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Utilities' Potential Use of Clean Coal Technologies

Statement of
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Before the
Subcommittee on Economic Stabilization
Committee on Banking, Finance and
Urban Affairs
House of Representatives

Madam Chair and Members of the Subcommittee:

We are pleased to be here today to discuss our past work on the Clean Coal Technology program and the preliminary results of our nationwide questionnaire survey on utilities' plans to use clean coal technologies. My comments today will address the possible impact that clean air legislation might have on the prospects for introducing these technologies in the United States. Our survey and past work were done at the request of the Chairman, Subcommittee on Energy and Power, House Committee on Energy and Commerce. The Chairman has agreed for us to testify before you on our utility survey work, which has not yet been completed. I should also caution you that my comments in this testimony on our utility survey are subject to change.

In summary, our work shows that:

-- Enactment of acid rain legislation would provide a major impetus for utilities to consider using clean coal technologies. Currently, utilities plan to use these technologies on only about 5 percent of their coal-fired generating units. However, should acid rain controls be mandated, utilities would consider such technologies for as many as 50 percent of their units to reduce sulfur dioxide emissions and 75 percent of their units to reduce nitrogen oxide emissions.

-- Utilities indicated that their willingness to consider specific technologies depends on the severity of the emission reduction requirements, target dates for compliance, present and future electricity demand requirements, their confidence in the technologies' expected performance, and cost considerations. Generally, the more stringent the requirements and the more lead time provided to comply, the more clean coal technologies were

considered as viable options. They also indicated that they would consider other options (such as switching to low-sulfur coal or using conventional scrubbers) to achieve emission reduction requirements. However, not all coal-fired units would need to reduce emissions (about 6 to 21 percent already meet the emission reduction scenarios in our questionnaire).

-- Uncertainty about the commercial availability of emerging clean coal technologies is a key factor in determining when they could be widely deployed. Despite their potential, the new technologies may not contribute significantly to the reduction of acid rain-causing emissions during the next 15 years. Many of these technologies are expected to be commercially available between the mid-1990s and 2000, but this time frame could be somewhat optimistic. Problems and delays have been experienced under the Department of Energy's (DOE) Clean Coal Technology demonstration program in formalizing cooperative agreements with project sponsors and getting demonstrations underway.

-- Even after the technologies are commercially available, utilities will likely test them on one unit before installing them on others, and lead time will be needed for ordering and manufacturing the technologies. Thus, according to industry estimates, it could take another 5 to 10 years beyond the date of commercial availability for the technologies to be widely deployed. Once they are proven and widely deployed, they could play a major role in combating acid rain.

HOW WE DID OUR SURVEY

Before I proceed, let me provide some background on the scope and methodology of our study. To determine how utilities would

respond to different emission reduction requirements and compliance dates, we developed a comprehensive questionnaire that included four hypothetical acid rain control scenarios. Our scenarios, which are summarized in attachment I to my statement (and on the chart before you), were based on our analysis of acid rain control bills introduced in the 100th Congress. As you will note, our scenarios require different levels of sulfur dioxide and nitrogen oxide emission reductions--we refer to these as "moderate and more stringent reductions"--by either a 1997 or a 2004 compliance date. In developing our questionnaire, we obtained technical assistance from utility industry groups, DOE, and the Environmental Protection Agency (EPA). We also visited several utilities to test the clarity of our questions. The specifics of our methodology for selecting utilities and generating units and for analyzing responses are also included in attachment I.

ACID RAIN CONTROLS WOULD GREATLY INCREASE INTEREST

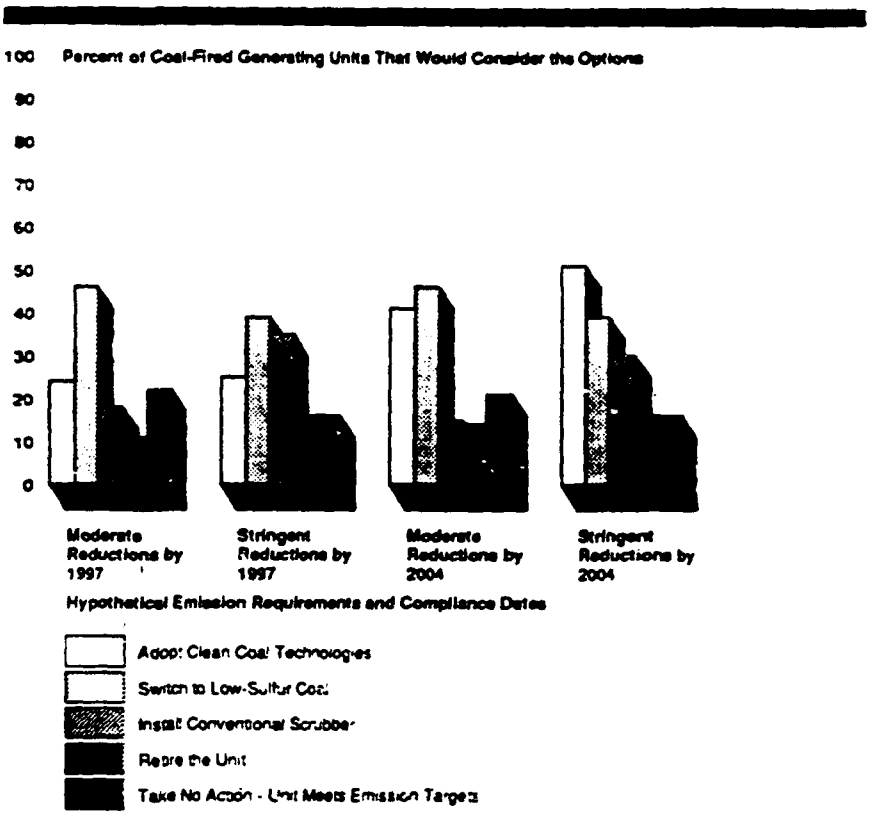
Few utilities have current plans to use emerging clean coal technologies at their existing power-generating units to reduce sulfur dioxide or nitrogen oxide emissions. Our analysis showed that utilities planned to use such technologies on only about 5 percent of their coal-fired units before 2010. However, given acid rain control legislation, many more would look to these technologies to meet emission reduction requirements. Our survey indicates that utilities would respond to our acid rain control scenarios in the following manner.

Sulfur Dioxide Emission Reduction

As shown in figure 1 (and on the chart before you), utilities' interest in using clean coal technologies to meet sulfur dioxide emission requirements seemed to be linked more to the time frames for compliance than the level of reductions to be met. Our

analysis showed that utilities would consider such technologies for up to 51 percent of their coal-fired units under a 2004 compliance deadline, but only for up to 25 percent of their units under a 1997 compliance deadline. I should point out that the questionnaire results also indicate that about 16 to 21 percent of utilities' coal-fired units would already meet our sulfur dioxide emission reduction scenarios, therefore, they may not be affected by acid rain control requirements.

Figure 1: Options to Reduce Sulfur Dioxide Emissions



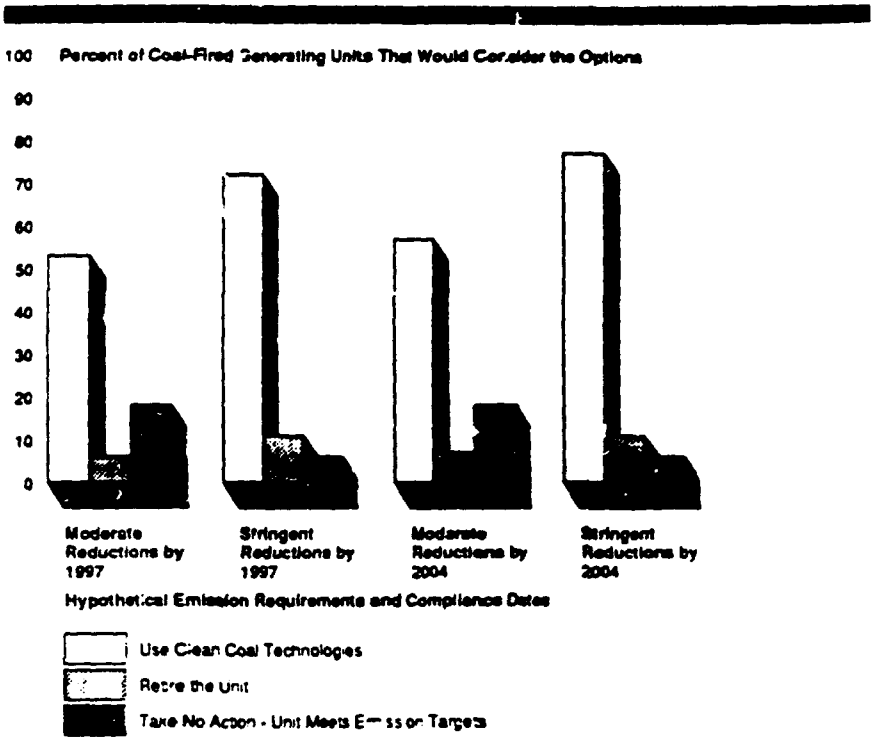
I should also add, as figure 1 indicates, that clean coal technologies were not the most frequently cited options for reducing sulfur dioxide emissions under three of our four scenarios. The utilities would also consider conventional options and technologies, such as switching to low-sulfur coal at up to 46

percent of their units and installing conventional flue gas scrubbers at up to 35 percent of their units. For example, under a 1997 deadline with moderate emission reduction requirements, utilities would consider switching to low-sulfur coal almost twice as often as using clean coal technologies. Given the same 1997 deadline, but with more stringent emission reduction requirements, they still indicated that they would consider switching to low-sulfur coal or using conventional scrubbers in more instances than using clean coal technologies. Only under our 2004 deadline requiring stringent emission reductions did utilities indicate they would opt for clean coal technologies more frequently than conventional options.

Nitrogen Oxide Emission Reduction

As shown in figure 2 (and on the chart before you), utilities' interest in using clean coal technologies for nitrogen oxide control was more directly related to the severity of the emission reduction requirements than the timing of the compliance deadlines. Our analysis of utilities' responses showed that under either a 1997 or a 2004 deadline, utilities would consider such technologies to reduce nitrogen oxide emissions at 53 to 57 percent of their coal-fired units under moderate emission reduction requirements and at 72 to 77 percent of their units under more stringent requirements. The questionnaire results also indicate that about 18 percent of utilities' coal-fired units would already comply with our moderate nitrogen oxide emission reduction scenarios and about 6 percent would meet the stringent scenarios.

Figure 2: Options to Reduce Nitrogen Oxide Emissions



This high level of interest in clean coal technologies for nitrogen oxide control seems to be based mainly on utilities' optimism that a group of related technologies categorized as low-nitrogen oxide combustion can be successfully deployed. Some of these technologies have already been successfully demonstrated in newly constructed boilers. Although retrofitting boilers with this type of equipment is still experimental, several utilities expressed confidence in the process on the basis of their experience with using the technology in new boilers.

COMMERCIAL AVAILABILITY OF THE NEW TECHNOLOGIES IS UNCERTAIN

Although acid rain control mandates may encourage utilities to give much more consideration to using clean coal technologies, the

new technologies have not been successfully demonstrated. Industry has indicated that a new technology is not considered to be successfully demonstrated until it has undergone multiple commercial demonstrations addressing a range of boiler designs, fuel types, and other operating variables to provide potential users with information and experience upon which to judge costs, efficiency, and reliability when compared to conventional alternatives for reducing emissions. On this point, about 41 percent of the utilities with coal-fired units indicated that having multiple demonstrations of the technologies that seemed most promising was the best way to promote the commercialization of clean coal technologies.

According to utility and coal industry estimates, many of the emerging technologies should be demonstrated and commercially available between the mid-1990s and 2000. These estimates generally assume that DOE's Clean Coal Technology program will be fully funded and that the selected demonstration projects will be completed successfully and on schedule. As you know, DOE has conducted three solicitations (or rounds) for project proposals under this program and has two more planned. As of February 28, 1990, cooperative agreements had been completed and signed for 13 of the 38 projects in the program, but only 3 projects were in the demonstration phase.

In March 1989, we reported that DOE had experienced major delays in negotiating cooperative agreements with round-one project sponsors and three projects withdrew from the program because of sponsors' difficulties in finalizing project financing and other business arrangements.[1] Our follow-up work has shown that these problems have continued under round two of the program. (DOE has recently taken action to shorten the agreement formalization

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[1]Fossil Fuels: Commercializing Clean Coal Technologies (GAO/RCED-89-80, Mar. 29, 1989).

process.) We also pointed out in that report, and our April 1989 testimony before the Subcommittee on Energy and Power, House Committee on Energy and Commerce, that delays were being experienced in getting projects underway once agreements were finalized.[2] We stated that DOE had extended the completion dates for two projects and expected to extend other projects that were behind schedule. These extensions could delay the commercial availability of these technologies. In fact, two of the funded projects dropped out of the program in June 1989 and January 1990 because of financing problems.

We just issued a report on the selection of round-two projects in which we raised two important issues.[3] One was that many of the projects are to demonstrate technologies whose potential to reduce nationwide emissions when used at existing coal-burning facilities was rated "weak" by DOE's evaluation board. The other centered on the need to focus the remaining $1 billion that has already been appropriated for the final two rounds of the program on the more promising technologies. Given the current status of the projects in the program, and in view of the nation's current budget constraints, we suggested that the Congress may want to have DOE delay selecting projects for rounds four and five of the program until it obtains additional demonstration results from projects already in the program. This would allow DOE to target the remaining funds to the more promising technologies and help ensure that program funds are used effectively and efficiently.

According to industry officials, two other issues are also affecting the demonstration of clean coal technologies--cost recovery and EPA emission requirements. The cost recovery issue

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[2]Status of DOE-Funded Clean Coal Technology Projects (GAO/T-RCED-89-25, Apr. 13, 1989).

[3]Fossil Fuels: Pace and Focus of the Clean Coal Technology Program Need to Be Assessed (GAO/RCED-90-67, Mar. 19, 1990).

centers on whether states will allow utilities that elect to participate in the development of clean coal technologies to recover the cost associated with demonstrating the technologies at their power-generating plants. Only a few states have developed specific incentives to allow utilities to recover demonstration costs. For example, Florida and Ohio have devised programs to allow for an accelerated recovery of demonstration costs.

Regarding EPA's emission requirements, units that are substantially refurbished are held to the same stringent emission standards as newly constructed units. The industry is concerned that EPA may require units that are modified to demonstrate clean coal technologies to meet the more stringent emission standards. Although EPA has granted an exemption for one power plant unit demonstrating a clean coal technology and has indicated that it will continue to consider such exemptions (on a case-by-case basis), the industry is concerned that the units will be subjected to the more stringent standards after the demonstration ends, even if the technology is removed. According to DOE and the utility industry, such a requirement could discourage utilities from participating in the Clean Coal Technology program. For example, in June 1989, one project sponsor and DOE mutually agreed to halt a planned demonstration project, in part, because a potential host utility would not commit itself to the project in view of the regulatory uncertainties.

WIDESPREAD DEPLOYMENT MAY TAKE 5 TO 10 YEARS AFTER TECHNOLOGIES ARE PROVEN

According to industry estimates, it may take 5 to 10 years for the technologies to penetrate the market once they are demonstrated and available for commercial order. This time span is needed for utilities to develop confidence in the new technologies and to provide the lead time for ordering, designing, manufacturing, obtaining, and installing the technologies. Even when commercially

available, utilities are apt to move cautiously in applying these new technologies. For example, industry officials have indicated that a utility will likely test the performance of a successfully demonstrated technology on a single unit before installing it on other units.

Utilities are also concerned about whether they will be allowed to recover their investment costs in installing new technologies once they are commercially available. According to industry officials, a utility's decision to invest in a clean coal technology would need to satisfy the same criteria as any other investment in the generating plant. Furthermore, such investment would need to be a prudent and cost-effective decision for the public utility commission to authorize a utility to recover the cost of bringing new technologies on line. On this point, I should note that our survey results indicate that, next to acid rain control legislation, cost was the most frequently cited factor that would influence utilities' decisions to adopt clean coal technologies. Furthermore, about 27 percent of the utilities with coal-fired units indicated that increased flexibility by public utility commissions on cost recovery would be an incentive to use new technologies.

SUMMARY

Although emerging clean coal technologies can play an important role in reducing emissions from coal-fired power plants, there is a great deal of uncertainty as to whether they will be commercially available and widely deployed within the time frame needed to meet acid rain control legislation requirements. Although utilities indicated that they would give much greater consideration to using these technologies if such legislation is enacted, their decisions to invest in the technologies will depend in large part on their confidence in how the technologies will compare with conventional technologies and other options in terms

of their technical feasibility, cost effectiveness, and emission control capability. Their decisions could also be influenced by their concerns over whether they will be able to recover their investment costs and what emission standards the technologies will be required to meet.

Because of the anticipated time frames needed for demonstration and deployment, emerging clean coal technologies may play only a limited role in reducing acid rain during the next 15 years. But once they are commercially available and widely deployed, they could contribute significantly to combating this problem.

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This concludes my prepared statement. We would be pleased to respond to any questions you or Members of the Subcommittee may have.

ATTACHMENT I

SAMPLING METHODOLOGY AND QUESTIONNAIRE SCENARIOS

Using probability sampling techniques, we selected 138 utilities and 480 of the nation's 1,503 fossil-fueled (coal, oil, and gas-fired) power-generating units that have at least 75 megawatts of generating capacity. We mailed our questionnaire to these utilities and requested information on their current plans to use clean coal technologies at each of the 480 units. We also asked whether the utilities have considered what they would do at these units if acid rain control legislation were enacted. For those that had explored emission control options, we asked whether they would consider using clean coal technologies, conventional technologies, or other options to meet the reduction requirements described in each of our four scenarios.

We received responses from 130 of the 138 utilities in our survey, which provided information on 93 percent of the sampled generating units. Although some clean coal technologies can benefit oil- and gas-fired generating units, our survey indicated that utilities would be primarily interested in the technologies for their coal-fired units. Of the 480 units in our survey, 307 (64 percent) were coal-fired units. We have, therefore, focused our testimony on utilities with coal-fired generating units. The responses were analyzed to develop estimates for the universe of 75-megawatt-and-greater coal-fired generating units and associated utilities from which the sample was drawn.

Our four hypothetical acid rain control scenarios called for reducing the utility's systemwide sulfur dioxide and nitrogen oxide emissions by a specified percentage below 1980 levels or to a specified level stated in pounds per million British thermal units

(lbs./MMBtus)--whichever requirement would be less stringent, as shown below.

Table I.1: Questionnaire Scenarios for Acid Rain Control Requirements

Scenario	Compliance date	Emission reduction requirement[a] Sulfur dioxide	Nitrogen oxide
1 (near-term moderate)	1997	35% or to 1.0 lb./MMBtus	25% or to 0.6 lbs./MMBtus
2 (near-term stringent)	1997	75% or to 0.8 lbs./MMBtus	50% or to 0.4 lbs./MMBtus
3 (long-term moderate)	2004	35% or to 1.0 lb./MMBtus	25% or to 0.6 lbs./MMBtus
4 (long-term stringent)	2004	75% or to 0.8 lbs./MMBtus	50% or to 0.4 lbs./MMBtus

[a]The percents refer to the extent that emissions would need to be reduced below 1980 levels.

We distributed our questionnaire to utilities several months before the current administration announced its acid rain control proposal. Our scenarios for sulfur dioxide emission reductions are more stringent than the administration's proposal, which essentially would require utilities to reduce sulfur dioxide emissions from fossil fuel-fired steam-electric generating units to 2.5 lbs./MMBtus after December 31, 1995, and to 1.2 lbs./MMBtus after December 31, 2000. The administration's proposal does not specify nitrogen oxide emission limits for generating units, but would require the Administrator, EPA, to establish nitrogen oxide emission rates for utilities' coal-fired steam-electric generating units to meet after December 31, 2000. The administration's proposal would also grant a 3-year extension (until Dec. 31, 2003)

for generating units that will be repowered with a qualifying clean coal technology to comply with emission requirements. Our scenario 3 is the closest to matching the administration's proposed sulfur dioxide emission reduction requirement.