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Coal Gasification for Melting Glass

Of all energy used by the glass industry, 85% is natural gas—which has increased in cost over the last 10 years from ~\$3 to \$14/million BTUs at the major wholesale markets. Energy prices have had a huge impact on manufacturing cost. For example, energy now represents 20–25% of the total manufacturing cost for the container industry, compared with 10% just a few years ago.

If the industry is to remain in business, we must reduce our cost of energy and obtain price stability to permit reliable long-term planning. Syngas (synthesis gas) from clean coal gasification (CCG) technologies may provide a part of the answer we need. Coal has been a source of combustion since our early history, but only in recent years have scientists been able to effectively and economically remove the inherent polluting chemicals and emissions from the process or the waste stream.

CCG is the partial oxidation of a solid or liquid fuel feedstock to manufacture a gaseous product predominantly made up of CH₄, H₂ and CO. Impurities such as particulates, sulfur, nitrogen and volatile mercury are removed (using

commercially proven systems) to produce Syngas that is almost as clean as natural gas.

Syngas has a lower heating value than natural gas (~800 vs. 1000 MBtu/ft³), but can be substituted in many industrial processes. It also can be converted to synthetic natural gas (methane) using commercially available methanation catalysts.

CCG is used primarily as an alternative to natural gas for creating the feedstocks needed for the chemical industry to produce its many products. Attention also is being focused on developing electric utility plants that would replace natural gas with Syngas in producing our nation's electricity needs.

Conversion of Syngas to electricity, however, wastes nearly 65% of the available energy. A more attractive alternative (other than using the Syngas directly) would be the conversion to methane and introducing the converted gas to existing pipelines with an energy penalty of only 25%.

Why Gasification?

The United States is the Saudi Arabia of coal! With more than 200 years of proven reserves, the economical and environmentally responsible use of this resource has the potential to substantially reduce our dependence on unpredictable foreign sources of fuel.

The gasification process is the cleanest coal/carbon conversion technology and is not limited to coal alone. Petcoke from many industrial processes, biomass, pulp and paper industry “black liquor,” and many others are all potential inputs to this process. This substantially adds to the potential flexibility of the process.

GMIC has been studying this matter for several years and concludes that there are three viable paths:

- *Utility-Sized.* A typical utility plant produces ~250 MWh of electricity, sufficient to provide power for about eight major glass plants (or other equivalent).

Glass plants could perhaps combine with other industrial operations in a centralized location to utilize the output of such a large plant. The cost of such a plant, however, would be in excess of \$1 billion.

- *Plant-Sized.* Technologies exist and are in development that would permit an individual plant to establish an on-site gasification operation. We are investigating these alternatives in conjunction with the National Energy Technology Lab, but expect that this would be a less desirable solution due to likely losses of efficiency inherent in a smaller operation.

- *Methanization of Syngas.* In this situation, a gasification plant would be located at a coalmine and would convert Syngas to synthetic natural gas and pump it into any natural gas pipeline for distribution. While there would be a conversion cost involved in converting Syngas to methane, it would eliminate the on-site modifications that will be inherent with using Syngas directly. It also would likely still produce gas at a lower (and more stable) price than natural gas. The purchaser could access the synthetic natural gas through any pipeline in the system.

One downside to the process must be kept before us at all times—the large volumes of CO₂ that are generated as a byproduct of the oxidation process. We must ensure, as we pursue this opportunity, that we contribute no additional damaging emissions to our already troubled biosphere. There are existing and developing technologies for either “sequestering” the CO₂ that is generated by injecting it into geologic formations for long-term storage, or removing it by other processes.

I invite readers to download the “Glass Industry – Gasification White Paper” from our website (www.gmic.org), and contact me (mgreenman@gmic.org) with your questions and expressions of interest.