Small-Scale Liquefaction Gains Traction In China

Small-scale liquefaction in China has experienced exponential growth in recent years as Beijing attempts to integrate gas into the country’s energy matrix. Unlike conventional LNG plants that require large economies of scale to pay back hefty capital expenditures, these lower-cost and flexible units require less equipment, energy consumption and upfront investment. As a result, they are thriving in China. Modularization of hardware also allows speedy and efficient manufacture, installation and startup. China already has more than 35 small onshore LNG plants that were producing a combined 2.64 MMt/y at the beginning of 2012. Another 30 or so small-sized liquefaction plants are under construction or in the planning phase, potentially boosting output capacity to around 8.5 MMt/y.

These plants are mostly concentrated in gas-rich western regions such as Sichuan, Xinjiang, Inner Mongolia and Shanxi. They typically supply isolated markets by truck. But another category of liquefaction plant is emerging in China that is larger than small-scale but still does not constitute a conventional-sized LNG plant. Although there is no clear capacity differentiation, mid-scale units are assumed to produce around 1 MMt/y to 1.5 MMt/y. When tallying both small and mid-scale LNG plants, China has 168 onshore sites that are either under construction or planned. Once these plants are operational, they will represent 28.5 MMt/y of capacity.

China’s central government remains uncomfortable with allowing small-scale liquefaction plants to draw gas from the country’s main grid, however, which supplies the dense concentrations of population and industry in major coastal regions. But the new leadership in Beijing needs small-scale LNG to help achieve the ambitious gas consumption strategy in China’s latest Five-Year Plan. The country wants to boost the share of natural gas in total energy
consumption to 10% by 2020, and reduce carbon dioxide emissions by 40-45% in the same timeframe. Booming demand for small-scale plants is attracting investments from both foreign and domestic technology companies. Non-Chinese firms such as Black & Veatch, Sofe, Air Product and Chemicals Inc, Linde, and Salof (Kryopak) are leading the way and have already engineered and constructed more than 20 of these units in China.

Local authorities and distributors prefer building small-scale LNG plants near dedicated fields, allowing them to capture nearby consumers that are not supplied by major pipelines, such as the soon-to-be commissioned third West-East line delivering gas from Central Asia, or LNG terminals under construction on the coast (see related article below). Further encouraging investment, smaller producers have more flexibility to set pricing based on local demand and supply, even though the central government continues to control the price of gas sold through the main grid. Small-scale LNG is also proving to be price competitive with alternative fuels such as liquid petroleum gas in these outlying markets. Retail LNG fueling stations will be a main outlet for output from the smaller units. PetroChina’s Kunlun Energy plans to add more than 1,500 LNG fueling stations and 22 liquefaction plants by the end of 2015, increasing the country’s LNG fueling station tally to about 5,000 sites.

Small-scale LNG sponsors hope that, as the gas distribution network expands, LNG demand in the automobile and trucking fleets will follow. Natural gas vehicle ownership in China is projected to increase from 1.2 million automobiles in 2012 to 1.5 million in 2015 and 3 million in 2020. Around 45,000 heavy LNG transport trucks and 18,000 LNG-powered buses will be on China’s roads this year.
In Chongqing, one of the largest metropolises in the country with a population of over 30 million in an area the size of Belgium, more than 80% of taxis and 90% of buses are already using natural gas engines. Other major metropolitan areas are also integrating more natural gas vehicles into the public transportation sector. Truck manufacturers such as BeiBen Trucks, Shanxi Automobile Group, and Dong Feng have provided most of the heavy duty LNG trucks in China. A lack of standardized regulations, infrastructure and transportation network have raised the cost of transporting LNG and lowered transportation efficiency, however.

Typical small-scale plants in China produce from 5,000 t/y to 1 MMt/y. Closed-loop single mixed refrigerant process is by far the most popular liquefaction technology used today. Several Chinese firms are gaining experience and have developed their own liquefaction processes. However, these procedures remain inefficient compared to those offered by their foreign competitors and are limited to maximum liquefaction capacity of 600,000 cm/d. Still, domestic LNG equipment providers and packagers are growing at a faster rate. In several operational plants, around 60% of the equipment has been manufactured in China. Domestic equipment suppliers are now enhancing their supply chain presence by providing reciprocating compressors, expanders and small cryogenic pumps. They still face limitations, however. For example, these players can only manufacture LNG storage tanks bigger than 10,000 cubic meters because of technological constraints. Major equipment such as cold-box, large cryogenic pumps and centrifugal compressors are still the exclusive domain of foreigner manufacturers as well.