

**Testimony of**

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**U.S. House of Representatives  
Committee on Science, Space and Technology  
Subcommittee on Energy and the Environment**

***“Advancing Coal Research and Development for a Secure Energy Future”***

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## Introduction

This statement is submitted on behalf of the American Coal Council (ACC), a trade association dedicated to advancing the development and utilization of American coal as an economic, abundant, secure and environmentally sound fuel source. The ACC ([www.americancoalcouncil.org](http://www.americancoalcouncil.org)) represents the interests of 170 U.S. coal suppliers, coal consumers and coal transportation companies. We represent the coal industry from the hole in the ground to the plug in the wall. The ACC welcomes the opportunity to present a perspective on how to advance coal research and development to ensure our nation's energy needs are met in an economic and environmentally sound manner.

## Coal is Vital to U.S. Economy

Our nation's domestic coal resources are critical to our economic well being, to ensuring our energy reliability and security, and to meeting our environmental goals. Today, coal generates nearly 44% of our nation's electric power; 36 states obtain at least 25% of their electricity from coal and 26 states obtain at least 45% of their electricity from coal. The Energy Information Administration (EIA) forecasts that U.S. coal generation will increase by 25% between 2009 and 2035, with coal's share of the total generation mix remaining steady at 43% in 2035.<sup>1</sup>

U.S. coal provides low-cost electric power and price stability compared with other fuel resources. Between 2000 and 2009, natural gas prices ranged from \$3.10/million Btu (mm Btu) to \$12.41/mm Btu. During that same time period, coal never exceeded \$2.28/mm Btu. Those states that rely on coal for a majority of their electric power are the states that have the lowest cost of electricity for their residents and industries.

High energy costs disproportionately impact low income and fixed income families. In 2001, the 50% of U.S. households making less than \$50,000/year spent an average of 12% of their after tax income on energy costs. Today, those families are now spending 20% of their household income on energy expenses.<sup>2</sup>

Industrial consumers are more likely to be price responsive than any other customer group. There is a strong correlation between the cost of electricity and the number of manufacturing jobs in the United States. Between 2000 and 2008, industrial electric prices increased from 4.6 cents/kWh to 7.2 cents/kWh. Over that same time period, manufacturing jobs decreased from 17.3 million to 13.4 million.<sup>3</sup> Low-cost electricity directly contributes to the competitiveness of America in international markets.

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<sup>1</sup> U.S. Energy Information Administration, Annual Energy Outlook 2011.

<sup>2</sup> Eugene M. Trisko, Esq. for American Coalition for Clean Coal Electricity, January 2011.

<sup>3</sup> Shively & Ferrare 2008 Enerdynamics.

Studies show that new coal plants create more construction and permanent employment jobs than any other electric generation options. Coal jobs created per billion dollars invested equal 9,166, versus 7,640 for natural gas and 1,053 for wind generation. One recent study details the prospective loss of 1.24 million jobs as a result of new coal power plants NOT being built. The National Mining Association report details how the Sierra Club's "Beyond Coal" campaign has targeted for destruction 116,872 permanent jobs and an additional 1.12 million construction jobs represented by the proposed power plants that have been prevented from being built.<sup>4</sup>

The U.S. has 29% of the world's recoverable coal reserves ~ more than any other nation. Our nation has a 200 year supply of coal at current annual production rates of about one billion tons. Globally, coal is the fastest growing fuel source. World coal consumption is projected to increase 50% from 139 quadrillion BTUs in 2008 to 209 quadrillion BTUs in 2035.<sup>5</sup> U.S. coal suppliers expect to take a greater role in international markets, welcoming the opportunity to contribute to improvements in our nation's balance of trade. In 2010, U.S. coal exports were up 36%, from 60 million tons in 2009 to 81 million tons in 2010. The forecast for 2011 coal exports is in the range of 100-105 million tons.<sup>6</sup>

The growing demand for clean energy technologies for the world's emerging economies will also provide U.S. technology transfer and export opportunities if we are willing to invest now in clean coal technology research development and deployment (RD&D). While other nations are increasing their use of coal resources and their installation of clean coal power plants, U.S. utilities are shutting down their coal facilities. Currently, 23 GW of coal power generation is slated to be shuttered in the next decade. Projected retirements are on the order of 56-101 GW, representing 15-30% of current coal power generation capacity. These retirements are due primarily to an inability to meet environmental regulatory requirements at reasonable costs within acceptable rate structures, as well as to economic demand destruction, aging fleet attrition and competition from natural gas fuels.

Meeting national environmental objectives continues to be coal's greatest challenge, a challenge that has been in the past and can be in the future addressed with technology applications. Significant progress has been made over the past 3-4 decades to reduce air emissions. Since 1970, coal use has increased 183% while criteria pollutant emissions have decreased 90% on average, including NOx reductions of 82%, SO<sub>2</sub> reductions of 88% and PM10 reductions of 96%.<sup>7</sup>

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<sup>4</sup> Energy Ventures Analysis, "Employment Impacts Associated with Electric Generation Options" for National Mining Association, September 2011.

<sup>5</sup> U.S. Energy Information Administration, International Energy Outlook 2011.

<sup>6</sup> Cloud Peak Energy presentation, ACC Coal Market Strategies Conference, August 23, 2011 & Fitch Ratings, U.S. Coal Producers Outlook, August 17, 2011.

<sup>7</sup> "Benefits from Investments in Advanced Coal Technology," Coal Utilization Research Council, National Mining Association, Edison Electric Institute, et. al. fact sheet attached hereto.

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The U.S. cannot achieve its economic, energy security and environmental objectives without coal and the advancement of clean coal technologies.

### Opportunities to Advance the Use of Coal

The benefits of clean coal technology include cleaner air, reduced pollution, increased energy efficiency, support for U.S. manufacturing, increased U.S. exports, enhanced national security and job creation. The role of the Federal government in RD&D is to develop technology options that can benefit the public good. The U.S. Department of Energy's Fossil Energy group carries out high-risk, high-value RD&D that can:

- Accelerate the development of new energy technologies beyond the pace that would otherwise be dictated by normal market or regulatory forces.
- Expand the slate of beneficial energy options beyond those likely to be developed by the private sector on its own.
- Produce revolutionary "breakthrough" technologies that achieve environmental, efficiency and/or cost goals well beyond those currently pursued by the private sector.

Federally funded RD&D provides public benefits in excess of the cost of RD&D. A National Academy of Sciences report noted that the economic benefits in real dollars provided by Fossil Energy research between 1986 and 2000 equaled \$7.4 billion versus an investment by DOE of \$4.5 billion.<sup>8</sup> The study noted that 600,000 jobs were created in the U.S. power equipment industry, resulting from the more than 700 patents awarded through the Fossil Energy research program. Between 2000 and 2020, investments in coal RD&D are expected to create nearly 1.2 million jobs, with an average of 60,000 jobs created on an annual basis.<sup>9</sup>

DOE's clean coal technology programs have resulted in over 30 successfully completed projects; more than 20 of the technologies have achieved commercial success, including the installation of advanced pollution controls on 75% of U.S. coal plants at one-half to one-tenth the cost of older systems. A detailed overview of DOE Fossil Energy RD&D technology achievements since the 1970s is attached.<sup>10</sup>

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<sup>8</sup> National Academy of Sciences, "Energy Research at DOE, Was It Worth It? Energy Efficiency and Fossil Energy Research 1978 to 2000." 2001.

<sup>9</sup> "Benefits of Investments in Clean Coal Technology" Management Information Services Inc., October 2009. Prepared on behalf of The American Coalition for Clean Coal Electricity.

<sup>10</sup> "Benefits from Investments in Advanced Coal Technology" ~ Fact Sheet Coal Utilization Research Council, et. al.

Given the success of the Fossil Energy RD&D program in terms of economic and environmental benefits realized, it is disturbing that investments in clean coal technology are not supported at levels commensurate with other energy resources. A recent study by the U.S. Energy Information Administration (EIA) estimated the value of federal support for direct expenditures, tax expenditures, R&D funding, and loans and loan guarantees for various energy resources. It noted that in FY2010, renewable energy resources, which produce less than 5% of U.S. power generation, received 45% of Federal electricity production incentives. Coal, which produced 46% of U.S. electricity in 2010, received just 10% of Federal electricity production incentives.<sup>11</sup>

During the past several years, the primary focus of DOE's coal RD&D program has been on Carbon Capture and Storage (CCS). The coal industry supports continued RD&D in this area. The U.S., however, faces additional energy and environmental challenges that would benefit from collaborative coal RD&D by the government and private sector. These challenges are more immediate than CCS.

There needs to be a greater balance between support for CCS initiatives and those for other coal RD&D projects that can advance coal generation efficiency and enhance environmental compliance.

Our environmental rulemaking and legislative efforts of the past few years have been hampered, in part, by the lack of economic, commercial and technologically viable solutions. Environmental regulations need to be supported by technologies that enable industry to meet target objectives in a timely and economic manner. The development of viable technologies will facilitate the establishment of regulations to help us achieve our environmental objectives. Regulations and technology development go hand in hand.

It is counterproductive to decrease Federal investment in coal RD&D at a time when our nation needs low-cost electricity to support our citizens and industries, at a time when we need all available means to increase the competitiveness of America's goods in the international marketplace and at a time when the security of domestic energy sources is a high priority.

Current programs should be maintained and additional resources appropriated to ensure utility and industrial compliance with both an increasing number of environmental regulations and increasingly strict targets for environmental objectives. We continue to impose more environmental regulations on coal consumers but seem unwilling to commit more resources to actually achieving those objectives. This is akin to setting ground rules for our children but not providing them with the tools and training to be able to obey the rules we set.

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<sup>11</sup> "Direct Federal Financial Interventions and Subsidizes in Energy in FY2010" U.S. Energy Information Administration, July 2011.

Why are we so amazed that coal generators are shutting down their power plants because they can't meet environmental objectives? Why are some folks gleeful about that? Where is the satisfaction in having our nation's largest electric power providers shut their doors, stop producing low-cost electricity, fire their employees, and still not reach our environmental objectives?

There can be only one conclusion ~ that the real objective is not to reduce emissions ~ that we are really not concerned with meeting environmental objectives. It would appear that other agendas are in play here, agendas to eliminate coal generation from our energy portfolio simply because it is based on coal.

DOE's recently released Quadrennial Technology Review (QTR) notes that the U.S. needs to be a leader in the development of a clean energy economy and that "our challenge is to provide electric power in environmentally responsible ways that strengthen U.S. competitiveness and protect the climate." These objectives can clearly be met through the use of our nation's vast domestic coal resources in conjunction with the advancement of clean coal technologies.

DOE has a proven track record of facilitating the development of clean coal technologies that are cost-effectively reducing emissions today and hold much promise for continuing to yield similar stellar results in the future. Going forward, we need to focus our RD&D efforts on:

- Carbon Capture and Storage
- Advanced Energy Systems
- Engineered Coal Fuels
- Water Use Technologies
- Clean Coal Power Initiative Demonstration Projects

### Coal RD&D Priorities

From an historical perspective, DOE's early clean coal technology programs focused on advancing technologies that would achieve reductions in criteria pollutants regulated under the Clean Air Act (CAA) and Clean Air Act Amendments (CAAA), including SO<sub>2</sub>, NO<sub>x</sub> and particulate matter. Following many years of RD&D, much success was achieved in reducing these emissions.

We should keep in mind that it was only a few short years ago when the pendulum of DOE funding swung toward advancing carbon management technologies. This was in response to the anticipation of legislation and regulations for greenhouse gas (GHG) management and to the increasing international focus on reducing CO<sub>2</sub>. GHG regulations are proceeding and so should these technology development efforts – even though U.S. GHG legislation is not imminent.

It takes substantial time to develop and deploy new technologies ~ on the order of 10-20 years. We should anticipate a continued need for CO<sub>2</sub> management technologies and stay the course. It is difficult to turn technology development initiatives off and on and still make cost-effective progress. If we shutter CCS or the Clean Coal Power Initiative (CCPI) efforts today and decide in a few years to resurrect them, we will be faced with the prospect of starting all over again at ground zero, negating any earlier gains.

To be successful, RD&D funding needs to be stable and continuous. A funding interruption or extreme swings of the funding pendulum are an inefficient use of Federal funds.

We should avoid the knee jerk impulse to pull back CCS technology development efforts as we refocus on addressing more near-term regulations for energy efficiency improvements and compliance with stricter criteria emissions targets. We should also keep in mind that CCS stands for “carbon capture and storage” not “coal capture and storage.” Development of CCS technologies is not a coal-only program. Our fossil energy colleagues in the natural gas industry will ultimately benefit from CCS developments as well.

*Carbon Capture & Storage Priorities* ~ Given the current uncertainty that Congress will pass climate legislation in the near term, it would seem easy to dismiss RD&D funding for CCS. In reality, however, the U.S. EPA is regulating GHG emissions and industry is currently being tasked with meeting compliance objectives for CO<sub>2</sub> reduction. It is, therefore, imperative that RD&D funding support continue. A “no regrets” approach to advancing technologies for carbon capture, carbon storage and carbon utilization today, will ensure that industry can meet current EPA regulations as well as prospective future legislation.

This longer-term technology need must, however, be balanced with RD&D funds to pursue more immediate and near-term environmental objectives with advanced energy technologies. While much work has been done in this area and ASTM code certification is certainly needed to advance commercialization, there still remains opportunities for advances in monitoring and control technologies for advanced combustion systems. These technologies can help us produce coal-based electricity more cleanly and more cost effectively. They also have the added collateral benefit of reducing CO<sub>2</sub> when integrated with CCS applications. Additionally, there may be broader applications for high-temperature, high-pressure materials outside of coal generation, e.g., in the aircraft industry.

*Advanced Energy Systems Priorities* ~ Advanced technologies are needed to enhance the thermal efficiency of power plants, which today operate at an average efficiency of about 33%. Power engineers can replace our aging coal plants with new clean plants exceeding 40% thermal efficiency. This can be achieved in two ways:

1. Advances in energy systems for new plants including:
  - The development and application of high-pressure, high-temperature materials in boilers and steam turbines for new supercritical and ultra-supercritical power plants. These high performance materials would enhance the efficiency of power plants and reduce emissions of criteria pollutants and GHG emissions.
  - Oxy-firing systems that replace combustion air in coal power plants with pure oxygen to greatly reduce emissions.
  - Integrated Gasification Combined Cycle (IGCC) systems which advance efforts to capture carbon.
  - Advanced turbine systems that can enhance plant efficiency and help meet the demands of IGCC plants with high levels of CO<sub>2</sub> capture.
  - Fuel conversion systems that facilitate the production of liquid transportation fuels from coal and biomass.
  
2. Efficiency upgrades and heat rate improvements for both existing and new plants. New Source Review (NSR) constraints have curtailed efforts to achieve efficiency improvements. A leading combustion systems engineer, Richard Storm, PE, CEO, Storm Technologies notes that we can achieve a 3-5% efficiency improvement at existing plants by upgrading turbine rotors, installing new high capacity boiler feed pumps and higher efficiency air heaters and ductwork, and by upgrading boilers, condensers and feed water heaters.<sup>12</sup>

Storm notes that operations and maintenance improvements could potentially increase heat rates up to 750 Btu/kWh and achieve fuel savings of \$2 million or more. Payback on a \$5 million investment would take two years. Capital projects that have a potential to trigger NSR are deemed by industry to be very risky. Better clarity, and potentially guarantees, are needed on what upgrades will not trigger NSR.

Also of note is that capital investments to improve thermal efficiency often compete with non-optional investments for environmental compliance and other energy projects that offer high returns on investment. While not a direct DOE RD&D funding need consideration, these operations and maintenance improvements can provide interim compliance with environmental requirements as we work toward longer term solutions. Efficiency gains in the existing coal power generation fleet can offset significant amounts of CO<sub>2</sub>, setting a more achievable bar for us to overcome with advanced technologies.

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<sup>12</sup> Richard F. Storm, "What can be done to improve the Thermal Performance of the existing coal fleet?", EPRI Heat Rate Conference, January 2011.

*Engineered Coal Fuels Priorities* ~ DOE's National Energy Technology Laboratory (NETL) has noted that "... increasing the average efficiency [of power plants] from 32.5% to 36% reduces U.S. greenhouse gases by 175 MMmt/year, or 2.5% of total U.S. GHG emissions in 2008."<sup>13</sup> At NETL's February 2010 Technical Workshop ("Improving the Thermal Efficiency of Coal-fired Power Plants in the United States"), industry and government representatives identified more than 50 opportunities to improve thermal efficiency. One of these opportunities included the "use of low-grade heat for coal drying" ~ an example of numerous Engineered Coal Fuels technologies available or under development today to improve heat rate, advance power plant efficiency and reduce emissions with prior-to-combustion treatments of coal.

Engineered Coal Fuels (ECF) provide an opportunity to extend the life of existing low-cost power plants in an economic, environmentally sound manner. Given the current state of our economy and waning competitive position in world markets, now is not the time to be shuttering low-cost power plants. As noted earlier, low-cost electricity supports domestic industries and manufacturing jobs, advances the competitiveness of the U.S. in international markets and provides for the well being of our nation's citizens.

ECFs treat and enhance coal prior to combustion, resulting in the following benefits:

- Reduced Fuel Consumption ~ increasing energy content by 30% results in less coal used.
- Decreased Emissions of Criteria Pollutants ~ reductions of SO<sub>2</sub> (10-80%), NO<sub>x</sub> (10-50%) and mercury (15-99%).
- GHG Reductions ~ increasing combustion efficiency by 2-4% results in a 5-10% reduction in CO<sub>2</sub> emissions.
- Increased Capacity ~ increased power output and improved heat rate enable higher capacity utilization and efficiency at the point of combustion.

ECFs represent low capital cost investments for utility and industrial companies ~ an operations and maintenance expense versus an intensive capital investment. Stricter pending regulations on SO<sub>2</sub>, NO<sub>x</sub>, PM, mercury and HAPs are driving the need for some of these more near-term solutions. There is a vital role here for government to take assisting with the deployment of these technologies through testing and evaluation. This type of a role for government dovetails with the following recommendation from the QTR:

"The Department [of Energy] needs a professional group that can integrate the major functions of technology assessment and cost analysis, program planning and evaluation, economic impact assessments, industry studies, and energy and technology policy analysis."

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<sup>13</sup> "Improving the Efficiency of Coal-fired Power Plants for Near Term Greenhouse Gas Emissions Reductions." DOE/National Energy Technology Laboratory, April 16, 2010, DOE/NETL-2010/1411. American Coal Council ~ [igellici@americancoalcouncil.org](mailto:igellici@americancoalcouncil.org)  
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A facility with the capability to test a broad range of temperature, pressures, coals and methods would provide an opportunity for companies that have developed advanced combustion systems and engineered coal fuels technologies to verify the benefits and economics of their solutions. It would provide an objective, third party evaluation that would benefit all stakeholders, including industry, policy makers and the environmental community.

In the case of Engineered Coal Fuels, we should also undertake RD&D of coal/biomass fuels that can be used in the existing coal generation fleet without significant power plant modification. DOE has committed to fund coal/biomass development of coal gasification applications. Extending the application to the existing coal fleet for purposes of advancing coal/biomass applications would provide a near-term solution to meeting environmental regulations.

*Water Priorities* ~ Water RD&D is critical for all energy technologies, not just coal but nuclear, solar and natural gas as well. We need to devote RD&D funding into technologies that can help us reduce water consumption and increase reuse of water discharge.

A sole focus on basic engineering research will not advance commercial technology to the marketplace. The CCPI demonstration program needs to be continued and adequately funded. Previous lack of funding for demonstration projects resulted in what has become well known as “The Valley of Doom” ~ a future in which no new coal generation facilities are being planned to be built in the U.S.

*Clean Coal Power Initiative (CCPI) Priorities* ~ The Administration has not requested funding for large-scale demonstration projects for three years now. Demonstration programs are critical for the commercialization of advanced coal, Engineered Coal Fuels and CCS technologies, including the FutureGen project which has received funding through the Recovery Act.

DOE’s proposal to increase the use of computer modeling has benefits in terms of reducing the amount of time and money to develop, demonstrate and deploy new technologies. But at some point, we need to build something to see how it actually works in real life. Modeling cannot replace the value of practical demonstrations. Demonstration projects validate the reality of technology applications and confer a higher level of understanding, knowledge and acceptance of new technologies. Computational modeling should be supported only to the extent that it does not come at the expense of funding other RD&D and demonstration activities.

Additionally, the \$187 million rescinded from the AEP Mountaineer Project should be reallocated for future demonstration projects.

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Going forward, RD&D funding should focus on advancing higher efficiency technologies, reducing capital costs associated with these advanced technologies and increasing the commercial availability of technology solutions. These efforts will help us achieve greater reductions in criteria pollutants, as well as CO<sub>2</sub> and other greenhouse gases.

Appended Materials:

- “Benefits from Investments in Advanced Coal Technology” ~ Fact Sheet Coal Utilization Research Council, et. al.  
<http://www.coal.org/userfiles/file/FINAL%20Benefits%20of%20Investment%20in%20Coal%20RD&D.pdf>
- “Retrofit Programs Increase Generation Efficiency and Decrease CO<sub>2</sub> Emissions” ~ National Coal Council Fact Sheet.  
[http://www.nationalcoalcoalcouncil.org/Documents/Advanced\\_Coal\\_Technologies.pdf](http://www.nationalcoalcoalcouncil.org/Documents/Advanced_Coal_Technologies.pdf)
- Engineered Coal Fuels Fact Sheet ~ American Coal Council  
[http://www.americancoalcouncil.org/associations/10586/files/pre-combustion\\_Apr\\_2011.pdf](http://www.americancoalcouncil.org/associations/10586/files/pre-combustion_Apr_2011.pdf)