

mining

Mining — Industry of the Future



The mining industry is developing new technologies for exploration, mine development and operation, and mineral processing that will lead us to the Mining Industry of the Future.



Office of Industrial Technologies



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

Unified vision fosters collaborative partnerships

Why work together?

By adopting the Industries of the Future strategy and remaining actively engaged in all aspects of the Office of Industrial Technologies partnership, the mining industry today enjoys:

- A powerful common voice
- Clear goals for technology development
- Expanded resources for R&D
- Increased collaboration among researchers, including national laboratories
- Cleaner, more energy-efficient technologies and processes to boost productivity and profitability, now and in the future

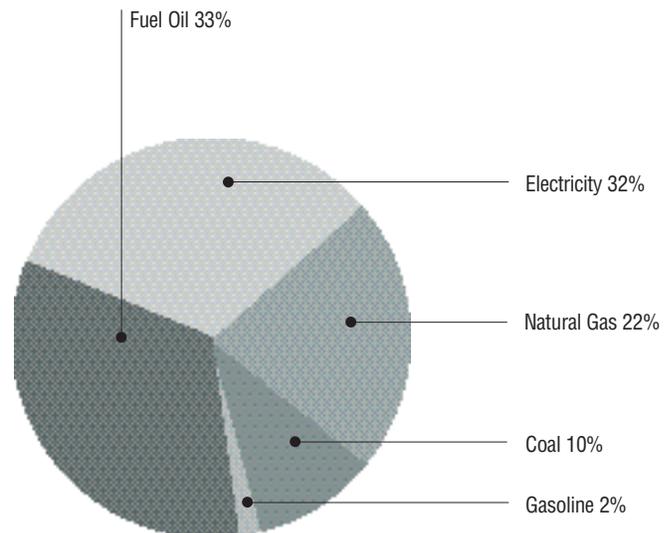
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With annual shipments valued at \$81 billion, the U.S. mining industry is a world leader in the production of metals, coal, and industrial minerals. Mining provides the raw materials for construction and manufacturing, as well as chemicals for fertilizers and food products. Mined products provide energy for more than three-quarters of U.S. electricity generation.

In 1998, mining industry leaders joined in a unique partnership with the U.S. Department of Energy's Office of Industrial Technologies (OIT) to foster the development and use of advanced technologies and processes. The Industries of the Future partnership has helped effectively position the U.S. mining industry for continuing prosperity while advancing national energy efficiency and environmental goals.

Achievement of the goals in The Future Begins with Mining will make the U.S. mining industry "the world's leader in producing and processing competitively priced minerals and mineral products and some of the world's lowest-cost coal, while minimizing land disturbance, environmental disruptions, and hazards to workers."

Energy Sources for Mined Products



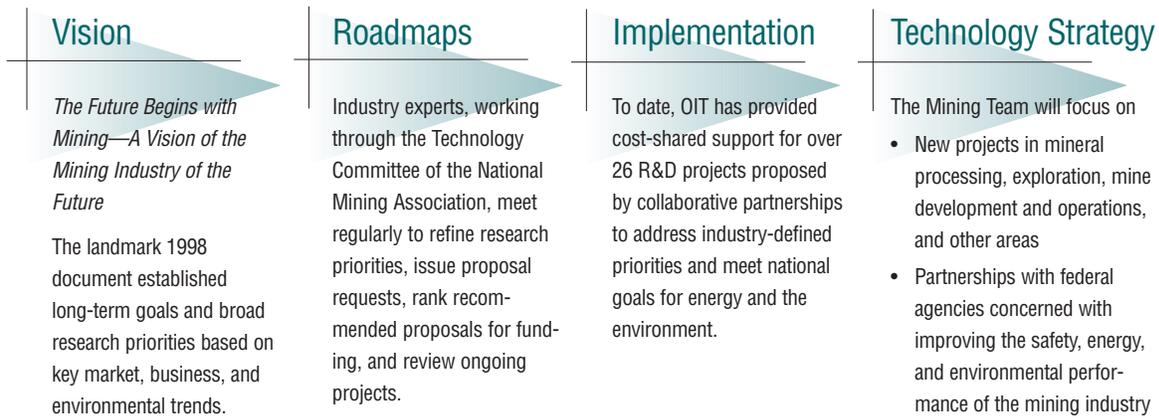
**Total energy use =
219 trillion Btu**

Source: Census of Mineral Industries, 1997.



Industry drives the process

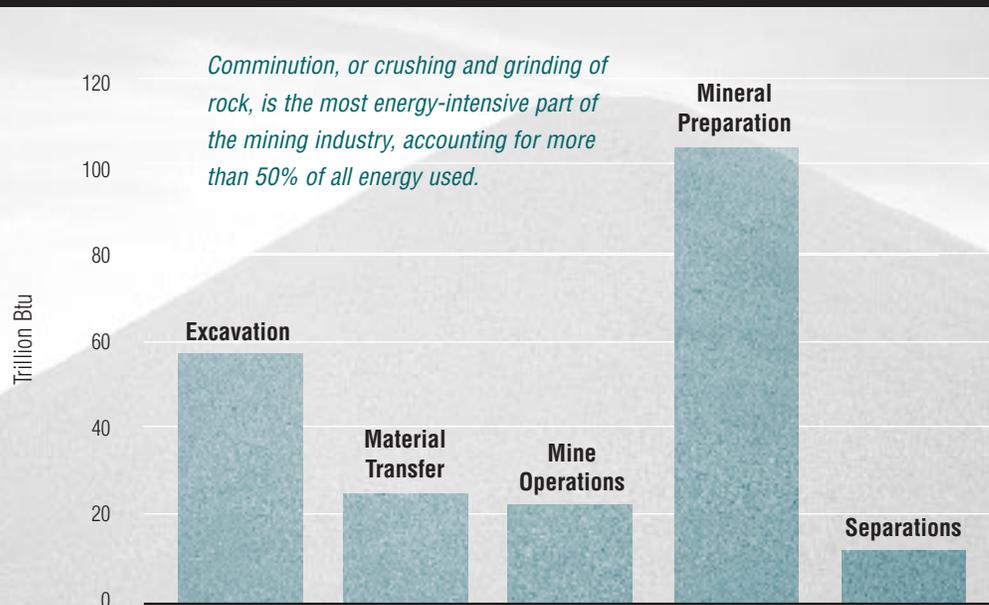
Under the leadership of the National Mining Association (NMA), the U.S. mining industry is actively implementing the Industries of the Future strategy. By coming to consensus on common goals and priorities, the industry has created a powerful force for attracting and guiding public and private investment in new technology development. With several projects already under its belt, the partnership continues to pursue promising technologies and take an active role in moving advances into commercial use.



Benefits to local communities and the nation:

- A cleaner environment
- Improved national energy security
- Reduced emissions of gases implicated in global climate change

Energy Use in the Mining Industry



Source: Census of Mineral Industries, 1997.
Note: Data are for selected commodities representing 85% of mined products.



results

Boosting industry performance

Based on industry-defined priorities and recommendations, OIT awards cost-shared support to projects that will improve the industry's energy efficiency and global competitiveness. Each year, OIT provides approximately \$4 million to projects in OIT's Mining portfolio. All awards are made on a cost-shared basis through a competitive solicitation process. Solicitations are open to collaborative teams with members from industry, academia, national laboratories, and other sectors that have a stake in the future of the mining industry.

For its share, the industry has provided over \$15 million in project funding as well as support in specialized expertise, materials, and facilities. Since beginning the Industries of the Future process, OIT's Mining Team has awarded a total of \$13 million in OIT funding to 26 projects.

Partnering for success

- Partnering with industry ensures that technologies funded under the Mining Industry of the Future are aligned with industry needs for energy efficiency, productivity, and safety.
- Partnering with state and federal agencies helps to better coordinate all government resources that concern the mining industry—including those for data collection, research and development, and regulation.
- Partnering with international mining research and development organizations provides additional resources to achieve industry vision goals as well as to propagate energy-efficient mining technologies worldwide.

The OIT Mining R&D portfolio addresses a broad spectrum of industry priorities. A representative listing of projects is shown at right. To learn more about the projects in OIT's Mining portfolio, visit www.oit.doe.gov/mining

Research, Development, and Demonstration Projects

ANNUAL ENERGY USE BY PROCESS
(TRILLION BTU)

57

Exploration and Resource Characterization

Imaging Ahead of Mining
Mine-Compatible Laser Analysis Instrument for Ore Grading
24-Channel Geophone Array for Horizontal or Vertical Boreholes
Calibration Methods for On-Line Analyzers
Mapping Induced Polarization
Real-Time Coal Content and Ore Grade Sensor

Drilling and Excavation

Drilling and Blasting Optimization
CastCon Process for Mining Applications
Cellular Composite Wear-Resistant Components
Projectile-Based Excavation



Active industry involvement

Through the Industries of the Future process, industry plays a central role in focusing near-term and long-term research investments. Industry-led task groups work with DOE to conduct annual solicitations, merit review of all incoming proposals, and technical review of all ongoing R&D projects. OIT makes the final selection for new R&D awards based on ranked lists from these task groups. Industry representatives also participate in periodic portfolio reviews with OIT.

Crushing and Grinding Rock

One of the most energy-consuming parts of the mining industry is comminution, the process of crushing and grinding to reduce the size of mined material in preparation for further processing.

Projects in several areas address this important process:

- *Advanced sensors to characterize ore*
- *Improved comminution strategies*
- *Modeling of grinding mill operations*
- *New wear materials and surfaces*
- *Novel excavation techniques to optimize particle size and crushability*

jects

24

22

105

4

7



Material Transfer

Development and Deployment of Automated Machine Fluid Analysis Systems
Hydride Fuel Cell Mining Vehicles
Advanced Underground Vehicle Power and Control



Mine Operations

High-Temperature Superconductors in Underground Communications
Robotics Technology for Improving Mining Productivity
Roof Bolt System Design
Remote Sensing and Imaging at the Cutting Edges of Mining Equipment
Wireless Mine-wide Telecommunications Technology



Mineral Preparation

Three-Dimensional Simulation of Charge Motion in Semiautogenous Grinding (SAG) Mills and Ball Mills
Advanced Abrasion-Resistant Materials
Comminution Circuit Optimization



Physical Separation

Selective Flocculation of Fine Mineral Particles
Dense-Medium Cyclone Optimization
Novel Dewatering Aids for Mineral and Coal Fines



Chemical Separation

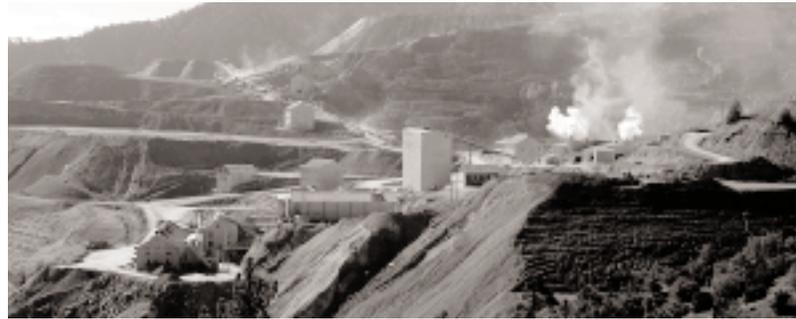
Mining Byproduct Recovery
Treatment of Cyanide Solutions and Slurries Using Air-Sparged Hydrocyclone Technology

resources

Coordinated assistance for today and tomorrow

OIT's Mining Team supplements its own R&D budget by coordinating activities with other OIT programs that can help advance the industry's goals. For example, OIT's Steel and Aluminum Teams fund R&D that can offer carryover benefits for mineral processing and by-product recovery. Similarly, technologies developed for separations by the OIT Chemical Team may transfer to many mineral processing areas.

OIT programs of value to the mining industry include research and development of **Enabling Technologies**, **BestPractices** initiatives, and **Financial Assistance**. In addition, **State-Level Industries of the Future** programs are starting up in a number of states to bring the energy, environmental, and economic benefits of industrial partnerships to the local level.



Enabling Technologies

Advances of Value to All Industries

OIT works with industry, the national laboratories, academia, and others to research, develop, and commercialize Enabling Technologies that can benefit a wide range of industries, including mining. In **Industrial Materials**, the focus is on strong, durable materials that can withstand the harsh industrial environments of comminution and materials handling. Efforts in **Combustion** target clean, cost-effective technologies that will increase productivity, improve energy efficiency, reduce emissions, and enhance fuel flexibility. Research in **Sensors and Controls** addresses such challenges as improving sensor reach and accuracy in industrial environments and providing integrated, on-line measurement systems for operator-independent control of processes in real time.



Plant-wide assessment of Peabody's Randolph Coal Preparation plant

Peabody Holding Company, the largest U.S. coal producer, has completed a project to improve the performance of a coal slurry pumping system at its Randolph Coal Preparation plant. Changes to the coal washing process resulted in cyclone pump systems that were not optimized to meet system requirements. The net cost to implement one recommended improvement was \$15,693, and the annual energy cost savings were \$5,231, resulting in a simple payback of 3.3 years.



BestPractices

Boosting Productivity with Today's Technology

Through the BestPractices program, OIT helps coal, metals, industrial minerals, and related industries apply existing technologies to save money, cut emissions, and reduce wastes. OIT works directly with mines and mills to alert them to opportunities for funding, tools, expertise, and applicable technologies emerging from OIT's extensive R&D portfolio. The returns for industry can be significant.

BestPractices also offers **plant-wide assessments**, helping miners and mineral processors develop a comprehensive strategy to increase efficiency, reduce emissions, and boost productivity. Up to \$100,000 in matching funds is awarded for each assessment through a competitive solicitation process. Participants agree to a case study follow-up of results. Alternatively, small to mid-sized plants can take advantage of the **Industrial Assessment Centers**, which provide no-charge assessments through a network of engineering universities.

Financial Assistance

Promoting Technology Innovation and Demonstration

Two Financial Assistance programs are offered by OIT to accelerate technology development and application. The **Inventions and Innovation** program awards grants of up to \$200,000 to inventors of energy-efficient technologies. Grants are used to establish technical performance, conduct early development efforts, and plan commercialization activities. The second program, **NICE³** (National Industrial Competitiveness through Energy, Environment, and Economics), provides cost-shared grants of up to \$500,000 to industry-state partnerships for demonstrations of clean and energy-efficient technologies.

How to get involved

Through Industries of the Future partnerships, U.S. mining companies reap the competitive advantages of more efficient and productive technologies and, in turn, contribute to our nation's energy efficiency and environmental quality.

To participate:

- Monitor the OIT Mining Team's Web site for news and announcements of R&D solicitations, meetings and conferences, and research projects. Sign up for e-mail notification of changes to the site at mining@ee.doe.gov.*
- Team with other organizations and respond to solicitations for cost-shared research.*
- Begin saving energy, reducing costs, and cutting pollution today by participating in any of the BestPractices programs.*
- Take advantage of OIT's extensive information resources, including fact sheets and case studies, training, software decision tools, searchable CDs, newsletters, and publications catalog.*
- Attend the biennial Industrial Energy Efficiency Symposium and Expo.*

For more information on these and other resources, please contact the OIT Clearinghouse at (800) 862-2086.

www.oit.doe.gov/mining



For more information on the Mining Industry of the Future,
contact the OIT Clearinghouse at (800) 862-2086
or visit www.oit.doe.gov/mining

Please send any comments, questions, or suggestions to webmaster.oit@ee.doe.gov



Office of Industrial Technologies
Office of Energy Efficiency and Renewable Energy
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least 50% wastepaper, including 20% postconsumer waste.

February 2001
DOE/GO-102001-1157