Sustainable Development Indicators for the Greek Industrial Minerals’ Sector

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1. INTRODUCTION

Since the concept of Sustainable Development (SD) became established, Sustainable Development Indicators (SDIs) have been seen as a prominent tool for the evaluation of different sectors of the mining and minerals industry. To this end, numerous, mostly voluntary, activities emerged proposing a set of SDIs for the establishment of a SD framework and for the measurement and assessment of the mining sector.
why Greece

- Due to its active participation in the global mining activities and
- as a member of the European Union, Greece’s mining and mineral industry is engaged to take part in the debate of SD and should be capable of responding to the challenges first raised at the Earth Summit Conference in Rio de Janeiro in 1992.
The Greek Mining Enterprises Association (GMEA) adopted in 2006 the 'Code of principles for SD' and agreed to work actively towards continuous improvement in economic, environmental and social performance.

GMEA presented ten sets of SDIs and asked members of the association to adopt them for the measurement and the assessment of the sector performance as a whole.
2. THE CONCEPT OF SD IN THE MINING AND MINERALS INDUSTRY

“Meeting the needs of the present generation without compromising the ability of future generations to meet their needs Brundtland (1987)”

- In the mining industry sustainability has been frequently considered as a controversial issue because it involves the extraction of non-renewable resources

- According to Mikesell, 1994 the concept of sustainability for the sector can be communicated as the maintenance by each generation of the capital value of the natural resources it inherits
1998, a new initiative, the Global Mining Initiative (GMI), was launched.

May 1999, the International Institute for Environment and Development (IIED) undertook a scoping study.

2002, the final report completed, known as the MMSD Report.

2004, a working group (Raw Materials Supply Group) was set up to develop SDIs for the sector.
the identification of key economic, environmental and social issues as well as the level of concern for stakeholders are considered of major importance.
Sustainability Indicators for the mining sector (based on Azapagic, 2004)
The mining and metallurgical sector in Greece covers a wide range of mineral commodities.

Source: 2006 annual review GMEA
### Key players in the Greek Industrial Minerals Sector

<table>
<thead>
<tr>
<th>Mining Company</th>
<th>Major Commodities</th>
</tr>
</thead>
<tbody>
<tr>
<td>S&amp;B Industrial Minerals S.A.</td>
<td>Bentonite, Perlite, Bauxite, Vollastonite</td>
</tr>
<tr>
<td>Grecian Magnesite S.A.</td>
<td>Magnesite, Caustic Magnesia, Dead burned Magnesia</td>
</tr>
<tr>
<td>Dionyssos Marbles Ltd.</td>
<td>Marble, Ornamental Stones, Various fillers</td>
</tr>
<tr>
<td>Lava Mining and Quarrying Co S.A</td>
<td>Pumice, Pozzolane, Gypsum, Quartz</td>
</tr>
<tr>
<td>Mevior S.A.</td>
<td>Feldspar</td>
</tr>
<tr>
<td>Elvior S.A.</td>
<td>Quartz</td>
</tr>
<tr>
<td>Ionian Kalk S.A.</td>
<td>Calcium carbonate /filler grade, Talk, Dolomite</td>
</tr>
<tr>
<td>Microfill - K.Zafranas S.A.</td>
<td>Various fillers</td>
</tr>
<tr>
<td>Possehl S.A.</td>
<td>Filler products, Refractories</td>
</tr>
<tr>
<td>Geohellas S.A.</td>
<td>Attapulgite</td>
</tr>
<tr>
<td>Interbeton Construction Materials S.A.</td>
<td>Kaolin, Pozzolane</td>
</tr>
</tbody>
</table>
“Cradle to grave” approach for the exploitation of Industrial Minerals
**SDIs for the Greek Industrial Minerals’ Sector**

- Greek Mining Enterprises Association announced in 2006 its commitment to embrace and apply the ‘Code of Principles for Sustainable Development’ and agreed to work actively towards continuous improvement in economic, environmental and social performance. Furthermore, it proposed a set of SDIs for the measurement and the assessment of the performance of the sector as a whole.

- An effort is made in this paper to develop SDIs tailored for the Greek Industrial Minerals Sector due to its importance for the national economy. The development of SDIs is based on a holistic approach ‘from cradle to grave’.
## Appropriate SDIs for the Greek Industrial Minerals Industry

**Indicators measuring:**

<table>
<thead>
<tr>
<th>SDIs proposed by:</th>
<th>Units</th>
<th>SDIs proposed by:</th>
</tr>
</thead>
<tbody>
<tr>
<td>GMEA Authors</td>
<td></td>
<td></td>
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</tbody>
</table>

### 1. Employment

- **a. Average number of people directly employed**
- **b. Average number of people indirectly employed (including contractors)**
- **c. Total number of hours worked (including a and b)**
- **d. Creation of new workplaces**
2. Development of Skills

a. Total number of training hours

<table>
<thead>
<tr>
<th>Hours per employee or %</th>
<th>Hours</th>
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</thead>
</table>

b. Training in innovative production & waste management techniques per year
### 3. Health and Safety of employees

<table>
<thead>
<tr>
<th>a. Number of working hours lost per year due to accidents</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>b. Number of hours of training in Health &amp; Safety</td>
<td>Number</td>
</tr>
<tr>
<td>c. Number of fatalities</td>
<td>Number</td>
</tr>
<tr>
<td>d. Frequency indicator for employees under supervision</td>
<td>Number</td>
</tr>
<tr>
<td>e. Seriousness indicator for employees under supervision</td>
<td>Number</td>
</tr>
<tr>
<td>f. Number of employees that are periodically under medical supervision</td>
<td>Number</td>
</tr>
<tr>
<td>g. Number of accidents (fatalities) per e.g. 100 workers or 1000 t of final product per year</td>
<td>%</td>
</tr>
<tr>
<td>h. Lost working hours per t of final product per year</td>
<td>Hours/ton</td>
</tr>
</tbody>
</table>
4. Total turnover & production
   a. Total turnover  
      Million €
   b. Production of marketable product  
      tonnes
   c. Daily production per employee  
      tonnes/employee
   d. Increase of annual income in nearby areas  
      %

5. Exploration costs
   a. Total exploration costs  
      Million €
   b. R&D cost as % of turnover per year  
      %
6. Communication with the local community

   a. Number of public events - “open days”
   
   b. Number of pupils/students visited the plant
   
   c. Number of trained students
   
   d. Resources available to the local community (infrastructure, unions, support, awards etc)
   
   e. Resources available to the wider community (same as d)
   
   f. Public acceptance
## 7. Energy Demand

a. Total energy consumption or per tonne of final product \( \text{MJ or MJ/t} \)

b. Reduction in energy consumption over a given period (e.g. 3 years) \( \% \)

c. Increase in the use of green energy over a given period (e.g. 3 years) \( \% \)

## 8. Water Demand

a. Total net water consumption (or water consumption per t of final product) \( 000 \text{ m}^3 \) (m\(^3\)/t)

b. Water consumption during production \( 000 \text{ m}^3 \)

c. Water consumption during environmental rehabilitation \( 000 \text{ m}^3 /\text{he} \)
9. Waste Management

a. Wastes from mining activities the current year

b. Wastes from mining activities used for backfilling

c. Volume of (hazardous) wastes produced

d. Volume of (hazardous) wastes produced per t of product

e. Volume of wastes recycled or/and used as added value material per t of product

f. Volume of greenhouse gases produced

g. Volume of greenhouse gases produced per t of product

h. Recycled water used per total water consumption
10. Land Demand - Environmental Rehabilitation

a. Total land in use for deposit exploitation at the end of the calendar year (rehabilitated surface is excluded)  hectares

b. Total new land for deposit exploitation the current year  hectares

c. Total land surface returned to beneficial use or rehabilitated by planting trees  hectares

d. Total land surface recreated (e.g. golf courses, open theatres etc)  hectares

e. Number of planted trees per unit (e.g. hectare)  Number

f. Cost for rehabilitation of mines and protection of the environment  000 €
11. Use of dangerous substances

a. Quantity of classified dangerous substances used in the production process (lubricants are excluded) according to the Directive 67/548/EEC

b. Increase in the use of environmental friendly reagents over a given period
4. CONCLUSIONS

- Greece’s mining and mineral industry is engaged to take part in the debate of sustainable development. The Industrial Minerals sub-sector plays a significant role.

- In order to measure and assess sustainability for the sector, SDIs have been seen as the predominant tool.

- For the case of Greece, in 2006 GMEA proposed a set of ten groups of SDIs for the assessment of mining operations.

- Additional SDIs were introduced and a new grouping was proposed aiming at enhancing the existing SDIs system and improving environmental, social and economic performance looking to increase competitiveness and credibly of the sector in the global market.
Thank you for your attention