

Senate Committee on Energy & Natural Resources

Future of Coal Conference

Submitter's Name: William G. Rosenberg/ John F. Kennedy School of Government

Contact: William G. Rosenberg

Email: william_rosenberg@ksg.harvard.edu

Phone: 919-601-0563

EXECUTIVE SUMMARY

The future of coal in the U.S. is inextricably linked to the future deployment of technologies that address environmental concerns raised by coal combustion. Deployment of advanced technologies that reconcile coal use and environmental protection will enable the nation to enjoy the energy, economic, and security benefits of expanded coal use without adversely affecting human health and the environment.

Coal gasification, which refines coal into synthesis gas and removes impurities prior to combustion, minimizes air pollutant emissions, water consumption, and solid waste production associated with coal use and provides a technical pathway for separating, capturing and storing carbon dioxide (CO₂) emissions. The U.S. Department of Energy (DOE) has invested billions of dollars to support research, development, and demonstration of gasification and IGCC technologies to bring them to commercial readiness. The U.S. should accelerate real time commercial deployment and investment in a fleet of IGCC and industrial gasification plants through a National Gasification Strategy to preserve industrial jobs (being lost due to high natural gas prices), refuel underutilized natural gas combined cycle power plants, and provide secure, reliable, and clean coal power to serve the nation's growing economy. The sooner gasification of abundant coal and biomass is operational, the sooner massive reliance on LNG imports and natural gas prices are moderated.

Early deployment of gasification requires federal incentives to overcome higher capital costs, technology risks, and financial market skepticism inhibiting investment and to encourage cost recovery approval by state public utility commissions. The federal government can stimulate deployment at low federal cost by providing loan guarantees for gasification investments, similar to those provided to support Alaska Gas Pipeline construction and transportation infrastructure. Loan guarantees reduce coal gasification electricity from about 5.5 cents/kWh to 4.2 cents/kWh, which is lower than the cost of new PC power. For industrial plants, synthesis gas can be produced for about \$4.3/mmBtu in a \$6.0/mmBtu natural gas market.

Comparing budget impact, loan guarantees cost the government about 80% less than investment tax credits, grants, and accelerated depreciation to achieve the same economic benefit for the projects. The lower cost of loan guarantees enables federal funds to support a larger gasification program to save jobs and lower natural gas and electricity costs—the National Gasification Strategy produces the equivalent of 1.5 TCF of natural gas. The federal government risk can be significantly reduced by requiring assured revenue streams (from state utility commission determinations or creditworthy off-take agreements) as a condition of qualification. With credit support, the loans are differentiated from the Synfuels Corporation, which put project and credit risks on the federal government.

It is possible to allow developers to choose from a menu of loan guarantees and tax incentives, so long as the selection criteria takes into account the cost to the federal government of each package. This will ensure projects with the least budget cost are selected.

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Question 3. Financial and Technological Improvements: *What technological improvements in coal use are most important to pursue? What financial and/or regulatory mechanisms are necessary to bring these technological improvements to market?*

Commercial deployment of coal gasification technology that reconciles coal use and environmental protection, including progress in addressing carbon dioxide (CO₂) emissions, should be pursued as a national priority. Federal loan guarantees that require specific credit enhancements for qualification, offer a low federal budget cost mechanism to stimulate coal gasification investments to preserve domestic industrial jobs, refuel underutilized natural gas combined cycle (NGCC) power plants, and provide secure, reliable, and clean coal power to serve the nation's growing economy.

Coal gasification technologies, including integrated gasification combined cycle (IGCC) electricity generation, are commercially ready and offer a paradigm shift in the use of coal—refinement of coal into a clean fuel prior to combustion, rather than direct combustion of coal and its impurities. Gasification technology minimizes air pollutant emissions, water consumption, and solid waste production and provides a foundation for separating, capturing, and storing CO₂ at lower cost than can be achieved with direct coal combustion. Synthesis gas manufactured in the gasification process can be substituted for natural gas and reduce natural gas and electricity prices. It also can produce pure hydrogen from coal for use in fuel cell technologies, produce heat, steam, and process fuel for industrial applications, and/or produce high value liquid fuels.

Research conducted in 2004 at the Kennedy School of Government¹ identified market conditions inhibiting investment in IGCC technology and proposed a cost minimizing approach for the federal government to stimulate near-term deployment. The recommended approach is to provide credit enhanced federal loan guarantees—structured to minimize federal government exposure to project risks—that address gasification deployment hurdles with low budget “scoring” by:

- Insulating the federal guarantor from default risk;
- Providing federal credit to projects to significantly reduce capital costs; and
- Ensuring developers access to low-cost capital for 80% of project costs.

¹ Rosenberg, W.G.; Alpern, D.C.; Walker, M.R. Deploying IGCC in this Decade with 3Party Covenant Financing; Belfer Center for Science and International Affairs, Kennedy School of Government, Harvard University, Cambridge, MA 2004; available at www.ksg.harvard.edu/bcsia/enrp.

Why Gasification Technology Deployment?

Energy independence and security -- The Department of Energy (DOE) has invested billions of dollars over the last 20 years to support research, development, and demonstration of gasification technology, which has helped bring it to a state of commercial readiness. Gasification technology provides for expanded use of domestic coal, both for electric generation and industrial processes, without adverse environmental consequences. The U.S. has more coal than any other country in the world with estimated recoverable reserves of 275 billion tons—approximately 25% of world supplies and more than a 250-year supply at current consumption. Domestic coal, which is geographically dispersed across the country, transported by rail and barge, and can be stockpiled for 30-90 days on-site, is our most secure, reliable, and affordable fossil energy resource.

Industrial Jobs--High natural gas prices are seriously undermining the economic competitiveness of many U.S. industries. The chemical industry estimates it has lost \$50 billion in business to foreign competition and more than 90,000 jobs since 2000 due to high natural gas prices. Similarly, the fertilizer industry reported in 2003 that 11 ammonia plants representing 21% of U.S. capacity had already been closed, that only 50% of the remaining U.S. capacity was operating, and that two major U.S. fertilizer producers had filed for bankruptcy. Incentives for commercial gasification deployment will give these and other industries the option to invest in the U.S. rather than move production and jobs overseas.

Natural gas markets-- Gas supplies in the U.S. can be significantly enhanced by manufacturing gas using commercially available gasification technologies. Gas supply from gasification could begin to come on-line in 5-7 years, providing a mid-term supply bridge to Alaska Gas Pipeline completion. Gasification would also relieve pressure on natural gas pipeline infrastructure—manufactured gas would be produced and used on site, rather than piped hundreds of miles. Refueling of existing, underutilized natural gas combined cycle power plants with coal gasification could provide an immediate and permanent reduction in natural gas demand from the fast growing electric sector. Loan guarantees or other incentives would make significant gasification investment attractive and feasible across the country.

Air quality-- The environmental concerns associated with coal-fired power plants are well documented and a significant factor that stands in the way of new pulverized coal (PC) power plant permitting and construction. The emissions performance of the current generation of IGCC power plants is better than the performance of the cleanest PC technology. For example, IGCC power plants have the potential to cost-effectively achieve very high (95-99%) mercury control with established technology, while no such technology exists for PC boilers. Future generations of IGCC plants will be even cleaner and more efficient.

Climate change—Gasification technology is capable of separating and capturing CO₂ emissions at significantly lower cost than direct coal combustion technologies through the addition of shift reactors and physical absorption processes. These processes are commercially proven in industrial applications and cost about half of what carbon capture is estimated to cost for PC. Near-term deployment of technology capable of addressing CO₂ emissions is critical to avoid locking in traditional steam coal technology for the 30 to 50 year life of new coal plants. Gasification technology is also able to produce pure hydrogen streams than can be used in fuel cell technologies to achieve near zero emissions electricity generation or vehicles.

Need for Gasification Incentives

Accelerating near-term investment in gasification technology requires overcoming higher capital costs (20% at the current state of the technology), new technology risks, and skeptical financial markets (tainted by failed investments in nuclear and natural gas generation). A 2003 decision by the Wisconsin Public Service Commission to approve a WEPCO proposal to build two PC power plants, but reject the company's proposed IGCC facility, illustrates the problem facing commercialization of gasification technology. In Wisconsin, the commission determined that "IGCC technology, while promising, is still expensive and requires more maturation. For these reasons, the application to construct the IGCC unit is denied."² In order for gasification technology to become commercially mature and economic it needs to be deployed, but in order for it to be deployed, gasification needs to be perceived as mature and economic by developers, financial institutions, and regulators. We recommend the federal government help resolve this dilemma through a National Gasification Strategy that provides federal credit assistance (or other incentives) to facilitate deployment of IGCC and industrial gasification facilities as a national energy policy priority.

As discussed below, loan guarantees are the recommended incentive approach because they can minimize federal costs while providing significant project benefits. It would be possible, as an alternative, to allow developers to choose from a menu of loan guarantees and tax incentives so long as the selection criteria takes into account the cost to the federal government of each package (see discussion below). This will ensure projects with the least budget cost are selected.

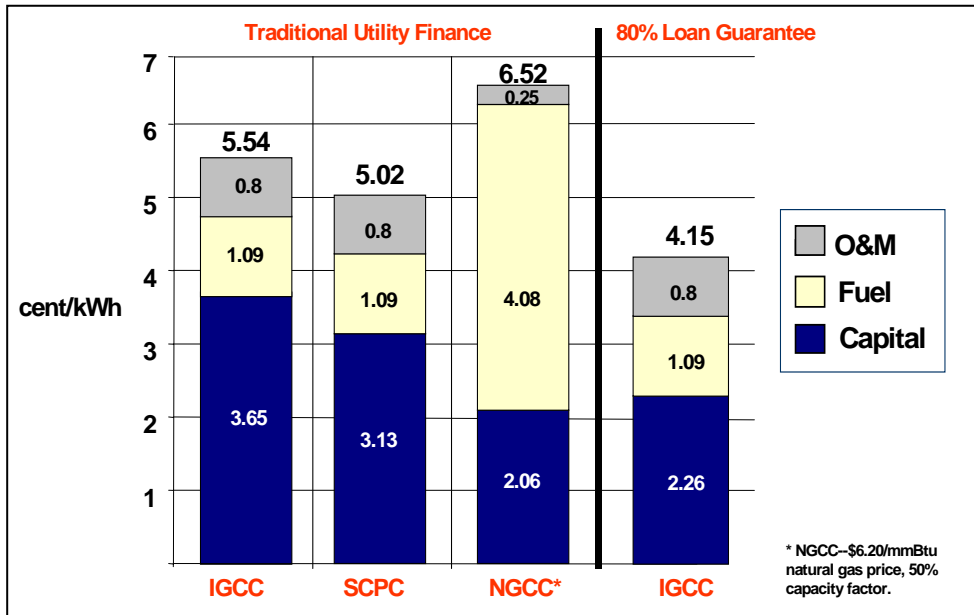
Federal loan guarantees improve project economics by substantially lowering capital costs. With loan guarantees, debt investors focus primarily on the federal guarantee to secure their investment rather than project economics and risks. Federally backed debt typically costs about 100 basis points less than mid-grade utility debt (5.5% versus 6.5%), making it an attractive source of capital for developers. The federal guarantee also enables key terms of the debt to be established by the federal guarantor, including that the guaranteed debt can be available for up to 80% of the total investment, which allows for a high debt/equity ratio (based on the Alaskan Gas Pipeline financial model). The high leverage and low-cost debt provides significant savings to the project and (in the case of regulated utilities) the ratepayers.

Important for stimulating IGCC and industrial gasification is ensuring the incentives make gasification a competitive alternative. The capital costs of current generation IGCC power plants are about 20% higher and less certain than the cost of new PC plants. These higher capital costs result in higher energy costs that make IGCC technology less attractive than PC. Figure 1 illustrates typical energy costs of new Super Critical PC (SCPC), NGCC and IGCC power plants and how 80% federal loan guarantees can significantly reduce IGCC capital cost, making IGCC a competitive alternative.

Industrial facilities interested in gasification face a similar economic challenge. Construction of large coal gasification facility requires a capital investment of \$350 million to over \$1 billion, depending on the size of the facility. With current technology and conventional

² Wisconsin Electric Power Co., 228 PUR4th 444, 459, 2003 WL 22663829 (Wisc. P.S.C. Nov. 10, 2003).

Figure 1. Cost of Energy Comparison IGCC vs Super Critical PC & NGCC with and without 80% federal loan guarantee.

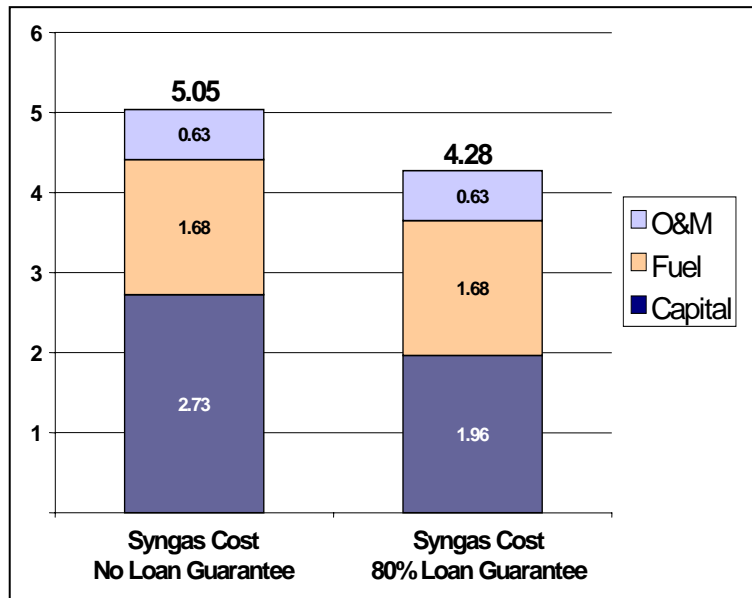


financing, gasification produces synthesis gas at about \$5.00/mmBtu. While this cost is below the current \$6.00 price of natural gas, it is not significantly below current long-term natural gas price projections.

Figure 2 illustrates that with 80% federal loan guarantees the cost of producing synthesis gas can be reduced to \$4.3/mmBtu, making the gasification investment a compelling option. In the face of high natural gas prices, industrial users are currently looking to move production and jobs overseas rather than investing to keep production and jobs in the U.S. A loan guarantee program for gasification investments would change this dynamic and make domestic investment an attractive option.

In addition to competitive costs, developers need access to competitively priced capital to build gasification facilities. While a few large companies may be in a position to invest in gasification or IGCC technology using their own credit, many industrial and independent power companies cannot access the needed low cost capital to make these investments because their corporate credit has deteriorated in the face of difficult market conditions and financial markets are wary of project financing involving new technology risks. Providing loan

Figure 2. Estimated Cost of Synthesis Gas Production with and without 80% Federal Loan Guarantee



guarantees for up to 80% of project costs provides credit support to ensure low-cost capital is available, but, as discussed below, does not require the federal government to assume all of the project risks.

Lower Federal Budget Costs

The risk and cost of federal loan guarantees can be significantly reduced (to achieve budget scoring of 10% of less) by requiring project credit support as a condition of loan guarantee qualification. This credit support can be created through assured revenue streams to service project debt obligations, construction guarantees to ensure on-time and on-budget construction completion, and establishment of construction and operating reserve funds to cover unforeseen startup problems.

For IGCC projects, assured revenue streams can be created through state utility commission review, approval, and pass-through of project costs for power projects in states with regulated utility systems (30 states), or through power (or other off-take) purchase agreements with creditworthy customers (such as a utility, municipality, cooperative, or industrial users) or direct investment grade corporate credit backing in competitive markets.

Requirements for credit support distinguish the loan guarantee mechanism recommended here from other loan guarantee programs, including those used to support the Synfuels Corporation that put all of the project and credit risks on the federal government. Making loan guarantees conditional on creditworthy assurances of revenues, is a mechanism for significantly reducing default risk born by the federal government and, as a result, for reducing the budget scoring cost of loan guarantees.

The federal budget impact of different incentive mechanisms is a vital consideration given the current deficit and the focus on less government spending. Figure 3 compares the present value federal budget cost of a loan guarantee program with other government incentive programs designed to provide equivalent support to gasification projects and to produce the equivalent of 1.5 TCF of natural gas. Credit enhanced federal loan guarantees (with 10% budget scoring) provide the same economic benefits but are 15 times less costly for the federal government than 30 year production tax credits and 5 times less costly than direct grants/ investment tax credits.

Figure 3. Present value federal budget cost of equivalent incentives to support gasification equal to 1.5 TCF¹

