

Gasification Technology Status and U.S. Industry

Gasification technology is a proven and commercially available option for converting carbonaceous material such as coal, petroleum coke (coke), and biomass to higher value products such as liquid and gaseous fuel, chemicals, and electricity. The market for gasification technology has been growing but is highly dependent on natural gas prices and country's national policies. The market for coal gasification technologies has primarily been in China, where national policy has established a major coal-to-chemicals industry. China is constructing new coal gasification plants and plans to add major coal-to-substitute natural gas and coal-to-liquid transportation fuels in the next few years. Coal gasification is being deployed to a lesser extent in other Asian countries and elsewhere. Biomass and municipal solid waste (MSW) gasification technology has been attracting more attention in the U.S. and some other countries in the recent years.

MARKET FORCES	
China	U.S.
<ul style="list-style-type: none"> ➤ Growing economy ➤ High natural gas prices ➤ High energy demand ➤ High chemical / liquid fuel industrial growth ➤ Receptive Social and political environment for coal ➤ Available indigenous resources 	<ul style="list-style-type: none"> ➤ Recovering economy ➤ Low natural gas prices ➤ Moderate energy demand ➤ Limited chemical / liquid fuel industrial growth ➤ Negative social and political environment for coal ➤ Available indigenous resources
GASIFICATION PLANT START-UP SINCE 2004	
42 - 45	1

Latest reports indicate that 232 gasification plants consisting of 642 gasifiers are in operation worldwide.¹ Out of these, 114 plants convert coal to higher value products. About 50% of these plants are located in China.² GE is the leading supplier of gasification technology worldwide with over 60 operating plants, followed by Shell with about 40 plants. More than 10 technology suppliers have provided the gasification technology for the remaining operating plants.

The coal, coke, and heavy oil gasification plants operating in the U.S. are shown below. The oldest U.S. operating plant is Exxon Chemical Plant in Baton Rouge which converts heavy oil to syngas for chemical production. The oldest coal gasification

¹ Chris Higman, Higman Consultancy

² NETL Gasification Database

plant is located within Eastman Chemical Co. in Kingsport, Tennessee. This plant has the highest reported plant availability among coal gasification plants in the world.

U.S. Operating Coal, Coke, and Heavy Oil Gasification Plants

Plant Owner	Plant Name	Gasification Technology Supplier	Year	Total Number of Gasifiers	Syngas Capacity (Nm ³ /day)	Primary Feed	Primary Product
Eastman Chemical Co.	Kingsport Integrated Coal Gasification Facility	GE	1983	2	1,600,000	Coal	Acetic anhydride
Tampa Electric Co.	Polk County IGCC Project	GE	1996	1	3,300,000	Coal / Coke	Electricity
Duke Power	Wabash River Gasification	E-GAS (CB&I)	1995	2	4,320,000	Coal / Coke	Electricity
Coffeyville Resources Refining and Marketing, LLC	Coffeyville Syngas Plant	GE	2000	2	2,141,200	Coke	Ammonia
Dakota Gasification Co.	Great Plains Synfuels Plant	Sasol Lurgi	1984	14	13,900,000	Lignite	SNG
ExxonMobil	Baytown Syngas Plant	GE	2000	2	2,540,000	Pitch	Syngas
Motiva Enterprises LLC	Convent H2 Plant	GE	1984	2	1,880,000	H-Oil Bottoms	H2
Exxon Chemical Co.	Baton Rouge Oxochemicals Plant	Shell	1978	3	570,000	Heavy fuel oil	Oxochemicals
Hoechst Celanese	Hoechst Oxochemicals Plant	GE	1979	2	500,000	Naphtha & Fuel Oil	Oxochemicals

The newest gasification plant is Duke Energy's Edwardsport 618 MW Integrated Gasification Combine Cycle (IGCC) plant in Indiana is undergoing start-up operation and is scheduled to start commercial operation (on coal) later this year. The gasification technology supplier for the Edwardsport plant is GE.

The next U.S. based gasification plant scheduled to commence operations is Southern Co.'s Kemper County 580 MW, IGCC plant in Mississippi. This plant utilizes a new technology referred to as Transport Integrated gasification (TRIG™). The Kemper IGCC plant is the first application of TRIG™ technology on a commercial scale. It was developed, over the last two decades, by the Department of Energy, Southern Company and KBR at the Power Systems Development Facility (PSDF) in Wilsonville, Alabama. TRIG™ technology is designed specifically to handle low rank coals such as lignite and Powder River Basin (PRB) coal.

PSDF is a U.S. Department of Energy sponsored research facility operated by Southern Co. It was recently renamed National Carbon Capture Center (NCCC) and is now focused on reducing carbon gas emissions through technological innovation, and serve as a neutral test center for emerging carbon capture technologies.

Some of the major U.S. firms, which have provided engineering, construction, and /or procurement activities for the gasification projects include but not limited to Bechtel, Fluor Daniel, Foster Wheeler, and Sargent & Lundy.

Gasification technology is commercially proven in the U.S. and around the world. Two U.S. technologies (i.e., GE and E-Gas) have demonstrated long-term operation in the U.S. and other countries. Another technology (TRIG™) is about to be demonstrated on commercial scale in the U.S. and overseas. A number of U.S. technologies are also at pilot scale and ready to be demonstrated. Commercial availability of the gasification technology no longer appears to be an issue. However, to ensure project success:

- Project fundamentals must be met;
- Risks must be clearly defined and the responsibility for accepting, minimizing, or mitigating them must be assigned to the party(ies) with the appropriate experience and capability to handle those risks (e.g.; have long-term term major maintenance and overhaul agreement with technology supplier and have trained operator and maintenance contractor to operate the plant).

In addition, a key ingredient to a successful project is project sponsor's and advisors' determination, endurance, and problem solving capabilities.