



# Memorandum of Understanding



Freiberg, 11th of June 2012



## **Preamble**

As a result of the worldwide co-operation in mining science and resource technology, the signees created a permanent international platform, known as the World Forum of Universities of Resources on Sustainability (WFURS). In order to promote fruitful co-operation, the representatives of 58 Universities of Resources from 39 countries have decided to sign the following memorandum of understanding.

## **The Supply and Sustainability of Raw Materials**

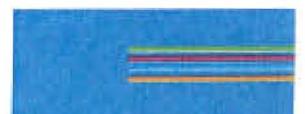
The exploitation of raw materials found in the earth's crust is a both part of a service in the interest of humankind and the basis for the development of modern societies. Thanks to the exploitation of mineral and fossil resources, we are able to enjoy the comforts of our everyday life and achieve the fulfilment of our basic human needs, such as habitation (building materials and energy) and food (fertilizer), as well as mobility (base metals) and communication (electronic metals). Further aspects of exploitation relate to the hitherto non-sustainable extraction of underground water resources (overpumping), the insufficient treatment of used water, and inappropriate soil management. In addition to utilising primary raw materials, the recyclability of secondary raw materials receives increasing attention. Only recycling processes are able to close the previously incomplete material cycles in a sustainable way and, thus, limit the exploitation of raw materials from the earth's crust to a necessary minimum.

The commodities market is characterised by a constant increase in demand, due to a growing global population, globalisation, industrialisation and a steady improvement of living standards. Strategies designed to reduce the consumption of raw materials or to promote the further development of recycling will not be able to prevent the medium-term production of raw materials, but they may be able to provide significant new approaches that can help to minimise the exploitation of the earth's crust. The world's ever-increasing demand for raw materials provokes the extraction of resources from more and more complex deposits under increasingly extreme conditions. Thus, intervention in natural environments and urban areas cannot be completely excluded, but should be minimised. However, risks and hazards for environment and society may increase.

The mining sciences are faced with the great challenge of not only securing additional raw material supplies to satisfy the growing demands of the future, but also to ensure that this is done in an economically priced, environmentally friendly and safe manner. A particular related focal point is the control, minimisation and the exclusion of negative consequences that the feedstock industry has on the environment. Therefore, further development of the principle of sustainable and responsible resource management is a mission of utmost urgency.

## **Detrimental Consequences of Primary Raw Material Processes (mineral processes)**

The universities dealing with the issue of primary raw material processes, particularly exploration, extraction, processing and further processing of mineral and fossil resources – hereafter named Resource Universities – state that the raw material processes lead to an intervention in existing natural, socio-cultural, ecological and



economical systems and relationships, which, despite all efforts, may still have negative effects.

This can result in negative consequences for the protected Earth resources: water, air, soils, humankind and nature, as well as cultural and material goods. Unfortunately, non-sufficient control of the raw material processes still leads to significant negative consequences, with partly catastrophic effects, such as leakages in deep-sea drilling, dam breaks at residue dumps, acidification of groundwater and surface water, large-scale landslides, mine gas explosions, rock bursts and other events, as numerous recent incidents have shown. The reputation and attractiveness of the resource industry suffers from such events.

### **Causes of Negative Consequences**

Causes of negative consequences in the mining industry are complex. This includes lack of or inaccurate knowledge, faulty management and lack of control, the acceptance of risks and secondary effects, as well as mislead motivation. Some of the greatest obstacles in the way of avoiding negative mining-related consequences are inadequate legal foundations, inadequate qualifications and a lack of environmental awareness and consciousness.

### **Crucial Requirements towards the Establishment of the Sustainability Principle in University Education**

The Resource Universities bear a great responsibility with regard to working toward the elimination of existing deficits in avoiding, recognizing and remedying negative consequences of raw material processes. With the (ongoing) education of qualified employees and managers, and by setting a clear orientation toward responsible and sustainable raw material processes (this applies to both primary and secondary raw materials), the Resource Universities have the opportunity to remedy faults on a medium-term and long-term basis.

To fulfil this responsibility, the Resource Universities obligate themselves to include sustainability-relevant subject areas in the curriculum of study programmes on resource processes. The core topics are process understanding and modelling, technical and management solutions toward a responsible management of scarce natural resources, such as water, earth, air, soils, energy and materials, as well as the protection of nature, landscapes and the human health. These topics should integrate subjects such as Best Available Technologies (BAT), Best Practice, Life Cycle Assessment, Key Indicators or Leading Occupational Health and Safety and Environmental Protection Standards, as well as established legal regulations for sustainable raw material processes. The interaction with the entire process chain and the environment needs to be considered, when examining individual raw material processes. The interventions on the protected resources, which are a result of the raw material processes, have to be discussed in a transparent and individual manner.

The issue of sustainability is to be established as a principle of corporate management. Qualified employees and managers have to be sensitised toward responsible action. The polluter liability principle has to be applied for the remediation of negative consequences caused by raw material processes. It is considered necessary that knowledge should be propagated, provided on a global scale, harmonised and networked.



## Implementation

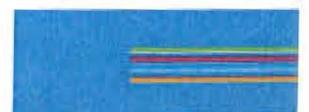
The Resource Universities obligate themselves to implement the necessary measures:

- to augment the level of public resource awareness and to advocate a knowledge-based, neutral shaping of public opinion
- to define education standards, with regard to content and quantity, for sustainability of raw material processes
- to ensure a close relationship between theory and practice
- to promote scientific research as the fundament toward a higher level of educational quality
- to carry out quality control of the educational standards
- to ensure that relevant teaching content is freely available
- to promote the mobility of students and lecturers with regard to encouraging an exchange of teaching contents and methods, as well as knowledge
- to develop a lasting international network

## Activities

To realise these goals, the Resource Universities oblige to form working groups dealing with the following (initial) topics:

- **Principles of Sustainability Science:**
  - Definition of the contents of responsible and sustainable raw material processes.
  - Constant further development of the sustainability concept in close cooperation with respective industry, economy and administration.
  - Preparation of a concept for the development of resource awareness in society.
- **Education:**
  - Analysis of existing study programmes on raw material processes and existing consideration of the aspects of sustainability.
  - Analysis of the strengths and weaknesses.
  - Definition of minimum requirements of teaching contents and volume, regarding sustainable development, in courses of study on raw material processes.
  - Development of appropriate teaching methods.
  - Preparation of teaching materials and integration of best practice of sustainability science in training and further education programmes.
  - Assurance of student mobility (excursions, partial studies, ...) and of lecturers for the exchange, supplementation and qualification of teaching contents.
  - Development of a new national and international study programme with a focus on sustainable raw material processes.
  - Development of tools for the quality assurance of the study; accreditation and certification.



• **International Networking:**

- Preparation of policy documents for a permanent World Forum on Sustainability and for its financing.
- Development of guidelines for the cross-boundary utilisation of resources.
- Development of standards for the membership in World Forum.
- Development of a concept for a regular exchange of information and conferences.
- Development of an internet platform for the provision of the latest information and teaching content.
- Preparation of information material and publicity material.
- Establishment of a brand and of respective honours.

The way forward for the further development of the World Forum of Resource Universities, such as, e.g., the drafting a constitution, the rules and procedures, and the definition of a roadmap for the implementation, will be prepared by an executive committee and presented latest at the next World Forum meeting. This executive committee shall be formed by six members, each representing one continent (Africa, Asia, Australia, Europe, North America, and South America).

The Resource Universities intend to arrange the next World Forum on ... (month, year) in ..... (location).

The following universities form an executive committee to prepare for the next forum:

... (list)



Mining University St. Petersburg  
St. Petersburg (Russia)



TU Bergakademie Freiberg  
Freiberg (Germany)



**Signees** (alphabetical order by geographical location)

RWTH Aachen  
Aachen (Germany)



Akita University  
Akita (Japan)



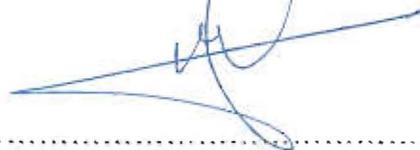
Ecole des Mines d'Ales  
Ales (France)



Kazakh-German University  
Almaty (Kazakhstan)



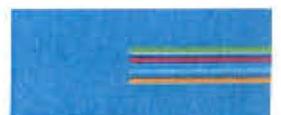
National Technical University of Athens  
Athens (Greece)



North University Centre of Baia Mare  
Baia Mare (Romania)



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**Signees continued** (alphabetical order by geographical location)

Institute of Technology Bandung  
**Bandung** (Indonesia)

Chulalongkorn University  
**Bangkok** (Thailand)

UPC-Universitat Politècnica de Catalunya  
**Barcelona** (Spain)

China University of Mining and Technology  
**Beijing** (China)

University of Belgrade  
**Belgrade** (Serbia)

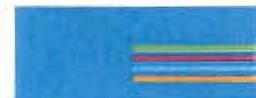
Virginia Polytechnic Institute and State University  
**Blacksburg** (USA)

Technical University of Crete  
**Chania** (Greece)

Technical University of Clausthal  
**Clausthal-Zellerfeld** (Germany)

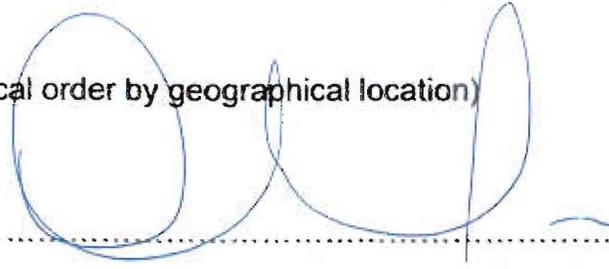
University of Concepción  
**Concepción** (Chile)

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**Signees continued** (alphabetical order by geographical location)

Universidad de Atacama  
Copiapo (Chile)



Delft University of Technology  
Delft (Netherlands)

Central Institute of Mining & Fuel Research  
Dhanbad (India)

P.K. Singh

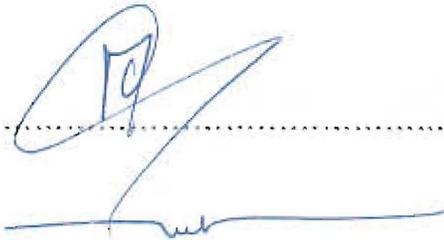
National Mining University Dnepropetrovsk  
Dnepropetrovsk (Ukraine)



Ekibastuz Engineering-Technological K. Satpayev Institute  
Ekibastuz (Kazakhstan)



Silesian University of Technology  
Gliwice (Poland)



Hanoi University of Mining and Geology  
Hanoi (Vietnam)

University of Zimbabwe  
Harare (Zimbabwe)



Michigan Technological University  
Houghton (USA)



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**Signees continued** (alphabetical order by geographical location)

University of Johannesburg  
Johannesburg (South Africa)



University of the Witwatersrand  
Johannesburg (South Africa)

Karaganda State Industrial University  
Karaganda (Kazakhstan)

Technical University of Kosice  
Kosice (Slovakia)



AGH University of Science and Technology  
Krakow (Poland)

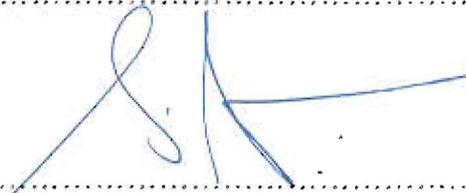
Kyushu University  
Kyushu (Japan)



University of Engineering & Technology Lahore  
Lahore (Pakistan)



Montanuniversität Leoben  
Leoben (Austria)



Pontificia Universidad Catolica del Peru  
Lima (Peru)

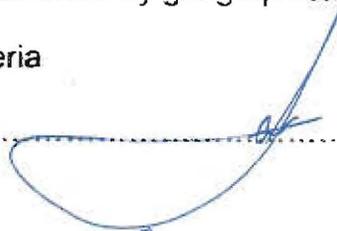


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**Signees continued** (alphabetical order by geographical location)

Universidad Nacional de Ingenieria  
Lima (Peru)



University Miskolc  
Miskolc (Hungary)



Gubkin Russian State University of Oil and Gas  
Moscow (Russia)



National University of Science and Technology  
Moscow (Russia)



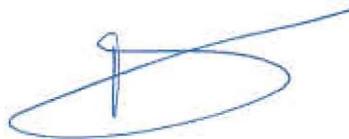
Moscow State Geological Prospecting University  
Moscow (Russia)



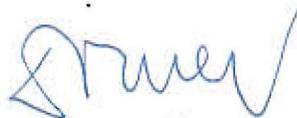
Moscow State Mining University  
Moscow (Russia)



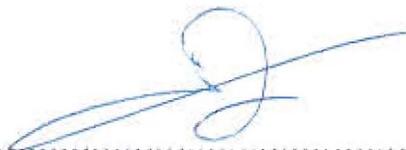
Ecole des Mines de Nancy  
Nancy (France)



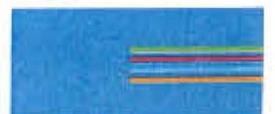
VSB-Technical University of Ostrava  
Ostrava (Czech Republic)



University of Petrosani  
Petrosani (Romania)



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**Signees continued** (alphabetical order by geographical location)

Universidad Autónoma "Tomás Frías"  
Potosí (Bolivia)

.....

RSGO Rudny Industrial Institute  
Rudny (Kazakhstan)

.....

University of Mining and Geology St. Ivan Rilski  
Sofia (Bulgaria)

.....



National Cheng Kung University  
Tainan City (Taiwan)

.....

University of Mines and Technology Tarkwa  
Tarkwa (Ghana)

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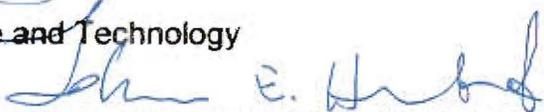
State University of Tirana  
Tirana (Albania)

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Norwegian University of Science and Technology  
Trondheim (Norway)

.....



University of Tuzla  
Tuzla (Bosnia / Herzegovina)

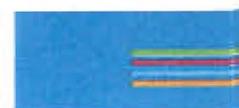
.....

Ukhta State Technical University  
Ukhta (Russia)

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**Signees continued** (alphabetical order by geographical location)

**Mongolian University of Science and Technology**  
**Ulaanbaatar** (Mongolia)



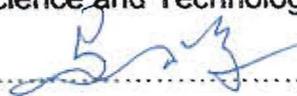
**Uppsala University**  
**Uppsala** (Sweden)



**Polytechnic of Namibia**  
**Windhoek** (Namibia)



**Wuhan University of Science and Technology**  
**Wuhan** (China)



**State Engineering University of Armenia**  
**Yerevan** (Armenia)



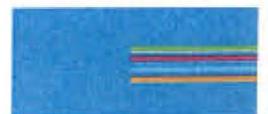
**University of Pembangunan Nasional "Veteran"**  
**Yogyakarta** (Indonesia)

**Society of Mining Professors**  
**(International)**



**INFOMINE Scholarly Internet Resource Collections**

Freiberg, 11th of June 2012



Prince of Songkla University   
Thailand.

**Signees continued**

**Prof. Dr. A. Murat TUNCER**  
Rektör

Hacettepe University  
Ankara (Turkey) .....



Ankara, 11th of June 2012

