TECHNOLOGY FOR FUTURE GENERATION OF ELECTRICITY FROM COAL

STATEMENT OF Dr. Frank Burke

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CONSOL ENERGY INC.

On Behalf of

CONSOL ENERGY INC.

AND

THE NATIONAL MINING ASSOCIATION

TO THE

HOUSE SUBCOMMITTEE ON ENERGY AND AIR QUALITY

JUNE 24, 2003

Mr. Chairman, my name is Frank P. Burke, and I am vice president of research and development for CONSOL Energy Inc. (CONSOL). I am appearing here on behalf of my company as well as the National Mining Association (NMA) to testify on the current and future technologies that are needed to assure that the nation has the clean coal-fired electric generating capacity required to meet our energy demands in the future.

I would like to commend you Mr. Chairman, for holding these hearings to discuss the new technologies, and improvements to existing technologies, which will allow America to continue to use its abundant coal resources to power our economy. This will be the focus of my statement to the Committee today: Why America needs coal, why it needs new technology for the production of electricity from coal, and why a federal program to support the development of new technology represents a vital investment in our nation's economic well being. Coal makes up over 90 percent of our domestic energy reserve. And, coal is electricity. It is the fuel for over 50 percent of the electricity that our citizens use to run our businesses and support our everyday lives. Coal is, and must continue to be, one of the cornerstones of our nation's energy strategy.

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General Introduction

CONSOL Inc., founded in 1864, is the largest producer of high-Btu bituminous coal in the United States, is the largest producer of coal by underground mining methods, and the largest exporter of U.S. coal. CONSOL has 23 bituminous coal mining complexes in six states and in Australia. The company has a substantial technology research program focused on energy extraction technologies and techniques, coal combustion, combustion emission abatement and combustion waste reduction. As you can see from the Appendix, CONSOL has been an active partner with DOE in the advancement of many technologies and in basic research. CONSOL is a publicly held company (NYSE:CNX) with over 6,000 employees].

The NMA represents producers of over 80 percent of America's coal, the reliable, affordable, domestic fuel used to generate over 50 percent of the electricity used in the nation today. NMA's members also produce another form of fuel – uranium that is the source of just over 20 percent of our electricity supply. NMA represents companies that produce metals and non-metals, companies that are amongst the nation's larger industrial energy consumers. In addition, NMA members include manufacturers of processing equipment, machinery and supplies, transporters, and engineering, consulting and financial institutions serving the mining industry.

Energy in the United States – And the Need for a Balanced Energy Policy that Includes Incentives to Expand the Electric Generating Fleet

Energy, whether it is from coal, oil, natural gas, uranium, or renewable sources, is the common denominator that is imperative to sustain economic growth, improve standards of living and simultaneously support an expanding population. The significant economic expansion that has occurred in the United States over the past two decades, and the global competitiveness of our industry, was in no small measure due to reliable and affordable energy.

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During the summer of 2000 this began to breakdown. Prices of energy in some regions of the country – especially prices of gasoline, natural gas and electricity – increased significantly. Spot shortages of electricity occurred in California and, although the price of energy receded, the base cause of this problem – too little energy supply chasing too much energy demand - has not been addressed. Just three years later, we again see soaring natural gas prices, and the real possibility of natural gas shortages that may lead to electricity curtailment. High prices and unreliable energy supplies three years ago were followed by a slow-down in the economy, and high natural gas prices now threaten to forestall economic recovery. And, while cause and effect may not be perfectly correlated, the experiences of the last several years reinforce the relationship between affordable energy and economic growth. Enactment of a national energy policy that balances energy supply with energy demand while simultaneously encouraging efficiency and greater protection of our environment must be a priority of the Congress and the Administration to ensure our economic future.

According to the Energy Information Administration, energy use will increase by an average 1.5 percent per year or by a total of 42 percent to 139 quadrillion Btu between 2000 and 2025. Consumption of all sources of energy will increase: petroleum by 47 percent, natural gas by 49 percent, coal by 30 percent and renewable energy by 46 percent. An important part of the forecast is the statement that the economy will become even more dependent upon electricity over the next 20 years than it is now: Thus, a viable National Energy Policy must include a strong component to support expansion of our electricity supplies.

The Need for Coal – Coal is Electricity

We learn in grade school that a person needs three things to survive: food, water and shelter. It is interesting that oxygen is not added to that list. The omission probably results because oxygen is so important and so ubiquitous, that we take it for granted.

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We can live for days without water, and perhaps weeks without food and shelter, but for only minutes without oxygen. I bring this up because, in the United States' economy, electricity is the equivalent of oxygen. Without electricity, the economy would grind to a halt not in days or week, but within minutes. Electricity is so ubiquitous, and the electricity generating industry and its fuel suppliers have made it so reliable, that to the average consumer, electricity must seem to come, like oxygen, from the air itself, or perhaps from that socket in the wall.

However, electricity, unlike oxygen, is not a product of nature. It must be manufactured and delivered, continuously and in ever increasing amounts. By 2025 we will need 55% more electricity than we generate today. This can only be accomplished through the creation and employment of technology, the investment of capital, and the labor of workers in three fundamental industries: fuel supply, transportation, and power generation. The industry, which I represent, is responsible, each year, for producing about 1.1 billion tons of coal a year, almost 1 billion tons of which America uses to keep more than half of its electricity flowing to homes, hospitals, schools, businesses and factories. Imagine what would happen to our economy and the well-being and aspirations of our citizens, if half our electricity were gone tomorrow. If you understand that, then you understand the importance of maintaining our existing electricity generating capacity, while providing for the new capacity necessary to supply the electricity that America will need to sustain its economic growth in the future.

As we discuss the future need for and cost of developing the clean coal technologies to upgrade and replace our coal-based generating capacity, it is important to understand what America's coal miners have already done to meet the demand of U.S. consumers for low-cost, reliable electricity. Between 1984, when the Clean Coal Technology Program was begun, and 2000, coal prices in the United States have been driven down by 55% in real dollars, because of a doubling in productivity achieved by America's miners. Had coal prices simply remained at 1984 levels, the additional direct cost to the

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U.S. economy would have been over $100 billion. The coal industry has done this through the excellence of its work force, development of innovative mining methods and equipment, and large capital investments in new technology. Without coal, the indirect cost, in terms of the impact of higher electricity prices on the domestic economy, would have been much, much greater

Today, more than one-half of U.S. electricity is generated from abundant, low cost, domestic coal. And, coal can play a greater role in meeting future demands, because it constitutes more than 90 percent of the United States' fossil fuel resources, enough to last more than 250 years at current consumption rates. What is needed now is the development and, more importantly, the commercial use of Clean Coal Technologies to take full advantage of the energy resource that American's coal miners are prepared to deliver.

The Need for Clean Coal Technologies

The analogy between electricity and oxygen is appropriate for another reason. One of the principal reasons for developing new coal-fired generating technologies is to ensure that electricity generation from coal does not compromise the quality of the air we breathe. Because of its chemical composition, coal poses more environmental concerns than other fossil fuels. On average, coal contains more sulfur and nitrogen, and more mineral matter, than oil or natural gas. Fortunately, the means are available to control the emission of these substances into the environment to levels that meet current regulatory limits. A wide range of technologies is already deployed on many coal-fired power stations to control emissions of these pollutants. These include particulate collection devices, such as electrostatic precipitators and fabric filters that control emissions of coal ash, flue gas desulfurization scrubbers of various designs that control emissions of sulfur dioxide (SO_2) and a variety of methods and devices for reducing nitrogen oxide (NOx) emissions. There are no commercially available

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methods to control emissions of mercury or carbon dioxide from coal-fired power plants, but as I will discuss, these are the subject of active research programs.

Like those throughout the world, the United States faces the challenge of meeting our need for low cost energy while reducing the environmental impact of energy production and use. The federal and state governments are likely to impose new environmental regulations that will reduce SO_2, NOx, and mercury emissions from existing power plants to levels well below current regulatory limits. This will require the widespread deployment of improved technology that further reduces SO_2 and NOx emissions below current regulatory levels at an acceptable cost. Mercury will be substantially reduced as a co-benefit of this, and, in the long run, it may be necessary to develop and deploy technology to further limit mercury. In addition, there are opportunities to improve the efficiency of existing generating units. Increasing efficiency can reduce emissions, because less fuel is required for each unit of electricity generated, and efficiency improvement is the only method currently available to reduce CO_2 emissions from power production.

A recent report by the Energy Future Coalition, and particularly, a number of misleading press releases and news stories engendered by it, imply that members of the coal industry, including CONSOL, have endorsed the need for mandatory carbon emission reductions. This is not true, and I would encourage you to read the section of the report written by the coal-working group, which was the only part of the report in which CONSOL and others in the coal industry participated. The coal working group section frames the debate on this issue, but it makes assertions or recommendations regarding the need for carbon emission reductions. Neither CONSOL nor the NMA believes that climate change resulting from carbon emissions is an established scientific fact. On the contrary, many credible scientists have presented strong arguments to rebut such claims. We strongly oppose imposition of a carbon tax or mandatory limit on carbon emissions. Nevertheless, we encourage the development and deployment of

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technology to increase power plant efficiency, where it makes economic sense, with the concomitant result of decreasing carbon emissions. We also support research to explore other technological options for greenhouse gas management within the DOE coal research program, because we as a nation need to know their cost and technical feasibility, to inform public policy decisions-makers and as a prudent investment in preparing a technological response so that we can continue to enjoy the benefits of coal-fueled electricity should public policy ever require carbon emission reductions.

These Clean Coal systems will need to be designed and integrated in a way that achieves the expected benefits of each, without creating any unintended consequences. For example, the use of combustion modifications to reduce NOx emissions can result in increased carbon in coal flyash, making flyash less valuable as a byproduct. Selective Catalytic Reduction, which is an effective means for NOx control, can cause deposition that impairs efficiency in the boiler system. On the other hand, the intelligent integration of technologies can have synergistic benefits. As noted earlier, emission control devices installed for other pollutants can remove mercury from the flue gas at no additional cost. As another example, the solid byproducts from coal combustion can be converted into salable materials such as wallboard gypsum and road aggregates. Research is underway to learn how to take full advantage of co-benefits such as these, and to incorporate them into the design of existing and new power plants.

In the future, we will need new coal-fired power plants to meet electricity demand growth and to replace existing facilities as they reach the end of their economic lives. Notable among these new technologies are supercritical pulverized coal combustion, advanced combustion, integrated gasification combined cycle (IGCC), and various hybrid power systems. These technologies hold the promise of high-energy efficiency and minimal environmental impact if they are developed and successfully deployed at an acceptable cost. For example, IGCC technology is currently being demonstrated at several sites, but it must still be considered pre-commercial technology because of its

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relatively high capital cost. Nevertheless, IGCC systems produce the cleanest power available from coal; emissions from these systems approach the levels generated by modern natural gas-fired power plants, and research is underway to reduce the capital cost through design improvements. As with all technologies, the full benefits of potential design optimization will not be gained until a sufficient number of full-scale commercial units have been built and operated.

Coal Characteristics and Regional Differences

Furthermore, we need to be sure that there are Clean Coal Technologies, which work well with all coals. Coals differ in the geological characteristics of the reserves, which affects the choice of mining method, and hence the cost of production. The geographic location of the reserve affects its economic availability to specific power plant markets. It is important that Clean Coal technology users have the flexibility to select coals that meet their technical specifications and economic requirements. New Clean Coal Technologies must be developed that can accommodate, or be modified to accommodate, a wide range of coals while achieving high efficiency and excellent environmental performance. Achieving fuel flexibility must be a key objective in designing the Clean Coal Technology development and commercialization plan.

This issue arises because coal is a highly variable geologic material, and differences in individual coal types affect their performances in electricity generating units. Individual coals differ on the basis of energy content, sulfur content, ash composition, and other properties. U.S utility coals can be categorized into three groups:

1. Bituminous coals are mined throughout the U.S. They have medium to high-energy contents. Bituminous coals from different regions differ greatly in sulfur content and mineral matter composition.
2. Subbituminous coals are mined in the western U.S., principally Wyoming and Montana. They are characterized by low sulfur and low energy content.

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3. Lignite coal is mined in Texas, Louisiana, and North Dakota. Lignite has the lowest energy content of U.S. coals (less than 8,300 Btu/lb), and low to medium sulfur content.

Mercury concentrations are variable across the coal regions, but tend to be somewhat lower for the subbituminous coals and somewhat higher for the lignites (on an equivalent energy-content basis). Other important coal-quality parameters, such as mineral matter composition, chlorine content, alkali content, and grindability, vary both across and within the above groupings.

The Role of the Federal Government in Technology Development

The DOE Office of Fossil Energy, through its Coal and Environmental Systems program, expends about $200 million/year to co-fund coal-related R&D, in addition to the current Clean Coal Power Initiative demonstration program. The DOE is supporting the development of new technology for mercury reduction and carbon management. The DOE coal program also includes the Vision 21 R&D program, which seeks to develop advanced, highly efficient, low-emitting energy complexes, for the production of electricity, fuels and chemicals. The federal government has had a significant role in the development of clean coal technology. The original Clean Coal Technology (CCT) program and the current Clean Coal Power Initiative support the first-of-a-kind demonstrations of new coal use technologies. These demonstrations encompass a wide range of technologies, including environmental controls, new power generating facilities and fuel processing. Forty projects were conducted in the original CCT program, with a total value of $5.4 billion, consisting of $1.8 billion in federal funds and $3.4 billion in non-federal funds (a 2/1 leverage on federal dollars).

In January of this year, the Energy Department announced the selection of eight projects to receive $316 million in funding under Round 1 of the Clean Coal Power Initiative program, the first in a series of competitions to be run by the Energy

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Department to implement President Bush's 10-year, $2 billion commitment to clean coal technology. Private sector participants for these projects have offered to contribute over $1 billion, well in excess of the department's requirement for 50 percent private sector cost-sharing.

Three of the projects are directed at new ways to comply with the President's Clear Skies initiative which calls for dramatic reductions in air pollutants from power plants over the next decade-and-a-half.

Three other projects are expected to contribute to President Bush's voluntary Climate Change initiative to reduce greenhouse gases. Two of the projects will reduce carbon dioxide by boosting the fuel use efficiency of power plants. The third project will demonstrate a potential alternative to conventional Portland cement manufacturing, a large emitter of carbon dioxide.

The remaining two projects will reduce air pollution through coal gasification and multi-pollutant control systems.

CONSOL has been an active participant in coal-use research since the 1940s. Our goals are closely aligned with those of the DOE coal program, and much of our research has been done in partnership with the DOE (see Appendix). We were a member of the project teams for two of the CCT projects, and we made both financial and technical contributions to these projects. We also were selected for award under the recent Power Plant Improvement Initiative program to demonstrate a multi-pollutant control technology, targeted at the smaller power plants that generate about one-fourth of our coal-based electricity.

Much of our research is directed at helping our customers deal with the consequences of environmental regulations. For example, we developed a new technology for the

beneficial use of the solid byproduct of flue gas desulfurization, by converting it into aggregates for use in road and masonry construction. This technology, which we piloted in partnership with DOE, reduces the cost and the land-use consequences of solid waste disposal. It can provide a valuable source of construction materials in areas without good indigenous sources, such as Florida, and areas of high growth, such as the southwestern states. Projects like this, which are a win for the economy and a win for the environment, justify CONSOL's commitment to work in partnership with the DOE to develop technology that makes sense from both perspectives.

In some cases, research and demonstration projects, such as those conducted under the DOE Coal and CCT programs, have been sufficient to bring important technologies directly to the marketplace. For example, over $1 billion in Low-NOx burners have been installed at U. S. power plants since being demonstrated in the CCT program. However, other CCT program technologies, such as Integrated Gasification Combined Cycle systems, have not been commercialized at their current stage of development because of the technical and economic risk that remains despite these one-of-a-kind demonstrations. Nevertheless, large scale demonstrations are essential to understand the technical and economic performance of these new technologies and to provide potential owners and inventors with sufficient confidence to be able to attract financing.

The DOE is now preparing to issue a second CCPI solicitation. We believe that these large-scale demonstration projects are essential to reduce the technical and economic risks of new advanced clean coal technology. Technology demonstrations are an integral part of the Clean Coal Technology Roadmap, as discussed below.

The Clean Coal Technology Roadmap

The term “Clean Coal Technology" (CCT) is used to describe systems for the generation of electricity, and in some cases, fuels and chemicals from coal, while minimizing environmental emissions. This is accomplished through increased efficiency

(i.e., electricity produced per unit of fuel [energy] input), equipment for reducing or capturing potential emissions, or a combination of the two. Various CCTs are commercially available, or have been demonstrated at full commercial scale, but need further commercial use for economic optimization. Other CCTs are in the research and development stage.

Currently available CCTs include the efficient pulverized-coal-fired boiler (supercritical type) equipped with a full complement of fully-developed, state-of-the-art pollution control technologies. An example of this would be a supercritical boiler equipped with selective catalytic reduction for NOx, high efficiency flue gas desulfurization for SO_2, and a particulate collection device. It is important to realize that many coal-fired generating units are currently equipped with these CCT systems, some of which were brought to the state of commercial readiness since 1986 in the Department of Energy's previous Clean Coal Technology program.

Clean Coal Technology also refers to high-performance technologies that are well along the development path, but not yet fully demonstrated to be commercially available because of either technical or economic risks. Examples of these are integrated gasification combined cycle (IGCC) and advanced combustion power plant technologies.

"Advanced" Clean Coal Technology refers to technology concepts that are in development for future use, such as advanced IGCC or ultrasupercritical boiler technology. In this context, the term “advanced” refers to improvements in costs, efficiency, and performance that are expected at some future date, assuming successful development.

Moving advanced clean coal technologies to full commercial operation will take a continuing commitment to research, development, demonstration and a strategy to

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ensure that the technologies, once developed, will be deployed commercially. To provide a means of planning future research needs, and to chart progress toward meeting them, the industry, largely through the efforts of the Coal Utilization Research Council, the EPRI, and the Department of Energy, has devised a Clean Coal Technology roadmap that sets cost and performance targets and a timeline (See Tables, below) for new coal technology. It must be clearly understood that these are merely research targets and are not intended to serve as a basis for regulatory requirements. Moreover, as noted later, progress along the roadmap will depend upon adequate funding. If the roadmap were followed, technology would be available in the near term to allow operators of existing coal-fueled power plants to meet increasingly stringent environmental regulations, such as those of the Clear Skies Act. Again, were the roadmap followed, it would be possible in 2015 to design a high efficiency power plant, capable of carbon capture, with near-zero emissions; by 2020, the first commercial plants of this design would be built.

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DOE/CURC/EPRI CCT Roadmap I

Roadmap Performance Targets	Reference Plant*	2010	2020
SOx, % Removal	98%	99%	>99%
NOx, lb/MMBtu	0.15	0.05	<0.01
Particulate Matter, lb/MMBtu	0.01	0.005	0.002
Mercury	"Co-benefits"	90%	95%
By-Product Utilization	30%	50%	~100%
*Reference plant has performance typical of today's technology. Improved performance achievable with cost/efficiency tradeoffs.			

DOE/CURC/EPRI CCT Roadmap II

Roadmap Performance Targets	Reference Plant*	2010	2020
Plant Efficiency (%,HHV)	40	45-50	50-60
Availability, %	>80	>85	~90
Capital Cost, $.\/kW	1000-1300	900-1000	800-900
Cost of Electricity, $/MWh	35	30-32	<30
*Reference plant has performance typical of today's technology. Improved performance achievable with cost/efficiency tradeoffs. W/o carbon capture and sequestration.			

The roadmap contains considerable detail on the specific technological advances that are necessary to meet the roadmap coal. Some of these "critical technologies" are listed below.

Improvements for Existing Plants

- Mercury control
- Low-NO_X combustion at reduced costs
- Fine particle control
- By-product utilization

Advanced Combustion

- Ultra-supercritical steam
- Oxygen combustion
- Advanced concepts (e.g., oxygen “carriers”)

Gasification Systems

- Gasifier advances and new designs (e.g., transport gasifier)
- Oxygen separation membrane
- Syngas purification (cleaning) and separation (e.g., hydrogen, CO_2)

Energy Conversion

- Advanced gas turbine technology using H_2-rich syngas
- Fuel cell systems using syngas
- Fuels and chemicals

Carbon Management

- CO_2 capture and sequestration
- <10% increase in cost of electricity for >90% removal of CO_2 (including sequestration)
- “Hydrogen economy”

Systems Integration

- Integrated power plant modeling and virtual simulation

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- Sensors and smart-plant process control

Finally, the roadmap makes it possible to estimate the cost of the research, development and demonstration programs necessary to achieve the performance targets, as shown in the table below. These values represent the total cost of the research programs, including both federal funds and private sector cost shares.

Coal Technology Platforms	**RD&D Spending Through 2020**
IGCC/Gasification	$3.5 billion
Advanced Combustion Systems	$1.7
Innovations for Existing Plants	$1.4
Carbon Capture/Sequestration	$2.3 (?)
Coal Derived Fuels and Liquids	$1.2
Total	$10.1

The cost for carbon capture and sequestration research is shown with a question mark, to denote the relatively greater uncertainty in the estimate of the cost of research in this unprecedented area. It could be substantially higher, particularly because a number of large scale, long-term demonstrations will be needed to understand the technical, economic and environmental feasibility of carbon sequestration technology. This was one conclusion of a recent National Coal Council report, entitled "Coal-Related Greenhouse Gas Management Issues," which provides a detailed discussion of the opportunities and impediments to developing, demonstrating and implementing greenhouse gas management options related to coal production and use.

Unfortunately, current funding levels are not sufficient to meet the roadmap goals. The table below compares the funding levels required to follow the roadmap to the level in the Administration's FY 2004 budget.

Technology Program (all figures in $millions)	Administration FY 2004 Request	CURC Roadmap Annual R&D Budget [a]
IGCC/Gasification	51.0	125.0
Advanced Combustion	0.0	42.0
Advanced Turbines	13	16.5 (for syngas from coal)
Innovations for Existing Plants	22.0	43.0
Carbon Sequestration	62.0	30.0
Advanced Research		
Advanced Materials Only	4.65	4.0
Coal Derived Fuels & Liquids	5.0	12.8
Total R&D	**157.7**	**273.3**
Clean Coal Power Initiative	130.0	240.0
TOTAL	**287.7**	**513.3**

[a] This number is 80% of the total R&D amount required and represents the federal contribution

Although it varies by program area, the overall R&D funding level is little more than half of that called for in the CURC roadmap. Unfortunately, this continues a pattern of past years of underfunding clean coal research. Unless research and demonstration funds are increased, it is unlikely that technology will be developed on the roadmap schedule, if at all.

Similarly the funding level for the CCPI falls well below the roadmap requirements. Furthermore, the progress of the CCPI program is hampered by the requirement for annual, as opposed to advance appropriations. Because of the necessary size and cost of demonstration projects, it was necessary for the DOE to take money from both FY02 and FY03 appropriations to be able to fund the first solicitation. Future CCPI solicitations are likely to be delayed or limited in scope for the same reason. It is even possible that some necessary demonstrations will not be done because the available appropriations are insufficient. Given this situation, it may be appropriate for the Department to consider targeted solicitations focused on the roadmap objectives, or to utilize other approaches to match demonstration priorities with budgetary limitations.

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The FutureGen Project

On February 27 of this year, the Department of Energy announced plans to build a prototype of a coal-based power plant of the future. Dubbed "FutureGen," this facility would be based around a 275MW IGCC system, but it would have the capability to convert synthesis gas into hydrogen and to capture and sequester up to one million tons per year of carbon dioxide. FutureGen would be designed to minimize emissions of criteria pollutants and mercury to "near zero" levels. Furthermore, the FutureGen facility would be designed to serve as a "research platform" capable of testing advanced components, such as air separation membranes or fuel cells, during the ten year duration of the project, and perhaps beyond. The Department issued a "Request For Information" with a closing date of June 16, 2003, soliciting responses from parties willing to undertake the FutureGen project. My company, CONSOL Energy Inc., is a member of a ten-company group of major U.S. coal producers and users, which submitted a response to the DOE RFI, offering to enter into negotiations to conduct the FutureGen project. In part, our submittal says that the FutureGen mission should have four key elements:

1) develop commercially competitive and affordable coal-based electricity and hydrogen production systems that have near-zero emissions
2) develop large-scale CO_2 sequestration technologies that are technically and economically viable and publicly acceptable
3) provide a large-scale research platform for the development and commercialization of advanced technology
4) provide opportunity for stakeholder involvement and education

The vision of FutureGen as a research platform is particularly significant because it means that the FutureGen facility can be used as a test site to bring promising technologies out of the core R&D program and to accelerate their testing at scales up to full commercial implementation without the need for separate stand-alone test facilities.

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However, it is important to understand that FutureGen should not be viewed as a substitute for either the core R&D program or the CCPI demonstration program for at least two reasons: First, the FutureGen facility will not be operating for at least five years. During that time we need to continue the research needed to bring new technologies to the state that they can be tested at FutureGen. Second, we need to continue R&D on technologies, such as combustion-based systems, that are not part of the FutureGen design. That said, as the FutureGen concept is further defined, industry and government should look for opportunities for efficiencies in the coordination of the R&D program, the CCPI, and FutureGen to produce the greatest benefits at the lowest possible cost. This coordination should be an integral part of the ongoing technology road-mapping process.

Finally, although the exact cost is not known, DOE has estimated the project cost as $1 billion, with 80% provided by the federal government, and 20%, or $200 million, provided by the industrial alliance and its partners. Both the 80/20 cost share ratio and the ability of the Government to commit its full cost share to the project before major costs are incurred are critical to the project's success.

Incentives for Clean Coal Technology Deployment

The foregoing discussion in this statement deals with the need for research, development and demonstration of advanced clean coal technology, and discusses technical and economic criteria that these new technologies will need to meet to achieve acceptance in the commercial marketplace. However, while the Clean Coal Power Initiative and the enhanced core Fossil Energy authorization in Sections 21501 and 21511 of H.R. 6 are necessary for the continued development of coal technology, they are not by themselves sufficient to ensure that these technologies will find their way into widespread commercial use. When they are initially introduced, they will need to be built with substantial engineering contingencies, to assure their operability and reliability, which will increase capital and operating costs. Over time, as operating

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experience is gained, these costs will come down. Therefore, there is a need for financial incentives to offset the increased technical and financial risk inherent in the initial deployments of advanced clean coal technologies, In this regard I note that H.R. 6 does **not** include the tax incentives for a limited number of commercial demonstrations of advanced clean coal technologies that were included in H.R. 1213, the "Clean Coal Power Act of 2003." These incentives are included in S. 597, the "Energy Tax Incentive Act of 2003, reported by the Senate Finance Committee, and we hope that they will be adopted by the Conference Committee on the Energy Bill.

Conclusions

Mr. Chairman, there is little doubt that coal will continue to be used in the United States and abroad as a principal fuel for electricity generation, and coal's use will grow over time. The interests of the economy, society, and the environment in coal can be reconciled if we invest now in the development and deployment of advanced clean coal technology. By working with industry to develop a coal technology development roadmap, the Department of Energy has and continues to align its program with a logical path forward to support the development of advanced clean coal technology. The coal industry remains committed to do our part to see that coal remains an abundant, affordable fuel for power generation, and to help to advance the technology roadmap to achieve its goals of societal, economic and environmental betterment.

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Appendix

CONSOL Energy Inc. R&D Contracts with the Federal Government Since 1990

DOE Contract No.	Subcontract No.	Title	Contract/ Subcontract Amount, $
DE-AC22-91PC91040	UKRF-4-25582-92-76	Univ. of KY subcontract "Advanced Liquefaction Concepts"	1,274,846
DE-FC22-93PC92642	91-328	NYSEG subcontract "Milliken Clean Coal Technology Demonstration Project"	4,747,616
DE-AC22-93PC93255	N-00238-F2	Roy F. Weston subcontract "Clay Boswell Utility Hg Sampling Program"	39,507
DE-AC22-94PC93054		DOE contract "A Characterization and Evaluation of Coal Liquefaction Process Streams"	2,536,595
DE-AC22-95PC95050		DOE contract "Exploratory Research on Novel Coal Liquefaction Concept"	1,567,925
DE-AF22-96PC01387	97-07	ICCI subcontract "Correlate Coal/Scrubber Parameters with Hg Removal and Hg Species in Flue Gas"	40,000
DE-AC22-95PC95257	980244	ADA subcontract "ADA subcontract to R&D"	81,109
DE-AC26-98FT40337	N/A	Spinheat subcontract "Continued Development of the Rotary Combustor for Refining Pulverized Coal Boilers"	143,035
DE-FC26-98FT40027		DOE contract "Production of Construction Aggregates from Flue Gas Desulfurization Sludge"	1,000,000
DE-AE26-00NT50516	27164	Mitretek subcontract "DOE IGCC Market Penetration Study"	100,000
DE-AC22-95PC95256	980167	ADA subcontract "ADA Mercury Sampling Program"	53,583
DE-FC26-99FT40525	CRD 1392-91008	McDermott subcontract "Coal-Ash Corrosion Resistant Materials Testing"	10,000
DE-FC26-00NT40771		DOE Cooperative Agreement "Characterization of $PM_{2.5}$, PM_{10}, and Gaseous Priority Pollutants in Steubenville, OH, and the Surrounding Region" (SCAMP)	2,977,687
DE-FC26-00NT40905		DOE Cooperative Agreement "Characterization of Coal Combustion By-Products for the Evolution of Mercury into Ecosystems"	172,266

DE-FC26-00NT40910		DOE Cooperative Agreement "Durability Evaluation and Production of Manufactured Aggregate from Coal Combustion By-Products"	173,289
DE-FC26-01NT41181		DOE Cooperative Agreement, “Multi-pollutant Emissions Control: Pilot Plant Study of Technologies for Reducing Hg, SO3, NOx and CO2 Emissions”	2,412,413
	TOTAL		17,329,871

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