



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)

赴新加坡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

服務機關：行政院環境保護署

出國人 職 稱：署 長 顧 問 處 長 簡任技正
姓 名：郝龍斌 莊文思 陳雄文 劉佳鈞

出國地點：新加坡

出國期間：九十二年八月二十日 至 九十二年八月二十四日

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/
C09202934

赴新加坡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

出國報告

目 錄

壹、前言	1
貳、成員名單	2
參、行程內容及參訪紀要	3
肆、心得摘要	11
伍、結論與建議	12
陸、附件	14

赴新加坡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

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。

環保科技園區為行政院挑戰二〇〇八國家重點發展計畫，為配合本（九十二）年十月於世貿中心辦理國際招商大會，及本署環保科技園區推動計畫正處於招商階段，由署長率團出訪新加坡，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。

貳、成員名單

考察新加坡由 署長率團擔任團長，成員有本署高級顧問莊文思教授、本署廢管處陳雄文處長及簡任技正劉佳鈞等四人；日期自本（九十二）年八月二十日至二十四日，共計五天。主要考察重點如下：

- 一、拜訪新加坡環境發展部，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、考察廢棄物管理制度、政策及相關環境設施。
- 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。

行政院所屬各機關因公出國人員出國報告書

參、行程內容及參訪紀要

一、參訪行程

日期	時間	地點	參訪行程	備註
8/20 (三)	下午 14:35 下午 19:05	台北→新加坡	下午 14:35 中正機場第一航站 華航 661 班機 台北-新加坡(抵達 時間下午 19:05)	1. 下午 12:30 前至第一航站中 華航空櫃檯集合 2. 住宿飯店: The Ritz-Carlton, Millenia Singapore 地址: 7 Raffles Avenue Singapore, 039799 Singapore 電話: 65-6-337-8888 FAX: 65-6-337-5190 3. 下午 20:30 歐陽代表晚宴
8/21 (四)		新加坡	拜會我國駐新加坡代表處及考察 公共設施及夜市整體環境維護與 垃圾處情形	
8/22 (五)	上午 10:00	新加坡 Courtesy Call Room, Environment Build- ing	拜會新加坡環境發展部林部長	地址: Courtesy Call Room, Environment Building, 25 th Storey, 40 Scotts Road, Singapore 228231 聯絡人: Ms. Karolyn Poon (Senior Assistant Director) 電話: 6731-9840
	上午 11:00		拜會新加坡環境發展部所屬國家 環境局 NEA 簡報: "新加坡廢棄物管理系 統" 主人: Mr. Loh Ah Tuan (Di- rector-General, Environmental Protection) 簡報人: Mr. Chung Dalson(Chief Engineer, Resource Conserva- tion Department)	地址: Environment Building, 11 th Storey Conference Room 聯絡人: Carrie Wong 工程師 (Resource Conservation De- partment) 電話: 6731-9435
	中午 12:00		離開 NEA	
	下午 2:00	新加坡 Citiraya 公司	參訪 Citiraya 公司 主人: Mr. Raymond Ng(Chief Executive Officer) 簡報人: Ms. Seow Siew Lan (Executive Director)	地址: 65 Tech Park Crescent, Singapore 637787 聯絡人: Ms. Seow Siew Lan (Executive Director) 電話: 6264-4338
	下午 3:15	Waste Management and Recycling As- sociation of Sin- gapore	Meeting with Waste Management and Recycling Association of Singapore (WMRAS) 主人: Ms. Loh Wai Kiew (Chairman) 簡報人: Ms. Loh Wai Kiew	地址: 65 Tech Park Crescent, Singapore 637787 聯絡人: Ms. Ang Kooi Hwa(Secretariat) 電話: 6278-2538
	下午 4:30	新加坡 ECO-IEE 公司	參訪 ECO-IEE 公司 主人: Col Chua Tiong Guan (Managing Director) 簡報人: Col Chua Tiong Guan	地址: 40 Tuas West Road, Singapore 638389 聯絡人: Col Chua Tiong Guan 電話: 6862-5333
	下午 5:15		離開 ECO IEE 公司並返回飯店	

行政院所屬各機關因公出國人員出國報告書

8/23 (六)	上午 9:30	新加坡 NEWater Visitor Centre 公司	參訪 NEWater Visitor Centre 公司 主人：Mr. Lim Choiw Giap (Director, Water Reclamation) 簡報人：Mr. Lim Choiw Giap 主題：Water Supply	地址：NEWater Visitor Centre, Koh Sek Lim Road 聯絡人： 1. Mr. Lim Choiw Giap (Director, Water Reclamation) 電話：6731-9528/6731-3510 2. NEWater Visitor Centre Manager / Assistant Manager 電話：6546-7874/6541-0511
	上午 11:00		離開 PUB site	
	上午 11:15	新加坡 SembCorp Utilities 公司	參訪 SembCorp Utilities 公司 主人：Mr. Tang Kin Fei, (President & CEO) 簡報人：Mr. Tang Kin Fei,	地址：下列二者擇一（刻確認中）： 1. SembCorp Utilities Pte Ltd, 60 Admiralty Road West, #02-01, Singapore 759947 2. 30 Hill Street 聯絡人：Mr. Yu Hong Gay Assistant Vice-President(Business Development) 電話：6750-8715
	中午 12:30		離開 SembCorp Utilities 公司	
8/24 (日)	下午 13:10 下午 17:25	新加坡→台北	長榮 226 班機 新加坡~台北(抵達時間下午 17:25)	

二、考察紀要摘要如下：

- (一) 八月二十一日，拜會我國駐新加坡代表處及考察公共設施及夜市整體環境維護與垃圾處情形。
- (二) 八月二十二日上午，拜訪新加坡環境發展部，由林部長介紹環境發展部的工作方向及新加坡綠色計畫2012。
(摘要如附件一)
- (三) 八月二十二日上午，拜訪新加坡環境發展部所屬環境局，由局長與該局同仁簡報固體廢棄物管理策略。
- (四) 八月二十二日下午，拜訪 Citiraya 公司(偉城工業公司)，該公司為具有電子廢棄物回收技術之回收貴金屬的廠商，且能為電子工業提供所有的廢棄物回收服務，回收之貴金屬包括金、銀、白金，及非鐵金屬中的銅。
- (五) 八月二十二日下午，由新加坡廢棄物管理及回收再利用協會會長介紹該協會成立目的，是協助其成員發展為亞洲地區專業的廢棄物管理及回收再生的主要公司，是新加坡主要的廢棄物交換機構，並為其成員提供商機及推廣最佳新技術。
- (六) 八月二十二日下午，拜訪 ECO Industrial Environmental Engineering Pte Ltd 公司，該公司主要從事商業及工業廢棄物回收再生，以協助業界高效率且安全的達成廢棄物減量、回收再利用、處理/處置的最佳管理方案，以達成對環境最有利的廢棄物處置。
- (七) 八月二十三日上午，拜訪新生水處理系統及展覽館，主要展示內容為告訴民眾，新加坡一天消耗的水源、節約用水及深渠污水處理系統。該系統是處理污水再經高級處理後，產生了新生水(NEWater)，主要應用在晶圓製造廠及家居食用水的間接供水。
- (八) 八月二十三日中午，拜訪 Sembcorp utilities 公用事業公

司，其是 SembCorp 工業公司的公用事業部門子公司，成立的目標是希望經由提供創新的、高品質的、高附加價值的服務，以成為亞太區能源及公用事業的領導者。

三、考察紀實如下：

(一) 八月二十二日上午，拜訪新加坡環境發展部林部長

1、與環境發展部林部長之討論重點

- 生活污水、廢水處理、及水資源回收在新加坡管理現況
- 可再生能資源、太陽能及風力發電技術在新加坡應用現況
- 綠色環保產業在新加坡推展現況

(1) 新加坡廢棄物管理及回收再利用

(2) 生活家電廢棄物回收再利用

(3) 電子、半導體及光電業製程廢棄物回收再利用

(4) 其他工業廢棄物回收再利用

- 環保科技技術與產業之交流與合作

(1) 環保科技園區計畫

(2) 雙邊環保技術與產業之交流與合作

2、環境發展部林瑞生部長介紹該部工作重點如下：(詳如附件二加坡綠色計畫 2012)

- 環境發展部的工作方向

(1) 空氣、水、固體廢棄物、公共衛生與國際合作的環境整體表現

(2) 加強國家可持續發展(永續發展)計畫

(3) 發展環境工業

(4) 擴大環境產業就業機會與提昇工作形象

- 國際經濟論壇將全世界一二〇國以永續發展指標予以排名，該國排名一一三，林部長認為不合理，並寫信抗議，修正排名後又再抗議，最後修正評估範圍與方式，最後因該國面積太小，不列入評比排名。
- 加強國家可持續發展計畫（永續發展）之具體作法
 - (1) 固體廢棄物與工業廢棄物再循環計畫：目前再循環程度為百分之四十四，二〇一二年之目標為百分之六十。
 - (2) 水循環計畫：推動水來源需求多元化、節約用水與再循環計畫。擴大水源保護區收集雨水、海外淡化廠與新生水。
 - (3) 空氣品質提升計畫：汽車、計程車、公車與電廠使用之燃料改為天然氣，並同時推動太陽能發電工作。
 - (4) 維持新加坡乾淨計畫：利用 SARS 機會，提出新加坡 OK 計畫，改變民眾八大項自然習慣，包括發燒時不進入公共場所、將垃圾包綁緊避免臭味逸散、不隨手亂丟垃圾、不亂丟剩餘食物、多運動、保持公共廁所乾淨等。另外進全國清潔綠化週，將全國分成五市及八十四個選區，每區選出三位最有環保意識民眾，再選出全國排名順序。
- 發展環境工業：運用投資環保設施、固體廢棄物與工業廢棄物再循環、海水淡化廠、新生水等計畫來擴張環保產業發展，同時創造就業機會。
- 擴大環境產業就業機會及提昇工作形象：以「提高工資及形象改變」之策略，推出一系列增加就業機會，促進

民眾願意參與環境產業工作。

(二) 八月二十二日上午，拜訪新加坡環境發展部所屬環境局局長

由該局同仁簡報固體廢棄物管理策略，內容包括廢棄物收集與處置現況、減量回收之核心策略及結論。(詳如附件三新加坡固體廢棄物的管理策略)

(三) 八月二十二日下午拜訪 Citiraya 公司 (偉城工業公司)

為電子廢棄物中貴金屬的回收廠商，已經在台灣有據點，為提供高品質的、創新的電子廢棄物回收技術，以創造顧客最大的經濟效益，並符合最高的環保、安全、健康標準。能為電子工業提供所有的廢棄物回收服務，二〇〇二年起偉城工業公司亦提供含貴金屬的有毒廢/有害棄物的處理設施。經由回收再利用，期望能提高原物料的使用效率，同時將廢棄物掩埋的數量降低；貴金屬中包括金、銀、白金，及非鐵金屬中的銅，均在回收再利用程序中。(公司簡介如附件四)

(四) 八月二十二日下午參訪 Waste Management and Recycling Association of Singapore 新加坡廢棄物管理及回收再利用協會

由新加坡廢棄物管理及回收再利用協會會長介紹該協會成立目的該協會成立於二〇〇一年八月，其目的是協助其成員發展為亞洲地區專業的廢棄物管理及回收再生的主要公司，是新加坡主要的廢棄物交換機構，其成員為所有廢棄物相關公司，為了達到其目標，該會經由參與各種活動為其成員提供商機及推廣廠商的最佳新技術，其主要方式為；安排座談會、商業參訪團、研討會、參與各種展覽會、資訊交流等等國內外活動；該協會同時也安排與政府單位間之交流座談會、參與法令說明會等等活動，並隨時為成員報告目前法令現況及未來政策方向；該協會並參與各項國內外相關活動、成為國際相關組織之會員，與相關國際組織簽訂合作協定、合作計劃、建立合作架構，也希望經由相關國際合作與

參與活動，而帶領協會成員進入國際市場。

協會成立的目標如下：

- 經由市場商機提昇會員廠商之專業與技術
- 帶領「廢棄物管理及回收再利用工業」達成並維持最高的績效及標準
- 提供企業與協會成員間之間的溝通平台，以利共同討論及處理相關環保議題

該會會長也介紹該會會員及 ENVIRO ASIA 2003（詳如附件五及六）

（五）八月二十二日下午，拜訪 ECO Industrial Environmental Engineering Pte Ltd 公司

該公司主要從事商業及工業廢棄物回收再生，以協助業界高效率且安全的達成廢棄物減量、回收再利用、處理/處置的最佳管理方案，以達成對環境最有利的廢棄物處置。目前有兩個子公司，為 ECO-RRC 回收再利用公司，提供一般廢棄物的管理及回收再利用，另一為 ECO-SWM 特殊廢棄物處理公司，能提供特殊/有害廢棄物的處理，故 ECO 集團可以提供全方位的廢棄物管理及處理服務。（公司簡介如附件七）

（六）八月二十三日上午拜訪新生水處理系統及展覽館

新加坡一天消耗約一、四 00、000 立方公尺的水，除了本地可提供的水源之外，亦從馬來西亞進口水，並興建渠道及集水處以收集可利用的水源。同時也以水價來抑制水的使用量，並加裝水錶來測量水量，及按時派員檢查水管管線。耗資七十億元興建深渠污水處理系統（Deep Tunnel Sewage System）來處理污水以避免海洋污染並且再利用處理過的水。污水經過聚丙烯(polypropylene)管再經由薄膜(membrane)過濾污水。懸浮固體及微生物等都吸附於薄膜上，而經過的水已被過濾乾淨。下一步驟，水再經過聚醯胺

(polyamide)的薄膜以負壓方式進入，再度消毒，去除鹽分、有機物及病毒。完成後再做紫外線消毒，經過這些步驟，就產生了高級新生水(NEWater)，主要應用在晶圓製造廠及家居食用水的間接供水。(新生水展覽館指南如附件八)

(七) 八月二十三日中午拜訪 Sembcorp utilities (SUT)公司

SembCorp 公用事業是 SembCorp 工業公司的公用事業部門，成立的目標是希望經由提供創新的、高品質的、高附加價值的服務，以成為亞太區能源及公用事業的領導者，SembCorp 公用事業由於過去為集團提供的服務經驗及經由集團內高度支援的特性，能提供任何客戶所需要的產品與服務；SembCorp 公用事業具有世界先進的集中式多功能公用支援系統，提供全方位的能源、水及各種公用系統產品與服務；同時也提供天然氣、發電設備，海上油氣鑽探設備，及各種化學品貯存設施。(公司簡介如附件九)

肆、心得摘要

由這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，均獲得新加坡廠商的熱烈反應，多家業者表達來台灣進一步了解之意願。
- 二、新加坡環境發展部林部長對我國環保科技園區的計畫內容充分了解，承諾將加強與我國的環保技術與產業交流與合作。
- 三、新加坡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。
- 四、於招商過程中，發現具有回收技術廠商自有資金不夠雄厚，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、新加坡之資源回收再生技術與固體廢棄物處理技術，在台灣均已有被引進應用之案例，但相關技術仍不斷推陳出新，有必要持續加強合作藉以提高再生物質的經濟價值。
- 六、新加坡環境發展部積極運用環保政策、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、新加坡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、新加坡發潔淨能源與新生水，潔淨能源以天然氣發電技術開發為對象。
- 九、加坡綠色計畫 2012 涵蓋內容豐富，也作為該國民眾與政府全體努力方向。

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，應有二家以上，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。
- 七、太陽能、天然氣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。

八、新加坡環境發展部運用投資環保設施、固體廢棄物與工業廢棄物再循環、海水淡化廠、新生水與參與公共環境清潔服務等計畫來擴張環保產業發展，同時創造就業機會，值得本署學習。

陸、附件



八月二十二日上午，拜訪新加坡環境發展部所屬環境局



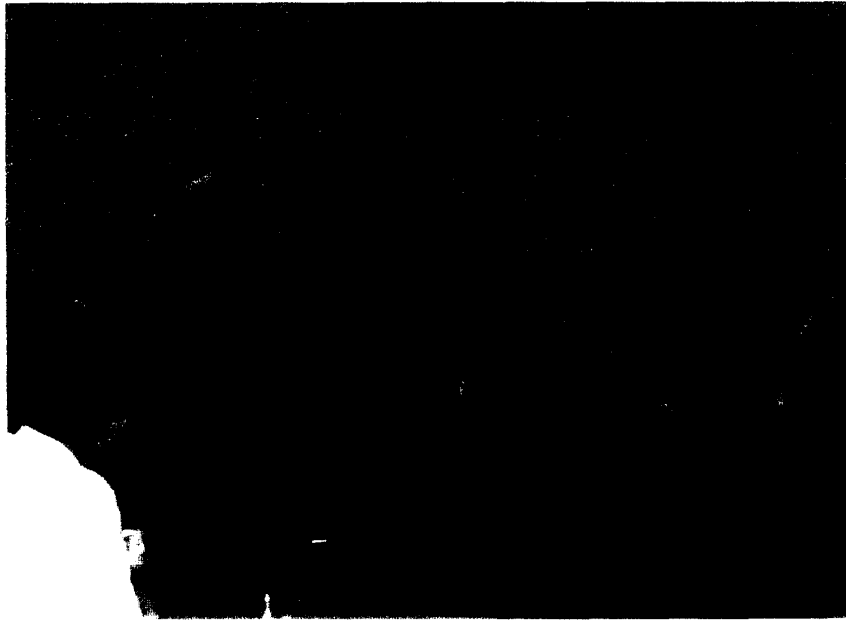
八月二十二日上午，拜訪新加坡環境發展部所屬環境局



八月二十二日下午拜訪 Citiraya 公司（偉城工業公司）



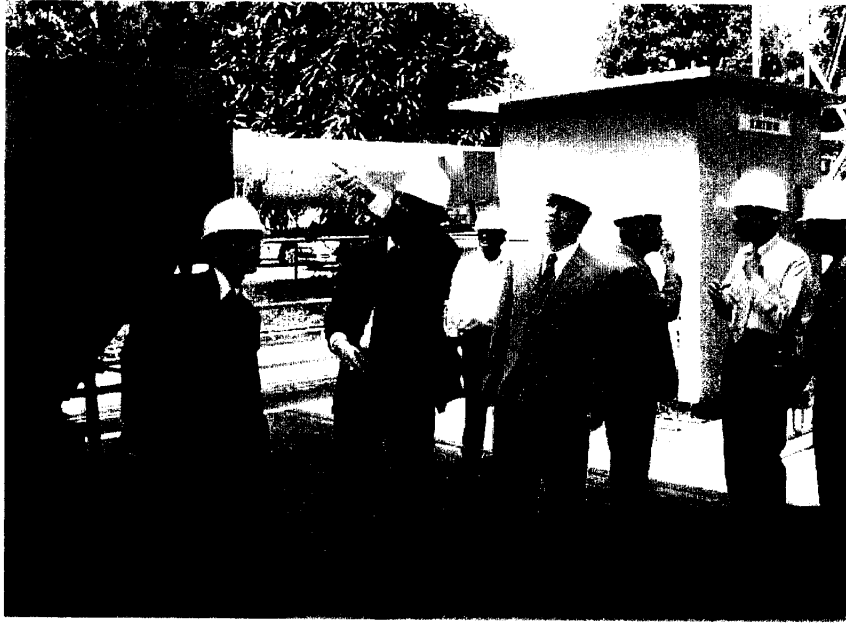
八月二十二日下午拜訪 Citiraya 公司（偉城工業公司）



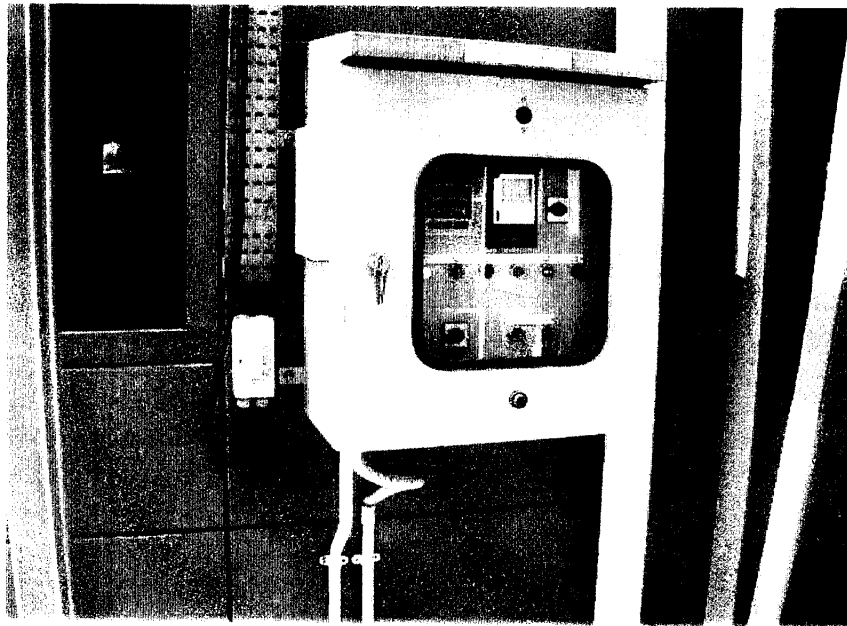
八月二十二日下午拜訪 Citiraya 公司（偉城工業公司）



八月二十二日下午拜訪 Citiraya 公司（偉城工業公司）



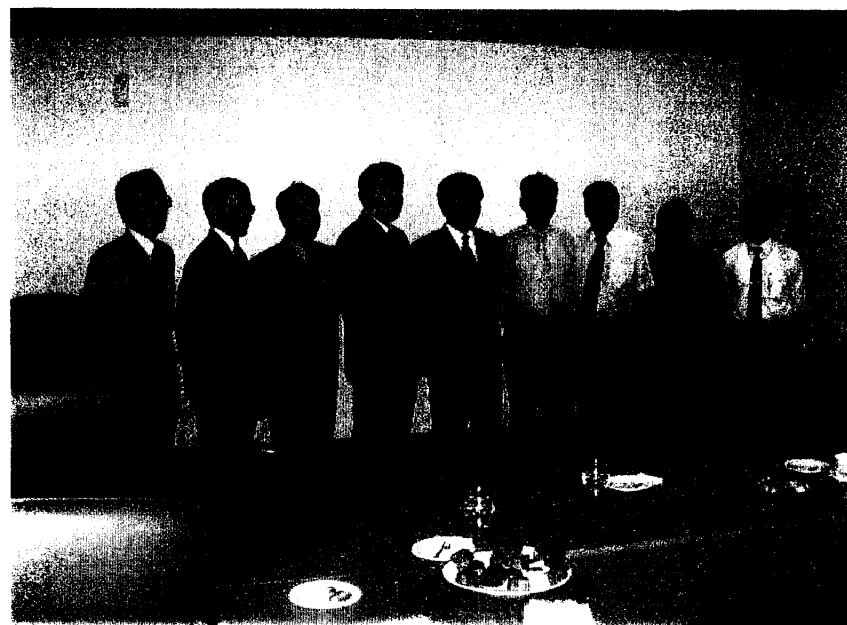
八月二十二日下午拜訪 Citiraya 公司（偉城工業公司）



八月二十二日下午拜訪 Citiraya 公司（偉城工業公司）



八月二十二日下午拜訪 Citiraya 公司（偉城工業公司）



八月二十二日下午拜訪 Citiraya 公司（偉城工業公司）



八月二十二日下午拜訪 ECO Industrial Environmental Engineering Pte Ltd 公司



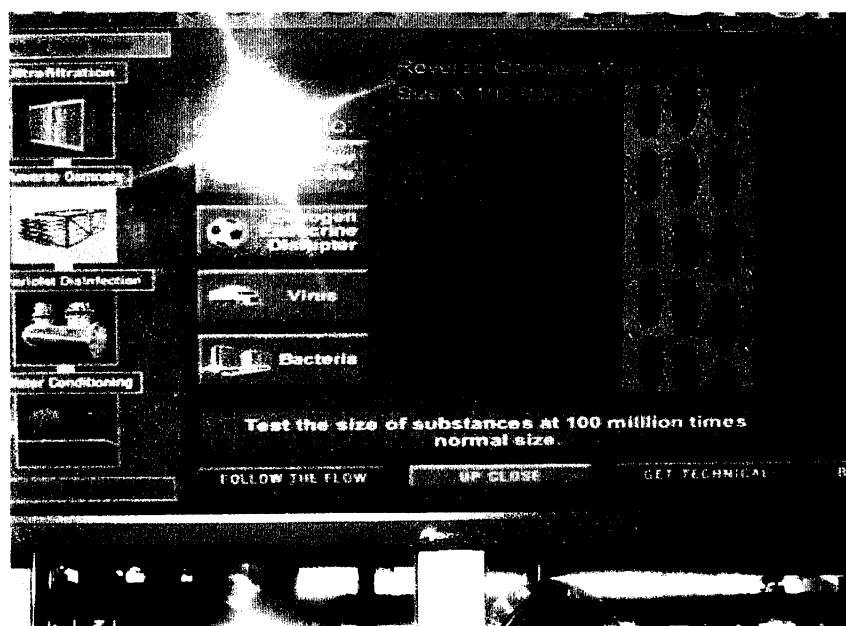
八月二十二日下午，拜訪 ECO Industrial Environmental Engineering Pte Ltd 公司



八月二十三日上午拜訪新生水處理系統及展覽館



八月二十三日上午拜訪新生水處理系統及展覽館



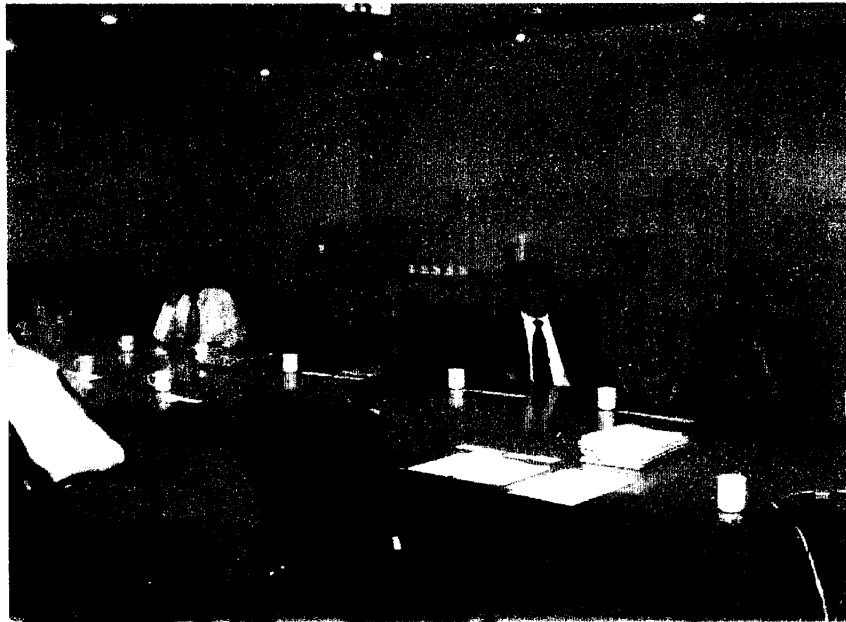
八月二十三日上午拜訪新生水處理系統及展覽館



八月二十三日上午拜訪新生水處理系統及展覽館



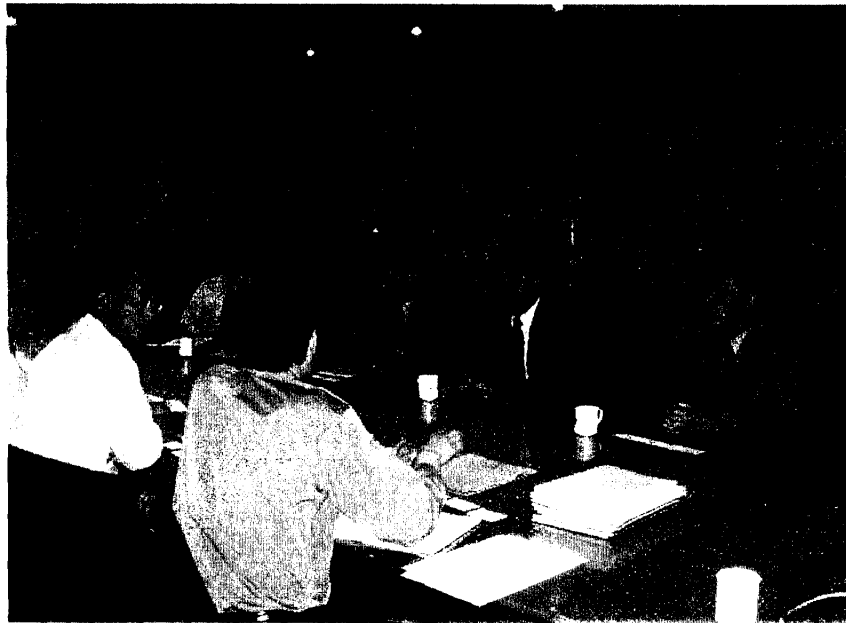
八月二十三日中午拜訪 Sembcorp utilities (SUT)公司



八月二十三日中午拜訪 Sembcorp utilities (SUT)公司



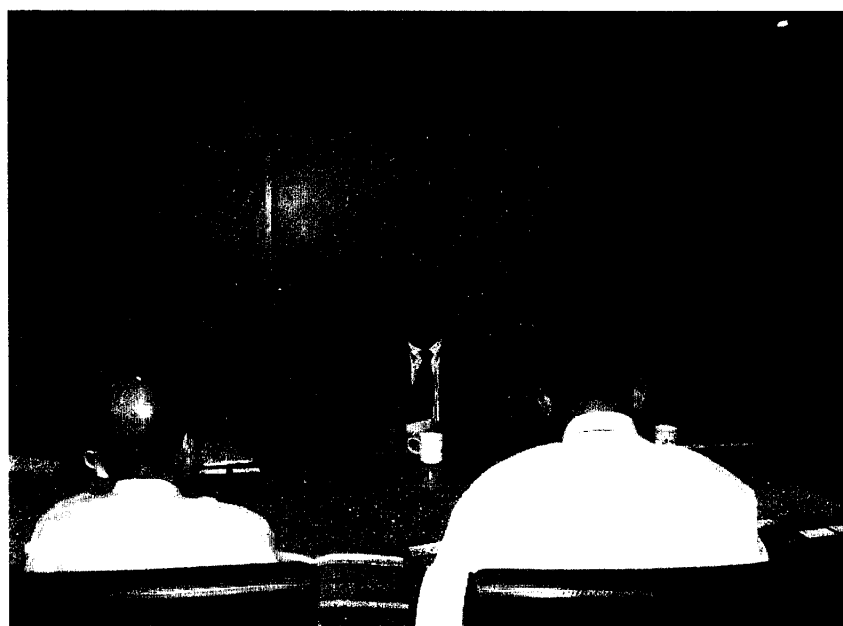
八月二十三日中午拜訪 Sembcorp utilities (SUT)公司



八月二十三日中午拜訪 Sembcorp utilities (SUT)公司



八月二十三日中午拜訪 Sembcorp utilities (SUT)公司



八月二十三日中午拜訪 Sembcorp utilities (SUT)公司

新加坡綠色計畫 2012

(The Singapore GREEN PLAN 2012)

清潔與綠，邁向環境永續

邁向永續新加坡

新加坡地窄人稠，四百萬人口居住在佔地只有 682Km² 的土地上，因此每人所擁有的資源非常有限。世界經濟論壇(World Economic Forum) 所評鑑的 2000 年環境永續指標(Environmental Sustainability Index (ESI))中，在 122 個接受評鑑的國家裡，新加坡名列資源最短缺的第 10 名。在此評論發表後兩個月，ESI 評鑑將新加坡升級為第 65 名。一年之後，ESI 將其面積小於 5000 Km² 的國家於評鑑中除名。雖然如此，新加坡仍參考 ESI 以衡量本身所擁有的資源及合適永續發展的計畫。

新加坡 2012 年的綠色計畫(或簡稱 SGP 2012)已放置在 www.env.gov.sg/sgp2012 的網頁上，可隨時上網瀏覽。

新加坡共有四家焚化廠及一家掩埋場。廢棄物大部分來自工業界及商業界，其中 44% 的廢棄物予以回收；非可回收的廢棄物，則送至其中一家焚化廠或送至 Pulau Semakau 的掩埋場做處理。新加坡法規禁止隨意傾倒垃圾，垃圾收集是每日必進行的工作。我們的目標是在 2012 年達到 60% 的廢棄物回收率，同時也希望在未來 15 年內能減少焚化爐的興建。因為我們的土地面積稀少，希望藉由廢棄物減量及資源回收來達到廢棄物零掩埋的目標。新加坡有設立 JTC Corporation 來協助工業廢棄物的回收；例如塑膠、紙、玻璃、及木材。我們在 2001 年的九月設立「新加坡廢棄物管理及資源回收協會」(The Waste Management and Recycling Association of Singapore (WMRAS))，並和北美的「北美固體廢棄物協會」(Solid Waste Association of North America (SWANA)) 及澳洲的「澳洲廢棄物管理協會」(Waste Management Association of Australia (WMAA)) 合作。除此以外，我們也設置回收點以供民眾將需回收的物品如塑膠、紙、舊衣服、玻璃瓶等投入回收桶。

自然生態保育方面，我們將一些區域規劃為自然保留區(Natural Areas)，此區域是位在 Bukit Timah 的自然保留區及中央獲取區(Central Catchment Areas)。它有 2100 公頃大小，其中 Garden City 保存了多量珍貴樹種，並提供市民休閒及優美的市容。

目前的廢棄物資源回收率及未來的目標			
	回收量 2001 (公噸)	回收率 (%)	目標回收率 (%)
食物	30,536	6	30
紙類	446,504	36	55
塑膠	57,031	10	35
建築廢棄物	299,764	85	90
木材	21,300	8	40
園藝廢棄物	88,793	32	70
鐵類金屬	969,618	87	95
非鐵類金屬	101,881	85	90
瀘渣	205,411	90	95
玻璃	5,156	15	50
紡織皮革類	415	1	2
廢輪胎	6,823	59	75
總計	2,233,232	44	60

新加坡致力於海底生態的保存，我們設置了 Sungei Buloh 自然公園及 Labrador 自然公園以保留珍貴海底生物，如瀕臨絕種之海龜，海星，海馬等。我們並規劃 Sungei Buloh 濕地保留區以供過境鳥類棲習。

新加坡有 700,000 車輛，但經由美國環保署測試，新加坡空氣品質皆在良好階段。「國際能源效率委員會」(National Energy Efficiency Committee)在 2001 年成立，致力於有效使用能源如引進壓縮天然氣(compressed natural gas)車輛以減少廢氣排放污染。我們計畫於 2012 年達成 60%電力均由天然氣取代。天然氣發電可達到 50% 的效益且不散發二氧化硫 (Sulphur dioxide) 及散發少量二氧化碳 (Carbon dioxide) 及塵粒。Tuas Power Station 為使用天然氣發電的範例。

新加坡一天消耗約 1400,000 平方公尺的水，除了本地可提供的水源之外，亦從馬來西亞進口水，並興建渠道及集水處以收集可利用的水源。同時我們也以水價來抑制水的使用量，並加裝水錶來測量水量，及按時派員檢查水管管線。我們並耗資 70 億元興建深渠污水處理系統 (Deep Tunnel Sewage System) 來處理污水以避免海洋污染並且再利用處理過的水。污水經過聚丙烯(polypropylene)管再經由薄膜(membrane)過濾污水。懸浮固體及微生物等都吸附於薄膜上，而經過的水已被過濾

乾淨。下一步驟，水再經過聚醯胺 (polyamide) 的薄膜以負壓方式進入，再度消毒，去除鹽分、有機物及病毒。完成後再做紫外線消毒，經過這些步驟，高級再生水 (NEWater) 就產生了。

新加坡發展「急症確認計畫」(Rapid Syndrome Validation Project) 以迅速找出可能的病例及症狀，它可同樣防止生化攻擊。食品衛生檢驗及疫苗普及使得平均人民壽命延長為 78 歲，嬰幼兒夭折率下降至千分之 2.2。環境衛生組織 (Environmental Health Institute (EHI)) 在 2002 年的四月成立，它的主要功能為防止傳染病，如蚊子所帶原的傳染病。

新加坡同時也致力於國際間環保機構的合作。例如四月舉辦的世界地球日 (Earth Day)，六月的世界環境日 (World Environment Day)，十一月的綠色清潔週 (Clean and Green Week)。同時我們也致力於民間團體與學校機關的合作，如綠色志工網路 (Green Volunteers Network) 以促進新加坡的環境保育。

新加坡致力於永續發展，而當前最大的挑戰為水資源不足的問題，我們十分願意和友邦分享現有的經驗。新加坡已設有 Pasir Ris Park 以拯救瀕臨絕種的 mangrove 樹、發展出不會釋放出二氧化硫的車輛，並追求廢棄物零掩埋的目標。新加坡亦投入兩千萬美金設立「環境永續基金會」(Environmental Sustainability Fund) 以發展永續社會。

SGP 2012 主要目標摘要

項次	範疇	目標
1	廢棄物管理	<ol style="list-style-type: none"> 1. 廢棄物資源回收率由 44% 提升至 60%。 2. 將 Semakau 掩埋場壽命延長至 50 年，並朝向「零掩埋場」的目標。 3. 減少新焚化廠的需求，由目前的每 5~7 年設一新廠降至 10~15 年。
2	自然保育	<ol style="list-style-type: none"> 1. 儘量保留自然區。 2. 由生物多樣性研究加強本土動植物的資訊。 3. 新設國家公園及建立生態廊道。 4. 設立國家生物多樣性研究中心。
3	空氣	<ol style="list-style-type: none"> 1. 空氣汙染指標 (PSI) 達每年「佳 (good)」85%，「普通 (moderate)」15%。 2. 新加坡的電力達到 60% 由天然瓦斯提供。 3. 加強使用天然瓦斯做為大眾運輸動力原料 (如公車、計程車)。 4. 以大眾交通運輸工具替代家用車。
4	水資源	<ol style="list-style-type: none"> 1. 增加可透水之地表面積，由 50% 提升至 67%。 2. 由非水庫來源增加水源，例如由海水淡化及使用水回收再生，計代替新加坡水需求量的 25%。 3. 維持水質合於國際標準。
5	大眾健康	<ol style="list-style-type: none"> 1. 成為環境相關流行病學診治及研究之區域領導中心。 2. 減少和環境問題相關的傳染病。 3. 發展「症狀回報系統 (syndromic reporting system)」以早期偵測緊急的傳染病。 4. 提早採取預防手段以避免國際性的健康問題進入新加坡。
6	社區發展	<ol style="list-style-type: none"> 1. 設立大眾教育機制教導民眾環境保護及自然保育。 2. 加強結合 3-P (公共、私人及群眾) 參與環境議題。 3. 在環境保護前提下建立更健全的 3-P 關係。
7	國際合作	<ol style="list-style-type: none"> 1. 在各種環境議題上持續密切的與 ASEAN 合作。 2. 與發展中國家建立良好的合作關係。 3. 加強區域性及全球性的合作以面對環境挑戰。 4. 持續參與對國際環境的努力及責任以符合國際環境條約。
8	創新發展	<ol style="list-style-type: none"> 1. 以更先進的科技加強新加坡環境工業管理。 2. 站在研究的先端, 採用最好的策略以促進環境永續。

THE SINGAPORE
GREEN PLAN
2012



BEYOND CLEAN AND GREEN
TOWARDS ENVIRONMENTAL SUSTAINABILITY

BUILDING ON THE PRESENT PLANNING FOR THE FUTURE



Global Challenges

A decade ago, the global community took a giant stride forward in its pursuit of sustainable development. It recognised that the long-term progress of mankind through economic and social development was intricately linked to and must be balanced with environmental protection.

Technology has shrunk time and space, and made the world a global village. But the world still faces challenges of poverty, food insecurity, inadequate access to freshwater and lack of proper sanitation and health services. It also faces unsustainable consumption and production patterns, and overexploitation of the natural resource base for economic and social development. Nations need to accept the common responsibility, and demonstrate the political will and commitment to come together to surmount these challenges. We can draw on our innate human resourcefulness to promote innovation and encourage adoption of best practices. Partnerships must go beyond the traditional government-to-government ones, to involve people and groups at all levels.

The World Summit on Sustainable Development at Johannesburg represents an important milestone in the global environmental agenda. It will enable the global community to do a health check on our combined push towards sustainable development, and to take remedial measures where necessary.

Singapore's Response

Singapore supports this endeavour, as is evident from our various bilateral, regional and international co-operation programmes. We look towards expanding these programmes in tandem with the action plans to be adopted at the Johannesburg Summit.

Singapore is committed to contributing to global sustainability efforts within our capability and resources. We continue to support the capacity-building efforts of fellow developing countries in the area of human resource development even as we learn from other countries' best practices in sustaining a quality living environment. We also collaborate with interested partners to bring about the spread of these best practices, and continue to work with stakeholders such as industry and academia to promote innovation in environmental management.

We know that what we have achieved today cannot be taken for granted. Sustaining the environment requires endless vigilance, action and innovation. Even as the world is still grappling with traditional environmental concerns, new ones emerge.

The Singapore Green Plan 2012 sets out our response to the challenges of sustaining a quality environment while pursuing economic progress. Our geographical circumstances and limited resources make it a daunting task. But rather than resigning ourselves to fate, we are making it a rallying point. While continuing to learn from others, we will tap on our stakeholders' resourcefulness and innovativeness to customise sustainability solutions for our circumstances.

The real test of our Green Plan's success will be the state of our environment in generations to come. As we reaffirm our commitment to sustainable development, we realise the paramount importance of a people who are personally committed to and involved in sustaining a quality living environment for the long term.

Addressing sustainable development is like aiming at a moving target: It is not enough to adjust policies to present-day realities; we have to anticipate change and be ready to respond to challenges of tomorrow. With our continued focus on sustainable development, coupled with good governance and forward planning, I have no doubt that we will rise to the challenge.



Lim Swee Say
Minister for the Environment
Singapore

“Technology alone will be insufficient to ensure sustainability. People are needed behind the sustainability drive.”

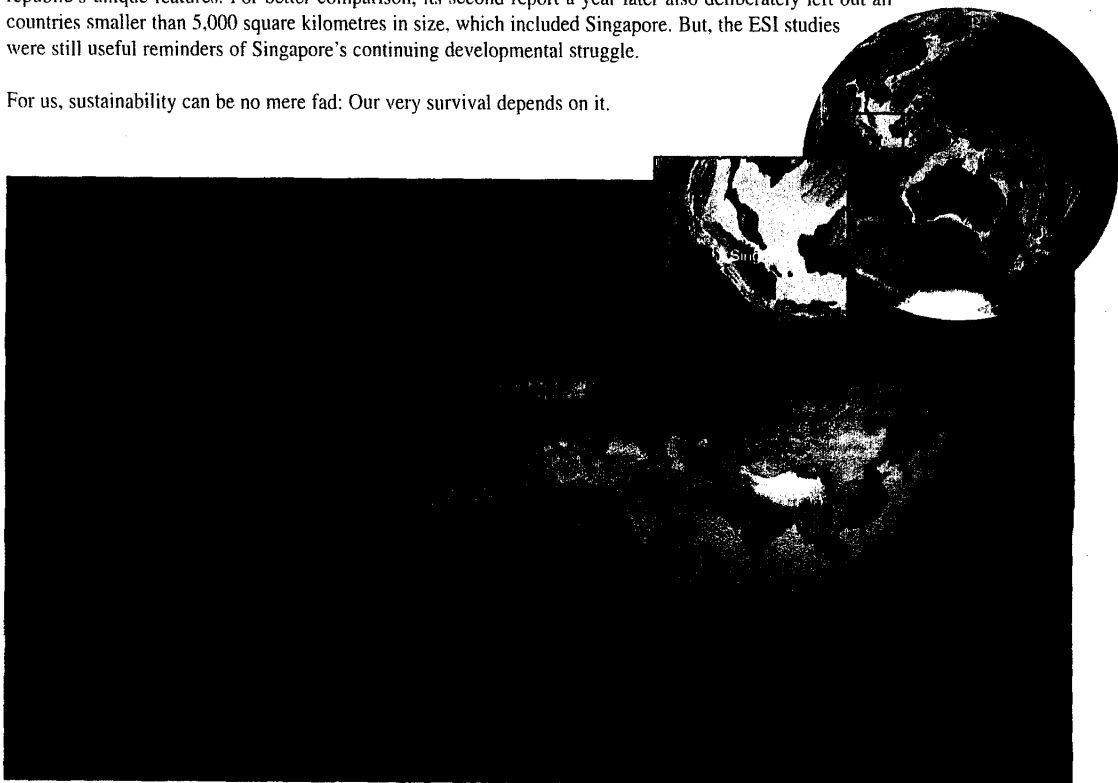
A LOOMING DOOM!?

The world faces the threat of environmental disaster brought on by unsustainable consumption patterns and the overexploitation of natural resources. Will Singapore too fall prey to such a threat?

With only 682 square kilometres to its name, land-scarce, water-short and energy-poor, the Garden City poses severe challenges to development planners. How does it support the four million people who live here? How does it find sufficient water to meet industrial and residential needs? How does it, indeed, ensure its continued existence beyond the lifespan of its present generations?

A preliminary project to derive an Environmental Sustainability Index (ESI), commissioned by the World Economic Forum and reported in Newsweek in late 2000, highlighted our fragile existence. The index rated Singapore among the worst 10 out of 122 countries. True, the ESI team's inaugural report published two months later re-rated Singapore 65th out of 122 after considering the republic's unique features. For better comparison, its second report a year later also deliberately left out all countries smaller than 5,000 square kilometres in size, which included Singapore. But, the ESI studies were still useful reminders of Singapore's continuing developmental struggle.

For us, sustainability can be no mere fad: Our very survival depends on it.





NOT IF WE CAN HELP IT

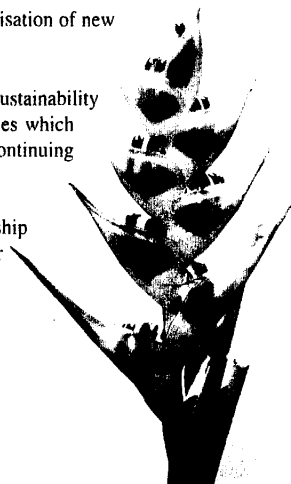
Our Green Plan for the next decade, in short SGP 2012, aims for the environmental consciousness that was borne out of our previous Green Plan to mature into personal responsibility for and civic commitment to the environment. It highlights our commitment to ensuring Singapore's sustainability.

To help save some trees, only key measures and targets in SGP 2012 are outlined in the following pages. A fuller version is available in pdf format in the attached CD-Rom, and on the Internet at www.env.gov.sg/sgp2012.

SGP 2012 will bring Singapore into exciting new areas yet untried in the city-state, such as the utilisation of new energy sources and the development of alternative water supplies.

Technology alone, however, will be insufficient to ensure sustainability. People are needed behind the sustainability drive. We look forward to continuing, fruitful partnerships with the business and civic communities which have been at the forefront of many environmental initiatives in recent years. We also look forward to continuing collaboration with our partners abroad, in the region and further afield.

Singapore has beaten the odds to come this far. If we continue to exercise wise and judicious stewardship of our resources, practise intelligent innovation and forge strategic partnerships, we will prevail over our limitations. There is much bloom yet in the Garden City.



“Because this land belongs to all Singaporeans, caring for it should be a responsibility that belongs to all.”

NO-WASTE LAND, NO WASTELAND

The sustainability of a small island-state begins with ensuring that physical land resources are not overwhelmed by the waste people generate.

At the moment, Singapore recycles about 44 percent of its waste. Most of the materials recovered come from the industrial and commercial sectors. The remaining waste is sent either for incineration at one of the four incineration plants, or to the landfill at Pulau Semakau.

Waste collection takes place daily, and covers all homes, industries, public places and even offshore islands. Regulations also stipulate how hazardous or bulky waste is to be disposed of. Illegal dumping, once rampant, is no longer a major problem.

Come 2012, we target to raise the waste recycling rate to at least 60 percent. A national waste recycling programme is in place to bring the means of recycling closer to homes and workplaces. In tandem with this, we also hope to reduce the need for additional incineration plants from the current one every 5 to 7 years, to one every 10 to 15 years, and longer if possible. Because of our limited land – only 682 square kilometres – we aim also for “zero landfill”, by minimising the amount of waste generated and recycling as much as is feasible.

CURRENT AND TARGETTED RECYCLING RATES FOR VARIOUS CATEGORIES OF WASTE

	Amount Recycled in 2001 (tonnes)	Current Rate (%)	Target Rate (%)
● Food	30,536	6	30
● Paper/cardboard	446,504	36	55
● Plastics	57,031	10	35
● Construction & Demolition	299,764	85	90
● Wood/timber	21,300	8	40
● Horticultural waste	88,793	32	70
● Ferrous metal	969,618	87	95
● Non-ferrous metal	101,881	85	90
● Used slag	205,411	90	95
● Glass	5,156	15	50
● Textile/leather	415	1	2
● Scrap tyres	6,823	59	75
Total	2,233,232	44	60

An aerial view of Pulau Semakau landfill.





Removing nails from wood so that the latter can be recycled

BOOSTING WASTE MANAGEMENT AND RECYCLING INDUSTRY

The JTC Corporation, the largest developer and manager of industrial estates in Singapore, recently set up a 19-hectare pilot Eco-Recycling Park at Tuas in western Singapore, dedicated to the recycling of industrial waste, especially plastics, paper, glass and wood.

The site enables recycling companies to cluster together to leverage on economies of scale and proximity to the industrial estates, as well as the Tuas Incineration Plant. Factories on the site are given 30-year leases, long enough for their heavy initial investments to pay off.

Already present is a plant making bricks from waste, and another recovering solids like wood and glass. In the pipeline, to be ready by end-2002, is a fully-automated waste sorting plant which will speed up the recycling process tremendously and encourage more players to enter the recycling market.

The Waste Management and Recycling Association of Singapore (WMRAS), which was set up in September 2001, has tied up with the internationally-acclaimed Solid Waste Association of North America (SWANA) and Waste Management Association of Australia (WMAA) to help it learn more about best practices in industrial recycling. It is also looking for similar partners in Europe.

BOOSTING HOUSEHOLD RECYCLING

A National Waste Recycling Programme was launched in April 2001 to bring the means to recycle nearer to consumers, at their homes and workplaces. Recyclables like paper, plastics, cans, old clothing and glass bottles are collected directly from households once every fortnight on pre-determined days of the week. Recycling bins for paper, plastics, glass and cans are also placed at public places where there is high human traffic.

About 15 percent of Singapore's households took part in the recycling programme at its start. The figure went up to 22 percent early this year. The Ministry of the Environment continues to work closely with public waste collectors and grassroots community organisations to encourage more residents to participate. It aims to achieve a 50 percent household participation rate by 2003.



“Protecting a country’s natural capital while pursuing economic development is more difficult than keeping up with the world’s capital markets.”

IN HARMONY WITH NATURE



Singapore seeks to balance land use needs with its environmental inheritance through careful planning. As part of the strategic land-use plan for Singapore, care was taken to ensure that Singaporeans would have enough green space for rest and recreation, even in the midst of our urban city-state setting.

In the strategic land-use plan, sites identified as Nature Areas will be kept for as long as possible. These sites are areas where natural flora and fauna remain relatively undisturbed by human activity, and which provide food, shelter and breeding sites for diverse biological species. Three principles guide our selection of Nature Areas: They must be rich in biodiversity; they must be mature, not transient, sites, and they must be sustainable.

The core of Singapore’s Nature Areas is made up of the Nature Reserves in the Bukit Timah and Central Catchment Areas; here a full 2,100 hectares of forest enjoy legal protection from other development claims. Active management measures include the reforestation of degraded areas, and the gradual re-introduction of indigenous species back into the forests.

HERITAGE ROADS AND HERITAGE TREES SCHEMES

Singapore is well-known internationally as the Garden City, with mature trees and luxuriant greenery the fruits of our decades-old greening programme. To safeguard them from the adverse effects of more intense urbanisation, Singapore introduced the Heritage Roads Scheme and the Heritage Trees Scheme in August 2001.



Trees designated as “Heritage Trees” are of magnificent size, generally with a girth of at least 5 metres when measured 1 metre from the ground. Other considerations include their educational, historical and cultural significance. The charming old Tembusu tree (*Fagraea fragrans*) pictured here is located in the Singapore Botanic Gardens and is 5.3 metres in girth and 32 metres tall. It is native to Singapore and probably stood in the Botanic Gardens when the Gardens were first laid out in 1859.



The Heritage Roads Scheme was initiated by the Garden City Action Committee to safeguard the more scenic and significant tree-lined roads in Singapore. More than 50 such roads have been identified as “Heritage Roads”. Through the scheme, agencies and developers are encouraged to retain the mature trees and greenery when working out their development plans.

*At Sentosa's Siloso Beach on
World Environment Day 2002*



SAVE THE TURTLES

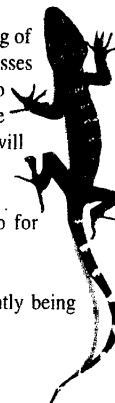
In September 2001, campers at the East Coast Beach spotted some 170 unusual eggs lying in the sand. They belonged to the *Haw Noddy*, an endangered sea turtle. To prevent them from being destroyed, the Agri-Food and Veterinary Authority of Singapore called upon a marine-turtle specialist for the delicate operation of moving the eggs to a laboratory at the Nanyang Technological University for artificial incubation. On 5 June, World Environment Day, 2002, some turtles hatched from the eggs were released back into the sea.

In 2001, in a historical milestone for Singapore, Sungei Buloh Nature Park and Labrador Nature Park were promoted from Nature Areas to Nature Reserves. They brought to four the number of nature reserves accorded legal protection under the National Parks Act. They were also the first to be accorded that status in post-Independence Singapore.

A survey of the flora and fauna in the Nature Reserves was carried out in the 1990s. The survey facilitated the zoning of the reserves for multiple and varied functions, ranging from recreation and the maintenance of ecological life processes to education and scientific research. A Recreational Masterplan for the Nature Reserves was formulated, taking into account the distribution of sensitive species. Biological databases were established, and these will go towards the setting up of a proposed National Biodiversity Reference Centre under the National Parks Board. The information will be made available on the Internet and will be accessible to everyone.

The centre will act as a clearing house not only for centralising biodiversity data about Singapore, but also for co-ordinating and facilitating research in biodiversity and ecology issues.

An inventory of the biodiversity of all the natural areas in Singapore – not just the Nature Reserves – is presently being considered. It will seek to verify and update information on indigenous flora and fauna.





Until it captured public attention in 2001, only die-hard nature-lovers knew about Chek Jawa on the eastern tip of Pulau Ubin. Most of the time, this jewel of an estuarine eco-system lies submerged under marine waters. The treasures it contains surface only a couple of hours for 4 days each month when the tide is low enough.

After careful study and consultation with nature lovers and experts, the Government decided in January 2002 to spare Chek Jawa from the land reclamation that had been planned years ago. Reclamation will now be deferred for as long as the land is not needed for other development purposes. The decision is an example of Singapore's constant balancing act between land use needs and consideration for nature conservation.

Over the past year, many Singaporeans have braved the bumpy boat ride and muddy tracks to see, feel and touch Chek Jawa's rich biodiversity. Here, nestled in sand and mud flats, varieties of starfish, sea horses and octopi bask in the tropical sun. Sea-grass meadows harbour carpet and peacock anemones. The coral rubble plays host to sponges exuding sheer exuberance of colours and texture.





SUNGEI BULOH WETLAND RESERVE

Picture a tranquil and balmy day outdoors, with the gentle lapping of water just beneath your feet. Where trees with fantastic aerial roots rise straight out of the water. Where splashes in the water give clues to the myriad life forms lurking beneath. Where the stillness is broken only by the calls of the kingfisher and its mate.

Welcome to Sungei Buloh Wetland Reserve. Situated at the northern tip of Singapore, overlooking the Straits of Johor, this wetland park is covered mostly by mangroves, and to a lesser extent, freshwater ponds. At low tide, wide stretches of mudflats lie exposed, their harbour of crabs, shellfish and worms serving as a tempting feeding ground for birds.

Indeed, it was the birds that first drew attention to this quiet mangrove habitat. For years, migratory shorebirds such as sandpipers and plovers made their annual pilgrimage down south to escape the cold winters of the Siberian tundra. Singapore, and in particular, Sungei Buloh, is in the flight path of these birds. It is at Sungei Buloh that the birds rest and feed, to recuperate from their travels and to prepare for the next leg of their journey.

In 1986, a group of avid birdwatchers from the then Malayan Nature Society (Singapore Branch) stumbled upon this ecological jewel, and subsequently wrote a proposal to the government for its conservation. The then Parks & Recreation Department, a precursor to the National Parks Board, undertook the development of Sungei Buloh, in consultation with experts in the field, notably, the Wildfowl & Wetlands Trust from the United Kingdom, Jurong Bird Park, Worldwide Fund for Nature and the Malayan Nature Society (Singapore Branch).

Over the years, the unique place that is Sungei Buloh charmed people from all strata of society to support its cause. It welcomed its 100,000th visitor in 1994. In 1997, the Park found its corporate sponsor in HSBC, which set up the Sungei Buloh Education Fund in support of its nature outreach programmes. In 1999, Woodlands Secondary School became the first school to adopt the park. It was followed by Commonwealth Secondary School two years later.

On 10 November, 2001, National Development Minister Mah Bow Tan announced that Sungei Buloh would be one of two parks to be gazetted as Nature Reserves. The applause that erupted was wholly spontaneous. Sungei Buloh is a natural heritage to Singaporeans and an internationally important site for the conservation of migratory shorebirds.

The next time you visit this wetland reserve, ponder on the unassuming muteness of its mudflats and marvel at how a park in tiny Singapore has a role to play in the world's stewardship of diversity.



“Moving upstream towards cleaner energy sources is key to sustainability.”

CLEAN AIR ALWAYS

Despite being densely-populated, heavily-industrialised and with almost 700,000 vehicles on the road, Singapore’s ambient air quality is usually well within the “good” range of criteria set by the United States Environmental Protection Agency (USEPA). This has been possible because of stringent controls on pollutive emissions and strict vigilance over air quality. Monitoring stations located all over the island track concentrations of pollutants such as sulphur dioxide, oxides of nitrogen, carbon monoxide, ozone and respirable suspended particles in the air.

We are now moving “upstream” to ensure that Singapore’s air stays clean in the years to come. A National Energy Efficiency Committee was set up in 2001 to spearhead programmes to encourage more efficient use of energy by industries, homes, commercial buildings and vehicles. Energy-efficiency benchmarks will be established for buildings like offices, hotels and public housing. Where useful, fiscal incentives may be introduced to motivate the private sector towards greater energy efficiency. A labelling scheme that differentiates energy-efficient electrical appliances from less energy-efficient ones has been introduced to help consumers make better-informed choices.

NATURAL GAS BUSES

Compressed natural gas (CNG) vehicles emit negligible particulates and significantly less carbon monoxide and hydrocarbons than diesel vehicles. They also emit less carbon dioxide, a greenhouse gas, and are less noisy than diesel vehicles. A pilot project to introduce CNG buses is underway in the Jurong area. A refuelling station has been set up and by end 2002, there will be 12 CNG buses serving Jurong East and Jurong Island.



The search for cleaner-burning fuels continues today with a major initiative to replace fuel oil with natural gas in power generation. The target is for 60 percent of Singapore's electricity needs to be met by natural gas by 2012.

Singapore is embarking on an exciting project that aims to recover waste heat from the petrochemical plants on Jurong Island to power a centralised cooling system for the Jurong Industrial Estate. Expected to begin operating in 2008 when it is assessed to be more economically viable, the system could slash more than 20 percent off the Jurong Industrial Estate's cooling bill. According to current estimates, Jurong Island produces so much waste heat that harnessing and channelling it to good use would remove 60,000 tonnes of carbon from the air a year.



FLAMINGOES IN BIRDPARK

In the heart of the Jurong Industrial Estate in the western part of Singapore, where millions of industrial products ranging from sausages to sequins to semi-conductors are churned out everyday, lies the Jurong Bird Park. Here, 8,000 birds from 600 species live on 20 hectares of land, their fate dependent on the effectiveness of Singapore's air quality control measures.

USING CLEANER FUEL: TUAS POWER STATION

Tuas Power Station has two power plants which together supply about one-quarter of the electricity demand in Singapore. It uses two types of fuel to generate electricity: fuel oil in its conventional steam turbine power plant, and natural gas in its combined-cycle power plant.

The conventional steam turbine power plant has a capacity of 1,200 megawatts while the combined-cycle power plant can produce up to 735 megawatts of electricity.

Another 735 megawatts combined-cycle power plant using natural gas is planned by 2006. This will increase the Tuas Power Station's total production capacity to 2,670 megawatts.

HOW NATURAL GAS IS USED:

The natural gas is fed to the gas turbine and ignited with compressed air to produce high temperature hot gases. The hot gases expand through four stages of the turbine to drive the compressor and generator to produce electricity.

The hot exhaust gases from the gas turbine is ducted to the heat recovery steam generator where heat from the hot exhaust gases is extracted to produce high pressure and temperature steam. The steam is used to drive the steam turbine to produce more electricity.

WHY NATURAL GAS IS USED:

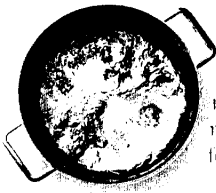
The natural gas-fired combined cycle power plant has a heat efficiency of 50 percent, better than the 40 percent for a conventional oil-fired power generation plant.

Because natural gas is a clean fuel, the plant does not emit sulphur dioxide. It emits only negligible amounts of particulate and less carbon dioxide than power plants run on fuel oil.



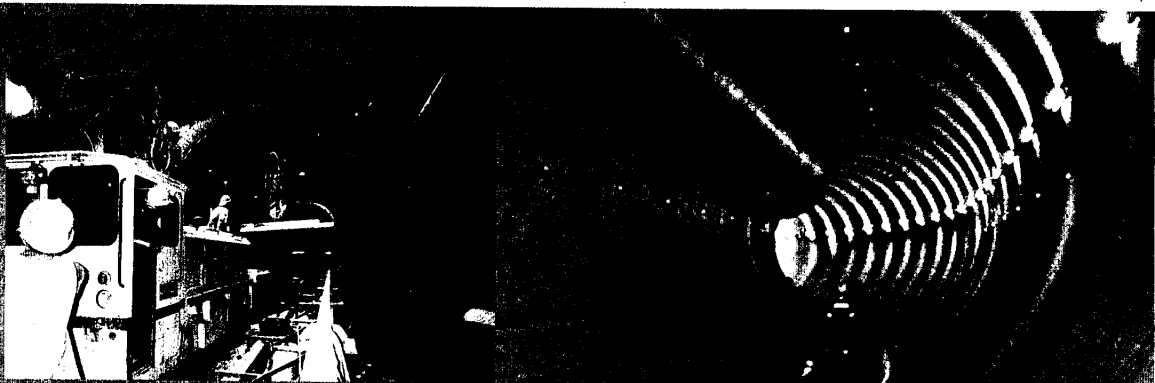
"We must be bold and innovative in our search for new water sources to augment existing ones."

KEEPING THE FLOW



Singapore consumes about 1.4 million cubic metres of water a day. Besides tapping rainwater from local sources, Singapore also imports water from Malaysia. Conservation practices are mandated by law for industrial premises and strongly encouraged in domestic households. Proper metering and operational checks on pipelines and water mains ensure that as little water is unaccounted for as possible. Right pricing has also generally kept water demand growth from rising excessively.

Singapore's challenge in the coming years will be to ensure the sustainability of our water supply. Water catchment areas, which now account for half of Singapore's land, will take up to two-thirds of the island with the building of more reservoirs, canals and drains to catch and channel rainfall. By 2009, the Marina Basin will be converted into a freshwater reservoir, while new reservoirs will be developed downstream of the present Lower Seletar Reservoir. Reservoirs in Singapore will also be linked so as to maximise the yield of the various catchment areas.



TUNNELS OF SUSTAINABILITY

Singapore's \$7-billion Deep Tunnel Sewerage System is its long-term solution for treating every drop of used water cost-effectively before discharge into the sea. It also holds promise as a potential large-scale supply of used water for reclamation as NEWater.

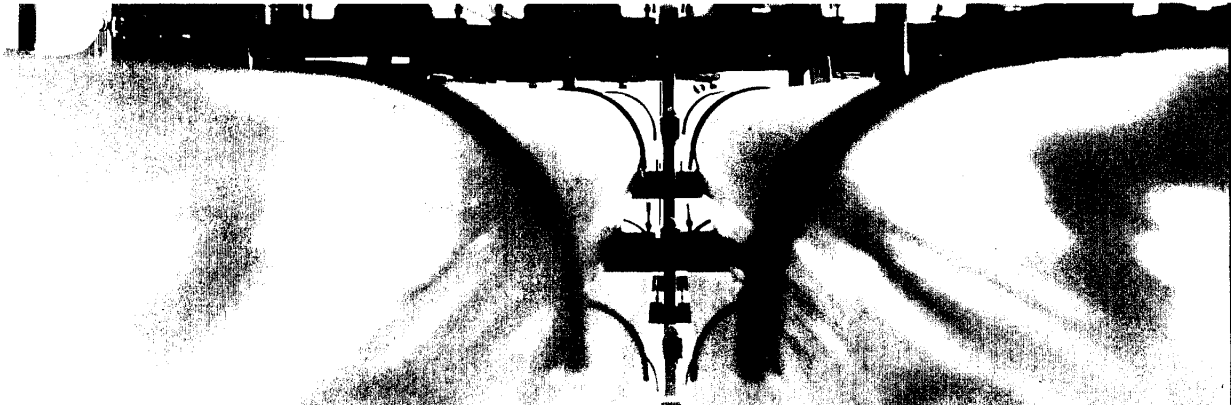
The scene is straight out of *Lord of the Rings*. Deep in the bowels of the earth beneath Singapore, tunnels wide enough for cars to drive through are being dug by sophisticated machines. When completed, these tunnels will span the length and breadth of Singapore. No goblins will scurry through them though. Instead, it will be used water from homes and factories that will fill their depths.

That used water will course through some 80 kilometres of these tunnels, which slope downwards towards the final treatment works, one in the east and the other in the west.

At these treatment plants, used water undergoes comprehensive physical and biological treatment processes.

The challenge is to treat and recover treated used water cost-effectively.

In the long term, after the Deep Tunnel Sewerage System is in place, the land on which the water reclamation plants and sewage pumping stations sit on can be released for other uses in the land-scarce republic.



NEW WATER FROM OLD

Gleaming white ceramic and steel tubes catch your eye as you enter the high-grade water reclamation plant at Bedok. "Missiles!" you think. Then you discover that inside these futuristic-looking tubes, water is speeding through faster than your eye can follow. It enters as treated used water, and exits as pristine as distilled water.

The treated used water is of a quality that meets international discharge standards to the sea. However, there are still suspended and dissolved solids, and organic material in the water.

At the NEWater plant, this water undergoes several stages of further purification, bringing it to high-grade water standard. The first is microfiltration/ultrafiltration in which the water is pumped through membranes, in the form of polypropylene hollow fibres with pore sizes 100 times smaller than a human hair. Suspended solid particles, viruses and protozoa are retained on the membrane surfaces. At this stage, the filtered water is already crystal clear.

In the next step, reverse osmosis, the water is driven by high pressure across a thin film composite polyamide membrane. This removes organics, dissolved salts and remaining viruses.

As an added safety barrier, the high-grade water undergoes ultra-violet disinfection. Finally, the acid-alkali or pH balance of the high-grade water is restored.

Out comes NEWater – used water given new life. It is a new frontier for sustainable water supply for Singapore.

It is clean too, as it exceeds drinking water standards set by both the World Health Organisation and the United States Environmental Protection Agency.



More than 37 square metres of composite polyamide membrane is coiled lightly in each "missile" tube.

Singapore will also be diversifying its sources of water more. It is envisaged that by 2012, non-conventional sources will account for at least 25 percent of our water consumption. The first large-scale desalination plant, with a capacity of 136,000 cubic metres per day, is scheduled to be ready by 2005.

By end-2002, two high-grade water reclamation plants at Bedok and Kranji will use the state-of-the-art dual-membrane technology (microfiltration/ultrafiltration and reverse osmosis) to produce 72,000 cubic metres a day of high-grade reclaimed water, called NEWater. The first phase of a dedicated reticulation system will be ready by 2003 to allow industries to take full advantage of NEWater's low total organic carbons for their process needs.

By 2010, the supply of NEWater to the industrial and commercial sectors is expected to exceed 250,000 cubic metres a day, or more than 15 percent of Singapore's total water needs. NEWater could also be considered for indirect potable supply.

Water reclamation is sustainable and environmentally-friendly. It is an important source of supply because it multiplies existing supplies, instead of merely adding to it. A 50 percent reclamation rate, for instance, eventually doubles our water supply, while a 75 percent reclamation rate leads to four times the initial amount.

“A country’s sustainability does not depend only on what it has – it depends also on what it does not.”

THE UNSEEN OPPONENTS

Since Independence in 1965, Singapore has built on the foundations left by the British to bring about a good standard of public health. Tropical infectious diseases are well under control. The World Health Organisation declared Singapore malaria-free in November 1982. The average life expectancy today is 78 years and the infant mortality rate has declined sharply to 2.2 per thousand livebirths. Childhood diseases such as poliomyelitis and diphtheria are non-existent. The result: Foreign diplomats and business executives have no hesitation bringing their families, including young children, here with them.



To ensure that Singapore’s public health standards remain excellent, disease surveillance and response systems will be strengthened. New laboratories are being set up and existing ones upgraded to identify dangerous infectious diseases and viruses swiftly. They also monitor food safety and try to pre-empt international health problems from reaching Singapore.

The universities and research institutes work with the relevant partners in government and industry to do research into disease control.

An interesting new project being explored is a syndromic reporting system, called the Rapid Syndrome Validation Project, that will help doctors identify symptoms and signs of potential infectious diseases, including those which might be the result of bio-terrorism.

Despite Singapore’s success in attaining high levels of public health so far, there can be no armistice in the unceasing battle against disease.



Checking that supermarket food is stored at correct temperatures



Mechanized sweepers keep Singapore roads clean, safe and effectively.

This little insect is a killer.



ENVIRONMENTAL HEALTH INSTITUTE

Launched in April 2002, the Environmental Health Institute (EHI) in Pasir Panjang conducts applied research to develop innovative and cost-effective ways of combatting vector-borne diseases, in particular those transmitted by mosquitoes. Its location in Science Park II gives it a useful proximity to other biotechnology laboratories. It enables the EHI to work more closely with institutions that are developing vaccines for dengue. It also enables the EHI to tap the genetic technology of the life sciences laboratories to identify mosquito species more rapidly, from a few days in the past to within an hour today.

VIRUSES, R.S.V.P

The Rapid Syndrome Validation Project (RSVP) is Singapore's planned response to the heightened threat of environment-related diseases and bio-terrorism. Still in the exploratory stage, it is intended to enable rapid response to sudden outbreaks of diseases like botulism and smallpox.

The project will involve selected general practitioners who will be enlisted as "sentinels" to help detect signs of emerging infectious diseases. These doctors will be equipped with a specially-designed software programme that enables them to report – real-time – suspicious or unusual combinations of signs and symptoms in patients. They will also be able to check if similar symptoms are being reported elsewhere, again real-time.

These computers form the nodes of an international syndrome-based reporting system, with reportable syndromes configured to detect emerging infectious diseases or bio-terrorisms according to local context. Once a pattern emerges from these reports, action can be taken rapidly to counter and contain the outbreak.

“No country is an island: We need the collaboration of others to enhance our own sustainability.”

EVERYMAN'S EARTH, AND EVERY COUNTRY'S TOO



1992 – the year Singapore launched its first Green Plan – was an important milestone in Singapore's convergence towards a more sophisticated understanding of the global community's green consciousness. Environmental awareness was kindled as schools set up Environment Clubs and grassroots bodies joined in with enthusiasm. Environmental issues are today woven into the teaching curriculum of all national schools. Environmental law, environmental engineering and environmental management are fast becoming popular courses to sign up for at university: The National Institute of Education/Nanyang Technological University in 1998 even made environmental studies a compulsory module for all arts and science undergraduate degree courses.

This year, as Singapore launches its Green Plan for the next decade, we aim for that environmental consciousness to mature into personal responsibility and civic participation. We aim for a population that is not only environmentally aware, but also committed to positive action and crucial community partnerships among the people, private and public sectors. The Ministry of the Environment helps by being a network facilitator, fostering closer relationships with employers, employees, civic groups, educators and the media to strengthen and deepen the message of environmental sustainability.



Citizens doing their part for the environment.



Children learning about protecting the environment.

Singapore believes in working with the relevant partners abroad to address environmental challenges, many of which are transboundary in nature. We also believe in sharing our experience and expertise with fellow developing countries, and have a number of programmes for this purpose. We are a party to various key multilateral agreements on the environment, and will continue to meet our obligations under these important international treaties. We will also continue to seek environmental partnerships at the bilateral, regional and international level with a view to contribute towards the global goal of sustainable development.



SINGAPOREANS DO THEIR BIT FOR THE ENVIRONMENT

Earth Day in April, World Environment Day in June and Clean and Green Week in November are occasions when the message to protect the environment goes out on a sustained and concerted basis to Singaporeans, at home, at work, or in school. Crucial to their success is the involvement of the dozens of companies and community organisations in the effort.

EDUCATION IS MORE THAN BROCHURES

A myriad of groups, both government-related and non-government, organise a rich variety of programmes to make caring for the environment a lifelong interest and commitment for Singaporeans of all ages. The following is a sampling:

GROUPS

Green Volunteers Network

Started in 1997, the Green Volunteers Network now has about 800 volunteers who offer their time and assistance for nature walks and other environmental programmes.

Habitat Forum

Habitat Forum is a community-action group that aims to alleviate littering problems in Singapore and to foster a culture of civic-mindedness for a clean environment. In 2001, members interviewed littering offenders undertaking their corrective work orders to find out their views on the problem. In 2002, they organised a dialogue session on littering jointly with the Ministry of Community Development and Sports.

National Parks Board

The National Parks Board reaches out to people from all walks of life to promote appreciation of Singapore's rich natural inheritance. Groups can take part in "Nature Hunts" in the Sungei Buloh Wetland Reserve, or take guided walks in the Singapore Botanic Gardens and along the Sensory Trail on Pulau Ubin. Volunteer guides are often at hand to share their passion for nature and wealth of knowledge.

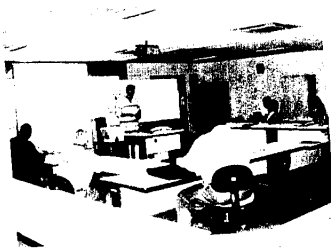
Nature Society (Singapore)

The Nature Society (Singapore) is a non-government, non-profit organisation dedicated to the appreciation, conservation, study and enjoyment of the natural heritage in Singapore. Malaysia and the

surrounding region. First started in 1954 as the Singapore branch of the Malayan Nature Society, it is one of the oldest NGOs in Singapore, and one of the most active in nature conservation matters.

Waterways Watch Society

The Waterways Watch Society patrols Singapore waterways weekly to help keep them clean and free of pollution. They send regular reports to either the Ministry of the Environment or the Maritime and Port Authority of Singapore based on their patrols.



Singapore believes strongly that developing countries must work together in order to overcome resource and capacity constraints. Under the aegis of the Singapore Co-operation Programme, regular training courses are conducted on a range of topics for participants from fellow developing countries. These include:

- ① The Singapore Technical Assistance Programme for Sustainable Development, which covers subjects like environmental management, water and wastewater engineering, environmental technology and urban transport planning and design. Since its 1997 launch, more than 330 officials from over 65 developing countries have attended courses under this Programme.
- ② The Third Country Training Programme, which provides training in collaboration with a developed country, a regional partner, or an international organisation. Programme topics have included solid waste and wastewater management,

PROGRAMMES

Thumbs Up for Earth

This programme trains pre-school teachers to develop environmental values in children through the use of songs, nursery rhymes, games, storytelling and outdoor activities.

Journey Through Our Sewers

This programme teaches school children how the Public Utilities Board manages, collects and treats wastewater.



Smile at the Beach

Through a hands-on clean-up session at the beach, this programme teaches students the importance of keeping the beaches clean so that the waters will not be polluted.

"How Green is Your School?"

This is a green audit designed to promote awareness of resource conservation in schools. Students calculate the school's usage of water and electricity, and the amount of waste generated. From these findings, they suggest ways to cut down on unnecessary usage, and to reduce and recycle garbage that is generated.

National Youth Achievement Award Council's Youth Environmental Award

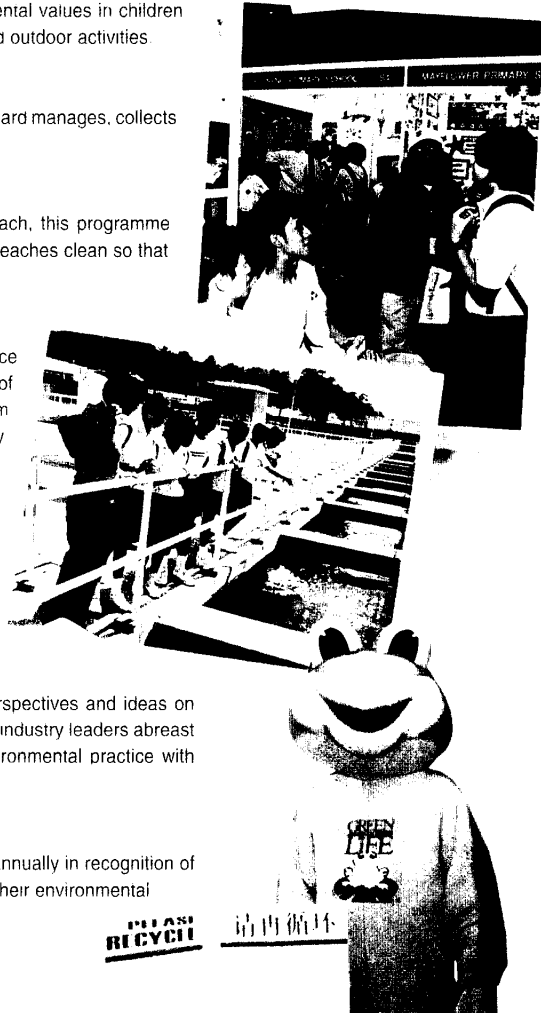
Established in 1998, the award recognises young people (aged 14 to 25) who have distinguished themselves in the area of environmental protection and nature conservation in Singapore.

Singapore Environment Lecture

The annual lecture, started in 1998, hopes to introduce new perspectives and ideas on business and the environment. It facilitates networking and keeps industry leaders abreast of innovations and developments that help synergise good environmental practice with sound business.

Singapore Environment Achievement Award

The Singapore Environment Council (SEC) gives out this award annually in recognition of efforts by local companies and government agencies to improve their environmental performance.



pollution control and marine environmental management. Partners have included Japan, Norway, Australia, the World Bank and the Asian Development Bank. Some 200 environment officers from more than 20 Asia Pacific countries have benefited from these regional programmes.

③ The Small Island Developing States Technical Co-operation Programme, which was launched in 1999. It provides training opportunities to 300 government officials from small-island developing states over five years.

Singapore hosted the preparatory meeting of the Alliance of Small Island States, a 43-member coalition of small-island developing countries, for the World Summit on Sustainable Development (WSSD). Jointly organised with the United Nations, the 5-day meeting in January 2002 concluded with a formal submission, called the Singapore Declaration, to the WSSD preparatory process. The Declaration contained detailed proposals on the next steps for small-island states to pursue sustainable development.

“For a small island-state, sustainability means climbing up and staying high on the learning curve of environmentally-friendly development as soon as it can.”

INNOVATING TOWARDS SUSTAINABILITY

Sustainable development is development that meets the needs of the present generation without compromising the ability of future generations to meet their needs. For resource-poor Singapore, it means being at the forefront of innovation and risk-taking. It means being eclectic in borrowing and adapting best practices from around the world.

Water supply will be one of Singapore’s biggest sustainability challenges in the coming years. We envisage that water reclamation, or recovering usable water from used water that would otherwise be disposed of, will play an increasingly important future role. It helps Singapore “short-circuit” the conventional water cycle, and also augments supply by multiplying it.

Energy-wise, Singapore is moving towards less environmentally-pollutive fuels like compressed natural gas and alternatives like hydrogen gas and solar power.

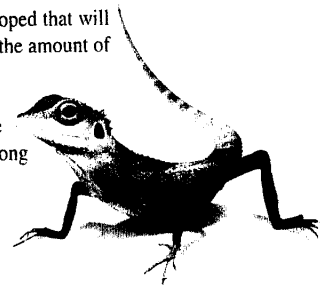
CAR OF THE FUTURE

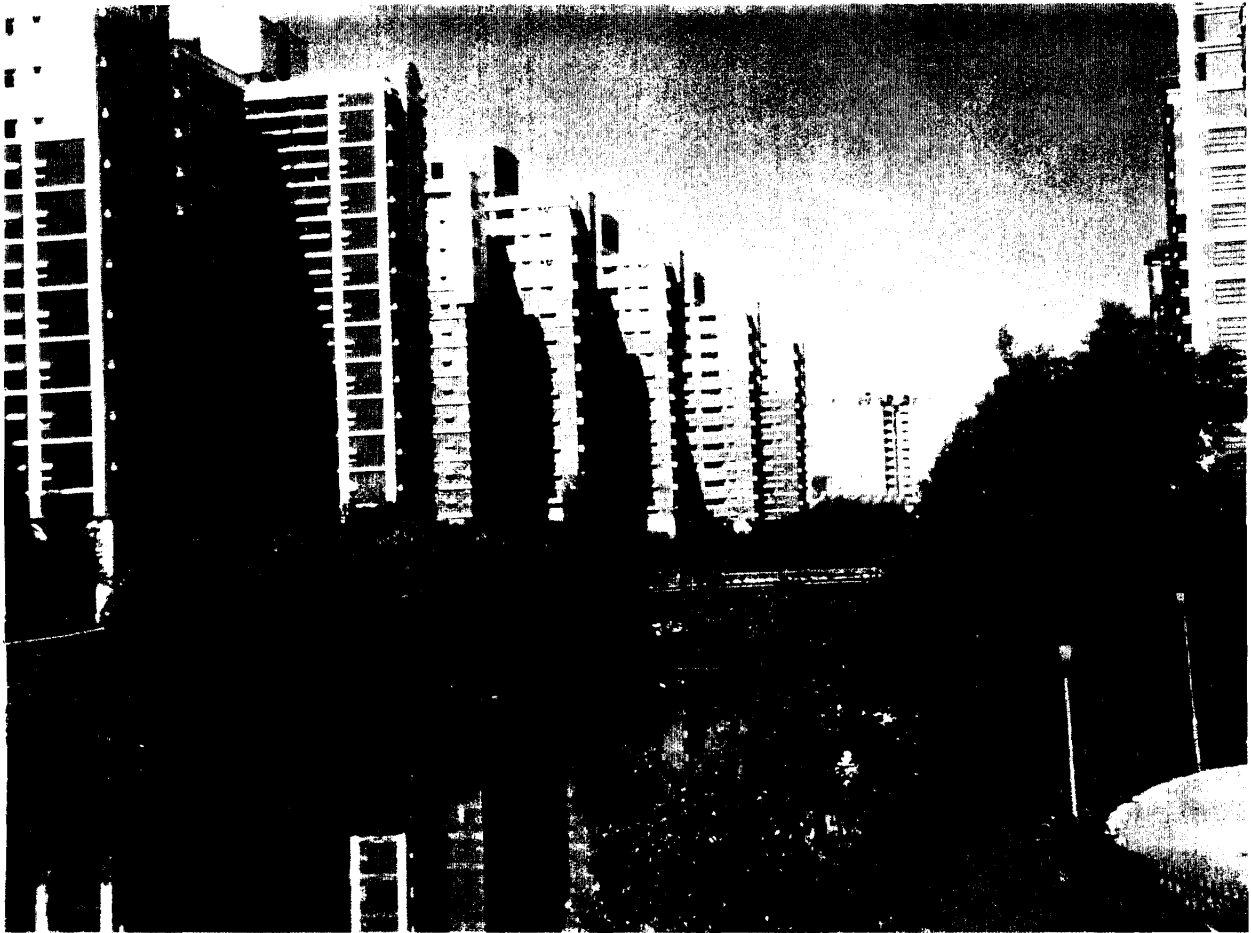
Singapore is one of the few countries in the world where cars that emit no sulphur dioxide, only steam and water, are going to be tested out. To provide the hydrogen fuel that these experimental vehicles need, BP is developing a hydrogen-refuelling infrastructure in Singapore, to be ready by 2003. Car manufacturer DaimlerChrysler plans to road-test a fleet of 10 to 20 “New Electric Cars” or Necars once the refuelling infrastructure is in place.



To conserve Singapore’s limited land, a gravity-driven Deep Tunnel Sewerage System is being developed that will free up substantial tracts of land for other uses. We also aim eventually for “zero landfill” – reducing the amount of waste generated to an extent that no additional land need be set aside for landfill purposes.

To assist in the regeneration of nature, the National Parks Board has taken proactive measures like the re-introduction of indigenous species into nature areas, and the rehabilitation of mangroves along some coastal areas affected by land reclamation.





REGENERATED MANGROVES AT SUNGEI API API

Pasir Ris Park in the north east of Singapore is home to a community of mangroves with one of the highest concentration of mangrove species, some of which are considered endangered locally. Against a skyline of tall residential flats, you can observe mudskippers grazing, and displaying their territorial and mating behaviour in the canals that drain through the park during low tide. Fiddler crabs can be seen easily at the sandy areas at the eastern-most edge.

Yet life was not always so idyllic here. Twenty years ago, the ecosystem here hung in the balance as reclamation work was carried out for the construction of Pasir Ris Park. To save the mangroves, the National Parks Board embarked on a historic experiment: remove the mangroves, do the requisite drainage work, re-create the natural river embankment, and re-establish the original mangrove habitat. The experiment worked: Today, the site looks so natural that few are aware that Nature had a helping hand from Man.

Singapore aims to become a hub for environmental technology, a role it is well-equipped to play as it has a good knowledge and technology infrastructure, strong protection for intellectual property rights, and a government that is committed to supporting research and development activities. It will also give us an advantage in the early adoption of technology that can boost sustainability.

Singapore has set up a \$20-million Innovation for Environmental Sustainability Fund to provide financing for projects that will help Singapore attain its goals of environmental sustainability. It is a fund that any Singapore-registered company can apply to if it has an idea that shows strong innovation qualities as well as the early adoption of emerging technologies.



An artist's impression of One North

ONE-NORTH: AN ECO-FRIENDLY BIOPOLIS

One-North is Singapore's multi-billion dollar icon of the New Economy. Being built at Buona Vista, it is envisioned as a vibrant Biopolis where a critical mass of talented entrepreneurs, scientists and researchers work, live and play.

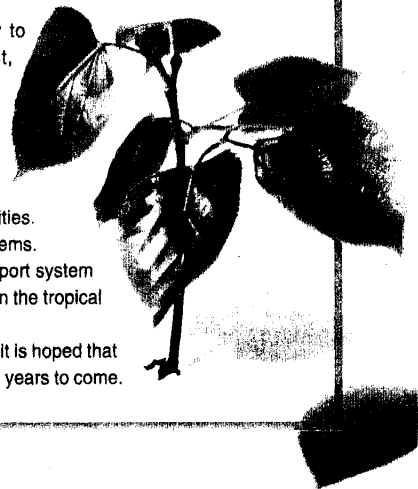
What distinguishes One-North from most other Science Parks is the widespread application of environmentally-friendly practices on its premises. Recycled materials will be used wherever practical – for roads, road curbs, paving bricks, flooring, doors, and furniture. Photovoltaic panels will be integrated into the building design to harness solar energy.

An underground network of pipes will convey solid wastes pneumatically to central bins. Water conservation will be designed into the living environment, through means such as water pressure regulation, self-closing sensor-operated sanitary appliances and landscaping using low water demand plants.



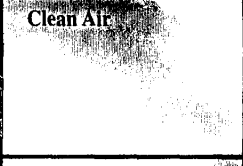
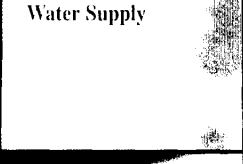




Both potable and non-potable water will be supplied. Used water will be channelled to the non-potable water system, after pretreatment, for non-potable uses such as the flushing of toilets and the watering of plants. Rainwater in the form of surface run-off will be collected and channelled to water treatment facilities. Treated, recycled water will be used for the cooling towers of air-conditioning systems.

Outside the building complex, a convenient, reliable and energy-efficient transport system will be in place to reduce dependence on cars. Linkways to shelter pedestrians from the tropical sun and rain will be provided, as will bicycle pick-up and parking facilities.

With the government's full backing and the private sector's active participation, it is hoped that One-North will prove to be a centre of scientific and environmental inspiration in the years to come.



AT A GLANCE: SUMMARY OF MAIN TARGETS IN SINGAPORE GREEN PLAN 2012

S/N	Area	Targets
1	 Waste Management	<ul style="list-style-type: none"> i) Raise the overall waste recycling rate from 44% to 60%. ii) Extend the lifespan of Semakau Landfill to 50 years, and strive towards "zero landfill" needs. iii) Reduce the need for new incineration plants, from the current one every 5 - 7 years to one every 10 - 15 years.
2	 Conserving Nature	<ul style="list-style-type: none"> i) Keep nature areas for as long as possible. ii) Verify and update information on indigenous flora and fauna through biodiversity surveys. iii) Put in place new parks and park connectors. iv) Set up a National Biodiversity Reference Centre.
3	 Clean Air	<ul style="list-style-type: none"> i) Strive for the Pollutant Standards Index to be within the 'good' range for 85% of the year, and within the 'moderate' range for the remaining 15%. ii) Meet 60% of Singapore's electricity needs through use of natural gas. iii) Extend use of natural gas in transportation beyond public buses and taxis. iv) Enhance public transportation as an attractive alternative to private cars.
4	 Water Supply	<ul style="list-style-type: none"> i) Increase catchment areas from 50% to 67% of Singapore's land surface. ii) Increase supply of water from non-conventional sources, such as desalination and water reclamation, to at least 25% of Singapore's water demand. iii) Ensure that water quality continues to meet international standards.
5	 Public Health	<ul style="list-style-type: none"> i) Become a leading regional centre in epidemiological surveillance and research on environment-related infectious diseases. ii) Retain low incidence of environment-related infectious diseases. iii) Develop a syndromic reporting system for the early detection of emerging infectious diseases. iv) Take pre-emptive action against international health problems reaching Singapore.
6	 Community Partnership	<ul style="list-style-type: none"> i) Step up public education on environmental protection and nature conservation. ii) Strengthen joint 3-P (public, private and people sector) ownership of environmental concerns. iii) Build stronger 3-P partnerships for environmental protection.
7	 International Relations	<ul style="list-style-type: none"> i) Continue to work closely with ASEAN neighbours on common environmental concerns. ii) Increase capacity-building partnerships with developing countries. iii) Intensify collaboration with partners at regional and global levels to tackle environmental challenges. iv) Remain committed to international environmental efforts and obligations under international environment treaties.
8	 Innovation	<ul style="list-style-type: none"> i) Enhance the environmental management industry in Singapore through greater use of technology. ii) Stay at the forefront of innovation and adopt best practices from the world to achieve environmental sustainability.

A Kuroki Abdul Rashid Ibrahim Adele Tan Shiao Ling Akbar Jhon Alvin Tan Amy Hing Andrew Chan Y K Ang Siew Kwai Angela Goh Angelina Ang Anne Liew B. K. Ng Belinda Yuen Benedict Lee Benedict Tan BP Singapore Pte Ltd Bruce Anderson Byong C J Ng Capt Khong Shen Ping Casey Tang Chan Kean Chan Kim Chwee Stephen Chang Siew Wen Chang Soo Yee Charles Foo Cheng Aik Toong Cheong Koon Hean Cheong Loong Fah Chew Ping Ting Chia Ah Tee Chia Hock Jin Chia Wee Boon Chiang Kok Meng Chim Chee Kong Chou Loke Ming Chris Keong Christina Goh Chua-Lim Yen Ching Col (Ret) Chua Tiong Guan Citiraya Holdings (S) Pte Ltd Colin Chee Cpt Chua Eng Kat Cynthia Lee DaimlerChrysler David Yan Desmond Chan Diong Cheong Hoong Edwin Khew Eileen Leow Eric Lim Eugene Heng Eugene Seah Eugene Tay Euston Quah

Singapore Pte Ltd F. Y. Szeto Boon Foong Hin Cheong Fung John Chye G Jagathisan Grosliere Gilbert Tan Goh Alan Goh Jiu Kiat Goh Lay Toh How Grace Tan Grant Mohamed Heng Chye Siew Lian Hong Yu Shun Environmental Science and Lau Hong Fai Jack Chuang James Soh Jan Tan Jarrod Chuan Jeffrey Lee Jenny R Matias Jonson Lai Joseph Kwa June Sim June Tay Vaithilingam Katherine Ng Kay Kuok Kelvin Ang Kho Soo Pei Khoo Hong Kheng Lian Koh Swee Guan Wah Lai Lee Tan Lam Keng Meng Seng Lau Khoon Chor Lee Bee Wah Lee Hee Boy Lee Keng Hai Lee Tzu Yang Leonard Lau Leow Meng Chiow Giap Lim Choon Lim Lim Hung Siang Lim Quee Yangchen Lo Nam Fatt Loh Wai Kiew Lok Kek Seng Look Boon Gee Low Koh Tien Sio LTC Chan Yoon Thomas Mah Yu Ling Mak May Yap Melissa Wong Wong Mike Ng Muhd Jamal Ng Cheng Siong Ng Kim Lik Noelene DeFoe Ong Lip Seng Ooi Ah Guat Ooi P Menon Pamela Lee Penelope Phoon Peter Peter Voegelé Poh Po Ting Shrinivas Raymond Chua Richard E Hale Richard Hoo Rodney Seow S Ganesh S J

Teong Chin Alvin Seah Bee Leng Seow Kah Ping SembCorp Cogen Pte Ltd Shawn Lum Shawna Sim Choon Siong Sim Pern Yiau Simon Tay Stan G Tebbe Stephen Wong Su Chee Chang Susan de Silva Susan Yang Suzaina Bte Abdul Kadir Sydney Chew Sze Thian Siong T.K. Ng Tam Li Phin Tan Ah Chor Tan Chee Chiang Tan Cheng Guan Tan Ee Khoon Tan Gee Paw Tan Hiang Seng Tan Hup Foi Tan Kim Sing Tan Peng Hwa Tan Sing Ong Tay Joo Hwa Tay Tong Seng Teh Joo Jing Teo Chai Seng Teo Yock Ngee Teoh Zsin Woon Tham Poh Kuan Thomas Frischmuth Thomas L Nelson Tjong Kiun Jin Tom Ng Tommy Ch'ng Tow Yin Tuas Power Limited Valentine Ng Victor Lim Victor Savage Voo Soon Sang Walter Yam Wang Hui Hua William Tan Wong Chong Wei Wong Kin Nyen Wong Kok Choen Wong Teck Hong Wong Teo Suan Wong Tuan Wah Wong Won Koon Woon Shih Lai Xie Rong Jing Yap Swee Cheng Yeo Ker Soon Yeoh-Looi Mei Fong Yio Su-San

The Ministry of the Environment wishes to thank all who have assisted in one way or another in the production of this book. In particular, we are indebted to the following for their expertise and knowledge which they shared so generously:

Agri Food and Veterinary Authority of Singapore
Asia Pacific Centre for Environmental Law
Building and Construction Authority
Energy Market Authority
Housing Development Board
Land Transport Authority
Maritime and Port Authority of Singapore
Ministry of Education
Ministry of Foreign Affairs
Ministry of National Development
Ministry of Trade and Industry
Ministry of Transport
National Parks Board
Nature Society (Singapore)
People's Association
Public Utilities Board
Review Committee for Conservation and Waste Minimisation
Review Committee for Environmental and Clean Technology
Review Committee for Environmental Education
Review Committee for Nature Conservation
Singapore Environment Council
Singapore Tourism Board
Waste Management and Recycling Association of Singapore
Urban Redevelopment Authority

We also express our gratitude to the three Focus Group Chairmen, Mr Chia Wee Boon, Mr Simon Tay and Prof Leo Tan, and hundreds of Singaporeans who contributed valuable insights and suggestions, through the focus groups and directly to the Ministry through letters and email. Without them, the Green Plan would not have been possible.

Our thanks also to Ms Chua Lee Hoong for writing the book, and the British rock band, Electric Light Orchestra, for use of its powerfully-evocative song lyrics.

Last but not least, we would also like to thank the following agencies, organisations and persons for their photo contributions:

National Parks Board
Public Utilities Board
Singapore Tourism Board
Singapore Zoological Gardens
Sungei Buloh Wetland Reserve
Singapore Press Holdings
BP Singapore Pte Ltd
ExxonMobil Chemical Singapore Pte Ltd
Tuas Power Limited
Little Skool House
Mr Lam Chuan Leong
Mr Francis L. K. Lim

ExxonMobil Chemical
Fong Wing Chor Foo Kim
Francis Phun Teow Kie
Geh Min Gek Fong Georges
Boey Keng Goh Hee Puay.
Guan Goh Lih Shiun Goh
W Pereira Haryati bte
Kiou Ho Kheng Hian Ho
Howard Shaw Institute of
Engineering Iris Goh Jac
Jagdish Ramakrishnan
Wee Jeffrey Chua Leong
Soh Jeraldine Ong Jonathan
Lai Tuck Kwong Josephine
Justin Taylor K.
Kathy Lai Kay Julia Diaz
Kelvin Sim Kheng Hua Iseli
Woo Koay Sim Huat Koh
Kok King Min Lai Chun
Gaik Lam Kit Wing Lam
Lawrence Koh Lee Bee Hua
Lee Hin Peng Lee Kai Meng
Lee Wai Chin Leo Tan
Hong Liew Chee Yin Lim
Hock Chye Lim Hock Kee
Huat Lim Soon Chung Lin
Tse Lynn Loh Wah Sing Loh
Loo Fey Shien Loo Kit Wan
Lip Low Seow Chay Low
Kum Lye Lin Heng Lynette
Yue Chong Mathew Yap
Michael Loke Michael
bin Abdullah Neo Koon Boo
Choon Ng Teck Lee Ng Tju
Hua Ong See Hee Ong Sin
Chwee Kim Ooi Giok Ling
Patrick H M Loh Paul Tan
Govindasamy Peter Sim
Poh Seng Choon Rai
Seng Chye Rebecca Yip
Robin Cheng Wak Heng
Hwang Sally Sally Tan Saw

THE SINGAPORE GREEN PLAN 2012

The Singapore Green Plan 2012 marks a new milestone in Singapore's journey towards sustainable development. It builds on our first Green Plan 10 years ago to ensure that even as we strive for economic progress, we leave behind an environment that will prevail in the long run. If we work together to implement the SGP 2012, we will be able to cultivate a nation of people committed to caring for the environment, and thereby to create a Singapore that our future generations can be proud of.



Published 2002

© Ministry of the Environment

Writer
Chua Lee Hoong

Design and production by **mcn** creative associates pte ltd

All rights reserved. No part of this publication may be reproduced or transmitted in any form or by any means, including photocopying and recording, without the written permission of the copyright holder, application for which should be addressed to the publisher. Such written permission must be obtained before any part of this publication is stored in a retrieval system of any nature.



Ministry of the Environment

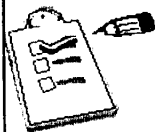
40 Scotts Road
Environment Building
Singapore 228231
Republic of Singapore
ENV Online: <http://www.env.gov.sg/sgp2012>

ISBN 981-04-6905-5

 This document is printed on recycled paper.

Singapore's Strategies on Solid Waste Management

Presentation by
Mr Dalson Chung
Resource Conservation Department
National Environment Agency

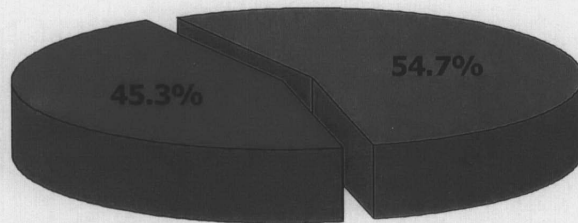


Presentation Outline

- **Background**
 - ✦ Refuse collection & disposal
- **NEA's Core Strategies for Waste Minimisation and Recycling**
 - ✦ Reduce waste to incineration plants
 - ✦ Re-use incineration ash to landfill
 - ✦ Reduce waste directly landfilled
- **Conclusion**



WASTE DISPOSED Domestic Vs Non-domestic Waste (2002)



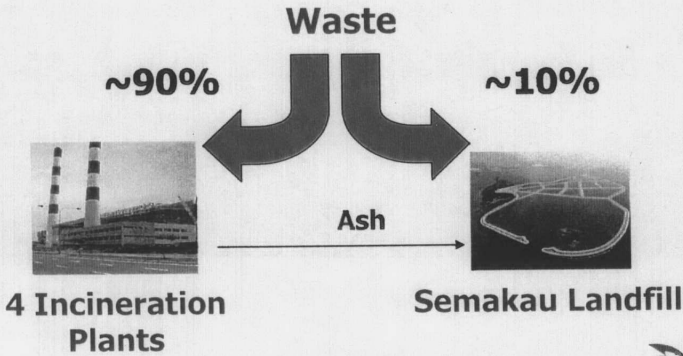
Non-domestic waste
3,258 tonnes/day

Domestic waste
3,934 tonnes/day

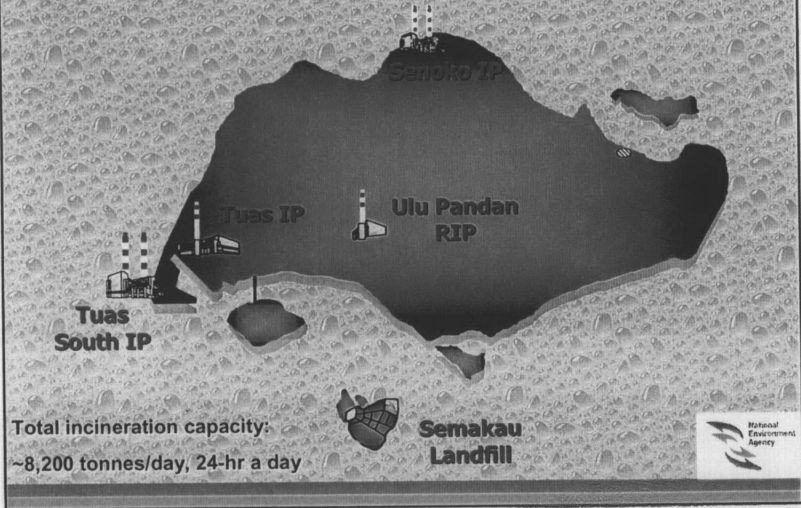
Waste Output : 7,192 tonnes/day

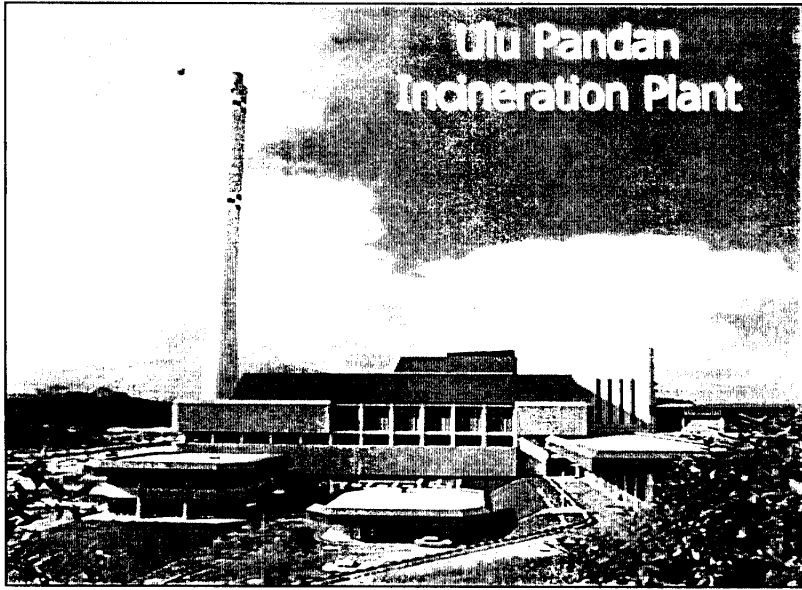


Waste Disposal Method

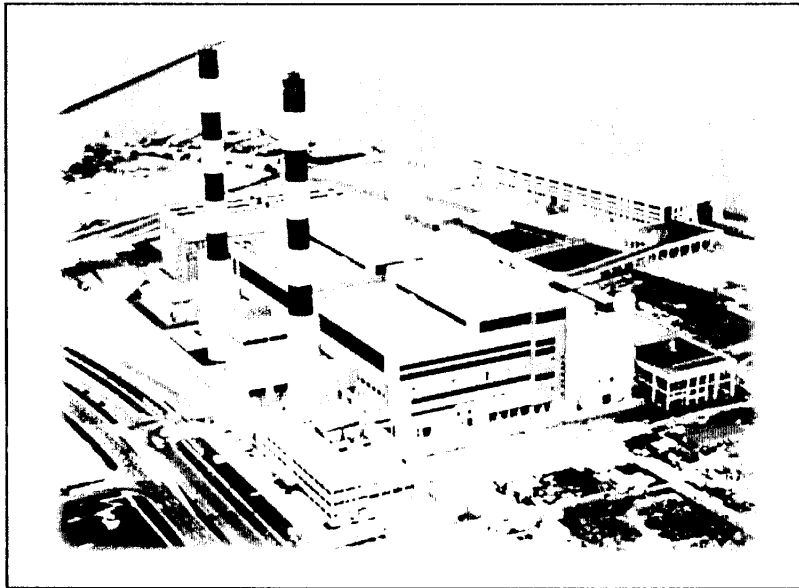


REFUSE DISPOSAL FACILITIES



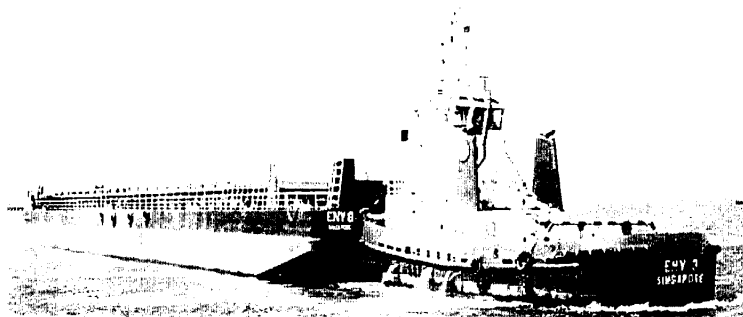


SENOKO
INCINERATION
PLANT



Landfill In Singapore

- **Last dumping ground on mainland Singapore was closed on 31 Mar 99 after 29 years (1970-1999) of operation**
- **Total amount of waste disposed of was about 20 million tonnes**

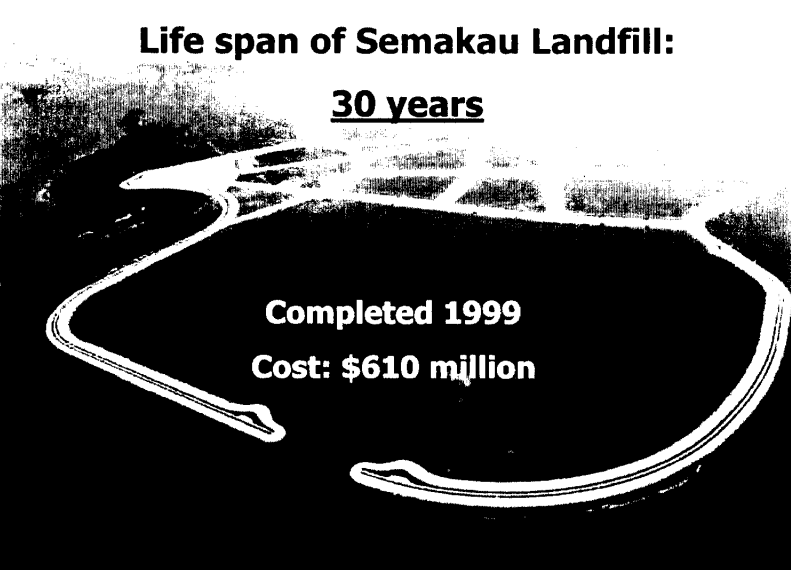


Barges transport waste materials



Life span of Semakau Landfill:

30 years






Completed 1999
Cost: \$610 million

WASTE CHALLENGES

Construction Cost of Incineration Plants is Very High

<u>IPs</u>	<u>Year</u>	<u>Capacity</u>	<u>Cost</u>
Ulu Pandan	1979	1,100 t/d	130 million
Tuas	1986	1,700 t/d	200 million
Senoko	1992	2,400 t/d	580 million
Tuas South	2000	3,000 t/d	890 million

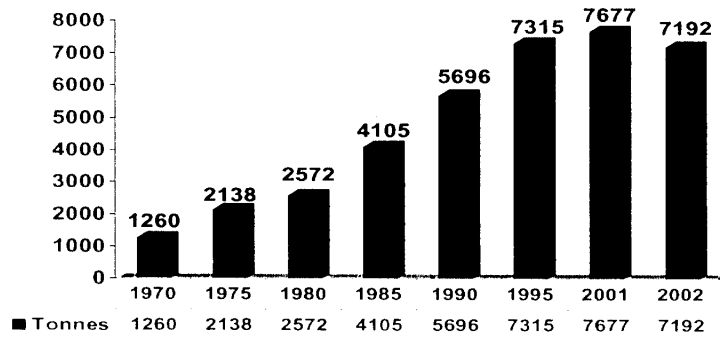




Challenges

- Scarcity of Land
- Costly Disposal Facilities
- Conservation of Resources



Waste Growth



• 1 new incineration plant every 5-7 years
...this is not sustainable



NEA's Targets



- Increase overall recycling rate
 - 44% in 2001 to 60% in 2012
- ENV/NEA strategies for sustainable solid waste management in moving Towards Zero Landfill:

Strategy 1: Reduce waste disposed of at incineration plants

Strategy 2: Re-use incineration ash to reduce landfill

Strategy 3: Reduce waste disposed of directly at landfill



Strategy 1 – Reduce Waste to IP



Increase Recycling Rate

Overall Recycling Rate :
44% in 2001 to 60% by 2012 (SGP2012)

Main waste streams:

- **Food/organic waste: 6% to 30%**
- **Paper/Cardboard: 36% to 55%**
- **Wood waste: 8% to 40%**
- **Plastic waste: 10% to 35%**
- **Horticultural waste: 32% to 70%**



National Recycling Programme

- Started in April 2001
- A structured and organised recycling programme for domestic households
- Require public waste collectors to set up recycling programmes for residential estates in the sector(s) they serve
- Public waste collectors to collect recyclables door-to-door
- Residents are given plastic bags and/or recycling bins
- Collection of recyclables is done once every fortnight



Common Recyclable Materials Collected for Recycling

- Paper
- Cans
- Glass bottles/glass jars
- Carton boxes
- Old clothing etc.



National Recycling Programme



- **NRP participation rate: 15% to 33%... to 50% by 2003**
- **Condominium participation: 4% to 30% by 2004**



Quality of Service (QOS) Standards

- Introduced on 1 Oct 2002
- Singapore is divided into 22 precincts for the implementation of the QOS standards.
- One permit for each precinct => only one recycling company is allowed to operate in each precinct .
- Permit holders are required to comply with minimum QOS standards.



Recycling Bins

- Orchard Road
- Holland Village
- Chinatown
- Raffles Place
- Hawker centres
- Food courts & Coffee shops
- Institutions
- Bus interchanges
- MRT stations
- Airport
- Flatted factories



Glass Recycling Programme @ Residential Estate



Recycling Bins @ BP Stations

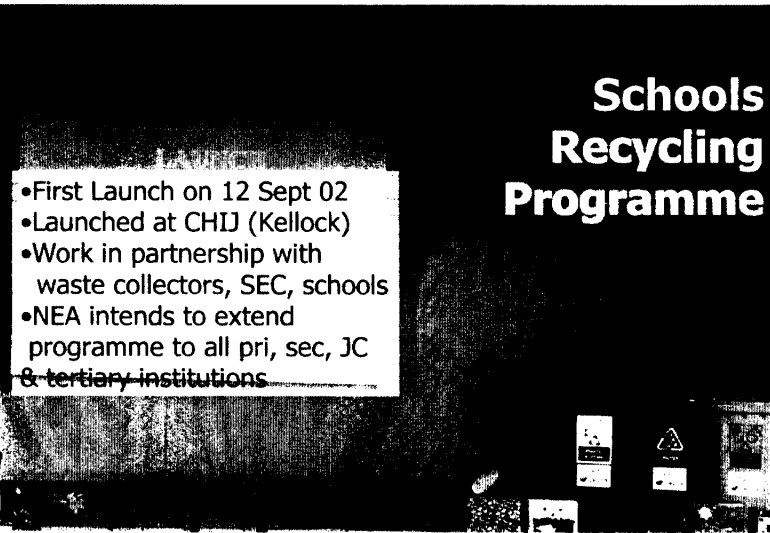


For
wastepaper
&
drink cans


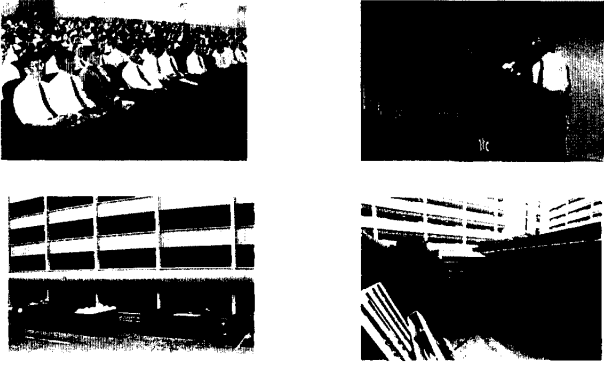


Schools Recycling Programme

- First Launch on 12 Sept 02
- Launched at CHIJ (Kellock)
- Work in partnership with waste collectors, SEC, schools
- NEA intends to extend programme to all pri, sec, JC & tertiary institutions



Introducing Recycling Programmes in Industrial Estates

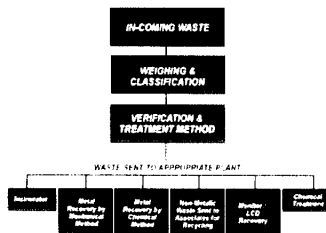
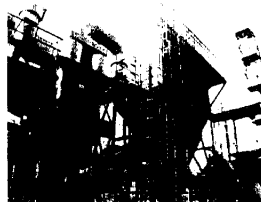
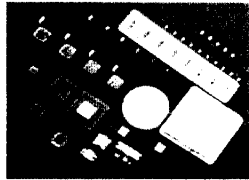


RECYCLING INDUSTRY


- Horticultural waste – Composting
- Food waste - Recycling plant
- Metals - Sorting & Recycling
- Paper/cardboard - sorting
- Used copper slag - recycling
- Wood/pallets/crates - reuse and recycle
- Construction & Demolition waste (C & D waste) - sorting and recycling
- Electronics Wastes - Re-use and recycle
- Tyres - Recycle



Recovery of Precious Metals from Electronic Scrap



Wood Waste Recycling



Technical Wood Products


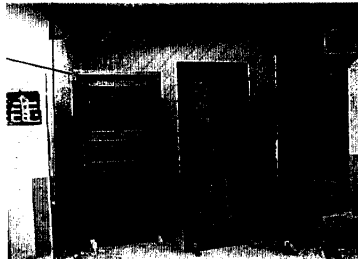
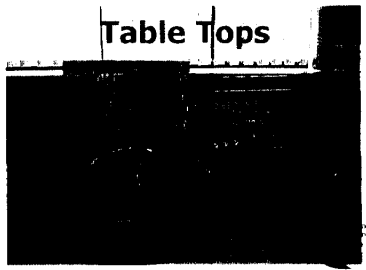
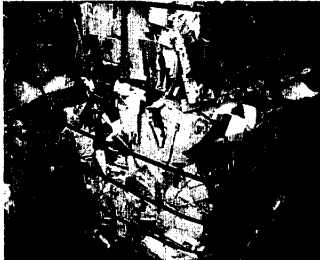



Table Tops

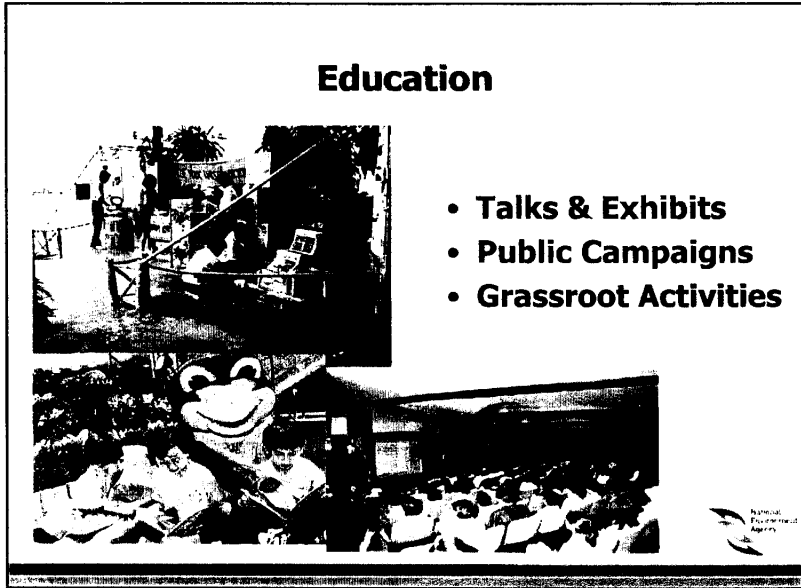
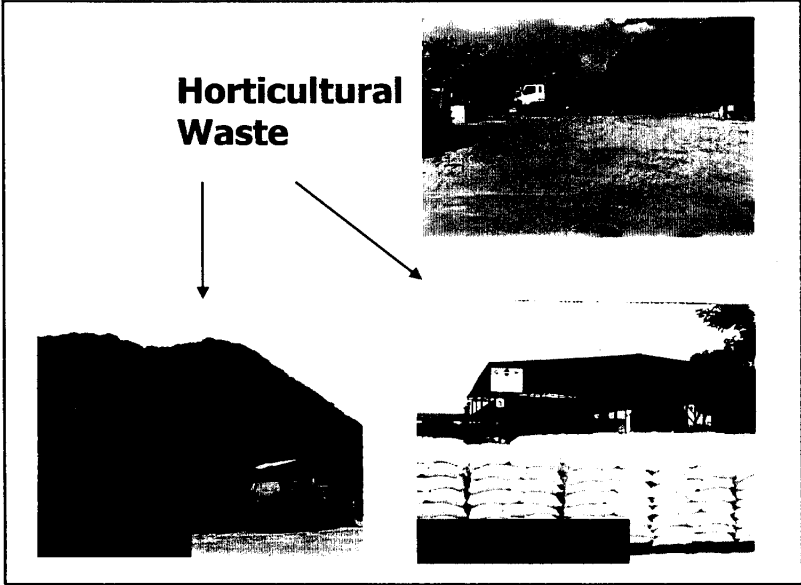


Ferrous & Non-ferrous Metals

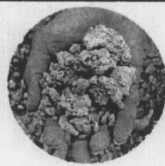


- Scrap metal yards
- Baling & packing
- Export





Strategy 2 - Re-use Incineration Ash



Incineration Ash



Situation

- Incinerate 6,630 tonnes of waste / day
- Generate 1,400 tonnes of incineration ash

Solutions

- Road construction
- Lightweight concrete products
- Land reclamation



Strategy 3 – Reduce Waste to Landfill

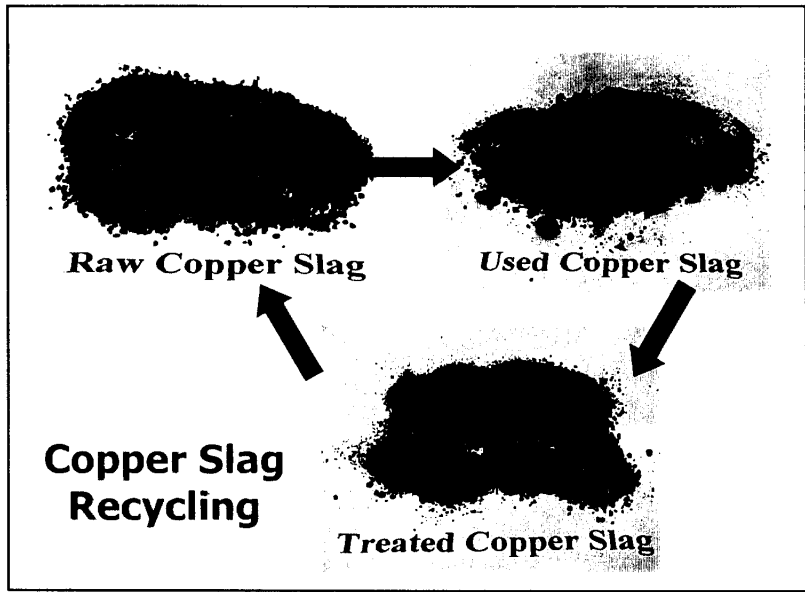
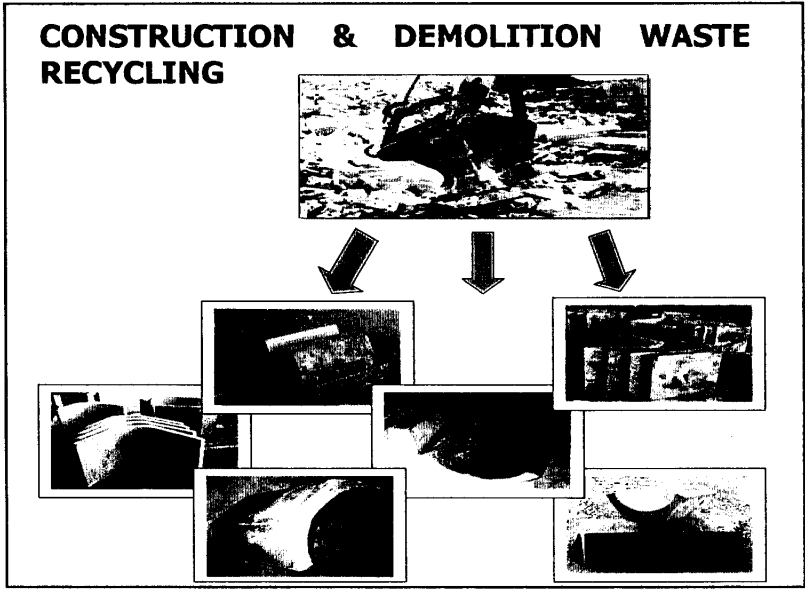


Landfill Waste

- **C&D: 85% to 90%**
- **Copper Slag: 90% to 95%**
- **Sludge, Ash, Silt**



CONSTRUCTION & DEMOLITION WASTE RECYCLING



Conclusion

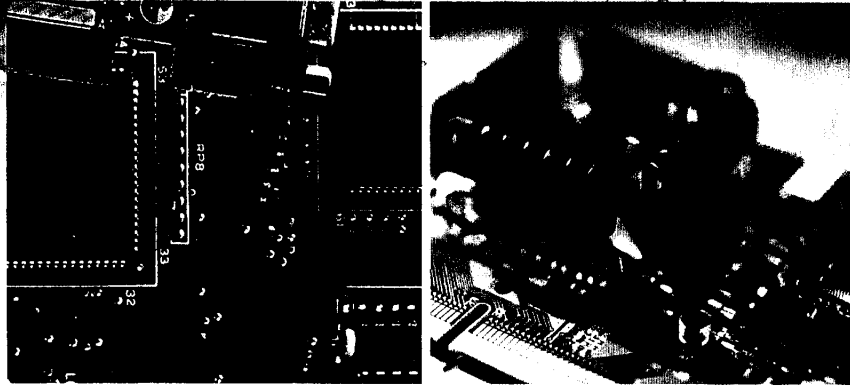
- Greater concern about impact of economic growth on the environment
- 3P partnership to work towards environmental sustainability
- We can prevail over our limitations and build an environmentally sustainable and enduring Singapore for generations to come



Thank You

<http://www.NEA.gov.sg>

CITIRAYA - PACKAGE SOLUTION FOR ALL



We have the technology and experience to process different types of electronics scrap and offer innovative solutions for managing non-metallic waste.

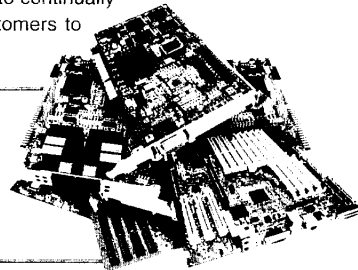
CITIRAYA provides a comprehensive recycling and processing service for all your electronic scrap and industrial scrap products - from discarded circuit boards to junked automobile electronic parts. We have the capacity to process up to 15,000 tonnes of electronic waste each year and partner multi-national companies in global take-back programmes aimed at persuading consumers to return products such as computers and mobile phones for recycling

Our expertise stems from the combined track record of our management and technical team who have many years of experience in waste management. We aim to continually improve our service capabilities and work closely with our customers to develop innovative approaches to each waste challenge.

Comprehensive range of materials processed

Plant improvement programme to increase capacity

Plans for further development of facilities globally



WASTE MANAGEMENT PROCESS

- ⊗ In-coming waste
- ⊗ Weighing and classification
- ⊗ Verification of treatment method
- ⊗ Waste sent to appropriate plant:
 - Incinerator
 - Mechanical recovery of metal
 - Chemical recovery of metal
 - Non-metallic waste to associates for recycling
 - LCD monitor recovery
 - Chemical treatment

MATERIAL CAPABILITIES

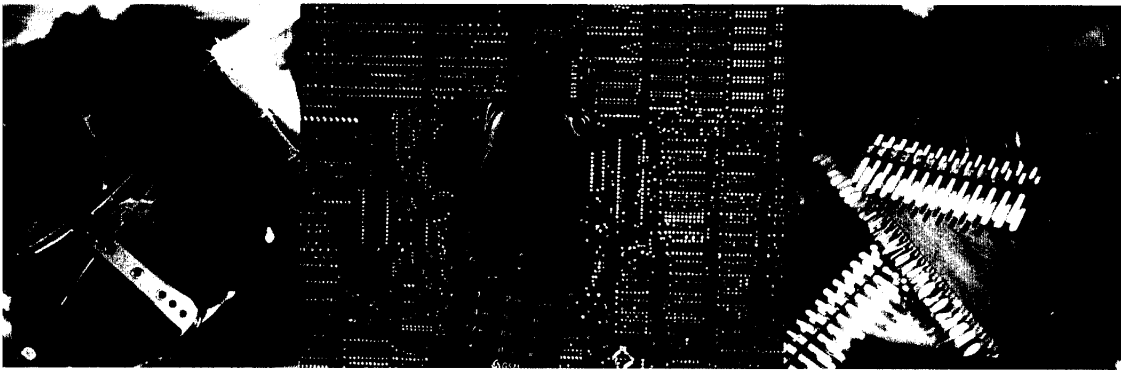
We currently process a comprehensive range of raw materials and have a programme of improving our plant capability for any new kind of electronic waste.

TELECOMMUNICATIONS SCRAP

The telecommunications industry produces vast quantities of scrap from old handphones to gold-plated circuit boards - we are fully equipped to dismantle and recover all valuable metal from this scrap.

ELECTRONICS SCRAP

Circuit boards, semiconductors, connectors, relays, switches and all other elements of today's complex electronic circuits contain precious metals such as silver, gold and palladium - we have the technology and expertise to dismantle all electronic waste and to recover these metals in the most effective way possible.



AUTOMOBILE SCRAP

We are experts in recovering and processing the precious metals and other valuable materials in all automotive electronic components - these include anti-lock brake controls, engine management systems and other complex systems and sensors.

PHOTO AND X-RAY FILMS

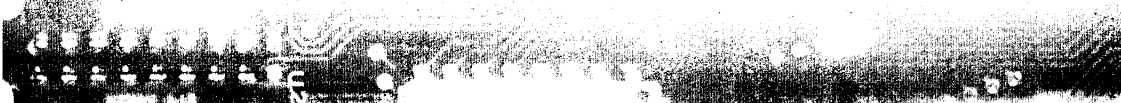
X-ray films and photographic prints contain valuable silver residues which we can recycle efficiently and cost effectively.

CATALYSTS, SLUDGE-CONTAINING PRECIOUS METALS AND TOXIC WASTE

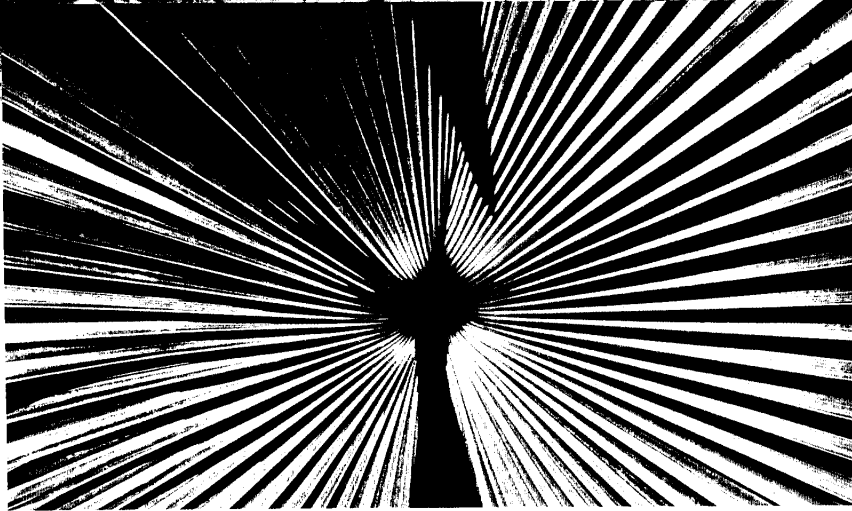
Automobile catalysts and precious metal concentrates are among the chemicals we can process and neutralise and from which we can recover precious metal.

LCD MONITOR RECYCLING

The video monitor is one of the most widely used pieces of office electronics and contains a variety of precious metals and other recyclables - we have the capability to dismantle these items, extract everything of value and dispose of toxins in an environmentally friendly way.



CITIRAYA - IN BUSINESS FOR THE ENVIRONMENT



The environment is the core basis of our business. Our work is to support environmentally-responsible companies and help them abide by the highest environmental control standards.

Environmentally-responsible and efficient waste management can help companies to achieve significant bottom line benefits - in terms of resource efficiency and financial returns from precious metal recovery.

CITIRAYA provides a one-stop solution to your electronics waste management needs. The heart of our business centres on our recycling process, which can recover and refine precious metals, and we also package environmentally friendly solutions for other materials. We help minimise your impact on the environment and environmental litigation risks.

We recycle as much as possible. Our environmental management programme strives for continuous improvement in all aspects of resource use and energy efficiency. Pollution control devices that continuously monitor discharge levels assist in stringent compliance with all local government legislation.



Environmental management system with periodic audits

Licensed by the Ministry of the Environment in Singapore

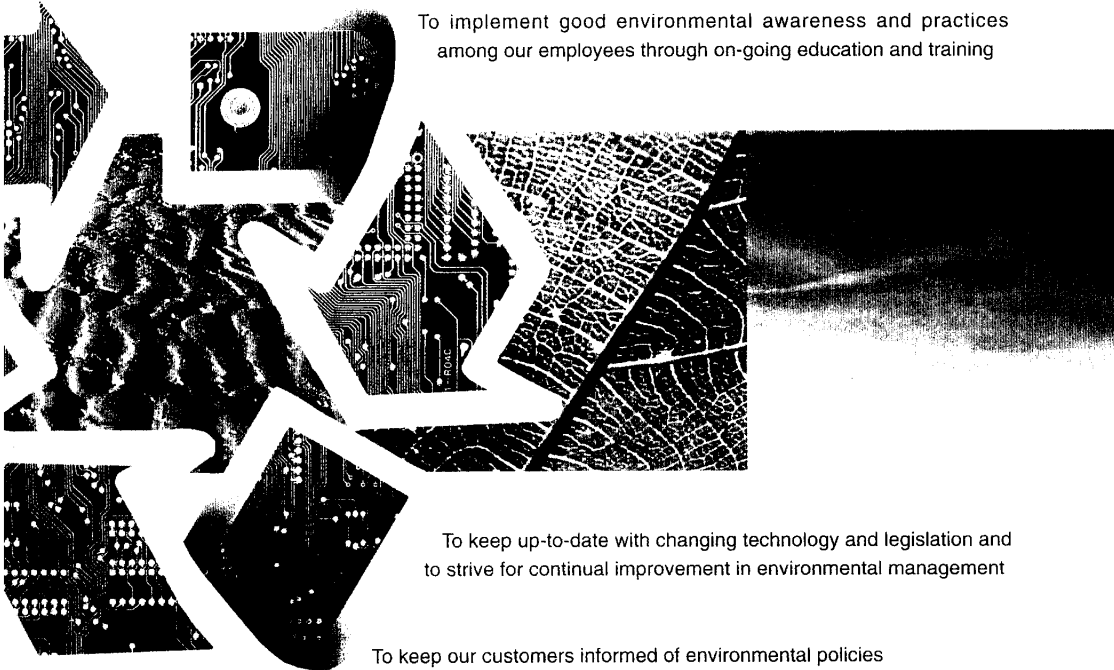
OUR COMMITMENT TO THE ENVIRONMENT

To continually improve our scrap and waste handling and disposal practices so as to maximise the recycling and reuse of all processed waste

To comply with all relevant environmental legislation, regulations and codes of practice with regard to our activities, services and products in Singapore

To strive for the most efficient utilisation of resources and energy in our production processes

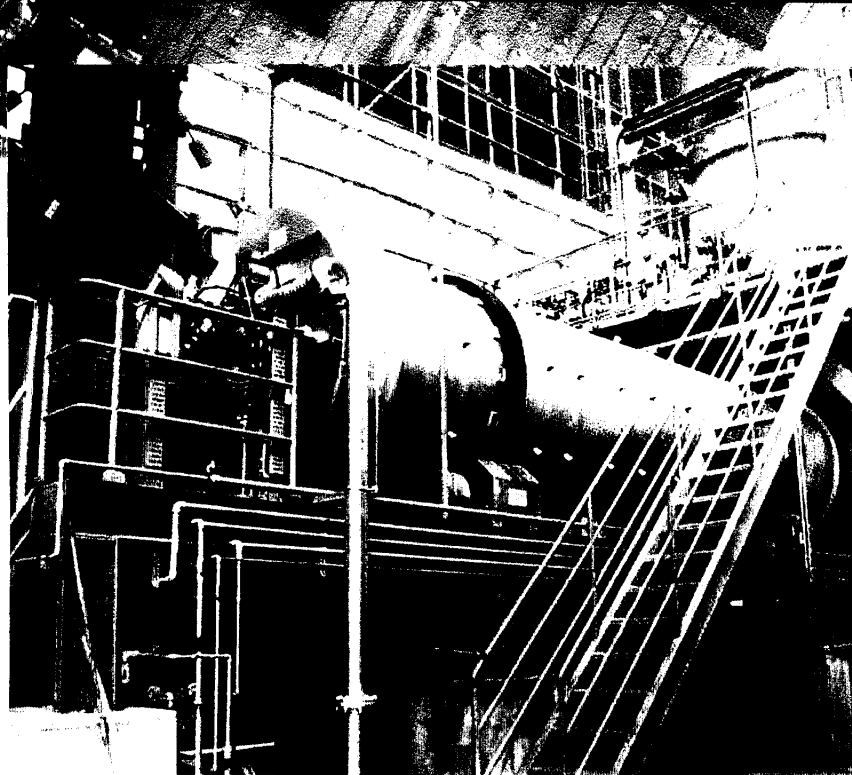
To implement good environmental awareness and practices among our employees through on-going education and training



To keep up-to-date with changing technology and legislation and to strive for continual improvement in environmental management

To keep our customers informed of environmental policies

CITIRAYA - FULLY INTEGRATED SERVICES



Our technical capabilities and our expert consultancy support ensure that we provide you with a comprehensive range of electronic waste recycling and refining services to meet your needs.

As a leading fully integrated provider of recycling and processing services for the electronics industry, CITIRAYA provides a one-stop service for electronics and non-metallic waste products to companies worldwide.

Our services start from our own collection of electronic components and products to the final extraction of precious metals for reuse. As far as possible, we maximise our use of recycling to achieve zero landfill. We are also continually developing innovative recycling solutions for our customers by focusing on R&D.



SERVICE PARTNERSHIP

We work in partnership with customers to ensure innovative, flexible and prompt service delivery for your total waste management needs.

CONSULTATION

Our sophisticated waste control systems allow us to provide total waste management consultation in order to address our customers' waste problems.

LOGISTICS SUPPORT

We provide a full range of transportation services for both local and international customers. Our international offices will arrange for the waste to be shipped from anywhere in the world to our plant in Singapore.



R&D PROTECTION

Fully-secured destruction is provided for all proprietary technology and R&D prototypes - confidential and high value scrap is immediately transferred into a secured area where it is crushed in the presence of our customer's waste management representative.

PRECIOUS METAL RECOVERY

We recover the full value of the precious metal content of electronics waste using state of the art laboratory equipment and our proprietary metal separation plant that adopts a continuous homogenising and sampling system. The recycled and refined precious metals are either sent back to customers or diverted to the electronics industry for maximum profit.

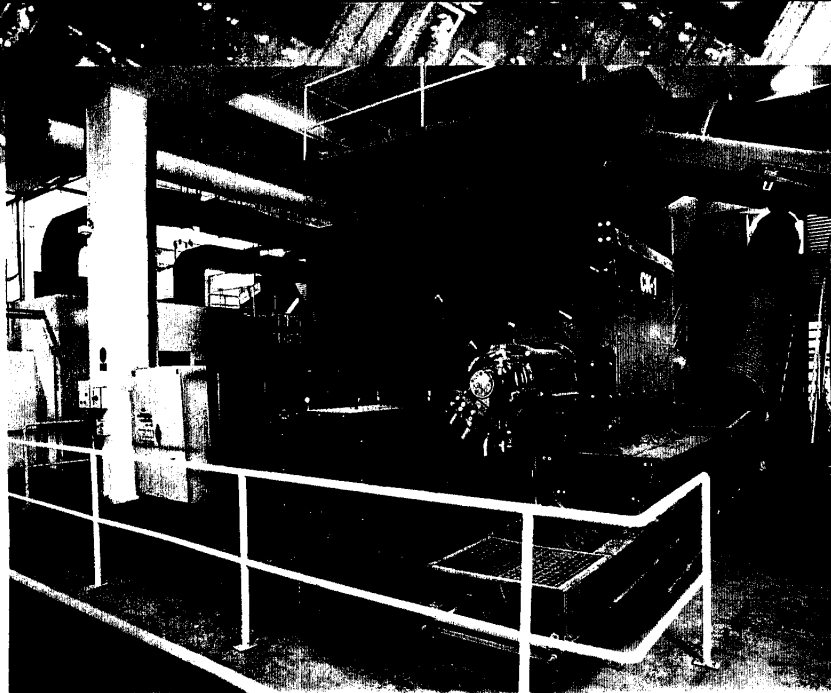
TOXIC WASTE INCINERATION

Our in-house incinerator allows us to destroy a wide range of toxic and non-recyclable materials according to the most stringent environmental parameters advocated by regulatory bodies and thus allows us to offer a complete environmentally friendly waste management service.

SOLUTIONS FOR OTHER WASTE

Our technical team is continually developing commercially profitable ways of recycling non-metallic materials.

CITIRAYA - INVESTING IN ADVANCED TECHNOLOGIES



We are committed to investing in advanced technologies to develop better solutions for waste management which comply with our environmental management programme. Our Integrated EHS system helps us to preserve natural resources and improve energy efficiency.

Over the last few years, CITIRAYA has invested in a multi-million dollar programme to be a leader in this competitive electronic waste management industry.

Our 105,000 sq ft Singapore plant is equipped with the latest recycling and processing machinery and equipment, all custom-designed to meet our exacting requirements and environmental standards. A strong focus on R&D also allows the constant improvement to our recovery and refining processes that puts us at the forefront of technological changes.

Our technological capabilities are backed by the Environmental, Health and Safety (EHS) system which involves all staff and management in a stringent process of continual review and improvement.

-
- ⊗ Experienced management and expert technical team with environmental excellence
 - ⊗ Computerised process control
 - ⊗ Online monitoring system
-

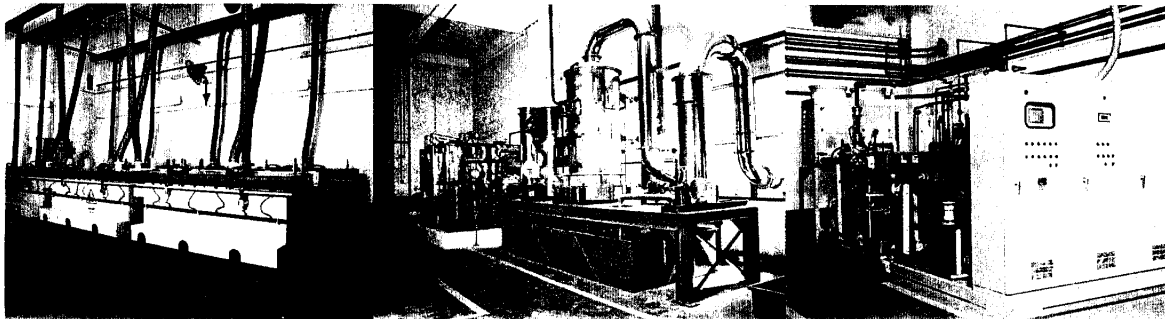
STATE OF THE ART EQUIPMENT

Laboratory analysis facilities

We use the latest computer-controlled ICP analysing equipment to evaluate metallic and hazardous wastes and determine the optimum processing treatment. Sampling and weighing are carried out under stringently controlled conditions using the most high tech precision equipment.

METAL SEPARATION PLANT

Our plant incorporates a continuous homogenising and sampling system, representing a totally new concept in the industry. It is equipped with an auto sampling facility to allow continuous automated operation and all dust from the separation process is collected using an elaborate system of ducts and air scrubbers.



CHEMICAL AND FURNACE PLANT

Custom-made to recover metal from chemical waste, solvents and solutions, our chemical treatment plant handles chemically contaminated waste and coated metals and is being developed to provide a full recovery of metals and safe disposal of the waste. Our high performance furnace allows on-site separation and smelting of a wide range of precious and non-ferrous metals.

INCINERATOR

Our custom built and state of the art incinerator includes all the latest monitoring systems and air-scrubbing devices to safeguard the environment and improve the recovery rate of metals. With a capacity of 32 tonnes per day it can deal with a wide range of toxic materials.

WATER TREATMENT PLANT

Featuring continuous monitoring with auto shut-off to ensure that the highest environmental standards are maintained, our on-site water treatment plant meets all local environmental discharge regulations.



CITIRAYA - SECURITY GUARANTEED



We offer a fully secured system that protects your intellectual property rights. Our fully automated system control, monitoring and video surveillance allow customers to keep track of the whole waste management process from collection to final disposal.

We have a comprehensive quality management system and well-organised security procedures for every aspect of our production process.

Our commitment to safeguarding your interests begins at collection point. At our factory, the electronic waste is labelled, categorised and weighed after which it goes through various recycling and refining processes. Our security system will provide proper traceability and ensure optimum and safe return on your waste management investment.

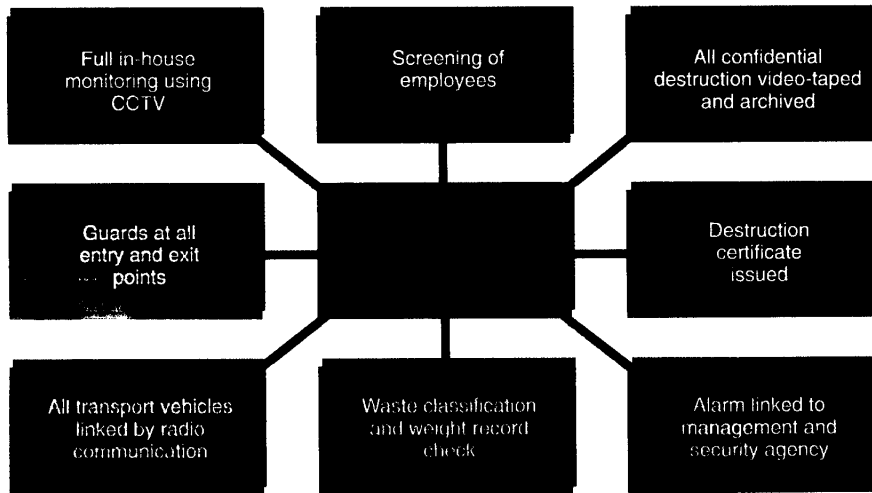
We provide a fully-secured recycling service for electronic waste to protect against any copyright infringements. We transfer such waste directly into a secured area and it is crushed in the presence of the customer's representative.

Our code and classification data system has been specially designed to allow us to deliver the highest quality service at all times and an audit report can be available on request. Customers and potential customers are encouraged to visit our plant to witness the efficiency and high standards of our operations. We are continually working to further strengthen our security arrangements so as to provide maximum protection to our customers' products.

-
- ④ Employee screening
 - ④ Full video surveillance
 - ④ Comprehensive material tracking procedures
-

SECURITY MEASURES

- ⊗ Our recycling plant is fully automated and requires minimum human intervention.
- ⊗ Our premises are fully protected by CCTV cameras.
- ⊗ Alarms are installed on perimeter doors.
- ⊗ Security guards patrol the premises and man entry and exit points.



CITIRAYA - AROUND THE WORLD



Electronic waste accumulation is a global environmental problem - we provide innovative solutions!

We work closely with customers to develop innovative approaches to each waste management challenge. We visit your factories to develop customised waste recycling strategies and provide the necessary logistical support. In order to continually improve our service, we aim to extend the reach of our network by investing in waste treatment plants in new countries.

🌐 Highest standard of service through close consultation

🌐 Worldwide logistics and waste collection network

CITIRAYA INDUSTRIES LTD

65 Tech Park Crescent Singapore 637787 Tel: +65 6264 4338 Fax: +65 6266 6731
Email: citiraya@singnet.com.sg Website: www.citiraya.com

CITIRAYA UK PLC

3 Drummond Crescent Riverside Business Park,
Irvine, Ayrshire, Scotland, UK KA11 5AN
Tel: +44 (0) 1294 277760 Fax: +44 (0) 1294 277764
Email: UK@citiraya.com Website: www.citiraya.co.uk
Contact: Mr. Ray Chaney

CITIRAYA RECYCLING (EUROPE) GmbH

Muhlenkamp 15 D-44575 Castrop-Rauxel, Germany
Tel: +(490) 2305 440244 Fax: +(490) 2305 440245
Email: Germany@citiraya.com
Contact: Mr. Manfred Haman

CITIRAYA ITALIA S. R. L.

Via M.G. Deledda, 1, 20041 Agrate Brianza (MI), Italy
Tel: +(39) 039 6892873 Fax: +(39) 039 6056382
Email: info@citiraya.it Website: www.citiraya.it
Contact: Mr. Alfio Gullifa

CITIRAYA RECICLAGEM LTDA

Rua Pedro Stancato, 388 Campo dos Amarais
Campinas - 13082-560 Sao Paulo, Brazil
Tel: +(55) 19 3246 2277 Fax: +(55) 19 3246 3077
Email: citiraya@terra.com.br
Contact: Mr. Mgm Ansari

CITIRAYA ELECTRONIC RECYCLING BANGKOK CO LTD

546/45 Sathupradit 40 Sathupradit Road
Yannava Bangkok 10120, Thailand
Tel: +(66) 02 682 2828/9 Fax: +(66) 02 294 4747 / 294 4949
Email: Thailand@citiraya.com
Contact: Mr. Ekapong Charoenwungrek

CITIRAYA TECHNOLOGY SDN BHD

103B Taman Melaka Raya, 75000 Melaka, Malaysia
Tel: +(60) 06-283 3650 Fax: +(60) 06-283 3655
Email: info@citiraya.com
Contact: Mr. Ung Yoke Hooi

CITIRAYA PRECIOUS METALS PVT LTD

39/17 Venkataraman Street
T. Nagar Chennai - 600 017, India
Tel: +91 44 815 2781 Fax: +91 44 815 5659
Email: citiraya@citiraya-india.com
Contact: Mr. Mgm. Ismail

SHANGHAI WEICHENG ENVIRONMENTAL

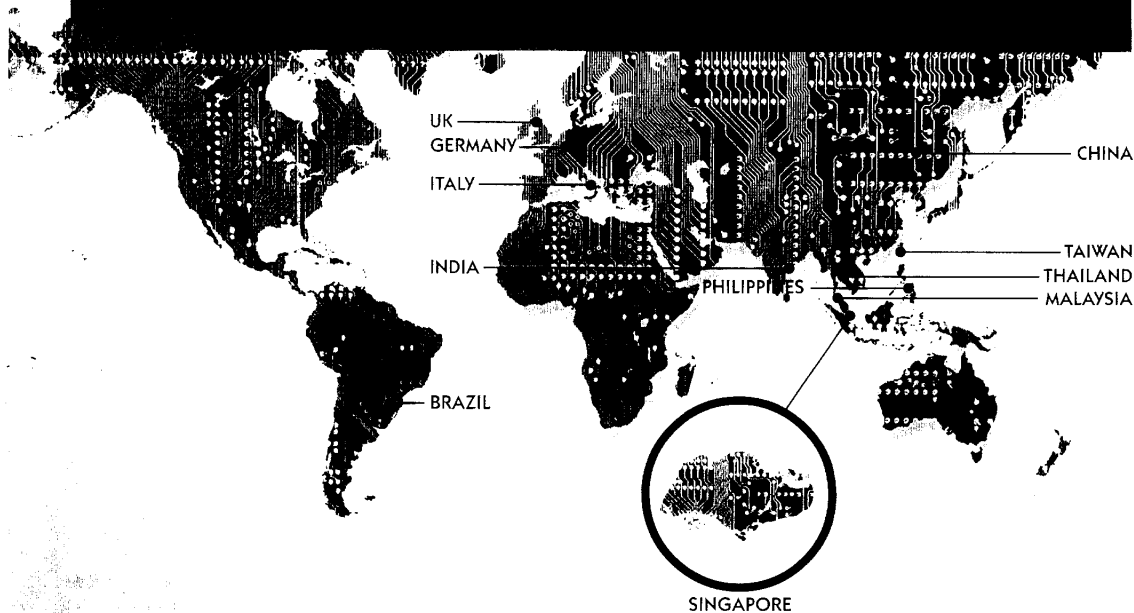
PROTECTION EQUIPMENT CO LTD
RM G, 17F No. 435 Gonghexin Road
Shanghai, PRC
Tel: +(86) 21 66600136 Fax: +(86) 21 36173439
Email: China@citiraya.com
Contact: Ms. Luo Yi

MARITRANS ELECTRONICS SCRAP EXPORT

Pelaez Building A.S. Fortuna Street
Mandaue City, Cebu Philippines
Tel: +(63) 032 3459525/6 Fax: +(63) 032 3459524
Email: maritrans@pacific.net.ph
Contact: Mr Phillip Tan Kuan Ghee

CITIRAYA TECHNOLOGY INC

No. 21-1, Chung Tan Lung Shen Village,
Chao Chiao Hsiang, Miao Li Hsien,
Taiwan, ROC
Tel: +(886) 37 651839 Fax: +(886) 37 651651
Email: Taiwan@citiraya.com
Contact: Mr. Smart Kuo





Waste Management and Recycling
Association of Singapore

DIRECTORY 2002/2003



ZENITH Engineering Pte Ltd

No 34 Joo Koon Circle Singapore 629060
Tel: (65) 6861 1100 Fax: (65) 6862 1948
Email: info@ze.com.sg

Leader in custom-built waste handling equipment in Singapore

The name of Zenith is synonymous with innovative waste-collection vehicles, cost effective refuse storage and handling equipment and tailor-made vehicle for sewerage maintenance.

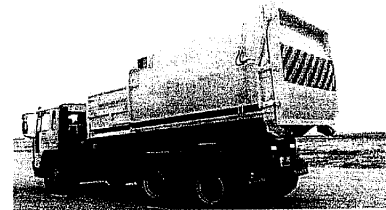
Today, Zenith is the leading supplier of waste handling & environmental equipment domestically and regionally. Operating in 2 factories, located in Singapore (Jurong) & Malaysia (Selangor), employing over 75 people

comprising a team of competent Engineering & Design personnels, exporting to over 15 countries in the region.

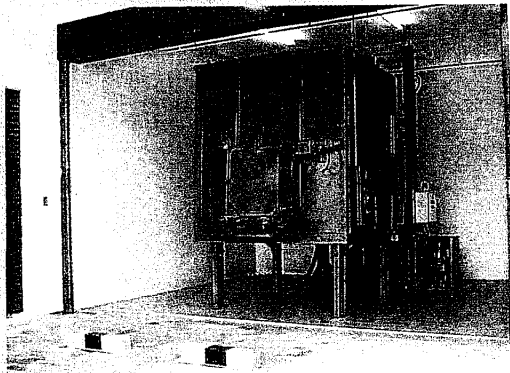
Zenith success have been due largely to a tradition of constant technical innovation and a strong commitment for continuous improvements in both our products and services in order to enhance our customers operational productivity & efficiency.



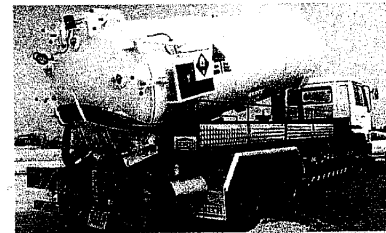
Refuse Collection Vehicle



Mobile Refuse Compactor



Dustscrew (Spiral Waste Bin)



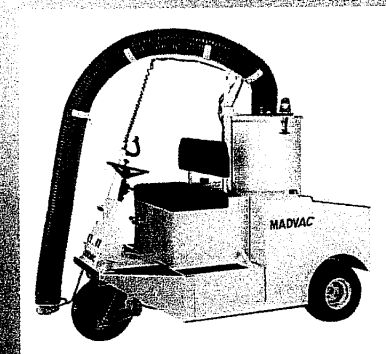
Vacuum Tanker



Pavement Sweeper



Road Sweeper



Litter Picker

For details - please visit our website at www.ze.com.sg

ONE-STOP SOLUTION

FOR ALL YOUR DISPOSAL NEEDS

**DISPOSE YOUR DOCUMENTS
CONFIDENTIALLY WITH US**

WASTE PAPER

Confidential Document sealed in bags and special printed boxes ready for collection. Sealed bag of waste papers are delivered Back to factory for shredding.

EXPRESS SHREDDER PULPER PROCESSING

Preparation of confidential documents to go for shredding. Confidential documents been infeed by rotating conveyor belt into the Express Shredder Pulper which shred the documents into small pieces to a size of 20mm size bits (about 10¢ Coin). Small pieces of waste papers which was shredded in the Express Shredder Pulper will be then compressed into bundle by meant of a Hydraulic baler.

The Waste Paper Expert



鄭紙原料私人有限公司
TAY PAPER RESOURCES PTE LTD

48 Gul Avenue Singapore 629681

Tel: 65-6863 3230 (4 Lines) Fax: 65-6863 3193 / 65-6863 2739

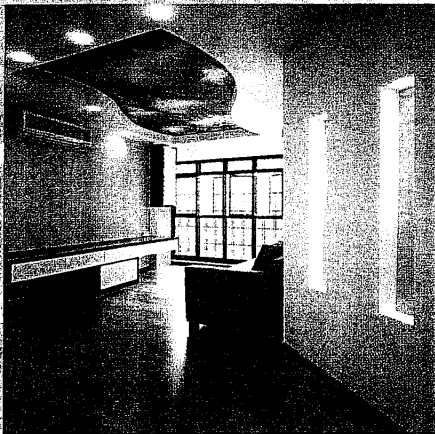
Website: www.taypaper.com.sg Email: taypap@pacific.net.sg

Towards Environmental Excellence

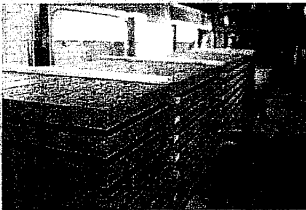
LHT Holdings Limited proudly presents the environmentally friendly Technical Wood, Greenflo Technical Wood Flooring System and Technical Wood made products.

The making of Technical Wood sees wood waste being recycled and mechanically shaped into a wide range of specially designed wooden products with performances such as fire and water resistance, cost effective and low formaldehyde emission level.

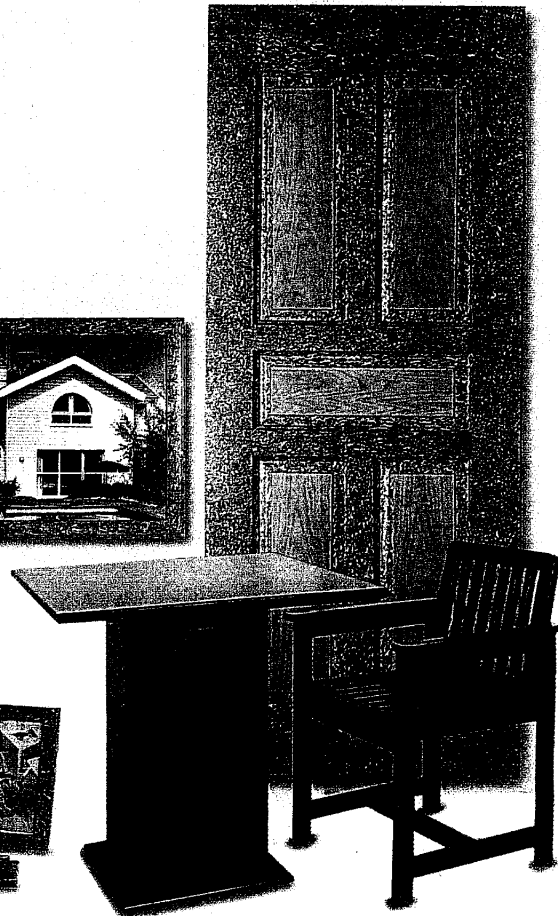
Technical Wood is a 100% recycled product that produced by an ISO14000 certified manufacturer.



Technical Wood Flooring



Technical Wood



LHT LHT HOLDINGS LIMITED
联合木业控股有限公司

Address: No.27, Sungei Kadut Street 1, Singapore 729335.

Tel: (65) 6269 7890 Fax: (65) 6367 4907 / 6269 1706

Website: <http://www.lht.com.sg>

<http://www.greenflo.com>

Email: enquiry@lht.com.sg



A black and white photograph of a hand holding a pen over a document. The document is covered in water droplets, suggesting a focus on environmental or recycling themes. The text is overlaid on the lower part of the image.

WMRAS

*"To professionalise and develop
a leading waste management and
recycling industry in Asia"*

CONTENTS

Message by Minister for the Environment, Ministry of the Environment, Mr Lim Swee Say	5
Message by Chairman, WMRAS, Ms Loh Wai Kiew	7
Message by Chairman, Publication Committee, WMRAS, Mr Jimmy Tay	9
Message by Deputy Director, Economic Development Board (EDB), Mr Kenneth Tan	11
Message by Chairman, International Enterprise Singapore (IES), Mr Stephen Lee	12
Message By Chief Operating Officer, Solid Waste Association of North America (SWANA), Ms Carol Fearn	13
Message By Chief Operating Officer, Waste Management Association of Australia (WMAA), Ms Val Southam	14
WMRAS Profile	15
WMRAS logo	17
Management Committee Listing for 2001-2003	18
EPC-WMRAS Secretariat Profile	20
Highlights of Industry Study	21
Membership Application Form	26
Profile of Ordinary Members	45
Profile of Associate Members	69
Profile of Institutional Member	73
Profile of Individual Members	75
Index list of Member Companies	81
List of Economic Development Board (EDB) offices	85
List of International Enterprise Singapore (IES) offices	87



**MESSAGE BY MR LIM SWEE SAY
MINISTER FOR THE ENVIRONMENT**

Through 40 years of urbanization and industrialization, Singapore's efforts in environmental protection have been unwavering, amid growing resource challenges.

Today, Singaporeans enjoy a living environment of quality comparable to that of the finest cities of the world. Despite the physical constraints that we face as a small island state, our people continue to enjoy reasonably clean air, clean water, clean land and a high standard of public health. Our environmental performance has been good so far.

We must, however, look beyond environmental performance. As we strive for continued progress, we can expect even greater challenges in our effort to balance between environment and development. For the well-being of our children and our children's children, our effort towards achieving long-term "environmental sustainability" is of utmost importance.

In this respect, we need to build a robust and world-class waste management and recycling industry in Singapore for better resource management. We need an industry that can provide leadership in sourcing for innovative and state-of-the-art solutions in waste recycling and minimisation. The Waste Management and Recycling Association of Singapore (WMRAS) has a pivotal role to play, both in championing the course of better resource management and facilitating the growth of the industry.

Under the Singapore Green Plan 2012, the 3P partners have set for ourselves ambitious 10-year targets on waste recycling. To achieve these targets, the government, the people and the industry must work hand in hand. These bold targets also present tremendous business and growth opportunities for our industry. The information and contacts provided through this first WMRAS Members' Directory 2002/2003 will help companies forge strategic partnerships. I commend WMRAS and its 73 members for this timely initiative.

I am glad that the National Environment Agency has been an active supporter of the various programmes and initiatives undertaken by WMRAS. It reflects our Government's commitment to work in partnership with the industry for the benefits of our community.

Together, we can succeed in our endeavour to progress from environmental performance to environmental sustainability.

LIM SWEE SAY

A black and white photograph showing a hand holding a pen, poised to write on a document with a grid pattern. The image is high-contrast and grainy, with the hand and pen in the foreground and the grid document in the background.

WMRAS

*"To professionalise and develop
a leading waste management and
recycling industry in Asia"*



**MESSAGE BY CHAIRMAN
WASTE MANAGEMENT AND RECYCLING
ASSOCIATION OF SINGAPORE**

Year 2001 has been an eventful year for the waste management and recycling industry. For one, the industry found a voice when 52 players decided to form the Waste Management and Recycling Association of Singapore (WMRAS) in August. Since then, its membership has grown 40% to more than 70 members. WMRAS is honoured to have the National Environment Agency as an Adviser, and the Economic Development Board and International Enterprise Singapore as Honorary Members.

Soon after its formation in August 2001, WMRAS signed 2 landmark Memoranda of Understanding with the Solid Waste Association of North America (SWANA) in September 2001 and the Waste Management Association of Australia (WMAA) in March 2002. WMRAS will continue to network across geographical borders and tie up with international organisations of similar purposes to foster closer business relationship.

With the uncertain economic climate ahead of us, the biggest challenge facing the industry is that of persuading businesses to be mindful of environmental management amidst concerns about cost management. Going forward, promoting professionalism and changing the image of the industry will remain a priority. As industry players, it is appropriate that we take the lead in environmental protection by effectively controlling the waste stream, so as to maximise recycling and minimise waste to landfill and incineration. This strategy is key to ongoing resource conservation. These are issues that will in turn provide the platform for economic as well as environmental sustainability. Thus, we will continue to play an active facilitative role to promote industry upgrading and development.

WMRAS is proud to present this first edition of the Industry Directory to mark our first anniversary. The production of the Directory is a timely one as it serves to provide professional industry information for members, customers and potential JV interests. The Directory also includes an executive summary covering the overall current environmental performance as an initial step for WMRAS to deliver future reports and commitments on business opportunities, strengths and weaknesses of the industry.

WMRAS would like to express our heartfelt appreciation to the government bodies and participating advertisers for their invaluable contribution and keen support in making this publication a success.

We have taken a giant leap of faith by coming together. Much work lies ahead of us. With everyone's support and commitment, WMRAS will, no doubt, rise admirably to these challenges and may there be many good years ahead of us.

LOH WAI KIEW



WMRAS

*"To professionalise and develop
a leading waste management and
recycling industry in Asia"*



**MESSAGE BY CHAIRMAN OF PUBLICATION
COMMITTEE, WASTE MANAGEMENT AND
RECYCLING ASSOCIATION OF SINGAPORE**

We are pleased to announce the launch of our very first edition of WMRAS Members' Directory.

Showcasing the profile of the members in the Association, the Directory is aimed at raising the awareness of the Association and more importantly, capabilities of our members. With the inclusion of industry information extracted from the findings of the industry study, we hope that the Directory will serve as a good industry reference. We also hope to encourage closer communication amongst members and promote strategic partnerships amongst companies.

This Directory will be widely distributed to all relevant organisations such as chambers of commerce, town councils, developers, estate management companies as well as various government bodies and embassies. Copies will also be given to our affiliated Associations, Solid Waste Management of North America (SWANA) and Waste Management Association of Australia (WMAA).

We would like to take the opportunity to thank the government bodies and our affiliated associations for their goodwill messages as well as all our advertisers for their active participation and support.

JIMMY TAY



WMIRAS

*"To professionalise and develop
a leading waste management and
recycling industry in Asia"*

MESSAGE BY DEPUTY DIRECTOR, SERVICES CLUSTER ECONOMIC DEVELOPMENT BOARD (EDB)

1. I wish to congratulate the Waste Management and Recycling Association of Singapore (WMRAS) on the launch of its first edition of the Members' Directory.
2. The Environmental Technology (ET) industry in Singapore, though nascent, is an area that Singapore can excel in. I am pleased that WMRAS has taken the challenge to play a leading catalytic role to spearhead Singapore's capability as a business hub for waste management and recycling activities, with the capacity to offer a broad range of services here and in the region.
3. Singapore has had more than 40 years of experience in remaking a clean and green garden city of international repute. The EDB's vision is to create a one-stop ET solutions centre for the region, with an ecosystem of companies – local and foreign, big and small, possessing integrated turnkey capabilities or niche technologies - with high-end capabilities based in Singapore, to service the region. We can achieve this by
 - i) Anchoring more intellectual property and process development activities related to ET in Singapore
 - ii) Promoting more testbedding and R&D activities in Singapore
 - iii) Encouraging the consolidation and upgrading of capabilities of the existing pool of environmental service providers in Singapore to provide a full suite of scalable solutions to the region
4. The demand for ET solutions in Asia is expected to rise steadily as governments and companies in the region adopt more responsible and financially beneficial ways to optimise resources and improve productivity in their search for higher economic growth. Singapore's competitive advantages: growing expertise in environmental management, particularly to problems common to the region, strategic location, pro-business government support, excellent track record supported by sound ET infrastructure puts us in good stead to serve the region better.
5. I am encouraged to see that waste management and recycling companies in Singapore, led by WMRAS, have pooled their resources together to publish this directory. I am confident that the directory will serve as an excellent reference material to related companies, regional and local, in their efforts to forge strategic partnerships for growth.
6. I congratulate all who have participated in this endeavour to produce this Members' Directory and further wish WMRAS and its members all success in its future endeavours.

MESSAGE BY CHAIRMAN, INTERNATIONAL ENTERPRISE SINGAPORE (IES)

The demand for environmental services is increasing within Asia due to the urbanisation and industrialisation by developing countries. The East and South East Asian market is estimated to reach US\$50 billion by 2010, presenting immense business opportunities for environmental companies in Singapore.

As a progressive user of environmental technologies in Asia, Singapore is known to have struck a balance between economic development and environmental protection. Through the years, Singapore environmental services companies have developed technical expertise in the areas of water technology, waste and wastewater treatment, clean air, consulting and engineering services.

Furthermore, with an intimate knowledge of Asia's culture and easy accessibility to the region, Singapore companies are well positioned to export their environmental services to the East and South East Asian market. International Enterprise Singapore (IE Singapore) is committed to help Singapore's environmental companies gain access into this market through the active pursuit of project opportunities. In this regard, IE Singapore and the WMRAS can work together to forge economic co-operation with partners abroad.

I am optimistic that WMRAS can deepen business linkages between our entrepreneurs and raise the profile and standing of Singapore's waste management and recycling industry.

STEPHEN LEE

**MESSAGE BY CHIEF OPERATING OFFICER
THE SOLID WASTE ASSOCIATION OF NORTH AMERICA (SWANA)**

Congratulations to WMRAS on its One Year Anniversary!

The Solid Waste Association of North America (SWANA) would like to extend its congratulations to WMRAS for a very successful first year. From its beginning in August 2001, WMRAS has worked to achieve goals and objectives similar to our association. These include **education, innovation and communication!**

During this past year, WMRAS has worked hard to educate those in the recycling and solid waste fields, providing technical sessions at conferences like the First Annual Water and Wastetech Asia Conference held in Singapore September 2001. SWANA was honored to be included in this historical event, and continues to work in partnership with its newest sister organization. Through this conference, many individuals were exposed to a variety of recycling and solid waste topics, in order to improve services, maintain costs, and explore new technologies.

The WMRAS organization is based on innovation. Through their dedication to the field, a small group of recycling and solid waste businesses provided many volunteer hours to form the organization. As a result of their efforts, this new entity was formed, and today provides the opportunity for the exchange of ideas, and the collaboration on changes to the industry.

Communication has been the foremost reason behind the development of WMRAS. The opportunity for communication within the industry, involving many individuals across various businesses can only improve our ability to provide outstanding services. In SWANA, our members rate the networking opportunities provided as the number one reason they join SWANA.

In order to facilitate **communication** among members, WMRAS is pleased to provide this membership directory. The publication is intended to put you in touch with your peers in the most efficient manner possible. Please take advantage of this document, and contact the businesses listed in this directory regularly.

As SWANA celebrates its 40th anniversary during 2002, it is refreshing to look back and see that those ideals that were important to us 40 years ago, remain compelling reasons for organizations to join together towards a common goal. We are inspired to be a partner with WMRAS and look forward to many more successful years of collaboration.

CAROL FEARNES

**MESSAGE BY CHIEF EXECUTIVE OFFICER
WASTE MANAGEMENT ASSOCIATION OF AUSTRALIA (WMAA)**

On 20th March 2002 the WMRAS and the WMAA (Waste Management Association of Australia) signed a memorandum of understanding at Parliament House, Melbourne in Victoria. The two associations recognise that they share a common concern for protection of the environment and future sustainability of their countries.

Solid waste management will be a pivotal issue over the next decade and solutions to mounting waste and dwindling resources will be critical. The two associations each have specific missions to create awareness of these issues and the Understanding is intended to establish a general collaborative framework between both parties. The parties intend to set up a regular exchange of information on topics of mutual interest and seek possible business ventures amongst members of either parties. It is also envisioned that visits, exchange programs to each other's events, conferences, seminars etc will encourage the sharing of knowledge and expertise.

The WMAA is looking forward to working more closely with WMRAS as the future unfolds for both Associations. WMAA has been in existence for more than 10 years now and has grown from an initial membership of 160 to its current 2002 membership base of over 1,000 members. We wish WMRAS every success in growing its Association in a similar way and offer our support in whatever way is appropriate.

WASTE MANAGEMENT AND RECYCLING ASSOCIATION OF SINGAPORE

BACKGROUND

Established on 8th of August 2001, the Waste Management and Recycling Association of Singapore (WMRAS) aims to professionalise and develop a leading waste management and recycling industry in Asia.

With the aim to promote business networking opportunities and best practices amongst members, the Association has been organising activities such as talks, mission trips, conferences, exhibitions and members get together sessions etc.

The first event which WMRAS organised was a Singapore Pavilion that features the local waste management and recycling industry capability at the Water and WasteTech Asia 2001 exhibition. In line with the Association's mission to promote waste minimisation and recycling, the Association participated in the Clean and Green Week to showcase members' products and services during last November. This year, the Association has also partnered with Hong Kah North Citizen Consultative Committee for a one-year recycling programme to promote environmental awareness in the constituency.

To foster information exchange, the Association has organised regular dialogue sessions with relevant authorities to keep members updated on the regulatory and policies developments. Meetings with the Ministry of the Environment, National Environment Agency, SPRING Singapore, JTC Corporation have allowed members to feedback their concerns and discuss how the public and private sectors could work together to address these needs. Members are also informed regularly with the latest industry updates through newsletters and publications.

In addition, the Association has also signed Memoranda of Understanding with Solid Waste Association of North America (SWANA) and Waste Management Association of Australia (WMAA) to establish a collaborative framework and affiliate status with them. The Association hopes that such alliances would act as a springboard for local industry players to have good access to the overseas markets and provide opportunities for strategic partnerships amongst the companies.

ASSOCIATION OBJECTIVES

WMRAS is committed to the following objectives for which it was constituted:

- a. To enhance professionalism and capabilities of members by promoting commerce and trade; striving to achieve and maintain the highest standards of excellence for practice, competence and conduct in waste management and recycling industry.



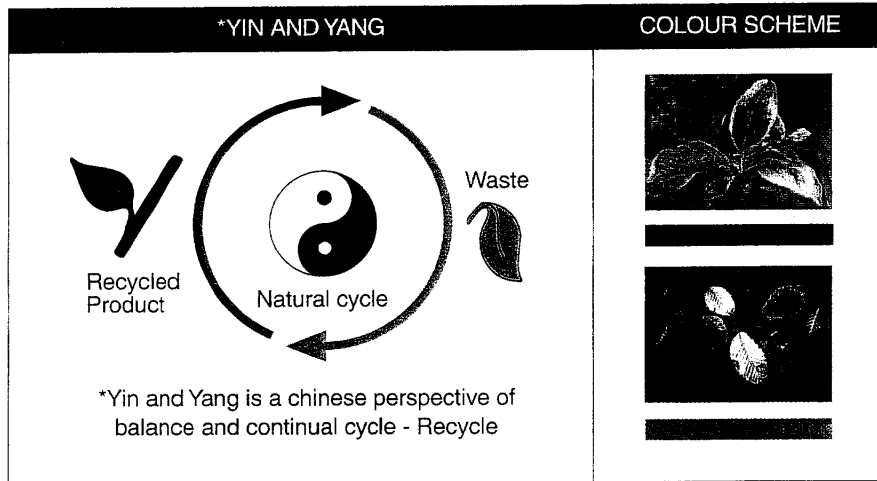
- b. To provide a platform for the members to come together to identify and address the environmental concerns and issues in the waste management and recycling industry.
- c. To promote waste reduction, recycling and reuse and recovery; and create public awareness on the waste management and recycling industry as well as environmental and industry concerns.
- d. To foster information exchange, networking and closer relationship among the members and between government, industry and people.
- e. To provide professional development and upgrading opportunities for the members by organizing industry and/or technology updates conferences, business mission trips, training workshops as well as through other forms of media such as newsletters, exhibitions etc.
- f. To advance the scientific, technical and practical aspects of waste management and recycling.
- g. To liaise and establish affiliations with local, national, and international organizations with similar purposes and concerns.

MEMBERSHIP

Since inception, the Association has been conducting active membership drive. Membership is open to any companies, individuals, associations or institutions in Singapore carrying on a business that falls within the association's field. To date, our membership size has grown more than 70. The membership categories comprised of the Ordinary, Individual, Associate, Institutional and Honorary members. Currently, the Economic Development Board and International Enterprise Singapore (former TDB) are sitting in the Association as Honorary Members. The Association is also glad to have the National Environment Agency as the Association Advisor and the Enterprise Promotion Centres Pte Ltd as the Secretariat to enhance the activities organised for the members of the Association and the environmental industry.

For further information, please contact:
The Association Secretariat
Tel: 6278 2538
Fax: 6278 7518
Email: secretariat@epc.com.sg

WMRAS LOGO



The Waste Management and Recycling Association of Singapore (WMRAS) logo embodies the essence of Yin and Yang which represents the well-balanced and continual cycle from waste management to waste recycling towards environmental sustainability. It also symbolises the cohesive spirit and integration of the public, private and people sectors to grow towards a competitive and world class leading industry in waste management and recycling.

- Colour Brown symbolises the continuous improvements to meet the future challenges in the waste management and recycling industry.
- Colour Green symbolises environmental friendliness through the 4 Rs, that is to reduce, reuse, recover and recycle.

WMRAS

MANAGEMENT COMMITTEE LISTING 2001 - 2003



Ms Loh Wai Kiew
Chairman

Sembcorp Waste Management Pte Ltd



Mr Peter Voegele
Vice Chairman
Altwater Jakob Pte Ltd



Mr Neo Koon Boo
Vice Chairman
LHT Holdings Ltd



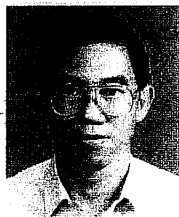
Mr Vincent Chan
Secretary
Graceland Recycling Pte Ltd



Mr Yeo See Ann
Asst Secretary
Colex Holdings Ltd



Ms Ho Siew Lian
Treasurer
JPL Industries Pte Ltd



Mr Wong Meng Khoon
Asst Treasurer
Ceramics Technologies Pte Ltd

WMRAS

MANAGEMENT COMMITTEE LISTING

2001 - 2003



Mr Ng Hock Chuan
Committee Member
Celtrad Metal Industries Pte Ltd



Ms Seow Siew Lan
Committee Member
Citiraya Industries Ltd



Mr Giam Yew Kang
Committee Member
Green World Holdings Ltd



Dr Patrick Loh, PBM
Committee Member
MG-Bio Products Pte Ltd

Page 19



Mr Parry Yeo
Committee Member
Morelastic Green Pte Ltd



Mr Franck Gibaud
Committee Member
Onyx Asia Services Pte Ltd



Mr Jimmy Tay
Committee Member
Tay Paper Resources Pte Ltd



Mr Seah Khen Hee
Committee Member
Singaport CleanSeas Pte Ltd



EPC- WMRAS Secretariat

Enterprise Promotion Centres Pte Ltd (EPC) is a non-profit making organisation set up in 1989 by the Economic Development Board to promote entrepreneurship and local enterprise development. Serving as an extension of government multi-agency network to help local enterprises to upgrade, EPC works closely with industries and businesses by offering a range of multi-disciplinary services from general promotion and facilitation, to specific hands-on assistance.

In Enterprise Promotion, EPC profiles role models, disseminates business information, promotes entrepreneurship and best management practices through organising CEO meeting points and industry forums.

In the area of Enterprise Development, EPC adopts a holistic approach to enterprises and industries. Our company has a pool of dedicated multi-disciplinary professionals, assuming the roles of business facilitator, consultant, advisor and matchmaker, linking you to regulators, promoters, service providers and investors. EPC has established a significant track record in rendering research and consultancy services to companies from start-ups to growing enterprises and large corporations. At the same time, EPC actively helps companies venture into overseas markets. EPC also assist local enterprises to maximise the use of government incentives and assistance schemes.

In Industry Facilitation, EPC works with the chambers of commerce and various industry associations to surface industry trends and directions, study current strengths and capabilities of local enterprises, and initiate industry-wide upgrading projects. We work hand-in-hand with associations in raising the standards of professionalism of industries in Singapore. Through our Industry Promotion Programme, EPC helps the associations operate more effectively, which in turn, promote growth and development of the local industries. Under this programme which began in 1994, EPC has supported and assisted many associations via secretariat services. These are some of the associations currently under this programme:-

- Association of Electronics Industries in Singapore (AEIS)
- Enterprise 50 Club (E50)
- Landscape Contractors Association of Singapore (LCAS)
- Pasir Panjang Wholesale Centre Association (PPWC)
- Singapore Fruits and Vegetables Importers and Exporters Association (SFVA)
- Singapore Institute of Landscape Architects (SILA)
- Singapore Surface Finishing Society (SSFS)
- Waste Management and Recycling Association of Singapore (WMRAS)

EPC is geared up to meet the challenges of assisting Singapore enterprises and industries to compete in the international arena.

For enquiries, you may like to contact our Industry Facilitators at
Tel: 6278 2538, Fax: 6278 7518 or
Email: iggroup@epc.com.sg

WMRAS COMPLETED GROUNDBREAKING INDUSTRY STRATEGY STUDY

WMRAS recently completed a study on the waste management and recycling industry in Singapore. The study was commissioned to coincide with the launch of WMRAS in 2001, and included hazardous waste, solid waste, and recycling.

Loh Wai Kiew, Chairman of the Waste Management and Recycling Association of Singapore gave the rationale for the study. "The waste management industry in Singapore and the region is undergoing a period of rapid change and development. But our industry is also very fragmented; there are a large number of players, and little joint planning or co-operation. Data on waste management in Singapore is also generally insufficient for detailed business planning purposes. The Industry Study was carried out in order to generate useful information and also chart the way forward for the industry, both in Singapore and the region."

The study was carried out by the Enterprise Promotion Centres Pte Ltd (EPC) and consultant Environmental Resources Management (ERM). The consultants worked closely with the subcommittee to develop the strategy and action plan, and also surveyed over 20 organisations involved in waste management in Singapore.

Peter Voegele, Chairman of the industry sub-committee notes "The strategy and action plan is the first effort to bring some consistency into the industry in Singapore, to create a unified understanding, and provide the industry with a common voice and objectives. The SWOT Analysis and Action Plan in particular have proven very useful in identifying key issues for the industry, as well as possible initiatives going into the future."

Other subcommittee members include Mr Yeo See Ann, Colex Holdings Limited, Mr Vincent Chan from Graceland Recycling Pte Ltd and Mr Seah Khen Hee, Singapore CleanSeas Pte Ltd.

HIGHLIGHTS OF THE MARKET SURVEY & INDUSTRY STRATEGY AND ACTION PLAN

Introduction

The Market Survey and Action Plan of the Singapore waste management and recycling industry identified the critical factors and trends in the industry and developed an action plan to propel the industry forward both locally and regionally in the coming years. The output of the project is divided into two volumes: the Market Survey and the Industry Strategy and Action Plan.

Market Survey

The market survey first looked at the macro-economic level trends that are affecting the industry and then focused on the following industries: general waste, recyclable waste and hazardous waste. Finally, an assessment of key issues was conducted in an analysis of strengths, weaknesses, opportunities and threats (SWOT) with the Sub-Committee.

The waste management and recycling industry is affected (both positively and negatively) by a wide range of external factors including the macro-economic climate, population growth, changes in the structure of industry, government regulation and privatisation, and social perception, as can be seen in Table 1. Data on population growth, waste profiles, etc were analysed to establish any trends.

Table 1 Macro-Economic Level Trends

Population growth and economic development	Singapore's per capita level of domestic solid waste disposal has risen from 0.75 kg/person/day to 1.14 kg/person/day between 1980 and 2001. Industrial development also grew correspondingly. These factors have resulted in dramatic increases in solid and hazardous wastes over the same period.
Changes in the structure of industry	Changes in the structure of waste generating industry will also affect the waste management industry. For example, a rapid increase in the number of semi-conductor and pharmaceutical facilities in Singapore has resulted in increasing amounts of solvent waste for disposal.
Government regulation and privatisation	The global waste management industry is fundamentally driven by government regulation and government action. Thus the standards, quality and detail of local regulations, and level of enforcement have a large impact on the health of the local industry. Privatisation of public waste services is another critical step in helping to develop a strong local industry. Government labour regulation also affects the industry directly.
Social perception	Public perception and activity in the industry is also important, but appears to be relatively poor at the present time. For example, participation in recycling programmes is still relatively low, while many companies have noted the difficulty in obtaining and retaining skilled managers and workers.

Focusing on each of the three industries, the quantities and sources of the waste collected, treated, recycled and disposed were determined. The methods of collection, treatment, recycling and disposal, the market structure, players and costs involved are also identified as far as possible. This is done mainly through interview sessions with the help of members of the industry and government personnel as well as collation of information from databases. A summary of the findings for each industry is presented below:

The General Waste Market

- Total tonnage of solid waste in 2001 was 2,802,183 tonnes;
- There is a clear long-term trend in terms of declining levels of growth in solid waste (annual growth of 0.39%. Source: Calculation based on ENV long term data between 1997 and 2001);
- SembCorp Waste Management, Altvater Jakob, FME-Onyx, and Colex now dominate the domestic waste collection market due to privatisation;
- There is a perception that the several hundred operators, small scale of companies, ease of entry and exit from this market, and difficulty in enforcing these operators in the industrial solid waste market can result in inconsistent standards of service provision;
- Thus privatisation programmes and regulation of the industry have an extremely important role to play in the development and health of the waste management sector.

The Recycling Market

- Total tonnage of recycled waste in 2001 was 2,233,232 tonnes;
- The total quantity of material recovered has been relatively flat over the last five years;
- Although no figures exist on industrial versus domestic recycling rate, it is expected that the vast majority of recovered materials is sourced from industrial activities;
- In Singapore, the industrial materials recycling is well developed while the recycling industry serving domestic publicly funded schemes (National Recycling Programme) is still in its infancy;
- Government plays a fundamental role: it has supported recycling in several ways, including public education, the recycling requirements in the PWC contracts, and the very innovative measure of a remuneration system for the PWCs based on "pass-through" of fees;
- However, Singapore lacks regulatory framework (for example, mandatory source separation, producer responsibility, and/ or preferential purchase) that are in place in most other countries to promote and ensure domestic recycling, as well as basic sorting facilities such as material recovery facilities.

The Hazardous Waste Market

- It is noted that there is particular growth in the solvent segment of the market, most likely due to the influx of industries in the pharmaceutical, semiconductor and speciality chemical industries that are the main generators of these wastes.
- This industry relies entirely on regulations and the enforcement of regulations for its existence. The fundamental driver of the hazardous waste sector (government regulation and enforcement) presents challenges for companies seeking to expand in the region, given the often low level of enforcement of regulations in these countries. In Singapore, regulations
- are generally well enforced, although there are some problems noted, such as the reported illegal practices with regards to waste oil collection and the bunker fuel market.

There will be important steps that both the industry and government in Singapore must take to ensure the local success and regional expansion of the Singapore waste management and recycling industry. Through the SWOT analysis, issues translating into strengths and weaknesses of the industry itself, as well as into threats and opportunities facing the industry are identified. This sets the basis for the development of the industry strategy and action plan for the industry.

Industry Strategy and Action Plan

The Industry Strategy and Action Plan generated strategies for each of the three industries. It should be noted that the general waste, recycling and hazardous waste markets share similarities in the strategies developed. Table 2 below provides the strategy components that were developed.

Table 2 Industry Strategy Components

The General Waste Market	The Recycling Market	The Hazardous Waste Market
<ul style="list-style-type: none"> • Industry consolidation and merger between players should be encouraged; • A firm regulatory and market foundation for the local industry must be ensured ; • Regional opportunities should be aggressively explored and capitalised upon; • Private sector waste management capabilities should be expanded beyond collection; and Professionalism and image of industry should be upgraded. 	<ul style="list-style-type: none"> • Encourage public participation in the recycling sector and upgrade image of industry; • Build a strong domestic materials recycling industry through the NRP; • Compensate of historical/ market distortions, in order to place recycling on same cost base with other disposal outlets; • Maximise opportunities overseas; • Encourage industry consolidation and integration; and Focus on appropriate and advanced recycling technology. 	<ul style="list-style-type: none"> • Encourage industry consolidation and mergers; • Ensure a firm regulatory and market foundation for the industry in Singapore; • Actively forecast and manage opportunities and risks created by shifting industrial structure; • Aggressively explore and capitalise on regional opportunities; and • Focus on technology intensive, high value solutions.

Further to the development of the strategy components, a detailed action plan for each market was developed. Over a hundred actions pertaining to individual companies, industry as a whole (either through WMRAS or other bodies) or the Singapore Government were identified.

The project is the initiating step taken by WMRAS and seeks to pave the way ahead for growth and opportunities in the Singapore waste management industry, both at home and in the region. The Singapore waste management and recycling industry will strive to be:

“A competitive, world class local industry, employing superior technology and practices, which serves as a basis for providing high-quality waste management and recycling services to countries and clients throughout the region.”

APPLICATION FOR MEMBERSHIP

Ordinary/ Associate/ Individual/ Institutional Membership

APPLICANT'S INFORMATION

Name of *Company/ Institution: _____

Mailing address: _____

Telephone: _____

Fax: _____

Established date: _____

Website address: _____

Business Activity: _____

Name of *Individual/Representative: _____

Designation : _____

Mobile no: _____

Email Address: _____

Page 26

TYPES OF BUSINESS ACTIVITIES *(please tick accordingly)*

- | | | |
|--|---|--|
| <input type="checkbox"/> Collection/Disposal | <input type="checkbox"/> Recovery | <input type="checkbox"/> Recycling |
| <input type="checkbox"/> Treatment | <input type="checkbox"/> Trading of resources | <input type="checkbox"/> Equipment providers |
| <input type="checkbox"/> Consultant | <input type="checkbox"/> R & D | <input type="checkbox"/> Others: _____
(please specify) |

TYPES OF WASTES *(please tick accordingly)*

- | | | |
|--|---|---|
| <input type="checkbox"/> Food Waste | <input type="checkbox"/> Horticultural Waste | <input type="checkbox"/> Sludge |
| <input type="checkbox"/> Paper/Cardboard | <input type="checkbox"/> Contaminated soil | <input type="checkbox"/> Glass |
| <input type="checkbox"/> Plastics | <input type="checkbox"/> Ferrous Metals | <input type="checkbox"/> Textile/Leather |
| <input type="checkbox"/> Construction Debris | <input type="checkbox"/> Non-ferrous Metals | <input type="checkbox"/> Tyres |
| <input type="checkbox"/> Scrapped Vehicles | <input type="checkbox"/> Electrical and Electronics | <input type="checkbox"/> Hazardous Waste |
| <input type="checkbox"/> Wood/Timber | <input type="checkbox"/> Oily Waste | <input type="checkbox"/> Water/ Waste Water |
| <input type="checkbox"/> Energy | <input type="checkbox"/> Air | <input type="checkbox"/> Others: _____
(please specify) |

(* Please delete accordingly)

Categories of Membership and membership fees

(please tick accordingly):

Category	Descriptions	Entrance Fee	Annual Subscription
<input type="checkbox"/> Ordinary Member	Any companies registered in Singapore whose business activity fall within Waste Management and Recycling.	\$1000	\$600
<input type="checkbox"/> Individual Member	Any person whose profession, business or company is associated to Waste Management and Recycling in Singapore.	\$250	\$200
<input type="checkbox"/> Associate Member	Any local or foreign organisations whose business is associated to and/or have dealing with Waste Management and Recycling in Singapore.	\$500	\$600
<input type="checkbox"/> Institutional Member	Any associations, institutions or societies whose activities fall within the Waste Management and Recycling and share objects of WMRAS.	\$500	\$600

Declaration by Applicant

I/We _____ hereby declare that the particulars given by me/us in this form are true and complete. I/We wish to apply for *Ordinary/Individual/Associate/Institutional Membership in your Association and if admitted, will abide by the provisions of the constitution of the Association and promise to give full support to the Association.

The undersigned hereby applies for membership in the **Waste Management and Recycling Association of Singapore** and agrees, if accepted by the Executive Committee, to pay all fees and dues and to abide by the Constitution of WMRAS.

(# Applicants for Ordinary membership are to attach a copy of the company's ROC together with the application form.)

(# Application of Membership shall be subjected to the approval of the committee.)

Upon approval of the application, an invoice will be issued to you for your immediate payment. Annual subscription fee will be pro-rated accordingly. Please kindly make your cheque payable to the "**Waste Management and Recycling Association of Singapore**".

Name and Signature: _____

Company Stamp: _____

Date: _____

Recommended by: _____

(*Company/Individual/Institution's Name)

For Official Use
Proposer: _____ (Name & Signature)
Seconder: _____ (Name & Signature)
Date Approved: _____



We ensure Mother Earth doesn't pay the price



At SembVisy Recycling, we make it our business to protect the environment. Our recycling programme helps more than 500,000 households and businesses in Singapore reduce, reuse and recycle, saving precious resources to ensure environmental sustainability for this generation, and many more to come.

In this disposable world, we make sure Mother Earth doesn't pay the price. Ever.

SembVISY Recycling Pte Ltd
12 Tuas Ave 18, Singapore 638896
Tel: 6868 5260 Fax: 6227 1443 Website: www.gowaste.com.sg



A joint venture between
SembCorp Waste Management
and VISY Recycling

We keep Singapore's reputation clean

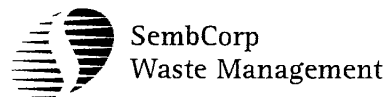


For years, Singapore has ranked among the world's cleanest cities. At SembCorp Waste Management, we make sure it stays that way.

Everyday, come rain or shine, our fleet of trucks fans out all over the island helping keep Singapore clean. As the leading waste management company, we have the technology, people and know-how to offer total integrated waste treatment solutions. From waste collection and post collection to recycling, and from industrial and street cleansing services to engineering and consultancy services. Using the best technologies available. Always.

At SembCorp Waste Management, we come clean everyday.

SembCorp Waste Management Pte Ltd
3 Lim Teck Kim Road #08-01 Singapore Technologies Building, Singapore 088934
Tel: 6323 4548 Fax: 6323 4598 Website: www.gowaste.com.sg



ALTVATER

■ **Altvater Jakob Pte Ltd**
Member of the **SULO** Group



Total Waste Management Solutions including

- **Domestic Waste**
- **Industrial & Commercial Waste**
- **Public Area Cleaning**
- **Event Cleaning**
- **Beach Cleaning**
- **Waste Paper Recovery & Trading**
- **Recycling Services**

Main Office
17 Tuas Avenue 12
Singapore 639037
Tel : 68635230
Fax : 68625488

Western Office
16 Tuas Ave 6
Singapore 639303
Tel : 68633173
Fax : 68633862

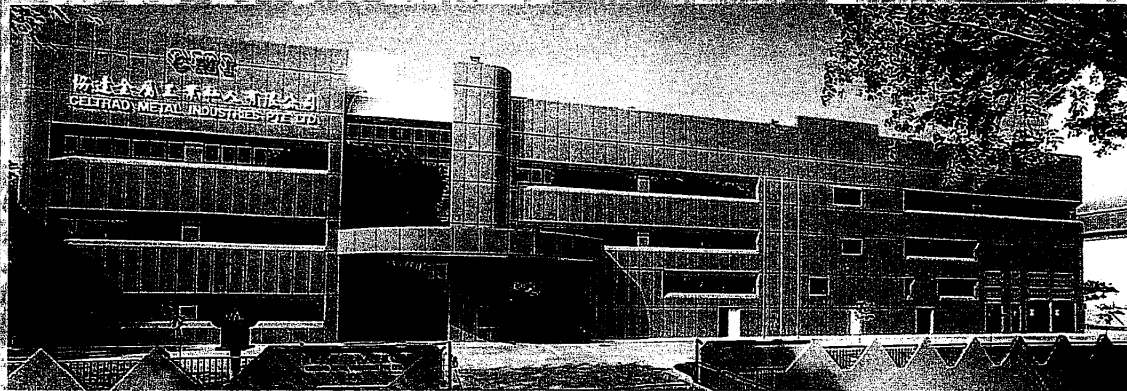
Eastern Office
350 Lorong Halus
Singapore
Tel : 64883408
Fax : 62855391



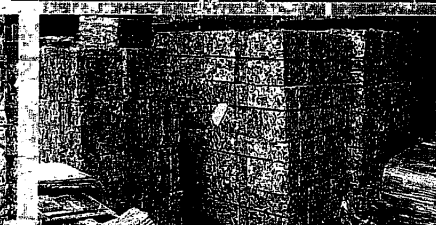
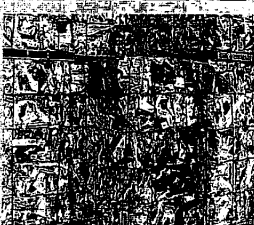
協達金屬工業私人有限公司
Celtrad Metal Industries Pte Ltd

Head Office:
No. 106 International Road, Jurong Industrial Estate, Singapore 629175
Email: ericapoh@celtrad.com.sg

Tel : (65) 6265 7766
Fax : (65) 6268 2289

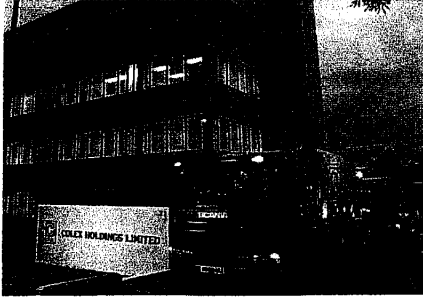


SCRAP METAL IS OUR BUSINESS



SCRAP IMPORTER & EXPORTER DEALING IN ALL KINDS OF INDUSTRIAL SCRAP, FERROUS & NON-FERROUS METAL, SCRAP ELECTRICAL CABLES/WIRE AND METAL WITH INSULATION.

COLEX - For A Clean Environment...



A pioneer as well as a leader in solid waste management industry, COLEX was established in Singapore in 1972. COLEX has successfully maintained its leadership status all these years by being exposed to new systems in advanced countries like the U.S.A., Europe and Australia. It has been consistently introducing new ideas into Singapore.



COLEX grew from two one-man operated and fully mechanized Front Loaders to a large fleet of fifty three trucks consisting of Front Loaders, Rear Loaders and Roll-On-Off trucks. It has a large clientele base all over Singapore, ranging from statutory boards to condominiums, hotels, offices and industrial premises. To complement its core service, in year 1999, COLEX acquired Integrated Property Management Pte. Ltd (IPM) to provide contract cleaning services. With IPM as part of the Group, COLEX is now able to provide one-stop waste disposal services to its clients.

COLEX HOLDING LIMITED

20 Jalan Tukang, Jurong Town, Singapore 619529. Email: colex@singnet.com.sg Tel: 62687711 Fax: 62641219





**ONE STOP SERVICE FOR
TOTAL ENVIRONMENTAL SOLUTIONS**

Non-hazardous Waste Services

ECO RESOURCE RECOVERY CENTRE PTE LTD

40, Tuas West Road Singapore 638389 Tel: 68615515 Fax: 68634466

- *Provide containers & trucks to collect general wastes and furnish accurate & timely Monthly Report*
- *Provide recycled products: wood, aluminum, paper, iron, plastic*
- *Special Service: demolition, destruction of confidential material, asbestos Audit, Removal and Disposal*

Hazardous Waste Services

ECO SPECIAL WASTE MANAGEMENT PTE LT

23, Tuas View Circuit Singapore 637768 Tel: 6863-3323 Fax: 68638713

- *Provide containers and trucks to collect and dispose toxic wastes*
- *Disposal by: incineration, physical & chemical treatment, cementation*
- *Special service: export, recovery, site decontamination*

Environmental Consulting & Laboratory Services

ECO INDUSTRIAL ENVIRONMENTAL ENGINEERING PTE LTD

40, Tuas West Road Singapore 638389 Tel: 6865-1587 Fax: 68620133

- *Transformer Oil Dissolved Gas Analysis*
- *Third Party Environmental Laboratory Analysis*
- *Environmental Baseline Studies*
- *In-Door Air Quality Products & Services*
- *Environmental Engineering Consulting*

YOUR PARTNER IN ENVIRONMENTAL SOLUTIONS

Website: <http://www.eco.com.sg>

Email: sales@eco.com.sg



FME ONYX

Environmental Solution Provider



We provide services for:

○ Solid Waste

○ Liquid Waste

○ Municipal Waste Collection

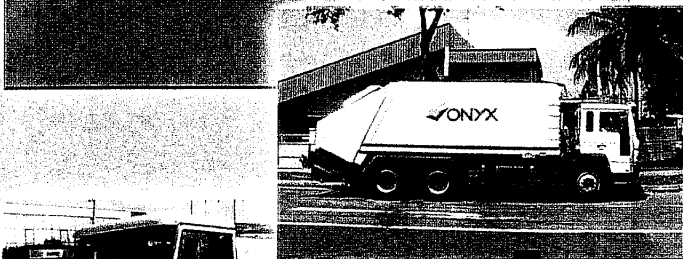
○ Street Cleaning

○ Industrial Services

● Facility Management

● Portable Chemical Toilets

● Recycling



Public waste collector for Tanglin Bukit Merah Sector
Toll-free 1800-8983133

Tel: 62641788 Fax: 62685545



The Mitsubishi FV517 series has been a favourite work horse in the waste management industry in Singapore. Tough and reliable, it has a payload of 17 ton. Powered by 11,945cc engine, turbo, intercooler, it delivers 257kw, which is more than adequate for the demand of the waste management industry.

The Mitsubishi FV517 series can be configured for almost all kinds of upperstructure used in the waste management industry. It has been used extensively for hooklift installations and the Mitsubishi FV517 fitted with rear end loaders are common sight on Singapore roads.

Special features are provided as standard on FV517 series:

- Full Floating Cab
- Electronic Control Governor
- High/Low Type Transmission with 10 Forward and 2 Reverse Speed
- Long Taper Leaf Spring with Double Acting Shock Absorbers
- Lock Brake
- Emergency Engine Cut-Off Device

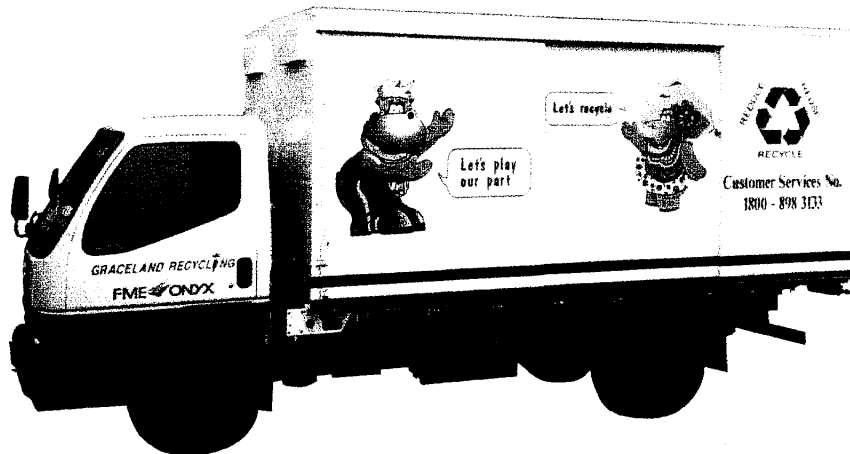


GOLDBELL ENGINEERING PTE LTD
 10 Tuas Avenue 18 Singapore 638894
 SALES . RENTAL . PARTS . SERVICE
 Tel : (65) 6861 0007 Fax: (65) 6862 1865
 Website : www.goldbell.com.sg

GRACELAND RECYCLING



For a Gracious Environment



- Industrial and commercial waste recycling
- Public waste recycling / national recycling programme
- Scrap tyre recycling
- Sales of recycling bins and equipment

We collect and sort newspapers, corrugated cartons, magazines, books, directories, clothes, shoes, toys, bags, metal containers, pots and pans, drink cans, CDs, VCDs, radios, computers, plastics, glass bottles and scrap tyres.

GRACELAND RECYCLING PTE LTD

(a member of NWI Recycling)

12 Tuas Avenue 1
Singapore 639497

A Recycling Company Registered With The Ministry Of Environment

MATERIALS RECOVERY FACILITY

16 Neythal Road Singapore 628581

Tel: 6268 3833 Fax: 6266 3383

E-mail: gracerec@singnet.com.sg

Solving Tomorrow's Problems Today



HOCK CHUAN HONG WASTE MANAGEMENT PTE LTD
HOCK CHUAN HONG ENTERPRISES PTE LTD

Operation and Correspondence

18, Pasir Ris Ave, Singapore 519685.
Tel: 6582 7183/4369 Fax: 6582 9727
Email: psengc@singnet.com.sg
lhphuah@singnet.com.sg

Sales Office

1 Mactaggart Road, #02-06,
Mactaggart Building,
Singapore 368078.
Tel/ Fax: 6324 7813

Sarimbun Recycling Park-Env

Approved Recycle Centre
Lot 616 Pt Mk 12
Lim Chu Kang Road.
Tel: 6795 4813 Fax: 6795 4812



International Bio-Energy (S) Pte Ltd

16 Gul Crescent, Jurong Industrial Estate, Singapore 629526

Tel: (65) 6558 7889 Fax: (65) 6558 7789

E-mail: info@bioenergy.com.sg Website: www.bioenergy.com.sg

Recycle for a friendly, cleaner and greener environment using advanced modern technology.

International Bio-Energy (S) Pte Ltd. was incorporated in Singapore to cater to the needs of recycling in all types of residential, commercial and industrial waste to produce solid fuel which is in common layman language called "Charcoal"

Total Recycling Process - From Waste to Energy Source

Recycling Services

Waste Management

- Horticultural Waste
- Waste Disposal Center

Wood-waste Recycling Plant

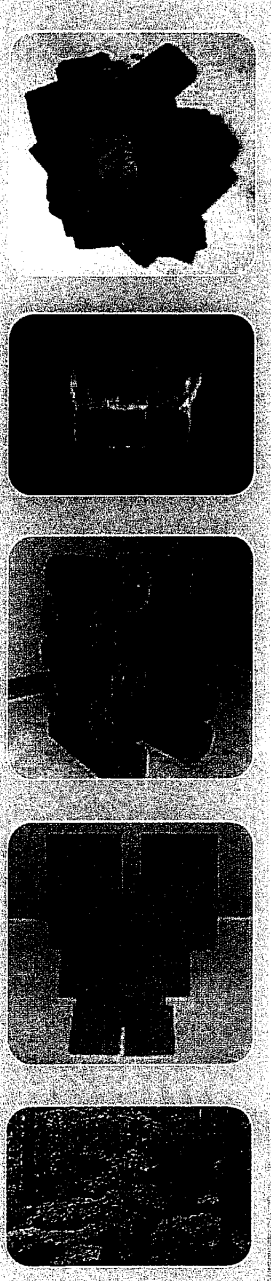
Solid Fuel (Charcoal) Production

- Processing of Wood/Horticultural Waste
- Carbonization Plant for Charcoal Production
- Charcoal
- Heat Logs
- Fire Starter
- Wood Tar
- Wood Vinegar
- Health & Medical Products
- Pharmaceutical Products

Recycling & Bio-Energy Consultancy

- Modern Charcoal Production Plant
- Complete Charcoal Plant Machinery
- Charcoal Manufacturing Technology

For enquiries please call Raymond Yap Tel: (65) 65587889
or Email: raymond@bioenergy.com.sg



Solving your problem?

We provide:

Waste Management

Send your used copper slag to our Government Approved Treatment Centre for recycling if you want to dispose it in a more economical way.

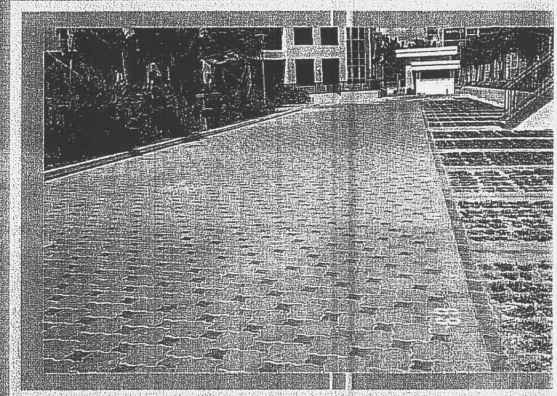
Abrasives

Various sizes of copper slag and recycled copper slag for

- blast-cleaning process
- use as replacement for sand and aggregates in concrete products.

Concrete Products

Various sizes, colour and shape of Interlocking Pavers for road, car park and walk pave.

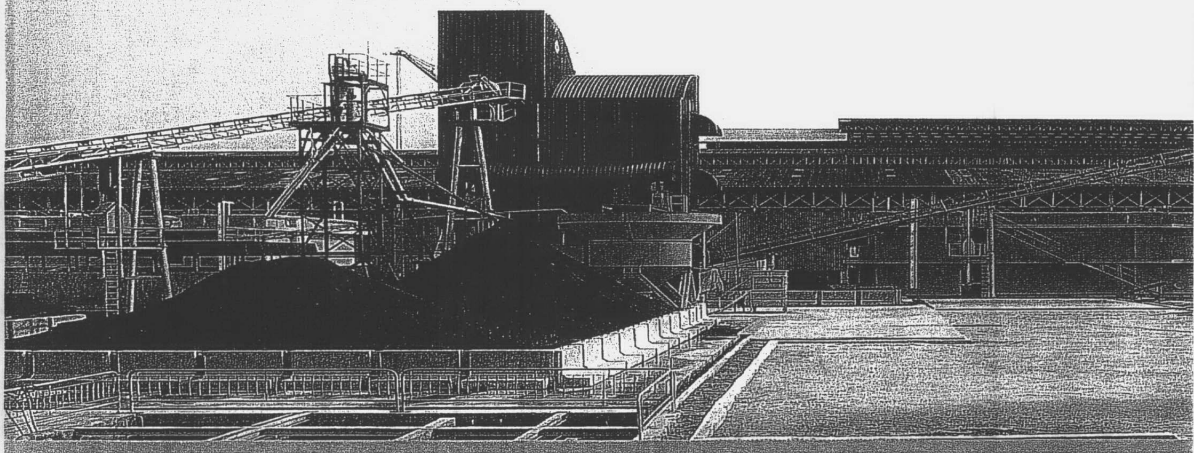


Stockist

- Garnet
- Steel shot

Call : 62662210

Fax : 62663002



JPL INDUSTRIES PTE LTD
JPL CONCRETE PRODUCTS PTE LTD

11A Jurong Pier Road Singapore 619166



NatFeros

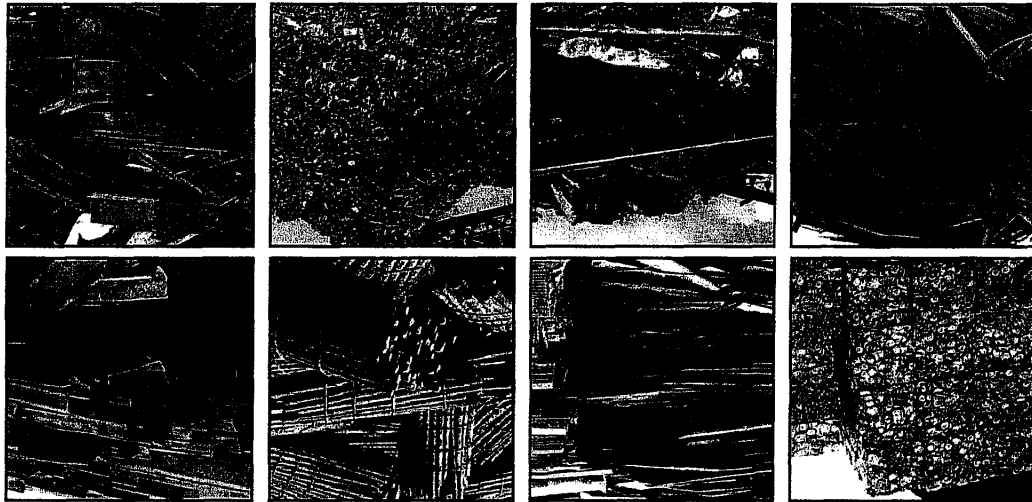
A member of Natsteel

22 Tanjong Kling Rd Singapore 628048

Tel: 6266 6683 Fax 6266 3382

CHOOSE THE SCRAPS THAT MEET YOUR NEEDS

WE SPECIALIZE IN:



PURELY METAL BASED SCRAP MERCHANTS

SCRAP PROCESSING FACILITIES:

- One German Shear, 1200 Ton Cutting Force.
- One Italian Shear, 1000 Ton Cutting Force.
- One German Shredder, 1250HP.
- One Italian Baler, 2 Bales Per Minute.
- 2 Units German Fuchs Telescopic Scrap Handling Excavators.

NATF 1

9 Jurong Pier Road
Tel: 6265 8393
Fax 6266 2387

NATF 2

16, Defu Lane 11 S(539172)
Tel: 6385 3256 / 6385 1592
Fax: 62801649

NATF 3

Lot 936, PTMK 13,
Site 5 Admiralty Rd West
Tel: 6365 6681 / 6368 8794
Fax: 6368 7758

Non-Ferrous Centre (NFC)

9, Jurong Pier Road
Tel: 6265 5264 Fax: 6266 7713

SFM / External Weighbridge

9, Jurong Pier Road
Tel: 6264 1149



We are simply the Best!

*Used & Preferred by Major Cities,
Town Councils and
Waste Management Service Companies.*



OTTO Waste Systems (S) Pte Ltd
20 Harbour Drive, #02-03 PSA Vista, Singapore 117612
www.ottoasiapac.com

ASIAN DISTRIBUTION CENTRE:
12 Tuas Avenue 1 Singapore 639497
Tel: (65) 6898 1267 Fax: (65) 6268 5193



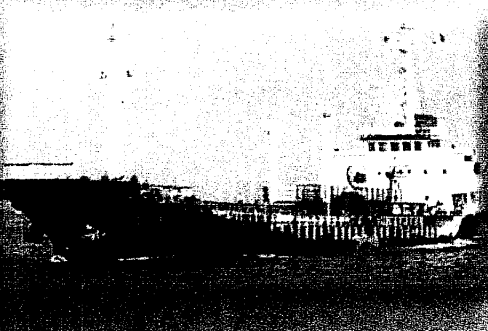
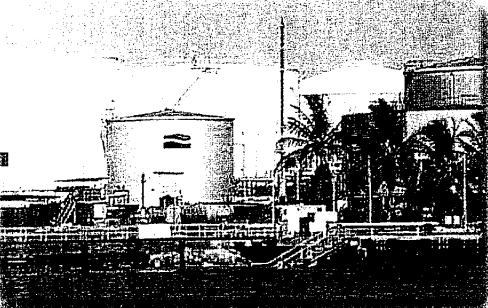
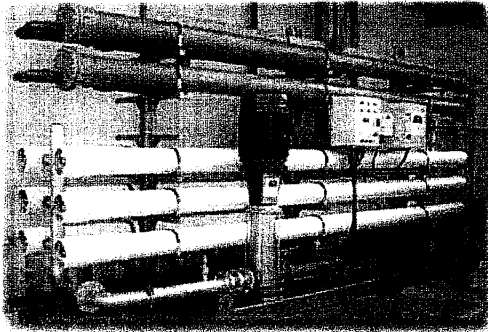
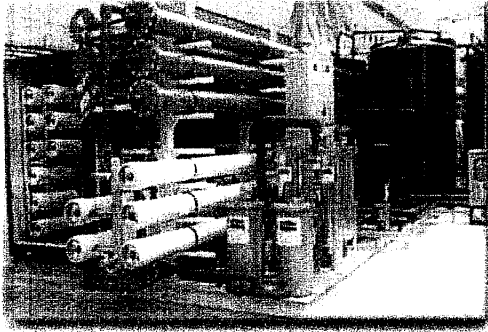
**SINGAPORE
CLEANSEAS**

SINGAPORE CLEANSEAS PTE LTD

2 Maritime Square, #03-01/02 SPI Building, Singapore 099255

Tel: (65) 6275-5868 Fax: (65) 6275-5850

E-Mail: cleansea@singnet.com.sg Web Sites: www.cleanseas.com.sg
and www.cleanwater.com.sg



Our Services

- Collection, Treatment, Disposal of Oil Slop and Sludge
- Waste Water & Water Treatment & Recycling

Our Facilities

- Centralised Treatment Plants at our Premises
- Build-Own-Operate Plants at Client Premises

Our Strengths

- Leader in our fields with 30 years' experience
- Strong operational expertise
- State-of-the-art technical know-how, supported by R & D

Industries Covered

- Tanker Shipping and Marine
- Petroleum and Petrochemical
- Electronic and Semi-conductor
- Pharmaceutical

WH

ESTABLISHED SINCE 1980

WAH & HUA PTE LTD

No. 23, Sungei Kadut Street 1, Singapore 729323

Tel: 6362 0078 Fax: 6362 0079

Email: info@wahhua.com.sg Website: <http://www.wahhua.com.sg>

"Our aim is to recycle as much waste as our environment could generate."

Wah & Hua provides a one-stop waste management service with experience, cost-effective & efficiency for a wide range of industries.

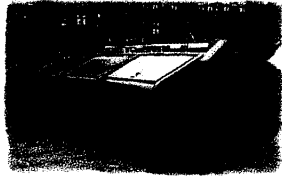
Wah & Hua offers the know how technologies necessary for separating, reprocessing and recycling of various types of materials that includes:

- Metals
- Paper, Cardboard, Carton Boxes
- PC, Electronic Parts
- Plastics
- Wood
- Waste Packaging Materials

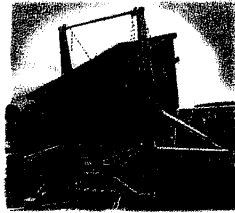
Processing Recyclable Materials



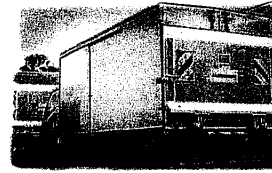
The Complete Load And Waste Handling Equipment Specialist



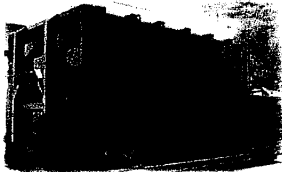
Container Bin



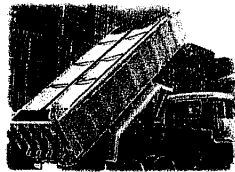
Skip Loader



Behrens EuroLift Aluminium Tailgate



Portable Compactor



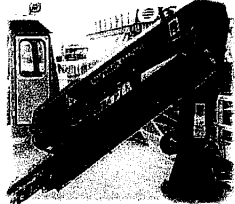
Dump Body / Tipper Body



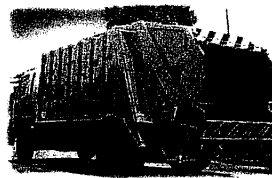
Self-Loader



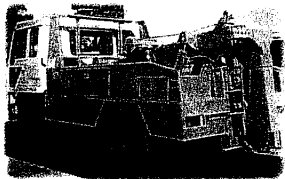
Palift Hookloader



Palfinger Marine Crane



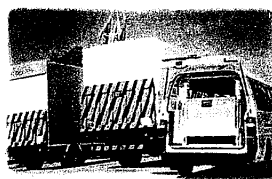
Rear End Compactor



Recovery / Wrecker / Tow Truck



Palfinger Truck Crane



Tailgate

MANUFACTURER OF:

Power Tailgate / Tail-Lift, Ambulance Lift, Dump Body, Tow Truck, Container bin, Rear End Compactor, Portable Compactor, Bin Lifter

SALES & SERVICE:

Palfinger Crane / Tailgate. Service of all type of truck mounted cranes and hooklifts. (Singapore Largest Service / Repair Center)



黄芳機器廠(1988)私人有限公司
WONG FONG ENGINEERING WORKS (1988) PTE LTD

79 Joo Koon Circle Singapore 629107
Tel: (65) 6861 6555 Fax: (65) 6861 3230
E-mail: wongfong@singnet.com.sg
Website: <http://www.wongfong.com>



Cert No: A1A0072501

TEL: (65) 68616555

FAX: (65) 68613230

**ORDINARY
MEMBERS**



Waste Management and Recycling Association of Singapore

Altvater Jakob Pte Ltd

Company address:	17 Tuas Ave 12, Singapore 639037
Telephone:	6863 5230
Fax:	6862 5488
Email:	enquiry@altvater.com.sg
Contact person:	Mr Peter Voegele, Director
Nature of business:	Waste Management / Waste Paper Recovery
Year established:	1998
Staff strength:	430

Business activities:

Altvater Jakob Pte Ltd, specializes in waste management activities such as waste collection, disposal, public area cleaning, beach cleaning, recycling, waste paper collection and trading; providing total solutions to modern waste problems and dedicated customized systems around the world.

Celtrad Metal Industries Pte Ltd

Company address:	106 International Road, Singapore 629175
Telephone:	6265 7766
Fax:	6268 2289
Email:	ericapoh@celtrad.com.sg
Contact person:	Mr Ng Hock Chuan, Managing Director
Nature of business:	Recycling
Year established:	1983
Staff strength:	30

Business activities:

Scrap Processor, Importer and Exporter.

Waste Management and Recycling Association of Singapore

Ceramic Technologies Pte Ltd

Company address: 61 Tuas Crescent, Singapore 638737
Telephone: 6863 3212
Fax: 6863 8006
Email: ctech@singnet.com.sg
Nature of business: Recycling

Business activities:

Recycling of waste soil and other solid wastes into high value added buildings products.

Page 47

Citiraya Industries Ltd

Company address: No. 65, Tech Park Crescent,
Singapore 637787
Telephone: 6264 4338
Fax: 6266 6731
Website: www.citiraya.com
Email: citiraya@singnet.com.sg
Contact person: Marketing Department
Nature of business: Waste Management.
Year established: 1992
Staff strength: 77

Business activities:

Citiraya Industries Ltd is a pioneer and leader in the provision of a ONE-STOP ELECTRONIC WASTE MANAGEMENT Solution to the electronics sector. In tandem with growing global concerns with the environment pollution, Citiraya offers an essential service by providing an environmental friendly solution to electronics byproducts. As a one-stop electronic waste management center, Citiraya provides a comprehensive range of services to its customers including logistics support, recycling and recovering of Precious Metals from electronic wastes, compliance with international environmental standards, and protection of intellectual property of customers. As a global player, Citiraya also provides its services to MNCs in many countries including Malaysia, Thailand, Taiwan, China, India, Brazil, Germany, UK, Italy and Philippines.

**Waste Management and Recycling
Association of Singapore**

Cleanway Disposal Services Pte Ltd

Company address:	7 Wah Shih Road, Singapore 627905
Telephone:	6264 4411
Fax:	6264 0715
Email:	cleanway@cyberway.com.sg
Contact person:	Mr Eddie Ong, Managing Director
Nature of business:	Waste collector /Waste Management
Year established:	1987
Staff strength:	30

Business activities:

Containerised general and project removal of domestic, commercial, industrial, port and exhibition waste and debris.

Colex Holdings Limited

Company address:	20 Jalan Tukang, Singapore 619257
Telephone:	6268 7711
Fax:	6264 1219
Website:	www.colex.com.sg
Email:	colexgm@singnet.com.sg / colex@singnet.com.sg
Contact person:	Mr Desmond Chan / Ms Penny Goh
Nature of business:	Waste Collection / Waste Management, - Contract Cleaning & Recycling Services
Year established:	1971
Staff strength:	140

Business activities:

Provide waste disposal services and contract cleaning to commercial offices, hotels, shopping complexes, food courts, cineplexes, factories, warehouses and residential buildings.

Sales, lease and services of compactors and plastic bins

Waste Management and Recycling Association of Singapore

Crimson General Contract Co

Company address: Blk 501, Jurong West St 51, #02-253,
Singapore 640501
Telephone: 6566 4330
Fax: 6567 5048
Contact person: Mr Lim Loo Beng
Nature of business: Waste Collector/ Waste Management,
Recycling.
Year established: 1971

Business activities:

We specialise in industrial waste, hardcore, spoil earth/ mud removal, maintenance of factory compound, shipyards, construction sites, condominiums, shopping centres. We also deal with grass and tree cutting, scrap materials etc.

ECO Industrial Environmental Engineering Pte Ltd

Company address: 40 Tuas West Road, Singapore 638389
Telephone: 6865 1587
Fax: 6862 0133
Website: www.eco.com.sg
Email: eco@eco.com.sg
Contact person: Col(Ret) Chua Tiong Guan,
Managing Director
Nature of business: Waste Collector/ Waste Management
Year established: 1995
Staff strength: 140

Business activities:

Total waste management solutions that includes auditing, collection, transportation, treatment, recovery, incineration, sorting, cementation, site decontamination, asbestos stripping and disposal, environmental consultancy, accredited lab services, disposal of all industrial hazardous and non-hazardous wastes.

Waste Management and Recycling Association of Singapore

Eng Cheong Leong Agri Chem Pte Ltd

Company address: 11 Jalan Buroh, Jurong Town,
Singapore 619472
Telephone: 6268 1185
Fax: 6261 2133
Contact person: Mr Tay Tho Bok, Chairman
Nature of business: Recycling
Year established: 1986

Business activities:

Manufacturing animal feeds.

Eng Siong Trading

Company address: Blk 4005, Depot Lane, #01-105,
Singapore 109759
Telephone: 6481 8729
Fax: 6481 0190
Contact person: Mr Chua Ah Cheong
Nature of business: Scrap Dealer
Year established: 1977
Staff strength: 5

Business activities:

Dealing in all kinds of metal alloys such as gold, silver, bronze, nickel, aluminum, copper, brass, solder waste residues and stainless steel, used electronic scrap and junks.

Waste Management and Recycling Association of Singapore

Eveready Manufacturing Pte Ltd

Company address:	32 Tuas South Street 3, Singapore 638029
Telephone:	6863 4138
Fax:	6861 2161
Website:	www.eveready-mfg.com
Email:	davewong@eveready-mfg.com
Contact person:	Mr Dave Wong Peng Phui, Business Development Manager
Nature of business:	Recycling
Year established:	1978
Staff strength:	35

Business activities:

Eveready Manufacturing Pte Ltd is a company specializing in plastics recycling, compounding and films manufacturing. We have more than 20 years of experience in this business and we are the largest plastics recycler in Singapore. We also provide services to help companies reducing their solid waste in term of plastic recycling. We collect, process and sell all kinds of thermoplastics including: ABS, AS, EVA, LDPE, LLDPE, PC, PC/ABS, PCTG, PETG, PMMA, PP, PS and PVC. For compounding, we are capable of manufacturing conductive, flame retardant and glass filled and colored compound as well as calcium carbonate masterbatches. We also manufacture films for up to 9 meters wide. Main applications are heat shrink packaging (EverWrap®), agricultural covering (EverGrow®) and industrial covering (Evershield®).

Evotech (Asia) Pte Ltd

Company address:	40 Gul Circle, Singapore 629575
Telephone:	6863 3881
Fax:	6863 4554
Email:	hubertho@evotechasia.com
Contact person:	Mr Hubert Ho
Nature of business:	Recycling, Scrap Metal Processor
Year established:	2001
Staff strength:	28

Business activities:

Our main activities involve the procuring, processing and exporting of ferrous (stainless steel based) and non-ferrous(eg copper and aluminium based) metal recyclables including alloys, electrical and electronic recyclables.

Waste Management and Recycling Association of Singapore

FME Onyx. Pte Ltd

Company address:	23 Pandan Ave, Singapore 609389
Telephone:	6264 1788
Fax:	6268 5545
Website:	www.fmeonyx.com
Email:	fme@pacific.net.sg
Contact person:	Mr Tom Ng, Managing Director
Nature of business:	Waste Collector / Waste Management and Recycling
Year established:	1998
Staff strength:	220

Business activities:

Domestic Refuse Disposal, Industrial & Commercial waste disposal, Liquid waste collection & treatment, Industrial cleaning services, recycling, Street Cleansing.

Gold Green Corporation Pte Ltd

Company address:	583, Orchard Road, Forum #16-01 / 17-01, Singapore 238854
Telephone:	6316 1351
Fax:	6316 1353
Website:	www.goldgreen.com
Contact person:	Mr Joseph Low, Managing Director Managing Director
Nature of business:	Recycling
Year established:	2001

Business activities:

Recycling of Horticulture & Construction Wood Waste into carbon products.

Waste Management and Recycling Association of Singapore

Graceland Recycling Pte Ltd

Company address:	12 Tuas Avenue 1, Singapore 639437
Telephone:	6268 3833
Fax:	6862 2183
Website:	www.graceland.com.sg
Email:	gracerec@singnet.com.sg
Contact person:	Mr Vincent Chan, General Manager
Nature of business:	Equipment providers and Recycling
Year established:	2000
Staff strength:	35

Business activities:

Industrial and commercial waste recycling, Public waste recycling, and sales of recycling bins and equipment.

Green World Holdings Ltd

Company address:	6 Tuas View Circuit, Singapore 637599
Telephone:	6799 0747
Fax:	6898 9068
Website:	www.greenworld.com.sg
Email:	giam@greenworld.com.sg
Contact person:	Mr Giam Yew Kang, Vice President, Sales & Purchasing
Nature of business:	Recycling
Year established:	1999
Staff strength:	120

Business activities:

Dealing in all kinds of ferrous & Non-ferrous metals, electrical & electronics and isolated cable scraps.

Waste Management and Recycling Association of Singapore

Hanson Building Materials (S) Pte Ltd

Company address: 13 Sungei Kadut Street 4,
Singapore 729064
Telephone: 6369 7888
Fax: 6368 9909
Mobile: 9787 3478
Website: www.hanson-pacific.com
Email: phil.schacht@hanson-pacific.com
Contact person: Mr Phil Schacht, Country Manager
Nature of business: Recycling
Year established: 2000
Staff strength: 250

Business activities:

Recycling of concrete sludge and incinerator bottom ash

Page 54

Hock Chuan Hong Waste Management Pte Ltd

Company address: No 1 Mactaggart Road # 02-06
Singapore 368089
Telephone: 6582 7183
Fax: 6582 9727
Email: psengc@singnet.com.sg /
lhphuah@singnet.com.sg
Contact person: Mr Poh Seng Choon, Director /
Mr Phuah Lian Heng,
Corporate Development Director
Nature of business: Recycling
Year established: 1973
Staff strength: 35

Business activities:

Total Construction and industrial wastes services providers. Services include collecting, recycling, recovering, segregating, and manufacturing of recycling pre-cast products. It has in houses developed waste processing processes that produce recycled aggregates for usage in pre-cast products and developed the formulation for concrete mix using recycled aggregates in pre-cast concrete products. With own fleet of container bins, transportation spread across island wide for collection to ensure waste stream supplies to recycling sites. Recycled facility located at ENV Sarimbun Recycling Park at Lim Chu Kang Road, Singapore.

Waste Management and Recycling Association of Singapore

Hong Gam Wooden Trading Pte Ltd

Company address: No. 9 Sungei Kadut Street 5,
Singapore 728956
Telephone: 6362 5839
Fax: 6362 6826
Email: honggam@singnet.com.sg
Contact person: Mr Toh Ban Swee, Director
Nature of business: Recycling
Year established: 1999
Staff strength: 20

Business activities:

Manufacture of Wooden boxes, packing cases, recycling of wooden pallets

Page 55

International Bio-Energy (S) Pte Ltd

Company address: 16 Gul Crescent, Jurong Industrial Estate
Singapore 629526
Telephone: 6558 7889
Fax: 6558 7789
Website: www.bioenergy.com.sg
Email: info@bioenergy.com.sg
Contact person: Mr Raymond Yap, Managing Director
Nature of business: Recycling
Year established: 2002
Staff strength: 30

Business activities:

Waste Management and Recycling, Manufacture of Charcoal

Waste Management and Recycling Association of Singapore

Introtech Trading

Company address:	30 Penjuru Road, NE4, Singapore 609135
Telephone:	6266 0245 / 6264 2991
Fax:	6268 9260
Website:	www.introtech.com.sg
Email:	intro@singnet.com.sg
Contact person:	Mr Toh Kim Seng, Director
Nature of business:	Recycling
Year established:	1991
Staff strength:	18

age 56

ISS Sanitation Services Pte Ltd

Company address:	315 Outram Road, #04-09, Tan Boon Liat Building, Singapore 169074
Telephone:	6227 9541
Fax:	6225 3919
Website:	www.issworld.com
Email:	steve.loh@iss-sing.com
Contact person:	Mr Steve Loh, General Manager
Nature of business:	Waste Collector / Waste Management and Recycling
Year established:	1983
Staff strength:	39

Business activities:

General & Domestic waste collection & disposal, construction waste disposal, recycling, rental of portable toilet, desilting of holding/septic tank.

Waste Management and Recycling Association of Singapore

JPL Industries Pte Ltd

Company address: 11A Jurong Pier Road, Singapore 619166
Telephone: 6266 2210
Fax: 6266 3002
Email: hosl@jplind.com.sg / waiyin@jplind.com.sg
Contact person: Ms Ho Siew Lian, Technical Manager /
Mr Cheong Wai Yin, Marketing Manager
Nature of business: Recycling and Processing
Year established: 1990
Staff strength: 31

Business activities:

As a company in the environmental conservation industry, JPL Industries embarked on the copper slag-recycling business to solve the biggest single source of waste generation of shipyards and industries. The company owns a copper slag Treatment plant, copper slag processing plant and JPL Concrete Products plant. Treatment plant is aimed to process and purify the used slag collected from various shipyards. After treatment the recycled copper slag can be re-used as an abrasive. JPL Concrete Products plant is converting recycled copper slag into concrete products-interlocking pavers and car-park blocks. The Processing Plant provides drying and grading facilities for new and recycled copper slag.

Page 57

K K Asia Pte Ltd

Company address: Blk 9010, Tampines Street 93, #03-111,
Singapore 528844
Telephone: 6787 3236
Fax: 6787 7905
Website: www.kkasiacorp.com
Email: kkasia@magix.com.sg
Contact person: Mr Robin Loh, Director
Nature of business: Plastic Scrap Recycler
Year established: 1998
Staff strength: 15

Business activities:

Plastic Scrap Recycling (PC, PMMA, PET,PA, POM, PBT, PVC, PE, PPO, ABS, HIPS, SAN, EPS, CA, CP,AS, EVA, MBS etc.)

Waste Management and Recycling Association of Singapore

KL Paper Trading Pte Ltd

Company address:	17 Defu Lane 8, Singapore 539313
Telephone:	6288 4084 / 6288 5935
Fax:	6281 4084
Email:	klpaper@singnet.com.sg
Contact person:	Mr Chan Kim Leong, Managing Director
Nature of business:	Recycling of waste paper
Year established:	2000
Staff strength:	14

Business activities:

K.L. Paper Trading Pte Ltd ("KL") is a associated company of Muda Holding Berhad, a leading player in the paper and packaging industry in Malaysia. KL is specializing in waste paper collection and collects about 24000MT of waste paper annually in Singapore. KL also actively play a role in the environment conservation activities through organizing various recycling awareness project in collaboration with schools, universities and private institutions to realise the objective for greener earth.

Lee Eng Huat Trading

Company address:	Blk 25, Hazel Park Terrace, #13-03 Singapore 678948
Telephone:	6762 3738
Fax:	6762 2509
Contact person:	Mr Teo Huat Soon, Proprietor
Nature of business:	Waste Collector / Waste Management and Recycling
Year established:	1989
Staff strength:	6

Business activities:

Dealers in scrap paper, metal and waste disposal services.

Waste Management and Recycling Association of Singapore

LHT Holdings Limited

Company address:	27 Sungei Kadut Street 1, Singapore 729335
Telephone:	6269 7890
Fax:	6367 4907
Website:	www.lht.com.sg / www.greenflo.com
Email:	enquiry@lht.com.sg
Contact person:	Mr Neo Koon Boo, Managing Director
Nature of business:	Recycling
Year established:	1980
Staff strength:	197

Business activities:

Manufacturing and trading of wooden pallets, flooring and timber related products. Leading manufacturer of technical wood and furniture components.

Likok Paper Trading Pte Ltd

Company address:	146 Gul Circle, Singapore 629604
Telephone:	6558 7758
Fax:	6558 7756
Email:	likok@likokpaper.com
Contact person:	Mr Goh Sia Meng, Director
Nature of business:	Recycling
Year established:	2002
Staff strength:	18

Business activities:

Waste paper collection / Waste Paper packer

Waste Management and Recycling Association of Singapore

MG Bio-Products Pte Ltd

Company address: 1 Joo Chiat Rd, #05-1001,
Joo Chiat Complex, Singapore 420001
Telephone: 6744 3206 / 9755 2317
Fax: 6748 7482 / 6243 0365
Email: loh123@magix.com.sg
Contact person: Dr Patrick Loh, CEO
Nature of business: Recycling / Bioconversion
Year established: 2001
Staff strength: 10

Business activities:

The application of a proprietary concentrated live microbial and microbial metabolites that are indigenous to the soils of use. The component micro-organisms with the processed organic composts and wastes after an in-house high fermentation process, are a combination of beneficial and effective rhizobacteria which have been experimentally and scientifically selected for their vigorous activity around the root zones (rhizospheres) of living plants.

Morelastic Green Pte Ltd

Company address: Lot 615/616. PT MK 12,
Lim Chu Kang Rd,
Singapore 700000
Telephone: 6862 8680
Fax: 6862 8691
Email: megreen@singnet.com.sg
Contact person: Mr Parry Yeo, Director
Nature of business: Recycling and Processing
Year established: 2001
Staff strength: 6

Business activities:

Recycling of tyres.

Waste Management and Recycling Association of Singapore

NatFerrous Pte Ltd

Company address: No.22 Tanjong Kling Road,
Singapore 628048
Telephone: 6266 6683
Fax: 6266 3382
Email: jcw1@natsteel.com.sg
Contact person: Mr Melvin Choo
Nature of business: Principal activities consist of purchasing,
grading, processing and sales of scrap.
Year established: 2001
Staff strength: 100

Business activities:

Natferrous has three scrap collection centres located at Jurong Pier, Defu Lane and West Admiralty. Besides ferrous scrap operation, the company also operates a Non-Ferrous Centre and a Scrap Car Dismantling Centre at Jurong Pier. Natferrous has the following scrap processing facilities to meet the all requirement:

- One German Shear, 1200 Ton Cutting Force, One Italian Shear, 1000 Ton Cutting Force, One German Shredder, 1250HP, One Italian Baler, 2 Bales Per Minute, 2 Units German Fuchs Telescopic Scrap Handling Excavators.

Natsteel EnviroTech Pte Ltd

Company address: 26 Tanjong Kling Road, Singapore 628051
Telephone: 6265 2181
Fax: 6261 0840
Website: www.natsteelenvirotech.com.sg
Email: enquiry@natsteelenvirotech.com.sg
Contact person: Mr Jonson Lai, General Manager
Nature of business: Waste Management and Recycling
Year established: 1985
Staff strength: 47

Business activities:

Natsteel EnviroTech Pte Ltd provides leading edge technologies and solutions to the environment, primarily focusing on treatment, recycling and development of industrial wastes into useful environmentally by-products. The company has expanded its business, comprising four divisions, to meet the increasing needs of its broad-based customers. The four divisions are: 1) Steel Mill Services Division - recycling of waste slag into premium aggregate 2) Industrial Waste Division - treatment and recycling of used copper slag 3) Air Quality Division - provides air and odour testing services, including turnkey dioxin destruction system and dioxin sampling and analysis services. 4) Water/wastewater Treatment Division-provides advanced non-chemical water treatment solution.

Waste Management and Recycling Association of Singapore

Onyx Asia Services Pte Ltd

Company address: 3 Temasek Avenue, #30-03,
Centennial Tower, Singapore 039190
Telephone: 6838 9580
Fax: 6838 9588
Email: gibaud@vivendiap.com
Contact person: Mr Franck Gibaud, Country Manager
Nature of business: Waste collector / Waste Management,
Recycling
Year established: 1997
Staff strength: 5600

Business activities:

Solid and Liquid Waste Collection, Hazardous Waste Collection and Treatment,
Street Cleansing, Landfilling, Sorting-Transfer-Recycling, Waste-to-Energy.

Purechem Onyx Pte Ltd

Company address: 7 Tuas Ave 10, Singapore 639131
Telephone: 6861 6668
Fax: 6861 5326
Website: www.purechemonyx.com.sg
Email: sales@purechemonyx.com.sg
Contact person: Mr Jacob Tan Yeow Chang,
Senior Manager
Nature of business: Waste Collector / Waste Management
Year established: 1987
Staff strength: 80

Waste Management and Recycling Association of Singapore

SembCorp Waste Management Pte Ltd

Company address: 3 Lim Teck Kim Road, #08-01,
Singapore Technologies Building,
Singapore 088934

Telephone: 6323 4548
Fax: 6323 4598
Website: www.gowaste.com.sg
Contact person: Mr Wong Kan Por,
Executive Vice President

Nature of business: Waste Management, Recycling,
Consultancy and Engineering

Year established: 1995
Staff strength: 856

Business activities:

Principal Business Activities - Collection & Post Collection, Industrial and Street Cleansing,
Waste-to-energy Incineration, Recycling & Reuse, Consultancy & Engineering.

Singapore CleanSeas Pte Ltd

Company address: 2 Maritime Square, #03-01/02,
SPI Building, Singapore 099255

Telephone: 6275 5868
Fax: 6275 5850
Website: www.cleanseas.com.sg
Email: cleansea@singnet.com.sg
Contact person: Mr Seah Khen Hee,
Director / General Manager

Nature of business: Waste Collector, Waste Management

Year established: 1993
Staff strength: 102

Business activities:

- 1) Collection, Treatment, disposal of oily wastes from the shipping and petroleum industries.
- 2) Providing client-specific oily waste treatment, waste-water treatment, water recycling and water upgrading services under Design-Build-Own-Operate (DBOO) scheme for all process industries, including electronic manufacturing, wafer fab, petrochemical, chemical, pharmaceutical industries.

Waste Management and Recycling Association of Singapore

Tay Paper Resources Pte Ltd

Company address:	48 Gul Avenue, Singapore 629681
Telephone:	6863 3230 / 6863 2739
Fax:	6863 3193
Website:	www.taypaper.com.sg
Email:	taypap@pacific.net.sg
Contact person:	Mr Jimmy Tay, Managing Director
Nature of business:	Waste Collector, Waste Management
Year established:	1989
Staff strength:	45

Business activities:

Processing of all kinds of waste papers. Buying and Selling of all kinds of recyclable waste products. Import and Export of paper products. Discard and destroy of all kinds of confidential documents.

Technochem Pte Ltd

Company address:	23 Tuas Avenue 11, Singapore 639086
Telephone:	6862 3130
Fax:	6871 1873
Email:	technopl@singnet.com.sg
Contact person:	Mr Lam Heng Thong, Senior Marketing Executive
Nature of business:	Waste Collector / Waste Management and Recycling
Year established:	1983
Staff strength:	49

Business activities:

Technochem is in the business of industrial chemicals waste management. We can dispose and recycle hazardous & toxic waste chemicals via our incinerator, chemical treatment and recycling facilities. Technochem is an ISO 14001 certified company.

Waste Management and Recycling Association of Singapore

Tian Lye Waste Disposal Pte Ltd

Company address: 1009 Tai Seng Ave, #01-2656,
Singapore 534418
Telephone: 6282 3352 / 6280 5980
Fax: 6284 4923
Contact person: Mr Lim Tian Lye, Managing Director
Nature of business: Waste Collector / Waste Management
and Recycling
Year established: 1981
Staff strength: 25

Business activities:

Waste Disposal and Transport services, dealing in scrap metal, hardware plastic materials and all types of paper boxes.

Tradecom Services Pte Ltd

Company address: 3 Shenton Way, #09-08, Shenton House,
Singapore 068805
Telephone: 6224 0036
Fax: 6223 0611
Email: ashvin@trdcom.com.sg
Contact person: Mr Ashvin Desai, Director
Nature of business: Waste Paper Exporter
Year established: 1986
Staff strength: 10

Business activities:

Exporters of all grades of wastepaper and finished product. Representatives of major manufacturers supplying consumables and equipment to paper mills.

**Waste Management and Recycling
Association of Singapore**

Tradelink Hardware Pte Ltd

Company address:	No. 20, Defu Lane 6, Singapore 539374
Telephone:	6280 1094
Fax:	6286 4352
Email:	tradelin@cyberway.com.sg
Contact person:	Mr Fredric Chew
Nature of business:	Trading of Non-Ferrous Metal
Year established:	1997
Staff strength:	10

Business activities:

Importer & Exporter of Non-Ferrous Metal

age 66

Trans Disposal (S) Pte Ltd

Company address:	6 Tuas Ave 16, Singapore 638928
Telephone:	6861 7555
Fax:	6863 0536
Contact person:	Mr Quah Kim Kok, Director
Nature of business:	Waste Disposal and Recovery

Waste Management and Recycling Association of Singapore

V8 Environmental Pte Ltd

Company address:	Blk 153, Bukit Batok St 11, #03-288, Singapore 650153
Telephone:	6569 2300
Fax:	6569 3226
Email:	cherlene@v8.com.sg
Contact person:	Mr Chay B H
Nature of business:	Waste Collector / Waste Management
Year established:	1999
Staff strength:	20

Business activities:

Waste Disposal, rental of portable toilets, desilting of septic tank / grease trap

Vac-Tech Engineering Pte Ltd

Company address:	No. 10 Chia Ping Road, Singapore 619978
Telephone:	6268 9270
Fax:	6268 5352
Website:	www.vac-tech.com
Email:	admin@vac-tech.com
Contact person:	Mr Paul Mulveney, General Manager
Nature of business:	Waste Management
Year established:	1993
Staff strength:	52

Business activities:

Environmental Service - oily sludge treatment, soil remediation, catalyst reuse, reactor services and catalyst changeout.

Waste Management and Recycling Association of Singapore

Wah & Hua Pte Ltd

Company address: No. 23 Sungei Kadut Street 1,
Singapore 729323
Telephone: 6362 0078
Fax: 6362 0079
Website: www.wahhua.com.sg
Email: info@wahhua.com.sg
Contact person: Mr Kenny Tan, General Manager
Nature of business: Waste Management, processing of
recyclable materials
Year established: 1980
Staff strength: 30

Business activities:

Licensed waste collector, one-stop waste management, recondition and supply of pallets, trading and processing of recyclable materials such as paper, metal, plastic and etc.

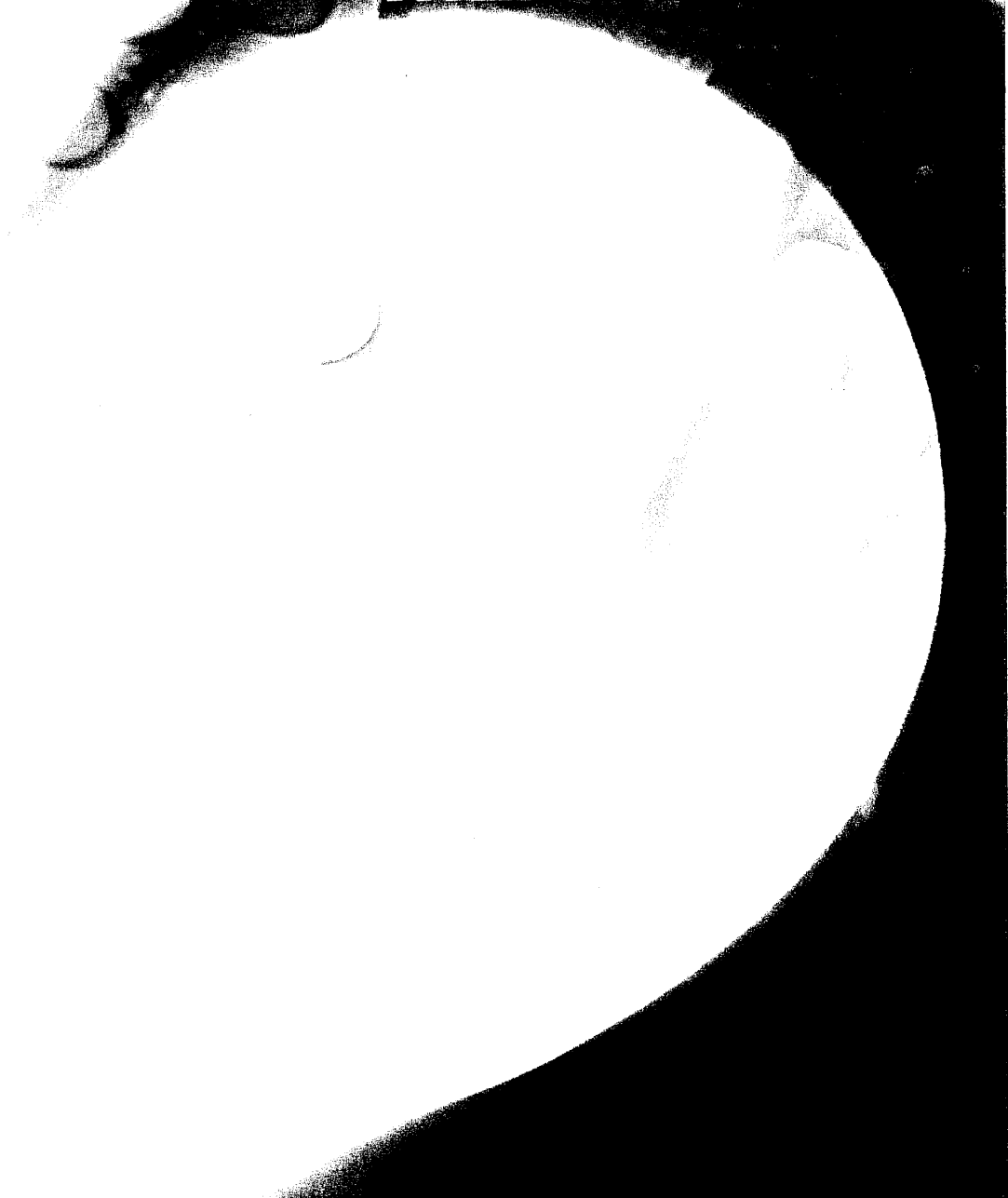
YLS Steel Pte Ltd

Company address: 76 Joo Koon Circle, Singapore 629096
Telephone: 6861 9833
Fax: 6862 9833
Website: www.ylss.com
Email: ylssteel@cyberway.com.sg
Contact person: Mr Ang Yu Seng, Managing Director
Nature of business: Recycling
Year established: 1984
Staff strength: 44

Business activities:

Trading of ferrous and non-ferrous scrap; provision of waste disposal services; stockist / rental of steel plate services; demolition contractor; scrap car center appointed by LTA..

**ASSOCIATE
MEMBERS**



Waste Management and Recycling Association of Singapore

Ekopak Technology Pte Ltd, a member of Hong Leong Asia

Company address: 14 Ang Mo Kio Street 63,
Singapore 569116
Telephone: 6481 7766
Fax: 6482 4982
Website: www.ekopak.com
Email: sinyue_rex@pacific.net.sg
Contact person: Ms Chee Sin Yue, Marketing Executive
Nature of business: Recycling, Environmental products
manufacturer
Year established: 1999
Staff strength: 15

Business activities:

EKOPAK™ uses natural agricultural waste fibers to make degradable and compostable products at cost effective prices with value add design advantages. EKOPAK™ products include disposable food & beverage containers, electronic and appliances packaging, agricultural and farm products and wide range of products which serve as advantageous replacement for non-degradable and non-environmental friendly products made of plastic, polystyrene and paper wood.

age 70

Marathon Equipment Asia Pte Ltd

Company address: No.12 Tuas Avenue 1, Singapore 639497
Telephone: 6861 8141
Fax: 6863 3310
Website: www.marathonasia.com
Email: sales@marathonasia.com
Contact person: Mr Ismail Adnan, Commercial Manager /
Ms Jenny Sia, Sales Manager
Nature of business: Equipment Providers
Year established: 1999
Staff strength: 20

Business activities:

Relating to the sale, engineering, manufacture, facility designing and construction management of waste disposal equipment

Waste Management and Recycling Association of Singapore

Otto Holdings Asia Pacific Pte Ltd

Company address:	12 Tuas Avenue 1, Singapore 639497
Telephone:	6898 1267
Fax:	6268 5193
Website:	www.ottoasiapac.com
Email:	sales@ottoasiapac.com
Contact person:	Mr Christopher Lopez, Regional Sales Manager
Nature of business:	Equipment Providers
Year established:	2000
Staff strength:	12

Business activities:

Otto Holding Asia-Pacific Pte Ltd is the Asian Headquarters of the OTTO Group dealing with the manufacturing, sales and distribution of OTTO waste containers in the Asia Pacific and Middle East regions. OTTO has supplied its products to major cities, town councils and waste management service companies and is so far the preferred brand of the users. OTTO is Simply The Best!

Schaefer Systems International Pte Ltd Waste Technology Div.

Company address:	No. 73 Tuas Avenue 1, Singapore 639512
Telephone:	6863 0168
Fax:	6863 0288
Website:	www.ssi-schaefer.de
Email:	ggornall@schaefer.com.sg / crleys@schaefer.com.sg
Contact person:	Mr Greg S.J. Gornall / Mr Christian Leys, Director of sales.
Nature of business:	Waste Collector / Waste Management
Year established:	1984
Staff strength:	41

Business activities:

Manufacturer of all types of domestic and industrial waste and garbage collection and storage systems

Waste Management and Recycling Association of Singapore

SUT Seraya Pte Ltd

Company address:	51 Sakra Ave, Singapore 627894
Telephone:	6266 0416
Fax:	6267 5737
Email:	paullim@sembcorp.com.sg
Contact person:	Mr Paul Lim, Asst Vice President
Nature of business:	Waste Collector / Waste Management, Recycling
Year established:	1994
Staff strength:	27

age 72

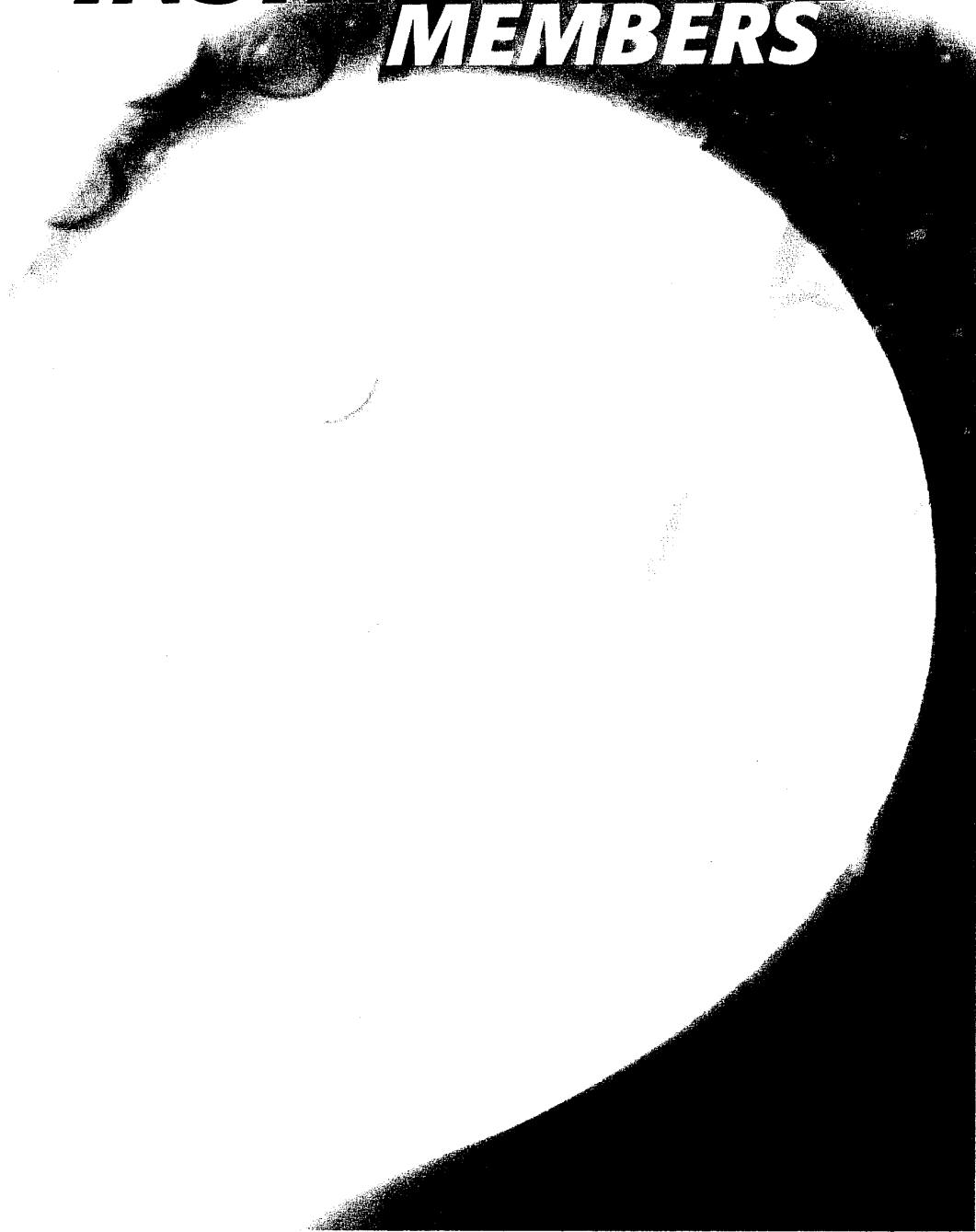
Zenith Engineering Pte Ltd

Company address:	34 Joo Koon Circle, Jurong Town, Singapore 629060
Telephone:	6861 1100
Fax:	6862 1948
Website:	www.ze.com.sg
Email:	info@ze.com.sg
Contact person:	Mr Branley Fong, General Manager
Nature of business:	Equipment Providers
Year established:	1972
Staff strength:	75

Business activities:

Design and Build, Import of Waste Handling Equipment, Compactors, Vacuum Tankers, Sweepers, Collection vehicles.

**INSTITUTIONAL
MEMBERS**



Waste Management and Recycling Association of Singapore

Institute of Environmental Science and Engineering

Company address: Nanyang Technological University,
Innovation Centre Block 2, Unit 237,
18 Nanyang Drive, Singapore 637723

Telephone: 6794 1533
Fax: 6792 1291
Contact person: Ms Tan Kim Suan
Nature of business: R&D

Business Activities:

The Institute of Environmental Science and Engineering (IESE) has been created as a center of research excellence to advance the state-of-art in environmental science and engineering. IESE aims to be a world-class center for environmental science and engineering and serve as a coordinator for environmental R&D investment in Singapore, to meet the country's needs for sustainable growth in a knowledge-based economy. IESE, under the Nanyang Technological University, is organised into six technology centers, i.e. Environmental Engineering, Maritime Research, Environmental Biotechnology, Membrane Technology, Clean Energy and Research of Ecomaterials.

**INDIVIDUAL
MEMBERS**



Waste Management and Recycling Association of Singapore

Name: Mr Ang Peng Hock
Address: Blk 448, Bukit Panjang Ring Rd,
#11-543, Singapore 670448
Telephone: 9040 7703
Nature of business: Waste Collector / Waste Management,
Recycling

Name: Mr Arthur Dietrich
Address: 36 Duxton Hill, Singapore 089614
Telephone: 6227 0227
Email: fichtner@singnet.com.sg
Nature of business: Consulting

age 76

Name: Mr Casey Oh Kian Chye
Address: 256 Serangoon Central Drive #11-44
Singapore 550256
Telephone: 97422843
Fax: 96812664
Email: caseyoh@magix.com.sg
Nature of business: Waste Management

Name: Mr Chia Yee Chuen
Address: 20 Bukit Batok Crescent, #09-07
Enterprise Centre, Singapore 658080
Telephone: 6569 5568 / 9846 3086
Fax: 6569 3776
Email: yc1800@theglobalserve.com
Nature of business: Recycling

Waste Management and Recycling Association of Singapore

Name: Mr Chris Prengels
Address: 170 Upper Bukit Timah Road, #17-04,
Bukit Timah Shopping Centre,
Singapore 588179
Telephone: 6462 1408
Fax: 6466 8906
Email: Chris_Prengels@bettertechnology.com
Nature of business: Equipment Providers

Name: Mr Goh Nam Siang
Address: Blk 5, Pioneer Road North, #01-34,
Singapore 628458
Telephone: 6268 0757
Fax: 6262 0777
Email: refuserv@singnet.com.sg
Nature of business: Waste Collector / Waste Management

Name: Mr Govind Madhava Srivastava
Address: 55 Lorong L, Telok Kurau ,#03-61,
Bright Centre, Singapore 425500
Telephone: 6440 6725 / 6344 1194
Fax: 6344 9177
Email: srigms@hotmail.com/ sales@alcomet.com.sg
Nature of business: Recycling and Consulting

Name: Mr Govindarajoo. R
Address: 38 Mayflower Terrace, Singapore 568581
Telephone: 6766 3954
Fax: 6451 2953
Email: gkrlenterprise@yahoo.com.sg
Nature of business: Recycling

Waste Management and Recycling Association of Singapore

Name: Mr Khoo Chin Huat
Address: 99 Cashew Road, #14-01, Cashew Heights,
Singapore 679670
Telephone: 6368 8013
Fax: 6765 0700
Email: khoo_ch@pacific.net.sg
Nature of business: Recycling

Name: Mr Lau Huat Lye
Address: Blk 545, Bukit Panjang Ring Road, #24-881,
Singapore 670545
Telephone: 6839 4905
Nature of business: Waste Collector / Waste Management,
Recycling

Page 78

Name: Mr Philip Kan
Address: 362 Upper Paya Lebar Road, Blk A, #07-13,
Da Jin Factory Building, Singapore 534963
Telephone: 6382 1151
Fax: 6382 1161
Email: philip@goettsch.com
Nature of business: Equipment Providers

Name: Mr Poh Chuan Hock
Address: Blk 730, Clementi West St 2, #06-340,
Singapore 127730
Telephone: 6777 6324 / 9644 8147
Mobile: 9644 8147
Nature of business: Recycling

Waste Management and Recycling Association of Singapore

Name: Mr Richard C. Reidinger
Address: 2 Shenton Way SGX Centre I, #17-03,
Singapore 068804
Telephone: 6222 6362 / 6236 1036
Fax: 6222 3978 / 6226 1636
Email: Rick.reidinger@erm.com
Nature of business: Consulting

Name: Mr Steve Mellor
Address: 10 Jalan Lempeng, #08-02, Park West,
Singapore 128797
Telephone: 9670 7850
Fax: 6873 3216
Email: stevemellor@pacific.net.sg
Nature of business: Equipment Providers

Name: Mr Tan Kong Eng
Address: Blk 23, Bendemeer Road, #09-507,
Singapore 330023
Telephone: 9666 5379
Nature of business: Waste Collector / Waste Management

Name: Mr Tan Peng Teck
Address: Blk 217, Choa Chua Kang Central, #07-212,
Singapore 680217
Telephone: 9675 1039
Nature of business: Recycling

Waste Management and Recycling Association of Singapore

Name:
Address:

Telephone:
Fax:
Email:

Mr Ting Chue Lit
Blk 4034, Ang Mo Kio Ind Park 1, #01-42,
Singapore 569641
6553 2168
6553 2138
envirogreen@pacific.net.sg

Name:
Address:

Telephone:
Fax:
Email:
Nature of business:

Mdm Wong Sok Mei
2 Kallang Ave, #08-12, Kallang Bahru Complex,
Singapore 339407
6293 5250
6296 7434
impactrecycling@pacific.net.sg
Waste Collector / Waste Management

Name:
Address:

Telephone:
Nature of business:

Mr Wong Cheng Seng
Blk 716, Jurong West St 71, #06-65,
Singapore 640716
9637 0353
Waste Collector / Waste Management,
Recycling

Name:
Address:
Telephone:
Fax:

Email:
Nature of business:

Mr Vamsi Krishna. Y
89 C Geylang Road, Singapore 389203
6741 5200
6741 6200
info@coselec.com.sg
Equipment Providers, R&D, Bin Identification

Waste Management and Recycling Association of Singapore

INDEX OF COMPANIES LIST

A	Altwater Jakob Pte Ltd	46
C	Celtrad Metal Industries Pte Ltd	46
	Ceramic Technologies Pte Ltd	47
	Citiraya Industries Ltd	47
	Cleanway Disposal Services Pte Ltd	48
	Colex Holdings Limited	48
	Crimson General Contract Co	49
E	ECO Industrial Environmental Engineering Pte Ltd	49
	Ekopak International Pte Ltd	70
	Eng Cheong Leong Agri Chem Pte. Ltd.	50
	Eng Siong Trading	50
	Eveready Manufacturing Pte Ltd	51
	Evotech (Asia) Pte Ltd	51
F	FME Onyx. Pte Ltd	52
G	Gold Green Corporation Pte Ltd	52
	Graceland Recycling Pte Ltd	53
	Green World Holdings Ltd	53
H	Hanson Building Materials (S) Pte Ltd	54
	Hock Chuan Hong Waste Management Pte Ltd	54
	Hong Gam Wooden Trading Pte Ltd	55
I	Institute of Environmental Science and Engineering	74
	International Bio-Energy (S) Pte Ltd	55
	Introtech Trading	56
	ISS Sanitation Services Pte Ltd	56

Waste Management and Recycling Association of Singapore

INDEX OF COMPANIES LIST

J	JPL Industries Pte Ltd	57
K	K K Asia Pte Ltd	57
	KL Paper Trading Pte Ltd	58
L	Lee Eng Huat Trading	58
	LHT Holdings Limited	59
	Likok Paper Trading Pte Ltd	59
M	Marathon Equipment Asia Pte Ltd	70
	MG Bio-Products Pte Ltd	60
	Morelastic Green Pte Ltd	60
N	NatFerrous Pte Ltd	61
	Natsteel EnviroTech Pte Ltd	61
O	Onyx Asia Services Pte Ltd	62
	Otto Holding Asia Pacific Pte Ltd	71
P	Purechem Onyx Pte Ltd	62
S	Schaefer Systems International Pte Ltd - Waste Technology Div.	71
	SembCorp Waste Management Pte Ltd	63
	Singapore Cleanseas Pte Ltd	63
	SUT Seraya Pte Ltd	72
T	Tay Paper Resources Pte Ltd	64
	Technochem Pte Ltd	64
	Tian Lye Waste Disposal Pte Ltd	65
	Tradecom Services Pte Ltd	65
	Tradelink Hardware Pte Ltd	66
	Trans Disposal (S) Pte Ltd	66

Waste Management and Recycling Association of Singapore

V	V8 Environmental Pte Ltd	67
	Vac-Tech Engineering Pte Ltd	67
W	Wah & Hua Pte Ltd	68
Y	YLS Steel Pte Ltd	68
Z	Zenith Engineering Pte Ltd	72



WMRAS

*"To professionalise and develop
a leading waste management and
recycling industry in Asia"*

Waste Management and Recycling Association of Singapore

Economic Development Board (EDB) Offices

Head Office, Singapore

250 North Bridge Road #24-00
Raffles City Tower Singapore 179101
Tel: (65) 6336 2288
Fax: (65) 6339 6077
Telex: RS26233
Website: <http://www.sedb.com>

New York

55 East 59th Street, Suite 21B,
New York, New York 10022-1112
United States of America
Tel: (1-212) 421 2200
Fax: (1-212) 421 2206
Email: edbny@edb.gov.sg

Boston, Massachusetts

8th Floor, One International Place,
Boston, Massachusetts 02110-2600
United States of America
Tel: (1-617) 261 9981
Fax: (1-617) 261 9983
Email: edbbt@edb.gov.sg

Chicago, Illinois

Two Prudential Plaza
180 North Stetson Avenue
Suite 970 Chicago
Illinois 60601-6712
United States of America
Tel: (1-312) 565 1100
Fax: (1-312) 565 1994
Email: edbch@edb.gov.sg

Dallas

MacArthur Center II
5605 North MacArthur Boulevard
11th Floor Dallas, TX 75038
Tel: (1-972) 819 3868
Fax: (1-972) 819 8226
Email: edbdw@edb.gov.sg

Los Angeles, California

2029 Century Park East
Suite 438 Los Angeles
California 90067
United States of America
Tel: (1-310) 553 0199
Fax: (1-310) 557 1044
Email: edbla@edb.gov.sg

San Francisco, California

210 Twin Dolphin Drive
Redwood City
California 94065-1402
United States of America
Tel: (1-650) 591 9102
Fax: (1-650) 591 1328
Email: edbsf@edb.gov.sg

Washington, DC

The Millenium Building
1909 K Street N.W
Suite 730
Washington D.C 20006
United States of America
Tel: (1-202) 223 2571
Fax: (1-202) 223 2572
Email: edbw@edb.gov.sg

London, United Kingdom

3 Charles II Street
London SW 1Y 4AE
United Kingdom
Tel: (44-20) 7839 6688
Fax: (44-20) 7839 6162
Email: edbln@edb.gov.sg

Frankfurt, Federal Republic of Germany

Kaiserstrasse 5 D-60311
Frankfurt am Main
Federal Republic of Germany
Tel: (49-69) 273 9930
Fax: (49-69) 273 993 33
Email: edbfr@edb.gov.sg

Waste Management and Recycling Association of Singapore

Economic Development Board (EDB) Offices

Milan, Italy

Corso Matteotti 1/A
20121 Milano, Italy
Tel: (39-02) 799 277
Fax: (39-02) 780 023
Email: edbmi@edb.gov.sg

Paris, France

356 Rue Saint- Honore
75001 Paris, France
Tel: (33-1) 4450 -5830
Fax: (33-1) 4297- 5355
Email: edbpr@edb.gov.sg

Stockholm, Sweden

Storgatan 42
S11455 Stockholm, Sweden
Tel: (46-8) 663 7488
Fax: (46-8) 782 3951
Email: edbst@edb.gov.sg

Tokyo, Japan

Office of the Counsellor (Industry)
c/o Embassy of the Republic of Singapore
The Imperial Tower, 8th Floor,
1-1 Uchisaiwai-cho 1-chome
Chiyoda-ku, Tokyo 100-0011, Japan
Tel: (81-3) 3501 6041
Fax: (81-3) 3501 6060
Email: edbto@edb.gov.sg

Osaka, Japan

c/o Consulate General of the Republic
of Singapore
14th Floor, Osaka Kokusai Building
2-3-13 Azuchi-machi
Chuo-ku Osaka 541-0052 Japan
Tel: (81-6) 261 5131/2
Fax: (81-6) 6261 0338
Email: edbos@edb.gov.sg

Hong Kong, China

3010-3012 One Pacific Place
88 Queensway, Hong Kong
Tel: (852) 2810 0036
Fax: (852) 2521 5732
Email: edbhk@edb.gov.sg

Jakarta, Indonesia

c/o Embassy of the Republic of Singapore
Block X/4 KAV No 2
Jalan H R Rasuna Said, Kuningan
Jakarta 12950, Indonesia
Tel: (62-21) 526 2158
Fax: (62-21) 520 1476
Email: edbjk@edb.gov.sg

Waste Management and Recycling Association of Singapore

International Enterprise Singapore (IES) Offices

Head Office, Singapore

230 Victoria Street #09-00
Bugis Junction Office Tower
Singapore 188024
Tel: 65-6337 6628
Fax: 65-6337 6898
Telex: RS 28617 TRADEV
Email: enquiry@iesingapore.gov.sg

Bangkok

c/o Embassy of the Republic
of Singapore-Bangkok
183 South Sathorn Road,
9th Floor Rajanakarn Building
Bangkok 10120, Thailand
Tel: 66-2-287 0897
Fax: 66-2-287 0971
Email: bangkok@iesingapore.gov.sg

Beijing

c/o Embassy of the Republic
of Singapore-China
1 Guang Hua Road
Kerry Centre 27th Floor
North Tower Chaoyang District
Beijing 100020, China
Tel: 86-10-8529 6240/ 6241
Fax: 86-10-8529 6237
Telex: 86-10-8529 6237
Cable: 22578 SINBJ CN
Email: beijing@iesingapore.gov.sg

Bombay (Mumbai)

c/o 706-10 Balarama
Bandra Kurla Complex,
Bandra (East)
Bombay (Mumbai) 400051, India
Tel: 91-22-659 1559/ 91-22-659 1560
Fax: 91-22-659 1564
Email: mumbai@iesingapore.gov.sg

Brussels

198 Avenue Franklin
Roosevelt
1050 Brussels, Belgium
Tel: 32-2-660 2979
Fax: 32-2-675 0905
Email: brussels@iesingapore.gov.sg

Budapest

c/o Representative Office for Central and
Eastern Europe
H-1054 Budapest
Bajcsy-Zsilinszky ut 42-46
Budapest, Hungary
Tel: 36-1-301 6620
Fax: 36-1-301 6621
Email: budapest@iesingapore.gov.sg

Chengdu

31-E First City Plaza
No 308 Shuncheng Street
Chengdu 610017
Sichuan, China
Tel: 86-28-8293 1293
Fax: 86-28-8293 1292
Email: peter_lee@iesingapore.gov.sg

Dubai

c/o Consulate of the Republic
of Singapore-UAE (Dubai)
#01A-Dubai Creek Tower (1st Floor)
Baniyas Road, Dubai,
UAE P.O Box 14970
Dubai, UAE
Tel: 9714-222 9789/ 222 5569
Fax: 9714-223 1515
Email: dubai@iesingapore.gov.sg

Frankfurt

Goethestrasse 5, 60313 Frankfurt am Main,
Frankfurt, Germany
Tel: 49-69-920 7350
Fax: 49-69-920 73522
Email: frankfurt@iesingapore.gov.sg

Geneva

c/o Permanent Mission of Singapore to the
UN- Geneva
Blk G, 6th Floor, route de Pre-Bois 20,
1215 Geneva 15, Int'l Centre Cointrin,
Geneva, Switzerland
Tel: 41-22-929 6655
Fax: 41-22-929 6658
Telex: 415909 SING CH
Cable: SINGAWAKIL GENEVA
Email: geneva@iesingapore.gov.sg

Waste Management and Recycling Association of Singapore

International Enterprise Singapore (IES) Offices

Guangzhou

Unit 25-01, No 233, Tianhe North Road,
CITIC Plaza, Tianhe District,
Guangzhou 510613,
Guangdong, China
Tel: 86-20-38 911911
Fax: 86-20-38 911772
Email: lawrence_phang@iesingapore.gov.sg

Ho Chi Minh City

Consulate-General of the Republic
of Singapore-Ho Chi Minh City
65 Le Loi Boulevard,
Saigon Ctr, 8th Floor, Unit 1 1st District,
Ho Chi Minh City,
Socialist Republic of Vietnam
Tel: 84-8-822 5173/ 5174
Fax: 84-8-825 1600
Email: hcmc@iesingapore.gov.sg

Hong Kong

Consulate-General of the Republic
of Singapore in Hong Kong
Units 901-2, 9th Floor
Admiralty Centre Tower 1,
18 Harcourt Road,
Hong Kong
Tel: 852-2-52 86185
Fax: 852-2-86 10048
Email: hongkong@iesingapore.gov.sg

Jakarta

c/o Embassy of the Republic
of Singapore-Indonesia,
Block X/4 KAV
No 2 Jalan H.R. Rasuna Said
Kuningan 12950, Jakarta, Indonesia
Tel: 62-21-522 9274
Fax: 62-21-520 1488
Telex: 62213 SINGA 1A
Cable: SINGAWAKIL JAKARTA
Email: jakarta@iesingapore.gov.sg

Kuala Lumpur

54C, 54th Floor, Empire Office Towers,
182 Jalan Tun Razak,
Kuala Lumpur 50400 Malaysia
Tel: 02-03-2162 5966
Fax: 02-03-2162 5963
Email: kl@iesingapore.gov.sg

London

53 Monument Street
London EC3R 8BU
United Kingdom
Tel: 44-0207-626 1717
Fax: 44-0207-626 1711
Email: london@iesingapore.gov.sg

Madras (Chennai)

No 43, First Avenue, Indira Nagar,
Adyar Madras (Chennai) 600020, India
Tel: 91-44-491 7901
Fax: 91-44-491 1007
Email: chennai@iesingapore.gov.sg

Manila

c/o Embassy of Singapore (Commercial Sect)
6766 Ayala Avenue cor. Paseo de Roxas,
The Enterprise Center, 35th Floor, Tower 1
Makati City, Manila 1226, Philippines
Tel: 632-759 4262
Fax: 632-759 4264
Email: manila@iesingapore.gov.sg

Mexico City

Bldv Manuel Avila Camacho
#36 Torre Esmeralda II Piso 14-02
Col. Lomas de Chapultepec,
Mexico 11000D.F.,
Mexico City, Mexico
Tel: 52-55-5202 0373
Fax: 52-55-5202 0527
Email: mexico@iesingapore.gov.sg

Waste Management and Recycling Association of Singapore

International Enterprise Singapore (IES) Offices

Moscow

c/o Embassy of the Republic
of Singapore-Russian Federation
Per Kamennaya Sloboda 5
Moscow 121099, Russian Federation
Tel: 7-095-974 1333
Fax: 7-095-974 1334
Email: moscow@iesingapore.gov.sg

New Delhi

c/o Singapore High Commission- India
E-6 Chandragupta Marg, Chanakyapuri
New Delhi 110021, India
Tel: 91-11-687 2846
Fax: 91-11-687 7940/ 611 3082
Telex: 3172169 SING IN
Email: india@iesingapore.gov.sg

New York

55 East 59th Street Suite 21B
New York, 10022 USA
Tel: 1-212-421 2207
Fax: 1-212-888 2897
Email: newyork@iesingapore.gov.sg

Pekanbaru

c/o Singapore Consulate in Pekanbaru
Jalan Sudirman No 395 4th Floor,
South Wing, Surya Dumai Building (Riau)
Pekanbaru 28116, Indonesia
Tel: 62-7613 3982
Fax: 62-7614 3555
Email: sim_cheng_huat@iesingapore.gov.sg

Pretoria

980 Schoeman Street,
Arcadia Pretoria 0083
Postal Address: PO Box 11084,
Hatfield Pretoria 0028,
Republic of South Africa
Tel: 27-1234-297 25
Fax: 27-1234-291 86
Email: pretoria@iesingapore.gov.sg

San Francisco

c/o Consulate -General of the Republic
of Singapore,
595 Market Street Suite 2450
San Francisco CA 94105, USA
Tel: 1-415-543 0488
Fax: 1-415-543 0484
Email: sanfrancisco@iesingapore.gov.sg

Seoul

28F Seoul Finance Center
84 Taepyunggro 1-ka,
Chung-ku Seoul 100-101, Korea
Tel: 82-2-736 1207/ 1208
Fax: 82-2-736 1209
Email: seoul@iesingapore.gov.sg

Shandong (Qingdao)

S'pore Shandong Business Council (SSBC)-
Representative Office in Shandong
No 76, Xiang Gang Zhong Lu Room 710,
Holiday Inn, Qingdao,
Shandong (Qingdao) 266071, China
Tel: 86-532-577 9933
Fax: 86-532-577 9922
Email: shandong@iesingapore.gov.sg

Shanghai

c/o Consulate-General of the Republic
of Singapore-China
400 Wulumuqi Zhong Lu
Shanghai 200031, China
Tel: 86-21-6437 0776
Fax: 86-21-6433 4150
Telex: 33540 SINSH CN
Cable: SINGAWAKIL SHANGHAI
Email: shanghai@iesingapore.gov.sg

Taipei City

c/o Singapore Trade Office in Taipei
No 85 Jen Ai Road,
Section 4, 10th Floor (UOB Tower)
Taipei 106, Taipei City, Taiwan
Tel: 886-2-2721 0664
Fax: 886-2-2781 7648
Email: taipei@iesingapore.gov.sg

Waste Management and Recycling Association of Singapore

International Enterprise Singapore (IES) Offices

Tokyo

c/o Embassy of the Republic
of Singapore-Japan
12-3 Roppongi 5-chome
Minato-ku
Tokyo 106-0032, Japan
Tel: 81-3-3584 6032
Fax: 81-3-3584 6135
Email: tokyo@iesingapore.gov.sg

Washington DC

c/o Embassy of the Republic
of Singapore-USA
3501 International Place, NW
Washington DC 20008, USA
Tel: 1-202-537 3100
Fax: 1-202-537 0876/ 537 3204
Email: washington@iesingapore.gov.sg

Yangon

c/o Embassy of the Republic of Singapore-
Myanmar
326 Pyay Road Yangon
Union of Myanmar
Tel: 95-1-527 403
Fax: 95-1-527 427

Honorary Business Representative Offices

Chandigarh

c/o DLF Centre 9th Floor,
Sansad Marg-New Delhi
Chandigarh 110001, India
Tel: 91-11-371 9202
Fax: 91-11-371 9233

Dhaka

c/o Transcom Limited Gulshan Tower
11th Floor Plot No 31 Road No 53
Gulshan North Commercial Area,
Dhaka 1212, Bangladesh
Tel: 880-2-881 8331/2
Fax: 880-2-988 7373
Email: dhaka@iesingapore.gov.sg

Liaoning

c/o Shangri-La Dalian Hotel
66 Renmin Road, Unit 520-521
Liaoning 116001 China
Tel: 411-252 4985
Fax: 411-252 4885
Email: liaoning@iesingapore.gov.sg

Santiago

c/o Andean Mining and Chemicals
Loteo Industrial Americo Vespucio
Calle Dos 9643 Quilicura,
Panamericano Norte, Casilla,
Santiago 176-D Chile
Tel: 56-2-623 0808
Fax: 56-2-623 1987
Email: chile@iesingapore.gov.sg

South Carolina

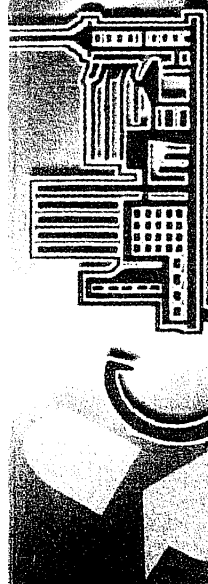
c/o Global Connections
327 Beach Club Villas Seabrook Is.
South Carolina 29455, USA
Tel: 1-843 768 4212
Fax: 1-843 768 0179
Email: southcarolina@iesingapore.gov.sg

Sydney NSW

c/o Lvl 9/32 Martin Place
Sydney NSW 2000, Australia
Tel: 61-2-9223 5357
Fax: 61-2-9233 5227
Email: sydney@iesingapore.gov.sg

Note

Note



**Citiraya, The Key To
A Better Tomorrow.**

Your One-Stop Electronics Recycling Partner



偉城工業

Citiraya Industries Ltd

The Strategic Partner for all MNCs

CITIRAYA INDUSTRIES LTD 65 Tech Park Crescent Singapore 637787

Tel: +(65) 6264 4338 Fax: +(65) 6266 6731 Website: www.citiraya.com Email: citiraya@singnet.com.sg

WMRAS

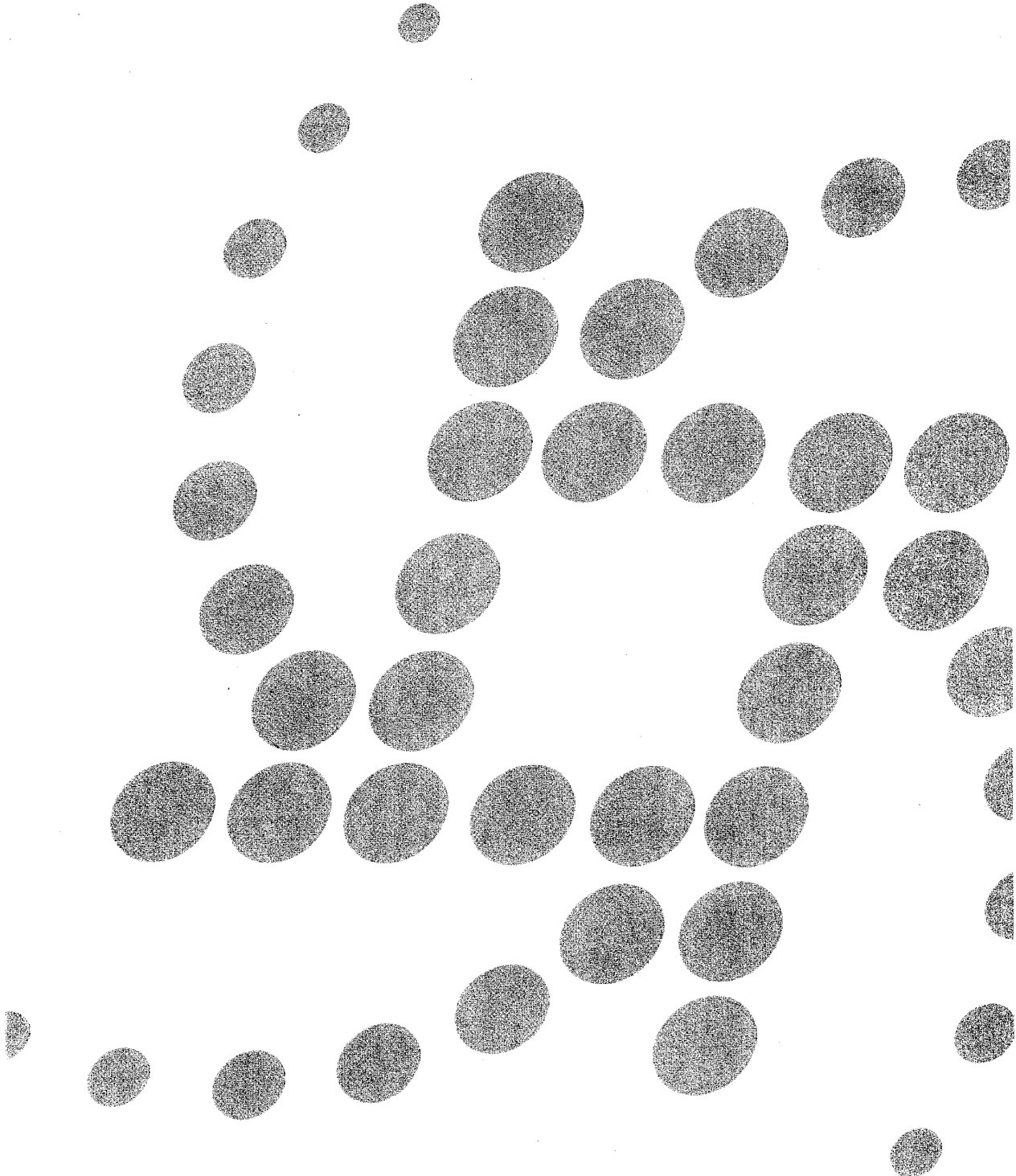
*"To professionalise and develop
a leading waste management and
recycling industry in Asia"*

c/o Waste Management and Recycling Association of Singapore
1003 Bukit Merah Central #02-10 Singapore 159836

Global Entrepolis @ Singapore

The Enterprise, Innovation and Technology Exchange

27th October - 1st November 2003
Suntec Singapore International Convention and Exhibition Centre



Natural Gas Pipeline

Anoa Platform

NATUNA A PSC
PREMIER

KAKAP PSC
GULF

KF Platform

SOUTH NATUNA
BLOCK B PSC
CONOCO

Natuna

Natuna Sea

Matak

Jemaja

SSTI-N

Belida

Belanak

SSTI-S

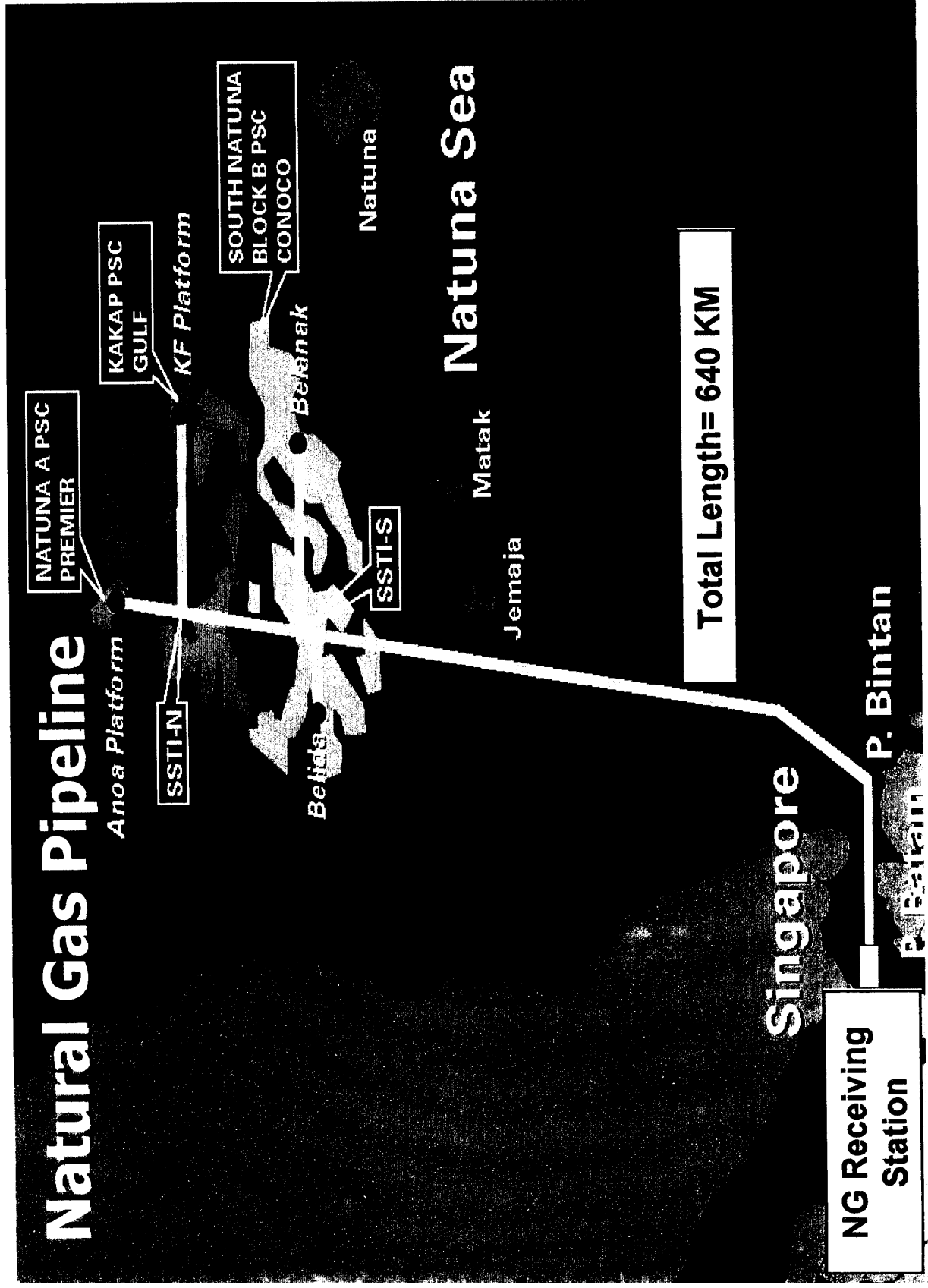
Singapore

NG Receiving
Station

P. Bintan

P. Batam

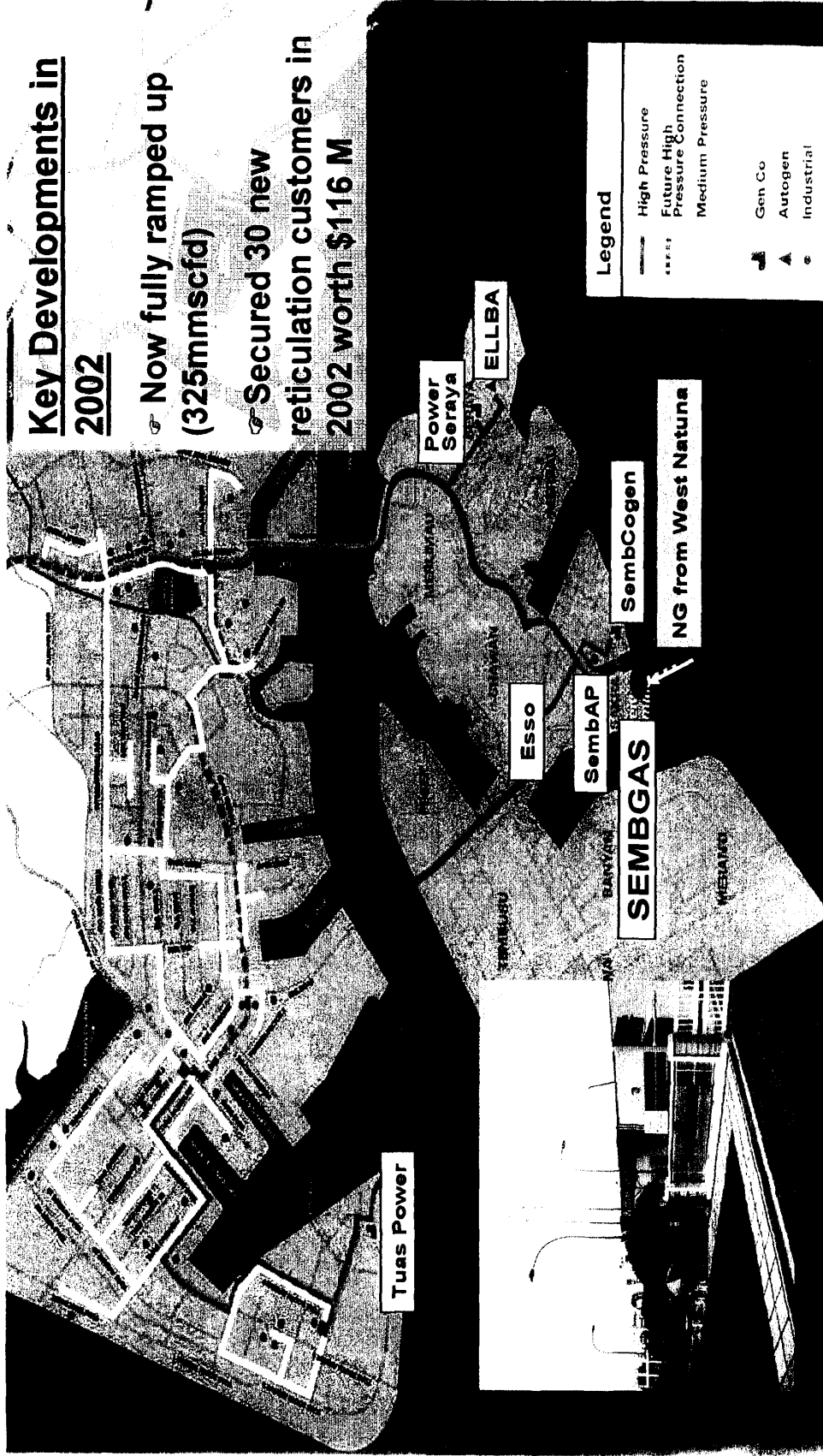
Total Length= 640 KM



Energy : Gas Business

Key Developments in 2002

- Now fully ramped up (325mmscfd)
- Secured 30 new reticulation customers in 2002 worth \$116 M

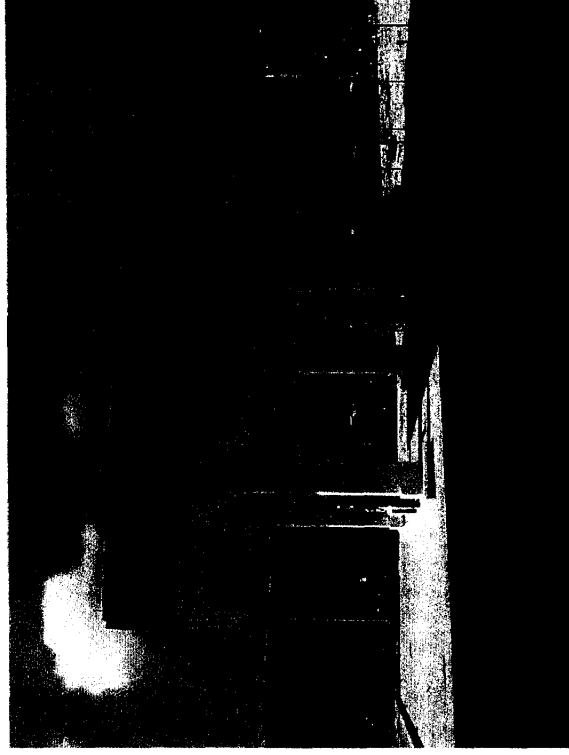


Legend	
	High Pressure
	Future, High Pressure Connection
	Medium Pressure
	Gen Co
	Autogen
	Industrial

Energy: Gas Business

Compressed Natural Gas Pilot Project

- CNG Station
- BOO Experience
- Supplier to Singapore CNG Pilot Fleet Transport - NEA, SBS, CityCab, Comfort Taxi & TIBS
- Total Cost S\$2.6million
- S\$1.3m invested
- Operational since April 2002
- First in Singapore



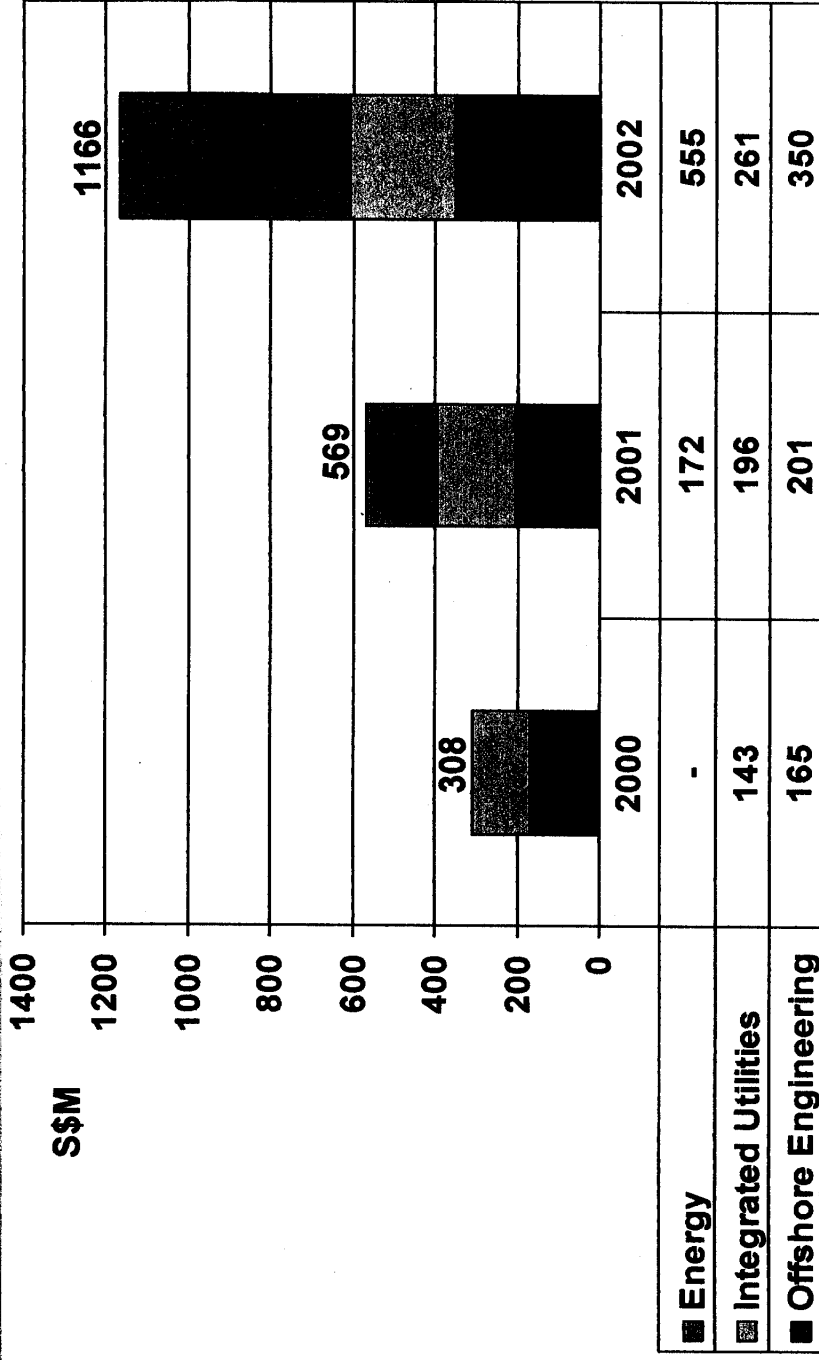
FINANCIAL OVERVIEW

Utilities Performance Highlights

	FY02	FY01	%	▲
Turnover (\$M)	1,088.6	549.5	95	
PATMI (\$M)	54.2	36.0	51	
ROE (%)	20.3	16.3		
Net Gearing (times)	2.2	2.7		
Net Gearing (excluding PF*)	0.6	1.2		

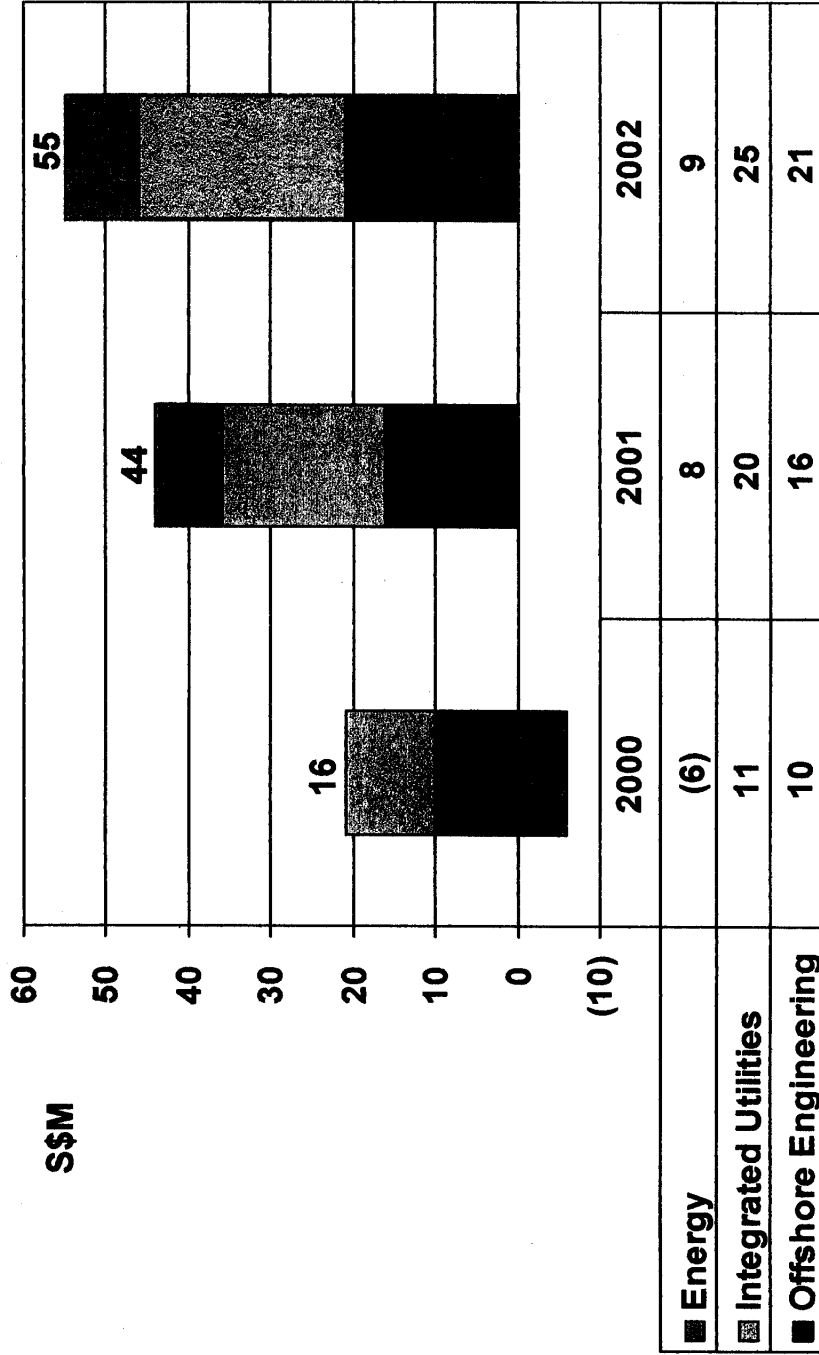
* PF - Project Financing

Utilities Turnover by Businesses



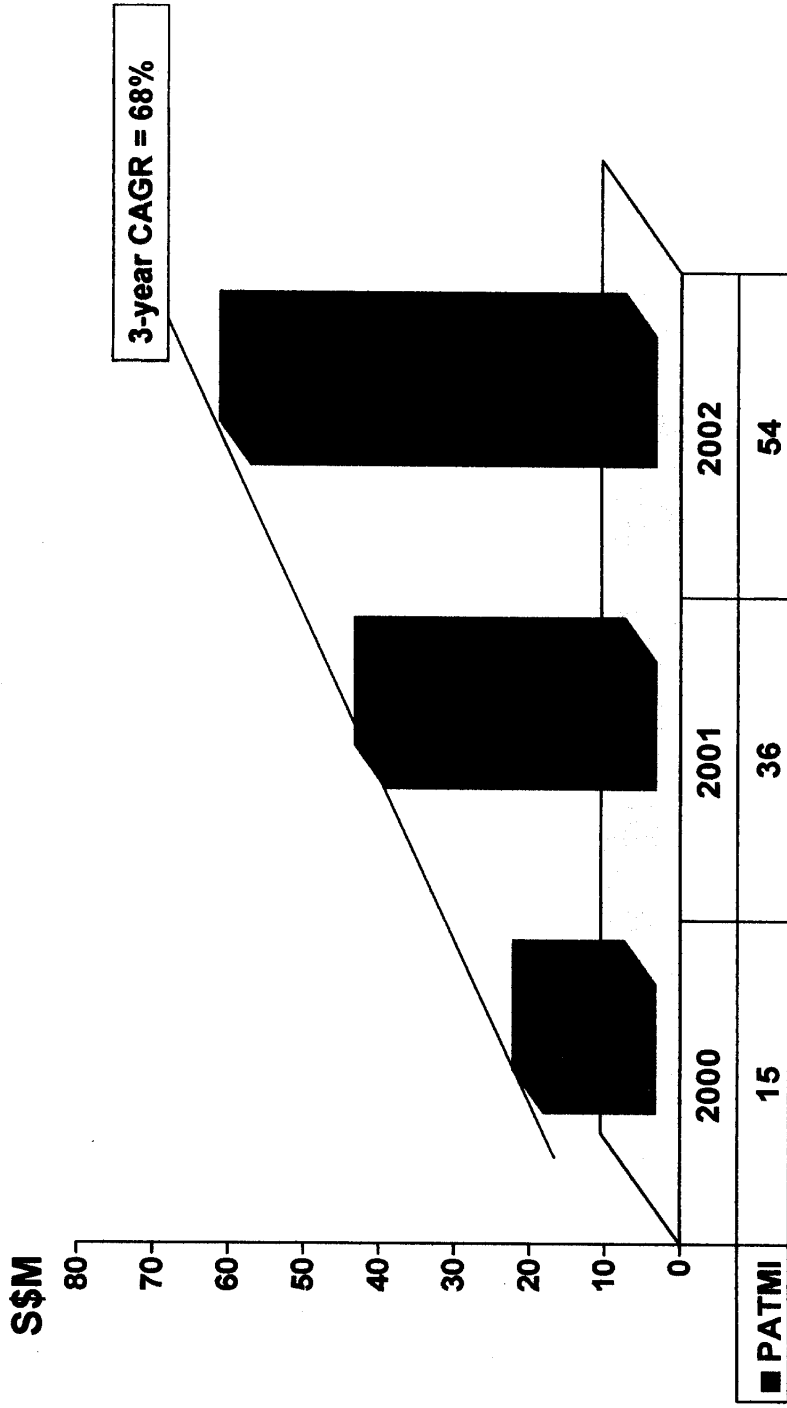
* Excludes inter-company elimination

Utilities PATMI by Businesses



* Excludes Corporate / Development costs

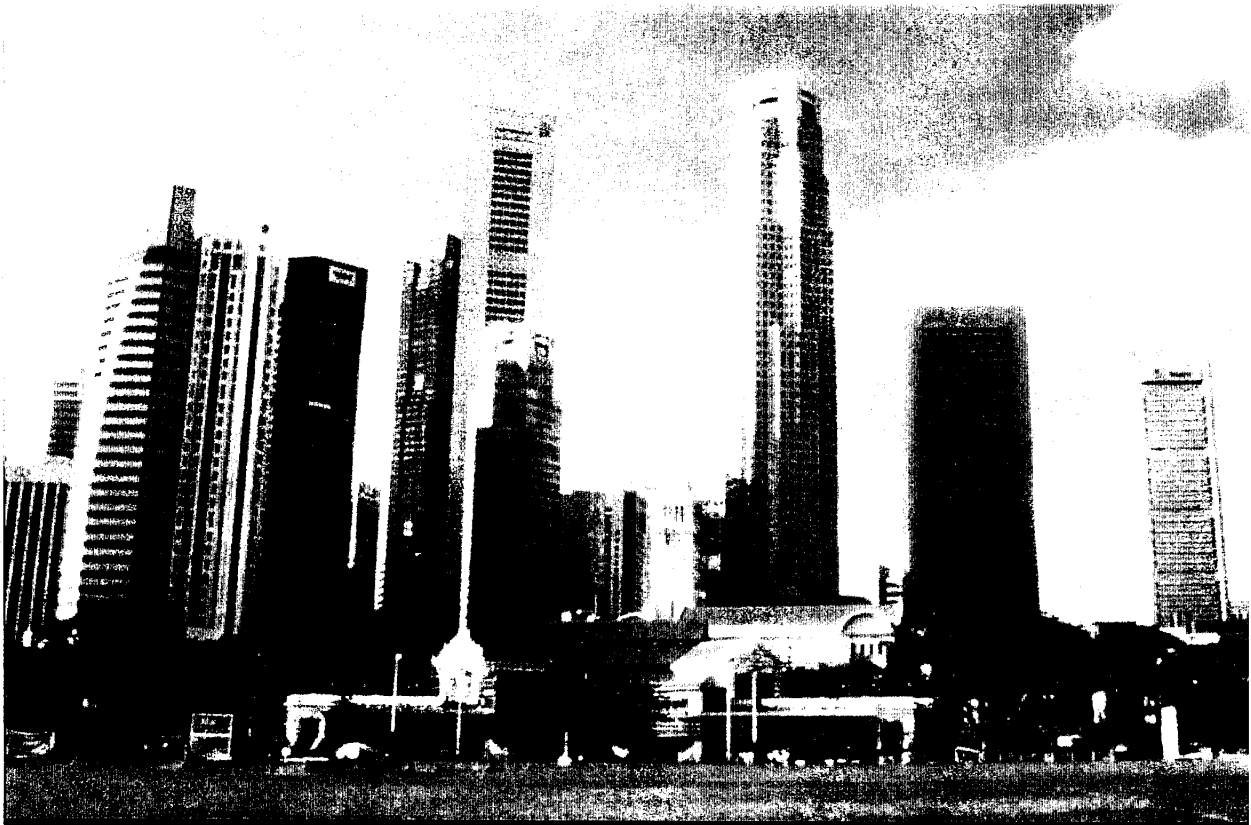
Utilities PATMI Performance



SembCorp Utilities

To be a Leading
Power & Integrated Utilities Group
By Year 2008





Global Entrepolis @ Singapore

is more than just an event; it is:

- An Enterprise, Innovation and Technology Exchange
- Where Ideas are exchanged - Partnerships are forged - Deals are made
- Where 10,000 participants will converge, including entrepreneurs, innovators, venture capitalists, leading visionaries and Chief Executives from the U.S., Europe, Japan, China, India and the Asia-Pacific.

It is a gathering of the world's best and most enterprising minds. A global marketplace of vast opportunities. An international showcase of the latest technologies and innovations.

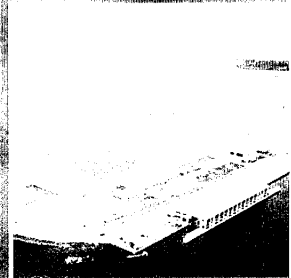
More than 10 major events will take place at **Global Entrepolis @ Singapore**. From top-level strategic conferences to industry application seminars, from a VC summit to entrepreneur workshops, this mega-event will also honour Asia's best innovations ... all under one roof - Singapore.



ENVIRO ASIA 2003

SINGAPORE EXPO • 30 October to 1 November 2003

The Drive Towards Environmental Management & Recycling Technology



Organiser:



Waste Management and Recycling Association of Singapore (WMRAS)

Co-Organiser:



National Environment Agency (NEA)

Joint Event Managers:



Conference & Exhibition Management Services Pte Ltd (CEMS)



Enterprise Promotion Centres Pte Ltd (EPC)

Supporting Bodies:



Ministry of the Environment (ENV)



Building and Construction Authority (BCA)



Singapore Economic Development Board (EDB)



International Enterprise Singapore (IE Singapore)



National Parks Board (NParks)



Environmental Engineering Society of Singapore (EES)



Solid Waste Association of North America (SWANA)

THE MARKET OF THE ENVIRONMENTAL INDUSTRY

ENVIRO ASIA 2003 - Leading the way in Environmental Management and Recycling

The inaugural Enviro Asia 2003 event will be the Asian launch pad of the latest technologies, resources and services in all fields of environmental management and recycling comprising water treatment, waste management, air pollution control and clean energy integrated under one roof.

The event will showcase sustainable solutions and state-of-the-art technology and know-how for implementing practical and economical measures; highlighting on governmental blueprints and industry developments impacting our environment together with a wide range of qualified services in these fields.

It will provide a unique opportunity for organisations wishing to reach the rapidly growing markets in regional government, industry and private sector organisations for products and services designed to reduce, re-use, recycle and recover waste materials - solid, liquid or gaseous - for both business and industry.

Enviro Asia 2003 will offer an essential networking platform for governments and municipalities, the private sector, manufacturers, consultants industry players and other qualified decision-makers in the fields of environmental management and recycling in the Asia Pacific region.

Asia's Environmental Industry

The demand for environmental services is increasing within Asia to ensure a balance between environmental protection and due to urbanisation drives by the developing and newly industrialised countries. Environmental Technology is therefore also one of the fastest growing industries in the Asia-Pacific due to detrimental effects on the environment produced by vigorous economic development, creating a large demand for providing an extensive range of remedial environmental products and services.

The East and the South East Asian markets are estimated to reach US\$50 billion by 2010. As Environmental Technology assumes a new phase in developing and test-bedding environmental biotechnology, resource recovery and clean energy expertises, business opportunities abound for companies both in Singapore and the region.

Across Asia, some 760,000 tons of solid waste are generated daily. By 2025, this rate would increase to 1.8 million tons per day.

Singapore's Environmental Services

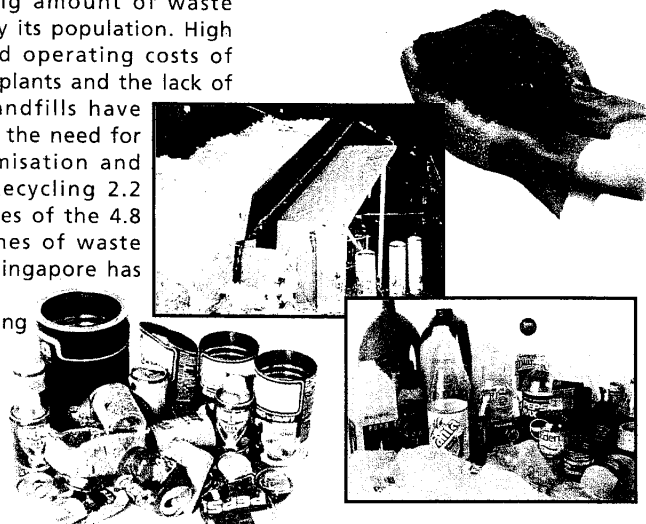
Singapore, a country with few natural resources, faces the challenging task of dealing with an increasing amount of waste generated by its population. High building and operating costs of incineration plants and the lack of space for landfills have given rise to the need for waste minimisation and recycling. Recycling 2.2 million tonnes of the 4.8 million tonnes of waste generated, Singapore has brought the overall recycling rate to 45% in 2002*.

The environmental services industry in Singapore is integrated both horizontally and vertically. Identified as a growth cluster, its core is centred on the linked services of cleaning (both commercially and domestic), pest control and waste management; accounting for an estimated annual turnover of S\$1.65 billion per annum. Its development can be strengthened to enhance its competitive advantages, reduce costs for its clients, and improve the overall quality of life.

As a progressive user of environmental technologies in Asia, Singapore is known to have struck a balance between economic development and environmental protection. Through the years, Singapore environmental services companies have developed technical expertise in the areas of water technology, waste and wastewater treatment, clean air, consulting and engineering services.

Furthermore with an intimate knowledge of Asia's culture and easy accessibility to the region and environmental expertise built up from similar economic, social and physical circumstances to many countries in the region, Singapore is well positioned as a regional headquarter to export environmental services to the whole Asia Pacific market.

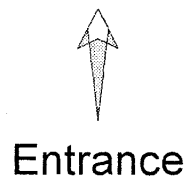
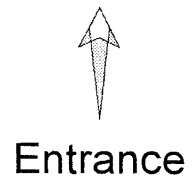
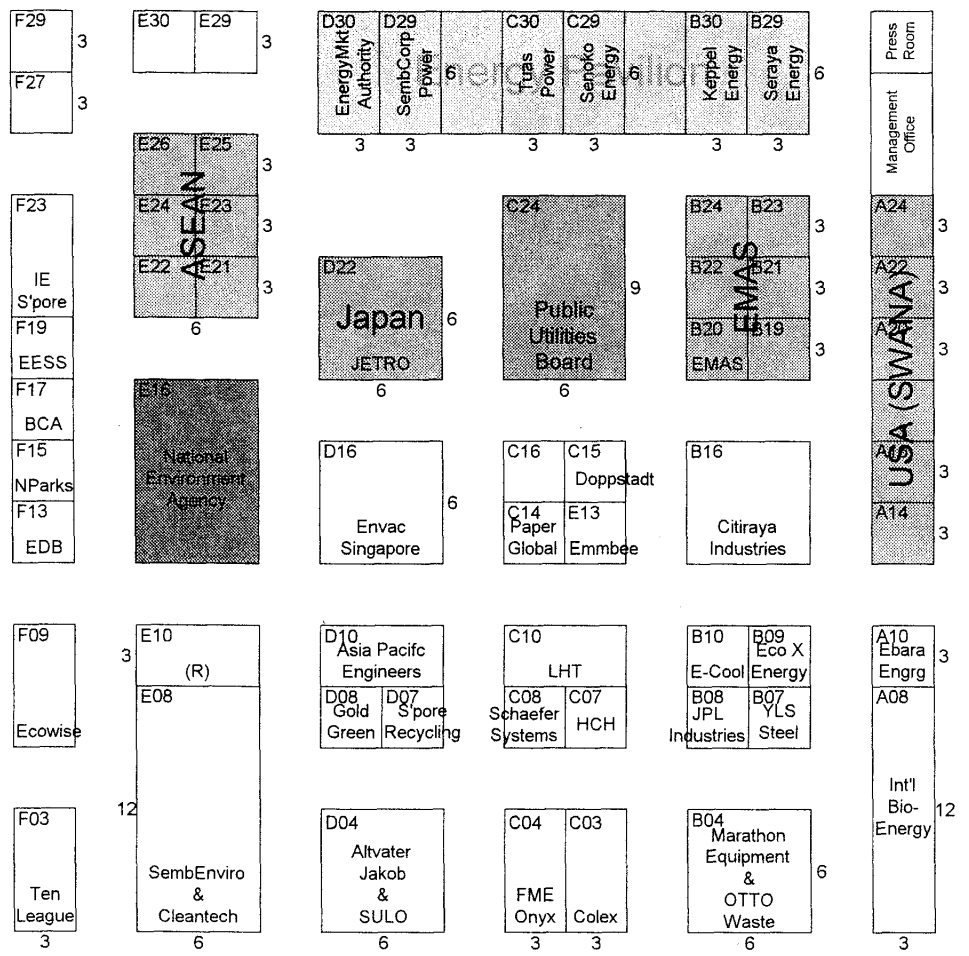
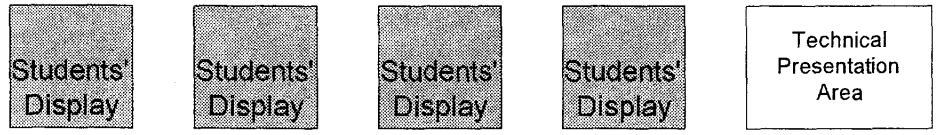
*Statistics from National Environment Agency, Singapore 2003.



Enviro Asia 2003
Singapore EXPO Hall 2
30 October to 1 November 2003



12



A SUSTAINABLE ENVIRONMENT, A BETTER TOMORROW
30 October – 1 November 2003
Singapore Expo

CONFERENCE PROGRAMME

Day 1, Thursday, 30 October 2003

Conference Registration
Welcome Address Mr Juergen Miltz, Chairman of Conference Programme Working Committee Waste Management & Recycling Association of Singapore
Presentation National Environment Agency
Green and Sustainable Businesses from a Local Government Perspective: Fostering Business Partnerships for Environmental Sustainability Dr. Hari Srinivas, Chief of Urban Environmental Management Unit International Environmental Technology Centre, United Nations Environment Programme Effective business partnerships enable local governments and the private sector to assume initiative and co-responsibility in focusing on the sustainability. Through effective and equal partnerships, the advantages of the private sector- dynamism, access to finance, knowledge of technologies, managerial efficiency, entrepreneurial spirit- are combined with the social responsibility, environmental awareness, local knowledge and job generation concerns of local governments. In the context of the paper, a business partnership is a forum for dialogue between the private sector and the local government, in order to enhance flow of information and promote sustainability opportunities and joint activities, in managing the local environment.
Trends and Opportunities of Waste Management Industry in Asia World Bank – to be confirmed
TEA BREAK
Waste Management in USA Solid Waste Management Association of North America – to be confirmed
Solid Waste Management in Philippines: A Small Island Experience Mr Alan Mair, Senior Associate ENVIRON Consulting Services (M) Sdn Bhd An ecological solid waste management program is being implemented in the Municipality of Odiongan, Province of Romblon, a small island community of 40,000 located in one of the more

underdeveloped regions of the Philippines. The program incorporates waste separation and segregation, vehicle collection and transport, composting, recycling, and landfill disposal. In 2001, a development plan for a new waste processing center was prepared to include composting, recycling, and landfill disposal operations. An operating permit was granted by the Department of Environment and Natural Resources in May 2001. Operations at the new site commenced in November 2001.

End of Session

Day 2, Friday, 31 October 2003

Session A: Solid Waste Management & Recycling

Conference Registration

Integrated Waste Management Project in South East Asia – An International Approach

Mr Edward A. Corcoran, President & CEO

Modern Asia Environmental (MAE) / Waste Management Siam (WMS)

The environmental business in South East Asia is going to enter into a transformation process during the next 3-5 years. South East Asia's environmental infrastructure will make a leap from the existing stage of being viewed as under developed (or barely adequate) to a category of a "Developing" and having real environmental infrastructure beginning successful commercial operation.

The many agencies involved in the regulations, administration, budgeting and review will be reduced to a select few agencies from the many agencies preventing progress. Two or three agencies will remain which can effectively deal with the environmental enforcement, EIA's & regulations, implementation, and budgeting. This will allow free flow of the market forces to improve and implement progress.

For example, it is obvious, given the conditions and service level for waste collection and disposal, that there must be incremental jumps to a higher quality and more efficient systems to protect the environment. It is clear that the solutions are already available. Many other countries have gone through this learning curve already, and South East Asia is the same as other markets in the steps of evolution of environmental infrastructure and needs. South East Asia has the economic resources to make these improvements now. These improvements will increase property values, and increase the competitiveness of South East Asia relative to its neighbors/competitors.

The Achievements of the "Restricted Use Policy On Plastic Shopping Bags & Disposable Plastic Tableware"

Mr Chen Hsiung-Wen, Director of Solid Waste Management Bureau

Environmental Protection Administration, Republic of China

To change people's disposing habits, the Taiwan EPA implemented "Restricted Use Policy On Plastic Shopping Bags & Disposable Plastic Tableware" in the public sector, department stores, large-scale markets, supermarkets, chain stores, fast food chain stores, and food and/or

beverage stores with a shop front. The policy has primarily achieved the goal of environmental education. Having been implemented for six months, the percentage of people carrying reusable shopping bags has increased from 20% to 79%. The use of disposable shopping bags or tableware has been significantly curbed.

TEA BREAK

Hewlett-Packard's Views on Producer Responsibility and Key Principles for the Take Back and Recycling of Electronic Products

Mr Jean-Claude Vanderstraeten, Environmental Director
Hewlett Packard Asia – Pacific and Japan

Several countries in the world start expressing concerns with regard to the growing volume of the discarded electronic products. Some countries have implemented legislative schemes aimed at regulating and minimising the impact on the environment due to the disposal of these products. Some others are in the process of evaluating and developing such schemes. Policy makers have to consider the views of many stakeholders involved in these schemes and have to analyse different alternative choices.

As a producer of electronic products, we will share our experience and propose some key principles that need to be considered in defining producers' responsibility and in developing policies relative to the take-back and recycling of electronic products. Finally we will briefly describe HP's own initiatives in the area of product take-back in order to provide our customers with end-of-life solutions for the disposal of their products.

Electronic Wastes: A Global Concern and Emerging Management Technologies

Mr. Venkatesha Murthy, Business Development Manager
Citiraya Industries Ltd

Rapid technological advances have effected an increased rate of obsolescence of electronic products. The resultant growing volume of electronic wastes from both the consumer and industrial sectors warrants the need for more sustainable approaches in the product end-of-life management, especially since electronics often contain hazardous substances. Environmental sustainability can be achieved through the reuse and/ or recycling of electronic wastes not only by minimising the waste volume, but more importantly, avoids the need to extract natural resources. Industrial practices of current recycling technologies will be exemplified through an introduction on Citiraya Industries Ltd, a local listed company specialising in the provision of one-stop electronic wastes management services.

Waste to Energy – to be confirmed

LUNCH AND NETWORKING

Financing Possibilities for Private Sector Activities in Waste Management and Recycling

Mr Herbert Jaeger, Country Director Thailand
DEG – Deutsche Investitions- und Entwicklungsgesellschaft mbH
(The German Investment and Development Company)

Advanced technology, logistics and legislation available in the industrialized countries needs to be adapted and further developed to match the special requirements of Asian countries with their

tropical climate, their budget constraints, technical skills and legal framework. Since such developments are often undertaken through pilot projects, commercial financing is hardly available. DEG, Germany's finance and consultancy institution for private sector development, presents financing possibilities for private sector activities in waste management and recycling.

Furthermore, DEG shows how commercial long-term project finance can be arranged for large scale projects for waste management as well as waster supply and treatment.

Singapore Waste Management & Recycling Industry Action Plan
Waste Management & Recycling of Association of Singapore

Pneumatic Waste Management System – A Proven Solution to a Cleaner and Greener Singapore

Mr Tan Chin Tiong, Managing Director
Envac Singapore Pte Ltd

This is a Swedish technology that is currently being used in over 20 countries in Europe and Asia. Basically it is a system that uses air to collect waste automatically and hygienically instead of the manual and old fashion waste collection modes.

The environmental benefits include freeing up more space for greening the city, to cleaner environment and ease of waste disposal. More importantly, with the automated system, it reduces the need for unskilled foreign workers that are usually engaged for the purpose of manual waste handling.

With this system, it will enhance the Public Cleansing image, and on a national scale, the image of Singapore.

TEA BREAK

The Theory and Practice of Landfill Rehabilitation in SE Asia

Dr Robert Eden, Managing Director
Organics Ltd

The paper addresses the issue of former landfill-site rehabilitation, particularly in a SE Asian context. It covers the principal options for rehabilitation and after-use as well as provides a short summary of after-use projects in Hong Kong, Malaysia and Singapore. An overview of the position in Indonesia and the Philippines is also provided.

The paper closes with a discussion of the possibilities for landfill gas utilization based up Organics' experience with the implementation of such technology at the Puchong landfill site near Kuala Lumpur, where a contract is ongoing.

Panel Discussion

End of Conference Presentation

<p>Conference Registration</p>
<p>Scheduled Waste Management – Malaysian Experience Datuk Syed Azmi Othman, Managing Director Kualiti Alam Sdn Bhd</p> <p>The paper will discuss the establishment of the scheduled waste management system of Malaysia, Malaysian regulations on scheduled waste, our experience in the setting up and operation of the Integrated Scheduled Waste Management Centre of Kualiti Alam.</p> <p>The paper will also touch on the complete management of hazardous waste from transportation to waste analyses and evaluation to treatment and final disposal of scheduled waste at the Waste Management Centre.</p>
<p>Sustainable Growth – How Safety, Health and Environmental Excellence can Benefit your company Mr Vipin C. Nair, Singapore Chemical Industries Council</p> <p>The topic of the presentation is about Sustainable Growth, and how this will benefit each and every company. Sustainable Growth means creating Shareholder and Societal value while decreasing our environmental footprint along the value added chain. Environmental footprint includes illnesses, injuries, serious incidents, waste & emissions as well as depletable forms of raw materials & energy.</p> <p>Goal is ZERO...ZERO incidents, ZERO injuries, ZERO emissions and ZERO waste generation at source. Key Strategies for Sustainable Growth are....Footprint reduction, Improved Productivity and Knowledge Intensity. Long term viability of a business strongly depends on these key strategies. Business Excellence is a result of how successfully these key strategies are implemented.</p>
<p>TEA BREAK</p>
<p>Improving Hospitals’ Environmental Performance through Pollution Prevention & Recycling Mr David Swanson, Swanson Environmental Management Systems, Inc.</p> <p>The presentation will share the American Hospital Association (AHA)– US EPA’s <i>Hospitals for a Healthy Environment (H2E)</i> model, which was established to assist US hospitals to eliminate mercury-containing wastes and implement pollution prevention.</p> <p>The US experience will be shared in addressing the reduction of wastes generated by hospitals, including case studies. In addition, the presentation will discuss how a successful pollution prevention and recycling program includes incentives, policies and infrastructure that favour source reduction and recovery of discarded materials, as well as proactive procurement practices.</p>
<p>SARS Management, Cleansing Technology Mr Chew Boon Koon, General Manager</p>

On-site treatment system of waste water from home and animal farm is described. Both facilities employ soil-charcoal layer to remove soluble organic materials and suspended particulates after aerobic and anaerobic decomposition of organic materials. Those systems have been proved to be efficient, economical and easily maintained after a few years of operation.

Panel Discussion

End of Conference Presentation

Day 3, Saturday, 1 November 2003

Technical Site Visits

- Tuas South Incineration Plant
- NEWater Visitor Centre

Organised By:



Co-organised By:



Event Managers:

(Conference)

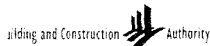


In-collaboration with:



Global Entropolis @ Singapore

Supported by:



ENVIRO ASIA 2003

Incorporating Waste Asia, Water Asia, Air Asia & Energy Asia



The Drive Towards Environmental Management & Recycling Technology

- Venue** : Singapore EXPO Hall 2
- Organiser** : Waste Management & Recycling Association of Singapore (WMRAS)
- Co-Organiser** : National Environment Agency (NEA)
- Event Managers** : Conference & Exhibition Management Services Pte Ltd (CEMS)
Enterprise Promotion Centres Pte Ltd (EPC)
- Supporting Bodies** : Ministry of the Environment (ENV)
Building and Construction Authority (BCA)
Economic Development Board (EDB)
Energy Market Authority (EMA)
International Enterprise Singapore (IE Singapore)
Public Utilities Board (PUB) – Pending
National Parks Board (NParks)
Singapore Exhibition & Convention Bureau (SECB)
Environmental Engineering Society of Singapore (EESS)
Solid Waste Association of North America (SWANA)

Exhibit Profile :

- Solid & Hazardous Waste Collection
- Waste Recovery & Recycling
- Sludge Treatment
- Water Waste & Sewage Treatment
- Filtration Equipment
- Pump, Valves and Fittings
- Instrumentation and Controls
- Transportation & Waste Disposal Equipment
- Waste Transportation Equipment's Components & Supplies
- Medical Waste
- Landfill Management
- Incinerators
- Environmental Protection
- Environmental IT Systems
- Energy Saving Equipment
- Waste-to-Energy
- Energy Consultation
- Electrical Saving Devices, Electronic Ballast, Motor Controllers, & Capacitor Banks
- Electrical Safety Products & Equipments
- Electricity Suppliers & Power Generators
- Air Dispersion
- Odour Control Systems
- Odour Studies
- Air Quality Management
- Air Pollution Monitoring Equipment
- Pollution Control
- Water Supply & Treatment
- Waterworks/Water Board
- Water Distribution
- Water Conservation
- Water Recycling/Desalination
- Biological Treatment
- Biotechnology Application
- Food and Drinks Processing
- Civil Mechanical & Electrical Works Contractors
- Transportation and Distribution Services
- Consultation & Engineering Services
- Regional Government Environmental Agencies
- Soil Treatment
- Cleaning Equipment

Visitors Profile :

- Government Ministries, Environmental Authorities
- Building & Construction Authorities
- Waste Processing Industry Professionals
- Transportation, Storage & Handling
- Biotechnology Professionals
- Industry Contractors
- Electrical/Electronics Manufacturers
- Rubber & Plastic Products Manufacturers
- Health & Safety Authorities & Enforcement Agencies
- Waste Management Control Authorities
- Food & Beverage Processing Manufacturers
- Estates & Facilities Managers
- Pharmaceutical & Health Specialists
- Chemical & Petrochemical Processing Professionals
- Waste & Water Management Recycling
- Pulp & Paper Manufacturers

ASIA PACIFIC

Projection for the Exhibition : Gross area (sqm) 4,000
Net area (sqm) 2,000
No of exhibitors 150
No of participating countries 12
No of visitors 10,000

Exhibiting Costs : Bare or raw space (min 18 sqm) SGD \$430 / sqm
Shell scheme stand (min 9 sqm) SGD \$500 / sqm

Shell scheme comprises needle-punch carpeting, wall partitions, fascia board, 2 fluorescent lamps, 1 power connection (13A), 1 table, 2 folding chairs, 1 wastebasket

Exhibition Highlights : National Pavilions
Association Networking Centre
Live Demonstration of waste vehicles
Special Project Displays by Students

Conference Theme : A Sustainable Environment, A Better Tomorrow

Conference Dates : 30 October to 1 November 2003

Conference Topics : Industry Blueprints
Industry Developments
Industry Best Practices
Environmental Management Strategies
Prospects of Asian Environmental Businesses
Others

Conference Highlights : Presentations by Renowned Speakers
Plenary Discussions
Specialised Breakout Sessions for Solid Waste, Hazardous Waste and Wastewater
Site Visits

Projected No. of Delegates : 300

For more Information : **Exhibition**
Conference & Exhibition Management Services Pte Ltd
1 Maritime Square, #09-43 HarbourFront Centre, Singapore 099253
Tel: (65) 6278 8666, Fax: (65) 6278 4077 Email: info@cemssvs.com.sg
Contact: Ms Judy Lee or Mr Steven Tan

Conference

Enterprise Promotion Centres Pte Ltd
1003 Bukit Merah Central #02-10
Singapore 159836
Tel: (65) 62782538, Fax: (65) 62787518
Contact: Ms Ang Kooi Hwa Email: kooihwa@epc.com.sg
Ms Goo Yen Peng Email: yenpeng@epc.com.sg

EXHIBIT PROFILE

- Solid & Hazardous Waste Collection
- Waste Recovery & Recycling
- Sludge Treatment
- Water Waste & Sewage Treatment
- Filtration Equipment
- Environmental Protection
- Pumps, Valves and Fittings
- Instrumentation and Controls
- Transportation & Waste Disposal Equipment
- Consulting & Engineering Services
- Medical Waste
- Landfill Management
- Incinerators
- Environmental IT Systems
- Water Supply & Treatment
- Waterworks / Water Board
- Water Distribution
- Water Conservation
- Water Recycling
- Water Desalination
- Biological Treatment
- Biotechnology Application
- Food and Drinks Processing
- Civil, Mechanical & Electrical Works Contractors
- Transportation and Distribution Services
- Waste Transportation Equipment Components & Supplies
- Regional Government Environmental Agencies
- Soil Treatment
- Cleaning Equipment
- Clean Air
- Pollution Control
- Waste-to-Energy

VISITORS PROFILE

Reaching out to key decision makers from the following

- Government Ministries, Municipalities, Environmental Authorities, Management Consultants.
- Health & Safety Authorities & Enforcement Agencies
- Building & Construction Authorities.
- Waste & Management Control Authorities.
- Waste Processing Industry Professionals.
- Food & Beverage Manufacturers and Processors.
- Transportation, Storage and Handling Professionals
- Estates & Facilities Managers.
- Biotechnology Professionals
- Pharmaceutical and Health Care Specialists.
- Industrial Contractors.
- Chemical and Petrochemical Processing Professionals.
- Electrical / Electronic Manufacturers.
- Waste & Water Management and Recycling Professionals.
- Rubber & Plastic Products Manufacturers
- Pulp & Paper Manufacturers.

Concurrent Event

Alongside the exhibition, Enterprise Promotion Centres (EPC) will be organising conferences entitled **A Sustainable Environment, A Better Tomorrow** to address the latest issues faced in the environmental industry. Targeted at the senior government officials, key decision makers of environmental authorities and agencies, health and safety authorities, waste management professionals from both public and private sectors of the Asia Pacific region, the conferences will feature presentations on the regional governmental blueprints, industry developments, innovative solutions impacting the environment, market opportunities, waste management strategies and others. In addition, plenary discussions will be organised to allow delegates to have more in-depth discussions on the impending issues of the industry and site visits will be included in the programme for delegates.

Strong Government and Industries Support

Enviro Asia is the premier event of its kind in Asia to be co-organised with the National Environment Agency (NEA) and supported by all major government agencies in Singapore and trade associations including:

Ministry of the Environment (ENV)
Building and Construction Authority (BCA)
Singapore Economic Development Board (EDB)
International Enterprise Singapore (IE Singapore)

National Parks Board (NParks)
Environmental Engineering Society of Singapore (EESS)
Solid Waste Association of North America (SWANA)



VENUE

Singapore Expo Hall 2
No. 1 Expo Drive, Singapore 486150

DATES

30 October - 1 November 2003

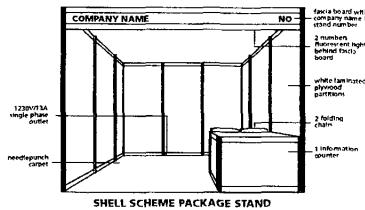
VISITORS

30 Oct - 31 Oct 2003:
Trade and Professionals Only
1 Nov 2003: Trade and Public

PARTICIPATION RATES

Bare space (min 18 sqm)
S\$430 per square metre

Shell Scheme (min 9 sqm)
S\$500 per square metre inclusive of carpeting, wall partitions, company name on fascia, one table, two chairs, two lights, one 13-amp power point and one wastepaper basket.



EASY TRAVEL GUIDE

By Taxi

Alight at taxi stands at Foyer 2 or Hall 6 of Singapore Expo.

By MRT

Take the east-bound train (Pasir Ris) and alight at Tanah Merah Station. Board a connecting train to Singapore Expo station.

By Public Buses

Bus service numbers to Singapore Expo are 2, 12, 24, 31, 34 and 35.

By Car

- Drive along ECP (East Coast Parkway) towards Changi Airport and take Exit 2B.
- Drive along PIE (Pan Island Expressway) towards Changi Airport and take Exit 4A.

The Singapore Expo is a 5 minutes' drive from the Singapore Changi Airport and a 20 minutes' drive from the city area.

BUSINESS REPLY COUPON

ENVIRO ASIA
2 0 0 3
Fax to: (65) 6278 4077

I am interested to exhibit at Enviro Asia 2003. Without obligation, my space requirement is likely to be sqm.

I am interested to visit only. Please send me updated visiting details when available.

Salutation:

Name:

Designation:

Company:

Address:

Country:

Tel:

Fax:

Email:

Mobile:

(Please provide if you wish to receive SMS messages on event updates.)

Please fax to **CONFERENCE & EXHIBITION MANAGEMENT SERVICES PTE LTD**
1 Maritime Square, #09-43 HarbourFront Centre, Singapore 099253.
Tel: (65) 6278 8666, Fax: (65) 6278 4077, Email: info@cemssvs.com.sg

Event Highlights

MON 27	TUE 28	WED 29
Global Start-Up @ Singapore Business Plan Competition	Captains of Industry Conference Distinguished Technopreneurs Forum TechVenture Asia TiE Asia Pacific Conference	
Grand Opening & Welcome Cocktail	Gala Dinner & Asian Innovation Awards	Official Opening of The Enterprise Exchange
Global Entrepolis -		

At Global Entrepolis @ Singapore, witness how ideas are exchanged, deals are made and partnerships are forged!

The Enterprise Exchange

- An international exposition and marketplace for innovative enterprises, big and small. This exchange provides a platform for innovators and buyers, entrepreneurs and venture capitalists, MNCs and enterprises, leading universities and the community to interact, transact, and find partners and funding.
- It also features leading-edge technologies, innovations and product launches, and emerging industries from all over the world, in particular China and India.



Captains of Industry Conference

- A summit where industry leaders like CEOs, COOs, CTOs, CFOs and other CXOs convene to examine strategic priorities, and address the issues and challenges faced in a time of dynamic change. From the summit, it is envisaged that these leaders will chart new territories, identify breakthrough trends and capture new opportunities.

TechVenture Asia 2003

- Providing valuable networking opportunities with leading names in the international Venture Capital and business communities, this 7th annual conference highlights issues in the VC industry, marks out leading-edge technologies for investment, and showcases growing technology business from the US, Europe and Asia.

Distinguished Technopreneurs Forum

- Leading technopreneurs from Singapore and the region discuss topics ranging from the power of disruptive technologies to the emergence of new industries and niche areas.

TiE Asia Pacific Conference

- TiE Singapore is part of The IndUS Entrepreneurs (TiE), a global not-for-profit organisation, holding their inaugural Asia Pacific meeting to exchange technology, strategy and best practices.

Asian Innovation Awards

- In association with the Far Eastern Economic Review, the Asian Innovation Awards recognise the spirit of enterprise and inventions in Asia that improve the quality of life.

Connections Funds Innovation

U
S

30

FRI
OCT 20 03

31

SAT
OCT 21 03

01

Asian Linux Conference
BizWorld Competition
CTO Workshop on Emerging Technologies
Enviro Asia
High Value Manufacturing Forum
Nanotech World
Photonics World
Technology Exploitation Forum
Wireless Venturing Forum

Community
Entrepreneurship Fair

Enterprise Exchange

Evening Networking Sessions
Social & Cultural Experience

Industry Focus

Asian Linux Conference

- As the influence of the Linux operating system and technology continues to extend, this conference will explore and discuss how this is impacting on the Asian landscape.

CTO Workshop on Emerging Technologies

- This workshop is designed to empower the CTO by developing the skills, competencies and tools to provide vital organisational knowledge and leadership for growth and competitiveness.

Enviro Asia

- This trade exhibition and conference focuses on the latest technologies and innovative solutions, products and services of the environmental management and recycling industry.

High Value Manufacturing Forum

- This conference centres on major issues on disruptive technology, innovative processes and new business models for high value manufacturing.

Nanotech World 2003

- The first ever trade show focusing on nanotechnology in Singapore, it examines the trends, issues and implications of nanotechnology, and how they will shape the future of business.

Photonics World 2003

- A showcase of technologies and breakthroughs from the photonics industry, which has experienced tremendous growth and is linked to some of today's most dynamic markets such as telecommunications, biotechnology, medical, healthcare and many more.

Technology Exploitation Forum

- A forum to discuss intellectual property and technology exploitation, including intellectual property protection, valuation, licensing, acquisition, portfolio management and technology transfer.

Wireless Venturing Forum

- This forum facilitates the exchange of ideas on wireless business opportunities and the development of collaborative networks between Singapore and leading wireless business research institutions worldwide.

Youth & Community

BizWorld Competition

- A competition for students aged 10 to 14 years that simulates business scenarios and helps foster their entrepreneurial skills.

Community Entrepreneurship Fair

- In the spirit of entrepreneurship, budding and veteran entrepreneurs trade ideas and share their experiences at this community fair.

Global Start-up @ Singapore Business Plan Competition

- A global business plan competition which draws teams from leading universities and institutes of higher learning.

MarketsStrategyTechnology

A global marketplace of opportunity and enterprise.



The list of speakers and delegates attending Global Entrepolls @ Singapore is extensive, and among them are:

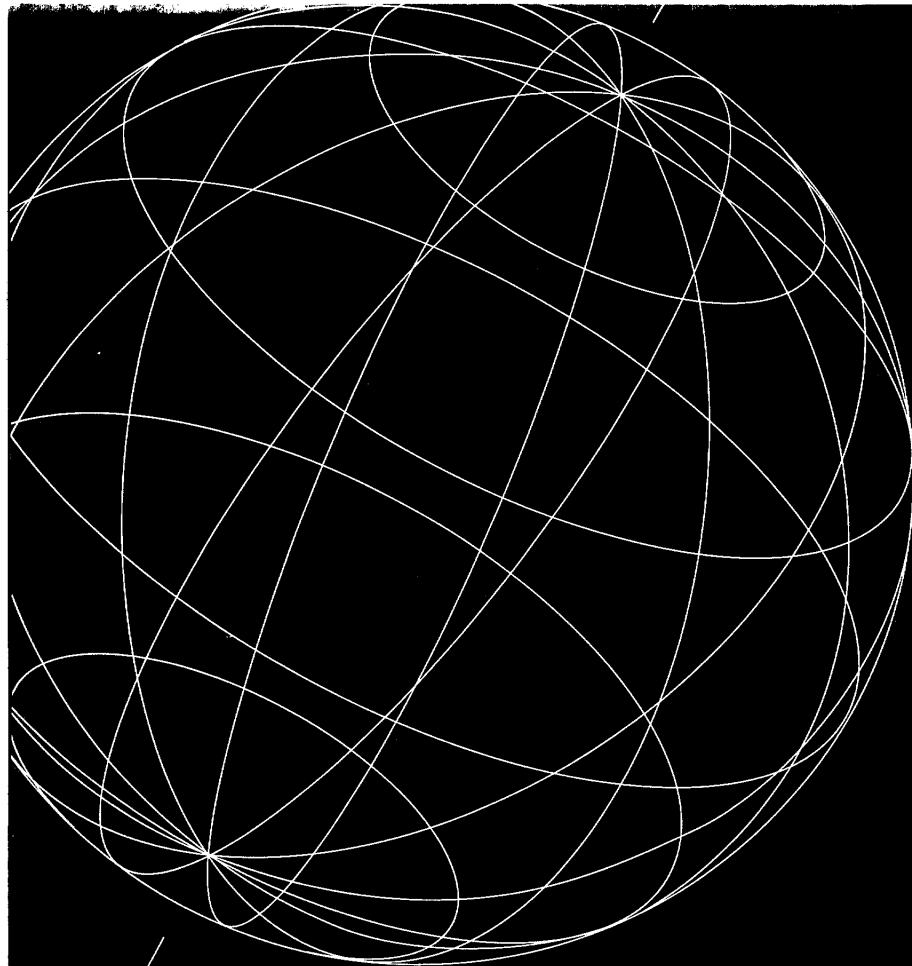
- Chief Executive Officers
- Chief Technology Officers
- Chief Financial Officers
- Entrepreneurs
- Technopreneurs
- Venture Capitalists & Business Angels
- Global Investors
- Leading Academics
- Trade & Business Association Representatives

At Global Entrepolls @ Singapore, speakers, delegates and visitors will be able to:

- Seize Business Opportunities
- Seek out New Markets
- Establish Partnerships
- Network and Make Connections
- Source for, and Interest Potential Investors
- Discover New Technologies, Products and Innovation
- Acquire Strategic Insights and Intelligence
- Access Funding and Growth Opportunities

Here is a unique opportunity to experience and participate in the entire process from innovation to enterprise:

- Uncover new ideas and disruptive innovations
- Realise the power of intellectual property
- View the showcase of successfully commercialised innovations and technology
- Peek into tomorrow's ground-breaking trends and outlook
- Bring away a strategic road map of directions and new opportunities



The power is there to disrupt and change the future.
Will you be there to witness, and shape it?

Go to www.globalentrepolis.com

Sponsorship & Exhibition Sales : wendy@globalentrepolis.com
derrick@globalentrepolis.com
General Enquiries : rita@globalentrepolis.com

Mailing Address : Global Entrepolis @ Singapore
250 North Bridge Road
#24-00 Raffles City Tower
Singapore 179101

Tel : +65 6832 6233
Fax : +65 6336 3845



Global Entrepolis @ Singapore

A reflection of passion and energy, the logo signifies the convergence of people, talent, enterprise, ideas and technology in one place - Singapore, the Global Entrepolis.

Thus, the four arrows come together in a dynamic swirl to show the strong pull of Singapore in drawing all these elements from the world over.

The arrows also represent the four key objectives of **Global Entrepolis @ Singapore**:

- **Markets** - Where delegates gain access to new markets and areas of opportunities
- **Finance** - Where Singapore is the gateway to locate sources of funding and support
- **Partners** - Where it is the marketplace to connect, network and collaborate
- **Technology & Ideas** - Where the cutting edge of innovation, enterprise and technology is showcased

The dots emphasise the innovation and new directions taken that could potentially be tomorrow's breakthrough.

Red is symbolic of Singapore and also expresses the excitement that will pulsate at **Global Entrepolis @ Singapore**.

www.globalentrepolis.com

Presented by:



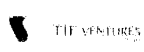
Organised by:



Sponsor:



In conjunction with:



Official Partners - Global Media:



THE WALL STREET JOURNAL

THE ASIAN WALL STREET JOURNAL

THE WALL STREET JOURNAL EUROPE
Registered trade marks of Dow Jones and Company.

Information correct as of March 2003.



ECO-IEE PTE LTD

A TOTAL WASTE MANAGEMENT COMPANY

CONTENT



INTRODUCTION ON ECO

NON-HAZARDOUS WASTE

- Public Incineration & Landfill
- Growth Rates Projections
- ICW Recovery Processes

HAZARDOUS WASTE MANAGEMENT

CONSTRUCTION & DEMOLITION WASTE MANAGEMENT

SECOND PHASE DEVELOPMENT & LONG-TERM PLAN

ENHANCEMENT OF INCINERATION CAPABILITIES





CORE BUSINESS

ECO is in the business of providing comprehensive waste management solutions to customers by offering one-stop services with facilities to treat both hazardous and non-hazardous wastes

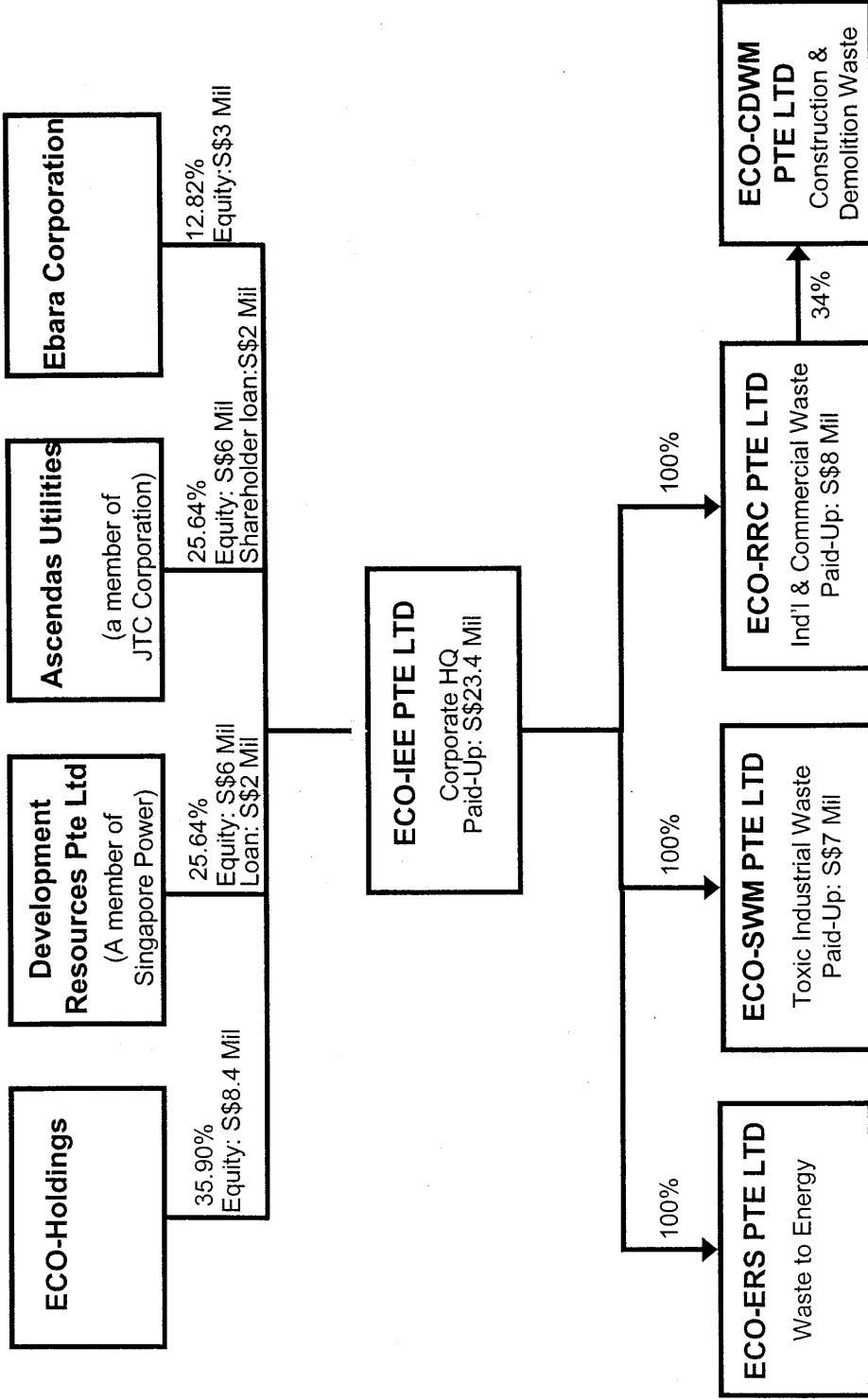
OUR VISION

To be the Waste Management Company of Choice

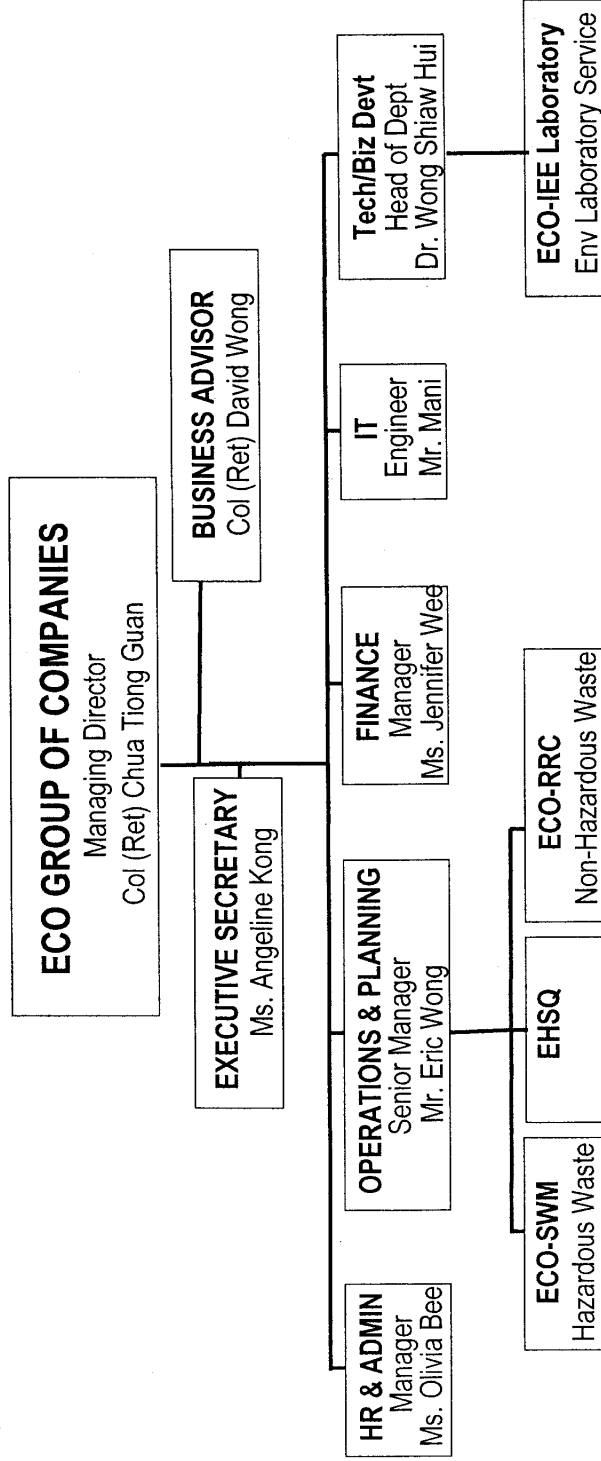
OUR MISSION

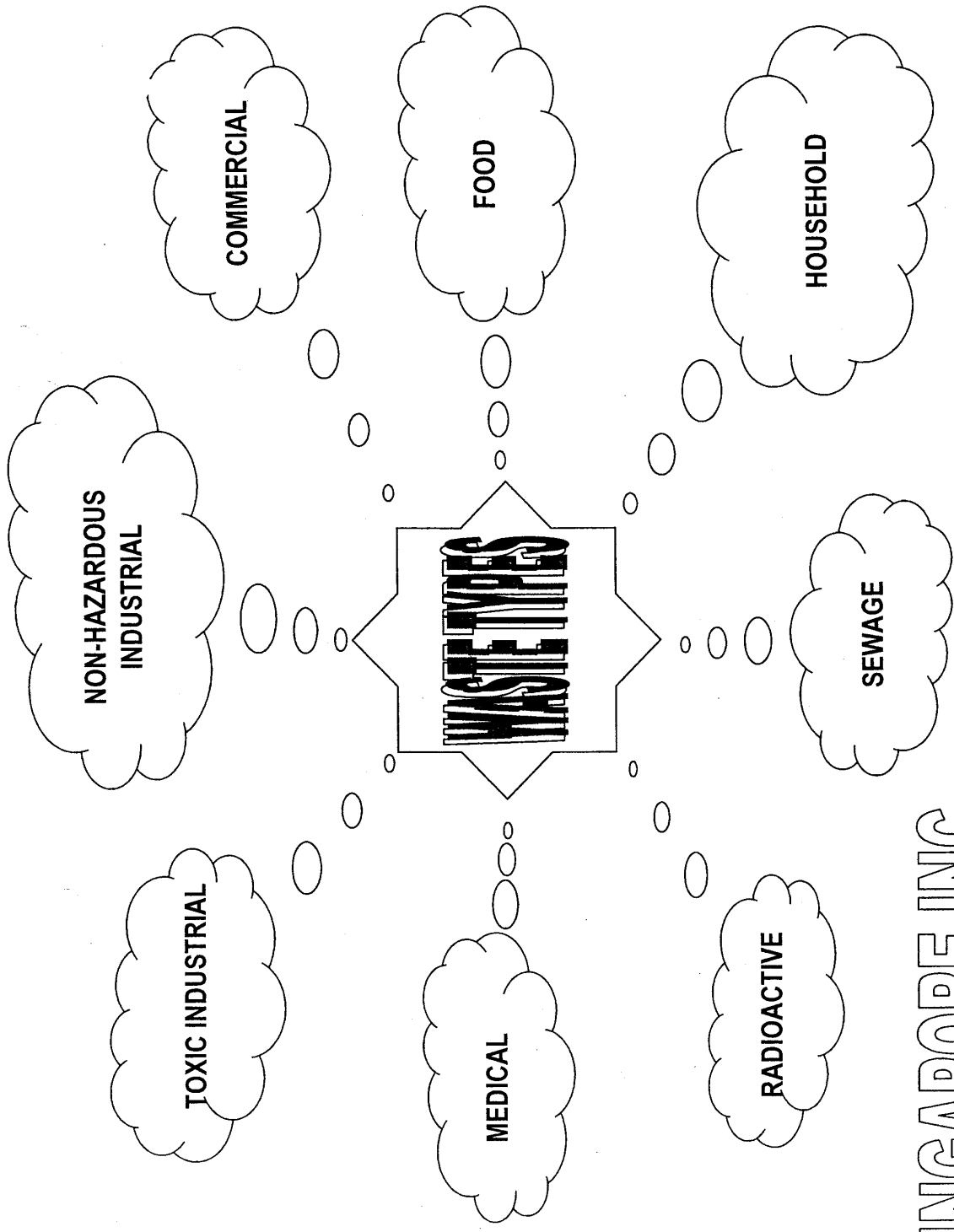
To help organizations manage their wastes efficiently and safely through comprehensive waste minimization, recovery and disposal solutions thereby complementing the Global efforts towards a cleaner and safer environment

CORPORATE STRUCTURE



ORGANIZATION CHART

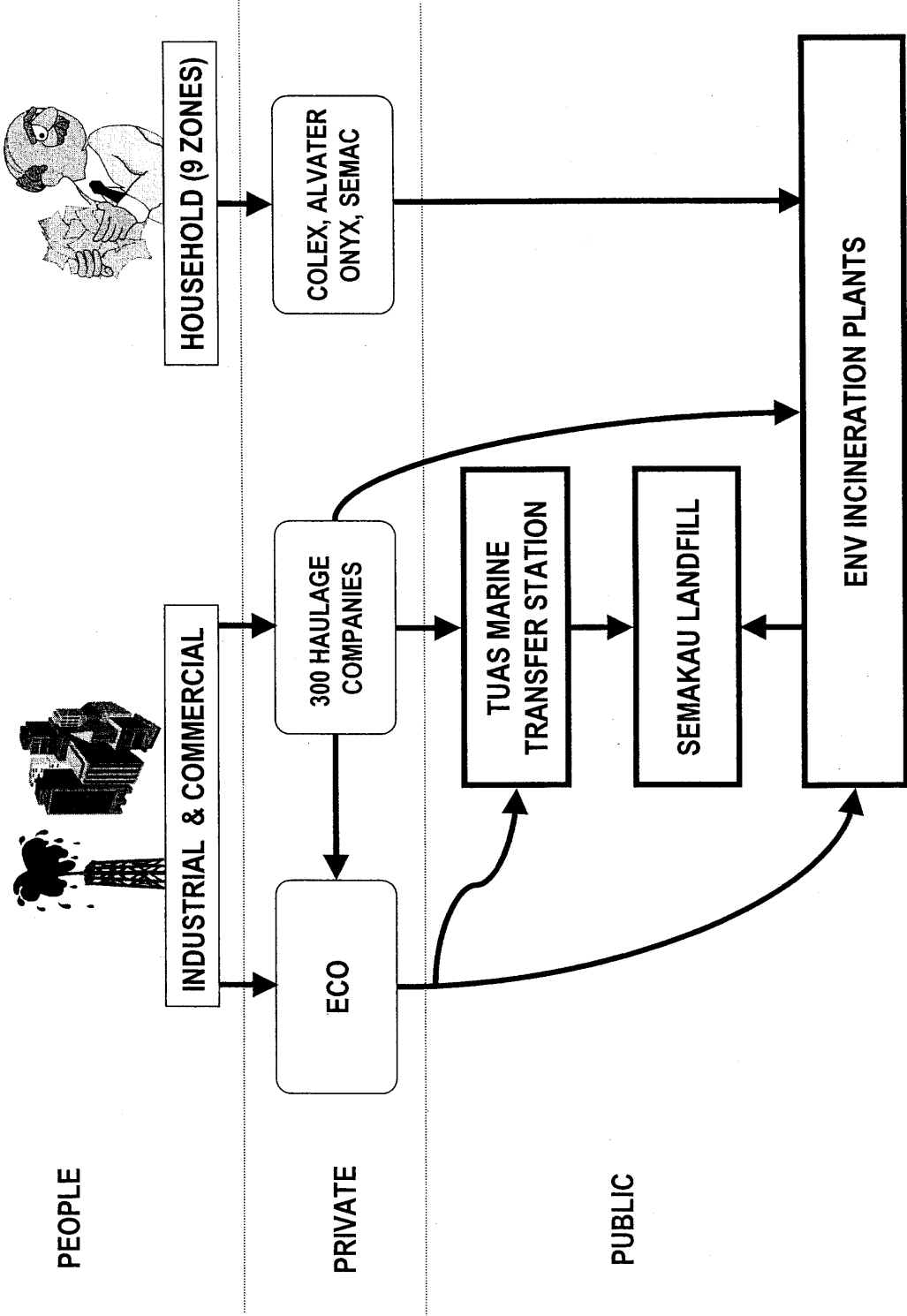




SINGAPORE INC.

**NON-HAZARDOUS
WASTE**

OVERVIEW OF NON-HAZARDOUS WASTE



NON-HAZARDOUS WASTE DISPOSAL & RECYCLING

Waste Statistics and Recycling Rate for 2001				
Waste Type	Quantity Disposed	Quantity Recycled	Quantity Generated	% Recycled
Food waste	505,112	30,536	535,648	5.7
Paper/Cardboard	789,633	446,504	1,236,137	36.1
Plastics	489,506	57,031	546,537	10.4
Construction Debris	51,524	299,764	351,288	85.3
Wood/Timber	247,088 (678 t/d)	21,300 (58 t/d)	268,388 (735 t/d)	7.9
Horticultural Waste	192,077	88,793	280,870	31.6
Earth Spoils	9,550	-	9,550	-
Ferrous Metals	145,312	969,618	1,114,930	87.0
Non-ferrous Metals	17,360	101,881	119,241	85.4
Used Slag	22,067	205,411	227,478	90.3
Sludge	79,016	-	79,016	-
Glass	29,239	5,156	34,395	15.0
Textile/Leather	93,853	415	94,268	0.4
Scrap Tyres	4,748	6,823	11,571	59.0
Others	126,098	-	126,098	-
Total:	2,802,183	2,233,232	5,035,415	44.4
Average Daily Tonnage	7,677 t/d	6,118 t/d	13,796 t/day	44.4%

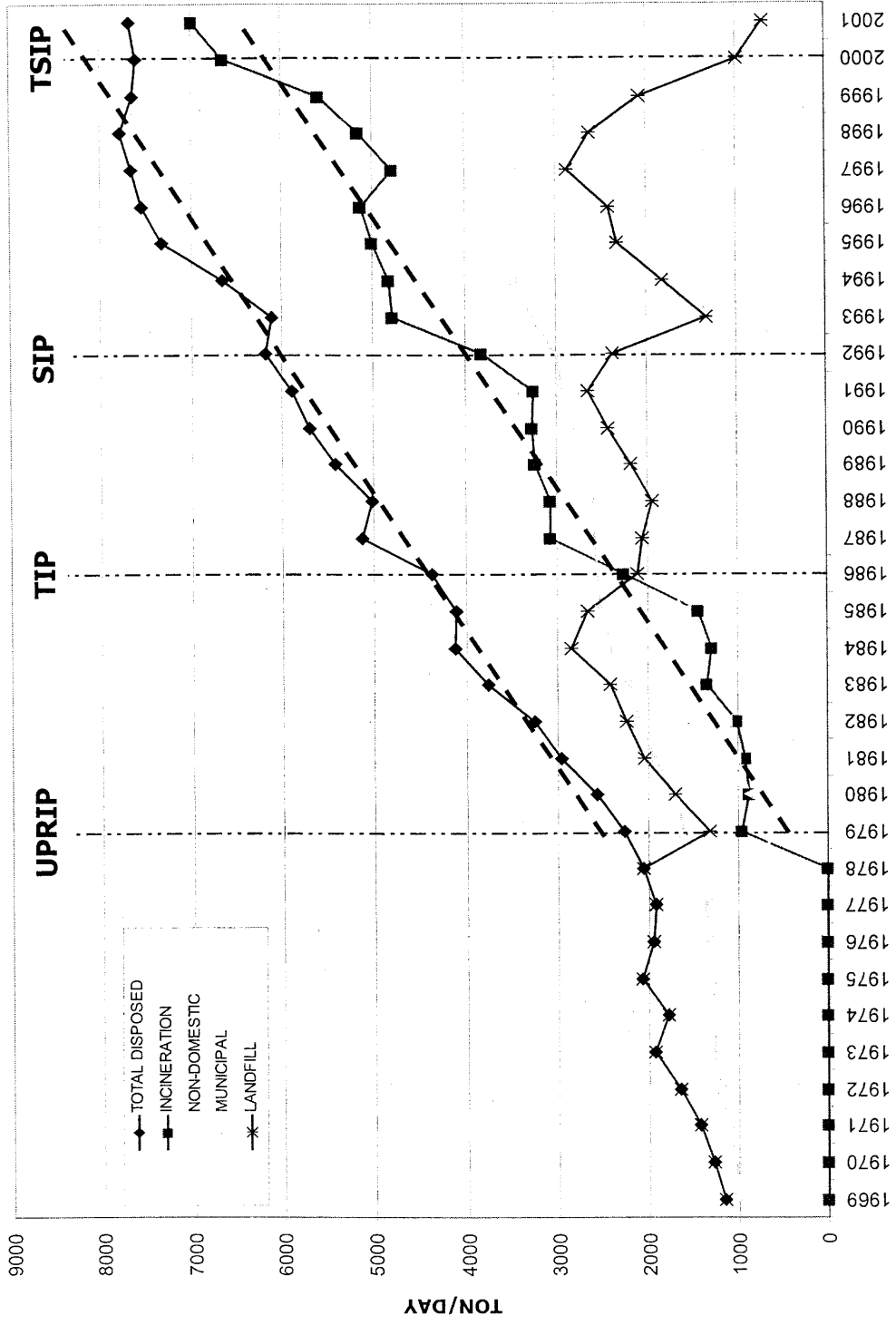
Source : NEA REPORT 2001

PUBLIC INCINERATION & LANDFILL

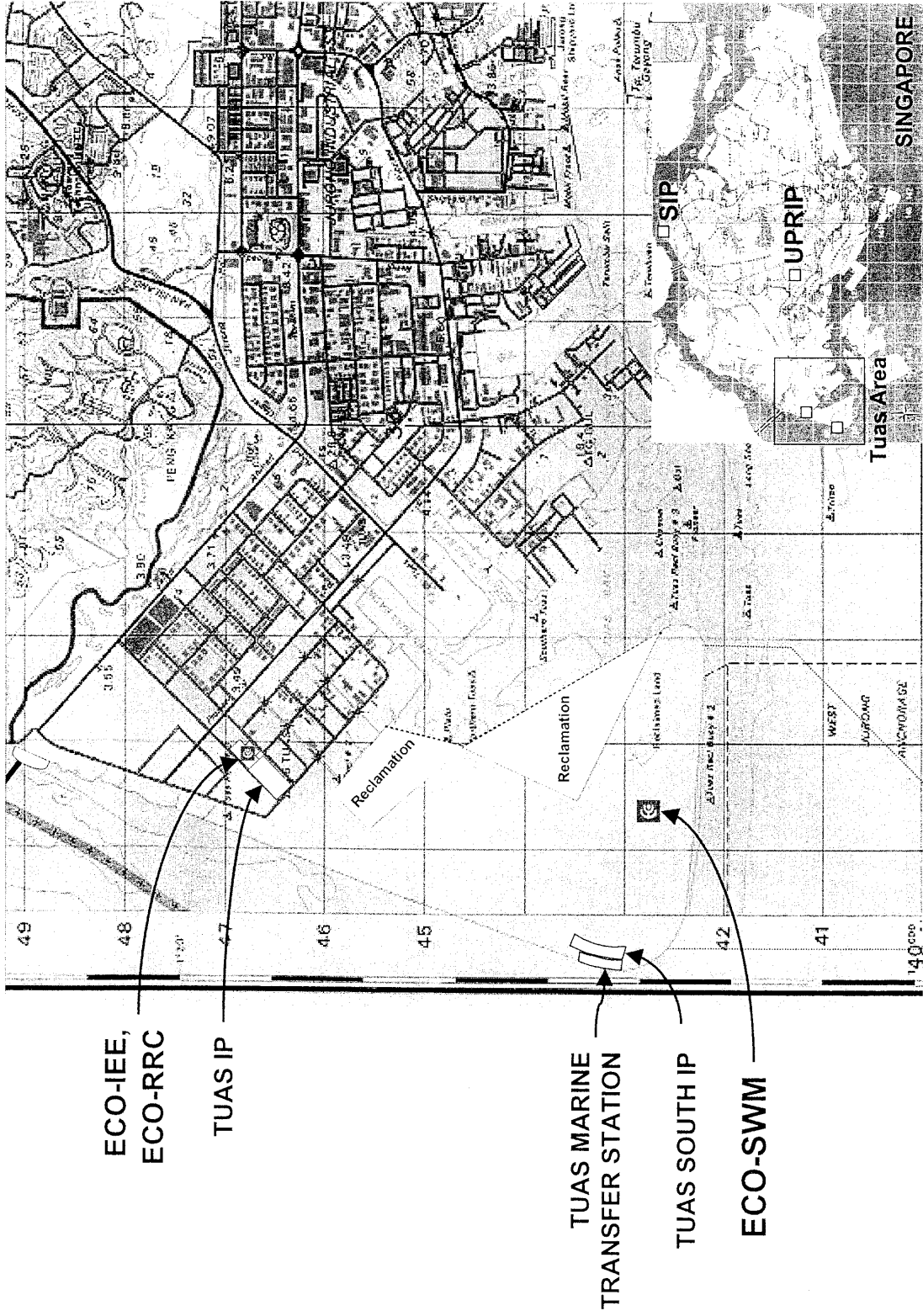
IP	CAPACITY		
	DESIGN, T/D	UTILIZED, T/D	% UTILIZATION
ULU PANDAN (UPRIP)	1,100	1,000	90
TUAS (TIP)	1,700	1,400	82
SENOKO (SIP)	2,400	2,100	88
TUAS SOUTH (TSIP)	3,000	2,500	83
TOTAL INCINERATED	8,200	7,000	85
ASH	1,700 T/D		
TOTAL DISPOSED	7,677 T/D (91% by incineration; 9% by landfill)		

SOURCE: ENV 2001 (approximate)

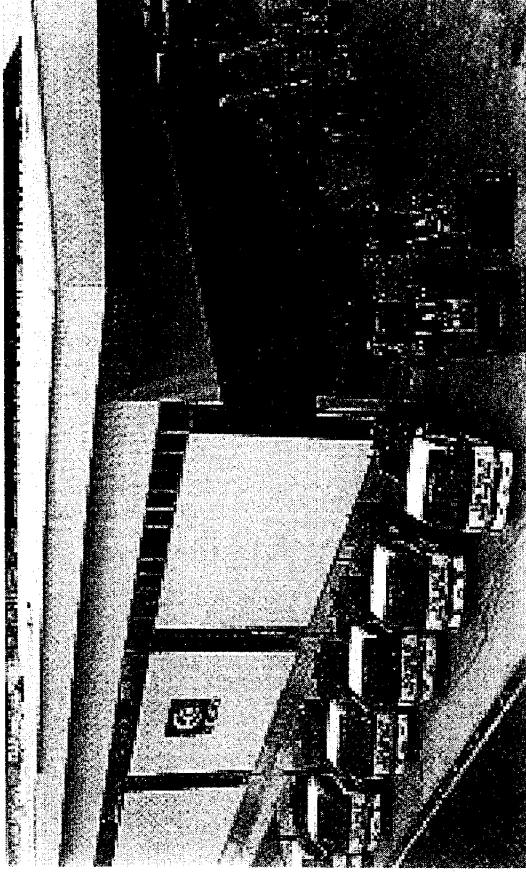
NON-HAZARDOUS WASTE DISPOSAL



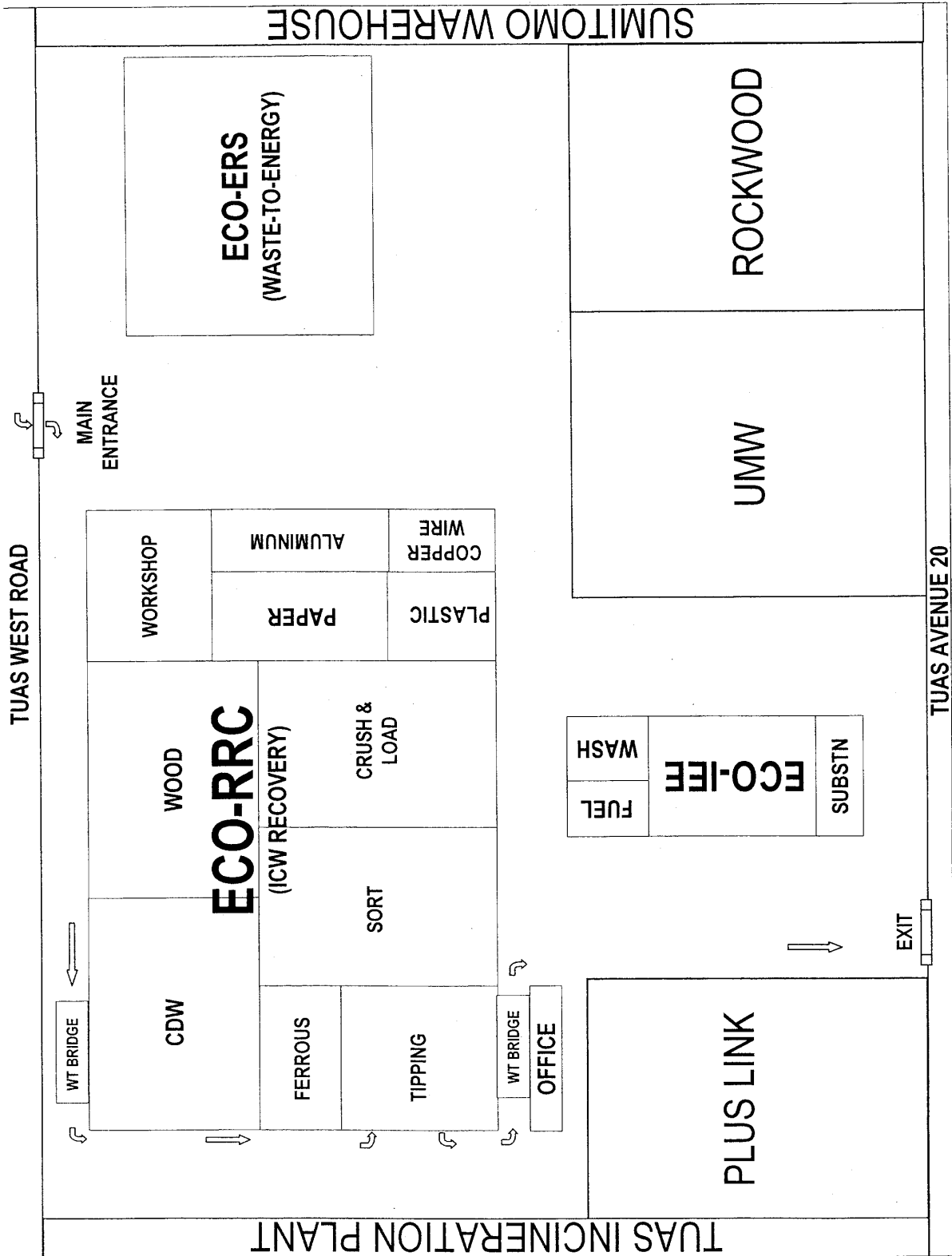
LOCATIONS OF INCINERATION PLANTS



ECO RESOURCE RECOVERY CENTRE PTE LTD



- * 3.4 hectare land
- * 150,000 ft² sorting floor
- * 46 Staff
- * 50% Utilization
- * 1,000 ton per day



TUAS WEST ROAD

TUAS AVENUE 20

SUMITOMO WAREHOUSE

TUAS INCINERATION PLANT

ECO-ERS
(WASTE-TO-ENERGY)

ROCKWOOD

UMW

MAIN
ENTRANCE

WORKSHOP

ALUMINUM

COPPER
WIRE

PAPER

PLASTIC

WOOD

ECO-RRC
(ICW RECOVERY)

CRUSH &
LOAD

WASH

ECO-IEF

SUBSTN

FUEL

SORT

CDW

FERROUS

TIPPING

WT BRIDGE

OFFICE

PLUS LINK

EXIT

ICW RECOVERY

WASTE TIPPING

- All wastes are tipped onto the tipping floor
- Valuables such as bulk wood, plastics, etc. are pick-up.

FERROUS EXTRACTION

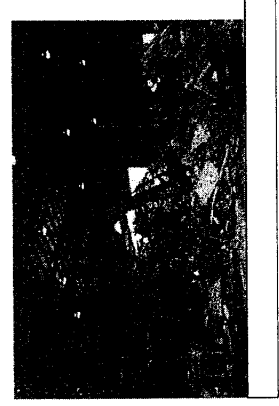
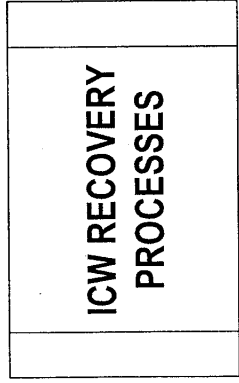
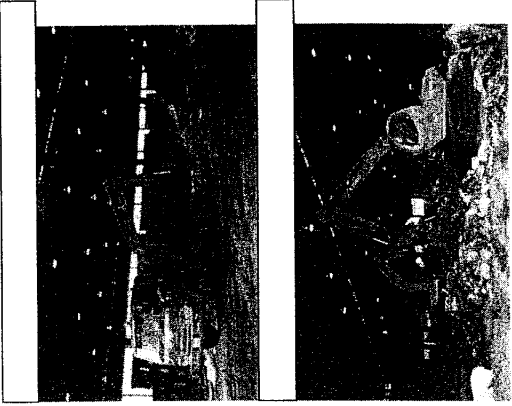
- Industrial magnet to pick all ferrous scraps
- Also serves to disperse the mixed waste

ICW RECOVERY PROCESSES

- Valuable resources are picked by different individuals manually
- Details in subsequent frames

CRUSHING

- Unrecoverable waste are crushed and put into 8' x 8' x 20' skips
- Useless waste sent to ENV incineration plants



PAPER RECOVERY



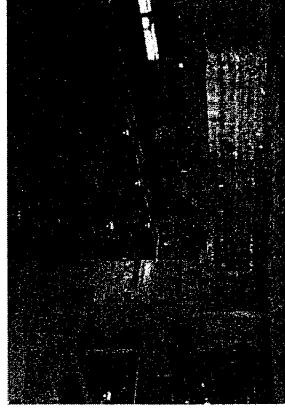
RECOVERY

- Old corrugated carton and mixed paper are picked and sorted
- OCC are sent to baler



BALING

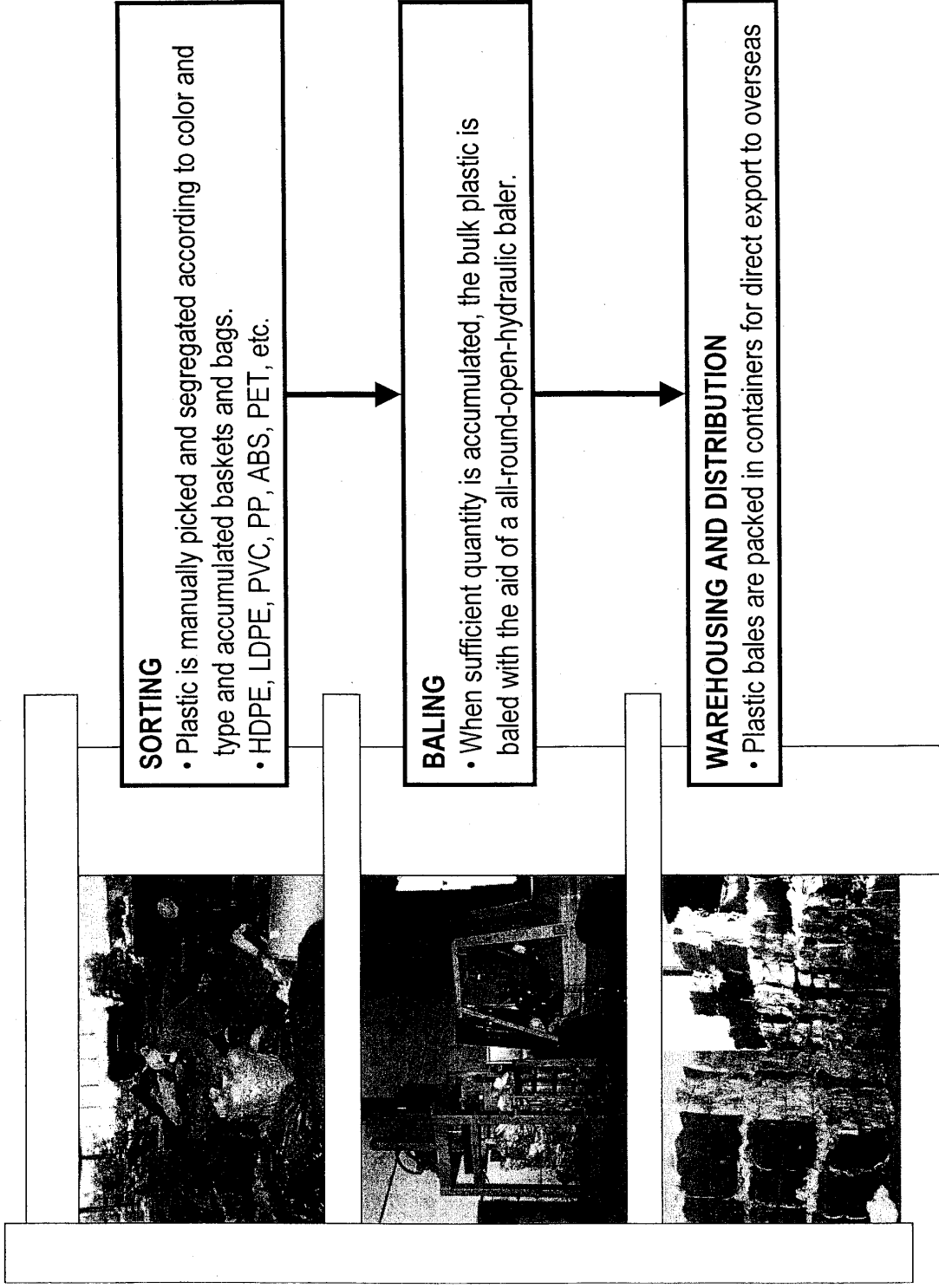
- Paper baler capacity 150ton/day



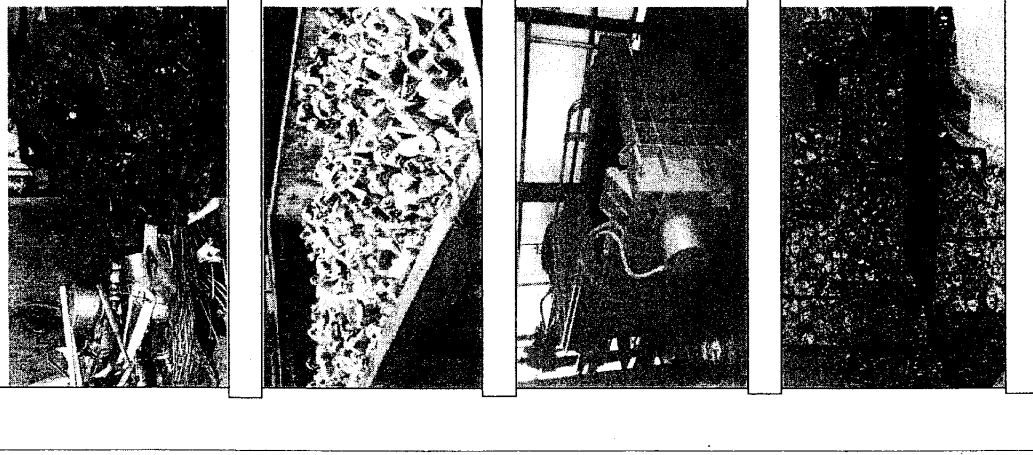
PAPER BALES

- Bales of paper await local collectors who further recycle them

PLASTIC RECOVERY



ALUMINUM RECOVERY



ALUMINUM SCRAP

- Scrap include drink cans, lamp housing, cooking utensil, etc.
- From factories and commercial buildings

SORTED ALUMINUM SCRAP

- Debris are removed to obtain higher purity bales
- Drink cans are punctured to drain water

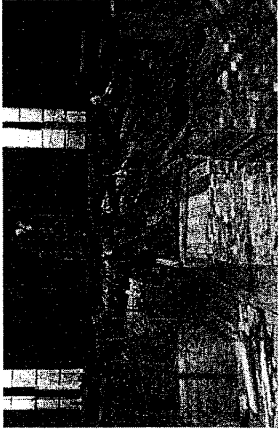
BALING PROCESS

- The baler is designed to reduce bulk volume to reduce logistic cost.

ALUMINUM BALE

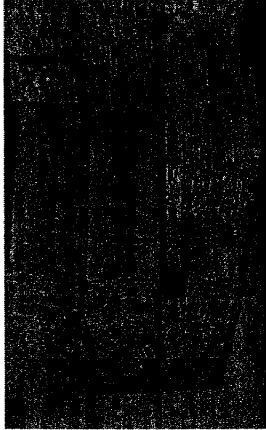
- Aluminum bales ready for sales.

WOOD RECOVERY & PROCESSING



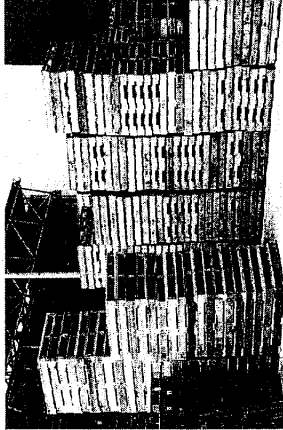
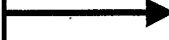
DE-NAILING, SORTING & CUTTING

- Wooden pallets and crates are dismantled or repaired
- Nails are removed with pneumatic extractor
- Timber/plank sorted according to thickness; cut to required length



PALLETIZED TIMBER

- Timber and plank are sold to makers of furniture, crates & boxes
- Remaining processed in-house into pallets and crates



RECYCLE-WOOD PALLETS/CRATES

- Pallets and crates of all sizes are made to order; standard sizes are available off-the-shelf

CONSTRUCTION & DEMOLITION WASTE (CDW)



MIXED HARDWARE

- Wood is extracted first
- Concrete, bricks, and general waste



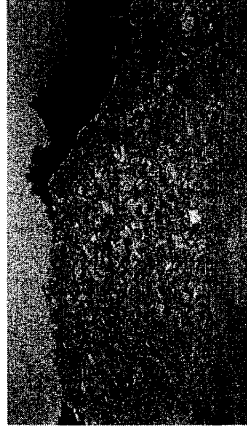
PIPES EXTRACTION

- PVC/PP pipes picked, washed and shredded



RE-BAR EXTRACTION

- Iron is extracted with electromagnet
- Crusher is used to break concrete from rebars

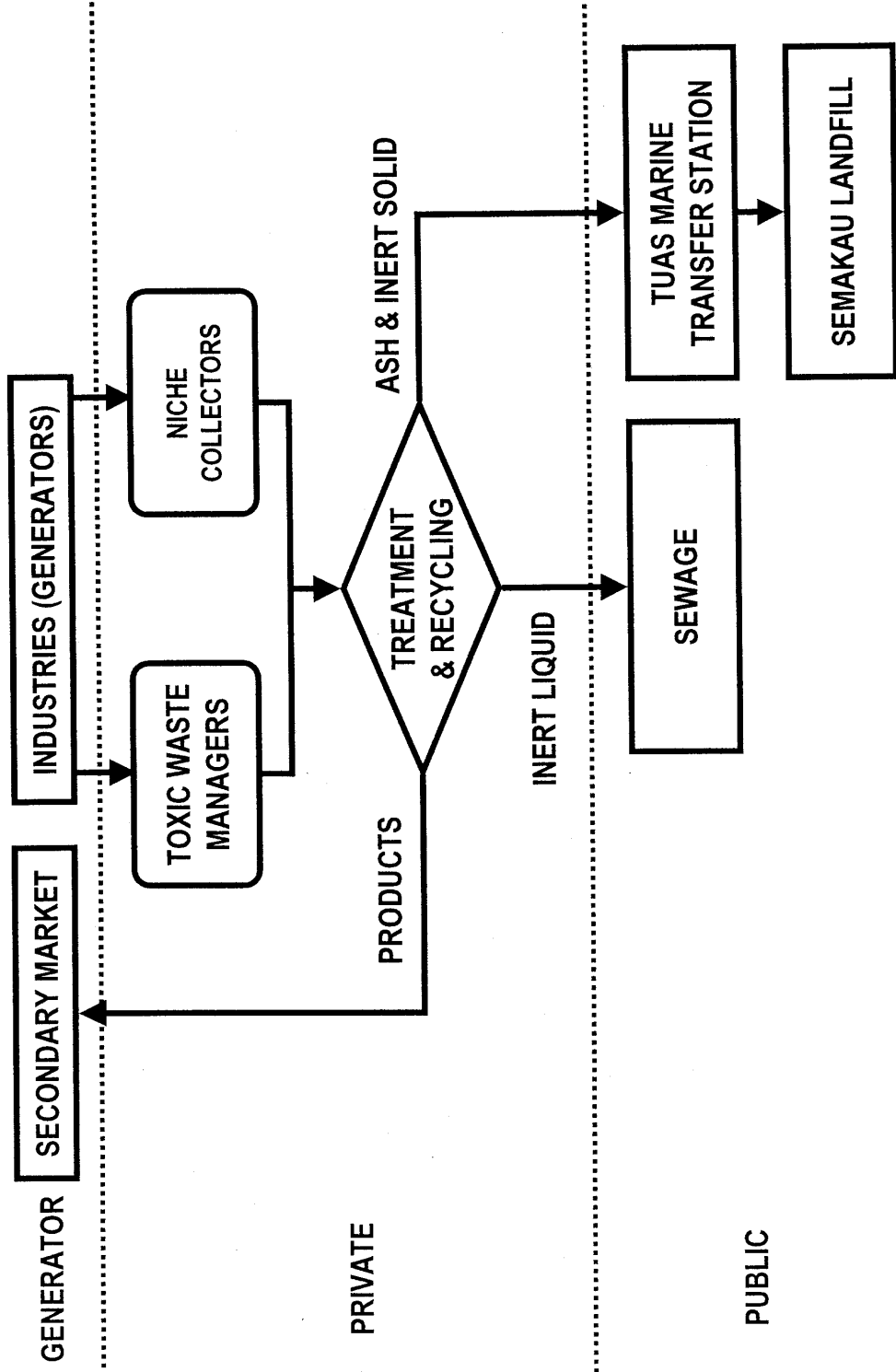


CLEAN HARDWARE

- Final concrete cleared of wood and other debris
- Need automation for larger volume

**TOXIC INDUSTRIAL
WASTE**

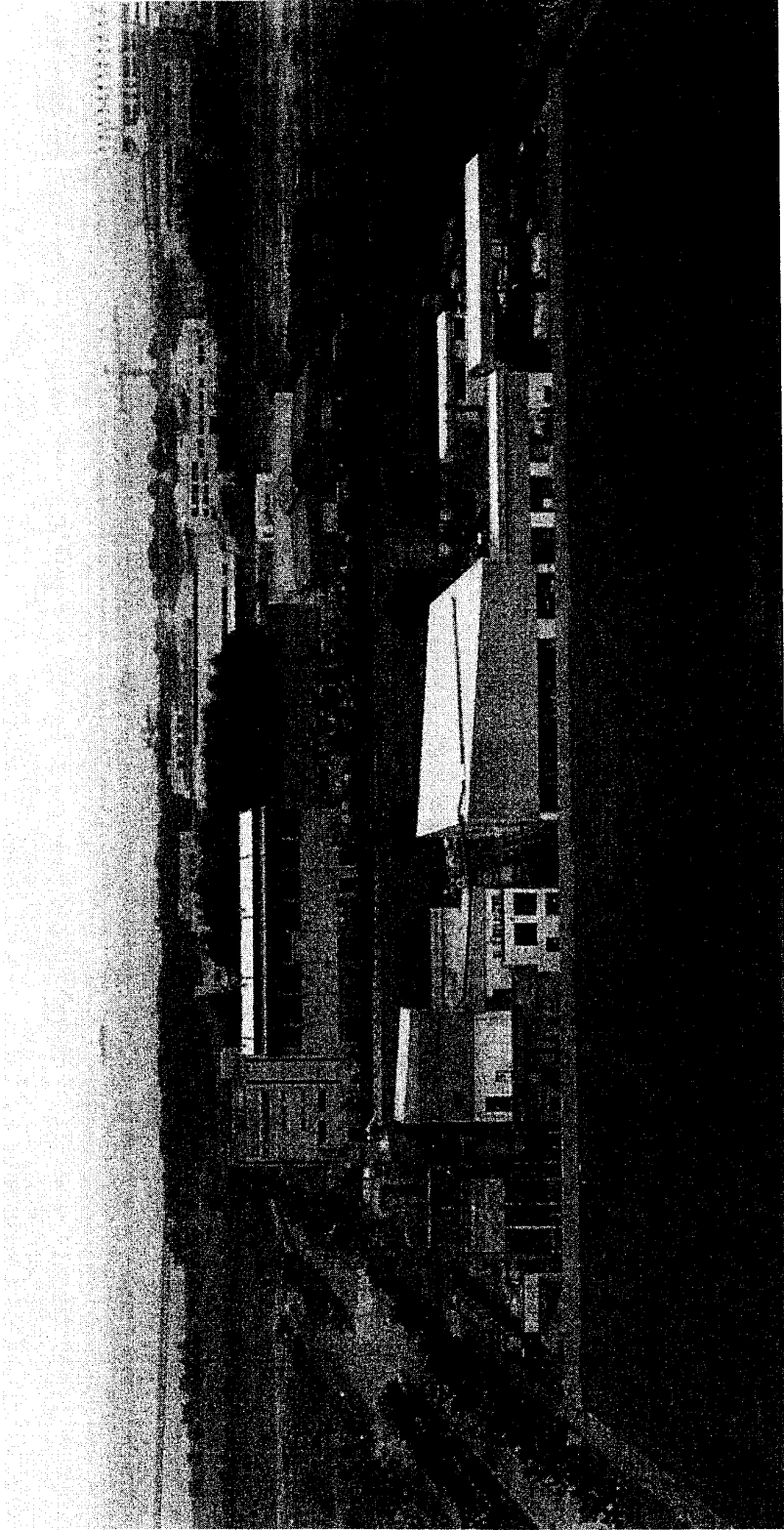
OVERVIEW OF HAZARDOUS WASTE



QUANTITY OF TOXIC WASTE

Year	1993	1994	1995	1996	1997	1998	1999	2000	2001
Halogenated solvent, m3	1,560	1,290	1,370	1,350	1,100	840	878	739	1,000
Non-halogenated solvent, m3	5,020	6,500	8,630	9,580	9,490	12,680	14,863	15,645	22,171
Waste oil, m3	9,390	10,010	13,000	13,280	11,020	8,890	13,394	12,397	12,675
Coolant, m3	3,140	2,760	3,130	3,570	3,790	3,420	4,174	4,152	4,334
Etchant, m3	18,540	26,740	27,470	23,500	21,870	21,760	30,024	26,971	27,646
Acid, m3	3,090	3,730	4,530	4,260	4,330	7,450	7,027	7,638	8,319
Alkali, m3	1,630	1,550	2,240	2,420	3,920	2,720	5,576	5,131	5,697
Others chemical, m3	6,590	3,290	4,510	6,140	12,010	20,970	12,079	17,845	19,964
Other chemicals, ton	20,500	12,810	11,870	11,740	14,130	15,390	33,342	31,411	34,714
Tanker sludge, ton					14,340	9,930	15,382	13,500	14,021
Carbide sludge, ton		12,140	15,920	14,270	17,070	16,280	18,507	19,269	20,290
Total	69,460	80,820	92,670	90,110	113,070	120,330	155,246	156,298	185,805

Source: ENV



ECO SPECIAL WASTE MANAGEMENT PTE LTD

*** 2.5 hectare**

*** 30,000 ton/year**

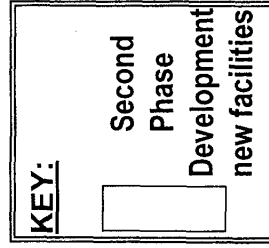
*** 86 employees**

*** Any Toxic Waste**

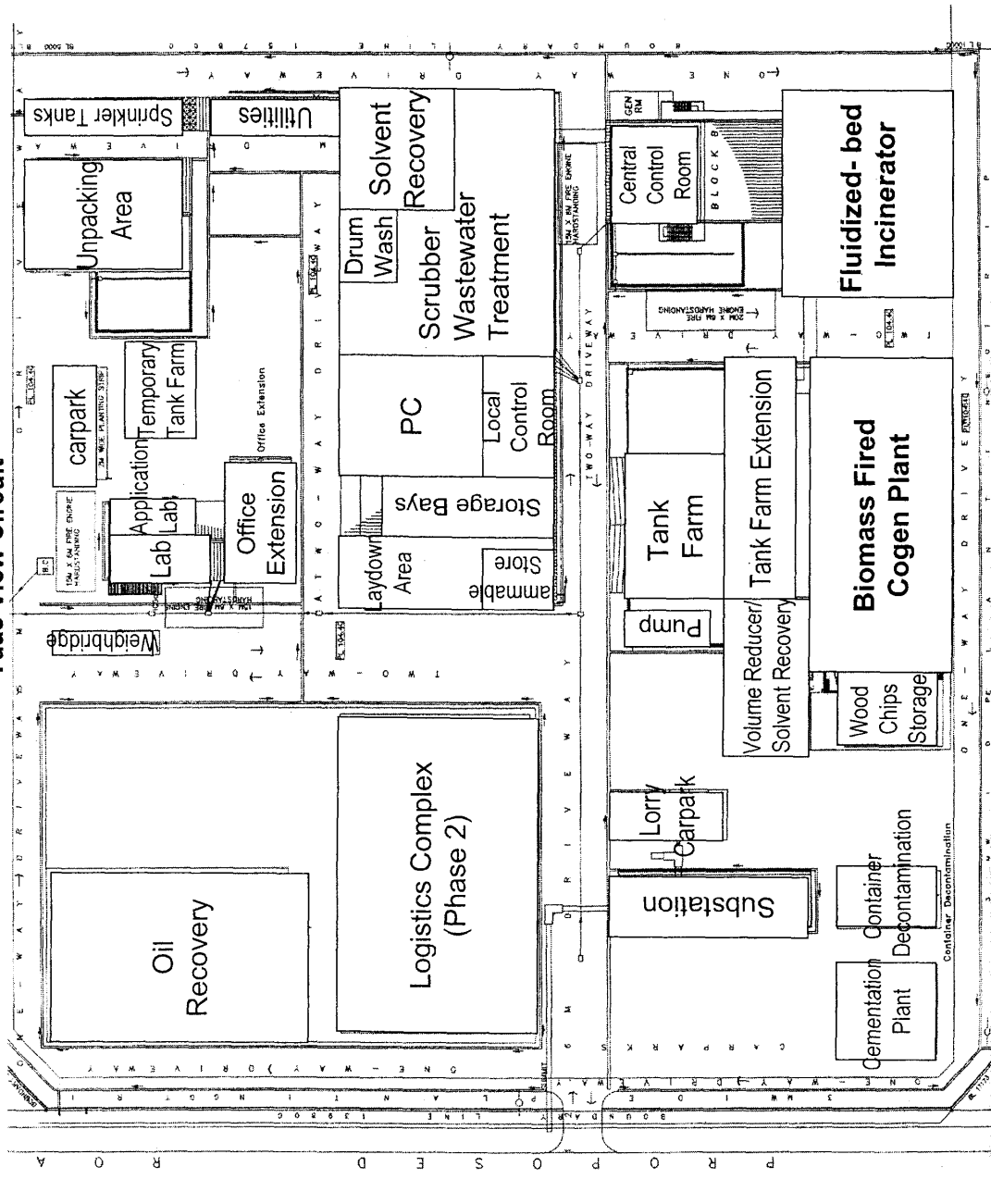


ECO-SWM:

Existing Layout
& Second Phase
Facilities

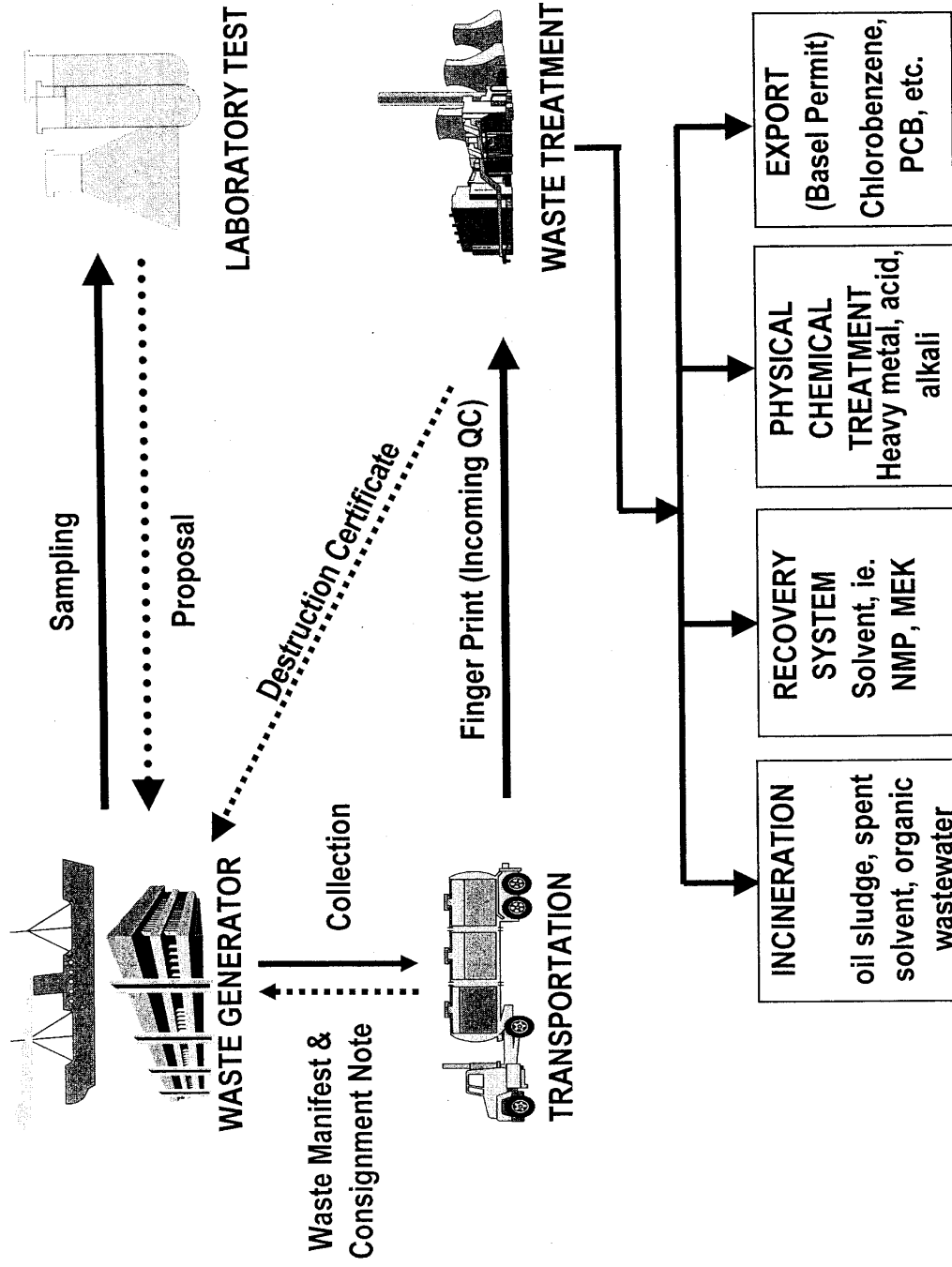


Tuas View Circuit

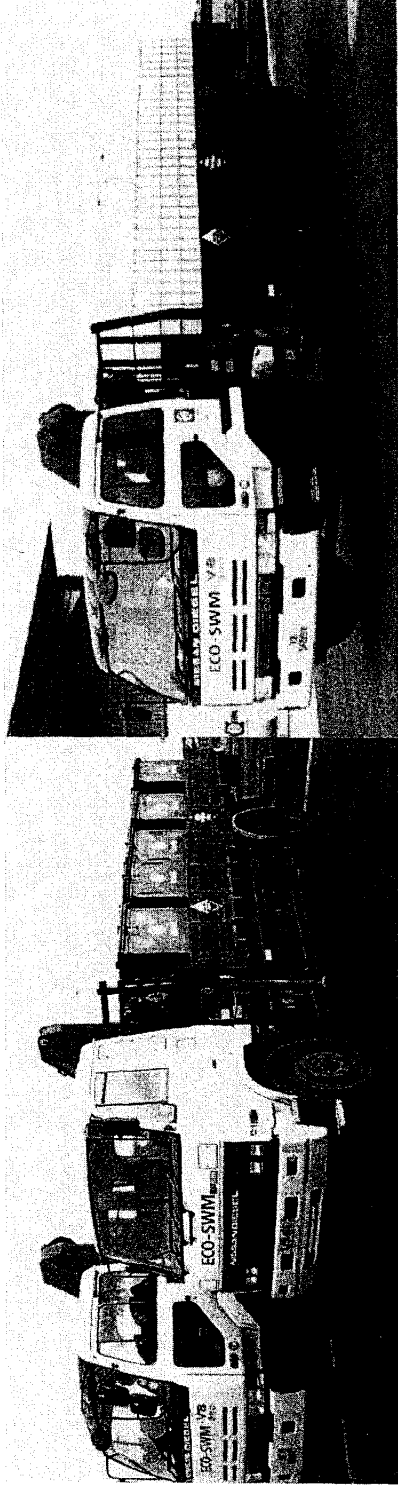


Tuas South Ave 3

OVERVIEW OF PROCESS FLOW

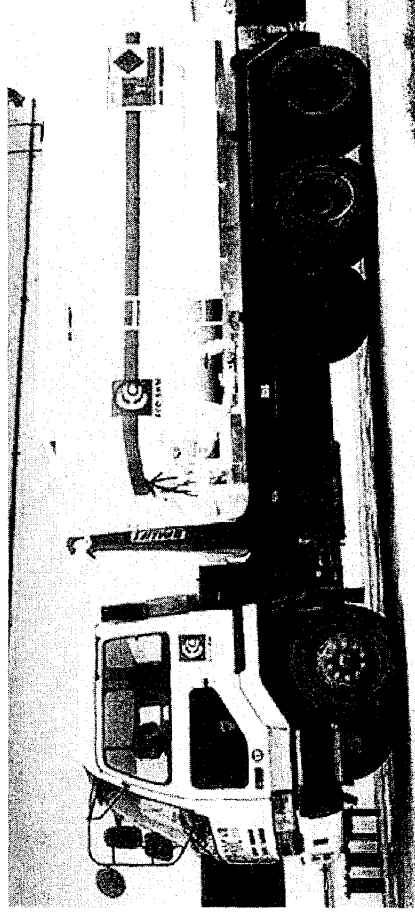


COLLECTION & TRANSPORTATION



SEMI-SOLID: CARBON STEEL CONTAINERS (CSC)

LIQUID: INTERMEDIATE BULK CONTAINER (IBC)



BULK LIQUID & SLUDGE: PORTABLE TANK / VACUUM TANKER

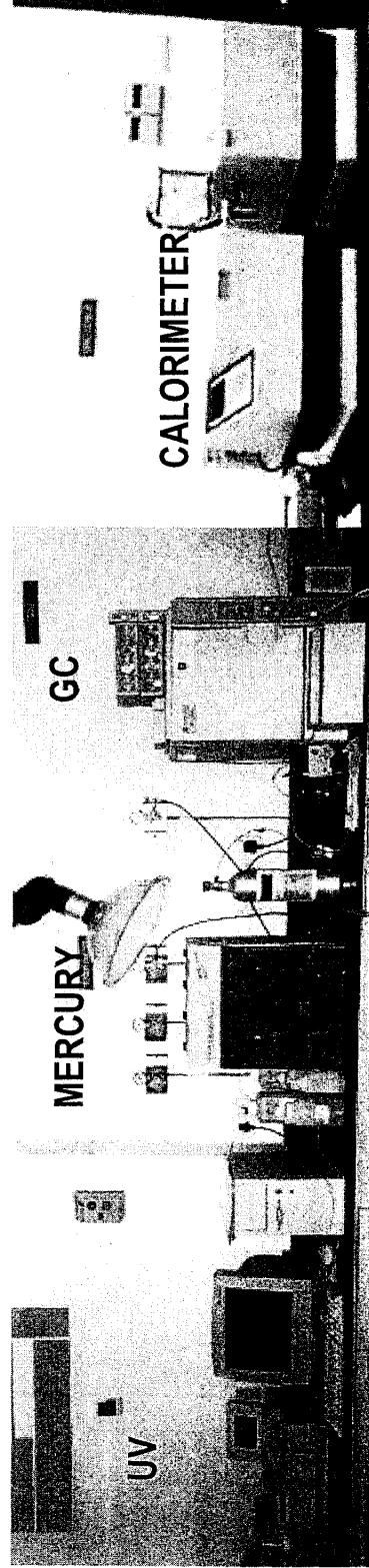
FACTS:

- Collector License
- Transport Approval
- 3rd Party Certificate
- SOC, SIC, BCA
- Motor Insurance

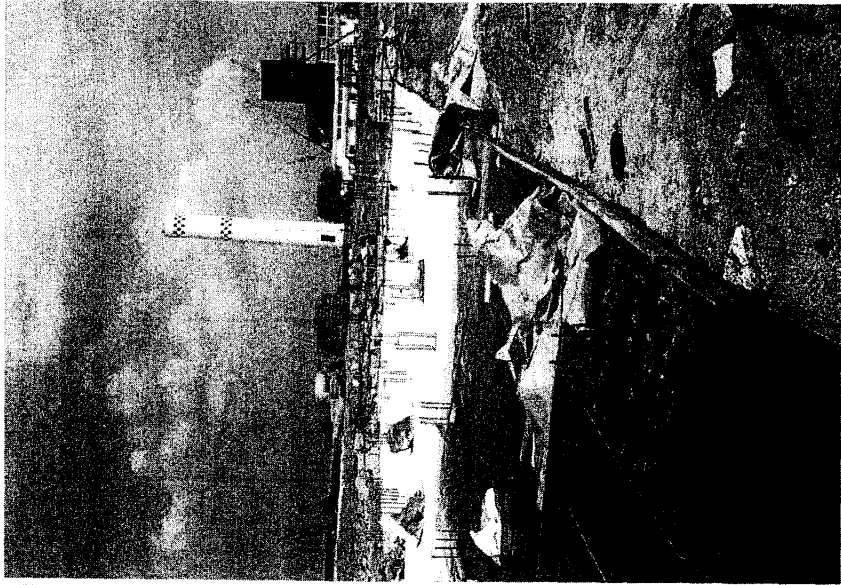
ACCREDITED LABORATORY



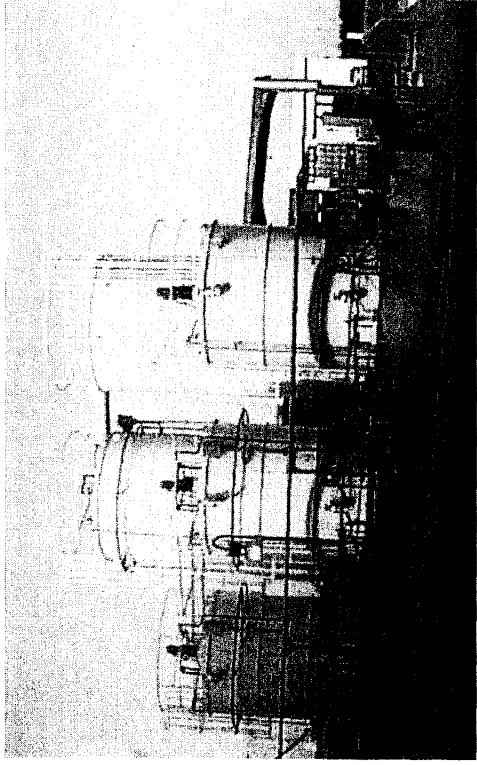
- Operation Support
- Third Party Testing
- Support R&D



PROTECTION AGAINST SUDDEN & NON-SUDDEN POLLUTION



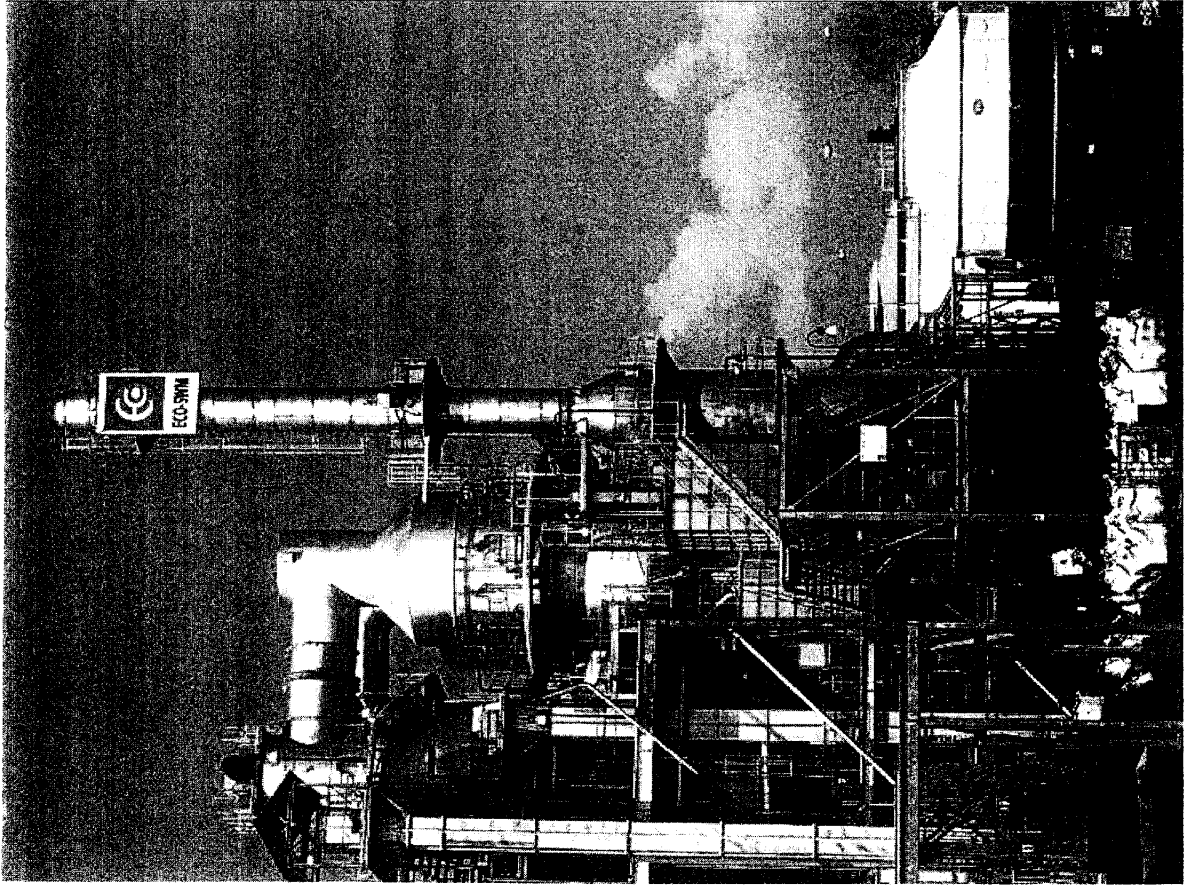
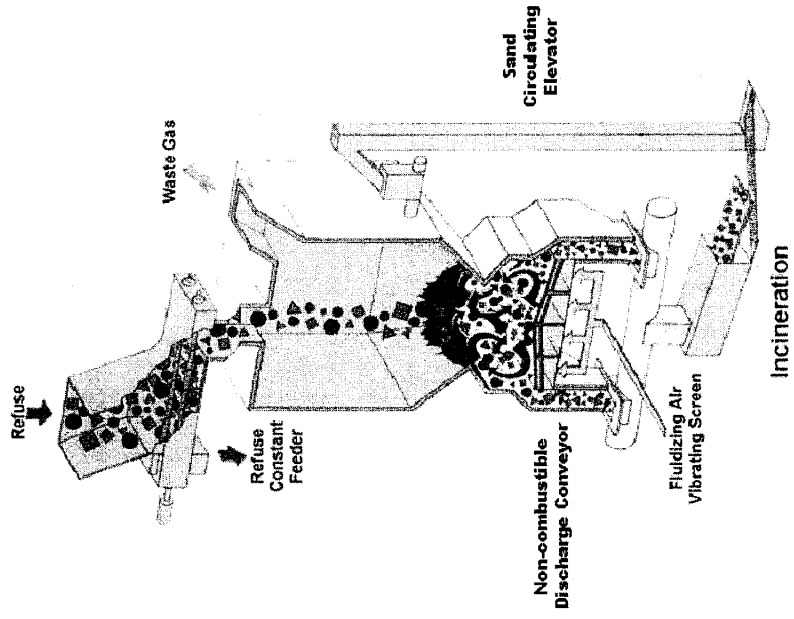
WATER PROOF MEMBRANE



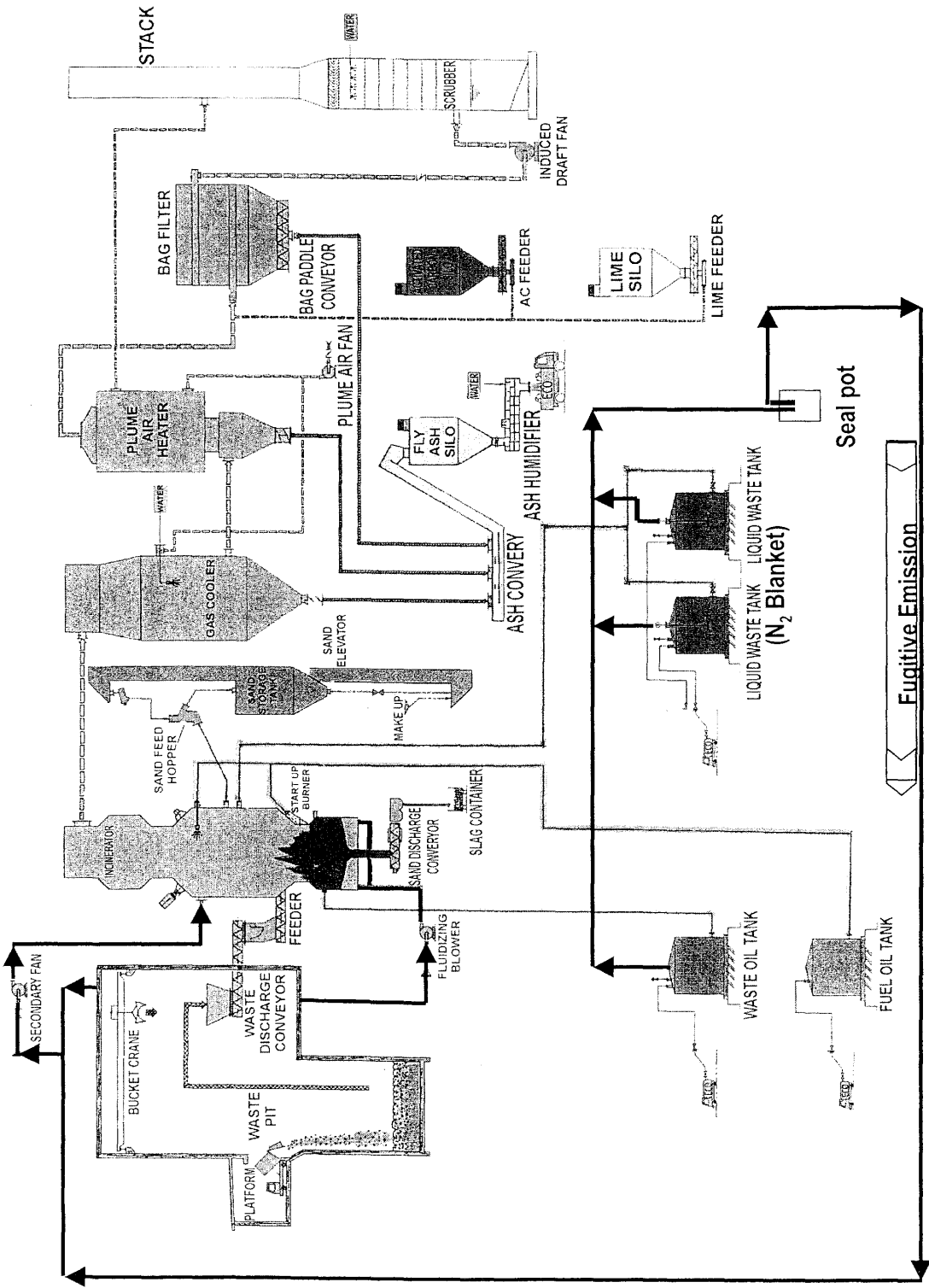
TANKFARM

FLUIDIZED-BED INCINERATION UNRECOVERABLES ORGANIC

- 50 ton/day
- Feed solid, liquid, semi-solid
- DRE > 99.999%

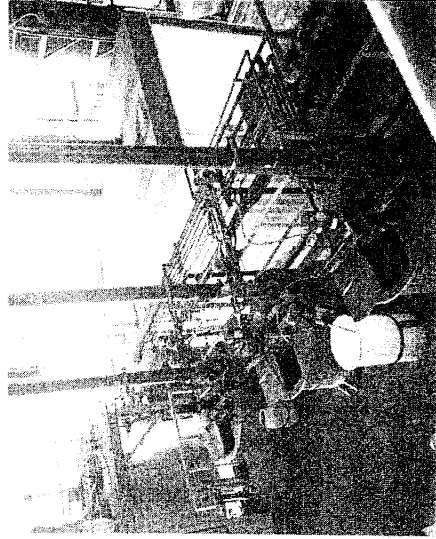


SPECIAL WASTE INCINERATION

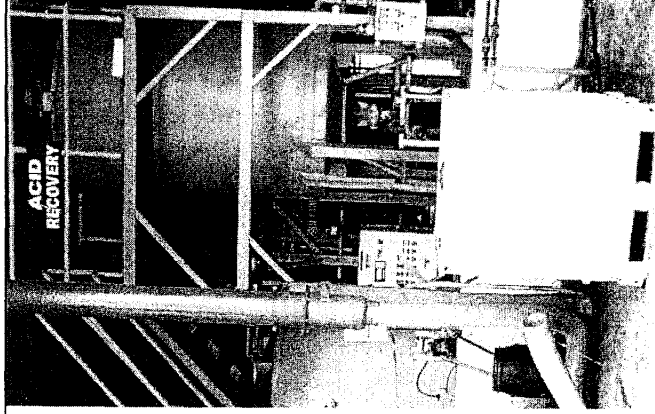


INORGANIC WASTE TREATMENT

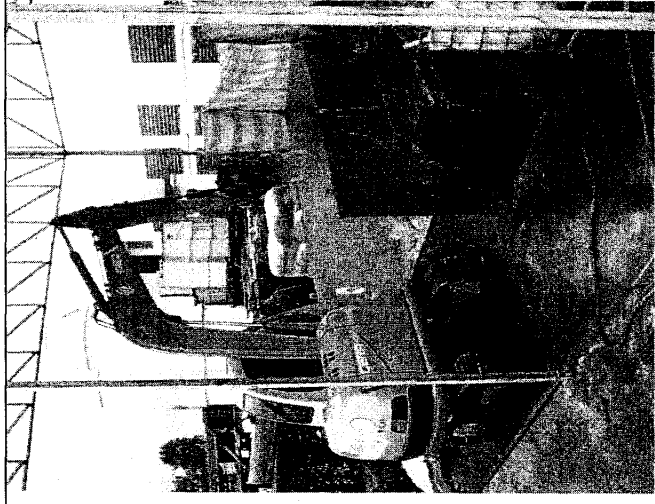
- Inorganic waste treatment processes
- Exhaust system for fumes control
- Waste container cleaning & control
- PLC control



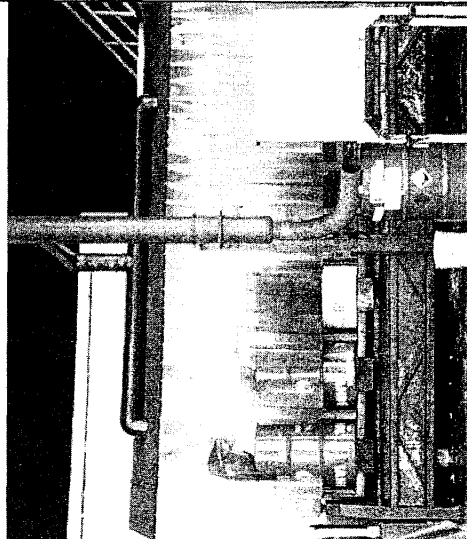
CHEMICAL TREATMENT



ACID RECOVERY

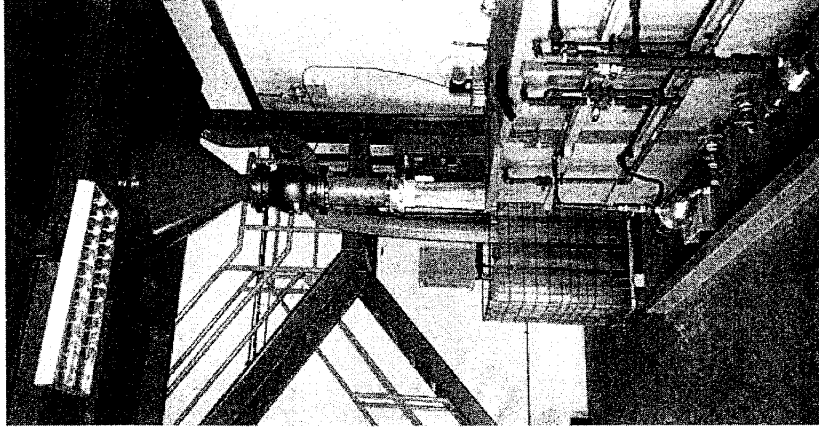


CEMENTATION

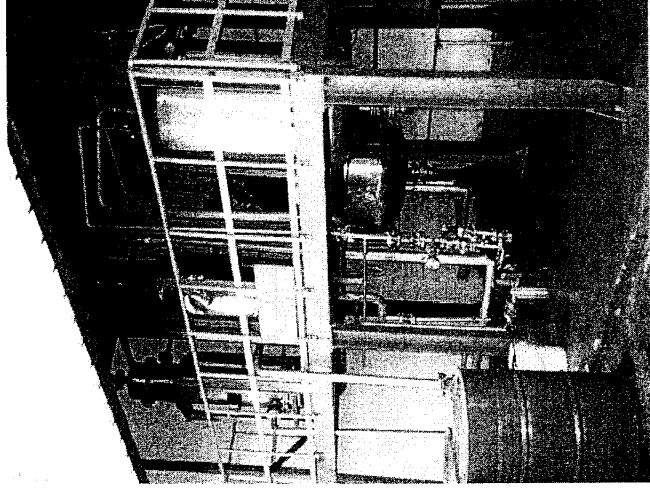


DRUM WASHING

OTHER PROCESSES



TREATMENT LINE
FOR DRY SCRUBBER



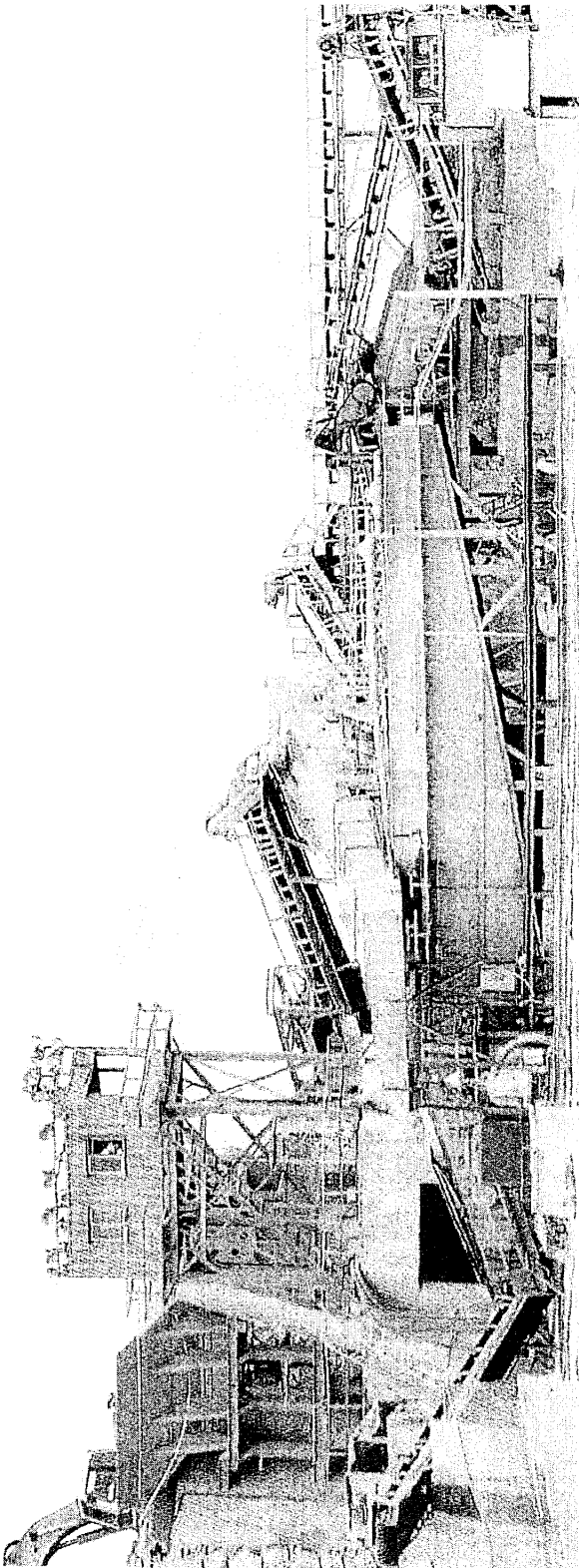
SOLVENT RECOVERY



CONSULTANCY & DECONTAMINATION SERVICES

- **Hazardous Waste Management Consultancy**
- **Containers Decontamination**
- **Site Assessment & Decontamination**
- **Plant & Machinery Decontamination & Demolition**

CONSTRUCTION & DEMOLITION WASTE MANAGEMENT





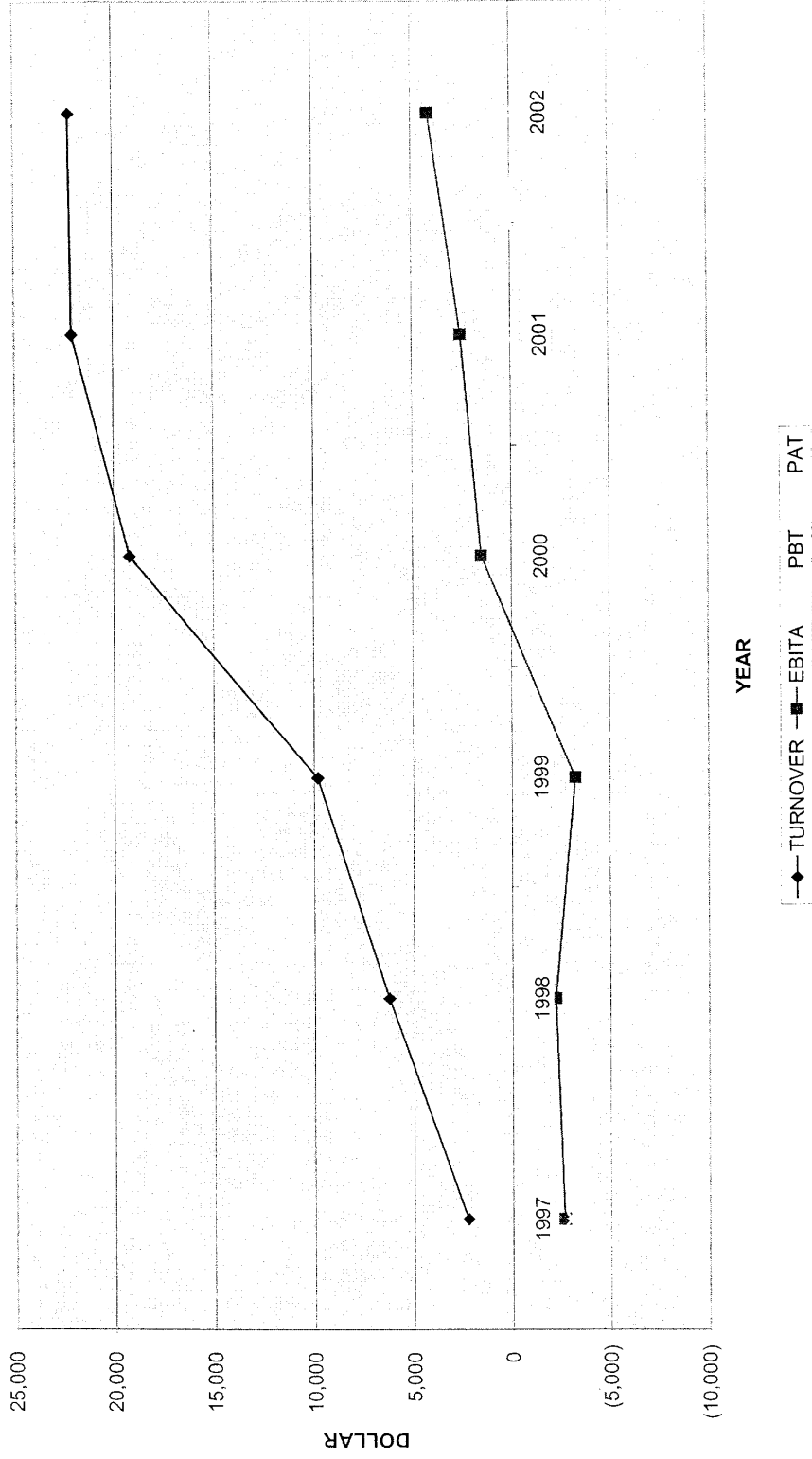
THE PROGRESS

- **From start-up phase to being a leader in comprehensive waste management services**
- **Committed Management Team**
- **Competent technical & operational staff**
- **Good reputation**
- **Strong alliances within S'pore & internationally**
- **Authorities' support**



ECO GROUP PERFORMANCE

ECO GROUP



SECOND PHASE DEVELOPMENT & LONG-TERM PLAN

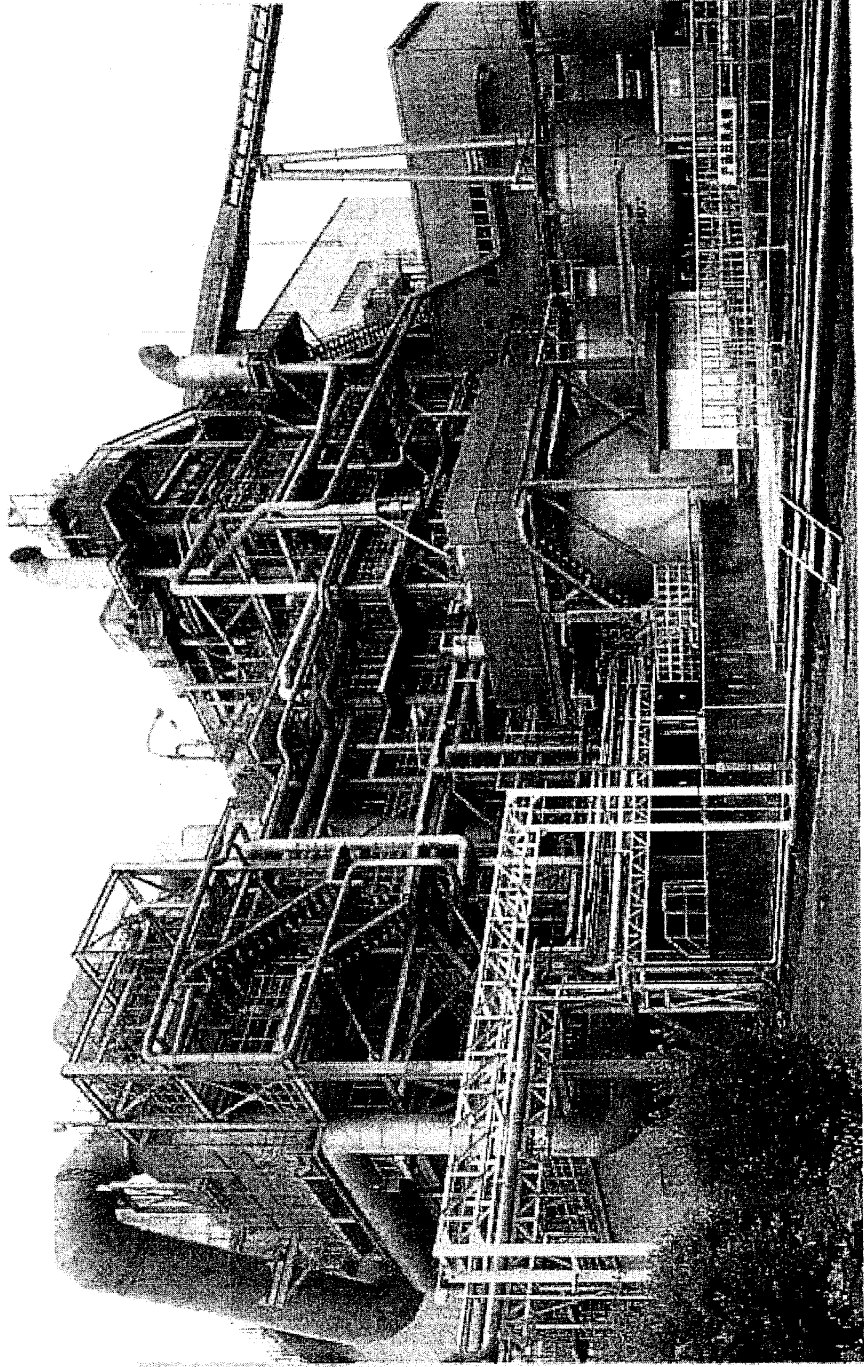
- 1. SWM Integrated Waste Treatment Project**
 - Waste Wood-to-Energy Cogen Plant**
 - Solvent Recovery System**
 - Volume Reducer**
 - Container Decontamination & ISO Tank Washing**
 - Oil Recovery System**

Second Phase Development & Long-Term Plan

- 2. Waste-to-Energy Plant as a Long-Term Solution**
- 3. Shareholders Restructuring**



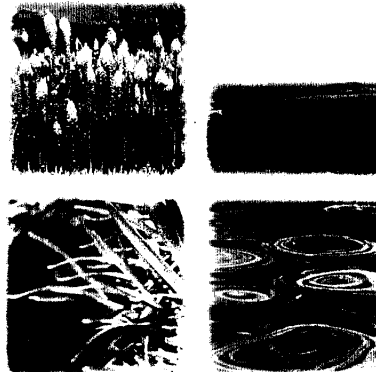
WTE Plant



Waste streams to be handled by the plant:

1. PUB sewerage sludge
2. Bio-sludge
3. SWM incineration waste
4. RRC mixed waste

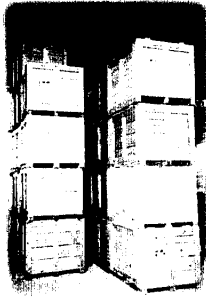
THANK YOU



Our Mission

To help organisations manage their waste efficiently and safely through a comprehensive waste minimisation, recovery and disposal program thereby supporting the National effort for a cleaner and safer environment.





Wood products
(Pallets / Timber)



Baled scrap metal and
aluminium



Electrical &
electronic parts



Baled paper / Old corrugated
paper (OCC)

ECO Resource Recovery Centre Pte Ltd

Non-Hazardous Waste Management
40 Tuas West Road Singapore 638389

ECO-RRC provides comprehensive solutions for solid non-hazardous waste management. The modern facility offers the following:

- Purpose-built sorting centre with a capacity to segregate 1000 tons of solid non-hazardous waste per day
- Weighbridges certified by the Ministry of Trade and Industry
- Computerised waste management system to ensure accurate and timely service and report
- A transportation fleet licensed to collect, transport and dispose waste
- Destruction of goods/materials with proprietary information
- CIDB-registered for demolition and disposal of building materials
- Provision of metal open-top skips with capacity of 10, 13, 17 or 32 cubic metres
- Supply and delivery of custom built or ready-made wooden pallets
- Supply of recovered resources such as metal (copper, aluminum and irons), plastics (PE, PP and PVC), timber, paper, old corrugated cartons (OCC), recycled pallets, electrical and electronic components
- Purchase of aluminum, papers, old corrugated cartons (OCC) and plastic materials
- Supply of Mobile Garbage Bins (MGB) with capacities of 120/, 240/, 660/, 1000/



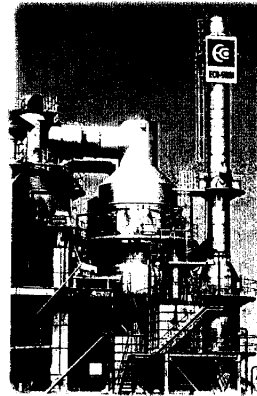
Purpose-built sorting
centre

ECO Special Waste Management Pte Ltd

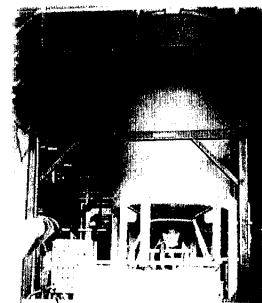
Hazardous Waste Management
23 Tuas View Circuit Singapore 637768

ECO-SWM provides total hazardous waste management solutions in full compliance with local and international regulations. The facility offers the following:

- Professional logistic team equipped with clean trucks and third party certified containers licensed to transport toxic liquid, semi-solid and solid waste
- Fluidized-bed incinerator for cradle-to-grave destruction of liquid semi-solid and solid waste such as oil sludge, waste oil, solvent, organic wastewater and solid hazardous waste
- Neutralization, stabilization or cementation of inorganic waste such as spent acid, alkalis, cyanide, catalyst, ash and heavy metal
- Recovery and supply of chemicals such as MEK, IPA, Acetone, Methylene Chloride and MiBK; spent acid, fixer, engineering plastic, metal, etc.
- Transformer oil analysis
- Removal and disposal of asbestos
- Removal/demolition/excavation, decontamination and disposal of contaminated soil, containers, equipment, factories, etc.
- Basel Permit to export wastes such as chlorobenzene, polychlorinated biphenyl, etc.
- SAC-SINGLAS Accredited Analytical laboratory services equipped with ICP, GC-MS, GC, UV-VIS, Calorimeter, etc.
- Guaranteed non-disclosure of Proprietary Information



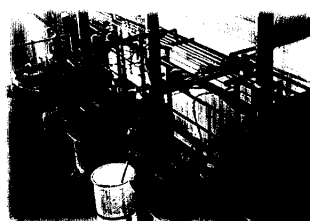
Fluidized-bed Incinerator



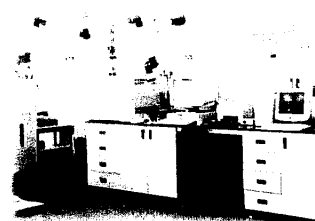
Acid Recovery



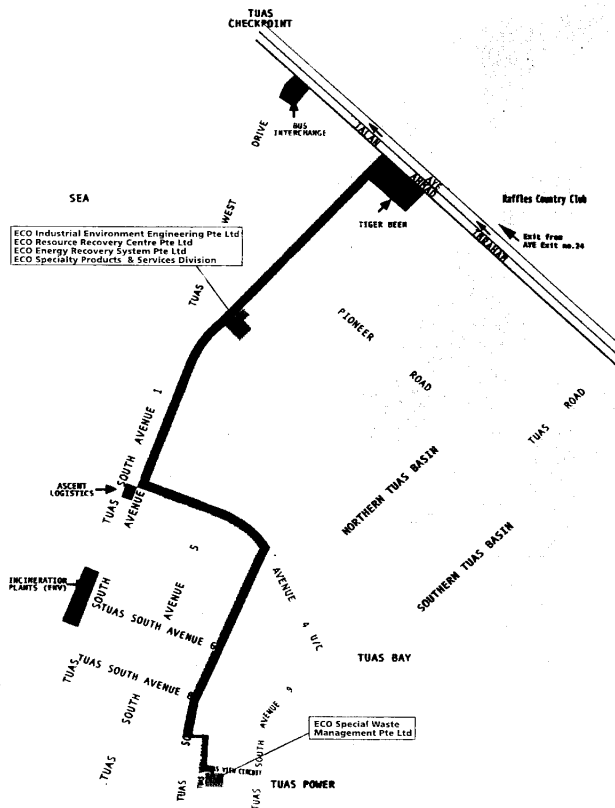
Solvent Recovery



Stainless Steel Reactor



State-of-the-art Analytical Laboratory



Our Location

As of November 2000.



Corporate Headquarters:

ECO Industrial Environmental Engineering Pte Ltd (ECO-IEE)

40 Tuas West Road Singapore 638389

Tel: 6865 1587 Fax: 6862 0133

Subsidiaries:

ECO Resource Recovery Centre Pte Ltd (ECO-RRC)

40 Tuas West Road Singapore 638389

Tel: 6861 5515 Fax: 6863 4466

ECO Special Waste Management Pte Ltd (ECO-SWM)

23 Tuas View Circuit Singapore 637768

Tel: 6863 3323 Fax: 6863 7813

ECO Energy Recovery System Pte Ltd (ECO-ERS)

40 Tuas West Road Singapore 638389

Tel: 6865 1587 Fax: 6862 0133

Division:

ECO Specialty Products & Services Division (ECO-SPS)

40 Tuas West Road Singapore 638389

Tel: 6865 1525 Fax: 6862 0133

Customer Service HOTLINE: 6863 3323; Fax: 6863 7813

E-mail: sales@eco.com.sg

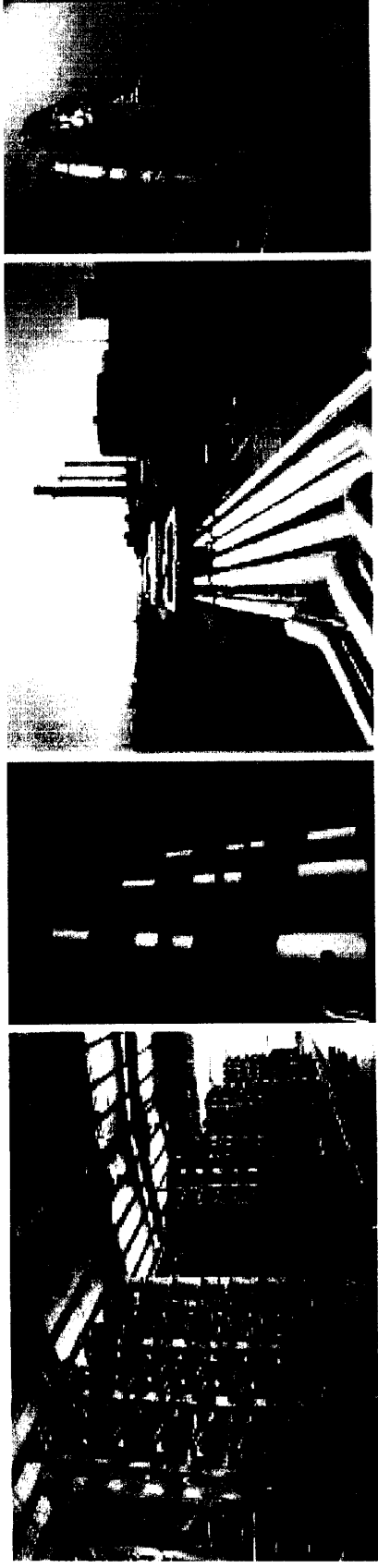
Website: http:// www.eco.com.sg

Presentation to

DR HAU LUNG-BIN

**ADMINISTRATOR,
ENVIRONMENTAL PROTECTION ADMINISTRATION**

23 August 2003



SembCorp Utilities

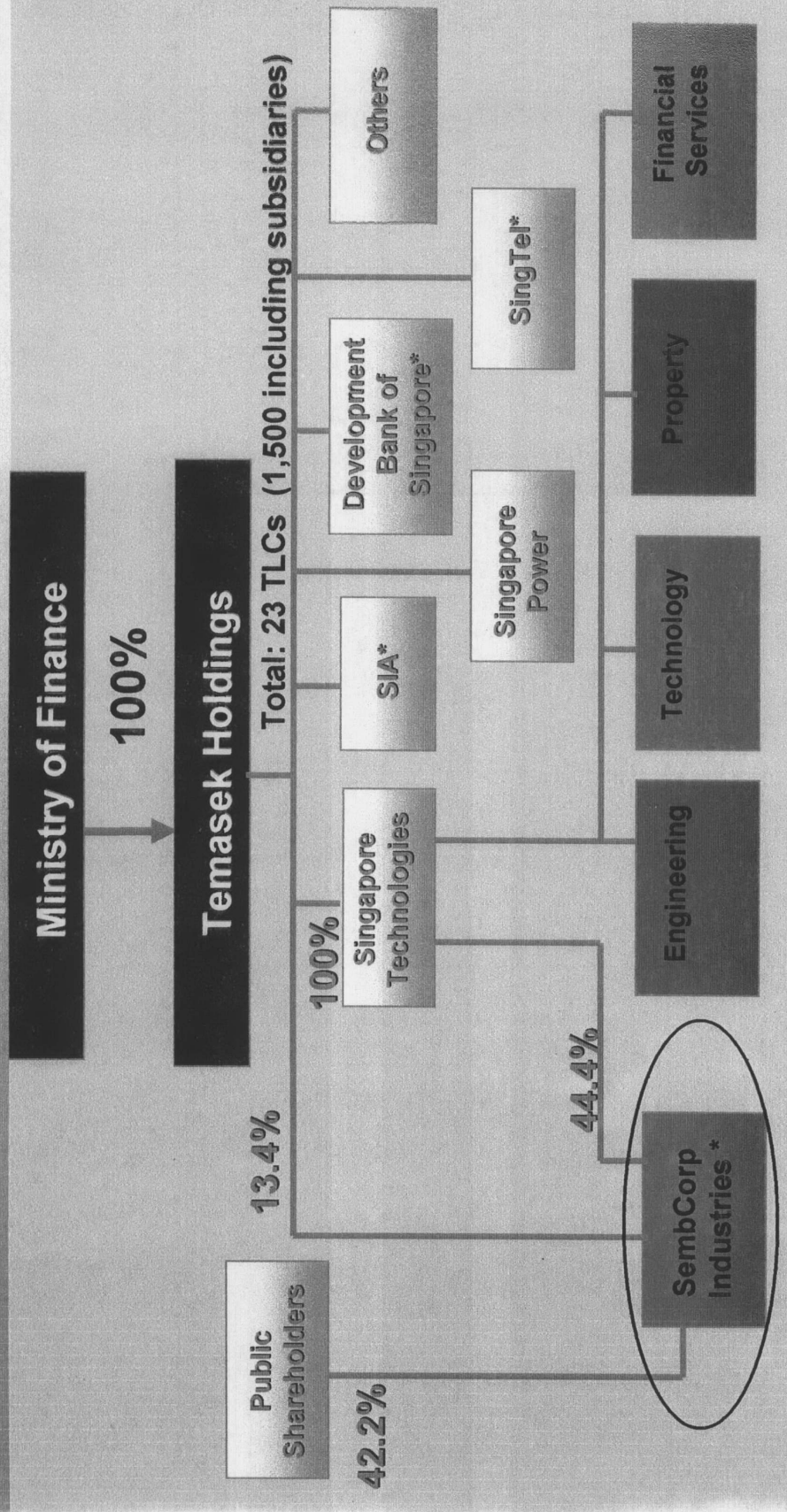
**An integrated approach to
Utilities business**



Scope of Presentation

- Overview of SembCorp Industries
- SembCorp Utilities Vision
- SembCorp Utilities Businesses
 - Integrated Utilities
 - Energy
- Financial Overview

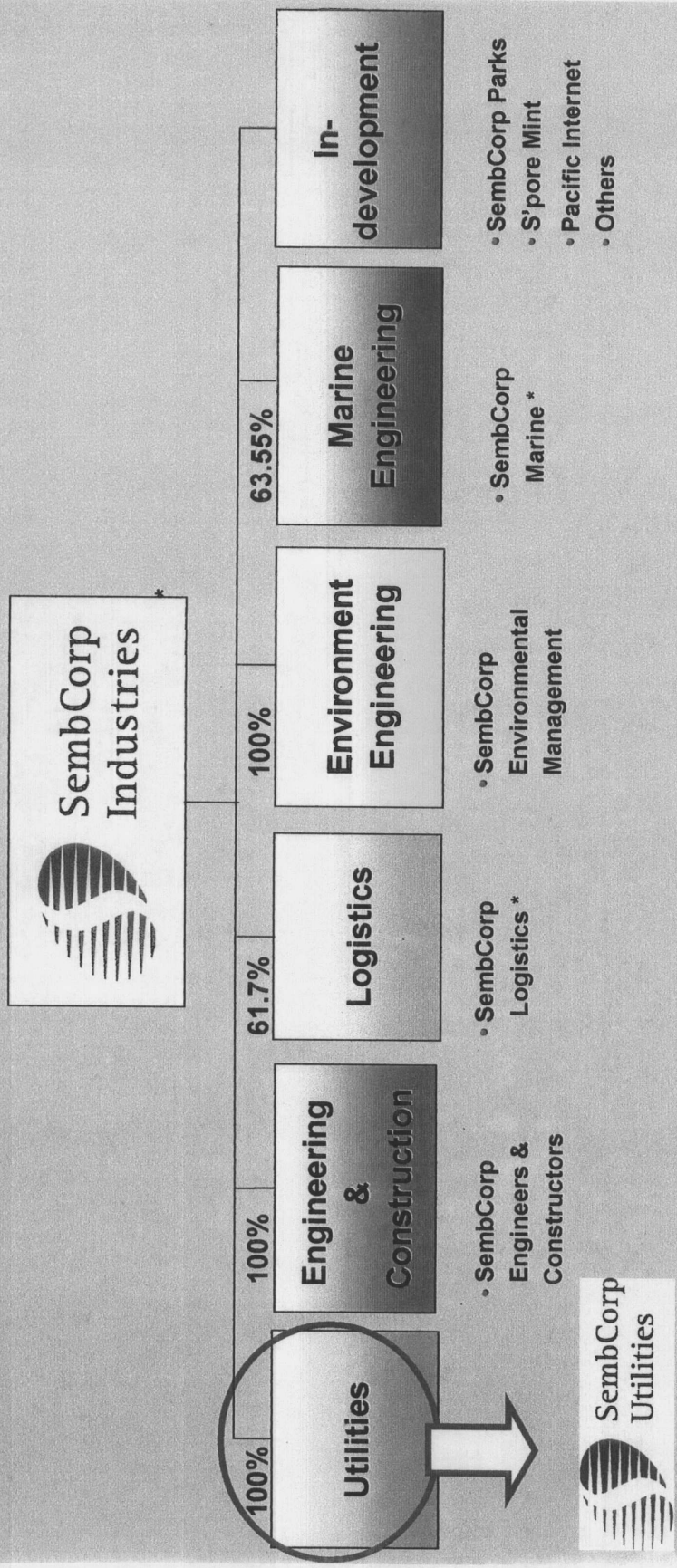
Temasek-Linked companies



* Listed on mainboard of Singapore Stock Exchange (SGX)



SembCorp Industries Organisation Structure



* Listed on Singapore Stock Exchange (SGX)



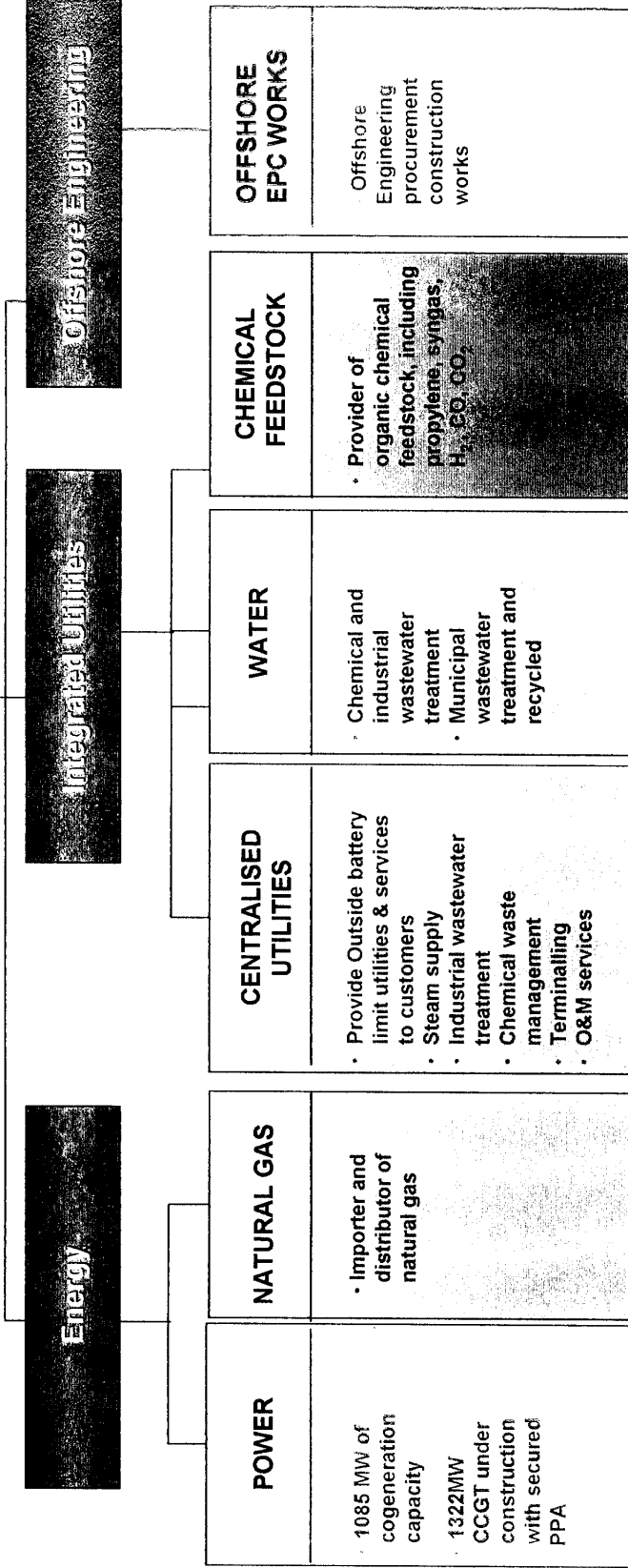
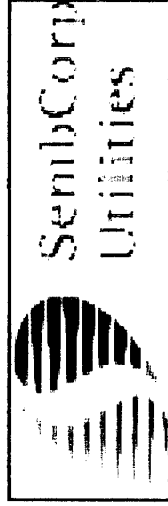
SembCorp Industries Key Statistics

	2002	2001	2000
Turnover (S\$ Bil)	4.2	3.25	2.9
PATMI (S\$ Mil)	178	174	117
No. of Employees	15,131	14,790	14,740

SembCorp Utilities Vision

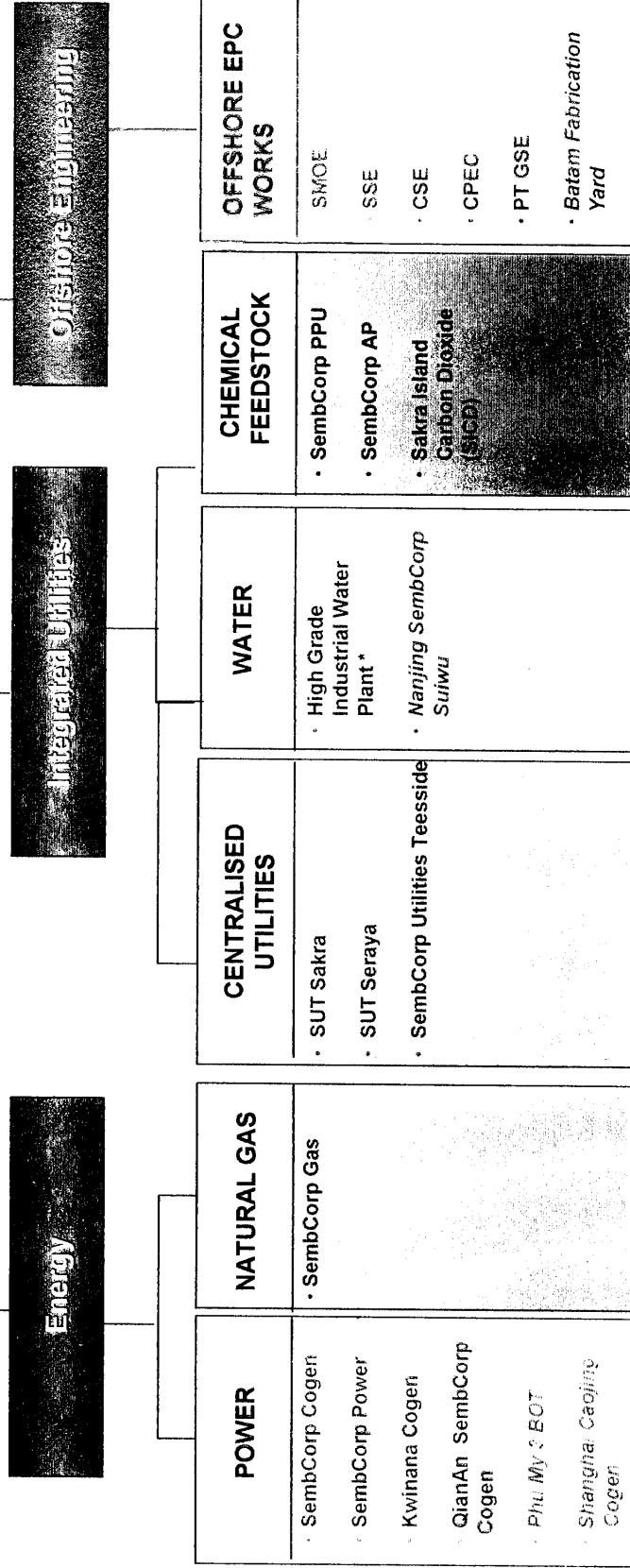
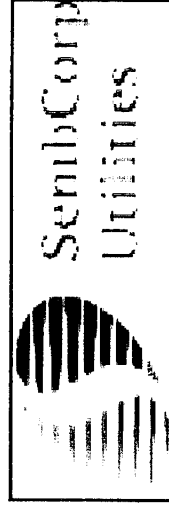
**To be a leading Power & Integrated
Utilities Group
by Year 2008**

Key Businesses



Wholly-owned subsidiary of SCI

Business Organisation



Note: In red are ongoing projects
 * The HGIW plant is a division of SUT Seraya

SembCorp Utilities Investments

<u>Local</u>	<u>Total Investment</u>	<u>SCU's Share</u>
<u>S\$M</u>	<u>S\$M</u>	<u>S\$M</u>
SUT Sakra	425	340
SUT Seraya	52	52
SembAP/PPU/SICD	112	78
SembCogen	600	420
SembPower	2	2
SembGas	140	70
TOTAL (Local)	1,331 M	962 M

<u>Overseas</u>		
Kwinana Cogen	181	55
Qianan SembCorp Cogen	34	22
SembCorp Utilities Teesside	296	296
Phu My 3	618	206
Nanjing SembCorp Suiwu	17	11
Kabil yard in Batam	10	10
Shanghai Caojing Cogen	725	218

TOTAL (Overseas)	1,881 M	818 M
TOTAL (Local + Overseas)	3,212 M	1,780 M

About 46% of SCU's investments are overseas!



INTEGRATED UTILITIES



Map of Singapore

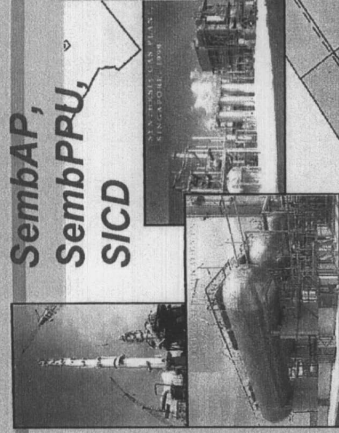


Jurong Island

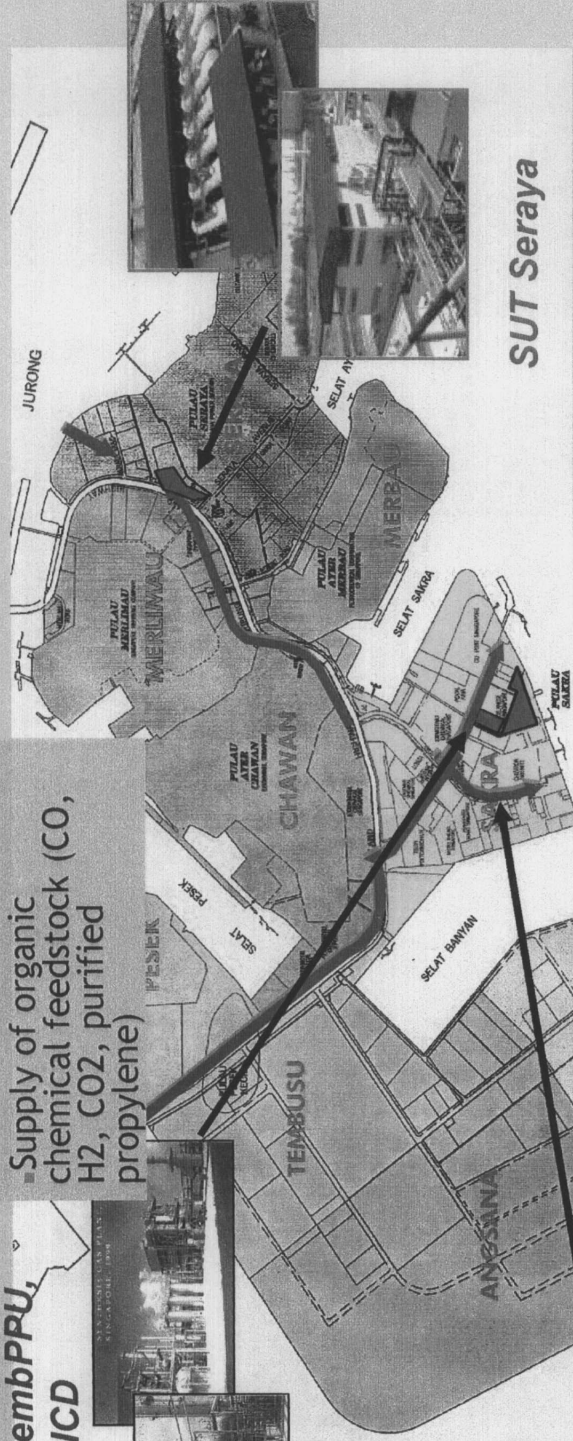


Integrated Utilities Business : Singapore

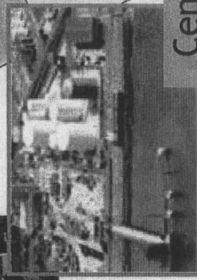
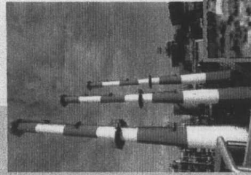
SembAP,
SembPPU,
SICD



- Supply of organic chemical feedstock (CO, H₂, CO₂, purified propylene)

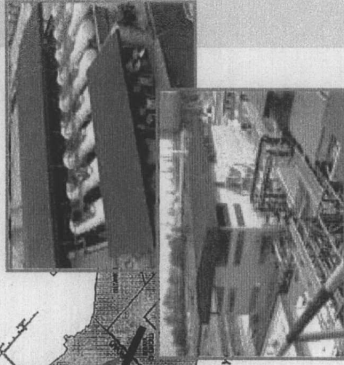


SUT SAKRA



Centralised utilities & services to chemical companies on Jurong Chemical Island

SUT Seraya



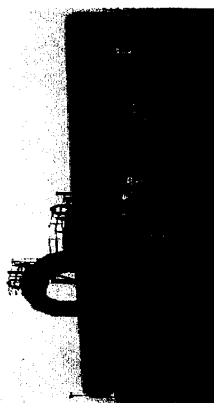
- High Grade Industrial Water
- Hazardous chemical wastes and solvents incineration for chemical and pharmaceutical companies



Centralised Utilities & Services



BOILERS



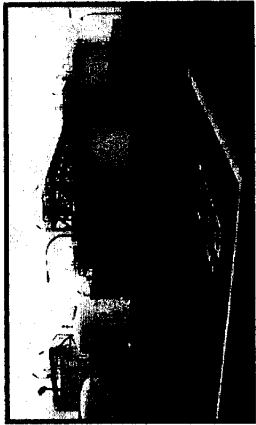
SEAWATER SUPPLY SYSTEM

Utilities Services

- ◆ Steam
- ◆ Seawater / Cooling Water
- ◆ Demineralised Water
- ◆ High Grade Industrial Water
- ◆ Refrigerated Water
- ◆ Fire Water
- ◆ Boiler Feedwater
- ◆ Condensate Return

Waste Management

- ◆ Waste Water Treatment
- ◆ Waste Incineration
- ◆ Waste Water Plant O&M Services



WASTEWATER TREATMENT

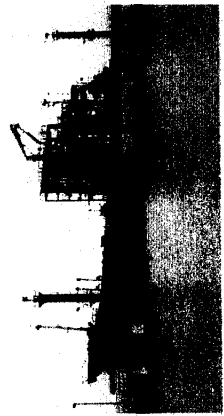


INCINERATION PLANT*



HIGH GRADE INDUSTRIAL WATER

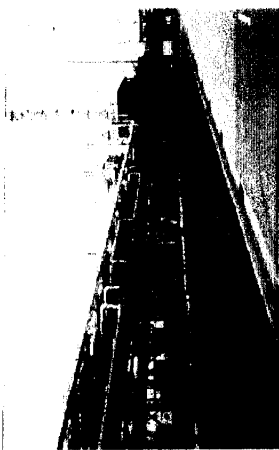
Centralised Utilities & Services



JETTY

Service Corridor

- ◆ Product Transport
- ◆ Rack Space Rental



SERVICE CORRIDOR



TANKFARM

Terrainalling / Logistics

- ◆ Liquid Berth (45,000DWT)
- ◆ Storage Facilities
- ◆ Drum Filling
- ◆ Isotainer Filling



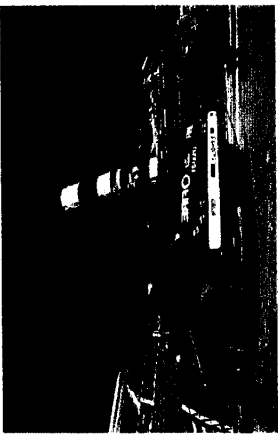
PIPE BRIDGE

Safety

- ◆ Industrial Fire Fighting



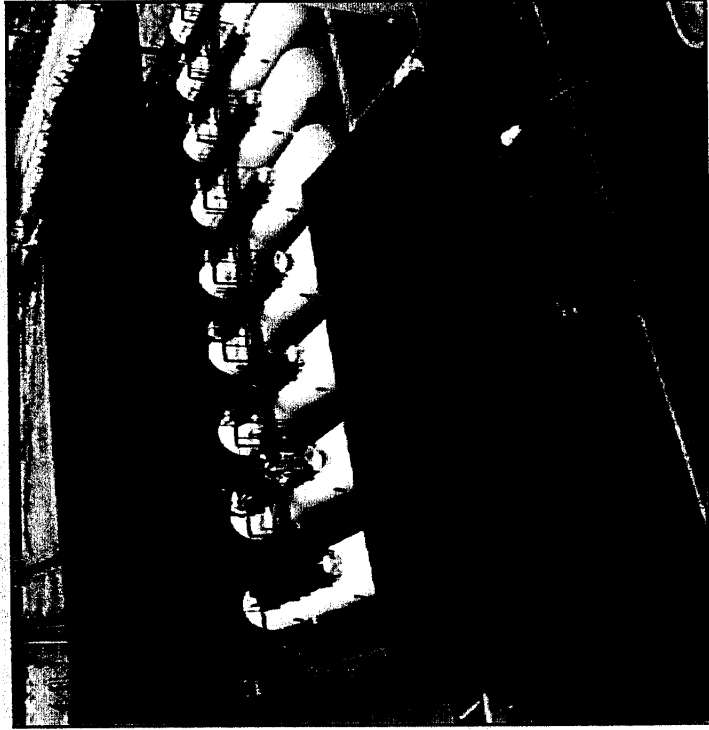
Utilities DRUMMING FACILITY



SAKRA EMERGENCY RESPONSE BRIGADE

INTEGRATED UTILITIES : WATER & WASTE MANAGEMENT

Water Recycling



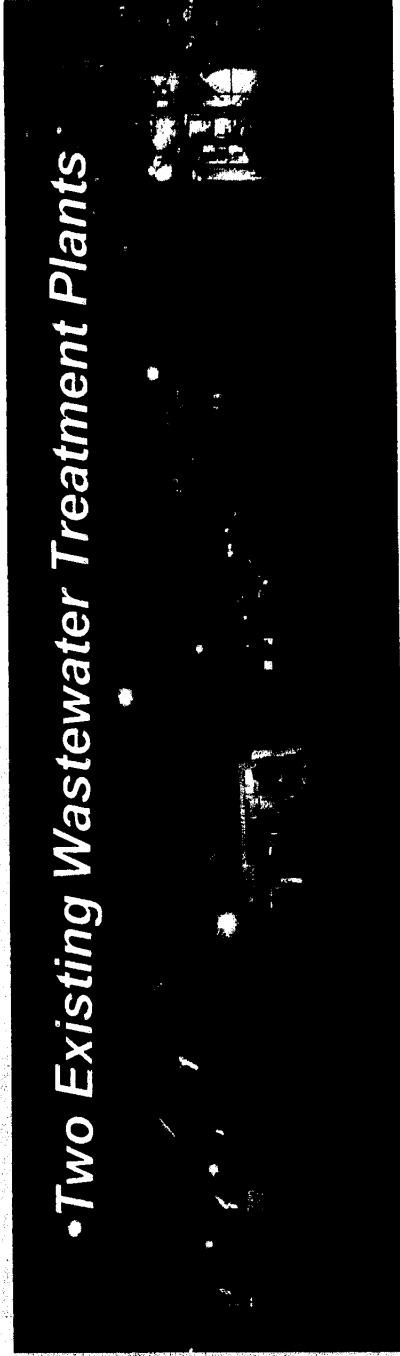
❖ High Grade Industrial Water (HGIW) Plant

- Capacity of 30,000 m³/d (replaces 7MGD of potable water)
- Conventional two-stage Dual Media Filter as pretreatment followed by Reverse Osmosis
- Commercially Operational since November 2000

❖ With this capability and experience, we are well-positioned to develop future projects in desalination and water recycling for Petrochemical, Chemical, Electronics and Pharmaceutical industries

SUT WWT Facilities

• Two Existing Wastewater Treatment Plants



IWWWT

Anaerobic Biogranular technology /
High-rate biofilm technology/ Activated
Sludge Process

Flow : 5,520 m³/d

COD : 3,765 ppm

TDS : 12,000 ppm

Chemicals mainly CN, Phenol, IPA, Hac,
Aldehydes, Esters etc.

EWWT

Anaerobic Biogranular technology/
Activated Sludge Process

Flow : 1,200 m³/d

COD : 10,416 ppm

TDS : 8,000 ppm

Chemicals mainly alcohols, org. salts &
quat. carbon cpds.

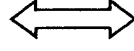
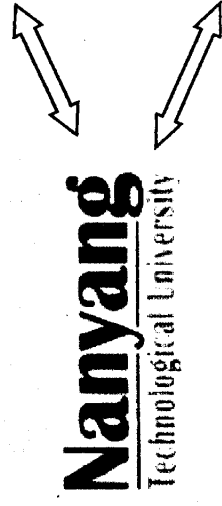
WWT Research & Development

International Collaboration in:

- Aerobic and Anaerobic Biogranulation Technologies
- Membrane Related Technologies
- Intelligent Process Control



SembCorp
Utilities



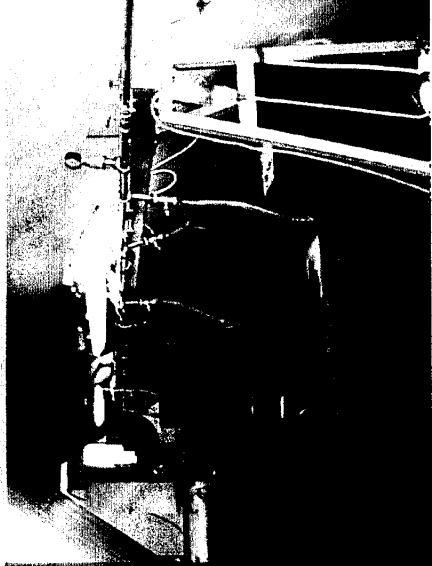
Stanford University



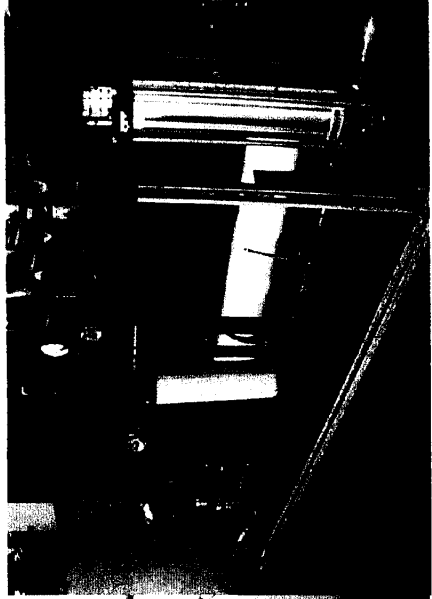
In-House WWT Pilot Studies



Process Optimisation
Study



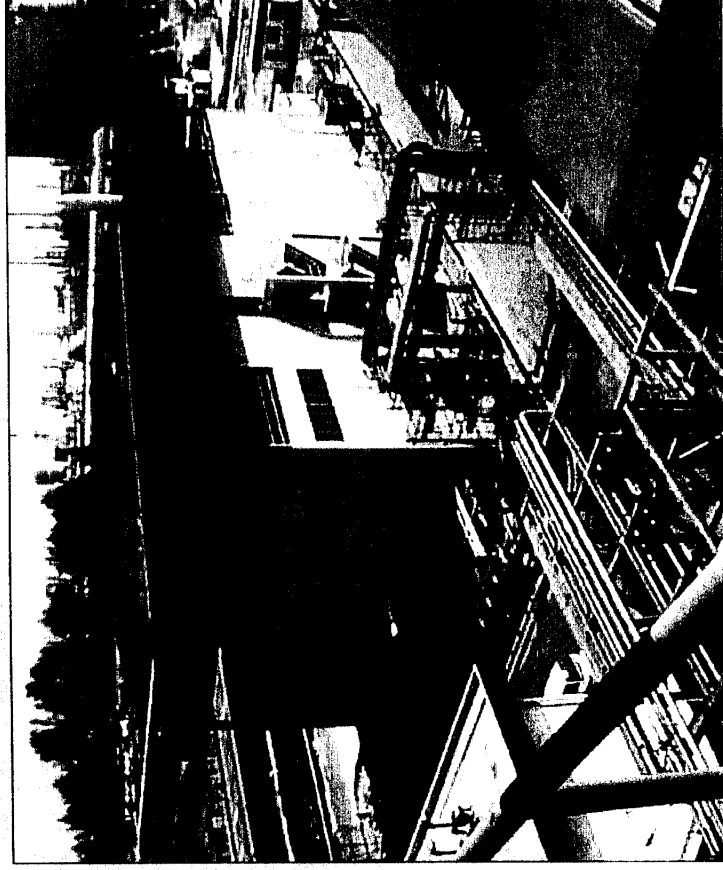
High Rate Carrier Study



Membrane Technology Study

Chemical Waste Incineration

Hazardous chemical waste Incineration plant in SUT Seraya, Jurong Island



- Capacity of 70 MT/day
- Fluidized Bed Technology from Seghers Better Technology
- Commercial Operational: February 2001
- Capable of incinerating solid, liquid, sludge wastes from Chemical, Petrochemical and Pharmaceutical Industries
- Meet ENV regulations on emission standards

Integrated Utilities Business :

Overseas

Nanjing SembCorp Suiwu (NCIP)
- China



- Total investment : S\$17 M
- Wastewater Treatment Plant
 - Phase 1 Capacity 12,500 m³/d
 - Commercial operation Q4 2004

SembCorp Utilities Teesside Ltd (SUTL)
- UK



- Total investment : S\$296 M
- Provision of essential utilities and services to customers (mainly petrochemical and chemical MNCs):
 - Electricity and Steam
 - Demin/potable/raw water
 - Service Corridors
 - Asset protection and asset management

Key Centralised Utilities Customers (Singapore)

Customer	Type of Plant	Utilities Supply Date
Celanese Singapore	Vinyl Acetate Monomer	Jul 1997
Air Products	Air Separation Plant	Jul 1997
Vopak	Tanks & Terminalling	Aug 1998
Chemical Industries	Caustic Soda	Nov 1998
Lonza Singapore	Purified Isophthalic Acid	Oct 1998
Semb Air Products	SynGas	Nov 1998
SembENG (PPU)	C3/C4 Purification	Nov 1998
Sumitomo Chemical	Arcylic Acid & Methyl Methacrylate	Nov 1998
Chevron	Lube Additives	Nov 1998
Eastman Chemicals	Oxo-Alcohol	Jan 1999
Teijin Chemicals	Polycarbonate	Apr 1999
Poval Asia	Polyvinyl Alcohol	Jan 1999
Mitsui Bisphenol	Bis-Phenol A	Apr 1999



SembCorp
Utilities

Key Centralised Utilities Customers (Singapore)

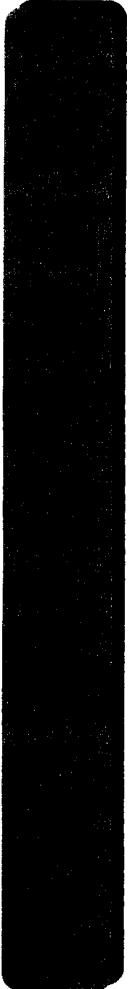
Customer	Type of Plant	Utilities Supply Date
Celanese Singapore	Acetic Acid & Acetate Esters	July 2000
Singapore Syngas	Synthesis Gas	Apr 2000
DuPont Singapore	Adipure / Zytel	End 2000
FACI SPA	Fatty Acid Derivatives	Apr 2000
Soxal	Industrial Gas	Apr 1999
ExxonMobil	Cracker	Mar 2000
Mitsui Phenol	Phenol	Jul 2001
SembCorp Cogen	Electricity & Steam	Apr 2001
SembCorp Gas	Natural Gas	Apr 2001
Stella Chemifa	Hydrogen Fluoride	May 2002
Asahi Kasei	PPE	Jun 2002
COIM	Polyurethane	Aug 2002
CPTC (Process & Tech Centre)	Kerosene Cracker	Oct 2002



SembCorp
Utilities

Key Customers (Teesside)

Customer	Type of Plant	Customer	Type of Plant
Huntsman	Olefins	Huntsman	Polyurethanes
DuPont	Adipic Acid Nylon Intermediates	DuPont SA	PET, PTA
TPL	Power Generation	Dow Chemicals	EO, Glycol
Uniqema (ICI)	Speciality Chemicals	BOC	Industrial Gases
Lucite Int'l	Acrylics	Petroplus	Refinery
Terra	Fertilizers	Air Products	Amines

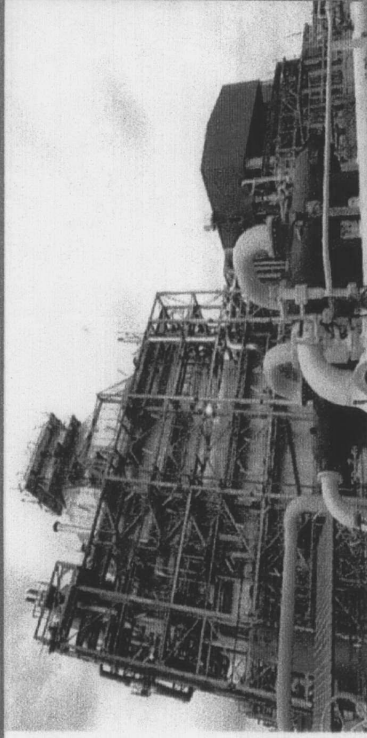


ENERGY

Energy : Local Power Business

SembCogen

- Total investment: S\$600 M
- Gas-fired combined cycle cogen plant
- Optimal Conditions
 - 650 MW power
 - 550 ton/hr of steam
- Power Generation & Sales
- Process Steam Production & Sale



SembPower

- Established power retail company with 80 industrial & commercial power supply accounts

Most efficient GenCo in Singapore!



SembCorp
Utilities

Energy : Overseas Power Business

Kwinana Cogen Plant
(Western Australia)



Total investment: S\$181 M
Gas-fired CCGT
Optimum Capacity
- 116 MW
- 117 MT/hr Steam

Qian'an SembCorp Cogen
(Hebei, PRC)

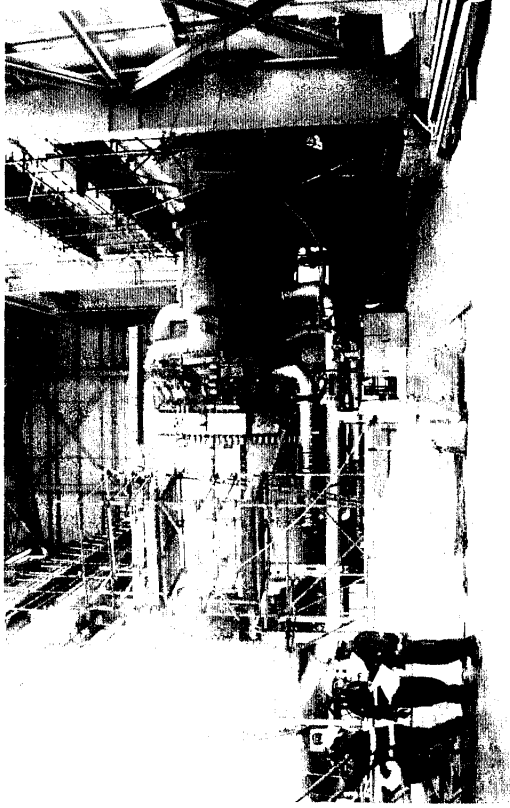


Total investment: \$34 M
Coal-fired Cogen Plant
Optimum Capacity
- 21 MW
- 118 MT/hr Steam

Energy : Overseas Power Business

Phu My 3 CCGT Plant
(Ho Chi Minh City, Vietnam)

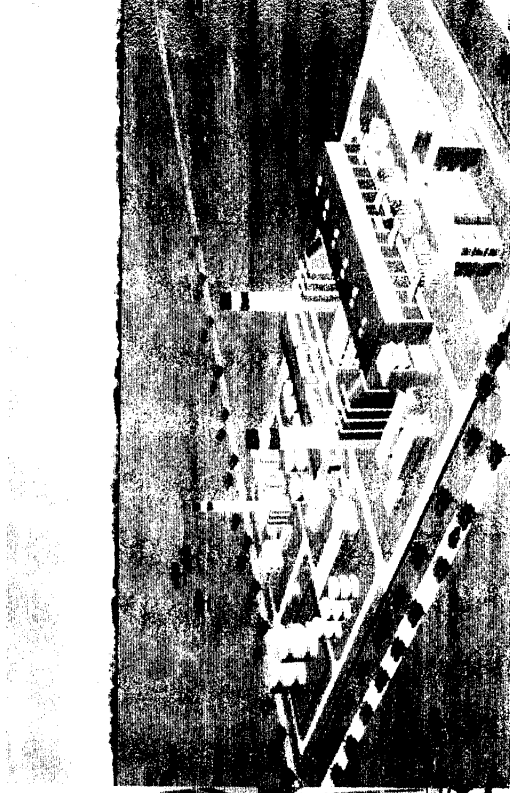
Under Construction (Est. COD: 31 Jan 2004)



Total investment: \$618 M
Gas-fired CCGT Plant
Optimum Capacity
- 717 MW

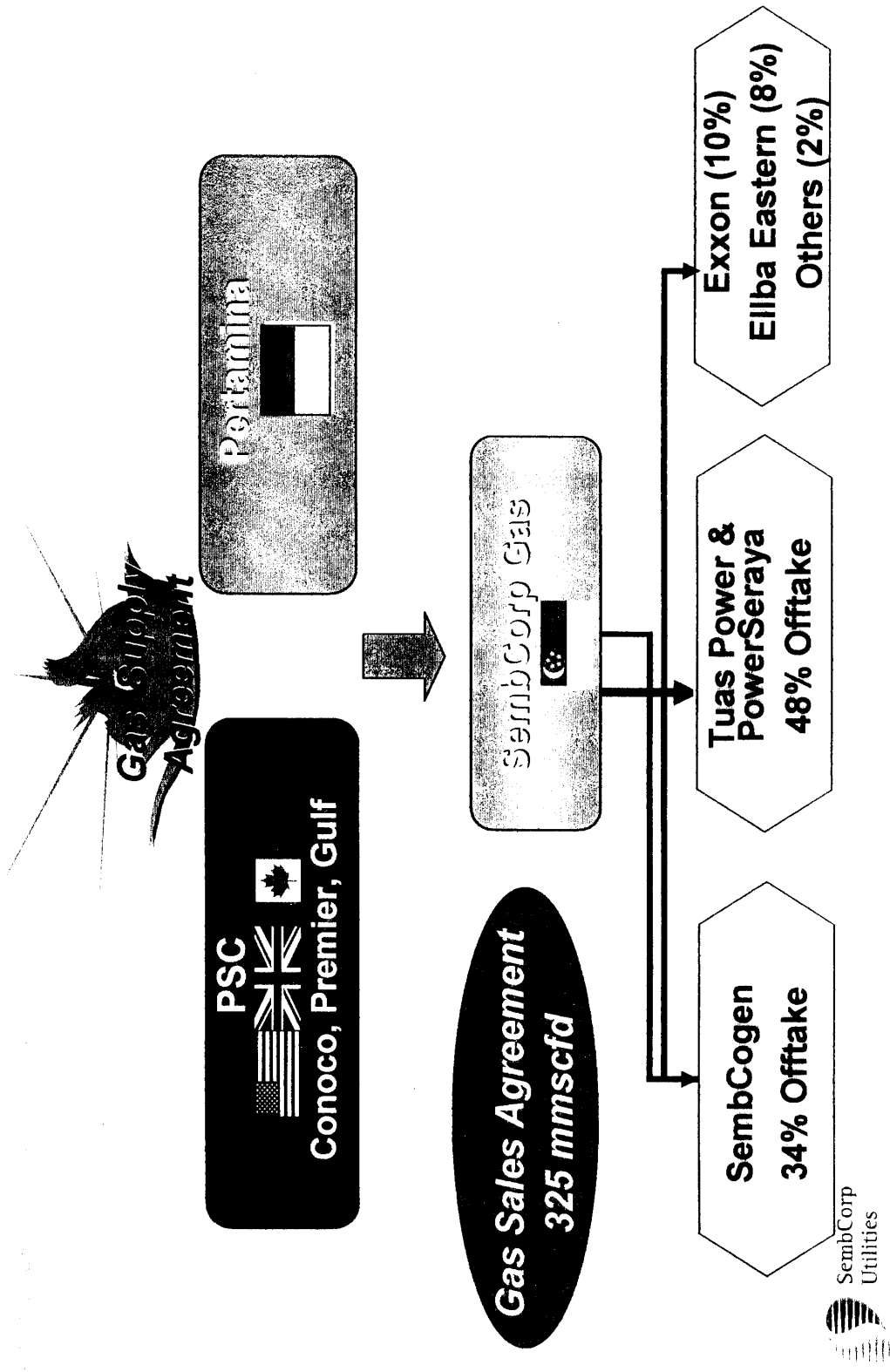
Shanghai Caojing Cogen Plant
(Shanghai, China)

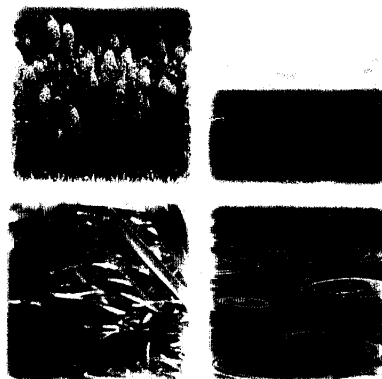
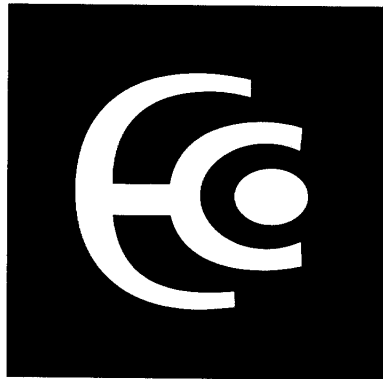
Under Construction (Est. COD: 4Q 2005)



Total investment: \$725 M
Gas-fired CCGT Plant
Optimum Capacity
- 605 MW
- 660 MT/hr Steam

Energy : Gas Business Offtake Structure





Our Mission

To help organisations manage their waste efficiently and safely through a comprehensive waste minimisation, recovery and disposal program thereby supporting the National effort for a cleaner and safer environment.





Wood products
(Pallets / Timber)



Baled scrap metal and
aluminium



Electrical &
electronic parts



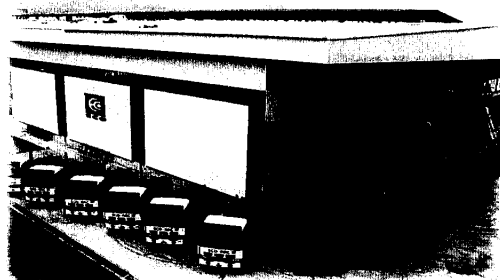
Baled paper / Old corrugated
paper (OCC)

ECO Resource Recovery Centre Pte Ltd

Non-Hazardous Waste Management
40 Tuas West Road Singapore 638389

ECO-RRC provides comprehensive solutions for solid non-hazardous waste management. The modern facility offers the following:

- Purpose-built sorting centre with a capacity to segregate 1000 tons of solid non-hazardous waste per day
- Weighbridges certified by the Ministry of Trade and Industry
- Computerised waste management system to ensure accurate and timely service and report
- A transportation fleet licensed to collect, transport and dispose waste
- Destruction of goods/materials with proprietary information
- CIDB-registered for demolition and disposal of building materials
- Provision of metal open-top skips with capacity of 10, 13, 17 or 32 cubic metres
- Supply and delivery of custom built or ready-made wooden pallets
- Supply of recovered resources such as metal (copper, aluminum and irons), plastics (PE, PP and PVC), timber, paper, old corrugated cartons (OCC), recycled pallets, electrical and electronic components
- Purchase of aluminum, papers, old corrugated cartons (OCC) and plastic materials
- Supply of Mobile Garbage Bins (MGB) with capacities of 120/, 240/, 660/, 1000/



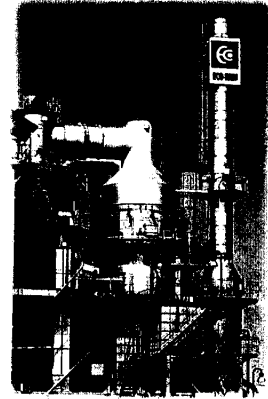
Purpose-built sorting
centre

ECO Special Waste Management Pte Ltd

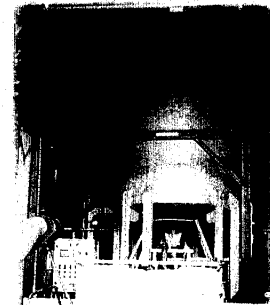
Hazardous Waste Management
23 Tuas View Circuit Singapore 637768

ECO-SWM provides total hazardous waste management solutions in full compliance with local and international regulations. The facility offers the following:

- Professional logistic team equipped with clean trucks and third party certified containers licensed to transport toxic liquid, semi-solid and solid waste
- Fluidized-bed incinerator for cradle-to-grave destruction of liquid semi-solid and solid waste such as oil sludge, waste oil, solvent, organic wastewater and solid hazardous waste
- Neutralization, stabilization or cementation of inorganic waste such as spent acid, alkalis, cyanide, catalyst, ash and heavy metal
- Recovery and supply of chemicals such as MEK, IPA, Acetone, Methylene Chloride and MiBK; spent acid, fixer, engineering plastic, metal, etc.
- Transformer oil analysis
- Removal and disposal of asbestos
- Removal/demolition/excavation, decontamination and disposal of contaminated soil, containers, equipment, factories, etc.
- Basel Permit to export wastes such as chlorobenzene, polychlorinated biphenyl, etc.
- SAC-SINGLAS Accredited Analytical laboratory services equipped with ICP, GC-MS, GC, UV-VIS, Calorimeter, etc.
- Guaranteed non-disclosure of Proprietary Information



Fluidized-bed Incinerator



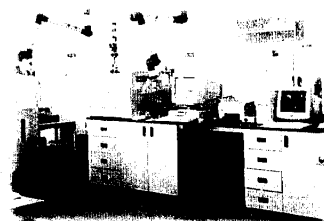
Acid Recovery



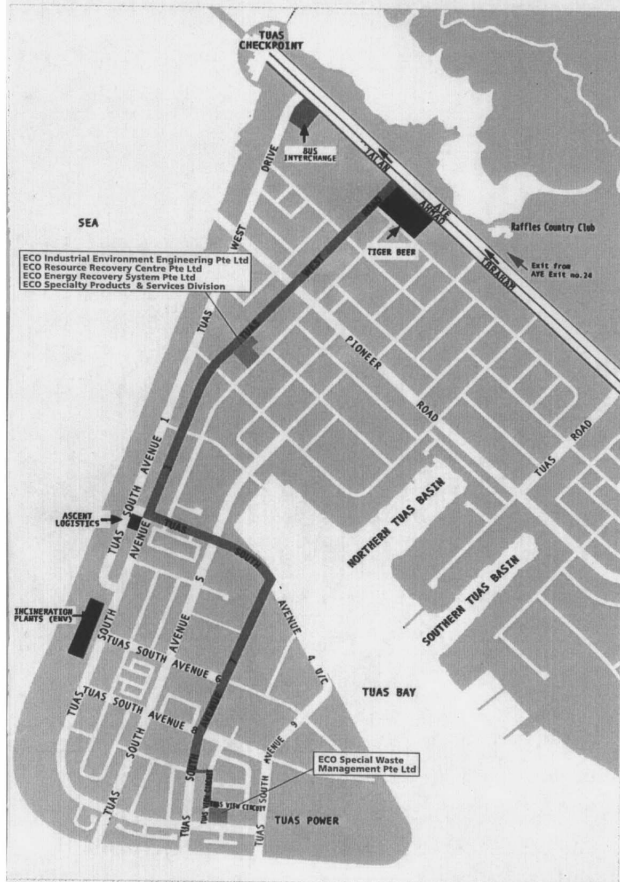
Solvent Recovery



Stainless Steel Reactor



State-of-the-art Analytical Laboratory



Our Location

As of November 2000.



Corporate Headquarters:

ECO Industrial Environmental Engineering Pte Ltd (ECO-IEE)

40 Tuas West Road Singapore 638389

Tel: 6865 1587 Fax: 6862 0133

Subsidiaries:

ECO Resource Recovery Centre Pte Ltd (ECO-RRC)

40 Tuas West Road Singapore 638389

Tel: 6861 5515 Fax: 6863 4466

ECO Special Waste Management Pte Ltd (ECO-SWM)

23 Tuas View Circuit Singapore 637768

Tel: 6863 3323 Fax: 6863 7813

ECO Energy Recovery System Pte Ltd (ECO-ERS)

40 Tuas West Road Singapore 638389

Tel: 6865 1587 Fax: 6862 0133

Division:

ECO Specialty Products & Services Division (ECO-SPS)

40 Tuas West Road Singapore 638389

Tel: 6865 1525 Fax: 6862 0133

Customer Service HOTLINE: 6863 3323; Fax: 6863 7813

E-mail: sales@eco.com.sg

Website: [http:// www.eco.com.sg](http://www.eco.com.sg)