

A CRITICAL REVIEW OF EFFICIENT AND ENVIRONMENTALLY SOUND COAL UTILIZATION TECHNOLOGY

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PURPOSE

The Secretary of Energy asked the NCC to review the scope of coal utilization technologies and prepare "a single source document which defines state-of-the-technology for coal-using systems and associated benefits." This study builds on several of the earlier NCC studies, including Clean Coal Technology (1986), Innovative Clean Coal Technology Deployment (1988), Export of Coal and Coal technology (1993), and Clean Coal Technology for Sustainable Development (1994). Overall, this report satisfies the request of the Secretary and provides one of the most complete reviews of coal utilization technologies to date.

FINDINGS

This study breaks and evaluates coal utilization technologies into 46 technology areas, including convention and unconventional coal cleaning, all types of combustion technology, and post-combustion control technologies. Within the 46 technology areas several hundred actual specific technologies were evaluated and included in either an aggregate form, when technologies could be combined, or individually. In addition, the report covers advanced power systems and looks at technologies involved with the conversion of coal into other useable products. The conclusions from this study include:

- All new coal utilization technologies need some form of risk sharing for first-of-a-kind commercial scale plants to accelerate the transition from demonstration to commercialization.
- Many of the promising technologies will be demonstrated under the DOE CCT projection; however, further development to reduce cost is critical to market acceptance.
- As federal and state environmental requirements are mandated, the relative importance of many of these technologies changes.
- A wide range of technologies is necessary to assure both short-term and long-term economically viable and environmentally acceptable options.

Each technology was evaluated to identify its most important immediate needs depending on the state of the development (i.e., research, development, demonstration, and commercial assistance). Finally, the report provides a priority listing for each technology area and specifies the emphasis which should be placed on further research, development, demonstration, or commercial assistance funding.

This report emphasizes that all coal utilization technologies have roots in basic research, and there is always a number of interacting scientific and engineering disciplines required in the progression from research to demonstration. The decline since the 1970s in the number of universities with facility expertise and graduate research programs related to coal is a problem which could threaten the future of coal utilization technology development by eliminating the basic research source of new ideas and concepts. Not only is there a current need for research, but there will be the related need for trained personnel with experience in coal technologies to design and manage the coal utilization facilities of the future. A strong concern in this area is expressed in the study as an overriding point of the review.

There are several different levels of need which may be addressed by different collaborative mechanisms. For example, advanced technologies must be evaluated by prospective users to determine how the technologies can best be integrated into their facilities and business operations, and the economic effects on their business must be analyzed and understood. New technologies must face the competition of existing technologies that are upgraded in performance through improvements in equipment or process operating conditions. It is important for the effective development of new technologies that industry and government collaborate to ensure that input from the user community is part of the efforts surrounding basic research and development. This report also concluded, as did the 1994 effort on sustainable

development, that government assistance is needed to move promising new technologies up the chain from concept to research to reality. This will involve some level of support as the new technology goes through the early phases of commercialization. The level of overall support is small during basic research and peaks during demonstration. The cost-sharing by industry increases dramatically as the new technology moves from demonstration to commercialization.

RECOMMENDATIONS

- All fourteen clean coal technology demonstration projects on indirect-fired cycles and molten carbonate fuel cells be completed.
- The needs of the select list of subject areas and technologies as shown in Exhibits 2-5 of the study be met as soon as possible so they may advance coal utilization in the next century.
- All effluent streams of current projects in the CCT Program be characterized to assess the need for hazardous air pollutant control.
- Mechanisms be established to provide commercialization assistance, in the form of risk-sharing and international marketing assistance, for five technologies which offer the greatest promise for near-term benefits.
- The federal government create an insurance program to provide a safety net for the first-of-a-kind new commercial facilities. This should be done in a partnership with coal stakeholders.
- U.S. Department of Energy consider a range of financial incentive options which not only can minimize federal expenditures, but also can assure initial pre-commercial deployment of the systems.
- Incentives be established 1) to shorten the time required for commercial deployment; 2) to improve prospects for exporting U.S. technology; 3) to ensure continued benefits of environmental protection, energy efficiency, and "highest and best" economic use of the national's most abundant energy resource: coal
- Section 29 of the existing tax code, "credit for producing fuel from a non-conventional source," be expanded to include advanced power systems, advanced emission control systems, and coal conversion processes which may require government risk-sharing in order to bring about commercialization of these technologies.
- The "facility original placed in service date" be extended from the present "before January 1, 1997" to "before January 1, 2007." This will provide an additional ten-year window of incentive to meet projected capacity growth and environmental performance goals. This also would allow sufficient time to plan, design, permit, and construct qualifying facilities.
- DOE maintain, to the maximum extent possible, support for coal technology research and development.
- DOE assume the responsibility of "technology caretaker" for coal liquefaction technology, since commercialization seems to be unlikely in the near future.
- DOE, working with the industry stakeholders, develop a deliberate plan of implementation 1) to identify the persons and institutions where coal research expertise can now be found; 2) to provide adequate and stable levels of funding to sustain significant research programs; 3) to provide incentives for productive programs and competition between programs; and 4) to ensure rewarding career paths for graduate students who address coal-related topics.
- High-priority needs addressed in this report be met by re-focusing the government/industry collaboration that proved successful with the DOE Clean Coal Technology Program.
- DOE consider cost-sharing with user groups that can demonstrate shared technical interest with DOE.