



## NETL's International Activities

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U.S. DEPARTMENT OF  
**ENERGY**

National Energy  
Technology Laboratory

# International Cooperation

- **DOE Mission: ensure America's security and prosperity by addressing its energy, environmental, and nuclear challenges through transformative science and technology solutions.**
  - GOAL 1: Catalyze the timely, material, and efficient transformation of the Nation's energy system and secure U.S. leadership in clean energy technologies**
  - GOAL 2: Maintain a vibrant U.S. effort in science and engineering as a cornerstone of our economic prosperity, with clear leadership in strategic areas**
- **NETL Mission: Advance energy options to fuel our economy, strengthen our security, and improve our environment.**
- **Drivers for International Cooperation:**
  - ❑ **Benefit our RD&D programs through accelerated development and deployment of key technologies by leveraging research with similar activities in the international arena.**
    - **Quicker, better, cheaper through access to unique world-class researchers and facilities**
  - ❑ **Benefit the Nation in terms of supporting broader national goals for energy security, climate change, and export.**

# Mechanisms for International Cooperation

- **Science & Technology Agreements**
- **Multi-lateral Agreements**
  - International Energy Agency (IEA)
  - Carbon Sequestration Leadership Forum (CSLF)
  - Asia Pacific Economic Cooperation (APEC)
  - Clean Energy Ministerial (CEM)
- **“Lab-to-Lab” Memoranda of Understanding (MoU)**
- **Cooperative Research & Development Agreements (CRADAs)**
- **Contributed Funds Agreements (CFAs)**
- **Informal**
- **Programmatic (Cooperative Agreements, Field Work Proposals with other National Labs)**
- **Work for Others (WFO)**
  - Agency for International Development (USAID)
  - Department of State

# NETL Bilateral International Cooperation

- **China: Ministry of Science & Technology**

- Annex I: Advanced Power Generation – cooperation on IGCC with China Power Investment Corp. and other utilities
- Annex II: Clean Fuels – cooperation on coal conversion and CCUS with NEA and Shenhua Group (Global Leadership Exchange Program)
- Annex III: Oil & Gas – cooperation on gas hydrates and CO<sub>2</sub>-EOR with China Petroleum and Chemical Industry Federation (CPCIF)
- Annex IV: Energy & Environmental Control Technologies – cooperation on CCUS with leading R&D centers and utilities (ex., bi-annual CCUS Symposium)
- Annex VI: Advanced Coal-Based Energy Systems Research, Development and Simulation – cooperation with Chinese Academy of Science and PNNL

- **U.S.-China Clean Energy Research Center/Advanced Coal Technology Consortium**

- 5-year program funded jointly (50/50) by government and industry focusing on CCUS, led by WVU and HUST

# NETL Bilateral International Cooperation

- **Brazil:**

- Brazilian Coal Association – cooperation on gasification
- Pontifical Catholic University of Rio Grande do Sul – cooperation on CCUS

- **Korea:**

- Korea Institute of Energy Research (KIER) – cooperation on gasification and CCUS
- Korea Ocean Research and Development Institute (KORDI) – cooperation on CCUS
- Korea Ministry of Knowledge Economy (KMKE) – cooperation on gas hydrates

- **India:**

- Directorate General Hydrocarbons (DGH) – cooperation on gas hydrates with
- NTPC's Energy Technology Research Alliance (NETRA) – new agreement being developed on modeling & simulation and sensors & controls

- **Japan:**

- Research Institute for Innovative Technology for the Earth (RITE) – cooperation on CO<sub>2</sub> sorbent development and evaluation
- Japan Coal Energy Center (JCOAL) – MOU signed for cooperation on gasification
- Japan Research Institute of Advanced Industrial Science & Technology (AIST) – cooperation on fuel cell research

# NETL Bilateral International Cooperation

- **Poland:**

- Central Mining Institute/Institute for Chemical Processing of Coal – cooperation on chemical looping

- **Switzerland:**

- Paul Scherrer Institute (PSI) – cooperation on GC-ICP/MS devices to quantify trace material concentrations in gas-phase process streams derived from biomass and fossil fuel conversion

- **UK:**

- Department for Business, Enterprise and Regulatory Reform – cooperation on materials, advanced sensors and controls

# NETL Multilateral International Activities

- **APEC Expert Group on Clean Fossil Energy (EGCFE)**
  - Annual Clean Fossil Energy Technology and Policy Seminar
  - Special Seminars (LNG Public Education, Low Rank Coal, CCUS)
  - CCUS Capacity Building
  - 3-4 studies annually on important fossil energy technology and market issues
- **Carbon Sequestration Leadership Forum (CSLF)**
  - Technical Working Group – focus on CO<sub>2</sub> storage risk assessment
- **Clean Energy Ministerial/Global Superior Energy Performance Partnership (CEM/GSEP) Power Working Group**
  - Expanded sharing low-cost efficiency improvement and O&M best practice for existing coal-fired power plants under former Asia Pacific Partnership Power Generation & Transmission Task Force
- **European Commission (EC)**
  - CCUS knowledge sharing and U.S. R&D organizations participation in several EC-funded CCUS projects with leading European R&D organizations
- **International Energy Agency (IEA)**
  - Advanced Fuel Cells Implementing Agreement (Annex XVIII SOFC)
  - EOR Agreement
  - Multi-phase Flow Implementing Agreement
  - Support for IEA Clean Coal Centre (dozen annual topical reports)

# NETL Multilateral International Activities

- **North American Energy Working Group**
  - North American Carbon Sequestration Atlas
  - CCUS Knowledge Sharing
  - Basal Aquifer Project (CO<sub>2</sub> storage estimation and mapping of cross-border basin underlying ND, Alberta and Saskatchewan)
- **CCS Sequestration Program Projects**
  - Cooperation on 10 major international CCUS projects with Algeria, Australia, Canada, China, Germany, Iceland, and Norway
  - IEA GHG Programme Weyburn-Midale CO<sub>2</sub> Monitoring and Storage Project – \$80 million, 8-year international study to assess technical feasibility of CO<sub>2</sub> storage in geological formations with focus on oil reservoirs, including development of world-leading best practices
- **Regional Carbon Sequestration Partnerships (RCSP)**
  - Joint government and industry program focusing on CCUS, with at least 26 international organizations from at least 14 countries in the seven RCSPs

# Other NETL International Activities

- **Department of State: interagency agreement for CCUS cooperation with China**
  - West Virginia University – Shenhua Group and others
- **DOE Office of Policy & International Affairs**
  - Kazakhstan – power plant upgrade and replacement options; planned visit to Samruk Energy in September 2013
- **U.S. Agency for International Development 30-year history of technical assistance to India's coal and power sectors through 6 interagency agreements**
  - Greenhouse Gas Pollution Prevention Project
    - » Power Plant Efficiency and Operations Best Practices
      - Avoided over 120 million tons of CO<sub>2</sub> over 15 years through introduction of low-cost U.S. technologies and best practices for efficiency improvement and O&M
- **Organizing committees for several international conferences**
  - Australia/Victoria State's International Low Rank Coal Symposium
  - Developing proposal to Indo-US Science and Technology Forum (IUSSTF) to convene joint chemical engineering conference on fossil fuels

# U.S. Agency for International Development - India

*Nearly 30 years of technical assistance (\$35.9M) from NETL  
through series of Participating Agency Service Agreements (PASA)*

Alternative Energy R&D - Capacity building for coal utilization R&D to BHEL	Phase I 1982 – 1987 Phase II 1987 – 1992
Energy Management and Consultancy - Power plant operations & maintenance	1993 – 1995
Program for Acceleration of Commercial Energy Research - Development of 1 <sup>st</sup> commercial non-coking coal washery in India	1993 – 1997
Indo-U.S. Coal Preparation & Beneficiation - Market studies, specifications, and financing for coal washeries	1994 – 1996
Greenhouse Gas Pollution Prevention (GEP) - Coal-fired power plant efficiency improvement and advanced biomass utilization in sugar mills using bagasse	1995 – 2002
GEP Climate Change Supplement I - Coal-fired power plant efficiency improvement	2002 – 2005
GEP Climate Change Supplement II - Coal-fired power plant efficiency improvement, distributed generation, clean alternative transportation	2003 – 2011