Gasification Technologies Council

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Statement of
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To the

Senate Environment and Public Works
Subcommittee on
Clean Air, Wetlands and Climate Change

January 29, 2002

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Introduction

The Gasification Technologies Council wishes to submit this statement regarding the opportunities that Integrated Gasification Combined Cycle (IGCC) power plants offer coal based electric power generators to meet more stringent SO_2 and NO_x emissions standards as well as possible new limitations on carbon and mercury emissions.

The Council's member companies own, operate or provide technologies, equipment or services to plants that account for more than 95% of the world's gasification capacity.

This summary statement is based upon technical papers, studies and data available on the Council's web site - http://www.gasification.org.

Gasification is a Commercially Proven Technology

Gasification is a widely used, commercially proven technology. Today there are approximately 130 gasification plants in operation around the world with some 35 additional facilities in various stages of development, design and construction. When all of these plants are operating they will have the capacity produce the energy equivalent of 750,000 barrels per day of clean gas for use in power generation as well as for the production of fuels and chemicals. In the U.S. there are 20 gasification plants in operation producing a variety of products including electricity; at least one-half again that many are in the pipeline.

The commercial value of gasification is based on its strong environmental performance and its ability to convert a variety of low-, or negative-value feedstocks such as coal, petroleum coke and other petroleum residues, and waste materials into commercial products. The greatest level of interest in the U.S. today, and the focus of this statement, is in the use of modern, high temperature gasification technologies in IGCC power plants to produce clean gas for generation of electricity. This application accounts for more than 90% of planned new U.S. gasification capacity.

The Gasification Process is Inherently Clean

Gasification is a process technology that reacts coal and other carbon-containing materials at high temperature and pressure under controlled conditions that convert the coal into a "synthesis gas" (syngas). The syngas is composed primarily of carbon monoxide, hydrogen and carbon dioxide and can be burned to recover its energy value or, using other commercial processes, converted into a variety of chemicals and fuels.

An IGCC plant is generally configured with a gasifier, oxygen plant, gas cleanup system(s) and a high efficiency combined cycle power island. Most commercially available systems can range in size from 250-300 megawatts of capacity to more than 1,000 megawatts, using multiple gasifiers.

During the gasification process, the syngas is cleaned of particulates, sulfur and other potential pollutants using proven, commercially-available processes. The sulfur is recovered in its elemental state or as sulfuric acid, both widely traded commodities. The temperature of the gasification process turns ash and other inert material in the feedstock into a molten liquid that, when cooled, is an inert, non-leaching, sand-like material -- called frit or slag -- that has construction uses. If the frit is landfilled, it exhibits none of the leaching characteristics of scrubber wastes from conventional pulverized coal (PC) plants that can cause water pollution problems.

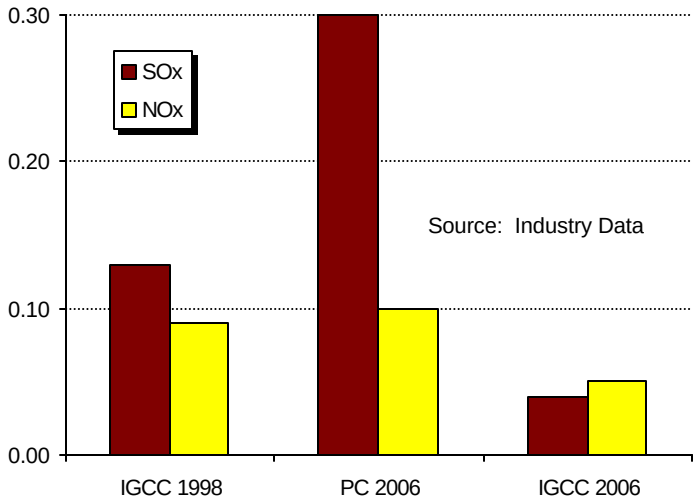
At the end of the process, a modern, high temperature slagging gasifier provides a clean gas that can be sent to a highly efficient combined-cycle power block without the need for post-combustion emissions controls. This obviates the need for baghouses, scrubbers and other "end of the pipe" cleanup methods used on PC plants that generate large volumes of wastes and reduce plant efficiency. It also reduces significantly the size of equipment needed for removal of sulfur, particulates, and other potential pollutants.

IGCC Criteria Pollutant Emissions Are Well Below Even Newest PC Plants

Because the syngas is cleaned prior to combustion, criteria pollutant emissions for a coal-based IGCC plant are well below those of even the most modern pulverized coal plants with post combustion cleanup.

Figure 1. Air Emissions for Coal-Based Power Plants

(Pounds per Million Btu's of Coal Input)



The chart above compares air emissions from three coal-based power plants. It illustrates the actual 1998 emissions for an IGCC plant that began operating in 1995 (IGCC 1998). Its emissions of SO_x and NO_x are below those of a new, "state of the art" PC plant (described as the "cleanest coal plant of its size east of the Mississippi") being proposed to start up in 2006 (PC 2006).

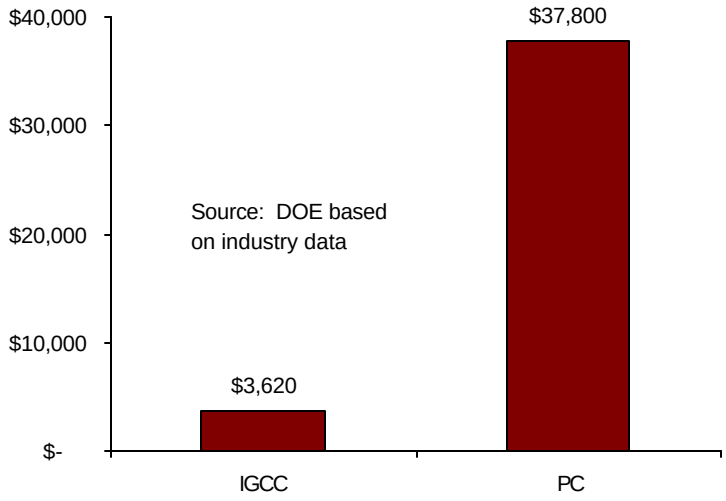
The next generation of IGCC employing the same technology (IGCC 2006), but reflecting improvements made through actual operating experience, will have SO_x emissions that are only 13% of those of the PC plant and NO_x emissions that are 50% lower.

IGCC Provides Cost-Effective Mercury Emissions Reductions

An IGCC plant will also have a significant economic advantage over a PC plant if limitations on mercury emissions are placed on coal-based power generation. Because the gasifier operates under high pressure, the syngas stream is compressed to a volume that is approximately 1-2% that of the post-combustion flue gas from a similar-sized pulverized coal plant. This concentrates the mercury in the syngas, making its removal less costly and more efficient than doing so from the much larger volume of flue gas of a PC plant.

Figure 2. Cost of Mercury Removal from Coal-Based Power Generation

(Dollars per pound removed)



A recently completed economic analysis by the Department of Energy found that, to achieve 90% removal of mercury from the syngas, the cost to remove a pound of mercury in a coal-based IGCC plant using an activated carbon bed is less than one-tenth the cost

of removing the same amount from the flue gas of a PC plant.

Mercury removal from coal-based syngas is being practiced commercially today. Removal of mercury from the flue gas of a PC plant is still in the R&D phase and may not be commercially available for years.

IGCC Can Reduce Carbon Dioxide Emissions from Coal-Based Power Generation

Carbon dioxide emissions from an IGCC plant are typically 15-20% below those of a comparably sized PC plant because of the IGCC's greater efficiency. If additional CO_2 emissions reductions are required, an IGCC plant can be configured to convert most of the carbon in the syngas into CO_2. The fuel for the combustion turbine then becomes mostly hydrogen and water. The concentrated CO_2 in the pre-combustion gas stream can be captured. In a PC plant CO_2 capture is post-combustion, more costly and inefficient.

Conclusion

Gasification is a proven technology, being widely practiced commercially in the U.S. and around the world. Integrated Gasification Combined Cycle Power Generation is the cleanest, most efficient means of generating electricity from coal. Because gasification technologies are inherently clean, an IGCC reduces criteria pollutants to levels not economically achievable in pulverized coal plants. Mercury and carbon emissions reductions are also available if limitations on these emissions are required.

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