

15TH ANNUAL CONFERENCE



Mining Energy Outlook: Economic Barriers and Solutions to Energy Issues in Mining

APRIL 19 - 21, 2006

THE GOLDEN HOTEL • GOLDEN, COLORADO

~ MEMS 2006 BIO AND ABSTRACTS ~

Ian Carter – Pre-conference Workshop

Bio – Ian Carter is the North America Policy Coordinator for the International Emissions Trading Association. Mr. Carter has ten years experience as a financial officer for a renewable energy technology company, targeting transfer of photovoltaic manufacturing technology. Mr. Carter joined IETA from Canada's Department of Foreign Affairs in late 2005.

Abstract - ••• Emissions Trading •••

The emissions trading workshop will provide an overview of the world carbon market. It will review fundamental units of exchange, and examine how emission tradings can be integrated into a global business strategy for a carbon-constrained future. With the cooperation of workshop participants, particular attention will be paid to opportunities and obstacles for the mineral resource sector.

Dirk van Zyl – Reception Speaker

Bio – Dirk Van Zyl is the Director of the Mining Life-Cycle Center and Professor and Chair of Mining Engineering at the Mackay School of Earth Sciences and Engineering of the University of Nevada, Reno. Dirk has over 30 years experience in research, teaching and consulting in tailings and mine waste rock disposal and heap leach design. Recently his attention has been focused on mining and sustainable development.

Dirk received a B.Sc. in Civil Engineering in 1972 and a B.Sc. (Honors) in 1974, both from the University of Pretoria, South Africa. He also received a M.S. and Ph.D. in Geotechnical Engineering from Purdue University in 1976 and 1979, respectively. In 1998 he completed an Executive MBA at the University of Colorado. He is a registered professional engineer in 8 States.

Dirk has consulted internationally on many mining projects. Projects have covered the Mining Life Cycle, from exploration to closure and post-closure, in a large range of climatic and geographic environments. His work has focused on geotechnical and environmental mining engineering aspects to provide solutions for environmental and human health protection. He previously taught at The University of Arizona and Colorado State University.

Dirk has over 70 publications to his credit. He has also presented numerous short courses on heap leach design, mining environmental management and mine closure in the US and abroad. He is the recipient of the three awards from the Society for Mining, Metallurgy and Exploration (SME). Dirk became a Distinguished Member of SME in 2003. He received the Bureau of Land Management Sustainable Development award in 2005.

Abstract - ••• Mining Energy Solutions Conference Success •••

This presentation will provide a short review and update on the Mining Energy Solutions Conference that was held in August 2003 in Elko, Nevada. This conference was sponsored by the Nevada Office of Industries of the Future in cooperation with the Nevada State Office of Energy, Mining Companies and the Department of Energy. There will also be a perspective on the implementation of other energy initiatives in Nevada. Another focus of the presentation is a summary of national and mine energy consumption data for the US and Canada. A number of important issues and concepts in the management of energy savings will be discussed.

Mike Canty – Session One Chair

Bio – J. Michael Canty is a Technology Manager for the Geothermal Technology Program within the U. S. Department of Energy. His responsibilities include project monitoring and technical reviews as well as mineral extraction from geothermal brines, drilling and other mining and mineral industry related projects.

Prior to joining the Department of Energy in 1999, Mr. Canty was involved in the mining, minerals and construction industries for over thirty years. His experience spans many aspects of the minerals industry, from exploration and mine development through operations and mineral processing, across a wide range of mineral commodities.

Lauri Gregg - Session One Speaker

Bio – Mr. Gregg is currently the Director of Energy Management for Falconbridge Limited where he has worked since 1967. His responsibilities include the management of energy use and cost within the Canadian and international operations of the company. He has held various positions in engineering and operations management related to maintenance, and utilities. He has administered the procurement of electricity and natural gas, as well as implementation of energy management strategies.

Mr. Gregg is the Past Chairman of the Association of Major Power Consumers of Ontario (AMPCO) and currently a director of the association. He is the Vice Chair of the Toronto Board of Trade Electricity Committee. He is Chairman of the Mining Association of Canada Energy Committee, and consequently a member of the Canadian Industry Program for Energy Conservation (CIPEC) Council. As such he has represented the mining industry in Climate Change negotiations with the Federal Government since 1999. Additionally, he is a director on the Board of Directors for the Industrial Gas Users Association (IGUA). He also is a member of the Ontario Mining Association Energy Committee.

Mr. Gregg graduated from the University of Waterloo with a degree in Electrical Engineering. He is a member of the Professional Engineers of Ontario.

Abstract - • *Mining Energy Requirements and Saving Opportunities*

The Presentation will:

- Focus on improving energy performance by building the internal capacity to control energy
- Discuss the Falconbridge approach used to build this capacity based on the Towards Sustainable Mining Indicators
- Describe the use of best practice bench marks and internal performance benchmarks

Mike Canty – Session One Speaker

Bio – PLEASE SEE SESSION ONE CHAIR

Abstract – • *U.S. Department of Energy Mining Industry of the Future R&D Program*

Mr. Canty will provide an overview of the U. S. Department of Energy's Mining Industry of the Future R&D portfolio. The Mining Industry of the Future manages R&D projects focused on reducing the energy consumption in the mining and mineral processing industry. Since 1999, this portfolio has managed 47 cost-shared projects, 146 project partners, 19 academia partners, \$27.3 million DOE funds, and \$34.8 million cost-share funds. Mr. Mosser will highlight portfolio successes including commercial and emerging technologies and five R&D 100 Award winners.

Lance Throneberry – Session One Speaker

Bio – Lance Throneberry is currently Director of Supply Chain Management with responsibility for Bulk Commodities and Enablement with Newmont's head office Global Supply Chain group - headquartered in Denver Colorado. Lance has been with Newmont since 1995 in various positions including Internal Audit, eBusiness and Supply Chain. Prior to Newmont, he worked in Public Accounting and the Oil and Gas industries. Lance holds a Bachelor of Science in Business Administration and is also a Certified Public Accountant.

- *Energy and Mining Operations: Costs & Efficiencies*

Jon Feldman – Session One Speaker

Bio – Jon comes to us out of South Africa, where he obtained a degree in Chemical Engineering from the University of Cape Town. He has spent close to 20 years working for clients in a wide range of process industries, including mining, mineral processing, metals, pulp & paper, manufacturing, and food & beverage. During the last four years Jon has led over 50 energy reviews at a range of large industrial facilities, including three Northern Ontario Mines. For Hatch's global clients, Jon focuses on combining the technical and organizational aspects of energy management to deliver substantial and sustainable savings. Jon uses a structured approach to identify and address the key action items for a particular facility. Engaging with site staff during workshops, and developing pragmatic implementation plans have been key factors in the success of these projects. Jon has conducted numerous innovative energy-management workshops, in a variety of industries, and brings a wealth of information about the practical energy-management issues facing mining companies today. His experience and expertise have been formally recognized through achieving the designation of Certified Energy Manager (CEM).

Abstract –• *Hemlo Gold: Simple Change in Practices – Impressive Delivery of Results*

Hemlo Gold: Simple change in practices – Impressive delivery of results Sustained energy savings depends on both technical improvements and a systematic, focused, continuous-improvement approach to the way a company manages its energy. Far too many companies looking for energy-cost savings become victims of the low-hanging-fruit syndrome. They find a few easy ways to create savings in their energy management programs, but they fail to carry the savings onward and outward. The leadership team at Hemlo Mines in Ontario, Canada, decided to take a risk, break from tradition and tackle energy management at its roots. The site team's enthusiastic commitment to the improvement process resulted in over \$1,000,000 in annual savings being identified. The outcome has been that energy management is now an integral part of the site's business process-

es. Close to half of the original savings identified have already been achieved through implementing low-cost and no-cost opportunities. As would be expected from a change in the way energy is managed, the site team are continually identifying and achieving more savings. How did they do it? This presentation will explain the process the site went through, and more importantly the fundamental changes they put in place to sustain the energy savings. The Hemlo Gold story will highlight the energy management practice improvements that have set the team up for continued success, and how they have been able to drive action and deliver impressive results.

Roy Tiley – Session Two Chair

William P. Wolf - Session Two Speaker

Bio – William P. Wolf is the Director, Business and Market Analysis at John T. Boyd Company (“BOYD”). BOYD provides technical and valuation services to the energy industry. Mr. Wolf holds a Bachelor of Science degree in Mining Engineering from West Virginia University and a Masters in Business Administration from the Katz Graduate School of Business, University of Pittsburgh. He has been with BOYD since 1991 and specializes in the study of energy and mineral markets, transportation logistics, and the valuation of domestic and international mining operations.

During his employ at BOYD, Mr. Wolf has completed numerous projects analyzing coal, lignite and aggregates markets; developing long- and short-range price and production forecasts including considerations of transportation, interregional competition, regulatory, and supply/demand issues; preparing evaluations of fuel supply plans and coal contract portfolios; and providing litigation support.

Mr. Wolf is a member of the Society for Mining, Metallurgy and Exploration, Inc. and Mineral Resources Alumni Chapter Executive Council (W. Virginia Univ.).

Abstract – • *Coal Market Overview*

In this presentation the dramatic changes which have occurred in the US coal industry will be explored. An overview of the demand side factors within the US will be presented, highlighting the major market drivers including future electricity generation, environmental issues, and international demand. From the supply side, ideas discussed will address the issues faced by US coal producers including:

- Constraints on new supply development
- Labor issues
- Changes in the industry size and implications on productivity
- Changes in intraregional supply and the associated market dislocation

We will also focus on the changing cost structure within the US coal industry and its effect on coal pricing going forward.

Dustin J. Garrow – Session Two Speaker

Bio – More than twenty-five years experience in commercial nuclear fuel market, principally natural uranium concentrates (U3O8) research, analysis and reporting to electric utilities, uranium mining companies and service industries located in North America, Western Europe and the Asia/Pacific regions. Delivered more than 30 presentations regarding nuclear fuel markets and commercial transaction design before industry conferences in Europe, Japan, the United States and Canada. Served on various industry advisory committees including Uranium Institute (London), Nuclear Energy Institute (Washington, DC) and Industry Sector Advisory Committee on Energy for Trade Policy Matters (ISAC 6) – U.S. Department of Commerce/International Trade Administration. Established ZB Marketing, LLC in 1999, serving as President, to provide commercial representation services to the nuclear fuel and minerals commodities industries. Founded Colorado Nuclear, Inc. in 2005 to provide market research and analysis and information services to the global nuclear fuel industry. Prior experience includes several senior commercial positions with uranium production companies as well as Vice President – Marketing and Sales for ConverDyn, a marketing joint venture responsible for the sales of uranium conversion services from the Metropolis Conversion Plant. Received Bachelor of Arts – Economics from the University of California, Los Angeles and completed graduate work in business administration at San Francisco State University. Served as an Anti-Submarine Warfare/Nuclear Weapons Officer in the U.S. Navy (1970-1973).

Abstract – • *Uranium Market Overview*

Nuclear power continues to undergo a revival in response to rapidly growing energy needs and concerns regarding global climate change. Operating license extensions and capacity up-rates are underpinning the existing nuclear reactor fleet while recent forecasts of installed nuclear generating capacity show a steady increase on a worldwide basis. According to the World Nuclear Association, installed nuclear generating capacity could rise from the current 367,000 Mwe up to as much as 518,000 Mwe by the year 2020.

Uranium requirements are escalating due to improving reactor operations and new build. Current global uranium needs estimated at 178 million pounds U3O8 per annum could expand to as much as 268 million pounds U3O8 per annum over the next 15 years.

The international uranium market was severely depressed for more than two decades as nuclear power struggled to maintain its position as a base-load source of electricity. Secondary sources of uranium in the form of both natural uranium inventories as well as military warheads being down-blended into commercial-grade nuclear fuel placed persistent downward pressure on uranium prices. Primary production of uranium dropped such that less than 60% of annual global uranium requirements are being supplied by mining operations.

Beginning in late 2002, the uranium price began to recover from single digit levels reaching US\$40.00 per pound U3O8 by March 2006 with further increases expected in response to utility demand in both the near-term (spot) and long-term markets.

Worldwide production of uranium grew from around 80 million pounds U3O8 in 1999 up to almost 110 million pounds U3O8 in 2005, but still providing less than 60% of annual global uranium needs. Aggregate world uranium output continues to increase but at a relatively slow rate due to minimal expansion capacity at existing production facilities and inherent delays in permitting/licensing and construction.

While the global uranium production sector is responding to positive market signals, even more must be done to meet expected growth in uranium demand, particularly in the event that new reactor orders are placed in North America, Western Europe and the Asia/Pacific regions.

Roderick G. Eggert – Session Three Chair

Bio – Roderick G. Eggert is Professor and Director of the Division of Economics and Business at the Colorado School of Mines, where he has taught since 1986. He also is Editor of Resources Policy, an international journal of mineral economics and policy, which he has edited since 1989. Previously he taught at the Pennsylvania State University and held research appointments at Resources for the Future (Washington, D.C.) and the International Institute for Applied Systems Analysis (Austria). He has a B.A. in earth sciences from Dartmouth College, a M.S. in geochemistry and mineralogy from Penn State, and a Ph.D. in mineral economics from Penn State. His research and teaching have focused on various aspects of mineral economics and public policy, including the economics of mineral exploration, mineral demand, mining and the environment, microeconomics of mineral markets, and most recently mining and sustainable development. He served for two terms on the Committee on Earth Resources of the U.S. National Research Council.

Juan Ignacio Guzman – Student Presentation

Bio – Ph.D. candidate, Mineral Economics Program, Mining Centre, Catholic University of Chile, Santiago, Chile,

Student Paper – • *Cooperation as a Price stabilizing Mechanism in Mineral Markets*

Typically, mineral markets are governed by boom and recession periods characterized by high price volatility. The extreme variability of prices, which causes a multiplicity of problems, for both producers and consumers, has encouraged a wide variety of studies of price stabilizing mechanisms. However, most of them have aimed at creating commodity buffer stocks between producers and consumers, with the UNCTAD's Integrated Program for Commodities during the decade of the seventies as the clearest example. The problem with this type of approaches is that they are more focused on setting prices on their mean values rather than on controlling their instability, which is precisely the target of price stabilization. The alternative view that I present explains how while allowing cooperation (explicitly or tacitly) among few large producers which pursue profit maximization in the presence of a sufficiently large competitive fringe, a price stabilization mechanism results as an outcome of this cooperative behavior. This can be illustrated by considering that during recession periods, each member's strategy should consist of either production cutbacks or stock holdbacks while in boom periods, the best strategy of firms should be an output expansion with the objective of restraining the entry of the competitive fringe. Consequently, a theoretical trigger price mechanism is derived, which is more likely to be successful than other previous stabilization mechanisms, as the preceding schemes do not consider profit maximization in order to keep low price volatility. As a matter of fact, many commodity buffer stocks have failed because this condition was not taken into account. Furthermore, I posit that the International Copper Cartel, which acted in the 1935-1939 period, used this type of mechanism in a successful way. Through an econometric model I show that this cartel engaged in cooperative behavior not only while facing recessions but also during booms. This behavior apparently did not damage social welfare but yet considerably reduced price volatility.

Louis Archambeault — Student Presentation

Bio – Department of Mining, Metals and Materials Engineering, McGill University, Quebec, Canada

Student Paper – • *Application of Artificial Intelligence to Mine Optimization and Real Option Valuation*

This paper describes preliminary research on the application of Markov Decision Processes (MDP) to Real Option Valuation (ROV) and the optimization of mine scheduling. The MDP framework is a novel approach to option valuation and scheduling in mining operations. A learning agent is introduced into the valuation process of an open pit, where prices and block ore grades have probabilistic values. The prices are modeled using a mean reverting diffusion process and the block grades using sequential Gaussian simulation. The agent is asked to learn which production parameters should be used in order to maximize the overall value of the project. The introduction of the agent permits a real option approach to mine valuation, such that the value associated with the robustness of a design to uncertainty can be measured. A simulated example is used in which there are 10 blocks to be extracted under conditions of grade and price uncertainty. Using policy iteration, an optimal policy is generated and the value of production options is found. The potential financial gains from applying MDPs to mine valuation and optimization are substantial and warrant further investigation.

Amy Jacobsen – Session Four Chair

Bio – Amy Jacobsen is the Vice President of Corporate Development for Behre Dolbear & Company, an international mining consulting firm. She is responsible for coordinating marketing and business development activities through Behre Dolbear's global network of offices. Amy has 20 years of diverse experience in consulting, technical project management, independent engineer technical reviews, and business development. Her consulting, engineering and management experience has been in the minerals, process hydrometallurgy, and electric power generation industries.

Amy holds a B.S. in metallurgical engineering from the Colorado School of Mines and a MBA from the University of Denver. In addition to Behre Dolbear, she has worked for Homestake Mining at the McLaughlin gold mine in Northern California, Hazen Research Inc., and Stone & Webster Management Consultants, Inc. She is also actively involved with the Society of Mining, Metallurgy and Exploration (SME) and the Mining and Metallurgical Society of America (MMSA) and is currently the chairperson of the Minerals Information Institute (MII).

Bradley Barta – Session Four Speaker

Bio – The development of Renewable Energy projects in conjunction with a new or existing mining project can offer mining companies and operations a potential competitive advantage. Renewable Energy project development can provide a green image, take advantage of existing infrastructure, and possibly offset the cost of power at mining operations. This paper will provide insights into generation development strategy and energy procurement considerations for mining operations. This presentation will focus on mining energy usage characteristics and the adaptability of renewable energy technologies, maximizing the value of existing infrastructure and real estate assets, and securing long-term competitive and reliable energy sources.

Abstract – • *Renewable Energy & Its Application to Mining*

The development of Renewable Energy projects in conjunction with a new or existing mining project can offer mining companies and operations a potential competitive advantage. Renewable Energy project development can provide a green image, take advantage of existing infrastructure, and possibly offset the cost of power at mining operations. This paper will provide insights into generation development strategy and energy procurement considerations for mining operations. This presentation will focus on mining energy usage characteristics and the adaptability of renewable energy technologies, maximizing the value of existing infrastructure and real estate assets, and securing long-term competitive and reliable energy sources.

David Robinson – Session Four Speaker

Bio – Dr David Robinson, Ph.D. is an Associate Professor of Economics at Laurentian University. He has been researching the mining economy of Northern Ontario since 1990 when he began an eight-year study of what happened to workers when the uranium mines in Elliot Lake closed. Since 2000 has been studying the Sudbury Mining Supply and Services Cluster and promoting mining research at Laurentian University. He specializes in Public Policy analysis and game theory.

Abstract – • *What Could Nuclear Power do for Mining? Can Current or Fourth Generation Reactors Help Solve Mining's Power Needs and Emission Problems?*

What could nuclear power do for mining? Can current or fourth generation reactors help solve mining's power needs and emission problems?

An economist discusses the potential economic and environmental gains for the mining and smelting industries from the small fourth-generation reactors that are under development. Mining is a major power consumer, and in many cases is threatened by rising power costs. Some mining operations are also power suppliers. Power generation and transmission systems are among the most significant ways mining impacts the environment. There is a compelling environmental case to be made for "the least*popular option", as it has been called. The talk is based on consultation with mining companies and Canada's Atomic Energy Corporation Ltd.

Amy Jacobsen – Session Four Speaker

Bio – PLEASE SEE SESSION FOUR CHAIR

Abstract – • *Renewable Energy Technology & Markets*

Renewable Energy has had a history of fits and starts in its role in the supply of energy in the U.S. Once again, we are seeing resurgence in the interest in Renewable Energy as the result of the passing of the Energy Bill of 2005, an increasing interest in sustainable development, and the lasting effects of Hurricane Katrina which will spark a greater desire to reduce our nation's dependency on fossil fuels and foreign oil. But Renewable Technologies are inherently different than traditional energy generation technologies. Factors such as resource dependency, dispatch and grid stability, technology maturity, project size and capital cost, incentives, public perception, and energy markets create a different universe for the financing and completion of Renewable Energy projects. This paper will compare and contrast these factors for several Renewable Technologies and will identify specific questions that must be understood as well as some of the challenges and potential requirements for successful development and financing of these projects.

Gerald W. Grandey – Banquet Speaker

Jerry has served as President and Chief Executive Officer of Cameco since 2003, and has been with Cameco for over 13 years. He has more than 30 years of experience in the mining industry and, previous to joining Cameco, was CEO of Concord Mining Business Unit and President of Energy Fuels. Jerry is a graduate of the Colorado School of Mines, obtaining his degree in geophysical engineering in 1968. After serving two years in the US military, he received his law degree from Northwestern. He is past chair of the World Nuclear Association and currently sits on the boards of Canadian Nuclear Association and Washington-based Nuclear Energy Institute.

Venkat Venkataraman – Session Five Chair

Bio – Venkat Venkataraman is currently serving as Senior Advisor for International Activities at the National Energy Technology Laboratory (NETL) of the U.S. Department of Energy. His prior responsibilities include Coordination of all activities pertaining to Petroleum Fuels at the Strategic Center for Natural Gas and Oil (SCNGO) of NETL. Dr. Venkataraman holds a Ph.D. in Chemical Engineering from the State University of New York at Buffalo and has completed advanced business and management-related courses at the Harvard Business School and the Wharton School of the University of Pennsylvania. He graduated from the Federal Government's Interagency Executive Potential Program (EPP) as NETL's candidate through the former Federal Energy Technology Center in 1997. He has over 10 years of industry experience including stints at Air Products & Chemicals, Inc. and Dow Corning Corporation in the area of advanced separations with specialization in membrane science and technology. Since joining NETL in 1990, he has had project management responsibility in several programs including advanced coal power systems, environmental waste management and natural gas processing and utilization. In 1997, he became the Product Manager for all of NETL's activities in the Natural Gas Processing and Utilization arena. He assumed his current position in September 2005. His area of expertise includes fuels chemistry, advanced synthesis gas, gas-to-liquids and hydrogen from natural gas as well as international activities in the Asia-Pacific region as well as India. His professional memberships include AIChE, North American Membrane Society and Sigma Xi.

William P. Wolf, - Session Five Speaker

Bio – PLEASE SEE SESSION TWO SPEAKER

Abstract – *China Profile & Energy Issues in the China Mining Industry*

As China's economy continues to boom, its demand for energy also continues to climb. Among all energy resources being employed in China, coal has played a dominant role. In this presentation, the basic Chinese energy composition will first be introduced. Emphasis will be given to the analysis of China's coal mining industry. Due to the uniqueness of China's economy and government management system, the mining industry in China has shown a very different view from other nations. Information regarding China's coal mining industry will be provided including its coal reserves base, overall scale of the industry, coal mine distribution and ownership, work safety issues, coal consumption and the domestic and overseas market. Based on this information and combined with the international market situation, further analysis will be conducted on the evolution of China's mining industry, how the mining operation has impacted China's environment and will be managed in the future, and what the government has done to improve the mining industry's productivity and safety. The outlook for the industry's future as defined by the government's future planning efforts will be introduced. Finally, some potential solutions to the problems the industry is facing will be discussed and prediction about the mining industry's future development will be given.

Venkat Venkataraman – Session Five Speaker

Bio – PLEASE SEE SESSION ABOVE

Abstract – *India Profile & Energy Issues in the Indian Mining Industry*

India's coal reserves provide a secure resource to economically generate electricity and meet the energy demands of the steel, cement, and manufacturing sectors, which currently consume 56% of the nation's commercial energy. The Government of India is undertaking an ambitious plan to supply "Power on Demand" to all Indian citizens by 2012. To meet increasing demand for electricity and to bridge the significant gap between supply and demand, India plans to double its current installed capacity of 108,929 MW. The costs of this anticipated capacity addition and the associated transmission and distribution systems have been estimated to be US\$160 billion.

Coal will continue to provide the mainstay of electric power in India for the future, and accordingly India has significant strides to make in overcoming various issues that constrain production of this abundant, indigenous resource. This presentation will provide an overview of India's energy issues, compared to several other countries, provide some focused insights into areas of concern in the Indian mining arena, provide information on coal utilization and mining related activities that have been supported in India by the U.S. Agency for International Development, and lastly, provide a high-level overview of the status of bilateral activities under the U.S.-India Energy Dialogue.

Michael van Aanhout – Session Six Chair

Michael van Aanhout is President and senior management consultant with Stratos. His work involves providing strategic sustainability and environmental management advice to organizations in a number of sectors including: mining, oil and gas, government, waste management and marine. In the private sector, Michael's work is focused on accountability and performance measurement including management systems and compliance auditing, developing performance measurement systems, and designing and assessing environmental and sustainability reports. In the public sector, his work encompasses policy and program development and managing consultation processes on a wide range of environmental and sustainability issues including pollution prevention, recycling, waste management, contaminated sites and abandoned mines, and climate change.

- • *Emissions Trading – Implications & Opportunities for Mining – Current Developments in Canadian Emissions Market*