Clean Coal: Skills Requirements and Funding for Training

Indiana Center for Coal Technology Research
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Coal Will be a Major Energy Source for the Foreseeable Future

World Marketed Energy Use by Fuel Type, 1980-2030

Coal Will Remain the Primary Fuel for Electricity Generation

World Electricity Generation by Fuel, 2006-2030

Coal: Energy Asset / Environmental Challenge

- Coal reserves are abundant in the United States and in many areas of the world,
  - The largest US energy Asset
  - Attractive option from the standpoint of affordability and supply reliability.

- Coal's energy potential is accompanied by significant challenges related to its effects on the environment and human health
  - NOx, SOx, Particulate Matter, Mercury
  - Water (Fossil-fueled power plants account for approximately 39 percent of the water used in the United States – mostly for cooling)
  - Ash & Slag
  - Now CO2
Clean Coal Technologies (CCTs)

Technologies that enhance both the efficiency and the environmental acceptability of coal extraction, preparation and use

- Reduce regulated emissions and waste
- Increase the amount of energy gained from each ton of coal
- Can reduce greenhouse gas emissions from any industrial or mining process involving coal,
  - but the international priority is reducing carbon dioxide emissions from coal-based electricity generation.
Even w/Growing Coal Demand Criteria Pollutants’ Emissions at lowest levels ever

Technologies with New/Changing Staffing Rqmts

- Coal Pre-treatment
  - Coal de-watering technologies (esp. for low rank coals) to improve calorific quality and burning efficiency & reduce emissions (up to 50%)
  - Chemically washing minerals and impurities from the coal

- Advanced Pollution Control Technologies

- Advanced Power Generation Systems
  - Supercritical pulverized coal combustion (PCC)
  - Fluidized bed boilers

- Advanced and Zero Emission Coal Technologies
  - Carbon Offset, Capture & Storage
    - Biomass co-firing
    - Post combustion
    - Oxyfuel
    - Pre Combustion
    - CO2 Compression and economic use or sequestration

- Coal to ???
  - IGCC, CTL, CT-SNG & Underground gasification
Clean Coal Deployment

- R&D over the past 20 years resulted in new, lower-cost, more efficient and environmentally compatible technologies for coal using electric utilities, steel mills, cement plants and other industries.
  - New products and systems entering the market
  - Political pressures accelerating deployment cycles
- Workers must be ready to design, build, install, operate, maintain and repair these new products and systems
Workforce Development
Policy Issues

- Occupations associated with Clean coal technologies tend to require modest to high competency in chemical and environmental knowledge and processes
  - Even IGCC plant operations require different technical skills than for power-generating utilities
  - Other gasification and clean coal require more chemical plant than power plant knowledge & skills
- To date, in Indiana, most clean coal related training largely incorporated in internal and vendor provided training
  - E.g., bagging, scrubbers, water mgmt
- Future, will need growing engagement w/ education and training system
- State (Department of Workforce Development) has committed to supporting Clean Coal and Gasification as a state economic priority
  - USDOL Grant due October 20
Elements of an Indiana Clean Coal Workforce Strategy: Near Term

- Work w/ ed/training orgs to support clean coal investments that increase use of Indiana coals & moderate increases in electricity rates
- Expand clean coal content in recently launched Power curriculum developed by Ivy Tech and “the Consortium” to meet looming retirement profile
- Work w/Duke re rqmts for Edwardsport IGCC staff upgrading & replacement (direct staff<100)
  - Launch will rely primarily on internal recruiting and skill upgrade training developed in consultation with vendors
- Work with Indiana Gasification LLC on recruiting, skill upgrades, and training pipeline for planned Rockport Coal-SNG plant (direct staff ≈ 200)
Elements of an Indiana Clean Coal Workforce Strategy: Medium – Longer Term

- Three prong approach under consideration
  - Basic chemical/environmental pgm to support traditional coal users as they adapt to changing regulatory rqmts
    - applicable to other carbon based fuels
  - Basic & advanced gasification program to support coal-to-whatever technology deployment
    - basic pgm applies to all refining/chemical processes incl. biofuels
  - Incorporation of CCS education/training as required
    - DOE selected Univ. partners for development of CCS skills pgm
Curricula Observations

- Most training similar to existing commercial technologies, can be adapted, not newly created
  - Combined cycle power
  - ASU
  - Gasification
  - Gas clean-up
  - Syngas/natural gas conversion to hydrogen, chemicals, liquid fuels, fertilizers

- New rqmts are more
  - Integration
  - Regulatory compliance
  - Scale-up/adoptions of technologies developed/commercialized offshore
  - Associated with CCS (see attached info on DOE pgm)
BACKGROUND

INFORMATION
Major Regulatory Drivers

- Title IV acid rain program, established through the 1990 Clean Air Act Amendments (CAAA)
- Title I National Ambient Air Quality Standards (NAAQS) for ozone that led to EPA's NOx SIP (state implementation plan) Call Rule in 1998
- Clean Air Interstate Rule (CAIR) Clean Air finalized in May 2005
- 2005 Clean Air Mercury Rule (CAMR)
- Potential CO2 controls
- Clean Water Act, Safe Water Drinking Act, and Resource Recovery and Conservation Act
DOE CCS Training Program: I

- Training activities will focus on the applied engineering and science of carbon capture and storage for
  - site developers, geologists, engineers, and technicians
- Targeted CCS skills and competencies in
  - geology, geophysics, geomechanics, geochemistry and reservoir engineering disciplines.
DOE CCS Training Program: II

Five activity areas:

- **Implement an Organized Sponsorship Development Program** – development of a self-sustained long term technology program, without federal government support

- **Short Courses on CCS Technologies** – work with experts in the field to identify and develop training materials for professionals

- **Regional Training—Outreach and Networking** – conduct training of carbon capture and storage technologies

- **Perform Regional/Basin Technology Transfer Services** – transfer technology with various outreach materials and coordination of regional/basin efforts

- **Plan and Manage the Recipient’s Regional Program**
DOE CCS Training Program: III

- **Board of Trustees of the University of Illinois (Champaign, IL)**—Create the Midwest Geological Sequestration Consortium Sequestration Technology Training Center
- **Environmental Outreach and Stewardship (EOS) Alliance (Seattle, WA)**—Facilitate development of a carbon capture and sequestration workforce through regional CO2 sequestration technology training in the northwest
- **New Mexico Institute of Mining and Technology (Socorro, NM)**—Develop the Southwestern U.S. Geologic CO2 Sequestration Training Center
- **Petroleum Technology Transfer Council (Tulsa, OK)**—PTTC Regional Technology Training Program
- **Southern States Energy Board (SSEB) (Norcross, GA)**—The Southeast Regional CO2 Sequestration Technology Training Program
- **The University of Texas at Austin (Austin, TX)**—Create an alliance for Sequestration Training, Outreach, Research and Education (STORE), as part of the Gulf Coast Carbon Center
- **University of Wyoming (Laramie, WY)**—Develop the Wyoming CCS Technology Institute (WCTI)