As the world continues to transition away from coal and heavier distillates in favour of cleaner-burning sources of fuel, the role of LNG in the global energy landscape has grown immensely. While much of the conversation surrounding the LNG industry in recent years has focused on the development of large and mid scale liquefaction projects and their importance in driving natural gas as ‘the fuel of the future’, far less attention has been paid to the opportunities emerging in the micro scale LNG market.

Michael Walhof, Siemens, USA, outlines the growing number of opportunities developing in the micro scale LNG market.
Micro scale LNG facilities (typically defined as those with capacities less than 160 tpd or 56 000 tpy) are increasingly proving to be a viable solution for monetising stranded gas reserves and cost-effectively supplying LNG to demand centres located far away from supply infrastructure. In many of these centres, the primary interest in LNG is as a transportation fuel for truck and heavy-duty vehicle fleets.

In the US for instance, there are more than 120 LNG refuelling stations across the country and more than 1600 CNG stations. Many of these are open to the public, while others are private depot-based stations for fleets. Opportunities also exist to convert drilling and hydraulic fracturing equipment to run on LNG, enabling oil and gas operators to reduce the environmental footprint of their operations and reduce fuel costs by as much as 30% when compared to diesel.

Additionally, micro scale LNG facilities are gaining traction as a solution to curtail gas flaring, which is a growing issue at many remote well sites and regions where pipeline bottlenecks have all but eliminated outlets for produced gas. In some regions, it is estimated that producers are flaring close to 10% of their produced gas.

In 2015 in the Permian Basin in Texas, for example, operators flared 45.5 billion ft³ of natural gas, enough to meet all of the residential demand for the region for two and a half years.

**Turnkey micro scale plants offer many benefits**

Recognising the growing need for a solution that could help monetise stranded gas supplies and open new markets for LNG as a transportation fuel, Siemens’ Dresser-Rand business developed LNGo™ – a turnkey micro scale liquefaction solution capable of producing up to 30 000 gal./d (48 tpd) of LNG. The system can be installed and commissioned within a matter of months and is designed to produce LNG without external power, making it deployable at nearly any site, especially those without access to grid electricity.

At its core, the LNGo solution focuses on the use of modular construction techniques and standardisation to minimise onsite labour requirements and facilitate accelerated commissioning. Sections of the plant can be built offsite and delivered on small-to-medium-sized skids, resulting in a minimal footprint and reduced execution risk for the operator. The modular approach facilitates ‘plug-and-play’ service, leading to lower CAPEX and a shorter time to achieve return on investment.

In 2016, the first LNGo micro scale natural gas liquefaction system was commissioned at the Ten Man LNG facility in Tioga County, Pennsylvania, US. The system allowed for ‘de-bottlenecking’ of the existing natural gas gathering network and enabled Frontier Natural Resources to monetise stranded gas assets at the Mainesburg field in the Marcellus shale formation.

The standardised micro scale LNG system deployed in Tioga County consists of four different modules, each handling one step of the liquefaction process. The system works by converting inlet gas to LNG, which is then used as a process refrigerant. The inlet gas stream is also used to power the system, along with purge gas from the gas conditioning module. The gas conditioning module cleanses and separates feed gas into two streams – one for power generation (purge stream) and one for liquefaction (product stream). The product stream is then routed to the compressor module, which features a four-throw Dresser-Rand® MOS reciprocating compressor. The
micro scale LNG system also includes a process module, which houses all of the liquefaction equipment.

The entire LNGo system for the Ten Man facility was transported on just eight trucks and deployed directly at the gas field. It has a footprint of approximately 508 m² – an area similar in size to a basketball court. Production from the plant started four months from contract signing and the LNGo system produced approximately 100 000 gal./d (405 tpd) of LNG in its first 30 days of operation and more than 445 000 gal. through the first three months.

**Micro scale applications in harsh environments**

More recently, Siemens was tasked with commissioning a high-pressure micro scale LNG plant for AltaGas Ltd’s Dawson Creek site in the Northwest region of British Columbia in Canada. Siemens provided a completely integrated solution for the project, including one LNGo-HP (high-pressure) system, site civil works, building construction, mechanical and electrical integration, commissioning, startup and operator training.

The system consists of various modules, including two Siemens gas engines, two MOS reciprocating compressors, three Siemens MV motors (400, 550 and 800 HP), variable frequency drives and associated auxiliaries. The system takes natural gas from the gathering line at the site and separates it into two separate streams – a feed gas stream and a waste gas stream. The waste gas stream is routed to the gas engine generator sets, which power the LNGo equipment. The feed gas is liquefied in the process to produce LNG. The entire footprint of the plant is approximately 2500 m².

The Dawson Creek plant began production in January 2018. It was built with one liquefaction module capable of producing 30 000 gal./d of LNG. To date, all contractual production performance guarantees have been met. The LNG produced is trucked approximately 1400 km to Whitehorse in the Yukon Territory, where it is being used to displace diesel in power generation applications.

**Scalability and reliability**

Scalability was of critical importance for the micro scale solution deployed at Dawson Creek. AltaGas is currently evaluating the viability of developing a network of small scale liquefaction facilities to supply LNG to parts of the Yukon, northern British Columbia and the Northwest Territories. As a result, the system must be able to accommodate additional production to meet potential growth in regional demand. The modularity of the system satisfies this requirement, as it allows for process and/or power modules to be added as needed. This ultimately ensures that the system is optimally sized at all times, allowing AltaGas to minimise CAPEX.

Modularity was also important to ensure timely deployment of the system in the harsh environment of northwest Canada, where temperatures can drop to as low as -40°C. The difficult conditions presented many unique project challenges when installing and commissioning the facility. By performing a portion of the work offsite, the manpower requirements at Dawson Creek were significantly reduced, and the risk of schedule delays was minimised.

**Conclusion**

The sheer volume of oil and gas production coming from both conventional and unconventional plays worldwide represents a generational opportunity for producers and suppliers alike. However, it has also given rise to some challenges. From curbing emissions to alleviating supply infrastructure bottlenecks, there are many problems the industry must address to grow sustainably.

Micro scale LNG facilities are poised to play an important role in helping the industry overcome these hurdles by enabling producers to reliably monetise stranded gas supplies, which make up an estimated 40 – 60% of the world’s current proven gas reserves. The micro scale concept also has the potential to accelerate the growth of LNG as a transportation fuel and open up new markets, particularly in areas located far away from traditional supply sources.

The LNGo systems deployed in Tioga County and Dawson Creek serve as concrete examples of the many tangible benefits that can be realised by embracing micro scale LNG – both from the perspective of the LNG plant operator and consumers in the surrounding region. Siemens is currently in discussions to apply the micro scale concept in other locations, including Alaska and Houston.

**References:**