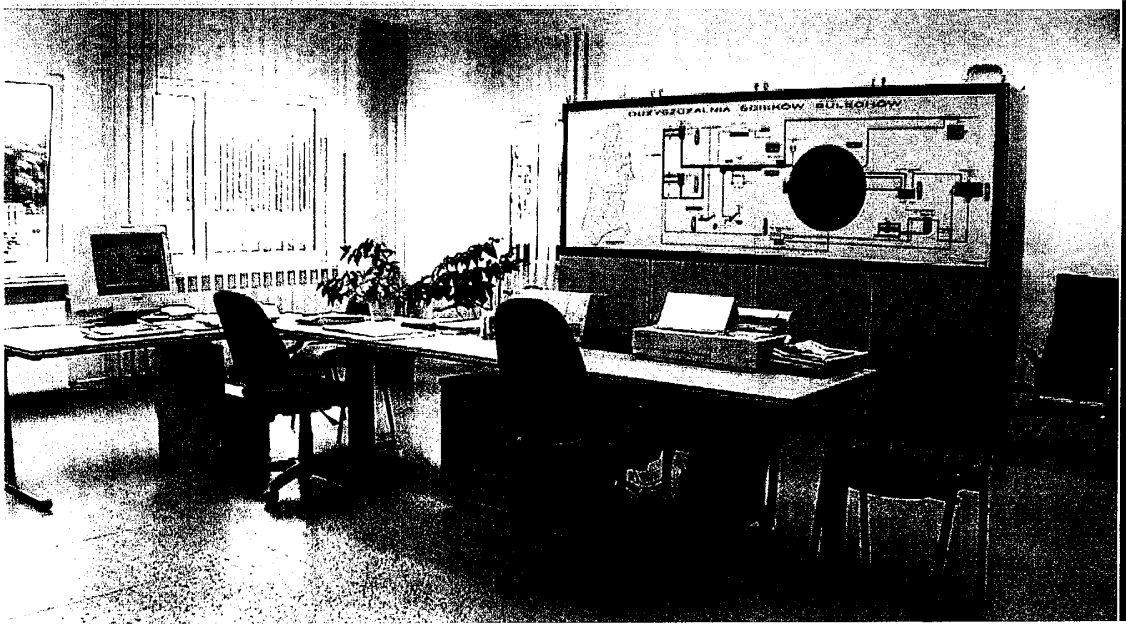


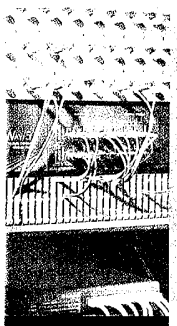
Marburg-Cappel effluent treatment plant (WTP): Operation and observation with the aid of beamer technology and PC working positions.

Since 1960, more than 1,000 plants, chiefly in the water, effluent and environmental sectors, were equipped with PASSAVANT-ROEDIGER's energy, measuring and control system. Approximately 200 process control computers and process control systems are in use and have proved themselves in actual practice. Not least in view of this experience, we are the qualified contact partner for electronic controls, electrical engineering units and operator-friendly software for individual projects ranging up to turnkey complete solutions which, if required, we realise in collaboration with other Divisions of the PASSAVANT-ROEDIGER Group, as well as with other suppliers active in the market.

PASSAVANT ROEDIGER

Control room equipment and mimic diagram at the Sulechow, Poland, sewage plant.



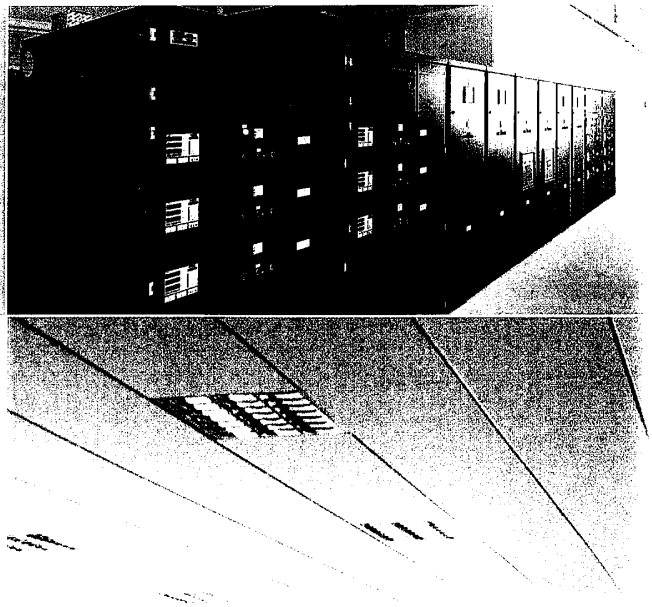


Individual process control technology

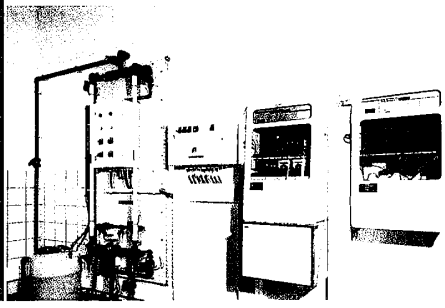
The control, monitoring and optimisation of technical processes, as well as the presentation, documentation and administration of process data set up exacting requirements to be met by the operation of municipal and industrial plants. This calls for software solutions which are, on the one hand, efficient and flexible and, on the other, visible at a glance and easy to operate.

The PAMSA for Windows NT™ process control system developed by PASSAVANT-ROEDIGER is the answer to the on the face of it insoluble contradiction between efficiency and operating convenience. This fifth generation of process control systems which has already been used extremely successfully for the control, monitoring and optimisation of technical processes, is based on the Windows NT™ standard operating system and provides a high degree of operator-friendliness and open interfaces for the user. This efficient as well as convenient system renders it possible to realise individual position solutions for small plants in the same simple and economic manner as locally cross-linked multi-user systems of redundant technology for complex plants.

The utilisation possibilities of the versatile PAMSA for Windows NT™ process control system go far beyond the possibilities of conventional process control technology. For example, individual plants can be extended into combined systems with the aid of telecommunication devices available in the market for drainage network control with central management or into sewage plant operation. A future-orientated system which, with the aid of data transfer and data processing, makes for intelligent effluent management and reduces the overall emission in the effluent incidence of a catchment area to a minimum.



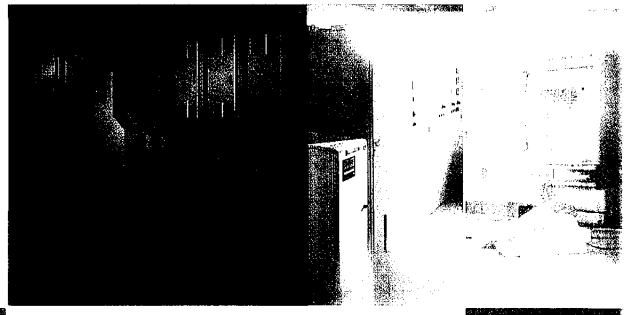
Process visualisation with large screens at the central control room of the Wiesbaden main sewage works.

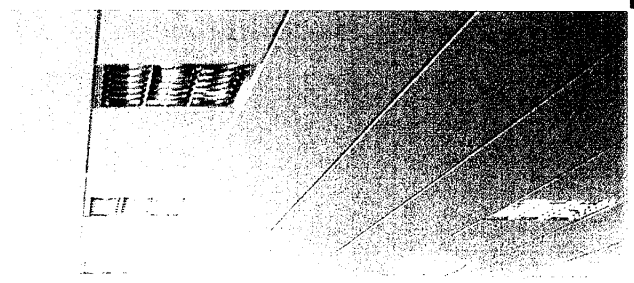


PO_4/NH_4 analysis measurement with automatic ultrafiltration unit.

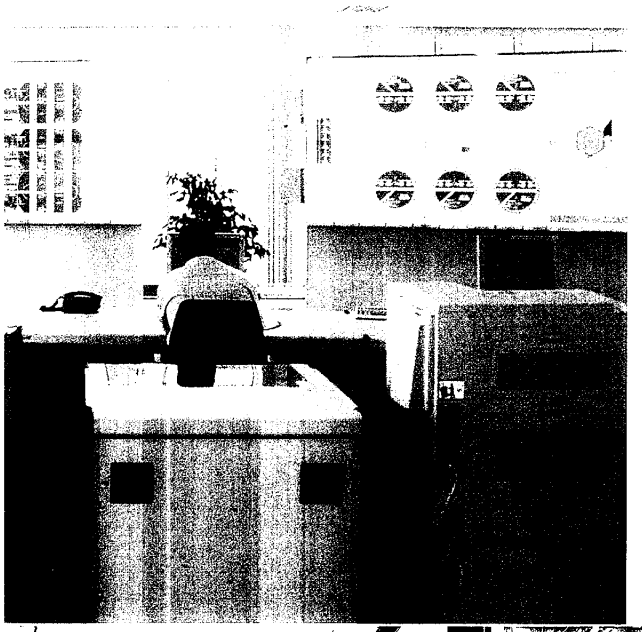
Weatherproof scraper control

Low voltage main distribution for the supply of low voltage switchgear





Low voltage switchgear with decentral arrangement of frequency converters



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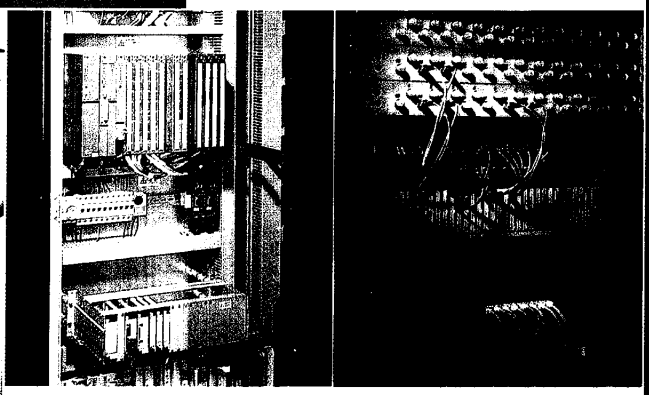


The programmable logic controller (PLC) - the heart of process automation

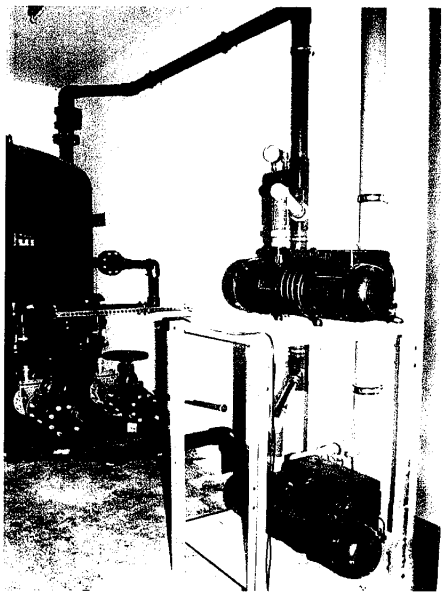
Network technology Data route for process information

Vacuum Drainage for the Collection of Municipal and Industrial Effluent

Residential area of low population density, high ground water level or lack of natural gradient are typical prerequisites of vacuum drainage.

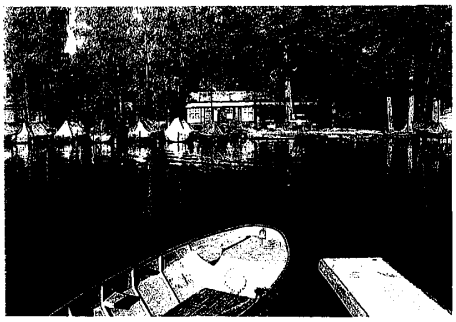
ROEVAC® Vacuum Engineering

Vacuum pumps, effluent pumps and tank of a vacuum station.



Vacuum drainage is in many cases the better alternative for the collection of municipal and industrial effluent, because this process developed by PASSAVANT-ROEDIGER is frequently superior to conventional drainage systems from the technical and ecological, as well as economic aspects.

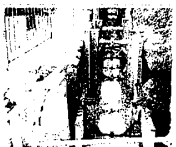
ROEVAC® vacuum drainage has proved itself over a period of decades. Considerably lower building costs, substantially shorter building periods and negligible adverse effect on traffic and local residents during the building stage are arguments in favour of this technology and which have even convinced protagonists of conventional processes. ROEVAC® vacuum drainage is recommended as a reliable and economic method for the collection of municipal and industrial effluent in the separation system by acknowledged institutions and has been successfully used worldwide for more than 30 years.

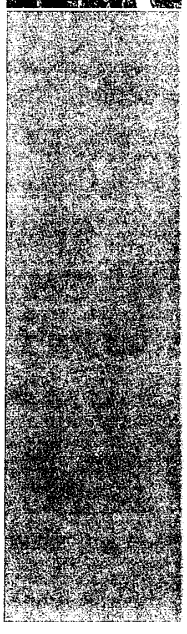


Vacuum drainage for the collection of effluent is the optimum system for the outlets of lakes, rivers, coasts and water protection areas.

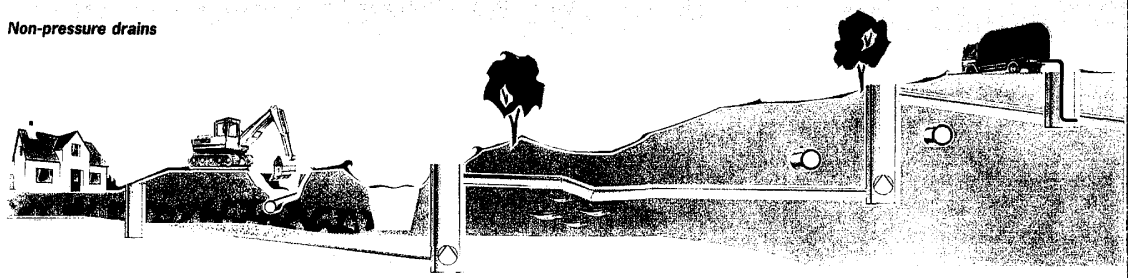
High ground water level, low population density, lack of natural gradient, unfavourable soil conditions, such as sandy, non-load bearing soil or rocky subsoil are the ideal prerequisites for Roevac® vacuum drainage. There is frequently no alternative to this method in areas along rivers, lakes, coasts and in water protection areas. It also has its specific advantages in residential districts of low or considerably fluctuating effluent incidence (eg in areas of tourism).

Irrespective of terrain, small pipe sections, higher flexibility and almost maintenance-free operation of plants clearly speak in favour of the use of vacuum drainage. Its advantages already become apparent during the building phase. Small pipe diameters mean narrow trenches and low earth movements, facts which render possible the use of roads and paths also during the building phase. An advantage which is particularly appreciated by the residents of the areas concerned and by all those involved in traffic.

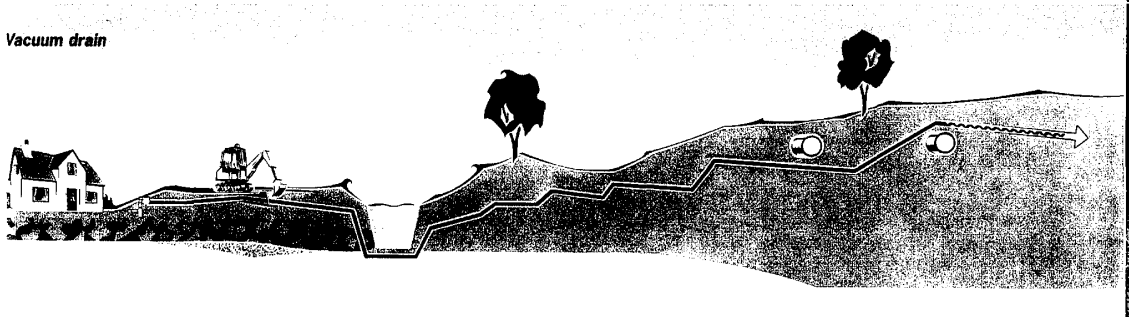




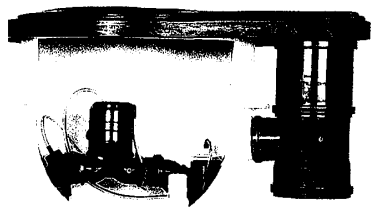
Non-pressure drains

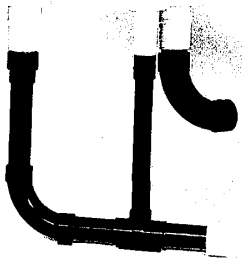


Vacuum drain



ROEVAC® vacuum drainage clearly provides more flexible utilisation possibilities than conventional sewers.

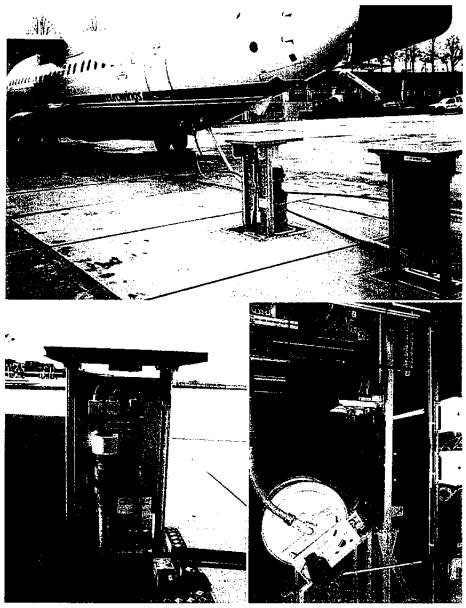




Section model of a ROEVAC® domestic connection shaft with separate effluent collection compartment.

PASSAVANT ROEDIGER

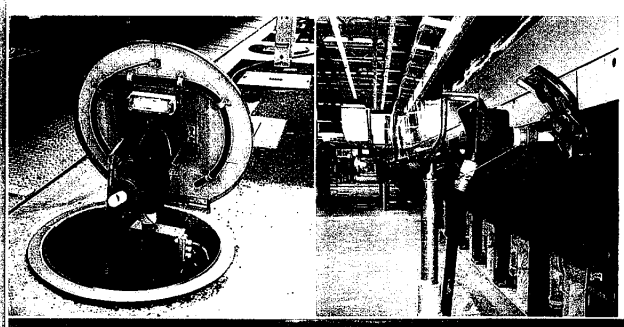
System Solutions for the Supply and Disposal of Means of Conveyance



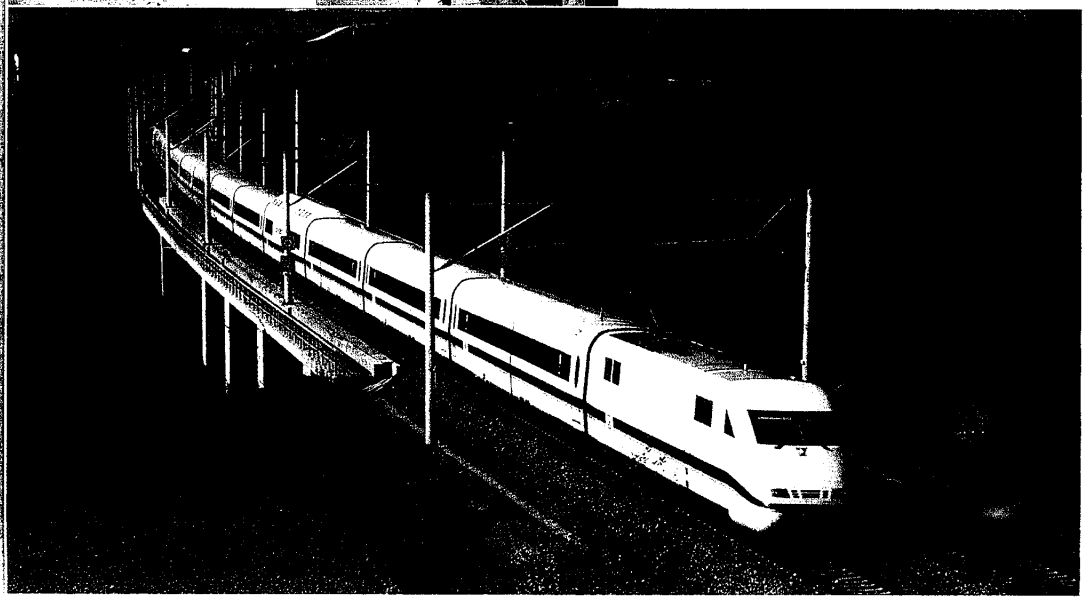
Mobility is a characteristic of our modern times. Mobility means progress and prosperity. Comfortable railway trains, large capacity jet aircraft and luxury liners carry many people to their chosen destination.

Wherever many people travel simultaneously, the supply of water as well as the disposal of effluent has to be ensured. PASSAVANT-ROEDIGER have developed professional system solutions for these special fields of activity. For the equipment of railway trains, ships and aircraft, as well as for speedy and hygienic supply and disposal in closed premises, at airports, railway platforms or ships' landing stages.

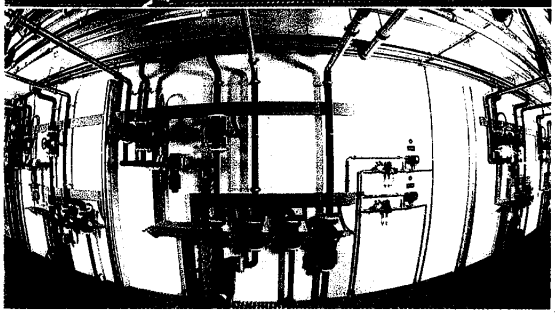
Aircrafts, ships and trains are equipped with PASSAVANT-ROEDIGER's special system technology for the supply of fresh water and the disposal of effluent.



The faeces tanks of ICE high speed trains are drained speedily, hygienically and drip-free by PASSAVANT-ROEDIGER's suction technology. This means short waiting times, hygienically clean station platforms and dispensing with suction vehicles.



Collection and Treatment of Medical Effluent

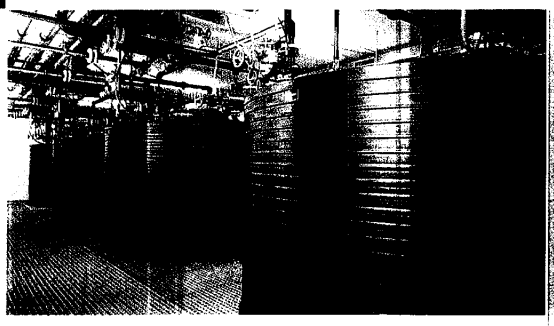


A glance at the "heart" of the decaying unit: The set of pumps with sampling device.

Safety first

Hospitals, clinics and hospices generate effluent which, in view of the substances contained in it, may not be taken to the drains without special treatment. An example is effluent containing radio-active substances of nuclear-medical departments. In accordance with the Radiation Protection Decree, this water may only be taken to the drains when its radio-activity has decayed to a safe minimum.

The decaying units developed by PASSAVANT-ROEDIGER for the treatment of such effluent have been in use throughout Europe for a great many years. These units are individually designed as a function of the effluent incidence, concentration of harmful substances and space available. Thanks to the provision of vacuum toilets, water consumption, and thus the effluent incidence, is being reduced considerably. This reduction of the effluent incidence allows for smaller storage volumes, as well as for lower space requirements, a fact which clearly increases the cost-effectiveness of the entire plant. Thanks to the higher operational safety of PASSAVANT-ROEDIGER's decaying units, the fact is ensured that radio-active effluent is unable to escape, either in an uncontrolled manner, or due to incorrect operating.



The loaded effluent is stored and treated in the decaying containers.

PASSAVANT
ROEDIGER

Vacuum Sanitary Technology in Building Construction and Shipbuilding

Flexibility with water saving effect irrespective of gradient

Vacuum engineering for sanitary installations constitutes a progressive technology from the ecological, as well as economic aspects. It is extremely flexible and can be used irrespective of a – natural – gradient. In view of these specific advantages, the vacuum system is suitable for installation in new buildings, as well as for the restructuring of old buildings or modernisation of existing buildings. Ideal fields of utilisation of vacuum drainage are buildings of high or considerably fluctuating effluent incidence (eg hotels, catering establishments, airports, railway stations), as well as in large building complexes and in trade and industrial establishments in which sanitary installations are separated by wide gaps.

The use of ROEVAC® vacuum sanitary engineering is an active contribution to the ecologically meaningful handling of the valuable resource water. In addition to the technical construction and ecological aspects, the substantial savings of water and effluent result in reduced costs for the operators of public, trade and industrial buildings, as well as for apartment owners and private property tenants.

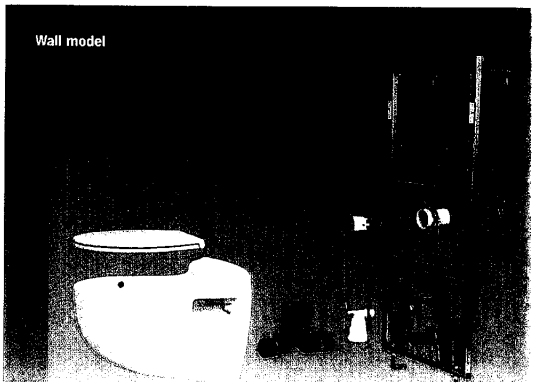
Compared to conventional effluent systems in building construction, water consumption is considerably reduced by the installation of the ROEVAC® vacuum sanitary method. This water saving and environment-friendly process demonstrates its superiority, particularly if:

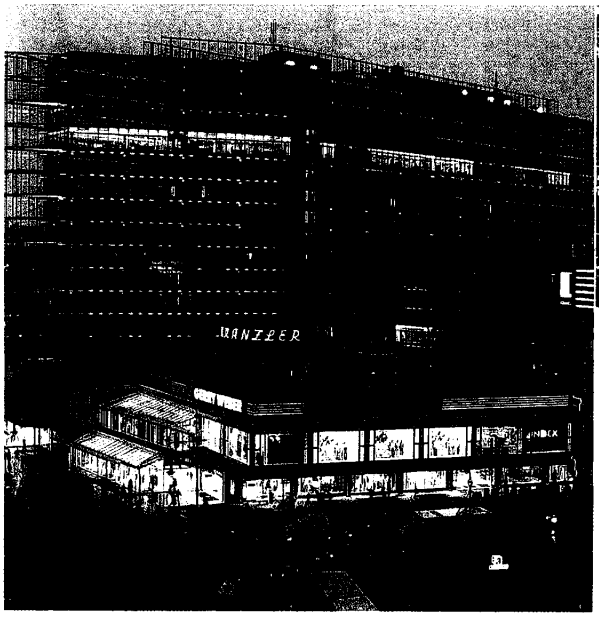
From left to right:

Vacuum toilets of a water consumption of only one litre. (Wall version can also be supplied as standing version.)

The separation toilet developed by PASSAVANT-ROEDIGER renders possible the non-diluted separation of urine which, for example, can be used in this form as a plant nutrient. (Illustration right)

Function diagram of a separation toilet with separate outlet and mechanically controlled closure.





Ideal fields of use of ROEVAC® vacuum sanitary technology: Old industrial buildings in which, as a result of horizontal or vertical pipes of small nominal widths, low technical construction expenditure is incurred.

Trade and office buildings in which optimum use of space is achieved thanks to flexible drainage.

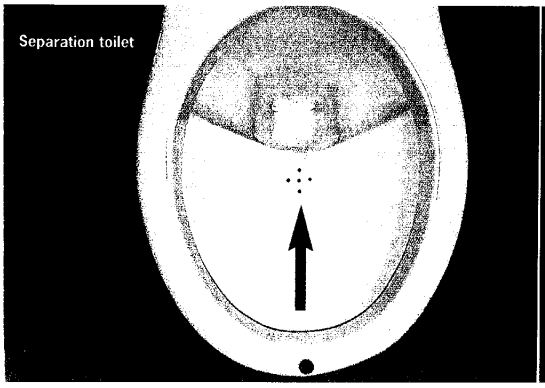
Ecological sanitary concepts

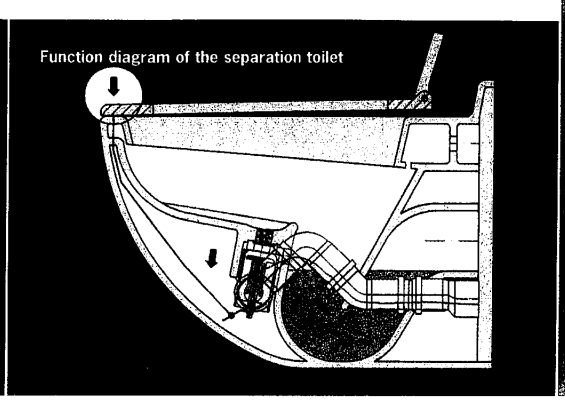
- only limited amounts of drinking water are available or consumption has to be reduced,
- technical construction factors prevent the free outflow of effluent,
- effluent separation is required,
- the decentralised incidence of effluent has to be taken to a central point

or where, as a result of other parameters, the conventional drainage processes are clearly inferior as a result of technical installation, economic or environmental drawbacks.

Ecological sanitary concepts call for creative solutions. Toilets which separate the urine form an important part of this concept. PASSAVANT-ROEDIGER offer already at present solutions which also meet future requirements of permanent water management. Substantial reduction of water consumption, as well as the recycling of substances are important aspects which favour the use of the separation toilet developed by PASSAVANT-ROEDIGER.

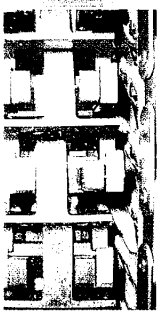
PASSAVANT ROEDIGER





Service Concepts for the Treatment of Water, Effluent and Waste

Service right from the outset



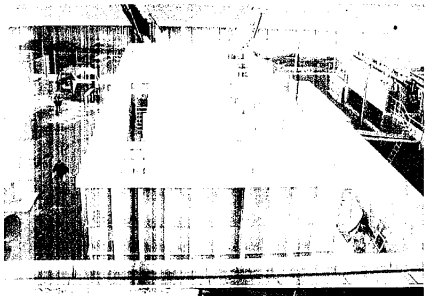
The image of a supplier is for a long time past no longer measured by excellent products and system solutions alone, but chiefly by the quality and scope of the services provided. The complexity and individuality of machinery and plant – particularly in the field of environmental technology – call to an increasing extent for a comprehensive offer of services of a maximum of specialisation.

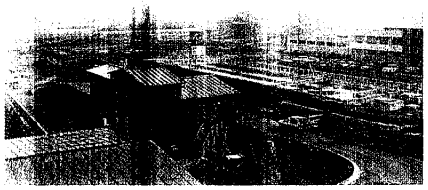
PASSAVANT-ROEDIGER's full service concept does full justice to this requirement. Because by full service we understand more than a package of services. We understand by full service, service with system, ranging from consultancy and design via assembly and commissioning up to maintenance, operation and spare parts service.

Our service strategy concentrates exclusively on our clients' wishes and requirements to make use of the machinery and plant for the treatment of water, effluent and waste. Irrespective of whether municipal or industrial sewage plants, drinking water treatment plants, water power plants or plant for the treatment of organic domestic refuse – we provide you with the complete service under one single roof. Incidentally, also if products and plants other than those of PASSAVANT-ROEDIGER are involved. Because whoever produces excellent machinery and plant for environmental technology also knows how to achieve optimum maintenance of products and plant for environmental technology.

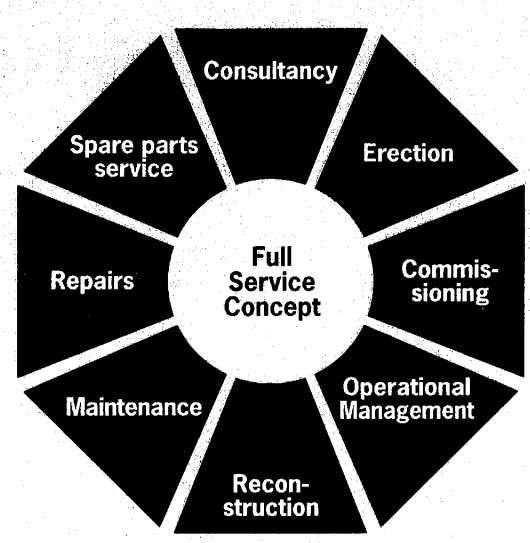
SERVICE

Only speedy service is also good service. PASSAVANT-ROEDIGER's large and well equipped fleet of vehicles guarantees speedy and comprehensive service.

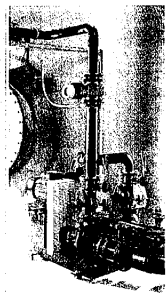


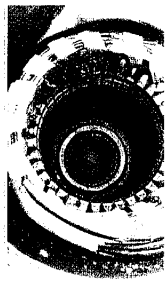


S[illegible] l container for micro drum screens at Höchst AG in [illegible]ankfurt (illustration top).
I[illegible]stallation of a sludge thickener at [illegible]stadt, Norway ([illegible]stration middle).
J[illegible] a sewage plant in the course of [illegible]onstruction ([illegible]stration below).



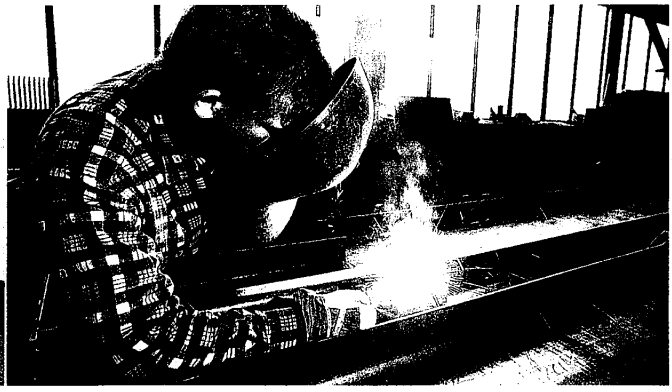
More than a service package: PASSAVANT-ROEDIGER's full service concept guarantees a maximum of service quality and specialisation at all phases of collaboration.





Expertise, know-how and long standing experience are attributes which distinguish our male and female staff – not only as far as service is concerned.

Irrespective of whether of our own production or in situ – precision and care are the chief requirements with a view to producing first class quality.



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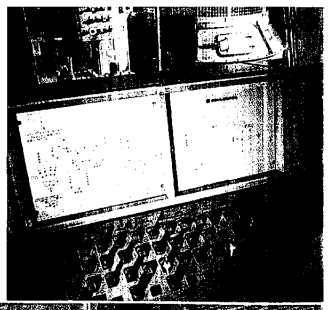
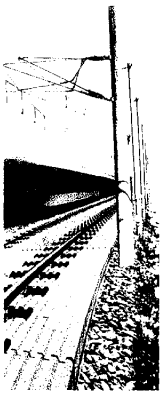
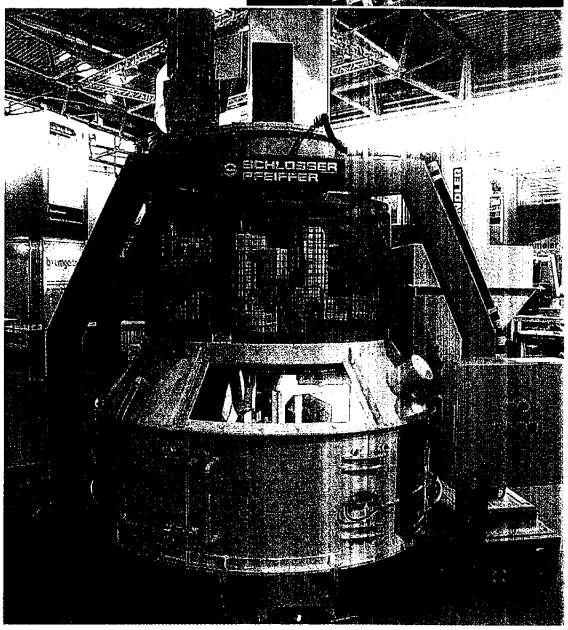


The VISP 3.0 visualisation system renders possible central control of the entire plant.



SCHLOSSER-PFEIFFER – within the PASSAVANT-ROEDIGER Group standing for development, planning, production and sale of machinery, plants and turnkey complete solutions for the rational manufacture of concrete products. Future-orientated thinking and the right flair for market requirements have repeatedly stimulated developments which proved trend-setting for the entire sector. The first stone manufacturing machine with compression by vibration or the first closed cycle plant for the concrete processing industry or the storage and setting of product-specific machinery data using a central computer control – process technical innovations and identification of requirements in a changing market have made SCHLOSSER-PFEIFFER a market-leading company of building material machinery engineering of high reputation throughout the world.

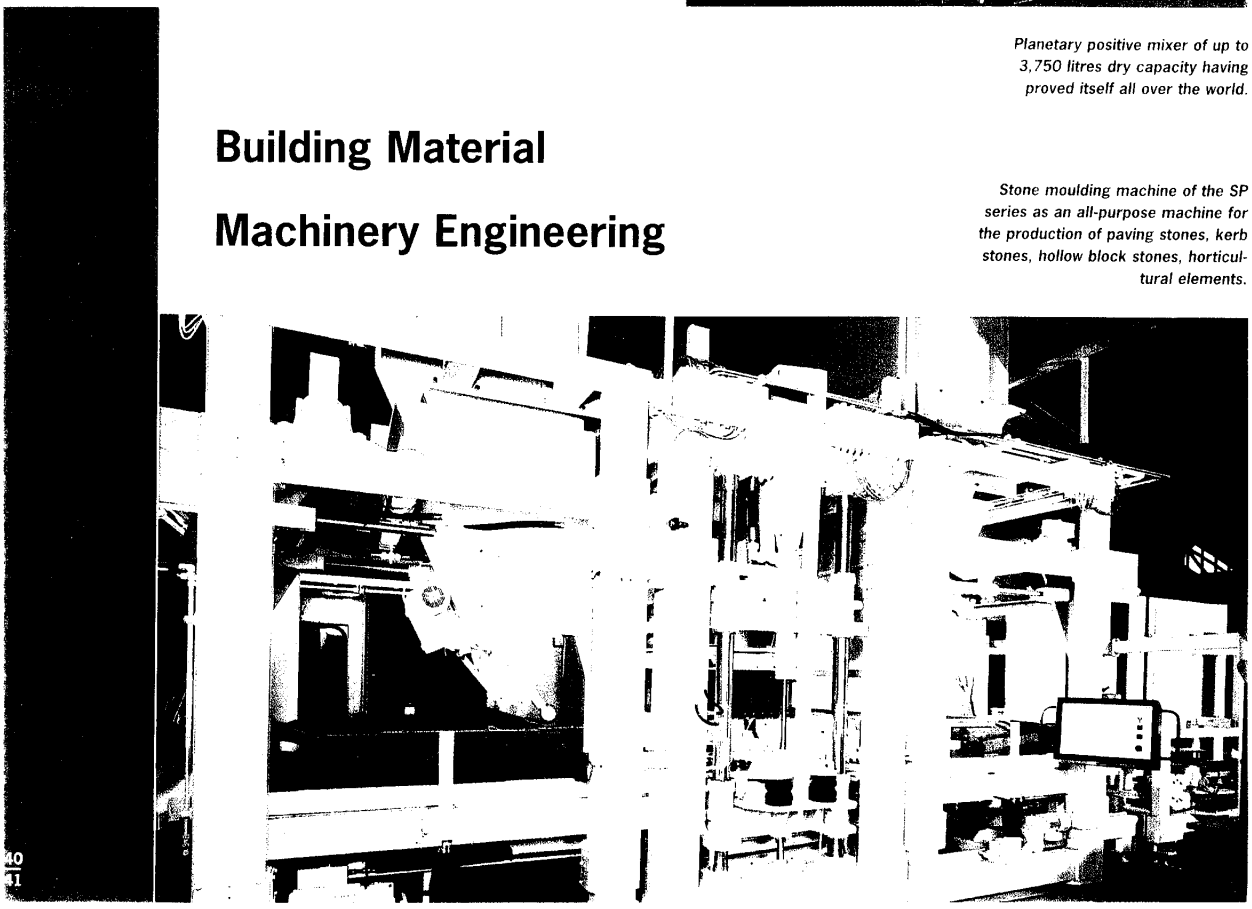


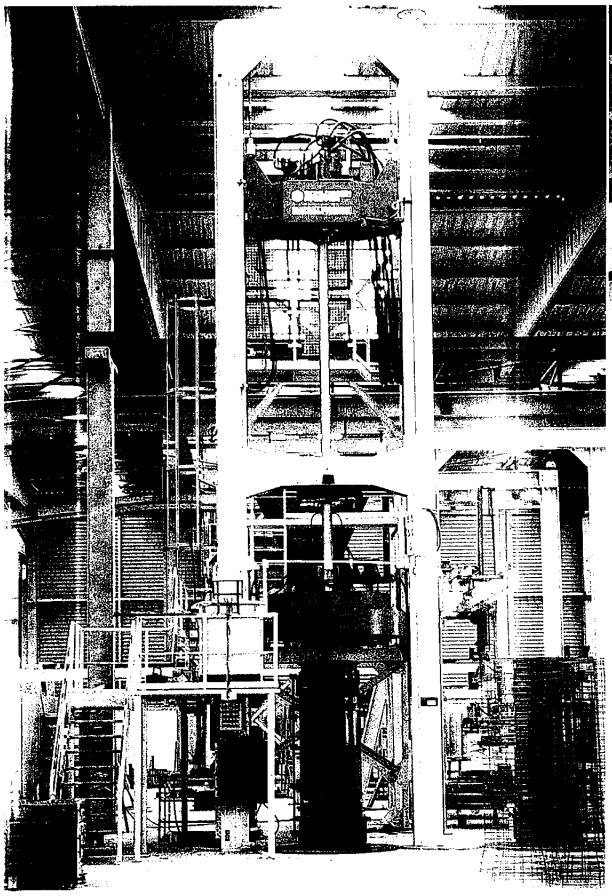
Planetary positive mixer of up to 3,750 litres dry capacity having proved itself all over the world.

Building Material

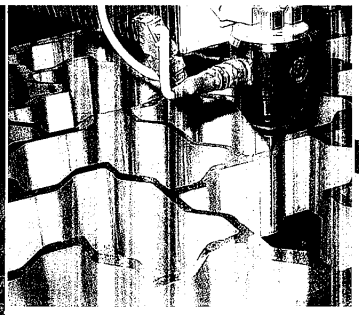
Machinery Engineering

Stone moulding machine of the SP series as an all-purpose machine for the production of paving stones, kerb stones, hollow block stones, horticultural elements.

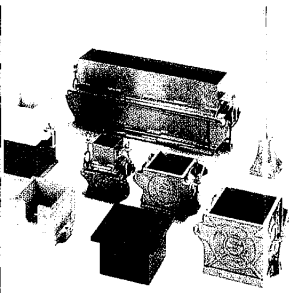




The economic production of reinforced and non-reinforced concrete pipes is at the forefront of SCHLOSSER-PFEIFFER's radial press.



High quality materials and a special production process of the moulds guarantee a long service life.



Sample moulds for all concrete laboratories.

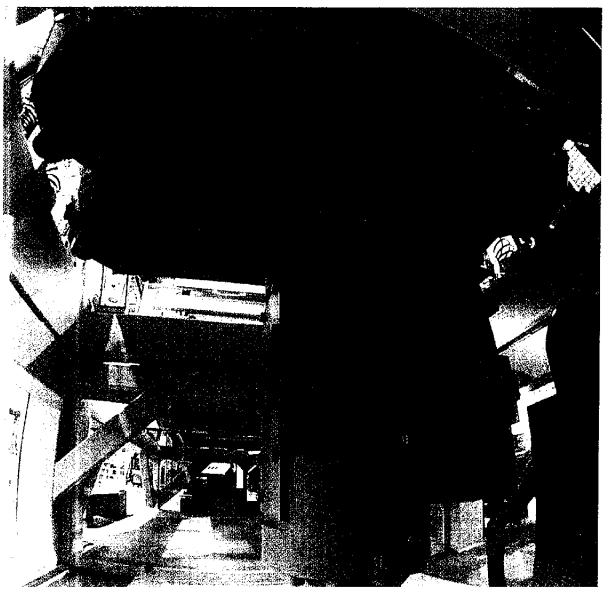
The SCHLOSSER-PFEIFFER's service range is extensive and provides versatile solutions for the concrete processing industry:

- Concrete block production plants,
- Pipe production plants,
- Mixing and dosing systems,
- Manufacturing of moulds and test piece moulds,

In view of their product-typical fields of application and required function, products of the concrete processing industry face production technical processes and electronic controls of varying requirements. SCHLOSSER-PFEIFFER provide for a large number of products made-to-measure and requirement-orientated components for speedy and cost-effective production of high quality products from soil moist concrete.

The economic production of high quality concrete components presupposes not merely sturdy, reliable and efficient machinery and plant, but chiefly also transparency and clarity of all working stages and processes. The process control system developed by SCHLOSSER-PFEIFFER convinces by its simple and user-friendly operation and renders possible the product-optimised control, as well as control of individual production stages in almost all fields of concrete component production. An example of successful integration and client acceptance of high technology in concrete component production.

HCS vibration system.
Presenting the advantage of greater compression of the stone products and the saving of cement.



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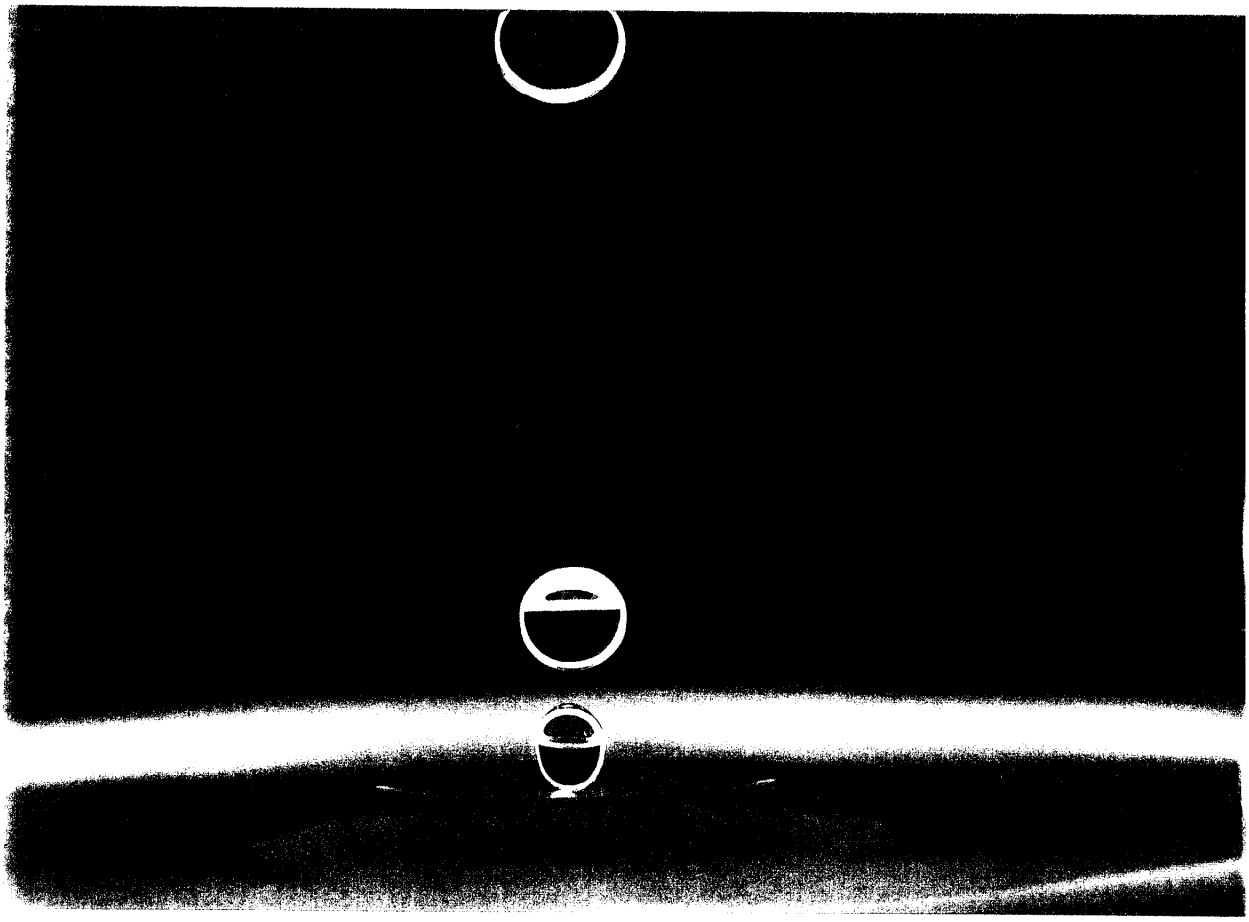

Epilogue

The considerable industrialisation of the last centuries and the massive urbanisation in all the earth's continents made protection of the environment and nature an international duty long ago. Conscious of the existential significance of vital resources, we therefore have to do everything in order to preserve a largely sound environment for ourselves and generations to come.

We contribute to achieving this object with the aid of our extensive know-how and with future-orientated solutions. But expertise in environmental technology means to us more than experience in the development of innovative technologies. We understand by it also responsibility for the thrifty handling of valuable and vital raw materials and products. Because nature does not need us, but we need nature.

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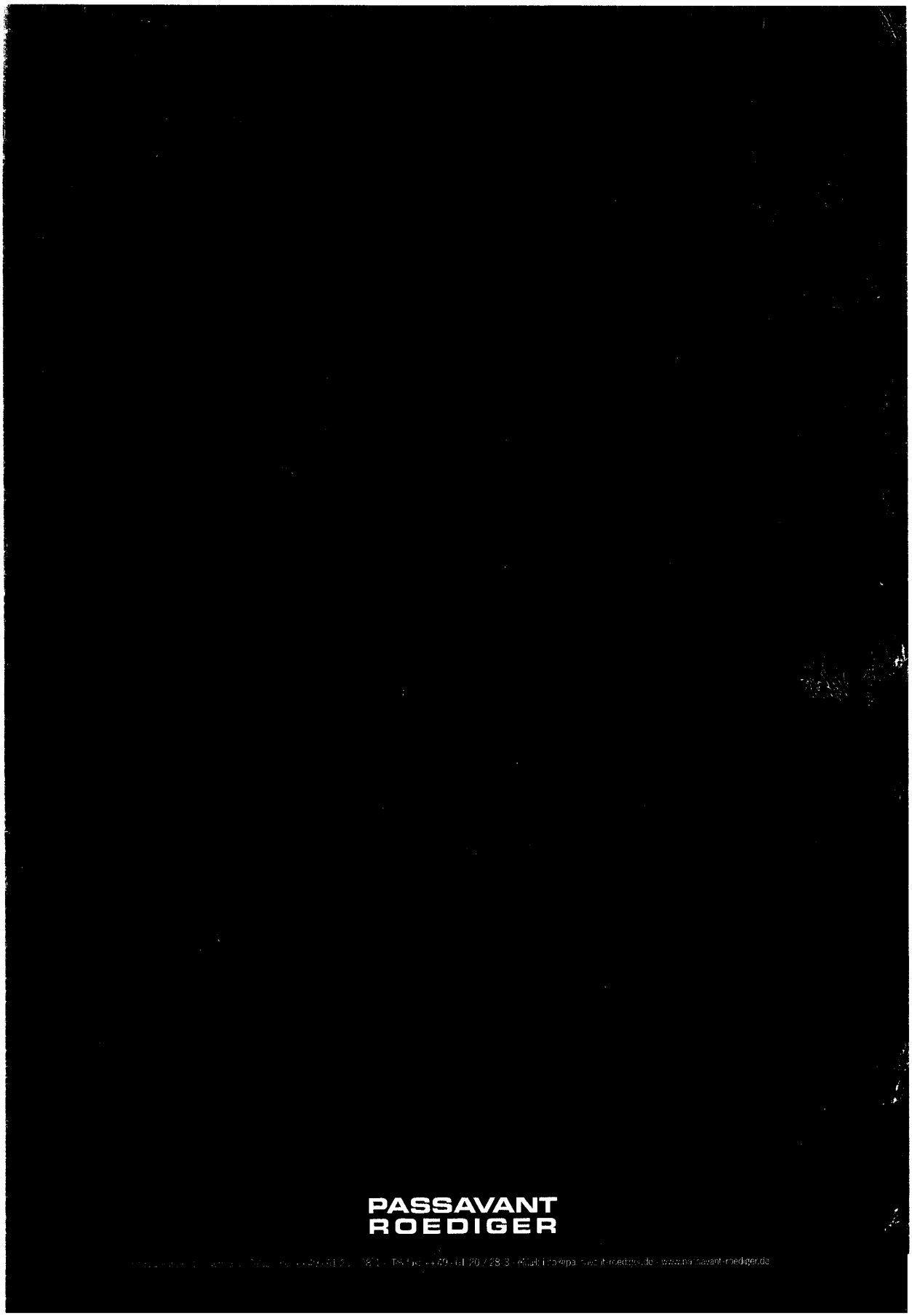
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Erweiterung und Modernisierung der Kläranlage **Wiesbaden**

Extension and Refurbishment of the WWTP **Wiesbaden**

Extension et modernisation de la station d'épuration de **Wiesbaden**

Der Auftrag zur Erweiterung und Sanierung der Kläranlage Wiesbaden erfolgte 1997 an das Joint Venture Hochtief AG Essen / Passvant-Roediger Anlagenbau GmbH Hanau.
Alle Arbeiten mußten bei laufendem Betrieb der Anlage durchgeführt werden.
Die Fertigstellung der erweiterten und renovierten Anlage war nach knapp zweijähriger Bauzeit 1999. Danach wurden die Anlagenteile in Betrieb genommen.
Die Vorklärung, Belebungsbecken, Nachklärbecken, Mikrosiebung des gereinigten Abwassers, Schlammbehandlung in Faulbehältern, Entwässerung des Schlammes in Kammerfilterpressen sowie die komplett neue Elektronische Steuerung der Anlage waren Gegenstand des Auftrages.

In 1997 the Joint Venture Hochtief AG Essen / Passavant-Roediger Anlagenbau GmbH was engaged to extend and rehabilitate the waste water treatment plant in Wiesbaden.
All the works were carried out while the plant was still in operation.
It took just 2 years to extend and rehabilitate the plant, which was then completed in 1999 and could entirely be put into operation immediately afterwards.
The following process engineering was an integral part of the order:
Preliminary clarification, activated sludge tank, secondary sedimentation tank, micro-strainer of the clarified waste water, sludge treatment in fermentation tanks, sludge dewatering in filter-presses
Complete new electronic control.

Le contrat pour l'extension et la rénovation de la station d'épuration de Wiesbaden a été obtenu en 1997 pour le groupement Hochtief AG Essen / Passavant-Roediger Anlagenbau GmbH Hanau.
Tous les travaux ont dû être réalisés pendant que la station restait en fonctionnement.
Les équipements ont pu être mis en service après une phase de construction de 2 ans seulement.
La décantation primaire, les bassins à boues activées, les clarificateurs, la filtration sur tamis rotatifs des eaux usées épurées, le traitement des boues par digestion, la déshydratation des boues par filtres-presses à chambres ainsi que le nouveau système de commande électronique totale de la station faisaient partie intégrante de ce contrat.

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Daten und Fakten

Ausbaugröße:
Ausbau / Endausbau:
325.000 EW

Wassermengen:	
Tagesmittel	100.000 m³/d
Trockenwetterzufluß	3.200 m³/h
Mischwasserzufluß	5.500 m³/h

Auftragserteilung:	1997

Inbetriebnahme:	
Mechanische Stufe:	1999
Biologische Stufe:	1999
Faulung/Gas:	1999

Passavant–Roediger Lieferumfang :

- **Mechanische Stufe :**
Überarbeiten der kompletten Vorklärung
4 Rechteckbecken je 650 m³

- **Biologische Stufe :**
Überarbeiten der kompletten Vorklärung von 5 Belebungsbecken mit Gesamtinhalt von 62.000 m³ mit 30 Mammut Rotoren 9 m Breite im Zusammenarbeit mit Rührwerken. Dies erlaubt eine Beckentiefe von 7 m. Sechs runde Nachklärbecken mit 38 m Durchmesser mit Räumerbrüchen mit Sink- und Schwimmschlamm Entfernung. Micro-Siebanlage mit 5 Sieben mit 20 mµ Polyester Siebgewebe zum Entfernen von Schwebstoffen.

- **Schlammbehandlung :**
Erweiterung der Faulungsanlage um einen Faulbehälter und Modernisierung der beiden bestehenden Faulbehälter mit Roediger Gaseinpressungssystem, Inhalt je 5.000 m³. Drei neue Schwerkrafteindicker 16m Durchmesser mit Passavant Zentral Antrieb und Passavant Eindickmechanismus Entwässerungsanlage mit 2 Passavant Kammerfilterpressen 2000 x 2000 mm.

- **Elektronische Steuerung :**
Liefern und Installieren von der gesamten Steuerung inkl. Hoch-Mittel-Niederspannung
Transformatoren
Schaltanlage
Prozess- und Kontrollsystem mit PLC
Prozessschaltbild als Übersichts- und Multimedia Terminal
Messeinrichtungen
Verkabelung und Montage

Data and facts

Size of plant when completed:
Current capacity/Final capacity:
325.000 P.E.

Water flows:	
Daily average	100,000 m³/d
Dry weather flow	3,200 m³/h
Mixed water flow	5,500 m³/h

Order placed:	1997

Commissioning:	
Mechanical stage:	1999
Biological stage:	1999
Digestion/Gas:	1999

Supplied by Passavant-Roediger:

- **Mechanical part:**
Renovation of the complete primary sedimentation
4 longitudinal tanks with each 650 m³

- **Biological step:**
Reconstruction of 5 aeration tanks with a total capacity of 62,000 m³ with 30 Mammoth Rotors 9 m long with 45 kW drives co-operation with submersible flow mixers. This technology allows for water depths up to 7 m.
6 final settlement tanks of 38 m diameter with scraper bridges with positive scum removal system with precursor bridge.
Micro-screening plant with 5 screening machines as tertiary treatment stage with 20 mµ polyester fabric, for suspended solids removal.

- **Sludge handling :**
Extension of the digester plant by addition of a digester and modernisation of the existing ones. Capacity 3 x 5000 m³, equipped with ROEDIGER gas injection system.
Equipment of 3 gravity sludge thickeners 16 m diameter with PASSAVANT centre drive thickening mechanisms.
Sludge dewatering plant with 2 PASSAVANT chamber filter presses, plate size 2000 x 2000 mm.

- **Electrical part :**
Supply and installation of the complete central electrical equipment, comprising medium voltage distribution
Power transformers
Low voltage switch gear
Process control system and automation with PLC, visualisation with display walls, overview and multimedia terminal (SCADA)
Process control measuring equipment
Cabling and installation

Données et faits

Capacité finale :
Capacité actuelle/capacité finale :
325.000 EH

Débits :	
Moy. journalière	100.000 m³/j
Moy. horaire temps sec	3.200 m³/h
Moy. horaire eaux mixtes	5.500 m³/h

Ordre de commande :	1997

Mise en service :	
Prétraitement :	1999
Trait. biologique :	1999
Digestion/gaz :	1999

Prestations de Passavant-Roediger :

- **Prétraitement :**
Amélioration de la décantation primaire complète
4 bassins carrés de 650 m³ chacun

- **Traitement biologique :**
Amélioration et extension des 5 bassins à boues activées d'un volume total de 62.000 m³, avec 30 rotors Mammouth, d'une largeur de 9 m et associés à des agitateurs. Ceci permet d'obtenir une profondeur de bassin de 7 m, six bassins circulaires de clarification avec un diamètre de 38 m et à ponts racleurs, avec évacuation des boues de fond et des surnageants.
Système de filtration sur tamis rotatif avec 5 tamis à filtre en polyester 20 µm pour l'élimination des matières en suspension.

- **Traitement des boues :**
Extension du système de digestion et modernisation des deux digesteurs existants avec système d'injection du gaz Roediger, volume de 5000 m³ chacun. Trois nouveaux épaississeurs gravitaires de 16 m de diamètre, à entraînement central Passavant et racleur Passavant, système de déshydratation avec deux filtres-presses à chambres Passavant de 2000 x 2000 mm.

- **Electricité :**
Livraison et installation de la distribution électrique complète, y compris haute et moyenne tension :
Transformateurs
TGBT
Système de contrôle et de process à PLC
Synoptique Supervision électronique
Instrumentation
Câblage et montage

PASSAVANT ROEDIGER ANLAGENBAU