



GOVERNMENT OF INDIA
MINISTRY OF COAL

US – India Energy Dialogue: Coal Working Group Work Plan



April 2006

**US – India Energy Dialogue
Coal Working Group Work Plan**

Representatives of the Department of Energy of the United States of America and the Ministry of Coal of the Government of India:

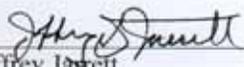
Recognizing a mutual interest in collaborating in the field of development of clean fossil energy technologies; recognizing a need to advance the objective of the Government of India, which focuses on practical approaches to dealing with energy requirements; and recognizing their mutual interest in creating an attractive climate for domestic and foreign investment in the energy sector of their respective countries, and in an efficient and environmentally sound energy infrastructure:

Hereby declare intentions to pursue implementation of the mutually agreed upon actions described in this document.

It is understood that undertaking these cooperative activities is not intended to create legally binding obligations between the participants.

It is understood that the participants' ability to undertake the activities contemplated by this agreement is subject to the availability of appropriated funds.

FOR THE DEPARTMENT OF ENERGY
OF THE UNITED STATES OF AMERICA:



Jeffrey Jarrett
Assistant Secretary
Office of Fossil Energy

Date: 5.04.06

FOR THE MINISTRY OF COAL
OF THE GOVERNMENT OF INDIA:



Pradeep Kumar
Additional Secretary
Ministry of Coal

Date: 5.04.2006

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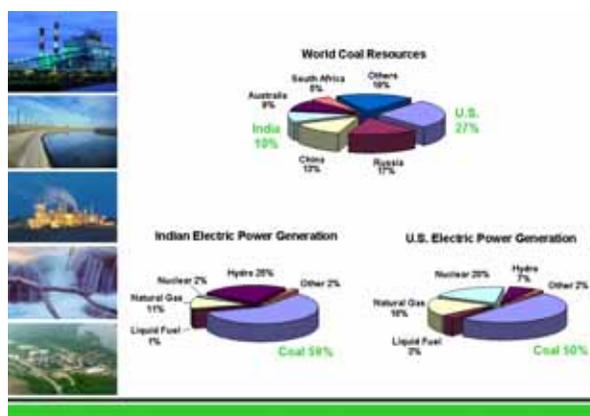
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Background and Overview

On May 31, 2005, U.S. Secretary for Energy, Dr. Samuel W. Bodman and Dr. Montek Singh Ahluwalia, Deputy Chairman Planning Commission of India, launched a new Energy Dialogue (Appendix I). The Energy Dialogue will build upon the broad range of existing energy cooperation between India and the U.S., as well as develop new avenues of collaboration and include working groups in the areas of coal, oil and gas, nuclear and renewable resources, electric power generation and energy efficiency. Several working groups, including the US-India Energy Dialogue Coal Working Group, Oil & Gas Working Group and the Power and Energy Efficiency Working Group are formed to support the new Energy Dialogue.

Prior to this new energy initiative with India, the US-India Coal Advisory Group (CAG), led by the Office of Fossil Energy on the U.S. side and the Ministry of Coal (MOC) on the Indian side, had been active for several years. During this period, CAG evolved from a concept to a functioning body. It prepared and signed a Memorandum of Understanding (MOU), held three meetings in two countries, had several field visits and developed a focused set of activities. The activities of the Coal Advisory Group have been subsumed within a new US-India Energy Dialogue Coal Working Group (CWG). This document presents the Work Plan for the Coal Working Group.

US and India's Coal Shares and Electric Power Generation Sources



The CWG met for the first time via televideo on July 12, 2005, under the co-chairmanship of Mark Maddox, U.S. Department of Energy (USDOE) Principal Deputy Assistant Secretary for Fossil Energy and Pradeep Kumar, Additional Secretary of India's Ministry of Coal. At this meeting the parties agreed that: (1) the group would initially focus on coal washing/ash reduction, in-situ gasification, coal liquefaction, coal-mine closure and coal safety and personnel training; (2) participants should include government as well as private sector entities; and (3) the CWG should meet in person in Washington, D.C., in the ensuing months.

The Second CWG meeting was held in Washington, D.C., on November 17-23, 2005. The meeting was co-sponsored by the U.S. Department of Energy and India's Ministry of Coal and attracted over 40 participants from

the U.S. and Indian government, industry, universities, national laboratories and research institutions. The Record of Meeting, including the meeting agenda, list of participants and list of papers presented is provided in Appendix II.

The participants discussed the CWG's overall goals and objectives, structure, scope of activities and membership and documented the outcome of these deliberations in a revised Terms of Reference (Attachment 4 of Appendix II). The Coal Working Group committed to establishing a Coal Business Council, as a resource to the group, consisting of representatives from business, industry, academia and other non-governmental organizations. The Council would be co-chaired by a representative from each country and consist of members from the U.S. and India who could provide expert guidance on the priority items of interest identified by the CWG.

In addition, the participants discussed:

- U.S. industry's interaction with India's coal industry;
- US-India Coal R & D initiatives in the areas of Clean Power and Clean Fuels;
- coal beneficiation;
- utilization of fly ash;
- coal liquefaction;
- coal-mine safety, training, closure and reclamation;
- coal-bed, coal-mine and abandoned coal-mine methane recovery; and,
- USDOE – India bilateral activities related to coal and energy.

The Participants noted current collaboration between U.S. and Indian companies, research agencies and government agencies and identified potential for enhanced collaboration in the areas of:

- the development and demonstration of technologies for better coal beneficiation and power generation utilizing coal wastes;
- the development and demonstration of technologies for coal liquefaction and in-situ coal gasification;
- the development and demonstration of technologies for capturing as well as utilizing coal-bed, coal-mine and abandoned-mine methane;
- training of the U.S.-Indian industry counterparts personnel;
- mine safety and proper coal-mine closure and reclamation; and,
- enhancing productivity in coal mines.

The Coal Working Group committed to developing a high level Work Plan that addresses the priority items of interest identified by the CWG.

Coal Working Group Record of Meeting Signing Ceremony



Coal Working Group Business Activities

The action items outlined below build upon existing collaborations or enhance mechanisms for information exchange, but new areas of cooperation are also described. Additional dialogue will be required to further define, enhance and accelerate the collaboration activities.

A. COAL WORKING GROUP BUSINESS ACTIVITIES

Background: The Coal Working Group was established in mid-2005. At the November 2005 meeting, the CWG discussed the need for mechanisms to ensure regular and timely contact between the U.S. and Indian members, to identify areas of mutual interest and to monitor progress being made.

Issues: For the CWG to be successful, there is a need for: (1) a clearly defined path forward (the Work Plan) that addresses issues of common interest to the two countries; (2) periodic communication and exchange of information; and (3) availability of appropriate support and expertise (including representatives from the governments of India and the U.S., as well as non-governmental representatives) in those areas within the scope of the CWG roles and responsibilities.

Activities: The Coal Working Group identified several administrative initiatives to facilitate the effectiveness of the CWG. They include: (1) developing a tentative schedule for future meetings; and (2) expanding CWG



membership by inviting additional supporting participants. The following lead individuals/organizations and activities are proposed to address these initiatives:

1. Third Coal Working Group Meeting

U.S. Government Lead: Ms. Barbara McKee, Director, Office of Clean Energy Collaboration, Office of Fossil Energy, USDOE

India Lead: Mr. Pravat Mandal, Advisor (Project), Ministry of Coal

The Third Coal Working Group Meeting is tentatively planned for April 4-5, 2006, in New Delhi, India.

Schedule: Plans completed by March 15, 2006

2. Establish a Coal Business Council

U.S. Government Lead: Mr. Jeffrey Jarrett, Assistant Secretary for Fossil Energy, USDOE

India Lead: Mr. Pradeep Kumar, Additional Secretary of the Ministry of Coal

A Coal Business Council will be established as a resource to the CWG. The Council will consist of representatives from business, industry, academia and other non-governmental organizations. The Council would be co-chaired by a representative from each country and consist of approximately 8 members from the U.S. and India each. The Council will provide expert guidance on the priority items of interest identified by the CWG.

Schedule: Identification of the representatives of the Council by mid-2006.

3. Finalize CWG Membership

U.S. Government Lead: Ms. Barbara McKee, Director, Office of Clean Energy Collaboration, Office of Fossil Energy, USDOE

India Lead: Mr. Pravat Mandal, Advisor (Project), Ministry of Coal

Finalize the membership list of the Coal Working Group members from the U.S. and India (Appendix III).

Schedule: January 11, 2006

B. COAL BENEFICIATION, WASTE COAL UTILIZATION AND COAL FINES RECOVERY

Background: India has a significant resource of thermal (steam) coal with proven reserves of 76 billion metric tons and combined indicated and inferred reserves of 140 billion metric tons. India is the third largest coal producing country in the world. The annual total production of coal within India is projected to increase significantly to 430 million metric tons by 2010, the majority of which will be used for thermal power generation. Indian thermal coals are characterized by high ash contents, resulting in low-calorific value but benefiting from relatively low sulfur content.

Until recently, most coal power plants in India burned coal without any prior cleaning. However, production of environment-friendly and affordable electricity with this high-ash coal necessitates coal beneficiation (CB) prior to its utilization as an energy resource. Moreover, CB reduces the load on India's overburdened rail system and reduces the need to import higher-quality coals. The need for more CB facilities – to mitigate environmental degradation, to enhance power plant equipment lifespan, to conform to regulatory requirements – is now well accepted in India and has been practiced in most coal consuming countries. More and more plants are being planned and implemented in India. However, there is a tremendous need to implement high efficiency CB plants using more modern technology.

As a by-product of CB, very large quantities of low thermal quality coal wastes are being produced. Waste Coal Utilization (WCU) for power generation is a well established practice in the United States, as well as in many other countries. However, in India, this material is generally stored at or near the CB plant site and has very limited use. Storage and/or use of this material requires careful consideration

of environmental issues and process efficiencies. This material could potentially be used for electric power generation using more advanced technologies. There are at least 40 known potential project sites in India should the economic and technical viability of utilizing this material be proven.

Indian coking coal also suffers from high ash content. Cleaning of coking coal generates large quantity of coal fines, usually with low ash content. Because India is importing coking coal to meet most of its needs, recovery of fines generated from beneficiation of the domestic coking coal has a great importance. There is a need to develop advanced fine coal cleaning and recovery (FCCR) technologies that can increase the efficiencies and reduce the processing costs.

Deliverables & Objectives: The primary objective of the Indian coal beneficiation industry is to build washing capabilities to be able to wash inferior grade non-coking coal produced in the coming years. A computer simulation program should be developed for Indian coal characteristics which should be able to design and develop washery flow-sheet as well as identify optimum operating conditions that maximize clean coal recovery.

The following items/outputs are required to be delivered during the process of execution of the work plan:

- I) A study report giving the details of exercises carried out in recommending optimum ash% in washed coal considering the distance of the washery from its consumer elaborating the benefits at consumer end.
- II) A study report on proposed waste coal utilization methods elaborating technologies, economics, etc.

III) Simulation package developed for Indian coal for the design and operation of coal beneficiation plants.

IV) Documents for funding and implementation of a detailed commercial CB/WCU project.

Activities: The following lead individuals/organizations and activities are proposed:

1. CB Conference/Workshop and WCU Orientation Visit in USA

U.S. Government Lead: Dr. Craig Zamuda, Office of Clean Energy Collaboration, Office of Fossil Energy, USDOE

Co-Lead: Mr. Mark Sharpe, Sharpe International, LLC; Dr. Kumar Sellakumar, Etaa Energy

India Lead: Mr. P. R. Mandal, Adviser (Projects), MOC

Co-Lead: Director (Tech.), MOC; Director (Tech.), CMPDI; Director (Tech.), BCCL

Support a field trip of selected Indian professionals from the coal and energy sectors to the annual Coal Preparation Workshop and Exhibition held in Lexington, KY, during the first week of May 2006.

Subsequently organize an orientation visit for the Indian delegation to selected WCU project sites. The visit would introduce the Indian delegation to various technical-financial-regulatory regimes dealing with WCU projects and help them evaluate the viability of these technologies in India.

Schedule: First week of May 2006. The proposed length of visit is approximately 10 days to 2 weeks.

2. CB/WCU/FCCR Conference/Workshop in India

U.S. Government Lead: Dr. Craig Zamuda, Office of Clean Energy Collaboration, Office of Fossil Energy, USDOE

Co-Lead: Mr. Mark Sharpe, Sharpe International, LLC; Dr. Kumar Sellakumar, Etaa Energy

India Lead: Mr. P. R. Mandal, Adviser (Projects), MOC

Co-Lead: Director (Tech.), MOC; Director (Tech.), CMPDI; Director (Tech.), BCCL

Organize a two-day conference/workshop on all aspects of CB/WCU/FCCR including the inter-relationship/inter-dependence of these processes. One day will be devoted to specialized issues of each area.

The conference/workshop will focus on technical, regulation, resource assessments, investment requirements and the financial viability of CB, combined CB/WCU as well as CB/FCCR projects. The participants will primarily be Indian professionals augmented by U.S. experts. U.S. participants could include USDOE, USEPA and USTDA, as well as participants from interested operating companies and experienced consultants.

Schedule: 3rd Quarter 2006

3. Engagement of Experts for Commercial Venture Modeling

U.S. Government Lead: Dr. Craig Zamuda, Office of Clean Energy Collaboration, Office of Fossil Energy, USDOE

Co-Lead: Mr. Mark Sharpe, Sharpe International, LLC; Dr. Kumar Sellakumar, Etaa Energy; Dr. Roe-Hoan Yoon, Vir-

ginia Polytechnic Institute and State University

India Lead: Mr. P. R. Mandal, Adviser (Projects), MOC

Co-Lead: Director (Tech.), MOC; Director (Tech.), CMPDI; Director (Tech.), BCCL

Provide expert assistance in CB/WCU as well as CB/FCCR process modeling. USDOE would facilitate discussions between India and U.S. experts and technology providers.

Schedule: 4th Quarter 2006

4. Development of a CB/WCU Model Project

U.S. Government Lead: Dr. Craig Zamuda, Office of Clean Energy Collaboration, Office of Fossil Energy, USDOE

Co-Lead: Mr. Mark Sharpe, Sharpe International, LLC.; Dr. Kumar Sellakumar, Etaa Energy

India Lead: Mr. P. R. Mandal, Adviser (Projects), MOC

Co-Lead: Director (Tech.), MOC; Director (Tech.), CMPDI; Director (Tech.), BCCL

Support a combined CB/WCU co-development model project. With the expansion of coal beneficiation capacity, the opportunity exists to demonstrate the benefits that can be achieved by integrating coal beneficiation and power generation. The project would develop a mechanism where the administrative, legal and fiscal regime is well defined for simultaneous high efficiency coal beneficiation and energy utilization.

The project would focus on formulating a preliminary strategy for development and production and preparation of documents for funding

of a detailed commercial project feasibility study, perhaps to be submitted to USTDA for consideration.

Schedule: 4th Quarter 2006

5. FCCR Orientation Visit to the USA

U.S. Government Lead: Dr. Craig Zamuda, Office of Clean Energy Collaboration, Office of Fossil Energy, USDOE

Co-Lead: Dr. Roe-Hoan Yoon, Virginia Polytechnic Institute and State University

India Lead: Mr. P. R. Mandal, Adviser (Projects), MOC

Co-Lead: Director (Tech.), MOC; Director (Tech.), CMPDI; Director (Tech.), BCCL

Organize an orientation visit for an Indian delegation from the coal and metallurgy sectors to evaluate FCCR in the U.S. and viability in India. The visit would introduce the Indian delegation to technical experts and enable the delegates to examine FCCR field operations at various operating conditions and feedstock qualities.

Schedule: 2nd Quarter 2006. The proposed length of visit is approximately 10 days to 2 weeks.

6. Developing a Flow sheet for an Advanced FCCR for Indian Coal

U.S. Government Lead: Dr. Craig Zamuda, Office of Clean Energy Collaboration, Office of Fossil Energy, USDOE

Co-Lead: Dr. Roe-Hoan Yoon, Virginia Polytechnic Institute and State University

India Lead: Mr. P. R. Mandal, Adviser (Projects), MOC

Co-Lead: Director (Tech.), MOC; Director (Tech.), CMPDI; Director (Tech.), BCCL

Froth flotation is the best available separation technique for cleaning fine coals. It is proposed, therefore, to develop process flow sheets, incorporating advanced flotation processes such as Microcel that can produce low-ash, clean coals at high yields.

It may also be useful to conduct a series of flotation tests after pulverizing an Indian coal to different particle sizes. The test results will provide a relationship between ash content and particle size.

One important aspect of cleaning fine coal is removing surface moisture (dewatering). In general, the cost of dewatering increases sharply with decreasing particle size. It is, therefore, suggested that several promising advanced fine coal-dewatering technologies be tested for Indian coals.

Schedule: 1st Quarter 2007

7. Developing a Coal Cleaning Plant Simulator

U.S. Government Lead: Dr. Craig Zamuda, Office of Clean Energy Collaboration, Office of Fossil Energy, USDOE

Co-Lead: Mr. Mark Sharpe, Sharpe International, LLC; Dr. Roe-Hoan Yoon, Virginia Polytechnic Institute and State University

India Lead: Mr. P. R. Mandal, Adviser (Projects), MOC

Co-Lead: Director (Tech.), CMPDI; Director (Tech.), BCCL

It is proposed to develop a computer simulation model that can be used to develop optimum process conditions for cleaning Indian

coals. The model will simulate each unit operation in a coal cleaning plant. The simulator can be used to design a plant on the basis of experimental washability and release analyses data specific for each coal fed to the plant. It can also be used to identify optimum operating conditions that maximize clean coal production for any given market specification.

Schedule: 2007

C. COAL-MINE SAFETY

Background: The number of coal-mine accidents and fatalities in India has decreased significantly over the last decade. The majority of recently reported accidents are associated with inundation and gas explosions. For underground coal mining, side and roof collapses are also a major cause of accidents, while for surface mining a major cause is slope failure.

Issues: Safety, welfare and health of mine workers are regulated by the Ministry of Labor and Employment (India). However, the Ministry of Coal (India) also has responsibility for reviewing coal-mine safety. The Indian delegation to the Coal Working Group has expressed interest in a number of coal-mine safety issues including: application of advance rescue equipment and associated services; procedures and techniques for locating and rescuing of trapped miners; procedures for rescue mobilization and services, techniques for mine fire mapping by thermal infrared remote sensing; and detection and mapping of old and unapproachable work areas and safety barriers for adjacent work areas.

Activities: Although the U.S. Department of Energy does not have responsibility in the area of coal-mine safety, it will facilitate cooperative activities under the Coal Working

Triangle of Success



Group with other appropriate federal agencies. For example, the Department of Labor, Office of Mine Safety and Health Administration (MSHA), is responsible for enforcement of rules, education and training of mining personnel and technical assistance to the U.S. mining community and has been a major contributor to the strides made in safety and health in America's mining industry. The following lead individuals/organizations and activities are proposed:

1. Exchange of Technical Safety Information

U.S. Government Lead: Dr. Craig Zamuda, Office of Clean Energy Collaboration, Office of Fossil Energy, USDOE

Co-Lead: USDOL

India Lead: Mr. P. R. Mandal, Adviser (Projects), MOC.

Co-Lead: Director (Tech.), MOC; Director (Tech.), CMPDI; ED, Safety (CIL), Director (Tech.), ECL

The USDOE/DOL will arrange for information on "Equipment, Health and Safety Hazard Alerts" to be available to Indian government and business sector. Electronic access to this information will be established, including access to Safety Flyers that can be printed and posted.

Schedule: 2nd Quarter 2006

2. Training at the National Mine Health and Safety Academy

U.S. Government Lead: Dr. Craig Zamuda, Office of Clean Energy Collaboration, Office of Fossil Energy, USDOE

Co-Lead: USDOL

India Lead: Mr. P. R. Mandal, Adviser (Projects), MOC

Co-Lead: Director (Tech.), MOC; Director (Tech.), CMPDI; ED, Safety (CIL), Director (Tech.), ECL

The mission of the MSHA is to reduce accidents and improve health conditions in the mining industry through education and training. To fulfill this mission, the MSHA conducts a variety of education and training programs in health and safety and related subjects for Federal mine inspectors and other government mining and industry personnel. Through discussions with the Indian members of the Coal Working Group, appropriate training opportunities will be identified and made available.

Schedule: Initial discussions and training opportunities identification will be conducted in 2nd Quarter of 2006.

3. Interactive Training Opportunities

U.S. Government Lead: Dr. Craig Zamuda, Office of Clean Energy Collaboration, Office of Fossil Energy, USDOE

Co-Lead: USDOL

India Lead: Mr. P. R. Mandal, Adviser (Projects), MOC

Co-Lead: Director (Tech.), MOC; Director (Tech.), CMPDI; ED, Safety (CIL), Director (Tech.), ECL

Electronic access to interactive training courses will be made available. The online courses will help mine operators to comply with appropriate safety regulations. Courses will focus initially on: Material Handling Safety; Mine Health and Safety Simulation Exercises; Hazard Communication; Job Task

Analysis; Self-contained Self-rescuers Training; and Surface Powered Haulage Safety.

Schedule: Courses will be made available in 2nd Quarter 2006.

4. Regulatory Information

U.S. Government Lead: Dr. Craig Zamuda, Office of Clean Energy Collaboration, Office of Fossil Energy, USDOE

Co-Lead: USDOL

India Lead: Mr. P. R. Mandal, Adviser (Projects), MOC

Co-Lead: Director (Tech.), MOC; Director (Tech.), CMPDI; ED, Safety (CIL), Director (Tech.), ECL

Copies of Federal statutory and regulatory requirements established to achieve improvements in mine safety and health will be made available to the Indian Government. This will include electronic access to the Federal Mine Safety and Health Act and Code of Federal Regulations.

Schedule: Materials will be made available in 2nd Quarter 2006.

D. COAL-BED, COAL-MINE AND/OR ABANDONED-MINE METHANE

Background: A major area of interest for India is the promotion of domestic coal-bed, coal-mine and abandoned-coal-mine methane (CBM/CMM/ACMM) development for energy security, safety and environmental reasons. India has significant CBM/CMM/ACMM resources, estimated at approximately 36 trillion cubic feet. The production and use of CBM/CMM/ACMM could help reduce India's reliance on foreign gas imports, reduce methane emissions, create relatively high paying jobs, improve mine worker's safety, improve mine productivity, help lower mining costs and reduce greenhouse gas emissions.

Issues: CBM/CMM/ACMM development in India is a cross-cutting activity affecting both the oil & gas and coal sectors. Responsibilities for this activity extend to two ministries: the Ministry of Petroleum and Natural Gas; and the Ministry of Coal (MOC). The specific activities pursued under the US-India Energy Dialogue will need to be coordinated between the working groups sharing responsibilities in this area.

Deliverables & Objectives: The following barriers have to be overcome:

(I) Capacity is lacking with respect to resource modeling in coal seams under de-stressed conditions.

(II) Working out economics of CMM project.

(III) Legal/safety framework under which CMM prospects can be developed and also the matter regarding ownership of the recovered gas/carbon credit is not properly understood.

CBM Drilling Rig



Photo: MT DEQ

(IV) Lack of infrastructure for cost effective transportation & utilization of recovered methane.

Activities: The following lead individuals/organizations and prospective bilateral CBM/CMM/ACMM activities would fall within the purview of the US-India Energy Dialogue and would constitute deliverables for either or both the Coal Working Group and the Oil & Gas Working Group.

1. CBM/CMM/ACMM Conference/ Workshop in India

U.S. Government Lead: Dr. Craig Zamuda, Office of Clean Energy Collaboration, Office of Fossil Energy, USDOE

Co-Lead: Mr. Mark Stern, MT Energy Associates; Jon Kelafant, Advanced Resources International, Inc.

India Lead: Ministry of Petroleum & Natural Gas

Co-Lead: Director (Tech.), MOC; Director (Tech.), CMPDI

Support a workshop on CBM/CMM/ACMM that focuses on regulation, resource assessments, investment requirements and combined CBM/CMM/ACMM project potential in India. U.S. participants could include USDOE, USEPA and USTDA, as well as participants from interested operating companies, experienced consultants in resource assessment, project planning and execution and regulatory experts (possibly including state regulators from Alabama, New Mexico, Colorado and/or Wyoming).

Schedule: A 3rd Quarter 2006 timeframe is proposed for this activity.

2. CBM/CMM/ACMM Orientation Visit to the United States - Regulatory

U.S. Government Lead: Dr. Craig Zamuda, Office of Clean Energy Collaboration, Office of Fossil Energy, USDOE

Co-Lead: Mr. Mark Stern, MT Energy Associates; Jon Kelafant, Advanced Resources International, Inc.

India Lead: Mr. P. R. Mandal, Adviser (Projects), MOC

Co-Lead: Director (Tech.), MOC; Director (Tech.), MOC; Director (Tech.), CMPDI

Organize a technical orientation visit to the United States for an Indian delegation from the coal and oil & gas sectors to address regulatory provisions that will allow for CBM production and coal gasification in or near active coal mining areas. The Indian delegation should be comprised of a small select group of

executives with specific regulatory responsibilities. The visit could consist of meetings in Washington, D.C. and field visits to the Black Warrior Basin (Alabama), the Raton Basin (Colorado), the San Juan Basin (New Mexico) and the Powder River Basin (Wyoming). The visit would introduce the Indian delegation to regulatory officials and legal experts and enable the delegates to examine CBM field operations under the various state regulatory regimes. They also will be able to address regulation from the perspective of U.S. operating companies.

Schedule: 3rd Quarter 2006.

3. Coal-bed Methane Clearinghouse Initiative

U.S. Government Lead: Ms. Pamela Franklin, USEPA; Ms. Marian Bassett, USTDA

Co-Lead: Mr. Mark Stern, MT Energy Associates; Jon Kelafant, Advanced Resources International, Inc.

India Lead: Mr. P. R. Mandal, Adviser (Projects), MOC

Co-Lead: Director (Tech.), MOC; Director (Tech.), CMPDI

USEPA and USTDA are interested in establishing and supporting a CBM/CMM Clearinghouse in India. The Government of India has expressed interest in developing such a clearinghouse, as expressed in a joint statement during President Bush's visit to India in March 2006. USEPA's primary interest in working to establish a CBM/CMM Clearinghouse in India is the potential to reduce coal mine methane emissions and to promote short-term and long-term sustainability. USEPA has developed successful clearinghouses in China, Russia, and Ukraine. USTDA's interest in supporting the Clearinghouse is to pro-

vide sustainable energy development in India and to promote the adoption of US technology and services in the development of this sector. USTDA has expressed specific interest in helping to launch the Clearinghouse with an opening conference or workshop. Both agencies agree that both coal mine methane and coalbed methane must be integral to the organization's mission and governance.

Schedule: Protocol expected to be signed by 2nd-3rd Quarter 2006 for establishing the Clearinghouse.

4. Engagement of Experts for Resource Modeling

U.S. Government Lead: Dr. Craig Zamuda, Office of Clean Energy Collaboration, Office of Fossil Energy, USDOE

Co-Lead: Mr. Mark Stern, MT Energy Associates; Jon Kelafant, Advanced Resources International, Inc.

India Lead: Mr. P. R. Mandal, Adviser (Projects), MOC

Co-Lead: Director (Tech.), MOC; Director (Tech.), CMPDI

Provide expert assistance in CBM/CMM/ACMM resource modeling. USDOE would facilitate discussions between India (MOC, CIL, CMPDI, etc.) and U.S. experts and technology providers.

Schedule: 3rd Quarter 2006

5. Development of a CBM/CMM Model Project

U.S. Government Lead: Dr. Craig Zamuda, Office of Clean Energy Collaboration, Office of Fossil Energy, USDOE

Co-Lead: Mr. Mark Stern, MT Energy Associates; Jon Kelafant, Advanced Resources International, Inc.

India Lead: Mr. P. R. Mandal, Adviser (Projects), MOC

Co-Lead: Director (Tech.), MOC; Director (Tech.), CMPDI

Support a combined CBM and CMM co-development model project. The project would be similar to the operation of Black Warrior Methane Corporation (BWMC) in Alabama, which combines CBM and CMM co-production as a successful commercial development. BWMC is the CBM producer while Jim Walter Mines is the coal producer. This co-development initiative is an excellent opportunity to demonstrate the benefits that can be achieved by cooperation between coal and methane producers. The project would develop a mechanism where the administrative, legal and fiscal regime is well defined for simultaneous coal extraction and methane recovery in the same mining leasehold.

The project would focus on formulating a preliminary strategy for development and production and preparation of documents for funding of a detailed commercial project feasibility study, perhaps to be submitted to USTDA for consideration.

Schedule: 4th Quarter 2006

E. OVERBURDEN DUMP STABILITY

Background: Opencast Mining contributes about 85% of the total production of Coal India Limited. A study indicates that opencast mining will continue to remain as a dominant mining technology in CIL for at least the next two decades. Depths of opencast mines are projected to increase in future. Opencast mines have already been planned with a maximum depth of about 300 m. The stability of internal over burden dumps, therefore, may pose a problem in future opencast mines. The problem is already acute in some of the mines of NCL like Jayant OCP, Bina OCP, etc.

Deliverables & Objectives:

- Assessment of pheratic surface in the internal over burden dump without installation of peizometers
- Monitoring of internal over burden dump slope to verify deviation from the planned dump slope
- To measure the rate of slope movement in internal dump and to predict failure of dump.

Technology transfer in the areas of application of laser based surveying technology for measurement of dump slopes, measurement of dump slopes movement and methods of prediction of failure of internal dump slope are therefore considered necessary.

Activities: The following lead individuals/organizations and activities are proposed:

1. Engagement of Experts

U.S. Government Lead: Dr. Craig Zamuda, Office of Clean Energy Collaboration, Office of Fossil Energy, USDOE

Co-Lead: Mr. Mike Mosser, NETL/USDOE

India Lead: Mr. P. R. Mandal, Adviser (Projects), MOC

Co-Lead: Director (Tech.), MOC; Director (Tech.), CMPDI; Director (T), NCL; Director (T), ECL

Schedule: 3rd Quarter 2006

F. IN-SITU COAL GASIFICATION

Background: Underground coal gasification (UCG) is an appropriate technology to economically access the energy resources in deep and/or unmineable coal seams and potentially to extract these reserves through production of synthetic gas (syngas) for power generation, production of synthetic liquid fuels, natural gas, or chemicals. India is a potentially good area for underground coal gasification. India has an estimated amount of about 467 billion tonnes (bt) of possible reserves, nearly 66% of which is potential candidate for UCG, located at deep to intermediate depths and are low grade. Furthermore, the coal available in India is of poor quality, with very high ash content and low calorific value. Use of coal gasification has the potential to eliminate the environmental hazards associated with ash, with open pit mining and with greenhouse gas emissions if UCG is combined with re-injection of the CO₂ fraction of the produced gas. With respect to carbon emissions, India's dependence on coal and its projected rapid rise in electricity demand will make it one of the world's largest CO₂ producers in the near future. Underground coal gasification, with separation and reinjection of the CO₂ produced by the process, is one strategy that can decouple rising electricity demand from rising greenhouse gas contributions.

UCG is well suited to India's current and emerging energy demands. The syngas produced by UCG can be used to generate electricity through combined cycle. It can also be shifted chemically to produce synthetic natural gas (e.g., Great Plains Gasification Plant in North Dakota). It may also serve as a feedstock for methanol, gasoline, or diesel fuel production and even as a hydrogen supply. Currently, this technology could be deployed in both eastern and western India in highly populated areas, thus reducing overall energy demand. Most importantly, the reduced capital cost and lack of facilities provide a plat-

form for rapid acceleration of coal-fired electric power and other high-value products.

In summary, UCG has several important economic and environmental benefits relevant to India's energy goals:

- It requires no purchase of surface gasifiers, reducing capital expense substantially.
- It requires no ash management, since ash remains in the subsurface.
- It reduces the cost of pollution management and emits few black-carbon particulates.
- It greatly reduces the cost of CO₂ separation for greenhouse gas management, creating the potential for carbon crediting through the Kyoto Clean Development Mechanism.
- It greatly reduces the need to mine and transport coal, since coal is used in-situ.

Issues: This relatively new area of energy exploitation would require solutions to numerous technical, economical and regulatory issues. At least two technical issues have to be resolved first: Research is needed to ensure that proper site selection provides both the desired conditions for suitable UCG processes and the confidence that the usable groundwater resources are not adversely impacted.

Groundwater/Environmental considerations: Even though most UCG operations have not produced any significant environmental consequences, some UCG demonstrations (including two in the U.S.) resulted in contamination of groundwater resource. A combination of site-selection, operational and monitoring criteria need to be developed to directly address the issue of environmental risk posed to groundwater.

Site/Process considerations: Site and process considerations are inter-dependent, one will affect the other. The parameters associated with the relevant process need to be explored to identify, in a quantitative context, which

scenarios are most favorable and which are least, for UCG at a particular site. Also, the coal seam should be located in a region where the products of UCG can be used; otherwise an expensive transportation/conversion scenario would develop.

Activities: The following lead individuals/organizations and activities are proposed:

1. UCG Conference/Workshop, Location: India

U.S. Government Lead: Dr. Craig Zamuda, Office of Clean Energy Collaboration, Office of Fossil Energy, USDOE

Co-Lead: Mr. Doug Rottman, Lawrence Livermore National Laboratory

India Lead: Mr. P. R. Mandal, Adviser (Projects), MOC

Co-Lead: Director (Tech.), MOC; Director (Tech.), CMPDI; Director (T), SECL; Director (T), ECL

Convene a workshop on UCG that focuses on the potential for UCG to be included in India's portfolio of coal exploitation processes and on lessons learned worldwide.

Schedule: 4th Quarter 2006

2. UCG Site Visits to the United States

U.S. Government Lead: Dr. Craig Zamuda, Office of Clean Energy Collaboration, Office of Fossil Energy, USDOE

Co-Lead: Mr. Doug Rottman, Lawrence Livermore National Laboratory

India Lead: Mr. P. R. Mandal, Adviser (Projects), MOC

Co-Lead: Director (Tech.), MOC; Director (Tech.), CMPDI; Director (T), SECL; Director (T), ECL

Organize a technical visit to operating and pilot UCG sites for an Indian delegation from the coal sector to address operational and regulatory issues associated with underground coal gasification. The Indian delegation should include geologists, process and mining engineers and regulatory stakeholders. Visits could include site visits to field sites in Wyoming and the new UCG project in western India and would involve workshops around local data sets, cores and infrastructure.

Schedule: 2nd Quarter 2006

3. Development of a UCG Pilot Project

U.S. Government Lead: Dr. Craig Zamuda, Office of Clean Energy Collaboration, Office of Fossil Energy, USDOE

Co-Lead: Mr. Doug Rottman, Lawrence Livermore National Laboratory

India Lead: Mr. P. R. Mandal, Adviser (Projects), MOC

Co-Lead: Director (Tech.), MOC; Director (Tech.), CMPDI; Director (T), SECL; Director (T), ECL

Building upon activity number 3 above, the engineering design, plans and construction of a UCG pilot could be undertaken at a site or sites identified as potentially commercial UCG sites. Part of this task would also include the design and installation of an environmental monitoring program to be run prior to, during and after the UCG pilot.

Schedule: 3rd Quarter 2007

G. EXTRACTION OF STEEP SEAMS AT LEDO MINE, NORTH EASTERN COALFIELD

Background: North Eastern Coalfields (NEC) is a unit of Coal India Limited, a Govt. of India undertaking, engaged in carrying out coal mining operations in the North Eastern Region of India. A total of about 910 Mte coal reserve occur in the North Eastern part of India. Coal reserves in this region are spread over four states in 17 coalfields out of which 9 are major coalfields in the region. These coalfields are located in extremely hilly areas dissected by numerous rivers and streams forming deep valleys and gorges. The coals occurring in this part of the country are tertiary coal, unique in character by virtue of low ash content in the range of 4% to 25%, high sulphur content in the range of 1.5% to 4% and caking characteristics.

NEC operates through its area at Margherita, looking after the coal mining activities in the state of Assam. At present the coal seams of Makum Coalfield are worked by 3 underground collieries namely Tipong, Baragolai, Ledo and 2 opencast collieries namely Tirap and Tikak. During the year 2004-05, Margherita area of NEC produced 0.63 million tonnes of coal. The two main coal seams in Makum Coalfield are a 20 ft seam and a 60 ft seam. The inclination of the seam in the area varies from 25° to 80°. All the underground collieries in this region are Degree-III gassy collieries and the seams are highly prone to spontaneous heating. The coal is friable in nature and results in soft roofs and floors. The mine water is highly acidic due to the presence of sulphur.

Present methods of extraction:

The methods of coal extraction in underground collieries of Margherita are the Tipong method (a modified Bhaska method) in Baragolai colliery and Tipong colliery (gradi-

ent 40° to 50°) and the Scraper Assisted Chamber method (a modified Tipong method) in Ledo colliery (gradient 30° to 35°). To improve upon the percentage of coal extraction and also coal production, various other methods such as Descending Shield method and Flexible roofing method have also been tried with limited success and later discontinued.

The collieries of Margherita were initially worked by Bhaska method. Due to lack of safety in this method where miners had to work under unsupported roof, the method was modified and named as Tipong method. The Tipong method provides more safety and yields higher percentage of extraction as compared to Bhaska method. At Ledo underground colliery due to low gradient of seam, the Tipong method has been modified by using a scraper to assist coal flow.

Deliverables & Objectives: Both of the existing methods presently have low production, in the order of 100 TPD per district, and a low percentage of extraction, of about 25 – 30%. For improving the production and percentage extraction from such steep and thick coal seams, a more suitable mining method is required. Ledo Colliery has been identified for applying a new, more suitable coal production method. Brief details of Ledo Colliery are given below.

Ledo Colliery:

Ledo colliery lies in the Lachitkhani block of Makum Coalfield. The colliery is situated at a distance of 8 Km from Margherita. The block lies west of Tirap Underground Block and east of Baragolai Block. Two main seams viz. the 60 ft seam and 20 ft seam are amenable for extraction.

Both these seams have been worked extensively above ground level by underground mining methods. Access to these seams is

through two inclines serving as main intake airways and transport route and a drift used as return airway fitted with axial flow exhaust fan.

The average seam gradient is around 30° to 35°. Both the seams are of degree III gassiness and crossing point temperature and ignition point temperature of both 20 ft seam and 60 ft seam are 165°C and 140°C respectively. The seams have presently been developed up to a depth of 160m (approximately 500 feet). The method used is the Scraper Assisted Chamber method.

The 20 ft and 60 ft seams are split at places within the mine take area. The thickness of the 20 ft seam being worked varies from 4m to 9m (13 to 20 ft approximately) and thickness of 60 ft seam varies from 5.4m to 19m (18 to 63 ft approximately).

As the seams are soft and friable in nature the permanent level drivages are made in the foot-wall or hangwall and the seams are touched by cross drifts at suitable intervals. The drivages in the seam are made by pick mining and are heavily supported by wooden supports.

As mentioned above, there is a need for improving the production performance and extraction percentage by a suitable technology.

Activities: The following lead individuals/organizations and activities are proposed:

1. Engagement of Experts

U.S. Government Lead: Dr. Craig Zamuda, Office of Clean Energy Collaboration, Office of Fossil Energy, USDOE

Co-Lead: Mr. Mike Mosser, NETL/USDOE; Mr. Alfred Whitehouse, DOE/OSMRE

India Lead: Mr. P. R. Mandal, Adviser (Projects), MOC

Co-Lead: Director (Tech.), MOC; Director (Tech.), CMPDI; Director (Tech.), CIL

Schedule: 4th Quarter 2006

H. GRANT AGREEMENT WITH USTDA FOR PREPARATION OF FEASIBILITY STUDY OF MINE-III PROJECT FOR NEYVELI LIGNITE CORPORATION LTD.

Background: Neyveli Lignite Corporation Ltd. (NLC), a state owned enterprise under India's MOC has so far been engaged in exploitation of lignite reserves available in Tamilnadu for Generation of electricity. NLC has been achieving good productivity and financial return in the past, which, the company wants to maintain and improve in the years to come. NLC has recently completed three major projects viz. Mine IA, Mine-I expansion and TPS I expansion. NLC has taken up number of new projects for implementation in X and XI plans to maintain the tempo of growth.

The entire mining operations at Neyveli are done departmentally with specialized mining equipment like Bucket Wheel Excavator (BWE). In view of the increasing OB, lignite ratio, mining of lignite with this mode of mining has become costlier. Besides, the introduction of new Electricity Bill 2003 and the ABT regime has called for higher competitive tariffs for electricity which in turn calls for reduced price of fuel i.e. lignite.

In this direction NLC has started exploring alternate technologies of mining and hiring/leasing of mining equipments with operators to bring down the price of lignite. For a production of 8 million tonnes of lignite per annum for the proposed Mine III project, large size conventional mining equipments are required. Such large machines are being manufactured, supplied and operated successfully in US. A feasibility study was done in-house using the current mining technology with BWEs but the lignite production cost worked out called for study of other mining options for comparison. Therefore, NLC is exploring for alternate mining technology, which should

be cost effective and technically suitable to remain competitive in the market. With this background, the assistance of US consulate in doing a feasibility study was sought.

NLC prepared a Feasibility Report for Mine-III of 8 million tones per annum capacity to supply lignite to Thermal Power Station-III of 1000 MW adopting specialized Mining Equipments (SME) viz., bucket wheel excavator, conveyor, spreader etc. USTDA has agreed for a grant of \$ 360,000 to NLC for carrying out a Feasibility Study for the Alternate Mining Technology for Mine-III Expansion project in India. In undertaking this major mine expansion project, NLC, is evaluating the feasibility of using Alternate Mining Technology (AMT) versus the Specialized mining Equipment (SME) technology which is currently being used.

Deliverables & Objectives:

- The Feasibility study would assess the technical viability of AMT technology, specifically the operation of AMT equipment given the difficult hydrological conditions at Mine-III.
- This project is a priority for the GOI, as the mined coal will be used to produce an additional 1000MW of electric power to meet growing demand. The lignite Mine-III project and associated TPS-III project will have a positive developmental impact on India. If implemented, the application of AMT for opencast lignite production will reduce capital costs, lower operating costs, increase efficiency to maintain continuous mining operations, and increase the ultimate recovery from the mine.

1. Engagement of Experts

U.S. Government Lead: Dr. Craig Zamuda, Office of Clean Energy Collaboration, Office of Fossil Energy, USDOE

Co-Lead: Mr. Mike Mosser, NETL/USDOE

India Lead: Mr. P. R. Mandal, Adviser (Projects), MOC

Co-Lead: Director (Tech), MOC; Director (Mines), NLC

Schedule: Mid-2006

APPENDIX I:

This appendix includes the India-US Energy Dialogue Joint Statement.

India – US Energy Dialogue

Joint Statement

The US Secretary for Energy, Dr. Samuel W. Bodman and the Deputy Chairman of the Planning Commission of India, Dr. Montek Singh Ahluwalia met in Washington, DC on May 31, 2005 to launch a new bilateral India – US Energy Dialogue. The establishment of the Dialogue reflects the transformed strategic relationship between the U.S. and India as called for by President George W. Bush and Prime Minister Manmohan Singh. Secretary Bodman and Dr. Ahluwalia agreed that it was important to show progress in the Energy Dialogue before the visit to the U.S of Prime Minister Singh.

The Energy Dialogue will build upon the broad range of existing energy cooperation between the two countries as well as develop new avenues of collaboration. Its work will be organized across five Working Groups, which will be supervised by a Steering Committee. Secretary Bodman named David Garman, Assistant Secretary for Energy Efficiency and Renewable Energy, as the U. S. co-chair of the Steering Committee, and Dr. Ahluwalia named Foreign Secretary Shyam Saran as the Indian co-chair. Together, they will promote increased trade and investment in the energy sector and work with the public as well as private sectors to identify areas of cooperation and collaboration. The first meetings of the working groups are expected to take place prior to the visit of Prime Minister Singh.

The Steering Committee will guide and manage the overall direction of the Dialogue, including activities of the Working Groups. It will establish broad goals and timelines and ensure coordination among the Working Groups on crosscutting issues such as energy security, future energy scenarios and trade and investment. The Working Groups will address such topics as oil and natural gas, electric power, coal and clean coal technology, energy efficiency, renewable energy, new technologies such as hydrogen, and civil nuclear power.

The salient goals of the various working groups will include:

- Strengthening mutual energy security and promoting stable energy markets to ensure adequate supplies of energy that will support desired levels of economic growth; exchanging information and developing lines of communication for policy coordination in times of market instability; promoting increased trade and investment in the oil and gas sector.
- Advancing understanding of efficient generation, transmission, distribution and use of electricity and promoting the exchange of information on regulatory policies; cooperating on programs and technologies with special emphasis on the “last mile“ distribution and utilization of electricity in urban and rural networks; developing cooperation on clean coal preparation and modern coal conversion systems in power generation.
- Enhancing the understanding of coal-related energy issues and promoting the exchange of information on policies, programs, and technologies with special emphasis on coal utilization for power generation and clean fuels production; promoting the efficient and environmentally responsible use of coal.
- Promoting the development and deployment of clean energy technologies and energy conservation practices that will improve the efficiency of energy use leading to enhanced energy security and stable energy markets that will support desired levels of economic growth with appropriate concern for the environment.
- Dialogue and action on issues associated with civilian uses of nuclear energy and its control; exchanges between the Department of Energy and the Nuclear Regulatory Commission (NRC) and India’s Department of Atomic Energy and Atomic Energy Regulatory Board on each country’s nuclear energy-related initiatives, practices, research interests, regulatory oversight and view of the role of nuclear energy in meeting global energy requirements; discussions on fusion science and related fundamental research topics.

APPENDIX II:

This appendix includes the Record of Meeting between the Department of Energy of the United States of America and the Ministry of Coal of the Government of India which was held in Washington, D.C. from November 17 through 23, 2005.

**Record of Meeting
Between
The Department of Energy, Of the United State of America
And
The Ministry of Coal, Of the Government of India**

Washington, D.C., November 17-23, 2005

Representatives of the Department of Energy of the United States of America (DOE) and the Ministry of Coal of the Government of India (MOC) met in Washington, D.C. on November 17 - 23, 2005.

The agenda for the coal working group meeting is attached (Attachment 1). A list of participants of the Coal Working Group Meeting is attached (Attachment 2). A list of the papers presented in the Coal Working Group Meeting is attached (Attachment 3).

The Participants discussed the overall Coal Working Group's goals and objectives, structure, scope and membership, and reflected the outcome of these deliberations in a revised Terms of Reference (Attachment 4).

The Participants discussed:

- US industry's interaction with India's coal industry
- future organizational structure and mode of operation of the CWG
- US-India Coal R & D initiatives in the areas of Clean Power and Clean Fuels
- coal beneficiation
- utilization of fly ash
- coal liquefaction
- coal mine safety, training, closure and reclamation
- coal bed methane
- US DOE – India bilateral activities related to coal and energy

The Participants noted current collaboration between U.S. and Indian companies, research agencies and government agencies, and identified potential for enhanced collaboration in the areas of:

- the development and demonstration of technologies for better coal beneficiation and power generation with rejects
- the development and demonstration of technologies for coal liquefaction and in-situ coal gasification
- the development and demonstration of technologies for capturing as well as utilizing coal bed/coal mine/abandoned mine methane
- training of personnel
- mine safety and proper coal mine closure and reclamation
- enhancing productivity in coal mines

The Participants identified actions and deliverables of the Coal Working Group (Attachment 5).

The Participants decided to meet on a regular basis with a frequency of quarterly video conferences, and one annual meeting with everyone in the same venue.

Representatives of the Department of Energy of the United States of America and the Ministry of Coal of the Government of India:

Recognizing a mutual interest in collaborating in the field of development of clean fossil energy technologies; recognizing a need to advance the objective of the Government of India, which focuses on practical approaches to dealing with energy requirements; and recognizing their mutual interest in creating an attractive climate for domestic and foreign investment in the energy sector of their respective countries, and in an efficient and environmentally sound energy infrastructure.

Hereby declare their intentions as follows:

1. To take the actions necessary in their respective countries to pursue implementation of the agreed upon actions between the Participants related to cooperation in the development of clean fossil energy technologies and other energy industry issues.
2. To initiate collaboration as follows:
 - a. On projects identified in the CWG meetings.
 - b. Organizing and participating in seminars and joint workshops on mutually agreed topics:
 - c. Exchange of relevant information, experts, and practical experiences;
 - d. Facilitating the development of strategic partnerships, joint ventures, collaborative research, licensing and the transfer of technologies, tools and equipment between organizations in the United States and India that could lead to economic and environmental benefits to both countries; and
 - e. Additional forms of cooperation, as may be agreed.
3. To develop a high level Work Plan, that will be a living document, that highlights key areas of collaboration including potential outcomes and benefits.

It is understood that undertaking the proposed cooperative activities is not intended to create legally binding obligations between the Participants.

It is understood that the Participants' ability to undertake the activities contemplated by Paragraph 2 above is subject to the availability of appropriated funds.



Mark R. Maddox
Department of Energy, United States



Pradeep Kumar
Ministry of Coal,
Government of India

Attachment 1

Agenda

US-India Coal Working Group Meeting

**The Virginia Room
Renaissance Mayflower Hotel**

Washington, D.C.

November 17-23, 2005

DAY 1: THURSDAY, November 17, 2005

2:00 – 5:00 PM

Meeting with the U.S. Trade and Development Agency

DAY 2: FRIDAY, November 18, 2005

9:00 – 9:30 AM

Opening Remarks and Welcome

- Mr. Mark Maddox, Principal Deputy Assistant Secretary, Office of Fossil Energy, USDOE
- Mr. Pradeep Kumar, Additional Secretary, Ministry of Coal, Government of India

Introductions - Coal Working Group Members and Other Participants

9:30 – 9:45 AM

Remarks on Behalf of U.S. Industry

- General Richard L. Lawson (Ret.), Chairman, Energy, Environment and Security Group

9:45 – 10:45 AM

Discussion of Coal Working Group Business Items

- Goals and objectives for coming year
- Terms of Reference
- Structure and Function
- Membership
- Other

10:45 – 11:00 AM

Break

11:00 – 11:30 AM

USDOE Coal R&D Initiatives

- FutureGen and Clean Coal Power Initiative: Mr. Jarad Daniels, DOE/FE
- Clean Coal Fuels: Dr. Lowell Miller, DOE/FE

11:30 – 12:00 PM

India Coal Initiatives

- V.K. Singh, MOC (India)

12:00 – 1:00 PM – Lunch

1:00 – 2:00 PM

Coal Beneficiation and Utilization of Fly Ash

- Goals, objectives and needs: V.K. Singh, MOC (India)
- Ongoing Activities and Opportunities
 - USDOE: William Aljoe, National Energy Technology Laboratory
 - U.S. Business: Mr. Mark Sharpe, Director, Sharpe International, LLC
 - U.S. University: Dr. Barry Scheetz, Pennsylvania State University
 - U.S. University: Dr. Roe-Hoan Yoon, Virginia Polytechnic Institute and State University

2:00 – 3:00 PM

Coal Liquefaction

- Goals, objectives and needs: P.K. Kanchan, MOC (India)
- Ongoing Activities and Opportunities
 - USDOE: Dr. Lowell Miller, DOE/FE
 - U.S. Business: Mr. James Lepinski, Vice President, Technology and Business Development, Headwaters, Inc.

3:00 – 3:15 PM

Break

3:15 - 4:30 PM

Coal-mine Safety, Training, Closure and Reclamation

- India presentation on goals, objectives and needs: P.R. Mandal, MOC (India)
- U.S. Department of Labor: Ms. Melinda Pon, Mine Safety and Health Administration
- U.S. Department of Interior: Dennis Rice, Office of Surface Mining
- U.S. University: Dr. Paul Ziemkiewicz, National Mine Reclamation Center, West Virginia University

4:30 – 5:00 PM

Panel Discussion on DOE Ongoing Bilateral Activity

- Ms. Barbara McKee, Director, Office of Clean Energy Collaboration, Office of Fossil Energy, USDOE -- Panel Chair
- Mr. Tom Cutler, Office of Policy and International Affairs, USDOE
- Mr. Scott Smouse, National Energy Technology Laboratory
- India (To be determined)

5:00 – 5:15 PM

Summary and Overview of CWG Activities for November 21-22

- Dr. Craig Zamuda, Coordinator, Coal Working Group

5:15 – 5:30

Closing Remarks

- Mr. Mark Maddox, Principal Deputy Assistant Secretary, Office of Fossil Energy, USDOE
- Mr. Pradeep Kumar, Additional Secretary, Ministry of Coal, Government of India

6:00 – 8:00 PM

Reception and Dinner

DAY 3: MONDAY, November 21, 2005

9:00 – 5:00 PM

Clean Coal and Power Conference

Renaissance Mayflower Hotel

DAY 4: TUESDAY, November 22, 2005

9:00 – 3:30 PM

Clean Coal and Power Conference

Renaissance Mayflower Hotel

4:00 – 6:30 PM

US-India Coal Working Group Meeting

Renaissance Mayflower Hotel

The Chinese Room

4:00 – 4:10 PM

Opening Remarks

- Mr. Mark Maddox, Principal Deputy Assistant Secretary, Office of Fossil Energy, USDOE
- Mr. Pradeep Kumar, Additional Secretary, Ministry of Coal, Government of India

4:10 – 5:00 PM**Coalbed Methane**

- Goals, objectives and needs: P.K. Kanchan, MOC (India)
- Panel Discussion on Activities and Opportunities
 - Mr. Mark Stern – MT Energy Associates, Moderator
 - Mr. Peter Lagiovane, Office of Fossil Energy, USDOE
 - Ms. Pamela Franklin, Coalbed Methane Outreach Program, USEPA
 - Mr. Jon Kelafant, Advanced Resources International Inc.
 - Ms. Marian Bassett, U.S. Trade and Development Agency

5:00 – 5:30 PM**CWG Path Forward: Discussion**

- Identification of items for future discussion
- Future plans

5:30 – 6:15 PM**Review and Signing of Record of Meeting****6:15 – 6:30 PM****Closing Remarks:**

- Mr. Pradeep Kumar, Additional Secretary, Ministry of Coal, Government of India
- Mr. Mark Maddox, Principal Deputy Assistant Secretary, Office of Fossil Energy, USDOE

DAY 5: WEDNESDAY, November 23, 2005**9:00 – 12:00 PM****Informal Discussions****Renaissance Mayflower Hotel**

Attachment 2

List of CWG Meeting Participants**Indian Participants**

- | | |
|-------------------|--|
| 1. Pradeep Kumar | Ministry of Coal (MOC) (Co-Chair) |
| 2. P.K. Kanchan | Central Mine Planning and Design Institute Limited (CMPDIL) (Lead Coordinator) |
| 3. G. Kumar | Ministry of External Affairs (MEA) |
| 4. P. R. Mandal | Coal India Limited (CIL) |
| 5. K. Ramakrishna | Singareni Collieries Company Limited (SCCL) |
| 6. K. Singh | CIL |
| 7. Rinchen Tempo | MOC |

U.S. Participants

- | | |
|-----------------------|---|
| 1. Mark Maddox | U.S. Department of Energy (USDOE) (Co-Chair) |
| 2. Barbara McKee | USDOE (Lead Coordinator) |
| 3. William Aljoe | USDOE-National Energy Technology Laboratory (USDOE-NETL) |
| 4. Marian Bassett | U.S. Trade and Development Agency (USTDA) |
| 5. Tom Cutler | USDOE |
| 6. Jarad Daniels | USDOE |
| 7. Pamela Franklin | U.S. Environmental Protection Agency (USEPA) |
| 8. Shannon Fraser | U.S. Department of Commerce (USDOC) |
| 9. John Kelafant | Advanced Resources International Inc. |
| 10. Pete Lagiovane | USDOE |
| 11. Richard Lawson | Energy, Environment and Security Group |
| 12. Jim Lepinski | Headwaters Technology Innovation Group |
| 13. Raj Luhar | USDOE |
| 14. Lowell Miller | USDOE |
| 15. Castlen Moore | USDOE |
| 16. Joe Neuhoff | USDOC |
| 17. Yinka Ogunsula | USDOE |
| 18. Melinda Pon | Mine Safety and Health Administration, U.S. Department of Labor |
| 19. Dennis Rice | Office of Surface Mining, U.S. Department of Interior |
| 20. Sridhar Samudrala | U.S. Energy Association (USEA) |
| 21. Barry E. Scheetz | Pennsylvania State University |
| 22. Edward Schmetz | USDOE |
| 23. Mark Sharpe | Sharpe International, LLC |
| 24. Scott Smouse | USDOE-NETL |
| 25. Somnath Som | CSI |

26. Mark Stern	MT Energy Associates
27. Justin Swift	USDOE
28. Venkat Venkataraman	USDOE-NETL
29. Amanda Vockerodt	U.S. Department of State
30. John Ward	Headwaters Technology Innovation Group
31. Tricia Williams	USEA
32. Roe-Hoan Yoon	Virginia Polytechnic Institute and State University
33. Craig Zamuda	USDOE
34. Paul Ziemkiewicz	West Virginia University

Attachment 3

2nd Coal Working Group Meeting**November 17-23, 2005****List of Presentations**

- Advanced Coal Separation Technologies – Roe-Hoan Yoon, Virginia Tech
- CBM and USTDA Involvement - Marian Bassett, USTDA
- CBM in India (Indian Presentation) – P. K. Kanchan, MOC (India)
- Coal Mine Remediation Methods and Closure Technologies - Paul Ziemkiewicz, WVU
- Coal Mining in India An Overview – V. K. Singh, MOC (India)
- Coal to Liquid Fuels - Edward Schmetz, USDOE
- Coal Washing and Power Generation from Washery Rejects – V. K. Singh, MOC (India)
- USDOE Coal Utilization Product R&D Program - William W. Aljoe, USDOE-NETL
- FutureGen and Clean Coal Power Initiative - Jarad Daniels, USDOE
- India's Coal Washing Business - Mark Sharpe, Sharpe International, LLC
- Introduction to CBM Panel Discussion - Mark Stern, Consultant
- Liquefaction of Coal (Indian Presentation) – P. K. Kanchan, MOC (India)
- Mine Closure (Indian Presentation) – P. R. Mandal, MOC (India)
- Mine Reclamation With Ash and Lessons for Gorbi Mine - Barry E. Scheetz, PSU
- Mine Safety (Indian Presentation) – P. R. Mandal, MOC (India)
- NETL USAID India Cooperation History - Scott Smouse, USDOE-NETL
- Opportunities to Reduce CBM Emissions in India - Pamela Franklin, USEPA
- Overview of CBM Development in the USA - Jonathan R. Kelafant, ARI
- Overview of Coal Liquefaction - James A. Lepinski, Headwaters Technology Innovation Group
- Overview of U.S. MSHA Activities and Indian Involvement - Melinda Pon, Mine Safety and Health Administration, U.S. Department of Labor

Attachment 4

US-India Energy Dialogue

Coal Working Group

Terms of Reference

Goals:

To enhance the understanding of coal-related energy issues and promote the exchange of information on policies, programs, and technologies with special emphasis on coal utilization for power generation and clean fuels production; to promote the efficient and environmentally responsible use of coal; to promote increased trade and investment in the coal and coal power sectors; to encourage India's active participation in the Carbon Sequestration Leadership Forum and Methane to Markets Partnership; and to work with the private sector to identify areas of cooperation and collaborate with the business community on joint activities. Both sides agree that discussion or consideration of specific activities in the Terms of Reference do not imply any financial commitment to fund such activities.

General Approach:

- A. Continue bilateral coordination with workshops, training opportunities, discussions, site visits and specific projects in the identified areas. The Coal Working Group will involve experts from government, private industry, academia and other non-government organizations.

Areas of Special Emphasis:

- B. Coal Preparation/coal waste utilization
- C. Mine Safety/Productivity
- D. Mine closure/reclamation
- E. In-situ coal gasification and coal liquefaction
- F. Coal-bed/Coal-mine/Abandoned-mine methane
- G. Ash utilization
- H. Emerging Technologies including CO₂ capture and storage
- I. Future technology paths

Attachment 5

Actions and Deliverables of the Coal Working Group**November 17 – 23, 2005**

The following actions were decided by the Coal Working Group:

Item	Lead	Action	Date Due
1	CWG	Share information on: <ol style="list-style-type: none"> a. Business opportunities in India, including the Coal Vision 2025 document and other related information. b. Regulatory information for India and U.S. coal-mine operations, including websites. c. Relevant information on the Gorbi Mine project and related U.S. coal-mine reclamation activities and lessons learned including acid mine water drainage. d. Relevant pilot projects and active R&D initiatives in U.S. coal industry, specifically for recovery of fines by micro-cell technologies and coal liquefaction by both direct and indirect methods. 	January 6, 2006
2	Barbara McKee / Pravat Mandal (Lead Coordinators)	Confirm the list of members of the CWG.	January 9, 2006
3	Barbara McKee / Pravat Mandal (Lead Coordinators)	Develop a high level Work Plan Document that identifies goals and objectives, deliverables and addresses the priority items of interest identified by the CWG, including: coal preparation/waste utilization; mine safety/productivity; mine closure/reclamation; in-situ coal gasification; coal-bed/coal-mine/abandoned-mine methane; ash utilization, coal liquefaction; emerging technologies including CO ₂ capture and storage; and future technology paths.	January 31, 2006
4	Barbara McKee / Pravat Mandal (Lead Coordinators)	Explore the possibility of a visit to India around March 2006 by U.S. experts in the area of coal preparation with representatives from India's coal companies to discuss a possible coal preparation pilot project.	January 31, 2006
5	Barbara McKee / Pravat Mandal (Lead Coordinators)	Plan for the next CWA meeting which would be held in approximately 6 months in New Delhi.	February 28, 2006
6	CWG / Co-Chairs	Establish a Business Advisory Council, as a resource to the CWG, consisting of representatives from business/industry, academia and other non-governmental organizations. The Council would be co-chaired by a representative each from the U.S. and India and consist of approximately 8 members from each country to provide expert guidance on the priority items of interest identified by the CWG. As the next step, the Business Advisory Council representatives should be identified.	March 31, 2006

Attachment 6

Clean Coal and Power Conference Agenda

The 2005 Clean Coal and Power Conference will focus on political, environmental, economic and social issues associated with satisfying the growing global demand for energy. Sessions will explore the significance of coal as a viable energy source that should be used to meet that demand as well as its role in the potential solutions to those issues. Assessments will be made of the dynamic changes that are resulting from the increasing competition in fuel markets, the restructuring of the utility industry, changing and tightening of environmental regulations and the potential impact of emerging global climate change initiatives.

Among the discussion topics will be the new challenges that coal users will face in meeting environmental concerns, including global climate change and the role of coal in the increasingly competitive electricity and fuel markets.

SPEAKER BIOS

Preliminary Program

Monday, November 21	
7:00 a.m. - 6:00 p.m.	Registration - Promenade
7:00 a.m. - 9:00 a.m.	Continental Breakfast - East/State Rooms
9:00 a.m. - 10:15 a.m.	<p>Opening Plenary Session - Grand Ballroom <i>Today's Technologies, Tomorrow's Potential</i></p> <p>Master of Ceremonies Stephen Miller, President and CEO, Center for Energy and Economic Development</p> <p>Keynote Addresses</p> <p>Climate Change and EPACT '05 - Update The Honorable Chuck Hagel, United States Senate <i>(Invited)</i></p> <p>Technology Is Transforming Coal From Concern to Answer--From Cool Water to Hot Prospects in a Time of Uncertainty Mark Maddox, Principal Deputy Assistant Secretary for Fossil Energy, U.S. Department of Energy</p> <p>Tomorrow's Promise Frank Alix, Chairman and CEO, Powerspan Corp.</p>
10:15 a.m. - 10:30 a.m.	Break - East/State Rooms

<p>10:30 a.m. - 12:00 noon</p>	<p>Panel Session 1 - Economic Stability - Grand Ballroom</p> <p>Co-Chairpersons: Thomas Altmeyer, Vice President, Federal Government Affairs, Arch Coal, Inc. Robert Beck, Executive Director, National Coal Council</p> <p>Speakers:</p> <ul style="list-style-type: none"> • High Energy Costs and the Manufacturing Sector--Is Coal The Answer? Jerry Jasinowski, President, The Manufacturing Institute <i>(Invited)</i> • IGCC Incentives Strategy Speaker TBD • Financing for New Coal Power Plants Peter Rigby, Director, Utilities, Energy, and Project Finance, Standard and Poor's
<p>12:00 noon - 1:30 p.m.</p>	<p>Luncheon - Colonial Room</p> <p>Master of Ceremonies: Jackie Bird, Director, Ohio Coal Development Office</p> <p>CO2 Credits and Their Affect on Existing Fleets Richard Sandor, Chairman and CEO, Chicago Climate Exchange</p>
<p>1:30 p.m. - 3:00 p.m.</p>	<p>Panel Session 2 - Energy Security - Grand Ballroom</p> <p>Co-Chairpersons: Carl Bauer, Director, National Energy Technology Laboratory, U.S. Department of Energy Barry Worthington, Executive Director, United States Energy Association</p> <p>Speakers:</p> <ul style="list-style-type: none"> • Energy, Environment and Security: Can These Be Resolved Successfully In The Year 2005? General Richard Lawson, Ret., Chairman Energy, Environment and Security, Ltd. • Homeland Energy Security Edward Badolato, President and CEO, Integrated Infrastructure Analytics, Inc. • Liquid Fuels and Natural Gas--Domestic Perspective in a World Market David South, Vice President and Executive Director, Pace Global Energy Services, LLC
<p>3:00 p.m. - 3:30 p.m.</p>	<p>Break - East/State Rooms</p>

3:30 p.m. - 5:00 p.m.	<p>Panel Session 3 - Transition to Sustainable Energy Future - Grand Ballroom</p> <p>Co-Chairpersons:</p> <p>Robert Bessette, President, Council of Industrial Boiler Owners</p> <p>Michael Parr, Senior Manager, Government Affairs, DuPont</p> <p>Speakers:</p> <ul style="list-style-type: none"> • Carbon Sequestration Leadership Forum Justin Swift, Deputy Assistant Secretary for International Affairs, Office of Fossil Energy, U.S. Department of Energy • President's Hydrogen Fuel Initiative Steve Chalk, Energy Efficiency and Renewable Energy, U.S. Department of Energy • Coal-bed Methane's Future Energy Role Kent Perry, Director, Exploration and Production Research, Gas Technology Institute
5:30 p.m. - 7:30 p.m.	<p>Poster Session and Reception - East/State Rooms</p>

Tuesday, November 22	
7:00 a.m. - 3:30 p.m.	<p>Registration - Promenade</p>
7:00 a.m. - 9:00 a.m.	<p>Continental Breakfast - East/State Rooms</p>
9:00 a.m. - 9:30 a.m.	<p>Conference Keynote Address</p> <p>The Honorable Samuel Bodman, Secretary, U.S. Department of Energy</p>
9:30 a.m. - 11:00 a.m.	<p>Session I - New Coal Power Technologies Leading to Zero Emission Coal - Grand Ballroom</p> <p>Co-Chairpersons:</p> <p>Victor Der, Director, Office of Clean Energy Systems, U.S. Department of Energy</p> <p>Lee Spangler, Director of Special Programs, Montana State University</p> <p>Speakers:</p> <ul style="list-style-type: none"> • FutureGen Michael Mudd, Manager, Generation and Development, American Electric Power, Inc. • Clean Coal Power Initiative Kenneth Markel, Director, Major Demonstration Projects, National Energy Technology Laboratory, U.S. Department of Energy • Gasification Leading to Near Zero Emissions Stu Dalton, Director, Generation Sector,

	<p>Electric Power Research Institute</p> <ul style="list-style-type: none"> • Producing Hydrogen by Utilizing Near Zero Emissions Clean Coal Technology David Gray, Director, New Energy Systems Analysis, Mitretek
<p>11:00 a.m. - 11:15 a.m.</p>	<p>Break - East/State Rooms</p>
<p>11:15 a.m. - 12:30 p.m.</p>	<p>Session II - Existing Power Plants: Improving Performance With New Technology - Grand Ballroom</p> <p>Co-Chairpersons: Thomas Feeley, Technology Manager, Innovations for Existing Plants Program, National Energy Technology Laboratory, U.S. Department of Energy C. Lowell Miller, Director, Office of Sequestration, Hydrogen and Clean Coal Fuels, U.S. Department of Energy</p> <p>Speakers:</p> <ul style="list-style-type: none"> • Innovations for Existing Plants Thomas Feeley, Technology Manager, Innovations for Existing Plants Program, National Energy Technology Laboratory, U.S. Department of Energy • Multi-Pollutant Control Technology Phillip Boyle, President, Powerspan Corp. • Development and Demonstration of Hg Control Technology Jean Bustard, Chief Operating Officer, ADA-Environmental Systems
<p>12:30 p.m. - 2:00 p.m.</p>	<p>Luncheon - Colonial Room</p> <p>Master of Ceremonies: Robert Beck, Executive Director, National Coal Council</p> <p>Integrated Gasification Combined Cycle--Making It Happen James Rogers, Chairman, President and CEO, Cinergy</p>
<p>2:00 p.m. - 3:30 p.m.</p>	<p>Session III - Sequestration Capture and Storage R&D: Challenges and Opportunities - Grand Ballroom</p> <p>Co-Chairpersons: Ben Yamagata, Executive Director, Coal Utilization Research Council William Fernald, HQ Senior Program Manager for Domestic Sequestration Activities, Office of Sequestration, Hydrogen and Clean Coal Fuels, U.S. Department of Energy</p> <p>Speakers:</p> <ul style="list-style-type: none"> • Deploying Coal with CO2 Capture and Storage David Hawkins, Director, Climate Center, Natural Resources Defense Council • New Sequestration Activities in China S. T. Hsieh, Director, Tulane University, U.S. China Institute

	<ul style="list-style-type: none"> • The DOE Regional Carbon Sequestration Partnerships John Litynski, Project Director, Environmental Project Division, National Energy Technology Laboratory, U.S. Department of Energy • Kicking Coal Combustion Technologies Up A Notch—Meeting the Challenges of Environmental and Carbon Constraints Woodrow Fiveland, Director, Combustion and Environmental Technologies, ALSTOM, Inc.
<p>3:30 p.m.</p>	<p>Conference Closing - Grand Ballroom</p>

APPENDIX III:

This appendix includes a membership list of the Coal Working Group members from the U.S. and India.

Indian Membership for US-India Coal Working Group

1. Pradeep Kumar, Additional Secretary, MOC
2. Pravat.Ranjan Mandal, Adviser (P), MOC
3. Shashi Kumar, CMD, Coal India Limited
4. Subrata Chaudhuri, CMD, CMPDI
5. J.V. Dattatreyyulu, Director (T), Singareni Collieries Co. Ltd.
6. K.S. Anandan, Director (T), Neyveli Lignite Corporation Ltd.
7. Abhay Kumar Jyotishi, Director, CPD, MOC

U.S. Membership for US-India Coal Working Group

1. Coal Working Group Co-Chair: DOE/Office of Assistant Secretary for Fossil Energy
2. Barbara McKee, Lead Coordinator; DOE/FE-27
3. Raj Luhar, DOE/FE-1
4. Justin R. Swift, DOE/FE-1
5. Craig Zamuda; DOE/FE-27
6. Lowell Miller; DOE/FE-24
7. Scott Smouse; DOE/FE/National Energy Technology Laboratory
8. Tom Cutler; DOE/Office of Policy and International Affairs (PI)
9. Barbara De Rosa-Joynt; U.S. Department of State
10. Pamela Franklin; U.S. Environmental Protection Agency
11. Marian Bassett; U.S. Trade and Development Agency
12. Shannon Fraser; U.S. Department of Commerce
13. Alfred Whitehouse; U.S. Department of Interior
14. Kenneth Nemeth, Executive Director, Southern States Energy Board
15. General Richard Lawson, (RET.), Energy, Environment and Security Group
16. Barry Scheetz, Penn State University
17. Roe-Hoan Yoon, Virginia Tech.
18. Paul Ziemkiewicz, West Virginia University
19. Doug Rottman, Lawrence Livermore National Laboratory
20. Ajay Kumar, U.S. Embassy in New Delhi
21. Eric Anthony Jones, U.S. Embassy in New Delhi