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Comments submitted to the Department of Energy by the Coal Utilization Research Council (CURC) in response to a Request for Information (RFI) issued by the DOE

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INTRODUCTION:

These comments are submitted on behalf of the membership of the Coal Utilization Research Council (CURC) in response to the Department of Energy's request for information related to the Department's intent to restructure the FutureGen project. A list of CURC's membership is attached. These comments address the proposed structure and content of the Department's revised FutureGen program but should not be interpreted, by this submission, as supporting the intention to terminate the government's participation in the FutureGen project.

The CURC opposes the proposed action to terminate DOE support of the current FutureGen project. A copy of our letter to various Members of Congress in which we urge reconsideration of the proposed action is attached for your information. In this same communication CURC also noted its support of the Department's initiative to undertake a solicitation in which the DOE would provide funding for the incremental costs associated with installing and operating carbon capture and storage systems (CCS) on commercial-scale electric power generation facilities.

SUMMARY OF CURC'S CONCERNS ABOUT THE PROPOSED CCS PROGRAM:

(1) The amount of funding, $1.3 billion (in as-spent dollars), over a 14 year period (the scope and duration of the proposed program) is not adequate to support "multiple" CCS projects;

(2) The program should not be limited to the installation and operation of CCS on commercial-scale IGCC projects; rather, a separate but parallel program for commercial-scale combustion-based projects, including both advanced pulverized coal with carbon capture and oxycombustion technologies, should be established, as well;

(3) The requirement to capture 90% of CO_2 and store at least one million tons per year of CO_2 into deep saline structures is overly restrictive; industry needs to obtain baseline data, demonstrated reliability and widespread confidence in CCS systems and these goals can be achieved more cost-effectively by requiring less aggressive percentages of capture;[1] and

(4) The lack of a regulatory structure to address the transport and storage (during the life of the project as well as longer term) of captured CO_2 along with a resolution to long term liability issues for selected power generation projects must be addressed, otherwise industry involvement is not likely to occur.

DISCUSSION OF SPECIFIC CONCERNS AND RECOMMENDATIONS:

1. FUNDING LEVEL AND DURATION OF PROPOSED PROGRAM

a. DESCRIPTION OF PROBLEM

On an annualized basis the level of funding proposed by the Department for this initiative is both inadequate and uncertain. Assuming an incremental capture and storage cost of $50/ton CO_2[2], the $156 million in funding requested for FY 2009 is sufficient to support no more than one to three projects for one year.[3] This assumes that the 300 MW project which would likely emit at least two million tons of CO_2 annually and be required to capture 90% of those emissions would choose to permanently store only one half of the CO_2 captured and "sell" the remainder to another entity for a beneficial use (e.g. enhanced oil recovery) or "release" such CO_2. If the project could sell the entire amount of captured CO_2 would it not do so? In which case, it would not be eligible for the program; alternatively if there were no opportunity to sell the CO_2 but the CO_2 must be captured, then the per ton of CO_2 benefit is even less given the fact that the government might compensate the project for only one half of the CO_2 captured.

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[1] The 90% capture requirement of total CO_2 emissions is more appropriately applied to the FutureGen project where technology demonstration is a principal goal rather than the type of commercial-scale projects contemplated by this proposed program. Furthermore, even after detailed characterization of a sequestration site, there is no certainty that it will be suitable for long term sequestration. Certainty only comes after injection of significant amounts of CO_2 and thus confirmation of predictions about the storage site. Projects need design flexibility to recover non-CCS operation if initial sequestration fails; thus, it is strongly encouraged that the program specifically recognize the possibility that long term sequestration may not be possible and specific allowance should be made for this contingency by insuring that a selected project sponsor will not be penalized and forfeit the DOE's financial support if long term storage proves unsuccessful.

[2] DOE (see: Jared Ciferno, National energy Technology Laboratory, "Existing Coal Power Plants and Climate Change: CO2 Retrofit Possibilities and Implications" January 24, 2008), and other studies have projected the incremental cost of CCS to be between $40 and $90 per ton.

[3] As an example, a large-scale commercial power project with CCS will need to proceed through a sequence of stages. Those and estimated costs (associated only with CCS) for a 300MW demonstration at ~2MM tons CO2/yr (90% capture) are:

Phase 1: Initial plant, pipeline feasibility study and preliminary sequestration site screening: $2-3MM
Phase 2. Plant Front End Engineering Design (FEED), pipeline design and sequestration site detailed characterization: $40-$50MM
Phase 3: Detailed engineering and construction – plant, pipeline, sequestration site facility and wells: $250-$350MM
Phase 4: CCS Commissioning, operation, monitoring for three (3) years: $300MM
Total Cost/project: $600MM-$700MM

Thus the program funding of $1.3B is adequate to support only 2 projects.

Even if subsequent year appropriations were assured (a highly unlikely event given that appropriation requests are determined annually by Congress and also given the uncertainty beyond 2008 when a new President is in office and support of the program may be terminated) the amount of funding to be acquired annually, in our judgment, is totally inadequate. The CURC has recommended a near term CO_2 program, one element of which is to support the installation and operation of carbon capture and storage on up to 9,000 megawatts of electric generation. The CURC program would provide a 30% investment tax credit for CCS equipment and a limited duration – up to ten years per project – production tax credit for CO_2 actually stored or otherwise used for beneficial purposes. The total estimated cost of the CURC program is $8.9 billion. This funding would support five to ten commercial scale projects which we judge to be the minimum number required to provide industry a degree of confidence that CCS is both feasible, reliable and can be made cost acceptable.

b. RECOMMENDATION TO MODIFY THE PROPOSED PROGRAM

Assurances that the contemplated multi-year program will be funded at even the suggested $1.3 billion level are absolutely essential. And, unfortunately, the action taken by the DOE with respect to the FutureGen project is primary evidence of this real concern. In addition, the total amount of funding, as explained above, is not adequate. The DOE is encouraged to modify the program and propose a greatly expanded program, like that already proposed by CURC, which would grant tax incentives to qualifying CCS projects. At a minimum, the Department is encouraged to plan for and commit to a much larger initiative so that there is a program legacy tied to a much more robust industry and government partnership thereby giving both the Department of Energy and industry a basis for encouraging the next Administration to continue a large-scale, industry supported CCS implementation partnership.

The RFI suggests that the DOE may provide support "up to" the incremental cost of a CCS project. The Department is encouraged to clarify the level of support that might be provided. Specifically, a final solicitation should clearly describe what portions of a CCS project (e.g. equipment associated with the capture of CO_2, pipeline transportation infrastructure, acquisition of storage rights, etc.) are eligible for assistance. It is also assumed that the program is intended to cover the **entire** cost of the CCS portion of the project given the fact that the industry participant is willing to add the CCS component to its commercial-scale power generation facility. If this understanding is not correct then the Department needs to explain what is intended. Finally, are annual operating costs of CCS operation for a minimum period of time included in a covered project?

2. ELIGIBILITY OF POWER GENERATION PROJECTS TO PARTICIPATE IN THE CCS PROGRAM:

a. DESCRIPTION OF PROBLEM

The proposed program would be limited to the installation of CCS technology on IGCC units. The goal of the program should be to encourage the application of carbon capture and storage to electricity generation units and not to a single form of electricity generation.

The CURC strongly encourages the Department to expand eligibility to include combustion based systems. This should include post-combustion CCS systems that utilize flue gas cleanup technologies as well as more advanced concepts like oxycombustion. It is imperative that any program like the one being proposed by the Department seek to insure that all power generation options be incentivized. In this way, the electric utility sector will continue to have a number of options available for the generation of electricity and the capture and storage of CO_2.

Should eligibility be expanded to include combustion-based units then it is also important that the unit size and percent capture criteria be modified, as well. The 300 gross megawatt per unit plant power train is not appropriate for a combustion-based unit.[4] The unit size of pulverized coal units vary widely and if the goal of the proposed program is to provide incentives for commercial scale projects then some other indicia besides megawatts per unit plant power train needs to be employed. In addition, CO_2 capture at this early stage of CCS development will involve capturing the CO_2 from a slipstream of the flue gases and the criteria that 90% of total CO_2 emissions from the unit be captured is also not appropriate.

b. RECOMMENDATION TO MODIFY THE PROPOSED PROGRAM

CCS projects utilizing combustion technology (i.e. flue gas scrubbing or oxygen-fired combustion technology) should be made specifically eligible for the proposed program. It is recommended, however, that there be a separate, parallel program established for CCS projects utilizing combustion technology. The criteria for CCS projects on gasification-based systems versus combustion-based systems are significantly different and trying to integrate into one program eligibility for two different technology paths is likely to cause confusion and controversy.

Second, the megawatt size criteria and the percent of CO_2 capture criteria must be modified to account for the varying unit sizes of commercially-installed coal combustion systems. In addition, early CO_2 capture systems installed on combustion-based units will be applied to portions of the flue gas stream and the 90% capture requirement on the entire flue gas stream is not appropriate. Combustion systems utilizing CO_2 capture systems (oxycombustion or scrubbers), should be validated at 75% to 90% capture efficiency and approximately one million metric tons per year of CO_2 captured. This goal would be realized at a single plant (oxycombustion) or a

[4] It is assumed that the reference to 300 MW with respect to an IGCC is gross, not net, capacity. The program should clearly state that parasitic power used for CO_2 compression, etc., impacts on the gasifier or gasification train due to elevation or rank of coal used in the project are factors that will not negatively impact the calculation of the 300 MW size.

single commercial scale train (i.e. scrubber) operating on a slipstream of the total flue gas.

3. REQUIREMENT TO CAPTURE 90% OF CO_2 AND STORE 1 MILLION TONS ANNUALLY

a. DESCRIPTION OF THE PROBLEM

Recent studies[5] have concluded that the costs to capture 90% of CO_2 from an IGCC rise dramatically once more than 65% is captured. On combustion systems, capture (oxycombustion or scrubbers), costs appear to be minimized near 85% capture, either from the entire plant (oxycombustion) or a single train (scrubbers).[6] [7]

Requiring 90% capture will dramatically increase the costs to the government (if the DOE provides financing for the incremental cost of the CCS system) and could dissuade participation by industry where the risk – and costs – will be judged too great. While the 90% requirement is an appropriate goal for the FutureGen project given the emphasis upon technology demonstration and maturation, nothing is gained by requiring a generating unit that is planned and constructed to provide competitive electric power to meet a 90% criterion when the goal should be to gain commercial experience by capturing some portion of the CO_2. At this stage of CCS technology development there is no compelling reason to require a commercial-sized power plant to assume any added risk, let alone increased costs, of a 90% capture system.

The RFI specifically states: "…the revised approach will place emphasis on gaining early commercial experience validating clean coal technologies through multiple demonstrations of CCS technology in commercially-operated … electric power plants." Given the immature state of experience in using capture technology integrated with an IGCC, for example, CURC believes it is much more prudent to simply encourage the installation of CCS technology on a unit that will be commercially-operated rather than dictate the level of capture. Industry should be free to determine what level of capture of CO_2 makes the greatest sense from both a cost and acceptable risk exposure perspective. Ultimately, as experience is gained and cost and reliability are demonstrated, it is assumed that the marketplace will demand and technology providers will supply the most cost effective and efficient

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[5] See: S. Gadde, J. White of WorleyParsons and R. Herbanek, J Shah of ConocoPhillips: "CO2 Capture: Impacts on IGCC Plant Performance in a High Elevation Application using Western Sub-Bituminous Coal" at Gasification Technologies Conference, San Francisco October 15 – 17, 2007.

[6] See: Rao and Rubin, 2006 and DOE-NETL 401/120106

[7] Two issues drive concerns regarding 90% capture on the combustion based plant. First, pulverized coal power plants are built to customer needs and one size does not fit all such needs. Economies of scale for pulverized coal units has led to units well over 500 MW in the US and globally. Therefore, to build 90% first of kind CO2 capture into a new PC would require multiple modules of a post combustion capture technology... essentially having to duplicate a demonstration multiple times on the same new power plant.... clearly an inefficient use of incentives. Second, the quantity of CO2 produced by high capture on full plant output results in quantities of CO2 which will likely exceed the scale of first of kind sequestration demonstrations, making siting and integration of sequestration a much larger problem. Oxyfiring does not face the same CO2 percent capture issues.

For large generating units, e.g. over 400 MW capacity, 65% capture even if judged technically feasible, will recover well over 1 million tons per year of CO2 (a 1000 MW unit would capture 6-7 million TPY). The state of knowledge of storage technology in geologic formations is not sufficient at this point to address this volume of gas in a storage project. The purpose of advancing storage technology would be better served by having more locations evaluated with less CO2 injection, as long as the injection quantity is substantial (e.g., 500,000 TPY).

systems. This demand likely will result in technology offerings capable of providing greater and greater percentages of CO_2 capture over time. At a minimum, if a level of capture is imposed in order to qualify for the program, then it is strongly urged that some minimum level of capture (not the maximum level of capture) be set against which the DOE might judge the best project(s) to be selected.

b. RECOMMENDATION TO MODIFY THE PROPOSED PROGRAM

The owner/operators of commercial scale electric generation projects who are willing to install CCS systems onto their projects that will cost hundreds of millions, if not billions, of dollars, should not be restricted to the 90% capture requirement that is otherwise germane only to a technology demonstration project (i.e. FutureGen). The goal is the installation of CCS technology at commercial scale. The CURC recommends that no percentage requirement be prescribed in order to qualify for the program but if the DOE determines that a percent requirement is desirable then such requirement should constitute a minimum and be expressed in terms of a "goal" with an expressed statement that the Department will give added weight or preference if a proposer intends to achieve a greater percentage.

4. THE NEED FOR CERTAINTY WITH RESPECT TO LONG-TERM LIABILITY

a. DESCRIPTION OF THE PROBLEM

The Department makes no mention in describing the proposed program of the current lack of a regulatory structure that is required to transport, inject and permanently store the captured CO_2. This is a vitally important element of any forthcoming CCS project. The experience of the FutureGen project as well as the on-going projects within the regional sequestration partnerships is ample evidence of the complexity surrounding particularly the matters of injection, pore space ownership and short term and long term liability associated with CO_2 storage. These matters are being addressed through federal, state and local government's affirmative intervention. First-of-a-kind commercial-scale CCS projects, like those anticipated by the proposed program, will require similar assistance.

The establishment of a permanent regulatory regime has yet to be addressed. The absence of such a regulatory structure creates an unacceptable degree of risk and uncertainty which means that no action to undertake CCS projects will likely take place. In the interim, CCS projects implemented on commercial-scale power generation projects cannot await the years necessary to consider, debate and structure a permanent set of regulations and practices to address the storage of CO_2. Answers to questions about transporting CO_2, ownership of the storage reservoirs, injection of the CO_2 and liability issues attendant to the near term and then long term storage of the CO_2 must be addressed at the outset of the process when a CCS project is planned. The DOE, and various agencies of the federal government, have major roles to play in this process. More importantly, with respect to those projects that may participate in

the program now under consideration, the DOE, and the federal government in general, must recognize that these early projects will require separate attention and unique consideration.

b. RECOMMENDATION TO MODIFY THE PROPOSED PROGRAM

The FutureGen project is clear evidence of the enormous complexity facing any project seeking to install CCS technology and store CO_2 in a deep saline reservoir. It cannot be assumed, as the RFI suggests, that potential project sponsors will chose to site commercial-scale electric generation plants within reasonable proximity of the four sites considered by the FutureGen Industrial Alliance just to participate in this program. If as DOE suggests this program is being initiated to support industry activity now underway then the prospect of financial incentives alone will not be sufficient. To reduce the time required to identify potential storage sites, characterize such sites, obtain federal and state and local government commitments related to long-term liability issues, conduct the necessary NEPA reviews and environmental impact statements, etc. all of which has been accomplished by the FutureGen project and requiring five and more years to complete will require a substantial commitment by government. The DOE must acknowledge this challenge in the final solicitation for projects and define specifically how the government intends to assist in addressing these various issues.

With respect to projects that are selected to participate in this program it is strongly recommended that the federal government commit to assume long-term liability for monitoring, safety, etc. of the stored CO_2. Without an assurance of this nature and in the absence of an existing regulatory regime that specifically addresses this issue it is not likely that owners/operators of commercial scale electricity projects will get involved. The CURC will be pleased to work with the DOE to suggest other specific actions that the Department or other federal agencies will need to take in order to address the challenges identified herein.

CONCLUSIONS:

In order to initiate the proposed program and insure industry participation it is strongly recommended that the DOE incorporate the recommendations made in this submittal. The need to develop carbon capture and storage technology if greenhouse gas regulation is enacted is not disputed. It will require the combined resources of industry and governments at all levels working in partnerships to accomplish rapid introduction of CCS technology. The CURC will be pleased to work with the Department in structuring this important program.