

出國報告（出國類別：出席國際會議）

參加「2011 礦業永續發展第 5 屆國際研
討會」報告

服務機關：經濟部礦業司

職 稱：副司長

姓 名：陳逸偵

派赴國家：德國

出國期間：100 年 6 月 12 日至 6 月 19 日

報告日期：100 年 7 月 30 日

摘要

聯合國永續發展委員會歷年決議礦物資源永續發展為全世界人類永續發展重要課題之一，各國亦依據推動礦業之永續發展。本年「2011 礦業永續發展第 5 屆國際研討會」於本年(100)年 6 月 14 日起至 17 日止在德國亞琛市 RWTH 大學舉行。計有 39 國 300 人參加，我國派經濟部礦業司陳副司長逸偵出席。該研討會分 9 個議題進行，會後並參觀 RWE 電力公司 Inden 露天褐煤採礦場之採絕跡地整復與利用。受到金融海嘯之影響，歐盟已在探討對那些礦物資源建立戰略儲存制度。另聯合國永續發展委員會聯合國 2010-2011 年第 18、19 屆年會主題所涵蓋為運輸、化學品、廢棄物管理、礦業和永續消費和生產模式十年方案框架這五個議題；雖然有關礦業部門的文字無異議通過，但因該委員會本年年 5 月第 19 屆年會閉幕時並未就該年主題整體文字達成最後決議，因此礦業部門的文字並未被接受。出席參加該會議有助了解世界各國永續發展發展最新情形供我國未來方向之參考，並與各國代表建立連繫管道有助爾後相關資訊之取得。

參加「2011 礦業永續發展第 5 屆國際研討會」報告

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參加「2011 礦業永續發展第 5 屆國際研討會」報告

壹、目的：

聯合國永續發展委員會歷年決議礦物資源永續發展為全世界人類永續發展重要課題之一，各國亦依據推動礦業之永續發展。「2011 礦業永續發展第 5 屆國際研討會」於本年（100）年 6 月 14 日起至 17 日止在德國亞琛市 RWTH 大學舉行。我國係由本部則負責礦業永續發展之執行與督導，出席參加該會議有助了解世界各國礦業永續發展發展情形及我國未來礦業永續發展方向之參考。

貳、我國出席人員： 經濟部礦業司陳副司長逸偵。

參、行程及工作內容

100.06.12-13 啓程
100.06.13-14 註冊及開幕式
100.06.15-16 開會
100.06.17 會後礦場參觀及移動
100.06.18-19 返程

肆、研討會名稱： “「2011 礦業永續發展第 5 屆國際研討會」”。

時間： 100 年 6 月 14 日起至 17 日止。

地點： 德國亞琛市 RWTH 大學。

主持人： RWTH 大學 採礦工程研究所所長
Nicola Martens 教授

伍、與會代表：

本次會議出席國家計有我國、日本、蒙古、印度、印尼、尼泊爾、土耳其、孟加拉、伊朗、澳洲、美國、加拿大、巴西、智利、英國、法國、德國、奧地利、波蘭、芬蘭、荷蘭、愛沙尼亞、克羅愛西亞、斯洛凡尼亞、葡萄牙、西班牙、意大利、比利時、瑞士、瑞典、挪威、匈牙利、希臘、塞浦路斯、阿爾及利亞、摩洛哥、科麥隆、烏干達、奈及利亞等 39 國 300 人參加。

（會議出席人員名單如附件 1）。

陸、研討會議程：（議程如附件 2）

2011 年 7 月 14 日（星期二）

17:00 註冊

19:00 歡迎接待會

2011年7月15日(星期三)

08:15 開幕-主席致詞

08:20 邀請貴賓專題報告

10:30 茶敘時間

A 組

B 組

C 組

D 組

11:00 礦物資源政治與治理 (I)。永續採礦實踐 (I)。 永續供應鏈 (I)。 社會永續 (I)

12:30 午餐

14:00 萊茵地區永續性褐煤。 永續採礦實踐 (II)。礦物資源政治與治理 (II)。關鍵初級資源與採礦與利用 自然資源之管理 (I)

15:30 茶敘時間

16:00 礦物資源政治與治理 (III) 永續採礦實踐 (III) 年輕研究者之永續性 永續報告-LCA, SDI-I 及社會永續

17:45 永續性互動與創新

19:00 本日研討會結束

2011年6月16日(星期四)

08:30 邀請貴賓專題報告

10:30 茶敘時間

A 組

B 組

C 組

D 組

11:00 永續報告-LCA, SDI-I。 永續採礦實踐 (IV)。礦物資源政治與治理 (IV) 永續採礦實踐 (V) 及社會永續 (II)

12:30 午餐

14:00 社會永續 (II)。 永續採礦實踐 (VI)。 永續供應鏈 (II)

15:30 茶敘時間

16:00 關鍵初級資源與自 然資源之管理 (II) 。德國的國際採礦與礦物資源 (III)。永續報告-LCA, SDI-I 及社會永續 (III)

17:45 研討會總結

18:15 本日研討會結束

2010年6月17日(星期五)

09:00 永續發展實例-參觀德國 RWE 電力公司 Inden 煤礦露天採礦場整復

14:00 參觀結束

柒、討論主題

本年研討會有 10 個專題報告、9 個主題 88 篇論文分口頭發表及 8 篇論文海報發表，分述如下：

一、 專題報告部分

由 10 位受邀請貴賓分別報告。包括德國 D. Mager 報告德國未來永續性礦物原料供應、瑞典 M. Ericsson 報告中國是友或敵 - 新採礦矛盾之一角、瑞士 M. Wittig 報告關鍵資源之管理-一個高科技成功之因素、德國 J. Geisler 報告供應之確保、永續性及資源效率、歐盟 Paul Anciaux 報告歐盟原料策略。

歐洲礦業公會 Corna Hebestreit 報告永續性原料使用當作永續性原料供應之前提、瑞典 Kent Tano 報告 LKAB 在永續生產框架下創新策略、德國 F. Wodopia 報告德國煤炭永續性使用之一般條件、美國 D.J. Shields 報告聯合國永續發展委員會第 19 屆年會中對礦業之磋商與決定、及德國 F.-W. Wellmer 報告非再生礦物原料永續使用之一條路是否可能。

二、主題部分

(一) 議題 1：礦物資源政治與治理 (MINERAL RESOURCES POLICIES AND GOVERNANCE)

由 16 位報告人分別發表論文。包括德國輸出入銀行報告利用礦業之融資計畫促進永續性礦業、德國 LBGR 報告 Brandenburg 州在永續性、環境相容性及民眾接受度下之礦業計畫程序、缺乏礦業政策對礦業典範所產生的影響。印尼的礦業政策與治理等。

(二) 議題 2：永續採礦實踐 (PRACTICING SUSTAINABILITY)

由 24 位報告人分別發表論文。包括德國報告 Sandvik 公司坑內採礦機械安全第一的進展；鉀鹽及岩鹽礦之永續性及資源效率；未來深礦智慧型及永續性之創新科技與觀念；越南煤礦經由不同廢石堆置概念達成永續性的報告；愛沙尼亞報告油頁岩廢石廢棄物管理；匈牙利報告礦物廢料利用之可能性；日本報告煤礦非酸性及可能成酸性廢石堆置之多層覆蓋以控制酸性排水；澳洲報告確保全世界夠格之礦業專業人員永續供應策略；Atlas Copco 公司永續性採礦作業之產品；英國報告岩栓在全世界煤礦應用情形；美國報告大型露天煤礦開採之永續性最佳設計；石礦業產品品質控制新方法之發展；Bibishahrbanoo 石灰石礦永續性礦山整復效果；永續性生物治療及產業生態模式；永續發展框架下坑內煤炭現地氣化貢獻之評估；褐煤灰作為泥漿及填充料之利用；P 波速度用於評估塊狀切割機噪音之評估；工程方法對採礦系統永續發展之貢獻；日本報告煤礦平巷坑內水之穩定效果；澳洲報告開發一套將永續性原則納入選礦場設計與操作的實用機制；德國 RWTH 大學報告選礦-未來的挑戰-水、能源、質量；鋁礬土紅泥再利用之新提議。

(三) 議題 3：永續供應鏈 (SUSTAINABLE SUPPLY CHAINS)

由 8 位報告人分別發表論文。包括德國分別報告礦業的公共建設；德國鈾為核燃料-稀有資源還是可充分取得?；許可貿易鏈礦物許可體系-盧安達及中非洲大湖區良善治理對礦物供應鏈的貢獻；物質與服務就地採購的社會衝擊；鐵礦的市

場拓展；波蘭報告礦物管理中礦物二次及廢棄原料的重要性-波蘭案例；澳洲報告永續性採礦具有什麼意義支柱。

(四) 議題 4：社會永續 (SOCIAL SUSTAINABILITY)

由 8 位報告人分別發表論文。包括澳洲分別報告將設計納入社會執照；澳洲轉型中區域的成長痛-資源詛咒或是缺乏整體性計畫；社會執照如何運作；為未來永續性處理土地觀光、農業與礦業使用之衝突；礦業界之公司的社會責任-歐洲與俄羅斯案例；德國分別報告永續性倡議中的一根支柱-文化；人權能否對社會永續有所貢獻；有責任地尋找煤源。

(五) 議題 5：永續報告-LCA, SDI-I 之進度 (SUSTAINABILITY REPORTING, ADVANCES IN LCA & SDI - I)

由 8 位報告人分別發表論文。包括德國分別報告為礦業建構證據原理中之語言變數；開發一種為評鑑礦業設施之環境永續性的工具；越南礦業的永續發展-職業安全與衛生之挑戰；克服與礦業相關之生產需求與當地衝突；運用地球觀察法提供礦物開採環境與社會面向之訊息需要；Freiberg 資源技術研究所對德國永續的原材料界供應的貢獻；美國報告運用永續性礦物永續性指標於地熱能源計畫；比利時報告利用生命週期評估作業作為礦物材料界永續性選擇之決策工具--比利時產品及其相當外國產品之環境宣言。伊朗分別報告 Taft 銅礦計畫之環境影響評估框架；使用以 GIS 為基礎之多層次決策用於伊朗一個銅礦的環境永續性評估。印度報告印度煤礦策略之願景。

(六) 議題 6：關鍵初級資源與自然資源之管理 (CRITICAL PRIMARY RESOURCES AND NATURAL RESOURCES MANAGEMENT IN EUROPE AND WORLDWIDE)

由 8 位報告人分別發表論文。包括德國分別報告全球礦業之能源成本與礦石品位之趨勢；運用獲利指標作多層礦床之評價；原物料生產引起之礦物資本存量的能源減少；關鍵原物料與歐盟；波蘭報告歐盟會員國的關鍵礦物-波蘭案例；斯洛凡尼亞報告強化東南歐永續的骨材資源管理與供應之 SARMa 計畫；瑞典報告 RMI 成果及歐盟關鍵金屬報告。

(七) 議題 7：萊茵地區永續性褐煤採礦與利用 (SUSTAINABLE LIGNITE MINING AND UTILIZATION IN THE RHINELAND)

由 4 位報告人分別發表論文。包括德國 RWE 能源股份有限公司分別報告擁有 Hambach、Inden、Garzweiler-2 三煤礦。係整合當地 15 家煤礦公司而成，為全世界最大褐煤礦。噪音、粉塵、地下水、採掘跡地整復及社區安置為該礦最重要議題。除

政府之外尚有民間監督團體關注採礦活動所產生之噪音、粉塵壓制措施。自 1950 年代起迄今已有 50,000 人被遷往 10-20 公里外新社區安置。為配合 Inden 煤礦採礦需要，Inde 河橫越其南北 4 公里長河道在 2005 年予以改道為長達 12 公里人工河道、並成功營造自然濕地復育與發展。

(八) 議題 8：年輕研究者之永續性 (YOUNG RESEARCHERS ON SUSTAINABILITY)

由 4 位報告人分別發表論文。包括加拿大分別發表受雇者能力構建在減少秘魯礦業公司與社區衝突之角色；加拿大英屬哥倫比亞礦業社區之健康研究。美國報告美國西維吉尼亞露天開採煤礦之採絕跡地作為風力發電之替代方案。澳洲報告將永續性原則整合至選礦作業決策過程的一個實用及活潑的手段。

(九) 議題 9：德國的國際採礦與礦物資源 (GERMAN FEDERATION OF INTERNATIONAL MINING AND MINERAL RESOURCES)

由 4 位報告人分別發表論文。包括德國 RWE 能源公司以其在褐煤開採百餘年，具有對噪音、粉塵、地下水、採掘跡地整復及社區安置之相當好的經驗，成立 RWE 國際能源公司，成為亞洲能源公司在越南 Phulbari 煤礦計畫之顧問公司，處理其最敏感地區地下水位的問題。

捌、礦業永續發展國際研討會緣起

礦業永續發展國際研討會係由德國亞琛市 RWTH 大學、希臘 Crete 大學、美國維吉尼亞科技大學聯合發起。第 1 屆礦業永續發展國際研討會於希臘，米洛斯島舉行，每 2 年易地舉辦 1 次迄今為第 5 屆。歷屆舉辦時間與地點如表 1

表 1 歷屆礦業永續發展國際研討會一欄表

屆別	時間	地點	
第 1 屆	2003 5.22-5.23	希臘，米洛斯島	
第 2 屆	2005 5.18-5.20	德國亞琛市	
第 3 屆	2007 6.17-6.20	希臘，米洛斯島	
第 4 屆	2009 7.6-7.8	澳大利亞黃金海岸	
第 5 屆	2011 6.14-6.17	德國亞琛市	
第 6 屆	2013	希臘，米洛斯島	

玖、議題中與我國相關重要項目

一、聯合國礦業永續發展委員會對礦業之檢討

聯合國永續發展委員會第19屆年會於今(100)年5月 2-15日在美國紐約聯合國總部舉開。本年度(2010-2011)檢討的部門為各專題組所涵蓋的運輸、化學品、廢棄物管理、礦業和永續消費和生產模式十年方案框架這五個議題逐一提交專題報告,由於協商沒有獲得結論,也沒有任何書面文字被通過。除了永續發展委員會53個會員國家有投票權之外,任一聯合國會員國均可出席及參與投票,另個別及集團代表如G77+中國、歐盟等亦有投票權。官方觀察員計有9個包括勞工、農夫、婦女、兒童及青年等5個非政府組織及地方機構;科技界有世界工程組織聯盟(WFEO)、國際科技協會(ICSC)等2個;商工界有國際商會及國際礦物與金屬協會等2個。

年會為正式會議包括開幕及閉幕式、區域性討論、主題討論、高層對話,僅受邀者可參加。另學習中心、伙伴展及附屬項目所舉辦活動均為開放式對話。

聯合國永續發展委員會聯合國1992年於里約舉辦之「地球高峰會RIO Earth Summit 1992」所成立,2002年於約翰尼斯堡舉辦之「永續發展界高峰會」後每2年就相關主題於以探討,包括第1年之準備、現況檢討與進展、第2年為執行周期、政策選項、可行措施。第18、19屆年會主題所涵蓋為運輸、化學品、廢棄物管理、礦業和永續消費和生產模式十年方案框架這五個議題。雖然有關礦業部門的文字無異議通過,但因聯合國永續發展委員會第19屆年會閉幕時並未就該年主題整體文字達成最後決議,因此礦業部門的文字並未被接受。

雖然聯合國永續發展委員會第 19 屆年會並無成效,不過聯合國於 2010 年之第 64 次大會中決議,將於2012年6月4-6日,在巴西里約舉辦「聯合國永續發展大會(United Nations Conference on Sustainable Development, 簡稱 UNCSD)」,又稱之為 RIO+20。有兩大討論主題:(1)永續發展及消除貧窮之語義下的綠色經濟(Green Economy within the context of Sustainability Development and Poverty Eradication);(2)永續發展的體制架構(Institutional Framework for Sustainable Development);另大會的三大目標為:(1)對永續發展重新作出政治承諾;(2)檢討已執行之永續發展進展及差距;(3)處理新浮現的挑戰。

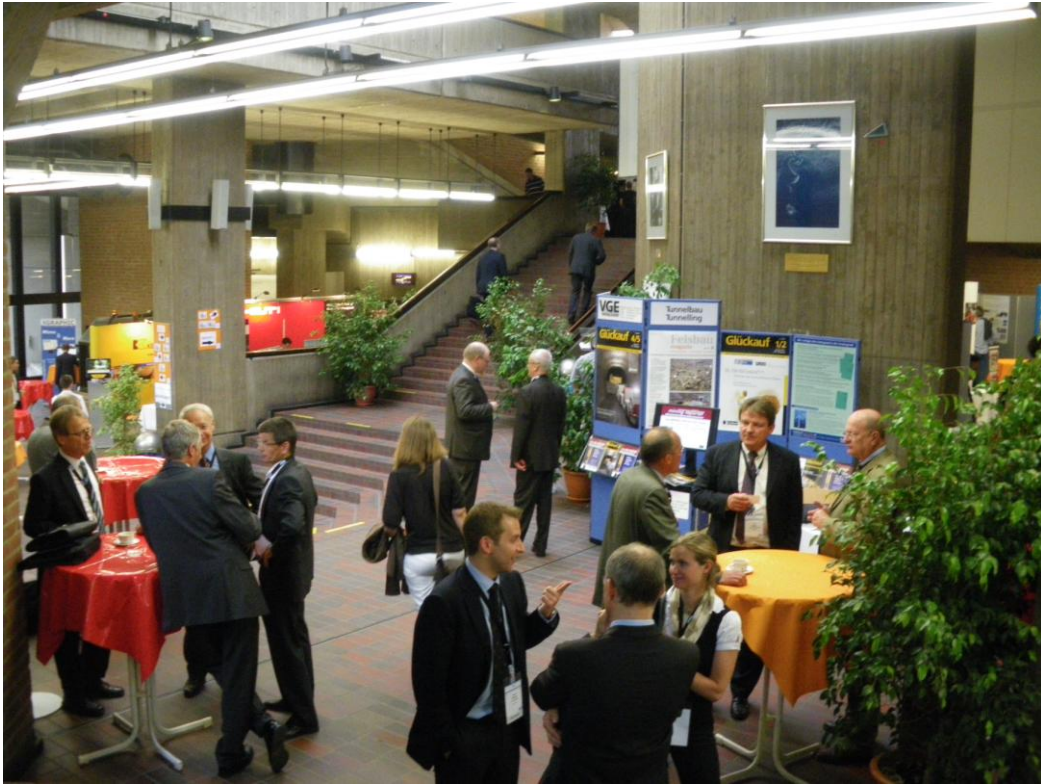
二、歐盟關鍵初級資源與自然資源之管理

受到金融海嘯之影響,歐盟的一些公司發現原料短缺,加上中國大陸管制高科技所需稀土元素出口,歐盟已在探討對那些礦物資源建立戰略儲存制度。歐盟對於 1. 對關鍵部門具有顯著經濟的重要性者、2.對歐盟具有高度供應風險者 3.現階段無替代品者予以歸類為關鍵物質(Critical materials)。現階段被歐盟歸類為關鍵物質有銻、鈹、鈳、鎳、螢石、鎘、銻、鎳、石墨、銻、鎂、銻、鉑族金屬、鈳、鎢、及 17 種稀土元素,為確保資源穩定供應,歐盟專家起草關鍵物質戰略儲存制度,而歐盟包括從所謂「城市採礦」的從廢棄物資源回收各類金屬。「原物料倡議」由歐盟主管工業及企業首長向歐盟議會提出。除了關鍵物質戰略儲存制度,尚包括從所謂「城市採礦」--從廢棄物資源回收各類金屬;歐盟將在財政及保證方面從事原物料粹取作業的公司。歐盟地質師將協助開發中國家地質師增強其地質知識,此外,改進歐盟內地質師間合作關

係，以對歐盟內礦物資源賦存有好的認知。ProMine 計畫預算為 1,700 萬歐元將尋求歐洲進口礦物及金屬之替代與鼓勵並資助採取業，所基金提供資助給先進坑內智慧型採礦技術、稀土元素及鉑族金屬替代品開發、歐盟國家間活動之配合。據估計歐盟內未開發的礦物資源價值達 1,000 億歐元。歐盟想從其境界外獲得大部分原物料，並計劃經由新貿易協定來運作；為減少對現行供應者之依賴將強化其與第三世界國家初級原物料的關係，並運用其所謂之「紛爭處理機制」來對抗貿易障礙。



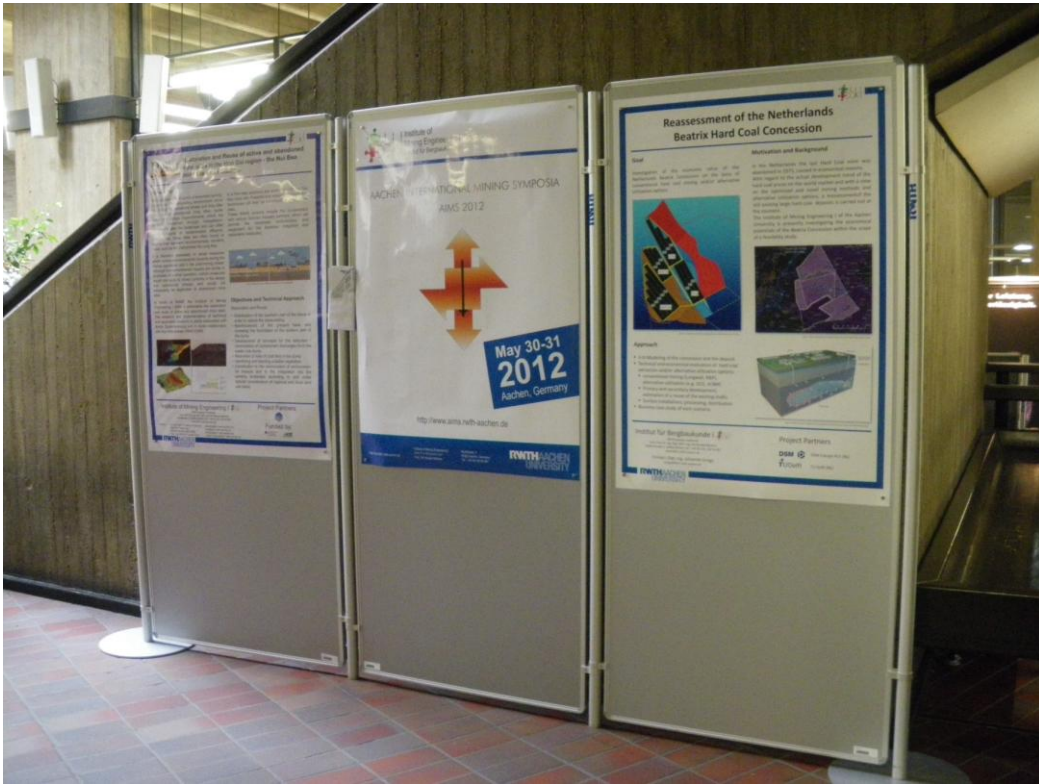
照片 1 「2011 礦業永續發展第 5 屆國際研討會議」會場外-德國亞琛市 RWTH 大學。



照片 2 「2011 礦業永續發展第 5 屆國際研討會議」會場之展示廳



照片 3 研討會會場之廠商展示坑內用防爆型頭燈



照片 4 研討會會場之與會者展示論文海報

照片 5-1~5-11 研討會各與會者報告之投影片首頁選編

The United Nations Commission
on Sustainable Development met
at UN Headquarters in New York
May 2 – 15, 2011



**Mineral Resources Policies and
Governance in Indonesia**

Günter Tiess
Sugeng Mujiyanto



UN CSD 19 Negotiations and Decisions
Shields
AIMS 5th SDIMI June 16, 2011



Sustainable Development in the Minerals Industry

**SDIMI
2011**

From Primary Production to Sustainable Supply
Chains
14 - 17 June, 2011
Aachen, Germany

Pär Weihed
Luleå University of Technology

"Raw materials produced by the extractive sector are a key factor for sustainable growth in industrialised, emerging and developing economies"

**BARRIERS TO UNDERGROUND
EXTRACTION OF AGGREGATE**

"There is a tendency to utilise
underground space for the less
ornamental purposes of civilization"
H G Wells – The Time Machine

Aachen International Mining Symposia; Fifth International Conference: "Sustainable Development in the Minerals Industry," June 14 – 17 2011

China: friend or foe - on the brink of a new mining paradigm?"

Per Storm,
Raw Materials Group

Raw
Materials
Group

Sustainable Lignite Mining and Utilization in the Rhineland

Recultivation and regional cooperation for a sustainable development of the post-mine landscape

Dipl.-Ing. Michael Eyll-Vetter
Vice President Mine Planning
RWE Power AG, Cologne

RWE
The energy to lead

The EU Raw materials strategy

SDIMI 2011, Aachen
15 June 2011

European Commission
Enterprise and Industry

Paul Anciaux
Policy Officer



Managing Land Use Conflicts for Sustainable Futures: Tourism, Agriculture and Mining

Professor Fiona Haslam McKENZIE

(Curtin University Graduate School of Business, Australia)

Dr Valeria Paul (Universidade de Santiago de Compostela Spain)

Dr Aileen Hoath

(Curtin University Graduate School of Business, Australia)

Sustainable Developments in the Minerals Industry Conference
Aachen, Germany, June 2011

Mineral futures collaboration cluster



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Long term demand for construction raw materials and the implications for minerals provision

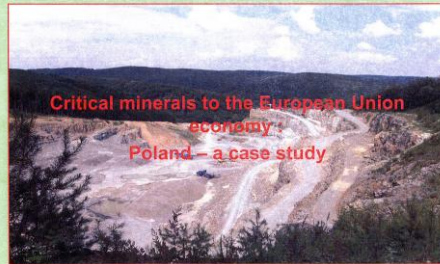
- The case of sand and gravel in the Netherlands -

Paul Groot
Economic Institute for Construction and Housing

SDIMI 2011 Conference - Aachen, June 15th 2011

1

Barbara Radwanek-Bak



Critical minerals to the European Union economy:
Poland – a case study

Sustainable Development in the Minerals Industry (SDIMI)

14 - 17 June, 2011
Aachen, Germany

SDIMI
2011
RWTH AACHEN
UNIVERSITY

The effect of mine reclamation program implementation on sustainability of region

M. Abdi Oskouei
M. Osanloo

拾、礦場參觀

一、礦區概況：

1. 礦業權者：RWE 能源股份有限公司。該公司擁有 Hambach、Inden、Garzweiler-2 三煤礦。係整合當地 15 家煤礦公司而成，為全世界最大褐煤礦。其中政府擁有 10% 股份、合併之組織成員 44%、個人 14%、員工 2% 及 當地市政府 21%。
2. 位置：德國亞琛市東北方 25 公里、科隆西方 25 公里。
3. 礦區面積：Hambach 礦 85 平方公里已開採面積 37 平方公里，1978 年開始。
Inden 礦 38 平方公里、深度 350 公尺（參觀之礦場）
Garzweiler-2 礦 48 平方公里。
4. 開採時間：1890 年起開始採礦，但自 1933 年起計有 23 家煤礦改用斗輪式鏟礦機大規模採取煤礦。
5. 員工：15,400 人與採礦有關者 8,200 人。

二、礦床地質

本礦區位於 North Rhine Westfalia (NRW) 褐煤田範圍，NRW 賦存面積有 282 平方公里，屬中生代三疊紀褐煤礦，儲量為 38 億公噸，Hambach 礦深度 370 公尺，Inden 礦深度 350 公尺。（如圖 1）

三、生產情形

1. 本礦區位於 North Rhine Westfalia (NRW) 褐煤田範圍，NRW 賦存面積有 282 平方公里，屬中生代三疊紀褐煤礦，儲量為 38 億公噸，已開採 100 年以上。本礦為德國最大露天開採褐煤礦，其中 Hamba 褐煤礦層在地下 390 公尺年產褐煤 4,000 萬公噸；Inden 礦層深度為地下 350 公尺。RWE 為最大的火力發電廠：該公司總發電量年 190 billion kWh 占德國發電量的 1/3；該公司在全德國燃燒褐煤總發電量為 33,000 MW，其中 11,000 megawatt 即來自 NRW 煤田。
2. 使用斗輪式鏟礦機（Bucketwheel excavator）產除覆蓋表土及採取煤礦，並用輸送帶分別運送剝離之表土及挖取之煤礦。煤礦可直接運到發電廠使用或經由鐵路轉運；表土則回填堆置於採絕跡地。共有 22 部斗輪式鏟礦機，斗輪式鏟礦機重 13,500 公噸、長 240 公尺、高 96 公尺，僅 4-5 人操作，每日採取量可達 240,000 公噸或表土/立方公尺。剝土比為表土 4.3 立方公尺/褐煤 1 公噸。Inden 礦有 3 部斗輪式鏟礦機；1 部作業中、1 部保養中、1 部維修中。24 小時 3 班作業。輸送帶每小時輸送 3,000 公噸表土或煤礦；三煤礦所設置之輸送帶總長度達 300 公里。
3. 迄至 1944 年為止 23 家煤礦已採取煤炭總共 6,000 萬公噸。
4. 目前該 3 礦年產褐煤 10,000 萬公噸以上。其中 196 平方公里已開採完並整復完畢。
5. 對外有長度達 600 公里鐵路將煤礦送往該區域內之所有發電廠。

6.褐煤品質：熱值: 7.8 to 10.5MJ/kg

灰份: 1.5 – 8.0%

水份: 50 – 60%

含硫量: 0.15 – 0.50%

四、植生綠化情形

- 1.採煤區仍繼續開採作業中，採絕跡地已植生綠化。已動過 290 平方公里，其中 290 平方公里採絕跡地已植生綠化。103 平方公里作農業使用、77 平方公里作森林使用、12 平方公里作住宅使用（含 8 平方公里湖泊及水塘）。
- 2.已著手進行植生綠化整復區域作為農地使用者種植甜菜及蔬菜；作為森林使用者已成濃密森林，為鹿、兔及胡狼之家園。
3. Inde 河橫越 Inden 煤礦為配合採礦需要，其中南北 4 公里在 2005 年予以改道為長達 12 公里人工河道、並成功營造自然濕地復育與發展，河水蜿蜒、河中有魚、河床及兩岸植物茂盛、參觀者若未經告知，會誤認其為自然河川。

五、環境保護

- 1.噪音、粉塵、地下水、採掘跡地整復及社區安置為該礦最重要議題。除政府之外尚有民間監督團體關注採礦活動所產生之噪音、粉塵壓制措施。
- 2.社區之住宅及空間利用由被安置住民參與規劃。自 1950 年代起迄今已有 50,000 人被遷往 10-20 公里外新社區安置。
- 3.為使採礦範圍之地下水面低於採礦面，每年須從 1,000 口水井抽出 6 億立方公尺的地下水。但周遭溼地及林地的地下水位不受影響。所挖出之 2 個大坑作成人工湖，面積 25 平方公里，水深達 150 公尺，可容納水體 350 億立方公尺。該公司將付錢給政府准許其由萊茵河引水注入該等人工湖。
- 4.開放民眾參觀採礦作業設置專屬觀景台並有專人專門車輛導覽，促進民眾瞭解與支持。

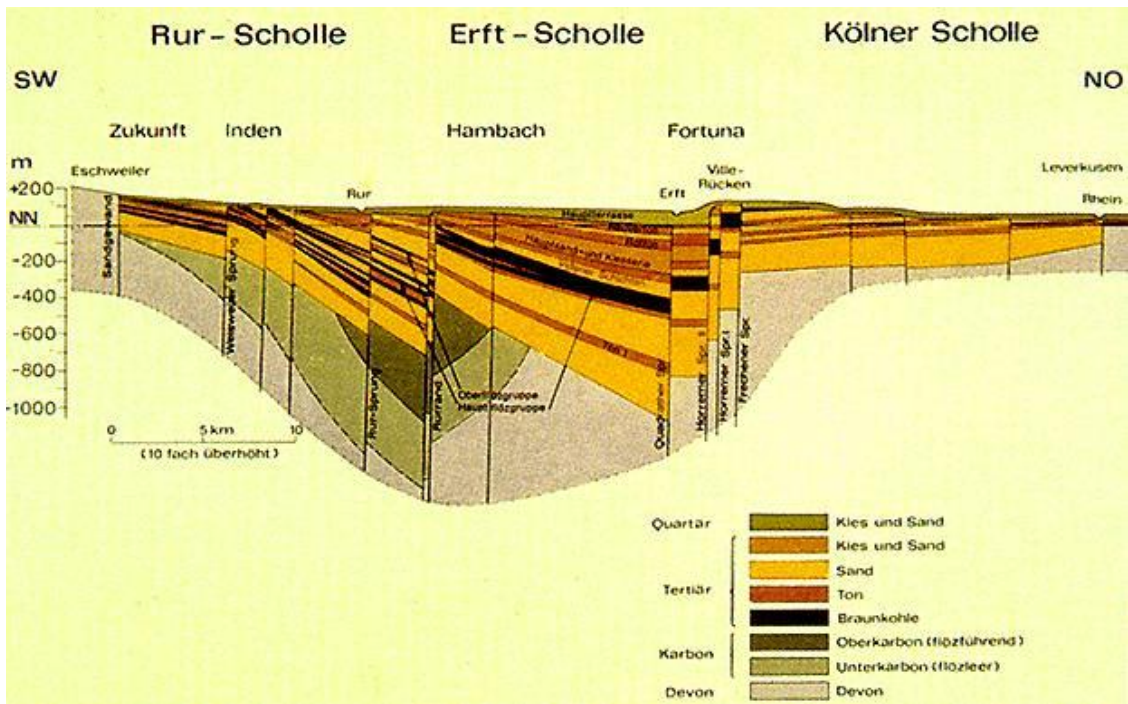


圖 1 RWE 能源公司之 North Rhine Westfalia (NRW) 褐煤田礦床地質

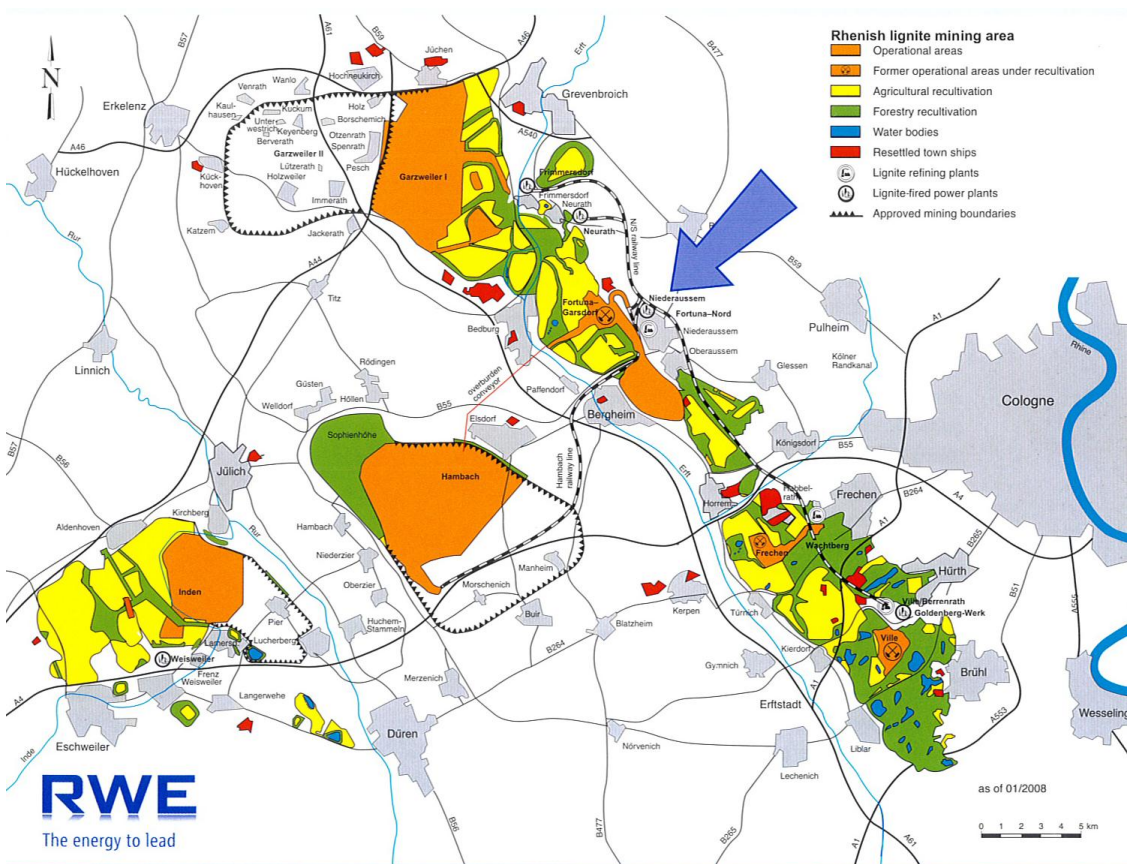


圖 2 RWE 能源公司煤礦採礦作業範圍及周邊經整復區域



照片 6 RWE 能源公司位於礦區旁以褐煤燃料之火力發電廠



照片 7 與會代表聆聽 Inden 礦方導覽人員介紹礦山現況並在保養中連續採煤機前合影



照片 8 作業中斗輪式鏟礦機每日採取量可達 240,000 公噸或表土/立方公尺。



照片 9 Inden 煤礦露天採煤與表土輸送轉運設備佈置-包括噴水壓制粉塵措施。



照片 10 Inden 煤礦露天採煤階段佈置-後方為表土堆置與整復。



照片 11 Inden 煤礦露天採煤表土整復植生綠化。



照片 12 Inden 露天煤礦採絕跡地整復後植生綠化成果與人造河流自然發育流動情形。

拾壹、心得與建議：

一、心得

(一) 歐盟各國相當重視礦物資源永續發展發展，分別舉辦各種研討會。其中「礦業永續發展國際研討會」每 2 年輪流在希臘、德國、澳洲會員國舉辦大會，本年為第 5 屆。每屆均有不同主題。另我國此次積極參與該會議，深受主辦單位重視，報告人亦積極與各國出席代表互動、交流，建立連絡管道。

(二) 受到金融海嘯之影響，歐盟已在探討對那些礦物資源建立戰略儲存制度。歐盟各國之對礦業永續發展發展 很重視，可供我國借鏡參考，會中並與各國代表建立連繫管道有助爾後相關資訊之取得。出席參加該會議有助了解世界最新情形供我國未來方向之參考，並與各國代表建立連繫管道有助爾後相關資訊之取得。

(三) RWE 能源公司以其在褐煤開採百餘年，具有對噪音、粉塵、地下水、採掘跡地整復及社區安置之相當好的經驗，成立 RWE 國際能源公司，成為亞洲能源公司在越南 Phulbari 煤礦計畫之顧問公司，處理其最敏感地區地下水位的問題。

(四) RWE 能源股份有限公司整合當地 15 家煤礦公司而成，擁有全世界最大褐煤礦。該世界最大的煤礦公司股份並由政府、合併組成由員工、個人、公司、當地市

民共同擁有。

(五) 歐盟已在探討砂石資源之管理，並正執行強化東南歐永續的骨材資源管理與供應之 SARMa 計畫，斯洛凡尼亞計畫於本年 9 月在舉行永續的骨材資源管理國際研討會討論非法及盜採砂石、骨材回收、環境友善的採取典範、自然資源永續管理、跨邊界骨材供應合作、及原材料之國際貿易。顯見砂石骨材之供應已跟礦物受到歐盟同等重視，非法及盜採砂石成爲討論議題亦反映歐盟供需嚴重失衡。

二、建議

(一) 「第 6 屆礦業永續發展國際研討會」在 (2013) 年在希臘舉行。爲繼續瞭解國際礦物資源探勘與開發技術之發展，供我國未來在此領域之推動方向之參考，建議繼續派員參與 2 年 1 次的礦業永續發展國際研討會。

(二) 雖然褐煤與砂石屬不同開採對象，但其大面積露天採礦所面臨的環保與社經問題雷同。RWE 能源公司在褐煤開採百餘年，其對噪音、粉塵、地下水、採掘跡地整復及社區安置之相當好的作法及處理經驗，建議可供我國砂石專用區規劃與對公眾溝通說明之參考。

附 件

List of Participants

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Fifth International Conference

**Sustainable Development
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From Primary Production to
Sustainable Supply Chains



14 – 17 June 2011
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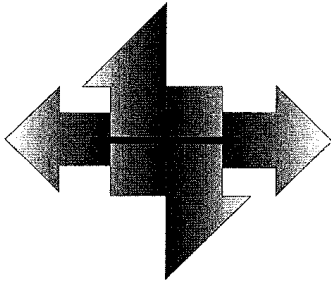
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Organization



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AIMS 2012



30 - 31 May, 2012
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Symposium Secretariat - Institute of Mining Engineering I
RWTH Aachen University
Wuellerstrasse 2 - 52062 Aachen, Germany
Tel.: +49-(0)241-80 95673 - Fax: +49 (0)241-80 92272
e-mail: aims@bki.rwth-aachen.de



Abdolkouei, Maryam
Amirkabir University of Technology
424 Hafez Ave
15875-4413 Tehran
Iran

Addie, Sean
University of Victoria
1830 Crescent Rd.
V8S2G6 Victoria, BC
Canada

Adey, Elizabeth
University of Exeter, Camborne School of Mine, Cornwall Campus
Tremough
TR10 9EZ Penryn
United Kingdom

Agjoutantis, Zacharias
Technical University of Crete, Department of Mineral Resources Engineering
University Campus
73100 Hania
Greece

Ahmad, Shakeel
RWTH Aachen University, Institute of Mining Engineering I
Wülflerstr. 2
52062 Aachen
Germany

Akbari, Aliakbar
Eastern Mediterranean University
Salamis street
5000-5999 Famagusta
Cyprus

Allen, Rob
Gemcom: Software Europe Ltd., Unit 6, Phoenix Business Park
Telford Way, Coalville
Leicestershire LE67 3HB
United Kingdom

Almadani, Mohammad Ahmad
44 Rue de L'ALMA
92400 courbevoie
France

Bessier, Reinhard
Schlesierweg 14
47495 Rheinberg
Germany

de Ruiter, Hans
TU Delft University
P.O. box 5048
2600 GA Delft
Netherlands

Förger, Dirk
VGE Verlag GmbH
Montebuchstraße 2
45219 Essen
Germany

Guicherd, Herve
Separation Technologies, TITAN
22a haikidos street
11143 Athens
Greece

Hünefeld, Malik
XGraphic Ingenieurgesellschaft mbH
Mantelbongard 24-28
52062 Aachen
Germany

Hünefeld, Rainer
RWTH Aachen University, IMR
Wülflerstraße 2
52056 Aachen
Germany

Ingendahl, Jürgen
Bucyrus Europe GmbH
Industriestr. 1
44534 Lünen
Germany

Jarrah, Niusha
TU Clausthal, Institut für Bergbau
Erzstr. 20
38678 Clausthal-Zellerfeld
Germany

Kojo, Ilkka

Outotec Oy
P.O. Box 86
02201 Espoo
Finland

Kreuz, Jörg

Houghton Deutschland GmbH
Beyenburger Str. 164-168
42287 Wuppertal
Germany

Leutner, Jana

GIZ
Dag-Hammarskjöld-Weg 1-5
65760 Eschborn
Germany

Lewandowski, Wlodek

Separation Technologies
Torgauer Strasse 231-253
04347 Leipzig
Germany

Mosser, Bernard

Kerneos
8 rue des graviers
92521 Neuilly sur seine
Germany

Narantuya, Uyanga

Carl Duisberg Training Center
Hildegundstr.18
51069 Köln
Germany

Pasche, Eckart

VGE Verlag GmbH
Montebruchstraße 2
45219 Essen
Germany

Rashidinejad, Farshad

Islamic Azad University (IAU), Science & Research Branch (SRB)
Hesarak, Poonak
14778-93855 Tehran
Iran

Reyes Bozo, Jorge

Universidad Andres Bello
Sazlé 2325
2325 Santiago
Chile

Salatino, Wolfgang

Minova Holding GmbH
Am Technologiepark 1
45307 Essen
Germany

Schippers, Frank

RWE Power
Stuttgenweg 2
50935 Köln
Germany

Scholl, Alexander

KIMA Echzelsysteme GmbH
Güterer Strasse 72
52428 Jülich
Germany

Steinbach, Volker

Federal Institute for Geosciences and Natural Resources (BGR)
Stilleweg 2
30655 Hannover
Germany

Wiegand, Jürgen

Minova CarboTech GmbH
Am Technologiepark 1
45307 Essen
Germany

Almasi, Jaber

Eastern Mediterranean University
 Department of civil eng. EMU
 0090 Famagusta
 Cyprus

Anciaux, Paul

European Commission, DG Enterprise
 Square Marie-Louise 28/1
 1000 Brussels
 Belgium

Apel, Günther

DMT GmbH & Co. KG
 Am Technologiepark 1
 45307 Essen
 Germany

Arias, Mafalda

Mafalda Arias and Associates
 349 W. Georgia St., PO Box 3768
 V6B 3Z1 Vancouver, BC
 Canada

Asha Lata, Baidya

Surjammukhi Sangsthis (SMS)
 22/Dilkusha, C/A, Dhaka, Bangladesh
 1000 Dhaka
 Bangladesh

Asi, Bahareh

Kavoshgaran Consulting Engineers. (KCE)
 No. 18, Babak Markazi Alley, Africa Blvd
 1917714413 Tehran
 Iran

Baki, Atilla

Atlas Copco MCT GmbH
 Langemarckstraße 35
 45141 Essen
 Germany

Baris, Kemal

Zonguldak Karaelmas University, Dept. of Mining Engineering
 67100 Zonguldak
 Turkey

Barjasteh, Arash

Khuzestan Water & Power Authority (KWPA)
 Golestan Road
 61395-137 Ahvaz
 Iran

Bataa, Batkhuu

Ministry of Mineral Resources and Energy, Mining and Heavy Industry Policy Department
 Government Bldg 2, United NatioStr 5/1
 21064e Ulaanbaatar
 Mongolia

Bauckmann, Stefan

Bucyrus Europe GmbH
 Industriestr. 1
 44334 Lünen
 Germany

Bauer, Mathias

CBM GmbH
 Horngasse 3
 52064 Aachen
 Germany

Bayer, Arne K.

E.ON New Build & Technology
 Tresckowstraße 3
 30457 Hannover
 Germany

Belboom, Sandra

University of Liège
 Allée de la Chimie 3, Bat B6a
 4000 Liège (Sart Tilman)
 Belgium

Bendouro, Zouhair

Managem Group
 Twin Center Tour A - Bd. Zeritouni
 5199 Casablanca
 Morocco

Benecke, Norbert

DMT GmbH & Co. KG, Exploration & Geosurvey
 Am Technologiepark 1
 45307 Essen
 Germany

Berger, Heiner

TU Clausthal, Institut für Bergbau
Erzstr. 20
38678 Clausthal-Zellerfeld
Germany

Bergkvist, Lars

Atlas Copco Rock Drills AB
Klerkgatan 21
70225 Örebro
Sweden

Böhm, József

University of Miskolc, Preparation and Environmental Processing
Egyetemváros
3515 Miskolc
Hungary

Boyd, Christopher

European Commission, DG Environment, B.2 Biodiversity
1049 Brussels
Belgium

Brenk, Hans Dietmar

Brenk Systemplanung GmbH
Helder-Hof-Weg 23
52080 Aachen
Germany

Brunnegger, Armin

Dywidag-Systems International GmbH
Alfred Wagner Strasse 1
4061 Pasching
Austria

Bussmann, Heribert

Bucyrus HEX GmbH
Karl-Funke-Str. 36
44149 Dortmund
Germany

Caspeler, Klaus

CBM GmbH
Hornegasse 3
52064 Aachen
Germany

Chandler, Frank

RWTH Aachen University, Institute of Nuclear Fuel Cycle (INFC)
Elisabethstraße 16
52062 Aachen
Germany

Chen, Yet-Jen

Department of Mines, Ministry of Economic Affairs
NO. 53, Zhonghua Rd.,
10042 Taipei
Taiwan

Choné, Jürgen

RWTH Aachen University, Institute of Mining Engineering I
Wülmerstr. 2
52056 Aachen
Germany

Chouinard, Rebecca

Mackenzie Valley Land and Water Board, PO Box 2130
7th Floor - 4922 48th Street
X1A2P6 Yellowknife, NT
Canada

Clausen, Elisabeth

TU Clausthal, Institut für Bergbau
Erzstr. 20
38678 Clausthal-Zellerfeld
Germany

Cowley, John

Mineral & Resource Planning Associates Ltd
23 Bayran Way
DT11 7RZ Blandford Forum
United Kingdom

Craynon, John

Virginia Tech, Department of Mining and Mineral Engineering
4 Dearborn Place
20878 Gaithersburg, MD
USA

Dauber, Christoph

Technische Fachhochschule Georg Agricola
Herner Straße 45
44797 Bochum
Germany

Daws, Graham

Graham Daws Associates Ltd
 Unit 3 Block 14, Amber Business Centre
 DE55 4BR Riddings
 United Kingdom

Deißmann, Guido

Brenk Systemplanung GmbH
 Heider-Hof-Weg 23
 52080 Aachen
 Germany

den Drijver, Jacobus

RWE Power AG
 Stütgenweg 2
 50935 Köln
 Germany

Dereli, Yilmaz

RAG Mining Solutions GmbH
 Shamrockring 1
 44623 Herne
 Germany

Dhakai, Hari Prasad

Samata Nepal
 Parsauri
 00977 Nawalparasi
 Nepal

Dorj, Tuvshinbayar

"Erdenet" Mining Corporation LLC
 Bayan-Undur Soum 198
 61000 Erdenet
 Mongolia

Dorner, Ulrike

Federal Institute for Geosciences and Natural Resources (BGR)
 Stilleweg 2
 30655 Hannover
 Germany

Dortans, Tim

Seebach GmbH
 Neckarweg 3-5
 34246 Vallimar
 Germany

Drötboom, Marcel

Vogel Business Media GmbH & Co. KG
 Max-Planck-Str. 7/9
 97084 Würzburg
 Germany

Duerksen, Alek

Virginia Tech
 106 Southampton Ct
 24060 Blacksburg
 USA

Dutschke, Joachim

RAG Aktiengesellschaft
 Postfach
 44620 Herne
 Germany

Dwars, Herbert-Karl

Zeitschrift "Bergbau"
 im Bäckebusch 6a
 45701 Herden-Berlich
 Germany

Egbe, Aaron

University of Yaounde II
 B.P. 118 Soa
 225 Yaoundé
 Cameroon

Enriquez, Maria Amélia

UFFA, MME
 AOS S. BLOCO C. APT 5-2
 70660063 Brasilia-DF
 Brazil

Esteves, Ana Maria

Community Insights Pty Ltd
 Akerhof 28
 9711 JC Groningen
 Netherlands

Everingham, Jo-Anne

University of Queensland, Centre for Social Responsibility in Mining
 St Lucia, Brisbane
 4072 Queensland
 Australia

hael

RWE Power AG
Stuttgenweg 2
50935 Köln
Germany

KWV IPEX-Bank GmbH
Palmengartenstr. 5-9
60325 Frankfurt
Germany

Managem. Group
Twin Center Tour A, Bd Zerkouni
5199 Casablanca
Morocco

ang

Kavoshgaran Consulting Engineers, (KCE)
No. 18, Babak Markazi Alley, Africa Blvd
1917714413 Tehran
Iran

RWTH Aachen University, Institute of Mining Engineering I
Wülfringerstr. 2
52056 Aachen
Germany

r

HeidelbergCement Baustoffe für Geotechnik, GmbH & Co. KG
Neubeckumer Str. 92
59920 Ennigerloh
Germany

an

RWE Power AG
Stütgenweg 2
50935 Köln
Germany

ian

De Beers Canada Inc
350 Ferrand Drive, Ste 900,
M89C 3G Toronto, ON
Canada

Franken, Gudrun

Federal Institute for Geosciences and Natural Resources (BGR)
Stilleweg 2
30655 Hannover
Germany

Franks, Daniel

University of Queensland, Centre for Social Responsibility in Mining
St Lucia
4072 Brisbane
Australia

From, Tomas

SveMin - Swedish Association of Mines, Mineral and Metal Producers
Box 1721
11187 Stockholm
Sweden

Fuchsschwanz, Marcus

RWTH Aachen University, Lehrstuhl für Geotechnik im Bauwesen
Mies-van-der-Rohe-Str. 1
52074 Aachen
Germany

Fuisz-Kehrbach, Sonja-Katrin

Center for Sustainability Management (CSM), Leuphana University Lüneburg
Seerosenweg 15
31515 Wunstorf
Germany

Furcas, Carla

University of Cagliari, DIGITA
Piazza d'Armi 1
09123 Cagliari
Italy

Gärtner, Dieter

RWE Power AG
Stütgenweg 2
50935 Köln
Germany

Gaidajis, Georgios

Democritus University of Thrace, Dept. of Production Engineering & Management
Vas. Sofias 12
67100 Xanthi
Greece

Galos, Krzysztof

Polish Academy of Sciences, Mineral & Energy Economy Research Institute
 Wybrzeże 7
 31261 Kraków
 Poland

Ganster, Michael

RAG Aktiengesellschaft, BW Saar
 Postfach
 44620 Herne
 Germany

Gárate, Kenny

RWTH Aachen University, IMR
 Wüllnerstraße 2
 52056 Aachen
 Germany

Geimer, Jens T.

ThyssenKrupp Steel Europe AG
 Kaiser-Wilhelm-Str. 100
 47166 Duisburg
 Germany

Geisler, Joachim

MIBRAG mbH
 Glück-Auf-Str. 1
 06711 Zeitz
 Germany

Gierenz, Stefan

K+S Aktiengesellschaft
 Bertha-von-Suttner-Str. 7
 34131 Kassel
 Germany

Giese, Andreas

Minova BWZ GmbH
 Am Kruppwald 10
 46238 Bottrop
 Germany

Göge, Michael

RAG Aktiengesellschaft
 Postfach
 44620 Herne
 Germany

Götze, Michael

KfW Entwicklungsbank
 Palmengartenstrasse 5-9
 60325 Frankfurt
 Germany

Gombkötö, Imre

University of Miskolc, Institute of RMP&EP
 Egycemváros
 3515 Miskolc
 Hungary

Gotsis, Johann

SST Prof. Dr.-Ing. Stoll und Partner, Ingenieurgesellschaft mbH
 Charlottenburger Allee 39
 52068 Aachen
 Germany

Graef, Alexander

KSL - Kupferschiefer Lausitz GmbH
 Lange Str. 14-16
 03130 Spremberg
 Germany

Grief, Ralf

Sandvik Mining and Construction G. m. b. H.
 Alpinestraße 1
 8740 Zellweg
 Austria

Groot, Paul J.M.

Economic Institute for Construction and Housing (EIB)
 Postbus 58248
 1040 HE Amsterdam
 Netherlands

Guesnet, Lena

Bonn International Center for Conversion, (BICC)
 Pfarrer-Byns-Straße 1
 53121 Bonn
 Germany

Gutberlet, Karsten

VGE Verlag GmbH
 Montebruchstraße 2
 45219 Essen
 Germany

Gutzmer, Jens

TU Bergakademie Freiberg, Institut für Mineralogie
 Brennhausgasse 14
 09596 Freiberg
 Germany

Habibian, Mohammad Javad

NICICO (National Iranian Copper Industry Co.)
 No. 55, Atlati 20 Alley, Safaee
 Yazd
 Iran

Hake, Jürgen-Friedrich

Forschungszentrum Jülich GmbH, Institut für Energieforschung (IEF)
 52425 Jülich
 Germany

Haney, Claudia

K+S KAU GmbH, Neuhof-Ellers
 Am Kallwerk 6
 36119 Neuhof
 Germany

Haslam McKenzie, Fiona

Curtin University, Graduate School of Business
 78 Murray Street
 6000 Perth
 Australia

Hasse, Jochen

GEA Group Aktiengesellschaft
 Dorstener Straße 484
 44809 Bochum
 Germany

Hebestreit, Corina

Euromines, European Association of Mining Industries
 12, av. de Broquerville
 1150 Brussels
 Belgium

Hejny, Horst

MIRO - Mineral Industry Research Organisation
 Concorde House, Trinity Park
 Solihull, Birmingham B37 7UQ
 United Kingdom

Hildebrand, Lisbeth

Geological Survey of Sweden, R & D and Mineral Resources Information
 Skolgatan 11
 95070 Malå
 Sweden

Hirtler, Friedrich

Sandvik Mining and Construction, Central Europe GmbH
 Hafenstraße 280
 45356 Essen
 Germany

Hüttemann, Iris

Minova CarboTech GmbH
 Am Technologiepark 1
 45307 Essen
 Germany

Hundrieser, Jens

Endress+Hauser Messtechnik GmbH+Co.KG
 Colmarer Strasse 6
 79576 Weil am Rhein
 Germany

Hyder, Zeshan

Virginia Tech
 460 Turner Street, Suite 304
 24060 Blacksburg
 USA

Ising, Bernd

BASF Construction Polymers GmbH
 Ernst-Thälmann-Straße 9
 39240 Gifhorn
 Germany

Jafari, Mohsen

Eastern Mediterranean University
 Salamis Street
 5000-5999 Famagusta
 Cyprus

Jakobs, Andre

Sandvik Mining and Construction, Central Europe GmbH
 Hafenstraße 280
 45356 Essen
 Germany

Jansen, Manfred

Draka Cable Wuppertal GmbH
Dickestr. 23
42369 Wuppertal
Germany

Janssen, Sebastian

RWTH Aachen University, Institute of Mining Engineering I
Wülfenerstr. 2
52056 Aachen
Germany

Johannes, Dieter

VRB Vereinigung Rohstoffe und Bergbau e.V.
Am Schillertheater 4
10625 Berlin (Charlottenburg)
Germany

Joyce, Susan

On Common Ground Consultants Inc
580 W. 18th Ave
V5Z 1V6 Vancouver
Canada

Junker, Martin

RAG Mining Solutions GmbH
Shamrocking 1
44623 Herne
Germany

Kahraman, Sair

Nigde University, Mining Engineering Department
Bor yolu
51245 Nigde
Turkey

Kalkert, Martin

Kreuzstraße 61
52428 Jülich
Germany

Kalkert, Peter

KIMA Echtzeitsysteme GmbH
Güstener Strasse 72
52428 Jülich
Germany

Karmis, Michael

Virginia Tech, VCCER
Mail Code 0411
VA 24061 Blacksburg
USA

Katz, Tobias

RWTH Aachen University, Institute of Mining Engineering I
Wülfenerstr. 2
52056 Aachen
Germany

Kauer, Arnold

Durstmüller GmbH, Bergbau- u. Drucklufttechnik
Saiburger Str. 59
4650 Lambach
Austria

Kessler, Jörg

Omya GmbH
Siegburger Straße 229 c
50679 Köln
Germany

Khalatbari, Hossein

Eastern Mediterranean University
Salamis Road, Famagusta (City)
North Cyprus, via Mersin 10
Turkey

Khalil, Abderrahmane

Managem Group
P.O. Box 469
40000 Marrakech Medina
Morocco

Kipp, Ramon

RAG Mining Solutions GmbH
Shamrocking 1
44623 Herne
Germany

Kistner, Philipp

CRONIMET Mining AG
Südbeckenstrasse 22
76189 Karlsruhe
Germany

Koenigshoven, Walter

Bucyrus Europe GmbH
 Industriestrasse 1
 44534 Lünen
 Germany

Kosma, Markus

RWE Power AG
 Stütgenweg 2
 50935 Köln
 Germany

Kratz, Thorsten

RWTH Aachen University, Institute of Mining Engineering I
 Wülflerstr. 2
 52056 Aachen
 Germany

Kreimeyer, Gerhard

BARTEC Sicherheits-Schaltanlagen GmbH
 Holzener Straße 35-37
 58708 Menden
 Germany

Kretschmann, Jürgen

Technische Fachhochschule Georg-Agricola
 Herner Straße 45
 44797 Bochum
 Germany

Krings, Johannes

Bucyrus Europe GmbH
 Industriestr. 1
 44534 Lünen
 Germany

Küsters, Markus

Hiltl Deutschland GmbH
 Timmerhellstraße 25
 45478 Mülheim/Ruhr
 Germany

Kuilik, Lars

RWE Power AG
 50935 Köln
 Germany

Kumar, B. Ramesh

The Singhereni Collieries Company Limited
 Khammam District
 507101 Andrapradesh
 India

Lacey, Justine

CSIRO, PO Box 883
 Kenmore QLD
 4069 Brisbane
 Australia

Lammer, Egmont

Sandvik Mining and Construction G.m.b.H.
 Alpinestrasse 1
 8740 Zellweg
 Austria

Langefeld, Oliver

TU Clausthal, Institut für Bergbau
 Erzstr. 20
 38678 Clausthal-Zellerfeld
 Germany

Laurence, David

The University of New South Wales, Australian Centre for Sustainable Mining
 Sydney 2052
 Australia

Law, Tanya

TU Delft University
 P.O. box 5048
 2600 GA Delft
 Netherlands

Lehnen, Felix

RWTH Aachen University, Institute of Mining Engineering I
 Wülflerstr. 2
 52056 Aachen
 Germany

Lichte, Thomas

BRIDON International GmbH
 Magdeburger Str. 14a
 45881 Geisenkirchen
 Germany

Lipsett, Lloyd

LKL International Consulting Inc.
 5430 St. Laurent Blvd 405
 H2T 1S1 Montreal
 Canada

Lumala, Badru

Ministry of Energy and Mineral Development
 P.O. Box 3546 KLA
 256 Kampala
 Uganda

Mackintosh Peter, Ighoro

Human Rights Initiative Niger Delta
 Suite 75a Efab Plaza, Area 11, Garki
 +23409 FCT Abuja
 Nigeria

Mager, Diethard

Federal Ministry of Economics and Labour, (BMWA)
 Scharnhorststr. 34-37
 10115 Berlin
 Germany

Malik, Jan

RWTH Aachen University, Institut für Mineralogie u. Lagerstättenlehre
 Wüllnerstr. 2
 52062 Aachen
 Germany

Malik, Muddasir-Waheed

SOAS, University of London
 Thornhaugh Street, Russell Square
 WC1H 0XG London
 United Kingdom

Malone, Devin

DSM
 Tudderenweg 113-42
 6137CC Sittard
 Netherlands

Marjito,

PT. Prakarsa Dyuk
 Jl Lenteng Agung Raya No 30
 12530 Jakarta
 Indonesia

Martens, Nicolai

Bronnoy Kalk A/S
 c/o Bronnoy Kalk
 8960 Hommelsto
 Norway

Martens, Per Nicolai

RWTH Aachen University, Institute of Mining Engineering I
 Wüllnerstr. 2
 52062 Aachen
 Germany

Mecit Altin, Evren

Turkish Mining Association, Istiklal Caddesi Tunca
 Apt. No: 233-1/1, Beyoglu
 34149 Istanbul
 Turkey

Meyer, Stefan

Hilti Deutschland GmbH
 Timmerhellstraße 25
 45478 Mülheim/Ruhr
 Germany

Mikki, Peter

CFT GmbH
 Belsenstr. 39-41
 45964 Gladbeck
 Germany

Mildner, Christina

MIBRAG mbH
 Glück-Auf-Str. 1
 06711 Zeitz
 Germany

Mistry, Mark

Nickel Institute Europe
 6th Floor, Avenue des Arts 13
 1210 Brussels
 Belgium

Moritz, Wilhelm

Drake Cable Wuppertal GmbH
 Dickestr. 23
 42369 Wuppertal
 Germany

Mucsi, Gábor

University of Miskolc, Inst. of Raw Mat. Prep. and Env. Proc.
 Miskolc Egyetemváros
 3515 Miskolc
 Hungary

Mullard, Zoe

InfoMine
 900 - 580 Hornby Street
 V6C3B6 Vancouver
 Canada

Narimo,

PT. Prakarsa Dyuk
 Jl Lenteng Agung Raya No 30
 12530 Jakarta
 Indonesia

Neumann, Michael

Sachleben Bergbau Verwaltungs-GmbH
 Wolbecke 1
 57368 Lemmestadt
 Germany

Neye, Esther

RWTH Aachen University, IMR
 Wüllnerstr. 2
 52056 Aachen
 Germany

Nguyen, Nga

RWTH Aachen University, Institute of Mining Engineering I
 Wüllnerstr. 2
 52062 Aachen
 Germany

Norovsambu, Buyantogtokh

Erdenet Mining Corporation
 1. Amarlin square
 213900 Erdenet
 Mongolia

Nurmi, Pekka

Geological Survey of Finland
 P.O.Box 96
 02151 Espoo
 Finland

Özarslan, Ahmet

Zonguldak Karaelmas University, Dept. of Mining Engineering
 67100 Zonguldak
 Turkey

Özdemir, Ismet

RWTH Aachen University, Institute of Mining Engineering I
 Wüllnerstr. 2
 52056 Aachen
 Germany

Oraham, Ikenna

University of Alberta, Department of Earth & Atmospheric Sciences
 1-26 Earth Sciences Building
 T6G 2E3 Edmonton
 Canada

Osanloo, Morteza Gholi

Amirkabir University of Technology, Department of Mining and Metallurgical Eng.
 424 Hafez Ave
 15875-4413 Tehran
 Iran

Oster, Arthur

RWE Power AG
 Stüttgenweg 2
 50935 Köln
 Germany

Ostermeier-Kittel, Imke

Vogel Business Media GmbH & Co. KG
 Max-Planck-Str. 7/9
 97064 Würzburg
 Germany

Pasche, Eckart

Redaktionsbüro NewsNetwork
 Steene Dyk 11
 47877 Willlich
 Germany

Paschedag, Uli

Bucyrus Europe GmbH
 Industr. 1
 44534 Lünen
 Germany

Pastarus, Jyri-Rivaldo

Tallinn University of Technology, Department of Mining
 5 Ehitajate tee Str.
 19086 Tallinn
 Estonia

Pateiro Fernández, José Benito

Brenk Systemplanung GmbH
 Heider-Hof-Weg 23
 52080 Aachen
 Germany

Paül, Valerià

Faculty of Geography, University of Compostela
 Praza da Universidade, 1
 15703 Santiago de Compostela-Galicia
 Spain

Pavides, Andrew

Technical University of Crete, Mineral Resources Engineering Department
 Aristotelous 2-4
 73100 Chania
 Greece

Perkovic, Ute

VGE Verlag GmbH
 Montebruchsstraße 2
 45219 Essen
 Germany

Pieper, Christoph

CDM Consult GmbH
 Am Umweltpark 3-5
 44793 Bochum
 Germany

Plack, Arne

RWTH Aachen University, Institute of Mining Engineering I
 Wüllnerstr. 2
 52056 Aachen
 Germany

Pörsch, Karsten

RAG Aktiengesellschaft
 Postfach
 44620 Herne
 Germany

Preisler, Michael

S.U.P. Societat für Unternehmensplanung
 Kennedyallee 113
 60596 Frankfurt
 Germany

Radwanek-Bak, Barbara

Polish Geological Institute, National Research Institute
 Skrzatów 1
 31-560 Krakow
 Poland

Rajkovic, Damir

University of Zagreb, Faculty of Mining, Geology and Petroleum Eng.
 Pierottijeva 6
 10000 Zagreb
 Croatia

Randaxhe, René

RWTH Aachen University, Institute of Mining Engineering I
 Wüllnerstr. 2
 52056 Aachen
 Germany

Rattmann, Ludger

RWTH Aachen University, Institute of Mining Engineering I
 Wüllnerstr. 2
 52056 Aachen
 Germany

Rautenstrauch, Oliver

Dywidag-Systems International GmbH
 Alfred Wagner Strasse 1
 4061 Pasching
 Austria

Reyes-Bozo, Lorenzo

Escuela de Industrias, Facultad de Ingeniería, Universidad Andres Bello
 Sazú 2325
 2325 Santiago
 Chile

Ripkens, Michael

DBE - Deutsche Gesellschaft zum Bau und, Betrieb von Endlagern für Abfallstoffe mbH
 Eschenstr. 55
 31224 Peine
 Germany

Rogers, Pratt

University of Arizona, Dept. of Mining and Geological Engineering
1235 E. North Campus Drive, room 241C
85721-0012 Tucson
USA

Rohwer, Jan

Bucyrus Europe GmbH
Industriestr. 1
44534 Lünen
Germany

Rose, Ronald

Kennametal AMSG GmbH
Max-Planck-Strasse 9
61381 Friedrichsdorf
Germany

Rubai, Norman

Becker Mining Systems AG
Barbarastraße 3
66299 Friedrichsthal
Germany

Rubinos, David A.

RWTH Aachen University, Dpt. of Engineering Geology and Hydrogeology
Lochnerstrasse 4-20
Aachen
Germany

Rumenjak, Damir

Ministry of Environmental Protection
Ulica republike Austrije br.20
10000 Zagreb
Croatia

Sa Caetano, Paulo

FCTUNL
Quinta da Torre
2829-516 Caparica
Portugal

Salopek, Branko

University of Zagreb, Faculty of Mining, Geology and Petroleum Eng.
Pierottijeva 6
10000 Zagreb
Croatia

Sasaoka, Takashi

Kyushu University, Department of Earth Resources Engineering
744 Motooka, Nishi-ku
819-0395 Fukuoka
Japan

Schacke, Volker

Zeitschrift "bergbau"
Apelank 34
44339 Dortmund
Germany

Scheid, Andreas

BARTEC Sicherheits-Schaltanlagen GmbH, Holzener Straße 35-37
58708 Menden
Germany

Scherschel, Manfred

Im Kunitberg 53
45665 Recklinghausen
Germany

Schütte, Philip

Federal Institute for Geosciences and Natural Resources (BGR) - Mineral Economics Division
Stilleweg 2
30655 Hannover
Germany

Schuller, Hans

Sandvik Mining and Construction, Central Europe GmbH
Hafenstraße 280
45356 Essen
Germany

Schulte, Martin

Kennametal AMSG GmbH
Max-Planck-Strasse 9
61381 Friedrichsdorf
Germany

Schwarz, Rüdiger

geotec Rohstoffe GmbH
Friedrichstraße 95
10117 Berlin
Germany

Shagdarsuren, Oyuntuya

The Asia Foundation, Mongolia
 United Nations Street 18
 14201 Ulaanbaatar
 Mongolia

Shandro, Janis

University of British Columbia, Norman B. Keevil Institute of Mining Eng.
 551 Tulip Ave.
 V9P 1T7 Parksville
 Canada

Shields, Deborah

Colorado State University
 819 Whitehall Ct
 80526 Fort Collins, Colorado
 USA

Shimada, Hideki

Kyushu University
 744 Motooka, Nishi-ku
 819-0395 Fukuoka
 Japan

Shtiza, Aurelia

Katholieke Universiteit Leuven
 Celestijnenlaan 200E
 3001 Heverlee
 Belgium

Sirajul, Islam

Surjammukhi Sangsthis (SMS)
 22/Dilkusha, c/a, Dhaka, Bangladesh
 1000 Dhaka
 Bangladesh

Sitte, Andreas-Peter

Gesamtverband Steinkohle e.V.
 Postfach 10 18 29
 44608 Herne
 Germany

Small, Fraser

Victor Products Ltd
 New York Way, New York Industrial Park
 Newcastle upon Tyne NE27 0QF
 United Kingdom

Smit, Ronald

Ron Smit Consulting
 Sardiniepad 21
 5632TZ Eindhoven
 Netherlands

Solar, Slavko V.

Geological Survey of Slovenia
 14 Dimitcva ulica
 Ljubljana 1000
 Slovenia

Somi, Sasan

Eastern Mediterranean University, Department of Civil Engineering No. 301
 Famagusta via 10 Turkey
 0090.12354
 Cyprus

Song, Zhen

Aalto University, Laboratory of Rock Engineering
 Vuorimiehentie 2
 02150 Espoo
 Finland

Spachtholz, Franz Xavier

K+S Potash Canada GP
 300 - 211 4th Ave S
 Saskatoon SK S7K 1N1
 Canada

Spiller, Andreas

Hilti Deutschland GmbH
 Timmerhellstraße 25
 45478 Mülheim/Ruhr
 Germany

Steinberg, Jens

Bucyrus Europe GmbH
 Industriestr. 1
 44534 Lünen
 Germany

Steinhage, Manfred

Verband der Kalk- und Salzindustrie
 31, rue du commerce
 1000 Brussels
 Belgium

Storm, Per

Raw Materials Group
 PO Box 44062
 10073 Stockholm
 Sweden

Stratmann, Thomas

Krummenauer Anlagenbau GmbH
 Postfach 1213
 66512 Neunkirchen
 Germany

Sulaeman, Dede

PT. Prakarsa Dwik
 Jl Lenteng Agung Raya No 30
 12530 Jakarta
 Indonesia

Szczepanik, Bozena

RAG Mining Solutions GmbH
 Shamrockring 1
 44623 Herne
 Germany

Taghizadeh Ansari, Mohammad

Nitco GmbH
 Ballindamm
 20095 Hamburg
 Germany

Tano, Kent

UKAB
 96381 Malmberget
 Sweden

Tayebi, Alireza

Technical University of Clausthal, Institute of Mining
 Erzstrasse 20
 38678 Clausthal-Zellerfeld
 Germany

Tercero Espinoza, Luis

Fraunhofer Institute for Systems, and Innovation Research ISI
 Breslauer Str. 48
 76139 Karlsruhe
 Germany

Thiele, Johann-Christoph

K+S Aktiengesellschaft
 Bertha-von-Suttner-Str. 7
 34131 Kassel
 Germany

Thiem, Hans-Georg

Landesamt für Bergbau, Geologie und, Rohstoffe Brandenburg (LBGR)
 Inselstraße 26
 03046 Cottbus
 Germany

Thyrock, Klaus

RAG Mining Solutions GmbH
 Shamrockring 1
 44623 Herne
 Germany

Tiess, Günter

University of Leoben, Mineral Resources and Petroleum Engineering
 Franz-Josef-Str. 18
 8700 Leoben
 Austria

Tokarczyk, Jaroslaw

KOMAG, Institute of Mining Technology
 Pszczyńska 37
 44-101 Gliwice
 Poland

Trotovsek, Rok

Dywidag-Systems International GmbH
 Alfred Wagner Strasse 1
 4061 Pasching
 Austria

Tschammer, Ilja

Hilti Deutschland GmbH
 Timmerhellstraße 25
 45478 Mülheim/Ruhr
 Germany

Tuazon, Daniel

University of Queensland, Sustainable Minerals Institute
 Sir James Fooks Bldg (bldg 47), QLD
 4067 Brisbane
 Australia

Tuedshki, Hossein

Technical University of Clausthal, Institute of Mining
Erzstrasse 20
38678 Clausthal-Zellerfeld
Germany

Tuusjärvi, Mari

Geological Survey of Finland
P.O. Box 96
02151 Espoo
Finland

Valero, Antonio

CIRCE
Mariano Esquivel Gomez, 15
50018 Zaragoza
Spain

Van der Kleijn, Piet Hein

TU Delft University
P.O. box 5048
2600 GA Delft
Netherlands

van Zyl, Dirk J.A.

University of British Columbia, Department of Mining Engineering
5th Floor, 6350 Stores Road
V6T 1Z4 Vancouver
Canada

Vatankhah Barenji, Reza

Eastern Mediterranean University, Department of Mechanical Engineering
Famagusta via 10 Turkey
0090 1243
Cyprus

Voigt, Wolfgang

Knauf Gips KG
Am Bahnhof 7
97345 Iphofen
Germany

Wasik, Michael

BARTEC Sicherheits-Schaltanlagen GmbH
Holzener Straße 35-37
58708 Menden
Germany

Wauthoz, Bastien

RND
Rue de la Converse 44
6870 Saint-Hubert
Belgium

Weber, Jörg-Michael

RAG Aktiengesellschaft
Postfach
44620 Herne
Germany

Weihed, Pär

Technical University of Lulea, Division of Ore, Geology and Applied Geophysics
97187 Luleå
Sweden

Weinand, Gregor

RAG Aktiengesellschaft
Postfach
44620 Herne
Germany

Weitkämper, Lars

RWTH Aachen University, Aufbereitung mineralischer Rohstoffe [AMR]
Lochnerstr. 4-20
52064 Aachen
Germany

Wellmer, Friedrich-W.

Neue Sachlichkeit 21
30655 Hannover
Germany

Wendeler, Josef

RWE Power AG
Stüttgenweg 2
50955 Köln
Germany

Wenmohs, Karl-Heinz

Atlas Copco MCT GmbH
Langemarkstraße 35
45141 Essen
Germany

Weyer, Thomas

CBM GmbH
 Horngasse 3
 52064 Aachen
 Germany

Wilde, Jörg

CBM GmbH
 Horngasse 3
 52064 Aachen
 Germany

Will, Michael

ELPRO GmbH
 Marzähler Str. 34
 3053 Berlin
 Germany

Williams, David

University of Queensland, School of Civil Engineering
 Staff House Road
 4072 Brisbane
 Australia

Wimmer, Bernhard

Durstmüller GmbH, Bergbau- u. Drucklufttechnik
 Salzburger Str. 59
 4650 Lambach
 Austria

Winkler, Teodor

KOMAG Institute of Mining Technology, Laboratory Modelling Methods and Ergonomics
 Psczynska 37
 44-101 Gliwice
 Poland

Withaus, Holger

RAG Mining Solutions GmbH
 Shamrocking 1
 44623 Herne
 Germany

Wittig, Martin C

Roland Berger Strategy Consultants
 Neumünsterallee 12
 8008 Zürich
 Switzerland

Wittmer, Dominic

Wuppertal Institute, for Climate, Environment and Energy
 Döppersberg 19
 42103 Wuppertal
 Germany

Wodopia, Franz-Josef

Gesamtverband Steinkohle (GVSt)
 Postfach 10 18 29
 44608 Herne
 Germany

Woll, Thomas

RAG Aktiengesellschaft, BW Saar
 Postfach
 44620 Herne
 Germany

Wotruba, Hermann

RWTH Aachen University, Aufbereitung mineralischer Rohstoffe (AMR)
 Lochnerstr. 4-20
 52064 Aachen
 Germany

Zenati, Djelloul

P.O.Box:1061, 5 July City
 17007 Djelfa
 Algeria

Ziegler, Manfred

Bucyrus Europe GmbH
 Industriestr. 1
 44534 Lünen
 Germany

Zuber, Peter

Bochumer Eisenhütte Heintzmann GmbH & Co.KG
 Klosterstraße 46
 44787 Bochum
 Germany

附件 2 研討會議程

AACHEN INTERNATIONAL MINING SYMPOSIA
AIMS 2011

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Fifth International Conference

**Sustainable Development
in the Minerals Industry**

From Primary Production to
Sustainable Supply Chains

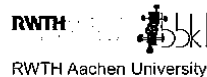


14 - 17 June, 2011

Aachen, Germany

Program
(as of 1 June, 2011)

Organization



www.aims.rwth-aachen.de

PRELIMINARY PROGRAM AT A GLANCE

SDIMI 2011



Aachen International Mining Symposia
Sustainable Development in the Minerals Industry
From Primary Production to Sustainable Supply Chains

14-17 June, 2011
Aachen, Germany
www.aims.rwth-aachen.de

PROGRAM IS SUBJECT TO CHANGE!

as of
June 8, 2011

RWTH Aachen University - Institute of Mining Engineering I – Wuellnerstr. 2 – 52056 Aachen – Germany
Tel.: +49-241-8095673 – Fax: +49-241-8092272 - email: aims@bbk1.rwth-aachen.de
www.aims.rwth-aachen.de

AACHEN INTERNATIONAL MINING SYMPOSIA
SDIMI 2011 - Sustainable Development in the Minerals Industry

Detailed Preliminary Program

Wednesday 15th June 2011

Plenary Session - I

Wednesday 15th June 2011, 08:30 - 10:30, FO1

- 08:15 **Welcome & Introduction**
P.N. Martens (Director, Institute of Mining Engineering I, RWTH Aachen University, Germany)
- 08:30 **1. Germany's future sustainable raw material supply**
D. Mager (Ministerial Councillor, Federal Ministry of Economics and Labour (BMWi), Germany)
- 08:50 **2. China: friend or foe - On the brink of a new mining paradigm?**
M. Ericsson (Board of Directors, Raw Materials Group, Sweden)
- 09:10 **3. Sustainable management of critical resources - a success factor for high-tech industries?**
M. Wittig (Chief Executive Officer, Roland Berger Strategy Consultants, Switzerland)
- 09:30 **4. Security of supply, sustainability and resource efficiency**
J. Geisler (Chairman of the Board of German Raw Material and Mining Association, VRB e.V., Germany)
- 09:50 **5. TBA**
N.N.
- 10:10 **6. Discussion**
Discussion of the presentations

Coffee Break

Wednesday 15th June 2011, 10:30 - 11:00, Foyer Kármán

- 10:30 **1. Coffee Break**
Coffee Break

Mineral Resources Policies and Governance - I

Wednesday 15th June 2011, 11:00 - 12:30, FO1

- 11:00 **1. Financing of mining projects - Can banks drive sustainability?**
P. Eysel (Vice President, KfW IPEX-Bank GmbH, Germany), M. Götz (Vice President, KfW Entwicklungsbank, Germany)
- 11:20 **2. TBA**
K. Freytag (President, Landesamt für Bergbau, Geologie und Rohstoffe Brandenburg (LBGR), Germany)
- 11:40 **3. Effect on best practices by the lack of mineral policy**
Z. Agioutantis (Director, Department of Mineral Resources Engineering, Technical University of Crete, Greece), A. Athousaki (Department of Mineral Resources Engineering, Technical University of Crete, Greece), E. Steiakakis (Department of Mineral Resources Engineering, Technical University of Crete, Greece)
- 12:00 **4. Mineral resources policies and governance in Indonesia**
G. Tiess (Senior Researcher, Department Mineral Resources and Petroleum Engineering, University of Leoben, Austria), S. Mujiyanto (PbD Student, Department Mineral Resources and Petroleum Engineering, University of Leoben, Austria)
- 12:20 **5. Discussion**
Discussion of the presentations

Practicing Sustainability - Engineering Solutions for a Sustainable Development - I

Wednesday 15th June 2011, 11:00 - 12:30, FO2

- 11:00 **1. "SAFETY FIRST" in the development of underground mining machines**
E. Lammer (Sandvik Mining and Construction G.m.b.H., Austria)
- 11:20 **2. Sustainability and resource efficiency in potash and rock salt mining**
F. Spachtholz (Head of General Mining Division, K+S Aktiengesellschaft, Germany)

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- 11:40 3. IntelliMine - Innovative technologies and concepts for the sustainable and intelligent Deep Mine of the future
H. Hejny (*Proposal Development Manager, MIRO - Mineral Industry Research Organisation, GB*)
- 12:00 4. Optimizing coal mine design for sustainable development at a large surface coal mining operation in Appalachia
J. Craynon (*Graduate Student, Department of Mining and Mineral Engineering, Virginia Tech, U.S.A*),
M. Karmis (*Stonie Barker Professor and Director, VCCER, Department of Mining and Mineral Engineering, Virginia Tech, U.S.A*)
- 12:20 5. Discussion
Discussion of the presentations

Sustainable Supply Chains - I

Wednesday 15th June 2011, 11:00 - 12:30, FO3

- 11:00 1. Infrastructure in mining industries: A geopolitical and investment challenge
M. Taghizadeh Ansari (*MD, Niitco GmbH, Germany*)
- 11:20 2. Social impacts of the local procurement of goods and services
A. Esteves (*Director, Community Insights Pty Ltd, Netherland*), M. Barclay (*Fellow, Centre for Social Responsibility in Mining, University of Queensland, Australia*), D. Brereton (*Director, Centre for Social Responsibility in Mining, University of Queensland, Australia*), D. Samson (*Professor, Faculty of Economics and Commerce, University of Melbourne, Australia*)
- 11:40 3. Importance of mineral secondary and waste raw materials in the minerals' management - Poland's case
K. Galos (*Head of Department, Polish Academy of Sciences, Mineral & Energy Economy Research Institute, Poland*)
- 12:00 4. N.N.
N.N.
- 12:20 5. Discussion
Discussion of the presentations

Social Sustainability - I

Wednesday 15th June 2011, 11:00 - 12:30, FO4

- 11:00 1. Social license in design: Constructive technology assessment within a minerals research & development institution
D. Franks (*Research Fellow, Centre for Social Responsibility in Mining, Sustainable Minerals Institute, The University of Queensland, Australia*), D. Brereton (*Director, Centre for Social Responsibility in Mining, Sustainable Minerals Institute, The University of Queensland, Australia*), T. Cohen, R. Barnes (*Researcher, Centre for Social Responsibility in Mining, Sustainable Minerals Institute, University of Queensland, Australia*), A. Littleboy (*Deputy Director, CSIRO Minerals Down Under National Research Flagship, Australia*), K. Moffat (*Research Scientist, CSIRO Minerals Down Under National Research Flagship, Australia*)
- 11:20 2. Managing land use conflicts for sustainable futures: Tourism, Agriculture and Mining
F. Haslam McKenzie (*Professorial Research Fellow, Graduate School of Business, Curtin University, Australia*), V. Pail Carril (*Faculty of Economics and Business Administration, Universidade de Santiago de Compostela, Spain*), A. Hoath (*Post Doctoral Research Fellow, CGSB, Curtin University, Australia*)
- 11:40 3. Corporate social responsibility within the mining industry: Case studies from across Europe and Russia
E. Adey (*Associate Research Fellow, Camborne School of Mines, CEMPS, University of Exeter, Great Britain*), R. Shail (*Senior Lecturer, Camborne School of Mines, CEMPS, University of Exeter, Great Britain*), F. Wall (*Head of Camborne School of Mines, University of Exeter, Great Britain*), M. Varul (*Lecturer, Department of Sociology and Philosophy, University of Exeter, Great Britain*), P. Whitbread-Aburat (*Senior Scientist, The Eden Project, Great Britain*), C. Baci (*Dean of Faculty of Environmental Sciences, University of Babeş-Bolyai, Romania*), T. Ejdemo (*Project Assistant, Department of Business Administration and Social Sciences, Luleå University of Technology, Sweden*), I. Lovric (*Vice-Dean of Faculty of Civil Engineering, University of Mostar, Bosnia Herzegovina*), V. Udachin (*Head of Geochemistry, Institute of Mineralogy, Russia*)
- 12:00 4. Culture, a pillar in your sustainability initiatives

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- 12:20 *M. Arias (President, Mafalda Arias and Associates, Canada)*
5. Discussion
Discussion of the presentations

Lunch

Wednesday 15th June 2011, 12:30 - 14:00, Lunch

- 12:30 **1. Lunch**
Lunch

RWE Power

Wednesday 15th June 2011, 14:00 - 15:30, FO1

- 14:00 **1. Holistic planning and approval of sustainable lignite mining and utilization**
L. Kulik (Head of Lignite Planning and Approval, RWE Power AG, Germany)
- 14:20 **2. Water management measures in lignite mining marked by the Water Framework Directive**
C. Forkel (Head of Water Management, RWE Power AG, Germany), J. Wendeler (Head of Water Supply Planning, RWE Power AG, Germany)
- 14:40 **3. Using the continuous improvement process to optimize opencast mine operations**
D. Gärtner (Head of Opencast Mine Segment, RWE Power AG, Germany), A. Oster (Head of Inden Opencast Mine, RWE Power AG, Germany)
- 15:00 **4. Recultivation and regional cooperation for a sustainable development of the post-mine landscape**
M. Eyll-Vetter (Head of Mine Planning, RWE Power AG, Germany), M. Kosma (Head of Opencast Mine Planning and Environmental Protection, RWE Power AG, Germany)
- 15:20 **5. Discussion**
Discussion of the presentations

Practicing Sustainability - Engineering Solutions for a Sustainable Development - II

Wednesday 15th June 2011, 14:00 - 15:30, FO2

- 14:00 **1. Contribution to sustainable development through alternative dumping concepts for coal mine waste dumps in Vietnam**
P. Martens (Director, Institute of Mining Engineering I, RWTH Aachen University, Germany), T. Katz (Senior Engineer, Institute of Mining Engineering I, RWTH Aachen University, Germany), S. Ahmad (Research Assistant, Institute of Mining Engineering I, RWTH Aachen University, Germany), M. Fuchschwanz (Research Assistant, Chair of Geotechnical Engineering, RWTH Aachen University, Germany)
- 14:20 **2. Waste management in Estonian oil shale industry**
J. Pastarus (Associate Professor, Department of Mining, Tallinn University of Technology, Estonia), M. Lohk (Senior Specialist, Eesti Energia Kaevandused Ltd., Estonia)
- 14:40 **3. Possibilities of utilizing mineral wastes in Hungary**
J. Böhm (Head of Institute of Raw Material Preparation and Environmental Process Engineering, University of Miskolc, Hungary), I. Gombkötö (Senior Lecturer, Institute of Raw Material Preparation and Environmental Process Engineering, University of Miskolc, Hungary)
- 15:00 **4. Study on multi layer covering systems of non acid forming and potentially acid forming of coal mine waste rock to control acid mine drainage**
H. Shimada (Associate Professor, Dept. of Earth Resources Engineering, Kyushu University, Japan), G. Kusuma (Doctor course student, Dept. of Earth Resources Engineering, Kyushu University, Japan), K. Hiroto (Kyushu University, Japan), T. Sasaoka (Assistant Professor, Dept. of Earth Resources Engineering, Kyushu University, Japan), A. Hamanaka, H. Tamamoto (Kyushu University, Japan), K. Matsui (Professor, Dept. of Earth Resources Engineering, Kyushu University, Japan)
- 15:20 **5. Discussion**
Discussion of the presentations

Mineral Resources Policies and Governance - II

Wednesday 15th June 2011, 14:00 - 15:30, FO3

- 14:00 **1. Can community-based mining support rural sustainable development objectives in Nigeria?**

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	<i>I. Oramah (PhD Candidate, Department of Earth & Atmospheric Sciences, University of Alberta, Canada), J. Richards (Professor, Department of Earth & Atmospheric Sciences, University of Alberta, Canada)</i>
14:20	2. The risks, challenges and benefits of using social media in the mining industry <i>Z. Mullard (Graduate Student, Department of Mining Engineering, University of British Columbia, Canada), D. van Zyl (Professor, Department of Mining Engineering, University of British Columbia, Canada)</i>
14:40	3. Zonal land use planning and the mineral industry: The need for a new approach to finding sustainability underground <i>S. Addie (Graduate Student, University of Victoria, Canada)</i>
15:00	4. Curse or blessing? The sustainable development dilemma of the mining regions in Brazil <i>M. Enriquez (Professor, Universidade Federal do Pará (UFPA), Brazil)</i>
15:20	5. Discussion <i>Discussion of the presentations</i>

Critical Primary Resources and Natural Resources Management in Europe and Worldwide - I

Wednesday 15th June 2011, 14:00 - 15:30, FO4

14:00	1. Trends of exergy costs and ore grade in global mining <i>R. Domínguez (PhD Student, CIRCE, Universidad de Zaragoza, Spain), A. Valero (Project Manager, CIRCE, Universidad de Zaragoza, Spain), A. Valero (Director, CIRCE, Universidad de Zaragoza, Spain)</i>
14:20	2. Evaluation of multilayer deposit layers using a profitability index <i>A. Pavlides (Graduate Student, Mineral Resources Engineering Department, Technical University of Crete, Greece), D. Hristopoulos, Z. Agioutantis (Professor, Mineral Resources Engineering Department, Technical University of Crete, Greece), C. Roumbos (Public Power Corporation of Greece S.A., Greece)</i>
14:40	3. The exergy decrease of the mineral capital endowment due to raw-material production <i>A. Valero (Project Manager, CIRCE, Universidad de Zaragoza, Spain), A. Valero (Director, CIRCE, Universidad de Zaragoza, Spain)</i>
15:00	4. Critical minerals to the EU economy on the national member level - Case study - Poland <i>B. Radwanek-Bak (Deputy Head of Carpathian Branch PGI, Polish Geological Institute, Poland)</i>
15:20	5. Discussion <i>Discussion of the presentations</i>

Coffee Break

Wednesday 15th June 2011, 15:30 - 16:00, Foyer Kármán

15:30	1. Coffee Break <i>Coffee Break</i>
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Mineral Resources Policies and Governance_III

Wednesday 15th June 2011, 16:00 - 17:30, FO1

16:00	1. Long term demand for construction raw materials and the implications for minerals provision; the case of sand and gravel in the Netherlands <i>P. Groot (Programme Manager Infrastructure, Economic Institute for Construction and Housing (EIB), Netherlands), M. Elb (Researcher, Economic Institute for Construction and Housing (EIB), Netherlands), R. Saitua Nistal (Senior Researcher, Economic Institute for Construction and Housing (EIB), Netherlands)</i>
16:20	2. Sustaining resource communities: A case for collaboration, coexistence and community considerations in mining-affected regions of Australia <i>C. Pattenden (Senior Research Fellow, Centre for Social Responsibility in Mining, Sustainable Minerals Institute, The University of Queensland, Australia), J. Everingham (Postdoctoral Research Fellow, Centre for Social Responsibility in Mining, Sustainable Minerals Institute, The University of Queensland, Australia)</i>
16:40	3. How can the past cease to be a burden for the future sustainable development? <i>A. Shtizga (Researcher, Katholieke Universiteit Leuven, Belgium)</i>
17:00	4. Underground extraction of aggregate - Barriers and opportunities

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- 17:20 J. Conley (Director, Mineral & Resource Planning Associates Ltd, Great Britain)
5. Discussion
Discussion of the presentations

Practicing Sustainability - Engineering Solutions for a Sustainable Development - III

Wednesday 15th June 2011, 16:00 - 17:30, FO2

- 16:00 1. Strategies for ensuring a sustainable supply of quality mining professionals for the world
D. Laurence (Director, Australian Centre for Sustainable Mining, The University of New South Wales, Australia), B. Hebblewhite (Head of School & Research Director, School of Mining Engineering, The University of New South Wales, Australia)
- 16:20 2. Sustainable mining operations with Atlas Copco's products
L. Bergqvist (Senior Adviser Mining, Atlas Copco Rock Drills AB, Sweden)
- 16:40 3. The introduction of UK rock bolting technology into coal mines around the world
G. Daws (Managing Director, Graham Daws Associates Ltd, Great Britain), A. Oxley (General Manager Geotechnics, Minova Weldgrip UK Ltd, Great Britain), N. Woodward (Managing Director, Rockbolting Technology Ltd, Great Britain)
- 17:00 4. Sustainability at Bucyrus
H. Busmann (Managing Director, Bucyrus HEX GmbH, Germany), U. Paschedag (Managing Director, Bucyrus Europe GmbH, Germany)
- 17:20 5. Discussion
Discussion of the presentations

Young Researchers on Sustainability

Wednesday 15th June 2011, 16:00 - 17:30, FO3

- 16:00 1. The role of employee capacity building in reducing company-community conflicts in Peru
M. Garcia Vasquez (M.A.Sc Candidate, Department of Mining Engineering, University of British Columbia, Canada), D. van Zyl (Professor, Department of Mining Engineering, University of British Columbia, Canada)
- 16:20 2. A practical and rigorous approach for the integration of sustainability principles into the decision-making processes at minerals processing operations
D. Tuazon (PhD Researcher, Centre for Social Responsibility in Mining, The University of Queensland, Australia), G. Corder (Senior Research Fellow, Centre for Social Responsibility in Mining, The University of Queensland, Australia), M. Powell (Chair for Sustainable Comminution, Julius Kruttschnitt Minerals Research Centre, Australia), M. Ziemiński (Manager for Water and Energy Projects, WH Bryan Mining and Geology Research Centre, Australia)
- 16:40 3. Health research studies in British Columbia mining communities
J. Sbandro (PhD Candidate, Norman B. Keevil Institute of Mining Engineering, University of British Columbia, Canada), M. Scoble (Professor, Norman B. Keevil Institute of Mining Engineering, University of British Columbia, Canada), A. Ostry (Associate Professor, University of Victoria, Canada), M. Veiga (Associate Professor, University of British Columbia, Canada), M. Koeboorn (Associate Professor, University of British Columbia, Canada)
- 17:00 4. Wind power as an alternative post-mining land use in surface coal mines in West Virginia, U.S.
A. Duerksen (Graduate Student, Department of Mining and Mineral Engineering, Virginia Tech, U.S.A), E. Westman (Associate Professor, Department of Mining and Mineral Engineering, Virginia Tech, U.S.A)
- 17:20 5. Discussion
Discussion of the presentations

Sustainability Reporting, Advances in LCA & SDI - I

Wednesday 15th June 2011, 16:00 - 17:30, FO4

- 16:00 1. Environmental impact assessment framework of Taft Copper Project
B. Asi (Senior Mining Engineer, Kavoshgaran Consulting Engineers, Iran), B. Farshadi (Project Manager, Kavoshgaran Consulting Engineers, Iran), M. Habibiyan (Project Manager, National Iranian Copper Industries Co, Iran)
- 16:20 2. Evidence theory in the construction of linguistic variables for mineral industry

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- 16:40 *D. Rumenjak (Ministry of Environmental Protection, Croatia), B. Salopek (Professor, Faculty of Mining, Geology and Petroleum Engineering, University of Zagreb, Croatia), D. Rajkovic (Faculty of Mining, Geology and Petroleum Engineering, University of Zagreb, Croatia)*
3. Development of a tool for assessing the environmental sustainability of mining facilities
- G. Gaidajis (Ass. Professor, Dept. of Production Engineering, Democritus University of Thrace, Greece), K. Angelakoglou (Ph.D candidate, Dept. of Production Engineering, Democritus University of Thrace, Greece)*
- 17:00 4. N.N.
N.N.
- 17:20 5. Discussion
Discussion of the presentations

Sustainable Interactions and Innovations

The space to create new ideas and build new collaborations

Wednesday 15th June 2011, 17:30 - 17:30, FO3

Organization



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Thursday 16th June 2011

Plenary Session - II

Thursday 16th June 2011, 08:30 - 10:30, FO1

- | | |
|-------|---|
| 08:30 | 1. TBA
<i>J. Kosmol (Umweltbundesamt, Germany)</i> |
| 08:50 | 2. TBA
<i>C. Moran (Director Sustainable Minerals Institute, The University of Queensland, Australia)</i> |
| 08:50 | 3. TBA
<i>D. Shields (Mineral Economist, Dept. of Economics, Colorado State University, U.S.A and Politecnico di Torino, Italy)</i> |
| 09:10 | 4. TBA
<i>P. Lindvall (Senior Vice President Technology & Business Development, LKAB, Sweden)</i> |
| 09:30 | 5. General conditions for sustainable coal use in Germany
<i>F. Wodopia (Managing Director, Gesamtverband Steinkohle (GVSt), Germany)</i> |
| 09:50 | 6. Is a road to sustainable use of non-renewable mineral raw materials possible?
<i>F. Wellmer (formerly President of Federal Institute for Geosciences and Natural Resources, Germany), V. Steinbach (Head of Department, Federal Institute for Geosciences and Natural Resources, Germany)</i> |
| 10:10 | 7. Discussion
<i>Discussion of the presentations</i> |

Coffee Break

Thursday 16th June 2011, 10:30 - 11:00, Foyer Kármán

- | | |
|-------|--|
| 10:30 | 1. Coffee Break
<i>Coffee Break</i> |
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Sustainability Reporting, Advances in LCA & SDI - II

Thursday 16th June 2011, 11:00 - 12:30, FO1

- | | |
|-------|--|
| 11:00 | 1. Adapting mineral indicators of sustainability to geothermal energy projects
<i>D. Shields (Mineral Economist, Dept. of Economics, Colorado State University, U.S.A), G. Blengini (Senior Researcher, Department of Production Systems and Business Economics, Politecnico di Torino, Italy), Verga F. (Politecnico di Torino, Italy)</i> |
| 11:20 | 2. Serving information requirements on environmental and social dimensions of mineral extraction by earth observation methods: First results from EO-MINERS
<i>D. Wittmer (Research Fellow, Wuppertal Institute for Climate, Environment and Energy, Germany), P. Schepelmann (Project Co-ordinator, Wuppertal Institute, Germany), S. Solar (Senior Associate Researcher, Geological Survey of Slovenia, Slovenia), W. Falck (Professor for Environmental Sciences, Université de Versailles Saint-Quentin-en-Yvelines, France)</i> |
| 11:40 | 3. Life cycle assessment as decision tool for sustainable choices in mineral materials field: environmental declarations of Belgian products and their foreign equivalents
<i>S. Belboom (Teaching Assistant, Department of Applied Chemistry, University of Liège, Belgium), R. Renzoni (Lecturer, Department of Applied Chemistry, University of Liège, Belgium), A. Léonard (Professor, Department of Applied Chemistry, University of Liège, Belgium), F. Tournour (General Secretary, Pierres et Marbres de Wallonie, Belgium)</i> |
| 12:00 | 4. TBA
<i>P. Chevalier (Director Strategic Outreach and Partnerships, Natural Resources of Canada - Minerals and Metals Sector (MMS), Canada)</i> |
| 12:20 | 5. Discussion
<i>Discussion of the presentations</i> |

Practicing Sustainability - Engineering Solutions for a Sustainable Development - IV

Thursday 16th June 2011, 11:00 - 12:30, FO2

- | | |
|-------|--|
| 11:00 | 1. Development of a new method for quality control in the quarry industry for practicing sustainability
<i>H. Tudehki (Managing Director, Institute of Mining, Technical University of Clausthal, Germany), A. Tayebi (Research Assistant, Institute of Mining, Technical University of Clausthal, Germany)</i> |
| 11:20 | 2. The effect of mine reclamation implementation on sustainability of |

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	Bibishahrbanoo Limestone Mine (Region) <i>M. Abdi Oskonei (Student, Amirkabir University of Technology, Iran), M. Osanloo (Professor, Amirkabir University of Technology, Iran)</i>
11:40	3. Sustainable bioremediation and industrial ecology model: A sustainable management alternative for mining industry <i>L. Reyes-Bozo (Professor, Escuela de Industrias, Facultad de Ingeniería, Universidad Andres Bello, Chile), A. Goday-Faúndez (Professor, Centro de Investigación para la Sustentabilidad, Facultad de Ecología y Recursos Naturales, Universidad Andres Bello, Chile)</i>
12:00	4. Assessing the contribution of underground in-situ coal gasification (UICG) within a sustainable development framework <i>Z. Hyder (Graduate Research Assistant, Department of Mining and Mineral Engineering, Virginia Tech, U.S.A), M. Karmis (Professor & Director VCCER, Department of Mining and Mineral Engineering, Virginia Tech, U.S.A)</i>
12:20	5. Discussion <i>Discussion of the presentations</i>

Mineral Resources Policies and Governance - IV

Thursday 16th June 2011, 11:00 - 12:30, FO3	
11:00	1. Tailings disposal options study for Sangam Iron Mine Project, Iran <i>S. Naraghi (MSc. Student, Science and Research Branch (SRB), Islamic Azad University, Iran), F. Rasbidinejad (Assistant Professor, Science and Research Branch (SRB), Islamic Azad University, Iran)</i>
11:20	2. The role of coal and CCS in energy policy and sustainable development of Turkey: Is it compatible to the EU energy policy? <i>K. Baris, A. Özarslan (Dr., Dept. of Mining Engineering, Zonguldak Karaelmas University, Turkey), N. Sabin (Dr., General Directorate of Mineral Research and Exploration of Turkey, Turkey)</i>
11:40	3. Uranium as nuclear fuel - scarce or sufficient available resource? <i>F. Charlier (Chief Engineer, Institute of Nuclear Fuel Cycle (INBK), RWTH Aachen University, Germany)</i>
12:00	4. Resource-related conflicts. Does the Kimberley Process Certification Scheme provide a solution? <i>L. Guesnet (Researcher, Bonn International Center for Conversion (BICC), Germany), M. Müller (Research Assistant, Bonn International Center for Conversion (BICC), Germany)</i>
12:20	5. Discussion <i>Discussion of the presentations</i>

Practicing Sustainability - Engineering Solutions for a Sustainable Development - V

Thursday 16th June 2011, 11:00 - 12:30, FO4	
11:00	1. Utilization of lignite fly ash as hydraulic binder and backfill material <i>G. Mucsi (Assistant Professor, Institute of Raw Materials Preparation and Environmental Processing, University of Miskolc, Hungary), B. Csöke (Professor, University of Miskolc, Hungary), I. Gombkötő (Assistant Professor, University of Miskolc, Hungary), J. Fajtli, B. Kovács (Associate Professor, University of Miskolc, Hungary), G. Földing (Director, Mecsek Éko Zrt., Hungary)</i>
11:20	2. The Assessment of noise from block cutting machines using the P-wave velocity <i>S. Kabraman (Dean of Mining Engineering Department, Nigde University, Turkey), M. Delibalta (Lecturer, Nigde University, Turkey), R. Comakli (Research Assistant, Nigde University, Turkey)</i>
11:40	3. Contribution of engineering methods to sustainable development of mining systems <i>T. Winkler (Head of the Laboratory of Modelling Methods and Ergonomics, KOMAG Institute of Mining Technology, Poland), M. Dudek, W. Chuchnowski, D. Michalak, J. Tokarczyk (Ph.D. Eng., KOMAG Institute of Mining Technology, Poland)</i>
12:00	4. Effect of mine water on the stability of underground coal mine roadways <i>T. Sasaoka (Assistant Professor, Dept. of Earth Resources Engineering, Kyushu University, Japan), H. Takamoto (General Manager, MMI Coal Tech Co. Ltd., Japan), H. Shimada (Associate Professor, Dept. of Earth Resources Engineering, Kyushu University, Japan), K. Matsui (Professor, Dept. of Earth Resources Engineering, Kyushu University, Japan), M. Ichinose (Technical Officer, CUIRE, Japan)</i>
12:20	5. Discussion <i>Discussion of the presentations</i>

Lunch

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Thursday 16th June 2011, 12:30 - 14:00, Lunch

- 12:30 1. Lunch
Lunch

Social Sustainability - II

Thursday 16th June 2011, 14:00 - 15:30, FO1

- 14:00 1. Growing pains in Australian regions in transition: Evidence of the "resource curse" or an absence of integrated planning?
A. Hoath (Post Doctoral Research Fellow, CGSB, Curtin University, Australia), L. Greer (Senior Research Officer, Central Queensland University, Australia), F. Haslam McKenzie (Professorial Fellow, CGSB, Curtin University, Australia)
- 14:20 2. How does a social licence operate? Modelling intergroup expectations, trust and behavioural intentions between companies and communities
K. Moffat (Social Research Team Leader, CSIRO, Australia), R. Parsons (Social Researcher, CSIRO, Australia)
- 14:40 3. Can human rights contribute to social sustainability?
L. Lipssett (President, LKL International Consulting Inc., Canada), S. Joyce (Principal, On Common Ground Consultants Inc., Canada)
- 15:00 4. Responsible coal sourcing: Taking the next step
A. Bayer (Head of Strategy, E.ON New Build & Technology GmbH, Germany), R. Strandahl (Business Director, E.ON Energy Trading SE, Germany)
- 15:20 5. Discussion
Discussion of the presentations

Practicing Sustainability - Engineering Solutions for a Sustainable Development - VI

Thursday 16th June 2011, 14:00 - 15:30, FO2

- 14:00 1. TBA
J. Hake (Director, Forschungszentrum Jülich GmbH, Germany)
- 14:20 2. Developing a practical mechanism for incorporating sustainability principles into mineral processing plant design and operation
G. Corder (Principal Research Fellow, Sustainable Minerals Institute, The University of Queensland, Australia), S. Green (CEO, Centre for Sustainable Resource Processing, Australia)
- 14:40 3. Mineral processing - Challenges for the future: Water, Energy and Masses
H. Wotruba (Head of Mineral Processing Unit, RWTH Aachen University, Germany)
- 15:00 4. A new proposal for reutilization of bauxite red mud: Exploring its use in isolation technologies for hazardous substances
D. Rubinos (Dpt. of Engineering Geology and Hydrogeology, RWTH Aachen University, Germany), F. Diaz-Fierros, M. Barral (Dpt. Edafología e Química Agrícola, University of Santiago de Compostela, Spain)
- 15:20 5. Discussion
Discussion of the presentations

Sustainable Supply Chains - II

Thursday 16th June 2011, 14:00 - 15:30, FO3

- 14:00 1. The CTC (Certified Trading Chains) mineral certification system: A contribution to supply chain due diligence and good governance in the mining sector of Rwanda and the Great Lakes Region in Central Africa
P. Schütte (Research Associate, BGR, Germany), G. Franken (Head of Mining Economics and Environment, BGR, Germany), M. Biryabarema (Director, Rwanda Geology and Mines Authority, Rwanda), J. Vasters, U. Dorner (Research Associate, BGR, Germany), F. Melcher (Senior Research Associate, BGR, Germany), D. Kuster (Head of Technical Cooperation Africa, Africa)
- 14:20 2. Market Development Iron Ore
J. Geimer (Manager Purchasing Raw Materials, ThyssenKrupp Steel Europe AG, Germany)
- 14:40 3. Mine tailings used as alternative materials for asphalt pavement
Z. Song (Researcher, Laboratory of Rock Engineering, Aalto University, Finland), M. Rinne (Professor, Laboratory of Rock Engineering, Aalto University, Finland), L. Korkkiala-Tanntu (Professor, Aalto University, Finland)
- 15:00 4. Does sustainable mining have any meaning?
D. Williams (Golder Professor of Geomechanics, School of Civil Engineering, The University of Queensland,

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- 15:20 *Australia*
5. Discussion
Discussion of the presentations

Practicing Sustainability - Engineering Solutions for a Sustainable Development - VII

Thursday 16th June 2011, 14:00 - 15:30, FO4

- 14:00 1. Sustainable underground mining operations at MOIL Limited
G. Manekar (Chief Mines, MOIL Limited, India), G. Kundargi (Director Prod. & Planning, MOIL Limited, India)
- 14:20 2. A vision on Indian coal mining strategy - Engineering solutions for sustainable development for future
B. Kumar (Chief General Manager, The Singareni Collieries Company Limited, India)
- 14:40 3. The applications of phosphogypsum in environmental remediation
B. Mesci (Assist. Prof. Dr., Faculty of Engineering, Ondokuz Mayıs University, Turkey), N. Turan (Assoc. Prof. Dr., Faculty of Engineering, Ondokuz Mayıs University, Turkey)
- 15:00 4. Removal of Cd 2+ from mining industry wastewater using Montmorillonite
F. Geyikçi (Assist. Professor, Faculty of Engineering, Ondokuz Mayıs University, Turkey)
- 15:20 5. Discussion
Discussion of the presentations

Coffee Break

Thursday 16th June 2011, 15:30 - 16:00, Foyer Kärnan

- 15:30 1. Coffee Break
Coffee Break

Critical Primary Resources and Natural Resources Management in Europe and Worldwide - II

Thursday 16th June 2011, 16:00 - 17:30, FO1

- 16:00 1. Critical raw materials and the EU
L. Tercero Espinoza, C. Gandenberger, F. Marscheider-Weidemann (Senior Researcher, Fraunhofer Institute for Systems and Innovation Research ISI, Germany)
- 16:20 2. The SARMA Project: Enhancing sustainable aggregates resource management and supply in Southeast Europe
S. Solar (Mineral Resource Geologist, Geological Survey of Slovenia, Slovenia), D. Shields (Mineral Economist, Dept. of Economics, Colorado State University, USA and Politecnico di Torino, Italy)
- 16:40 3. Consequences of the RMI and the EU report on critical metals
P. Weibed (Director CAMM - Centre of Advanced Mining and Metallurgy, Technical University of Lulea, Sweden)
- 17:00 4. Methods of geological-mining assets valuation based on results of geological works
H. Wirth (President, KGHM Polska Miedz S.A., Poland), J. Kudelko (Vicepresident, KGHM CUPRUM Sp. z o.o. CBR, Poland)
- 17:20 5. Discussion
Discussion of the presentations

German Federation of International Mining and Mineral Resources

Thursday 16th June 2011, 16:00 - 17:30, FO2

- 16:00 1. Bundling of German expertise in sustainable raw material economy
H. Brenke (Chairman of the German Federation of International Mining and Mineral Resources and President of BS - Consultants GmbH, Brenke Systemplanung GmbH, Germany)
- 16:20 2. Engineering solutions for sustainable development in German hard coal mining
H. Witthaus (Dienstleistung Bergtechnik, RAG Mining Solutions GmbH, Germany)
- 16:40 3. METSI - Innovative solutions and technologies for management of mining related water in South Africa
R. Schwarz (Geschäftsführender Gesellschafter, Geotec Rohstoffe GmbH, Germany), E. Pusch, A. Juch (Geotec Rohstoffe GmbH, Germany)
- 17:00 4. Transfer of German environmental expertise for mine site rehabilitation challenges worldwide - A case study: Vietnam
G. Deissmann, T. Cramer, O. Nitzsche, R. Barthel (Senior Scientist, Brenke Systemplanung GmbH, Germany), J. Pateiro Fernández (Head Mining and Environment, Brenke Systemplanung GmbH,

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17:20 Germany)
5. Discussion
Discussion of the presentations

Social Sustainability - III

Thursday 16th June 2011, 16:00 - 17:30, FO3

16:00 1. Social sustainable development in Vietnamese coal mining industry - challenges in occupational safety and health
J. Kretschmann (President, Technische Fachhochschule Georg Agricola, Germany), N. Nguyen (PhD Candidate, RWTH Aachen University, Germany)

16:20 2. Influence of work culture on job satisfaction of mining engineers: A case study
K. Ram Chandar (Assistant Professor, National Institute of Technology, India)

16:40 3. Overcoming local conflicts and production needs related to mining. Social impact assessment and local participation
G. Balletto, C. Furlas (Researcher, Faculty of Engineering, Cagliari University, Italy)

17:00 4. Producing a GIS based multi attribute decision making for social and environmental sustainability assessment in a copper mine in Iran
B. Farshadi (Project Manager, Kavosbgaran Consulting Engineers, Iran), B. Asi (Senior Mining Engineer, Kavosbgaran Consulting Engineers, Iran), M. Habibiyan (National Iranian Copper Co., Iran)

17:20 5. Discussion
Discussion of the presentations

Mineral Resources Policies and Governance - V

Thursday 16th June 2011, 16:00 - 17:30, FO4

16:00 1. Promoting sustainable development in the minerals industry: The phosphate project in Saudi Arabia
M. Aldagheiri (Department of Geography, Qassim University, Saudi Arabia)

16:20 2. Benchmarking political risk abatement strategies of coal companies in developed countries through data mining
W. Rogers (Graduate Student, Department of Mining and Geological Engineering, University of Arizona, U.S.A), S. Dessureault (Associate Professor, Department of Mining and Geological Engineering, University of Arizona, U.S.A)

16:40 3. Regional development planning in Western Australia#s Pilbara Region - Facilitating growth and building a positive social legacy
J. Gawler (General Manager Communities, Rio Tinto Iron Ore, Australia), B. Harvey (Global Practice Leader Communities, Rio Tinto, Australia), S. Nish (Principal Advisor, Rio Tinto, Australia)

17:00 4. N.N.
N.N.

17:20 5. Discussion
Discussion of the presentations

Coffee Break

Thursday 16th June 2011, 17:30 - 17:45, Foyer Kármán

17:30 1. Coffee Break
Coffee Break

Summary Session

Thursday 16th June 2011, 17:45 - 17:45, FO1

17:45 – 18:15 P.N. Martens / D. Shields / D. van Zyl

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Friday, 17th June 2011**Field Trip RWE Power AG****Rehabilitation of Lignite Open Pits and Resettlement**

Friday 17th June 2011, 09:00 – 14:00

RWE Power operations include lignite mining and lignite-based power generation, lignite upgrading, the extraction of bituminous coal and coal gas as well as gas-based power generation. The company has four big power plants in the Rhineland with total installed capacity of some 10.000 MW.

Because the lignite is located relatively close to the surface at depths of down to 400 m below unconsolidated rock, it must be mined in opencast operations. The huge bucket wheel excavators, the conveyor belts in the opencast mines and the spreaders deployed to backfill depleted pits incorporate top mining technology. The Garzweiler, Hambach and Inden mines currently in operation produce up to 100 million tons of lignite per year using this technology.

Opencast mining operations leave definite traces in the landscape. The entire surface above the coal must be removed - fields and forests, houses and streets. Geological conditions in the Rhineland do not allow lignite to be mined in underground operations.

All the same, anyone looking at former lignite mining fields today will appreciate the sense of responsibility and care that goes into recultivation work once a mine is depleted.

Experts in agriculture and forestry, biologists and geologists, ecologists and regional planners make in-depth efforts to create new housing and habitats for humans and nature that are on a par with what was - and may even be superior in places.

Duration: 5 hours
Participants: at least 10 persons
maximum 70 persons
Cost: Euro 100 per person



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WELCOME

Aachen International Mining Symposia
welcomes you to the 5th International Conference
"Sustainable Development in the Minerals Industry"
From Primary Production to Sustainable Supply Chains
sponsored by
RWE Power AG
Minova CarboTech GmbH
Hilti Aktiengesellschaft
Nickel Institute
Sandvik Mining and Construction Central Europe GmbH
Taylor & Francis Group



Prof. Dr.-Ing. Dipl.-Wirt.Ing.
Per Nicolai Martens

Dear Participant,

it is an honour and a pleasure for me, as head of the Institute of Mining Engineering I at the RWTH Aachen University and as chairman of the Executive Committee of AIMS, to welcome you here at Aachen at the 5th International Conference "Sustainable Development in the Minerals Industry" (SDIMI) within the "Aachen International Mining Symposia" (AIMS) conference series.

The AIMS series has come to be recognized by the mining and minerals society as a leader in promoting the international transfer of information on latest technologies, developments in research and overarching questions related to the minerals and mining industry. In view of the expressed interest by mining professionals from around the world, AIMS Symposia like "Rockbolting in Mining", "High-Performance Mine Production" and "Rapid Mine Development" have been organized on an annual basis since 1987.

SDIMI 2011 is the 5th in a series of international conferences dedicated to the issue of Sustainable Development in the minerals industry worldwide. This conference series is jointly organized by RWTH Aachen University (Germany), Virginia Tech University (USA) and the Technical University of Crete (Greece).

Given the necessity of an economic and resource efficient extraction of mineral raw materials on the one hand and its impacts on society and environment on the other hand, the SDIMI 2011 conference will deal with the latest trends in this area and show the road ahead.

About 100 presentations will be the showcase of a unique combination of hands-on industrial experience, institutional aspects and research developments in the field of Sustainable Development in the minerals industry. High-ranking representatives and experts from international companies, governmental institutions, geological services and research institutions from Europe, Australia, Brazil, Canada, Chile, India, Japan and the United States will present their experience and perspectives to more than 300 participants.

As a novelty in the SDIMI conference series, at a special session young researchers will be given the opportunity to engage in a dialogue about the latest research results and conclusive opinions on the issue of Sustainable Development.

In the heart of the imperial city of Aachen you will have ample opportunity at the conference, the exhibition and at the Dinner Party in the historical Aula Carolina to make contacts and renew old ones.

At this point, I would like to thank a large number of people for their help organizing and executing such an event. This includes authors, presenters, chairmen and the companies who support us by advertising in the proceedings. In particular I would like to thank our sponsors RWE Power AG, Minova CarboTech GmbH, Hilti Aktiengesellschaft, Nickel Institute, Sandvik Mining and Construction Central Europe GmbH and Taylor & Francis Group - and our organizing partners Virginia Tech University and Technical University of Crete and last but not least the City of Aachen and the RWTH Aachen University.

Come and take the opportunity to discuss the status quo and new developments with other experts of the mining world. Take a look at the preliminary program.

Looking forward to welcoming you in Aachen!

附件 3-米洛斯宣言

- The American Society of Mining and Reclamation
 - The Australasian Institute of Mining and Metallurgy
 - The Canadian Institute of Mining, Metallurgy and Petroleum
 - The European Federation of Geologists
 - The Iberoamerican Association of Mining Education
 - (The Asociación Iberoamericana de Enseñanza Superior de la Minería)
 - The Institute of Geologists of Ireland
 - The Peruvian Institute of Mining Engineers
 - (Peruvian El Instituto de Ingenieros de Minas del Peru)
 - The Society for Mining, Metallurgy and Exploration
 - The Society for Mining, Metallurgy, Resource and Environmental Technology
 - (Gesellschaft fuer Bergbau, Metallurgie, Rohstoff- und Umwelttechnik e.V.)
 - The Society of Mining Professors
 - (Societaet der Bergbaukunde)
 - The South African Institute of Mining and Metallurgy
 - The Spanish Association of Mining Engineers
 - (Consejo Superior de Colegios de Ingenieros de Minas)
-
- The Milos statement was introduced on the occasion of the 14th Annual General Meeting of the Society of Mining Professors (Societaet der Bergbaukunde), May 19 to 21, 2003 and the First International Conference on Sustainable Development Indicators in the Minerals Industry, May 21-23, 2003, held in the Island of Milos, Greece.
 - Contact Information:
 - The Society for Mining, Metallurgy and Exploration, Inc.
 - P. O. Box 277002, Littleton, Colorado, 80127, USA
 - Phone: (00)-1-303-973-9550
 - E-mail: sme@smenet.org
 - URL: <http://www.smenet>.

Milos Statement

May 2003

Contribution of the Minerals Professional Community to Sustainable Development

- **Who we are:** The minerals professional community comprises engineers, scientists, technical experts, and academics who work in, consult for, educate, study, or are in some other manner associated with the minerals industry.
- Society's transition towards a sustainable future cannot be achieved without the application of the professional principles, scientific knowledge, technical skills, educational and research capabilities, and democratic processes practiced by our community. Our members share a mutual responsibility with all individuals to ensure that our actions meet the needs of today without compromising the ability of future generations to satisfy their own needs.
- **What we believe:** We believe minerals are essential to meeting the needs of the present while contributing to a sustainable future.
- The process of civilization is one of advancing intellectual, social, and cultural development for all of humankind. An important aspect of the history of civilization is the scientific discoveries and technological advancements that transform raw materials into resources, thus providing the means for increased human well-being. The benefits and services derived from minerals, metals, and fuels can contribute to the achievement of a sustainable future because the inherent characteristics of these resources make productivity and consumption gains possible.
- Achieving a balance among economic prosperity, environmental health, and social equity will require significant changes in business strategies, operating technologies, personal behaviours, and public policies. Minerals professionals can engage with communities of interest in the process of improving quality of life by helping to balance the need for minerals, metals, and fuels against the need to protect the environment and society from unnecessary adverse impacts.
- **Our vision for the future:** Our minerals community will contribute to a sustainable future through the use of our scientific, technical, educational, and research skills in minerals, metals, and fuels.

- **What needs to be done to achieve our vision:**
- Professional Responsibility:
 - • Employ science, engineering, and technology as resources to people, catalysts for learning, providers of increased quality of life, and protectors of the environment, human health, and safety.
 - • Encourage the development, transfer, and application of technologies that support sustainable actions throughout the product and mine life cycles.
 - • Give high priority to identifying solutions for pressing environmental and developmental challenges as related to sustainable development.
 - • Address social equity, poverty reduction, and other societal needs as issues that are integral to minerals and mining related endeavors.
 - • Participate in the global dialog on sustainable development.
 - • Engage in all stages of the decision-making process, not only in the project execution phase.
- Education, Training, and Development:
 - • Attract the best people to the fields of mining and minerals by encouraging, facilitating, and rewarding excellence.
 - • Build up and maintain a critical mass of engineering, technical, scientific, and academic capacity through improved education and training.
 - • Promote the teaching of sustainability principles in all engineering programs at all academic levels.
 - • Support and commit funding to the infrastructure that enables nations to provide mineral education, professional training, information, and research.
 - • Prevent the loss of core competencies.
 - • Encourage a global exchange in academic training, as well as apprenticeship and internships programs.
- Communication:
 - • Support professional growth and interaction through books, articles, symposia, short courses, and conferences on minerals and mining in sustainable development.
 - • Share and disseminate to the public sound information, knowledge, and technology, including information on every aspect of minerals and mining, through print, electronic, and other appropriate media.
 - • Disseminate technical information on sustainable development and the role of the minerals, metals, and fuels in sustainable development, including information on the role of minerals in maintaining a high quality of life.
 - • Promote the achievements and capabilities of mineral community professionals to managers and executives, policy makers, and the general public.

AACHEN INTERNATIONAL MINING SYMPOSIA

Fifth International Conference



**Sustainable Development
in the
Minerals Industry**



Institute of Mining Engineering I

RWTH Aachen University, 14 - 17 June 2011



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Preface

The “Aachen International Mining Symposia” (AIMS) series has come to be recognized by the mining and minerals society as a leader in promoting the international transfer of information on latest technologies, developments in research and overarching questions related to the minerals and mining industry. In view of the expressed interest by mining professionals from around the world, AIMS Symposia like “Rockbolting in Mining”, “High-Performance Mine Production” and “Rapid Mine Development” have been organized on an annual basis since 1987.



Prof. Dr.-Ing. Dipl.-Wirt.Ing.
Per Nicolai Martens

As the mining industry worldwide recovers from the economic crisis, the question of how the industry will meet the demands of the triple bottom line are in focus more than ever. Thus, the challenges and the opportunities for the stakeholders in the process of Sustainable Development gain an ever increasing importance in our society.

Given the necessity of an economic and resource efficient extraction of mineral raw materials on the one hand and its impacts on society and environment on the other hand, the conference “Sustainable Development in the Minerals Industry” (SDIMI 2011) will deal with the latest trends in this area and show the road ahead.

SDIMI 2011 is the 5th in a series of international conferences dedicated to the issue of Sustainable Development in the minerals industry worldwide. This conference series is jointly organized by at the Institute of Mining Engineering I (BBK I) of RWTH Aachen University (Germany), Virginia Tech University (USA) and the Technical University of Crete (Greece).

The papers printed in this volume were presented at the RWTH Aachen University on 14 – 17 June, 2011 in the context of the AIMS conference series.

The offers to present a paper exceeded our expectations. As a result we weren't able to accept them all, despite parallel sessions. I kindly wish to thank those authors for their efforts whose papers could not be included in the program. We kindly invite them to participate in the next event.

At this point, I would like to thank a large number of people for their help organizing and executing such an event. This includes authors, presenters, chairmen and the companies who support us by advertising in the proceedings.

In particular I would like to thank our sponsors RWE Power AG, Minova CarboTech GmbH, Hilti Aktiengesellschaft, Nickel Institute and Sandvik Mining and Construction Central Europe GmbH - and our organizing partners Virginia Tech University and Technical University of Crete and last but not least the City of Aachen and the RWTH Aachen University.

I wish all parties interested in “Sustainable Development in the Minerals Industry” a beneficial conference.

Glückauf!

Aachen, June 2011

Per Nicolai Martens