



U.S. Department of Energy
Energy Efficiency and Renewable Energy

industrial technologies program

Mining Energy Analysis

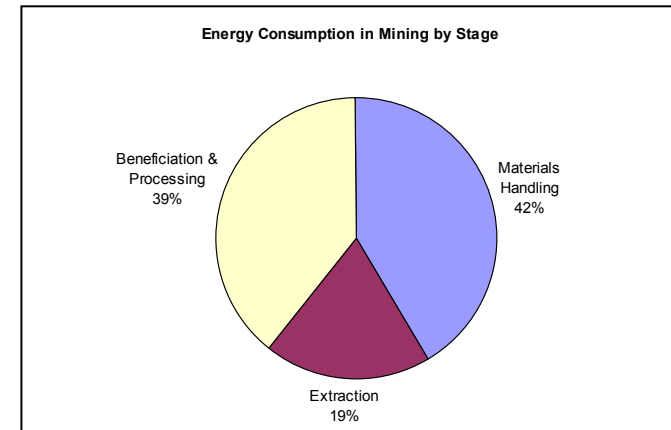
Mining Industry of the Future

January 27, 2004



Mining IOF Targets

- Reduce energy consumption in **Materials Handling**
 - Diesels accounts for 87% of energy used in **Materials Handling**
 - Target – develop alternatives to diesel technologies
- Reduce the energy consumption in **Beneficiation & Processing**
 - Comminution activities account for 75% of energy used in Beneficiation & Processing
 - Target – develop energy efficient alternatives to current comminution processes
- Reduce the energy consumption and increase recovery efficiencies in **Extraction**
 - Improvements in Extraction will reduce energy use in Materials Handling & Beneficiation and Processing: Target improve Extraction efficiencies
 - Pumps account for 41% of Extraction: Target – develop alternatives to pumps



Includes coal, hard rock (metals), and industrial minerals mining. Sand and Gravel is included in industrial minerals.



Target Area Barriers

- **Materials Handling**
 - Alternatives to diesel trucks are not cost effective or technology proven. Any alternatives must be cost effective and meet or exceed current production capacity.
- **Beneficiation & Processing**
 - Lack of materials that can withstand these high-impact environments
 - Inability to design systems that can predict the behavior of crushing and grinding processes.
 - Inability to minimize and pinpoint the specific location of energy losses in current crushing and grinding activities.
- **Extraction**
 - Lack of sorting process sensors and method for selective mining
 - Lack of knowledge to expand application of in-situ copper/gold mining for other commodities.



Methodology Used to Develop Targets

1. Analyzed E&E Profile results: estimated energy consumption by commodity on per ton & total mine basis for:
 - Mining technologies
 - Processing technologies

2. Grouped mining technologies into three stages
 - Materials Handling
 - Beneficiation and Processing
 - Extraction

3. Identified most energy intensive technologies within each stage
 - Diesel technologies in Materials Handling
 - Comminution (crushing and grinding) in Beneficiation and Processing
 - Pumps in Extraction



Criteria Discussed at Development Workshops

- Operating costs
- Provide analysis that demonstrates the scope of the project (is it a grand challenge effort)
- For the given application, proposers must provide
- Demonstration of zero degradation with regard to product quality and variance to address process control issues
- An environmental analysis that defines emission units and shows estimated reductions
- Description of benefits and improvements in worker safety and health issues
- A risk assessment that addresses barriers, pathways, and decision points
- Worker safety and health such as dust and noise control, ergonomics, and miner exposure
- Durability and reliability
- Flexibility and availability demonstrating compatibility with existing plant and flow sheet and capacity for future expansion
- Maintainability and support services
- Environmental issues such as emissions, noise, water use/quality, and footprint of equipment size
- Productivity including automation and instrumentation and quantity processed over time
- Equipment/Process capacity
- Product quality of end products through selectivity addressing product and waste issues, the ability to alter chemistry to increase value added, and mixing and segregation issues.
- Process/Equipment training issues and personnel costs
- Technology life addressing obsolescence
- Process integration and consolidation of unit operations
- By-product handling
- Process requirements



Recommendations for Proposal Structure

- Proposal development time should be a minimum of 120 days
 - 2 week review of draft solicitation
 - 90 day issued solicitation
- Cost share as low as 30%
- Must have a minimum of 2 mining partners. They can be either:
 - 2 mining companies**OR**
 - 1 mining company and 1 equipment manufacturer/remanufacturer or service provider to the mining industry
- Project life time 1-6 years
- Evaluation points; Go/No Go decision points must be included in the project