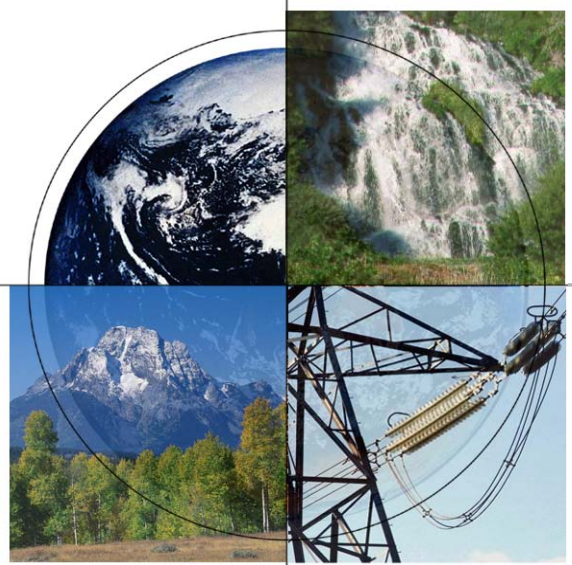
A 25-Year History of Cooperation with India



Coal Working Group
U.S.-India Energy Dialogue
Washington, DC
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International Coordination Team Leader

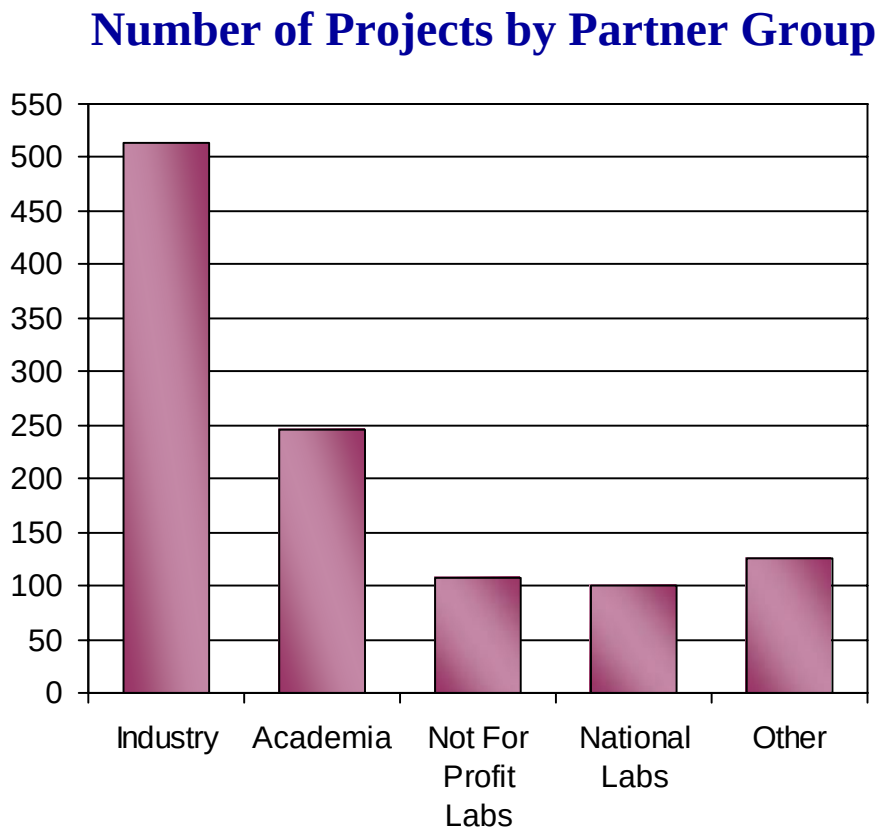
Office of Fossil Energy • National Energy Technology Laboratory

National Energy Technology Laboratory

- **One of DOE's 17 national labs**
- **Government owned & operated**
- **Sites in Pennsylvania, West Virginia, Oklahoma, and Alaska**
- **More than 1,100 federal and support contractor employees**
- **Primarily support DOE's Office of Fossil Energy and Office of Energy Efficiency and Renewable Energy**
  - also support other DOE program offices, DOD, DHS, NASA
- **FY05 budget of about $750M**

Shape, Fund, and Manage Extramural RD&D

- About 1,500 projects in all 50 states and many foreign countries
- Total award value of $7.9 billion
- **75** active MOUs and MOAs
- Dozen or so CRADAs with U.S. private sector organizations



Support to U.S. Agency for International Development – Delhi Mission

- **USAID provides development assistance to lesser developed countries**
- **25-year history of technical assistance from NETL, and its predecessor organizations, through series of Participating Agency Service Agreements (PASAs)**
  - 5 major agreements, some with multiple extensions or phases
  - wide range of capacity building and demonstration activities in the coal, power, and biomass sectors
  - $28 million to NETL over this period with over $125 million of partner funding

USAID-India Projects

- **Technical assistance for:**
  - Training in U.S. power plant testing, and operation & maintenance procedures
  - Demonstrations of U.S. technology in Indian power plants
  - First-of-a-kind commercial projects
- **Balanced mix of training in both India and U.S.**
  - Classroom training, and info exchange through technical workshops and other events
  - Hands-on training (train-the-trainer approach)
- **Technology transfer and education through**
  - Demonstration projects
  - Conference, workshops, and seminars attended by U.S. experts

USAID-India Projects

- **Early projects focused on**
  - Building capacity for coal power generation-related R&D
  - Demonstration projects and training
    - life assessment and extension of Indian power plants
    - first comprehensive environmental monitoring at Indian power plant
  - Supporting first-of-a-kind commercial projects
    - first commercial non-coking coal washery
    - bringing biomass power to grid from Indian sugar mills

- **More recent projects focus on technology transfer, capability building, and technology demonstrations**
  - Primarily related to improved coal power plant performance (efficiency and emissions)
  - Assessment of IGCC for India

USAID-India Projects
Early R&D and Technology Demonstration Activities

- Assisted with design and initial operation of 2 state-of-the-art pilot-scale combustion test facilities - the first of their kind in South Asia
  - one of these facilities is routinely used today to evaluate domestic, mostly high-ash, coals, imported coals, and coal blends to improve power plant designs

- Supported development of first private commercial non-coking coal washery in India
  - analyzed costs and power plant + transportation benefits of washing high-ash Indian coals
  - new legislation now requires all coal shipped >1,000 km to have <34% ash content
  - helped open market valued at >$1 billion

USAID-India Projects
Greenhouse Gas Pollution Prevention (GEP) Project

- Successfully demonstrated value of improving power plant efficiency to Indian utilities and Ministry of Power
  - improved efficiency at NTPC's Dadri plant by 1.5%
  - reduced coal use by 81,000 tons/yr, saving $2.4M/yr, and reducing CO_2 emissions by >100,000 tons/yr
- Subsequently, demonstrated at least 1% efficiency and substantial load factor improvements attainable in every Indian coal-power plant largely through just operating practices changes with minimum capital investment
  - supported replication at other plants (>13,000 MW)
  - Indian utilities are now largely on their own

USAID-India Projects
Greenhouse Gas Pollution Prevention (GEP) Project

- Provided technical assistance and training on best practices, technologies, and systems for coal-fired power plant overhauling and maintenance
- Introduced predictive diagnostic maintenance practices over routine condition-based maintenance, which are becoming widely practiced
- Demonstrated viable particulate control technologies and ash disposal options to address Indian power plants' No. 1 environmental issue

USAID-India Projects
Greenhouse Gas Pollution Prevention (GEP) Project

- Evaluating techno-economic feasibility of coal-based integrated gasification combined cycle (IGCC) power generation in India (28% → 36% → 42+% efficiency)
- Evaluating fly ash cenosphere market in India
  - cenospheres - hollow ceramic microspheres formed during combustion with unique physical and chemical properties
  - ideal for wide variety of industrial applications - especially those requiring high-strength, light-weight fillers - replacing ground mined minerals, such as clay, talc, calcium carbonate, and silica
  - extract high-value material from negative-value power plant wastes, or at best low-value byproduct

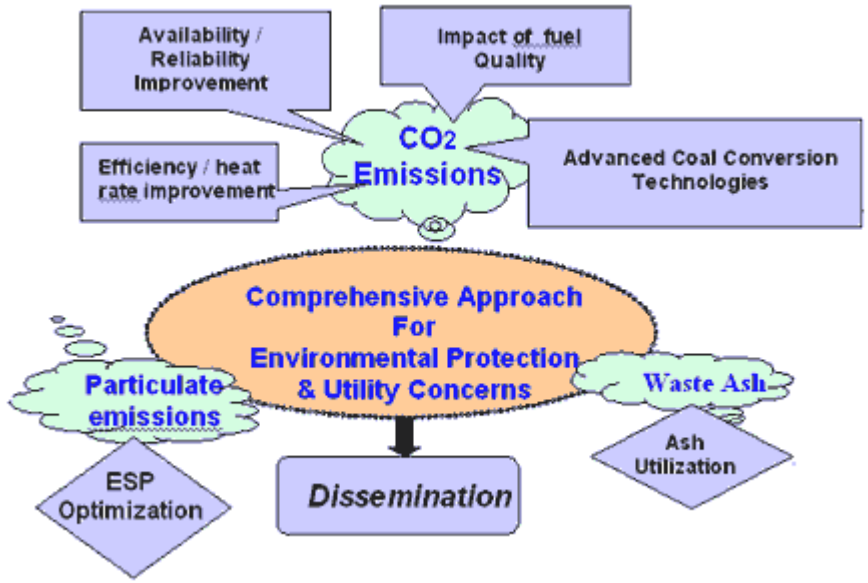
USAID-India Projects
Greenhouse Gas Pollution Prevention (GEP) Project

- Established Centre for Power Efficiency and Environmental Protection (CenPEEP) at NTPC's R&D Centre near Delhi and two regional centers
  - provide technical and training services to all Indian power plants, eventually on cost-recovery basis
    - Indian plant engineers received >3,500 days of training
    - conducted 12 workshops and training courses
    - 8 major international meetings
    - published periodic newsletters
    - published number of tech-lines
- Since 1982, participated in more than 20 major international conferences and workshops on coal- and biomass-related power generation

USAID-India GEP Project Awards

- **2002 - Climate Technology Award from the Climate Technology Initiative**
- **2003 - Climate Protection Award from the U.S. Environmental Protection Agency**

NTPC's 840-MW Dadri Station



U.S.-India Energy Dialogue
Coal Working Group

- **Nearly 25-year history of cooperation with USAID in India**
- **Wide range of activities in the coal and power sectors**
- **Provides FE/NETL with unique knowledge and understanding of India, its development needs, and its vision for the future**
- **Provides a rich base to begin bilateral cooperation under CWG of the Energy Dialogue**

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