



## **SCIENTIFIC AND SUSTAINABLE MINING**

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The topic selected for this Seminar is very timely particularly when we are expecting a surge in mining activity following the acceptance and the implementation of the recommendations of Hoda Committee now before the Government of India. The title words “scientific” and “sustainable” are complementary : what is “scientific” should be sustainable and what is “sustainable has to be scientific. Termination of World War II resulted in catapulting economic and social fabric of the people world-wide. Establishment of peace and better health and education facilities and growth in population, particularly in the newly freed colonies, required re-engineering of the manufacturing process. During early sixties “re-engineering” of a company was a fashionable concept. However, in late eighties, a new and more catchy phrase “sustainable” was coined which has since become *sine qua non* for everything that one does or lives with.

### **CONCEPT**

2. While we do talk and use the word “sustainable”, nobody, atleast me, knows what it really means. Its interpretation is as varied as that of “democracy”. However, the World Commission on Environment and Development, popularly known as Brundtland Commission (constituted in 1983), in its report submitted to UN in 1987 defined sustainable development “to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs”. The Brundtland Commission’s definition came out of a scare generated by Club of Rome which in 1956 warned that the rate at which the



mineral resources were being exploited, a day was not far when the world will be left without any resources. This scare was repeated in 1974 when the Club of Rome argued that there would be limits to growth based on availability of resources. In the case of mineral resources, it was believed that global depletion of certain resources was imminent within the next few decades.

3. The alarmist attitude of Club of Rome was probably because of the fact that they had not anticipated the phenomenal technological developments. Minerals are elements of nature and are therefore re-cycleable. Today metals are being re-cycled upto 80-90% ( more than half of the metals used in Europe are from recycling) and there is also a better and more efficient utilisation of these resources. Over the course of time, the efficiency of usage of metals has increased by a factor of four and subsequently to a factor of ten. New technological developments have since taken place which has put the apprehension of Club of Rome way behind.

4. I therefore do not agree with the definition given by Brundtland Commission simply for the reason that there cannot be any unbridled exploitation even if one wants to because of limitation of market forces. One can exploit to the extent it is demanded and at an economic price. The myth that the present generation is exploiting resources unmindful of the future generation is not borne out by facts. This sort of thought-process will deprive the present as well as future generations optimal utilisation of resources. Scientific and technological developments have made today's waste into tomorrow's resources. It may be what we preserve today, the future generation may not require that at all. We cannot therefore envisage what the world will require, let us say, 100 years hence at that level of technological developments.

5. One cannot envisage the pace of technological developments or quiet revolution taking place without much fanfare world wide. Already work is on full



pace on the development of nano-technologies\* leading to production of light, low-density and high strength materials to replace steel and other metals. Prof. Ray Baughman of University of Texas created a material in 2004 which is stronger than steel, transparent and very light. A hectare-size sheet would weigh just 280 grams. Carbon in the form of graphite is soft, malleable and easily broken. But carbon nanotubes, a very thin sheet of graphite formed into a tube — a tiny strawlike cylinder as small as half a nanometre wide — are upto 100 times stronger than steel and six times lighter. These are hardest, stiffest, strongest materials known and are among the world's best conductors of heat and electricity. They can carry some 1000 times more electrical current than copper wire. Further, there are technologies under development to derive energy from nuclear fusion which may make coal redundant for energy generation. Efficient and better usage of these elements of nature would almost ensure that the world will never be able to foresee a time when there is a possible danger of resource exhaustion, renewable or non-renewable.

6. I made a study of the resources of some of the minerals which existed in 1970 and in 1997, after adjusting production between 1970-96:

**Reserves : 1970 and 1997  
(plus cumulative production from 1970 to 1996)**

	<b>1970 Global Resources (Club of Rome)</b>	<b>1970-96 Cumulative mine production (WBMS/ABMS)</b>	<b>1997 Global Reserves (USGS)</b>
Copper	279 x 10 <sup>6</sup> tonnes	226 x 10 <sup>6</sup> tonnes	310 x 10 <sup>6</sup> tonnes
Zinc	112 x 10 <sup>6</sup> tonnes	178 x 10 <sup>6</sup> tonnes	140 x 10 <sup>6</sup> tonnes

\* Nano comes from the Greek word for dwarf. Usually nanotechnology is defined as the study and manipulation of matter smaller than 100 nanometres - that's the scale of things like molecules and viruses. Ten hydrogen atoms nestled up against each other are just one nanometre long. And one million nanometres fit into a millimetre. Hard to grasp? Think of it this way: if a person was a nanometre wide, then 13 million of them, standing shoulder to shoulder, would fit on your thumbnail.



Silver	171 x 10 <sup>3</sup> tonnes	326 x 10 <sup>3</sup> tonnes	280 x 10 <sup>3</sup> tonnes
Gold	11 x 10 <sup>3</sup> tonnes	43 x 10 <sup>3</sup> tonnes	46 x 10 <sup>3</sup> tonnes

WBMS - World Bureau of Metal Statistics  
ABMS - American Bureau of Metal Statistics  
USGS - United State Geological Survey

It would be observed that having exploited between 1970 and 1996 more resources than what existed in 1970, the resources in 1997 were still enough to put the apprehensions of the Club of Rome as well as the Brundtland Commission in the background. On the other hand, ironically, it is the so-called renewable resources that are under intense pressure and threat of scarcity (e.g. fish, agricultural land and fresh water).

## **SUSTAINABLE DEVELOPMENT**

7. This however does not mean that the minerals should not be exploited scientifically and consumed/processed in a way where they are utilised fully. Exploration, extraction and primary metal-processing activities create wealth contributing to sustainable development. These activities can help alleviate poverty, particularly in remote areas and foster sustainable improvements in the health, education, prosperity and standard of living of communities near about the mining areas. If properly managed, the development and use of natural resources can result in the generation of financial and physical assets, including roads, buildings, power grids, hospitals and schools. Such activities can also spur the development of human capital, in terms of educated and trained workers and professionals as well as the formation of institutions that can support the well-being of society, good governance and human rights.

8. The transformation of natural resources into other types of capital can provide sustainable economic and social benefits, even after the closure of mining and metal-processing industries. The realisation of these benefits and



their equitable distribution require the implementation of appropriate policies. The country has developed enough capacity to deliver social services and promote the growth of local and regional economies.

## **ENVIRONMENTAL PROTECTION AND CHANGING CORPORATE CULTURES**

9. While the environmental footprint of mining is relatively small in comparison with agriculture, urban sprawl and other forms of land use, the intrusive nature of this activity cannot be denied. Regional development stimulated by mineral discoveries may have substantial effects due to the growth of population and infrastructure. There can also be impacts on biodiversity, and where minerals are found in remote areas, on the traditional lifestyles and cultures of indigenous peoples.

10. With respect to environmental protection, significant technological and managerial progress has been made in the development of less intrusive exploration methods, cleaner and more efficient process and control/containment technologies, environmental management systems and land rehabilitation techniques. While each environment presents its own unique set of challenges, experience has shown that the application of sound technology and best practices throughout all phases of the mining cycle can ensure the protection of the environment.

11. Changing societal values have had a profound impact on corporate culture and ways of doing business. Today, leading mining and metal-processing companies are committed to providing sustainable economic and social benefits to the communities in which they operate, while minimising adverse environmental and community impacts. Many companies have put in place environmental policies and management systems that require regular audits and public reporting.



## **SUSTAINABLE MINING RESEARCH NETWORK (SMRN)**

12. We in FIMI have given deep thought on sustainable mining operations for some time. A study was also made by a Committee under the Chairmanship of Shri G.L. Tandon, former Chairman, Coal India Ltd. It was felt that there is a need to create an institutional frame work for a constant interaction between the industry, community, government, environmentalists and all affected stake holders. We have decided to conceptualise a **Sustainable Mining Research Network (SMRN)**, a voluntary institution involving the industry, government, community, environmentalists as well as international organisations.

13. Creation of SMRN would aim to

- develop policy mechanism and institutional support work such as collaboration between mining units, government, community, etc.
- promote regulatory flexibility e.g. performance standards
- avoid uncertainty in policy formation
- remove disincentive for clean up
- creation of an apex body - custodian of closed mines and profitable usage of abandoned/worked out mines.

14. SMRN work would include:

- expression of financial incentive to promote ecologically proficient practices, technology innovations and socially acceptable responsible mining practices.
- use of regional ecological assessment and planning techniques as a ongoing process
- market definition that would indicate the extent to which progress towards sustainable development objective could be met.



- education, research and training to create and enhance awareness throughout the mining stake holders, workforce and the community living in and around mining areas.
- encourage demonstration and pilot projects to simulate clean technology, support collaborative policy research and dissemination activity.
- tie up with international organizations for best mining practices.

15. SMRN would also develop strategy and modalities for developing community development programme

- (i) Survey and projectization of the felt-needs through leading NGOs, self-help-groups or specially constituted community contact teams.
- (ii) Formulation of a comprehensive package, besides cash compensation, which would include:
  - Alternate agricultural land for resettlement in colony.
  - Employment package, direct and indirect jobs, out sourcing of jobs, unskilled and secondary functions given to local village bodies on contract, etc.
  - Participation of local people in managing mining operations as well as reclamation of the areas after mining operations are over.
  - Usage of worked out/exhausted mines as a commercial venture.
  - Capacity building of local people for gainful employment by training either by the organisation or involving NGOs.
- (iii) Separate special package for tribal in the Scheduled Tribe Area in consultation with local panchayats and Panchayat Samiti.



## CONCLUSION

16. While dealing with the concept of sustainable development, I have only limited myself to macro-viewpoint. The papers to follow will throw more light on the micro-aspects relating to various stages of mining. In fact, at micro-level, the concept of scientific and sustainable mining will change from area to area, mine to mine, deposit to deposit and mineral to mineral. Let this be dealt by those experts who are more experienced.

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