

Big country, cheap gas:

These are two main conditions for a successful mini-LNG business



The whole world is waking up to benefits of small-scale LNG. The leaders in this business development are the U.S.A. and China where even drilling rigs

are sometimes powered by liquefied gas. Experts believe the scenario cannot be repeated in any country: a relatively low price of gas and great distances are the sine qua non.

A startup niche

The state's first commercial small-scale LNG plant is to be inaugurated in the fourth quarter in Tioga, ND, right within the Bakken shale basin. The plant's capacity is 76,000 gallons per day (44,000 tonnes a year), and the first phase will produce 10,000 gallons of liquefied gas daily.

The methane feed will come from a nearby gas processing plant of Hess Corporation. One local enterprise, Slawson Exploration Company, has already subscribed to the new fuel. It intends to power its eight drilling rigs in the region with LNG.

The owner of the plant, Prairie Companies LLC, assumes the costs of installing the necessary equipment at the consumer's end of the chain. Prairie is a conglomerate of companies catering to the needs of oil and gas producers in the area. Apart from the newly-born North Dakota LNG (NDLNG), it runs a hotel business, a hydraulic fracturing water disposal service, and a cargo delivery business.

Patrick Hughes, the CEO of Prairie Companies and North Dakota LNG, announced in May at a presentation of the project that the accumulated local connections and well-developed local infrastructure had encouraged Prairie on to launch an LNG business. Nobody feels deterred by the lack of experience in this job. Finding a good market niche was the main thing.



There is such a niche at Bakken. Hughes says that the volume of diesel oil used by drillers varies but may reach 2,500 gallons per day. The new plant will replace about 45,000 gallons supplying fuel to up to 18 sites.

NDLNG will start with rigs but is planning to fuel fracking equipment, transport, and probably cogeneration facilities. The consumption capacity of drilling rigs justifies up to ten such plants. There are currently 193 operating rigs in North Dakota that require over 480,000 gallons of diesel per day.

The switch from diesel to gas will accelerate after 2015 when Tier 2 of the federal diesel emission standards comes into effect. The managers of Prairie Companies are not the only visionaries in the oil and gas producing regions.

Joe Bradford, the President of SANCUS and its affiliated company SST Process Solutions, which supplies equipment for the NDLNG plant, assured RusEnergy that many such projects would appear soon in the United States. SANCUS has already collected a few new contracts and new deals are in the making.

'I see this smaller scale LNG becoming a norm for the LNG business, to fit the niche markets, not only in the USA but worldwide,' he says. 'Why? The larger LNG facilities are focused to sale large quantities to the large end users, related to large cities or industries. What is forgotten are the small industries, smaller cities or countries that cannot or do not want to, purchase these large ship load quantities (storage would not last to store for long periods) Hence, we can install small scale and supply smaller quantities on a regular basis to these areas of need.'

U.S. federal diesel exhaust emission standards, g/kWh

Models	Categories	CO	Non-methane hydrocarbons	NOx	Solids*
2011-2014	Engines over 900 kW	3.5	0.40	3.5	0.10
2015+	All engines	3.5	0.19	3.5	0.04

* air pollutants with particles under 10 microns

Source: US EPA

Not for Europe

Not all countries can offer a convenient environment for small-scale LNG, and European nations do not belong in this category. Even though Gazprombank delivers LNG to distant Polish villages, this is an exception rather than a rule. Gas Infrastructure Europe association issued in March a [map of small-scale LNG](#) capacities in Europe, showing that only one such facility was planned, in Norway.

Luxemburg-based Gasfin SA has had to suspend a contract with General Electrics for 'LNG in the Box' modules with the annual capacity between 6,000 and 30,000 tonnes of LNG. The project was to become the first application of this new equipment, presented just a year earlier. The reason for a decision to stop the deal was 'the dynamics of the European market', as GE Oil&Gas representative Caitlin Shaw told the Natural Gas Intelligence.

Later, GE bought one of the leading manufacturers of cryogenic equipment in the U.S., Salof Companies, dropped the 'LNG in a Box' idea and expanded the scope of its small-scale LNG modules to embrace as many clients as possible. As to Gasfin, it has switched the aims to small-scale LNG in Trinidad and Tobago.

Thomas Campbell, the chief analyst of Zeus Intelligence, told RusEnergy: 'You're correct in noting that small-scale LNG production (what we often call "merchant plants") have only had a limited space in Europe. However, as this is a primarily gas importing region with dramatically lower transportation distances, I do not expect this to change. This is because a) it is more cost effective at this point to bring in LNG, rather than liquefy already imported (and costly) pipeline gas, and b) LNG sourced from an import terminal is not a problem economically when hauling distances are fairly short in Europe.'

'To elaborate on this further,' he went on, 'the situation is something of a reverse to here in the United States. Here we have vast quantities of cheap natural gas that will be dramatically cheaper than anything we could be importing as LNG. Moreover, those import terminals are often very far from centers of demand (such as oil and gas shale fields). As a result, a merchant plant (or SSLNG, as you call them) is an excellent solution.'

The price doesn't matter

What will happen with this trend if the U.S. gas prices start soaring? 'Even if Henry Hub reached \$6, there will still be a fair amount of attraction for LNG as a fuel,' Campbell says. The price of LNG is less associated with the market price than the price of gasoline and diesel. Actually, the Henry Hub index affects just less than a quarter of the price of LNG. The rest comes from liquefaction and transportation costs plus taxes. While in a gallon of gasoline, according to EIA, the price of crude oil accounts for about 67%.

Even if the price of natural gas increases by half, LNG will remain an attractive kind of fuel. 'To put some rough back of the envelope calculations to that, a current MMBtu of natural gas here is \$3.87.

Meanwhile, Clean Energy has reported they are selling LNG at their California stations for roughly \$2.93/diesel gallon equivalent, or \$1.86 per LNG gallon (while diesel is currently being sold for about \$3.60). Each LNG



gallon is equal to 0.08 MMBtu, thus the actual commodity price for the natural gas used to produce the LNG is actually only about \$0.30 per gallon. Thus even if natural gas prices rose an additional 50% (say, from \$4/MMBtu to \$6), LNG fuel prices would only rise \$0.15,' according to Campbell.

Liquefaction costs vary between \$3 and \$5 per MMBtu, and equipment producers keep working on making the costs smaller. One of possible solutions is to connect the liquefaction facility with a gas processing plant (if there is demand for ethane and liquid components of natural gas nearby) and save on cryogenic processes.

'Linde Process Plants is in the unique position to integrate LNG into your NGL plant,' the company says in a press release. 'Our product allows you the opportunity to give away LNG and still increase your net revenue.'

Sven Assmus, a senior manager in Linde's department of LNG and natural gas processing, says that Linde's StarLNG technology 'is a revamp of an existing NGL plant that basically enhances the NGL production and at the same time delivers LNG product. Typically the cost for such an addition to the NGL plant is paid off by the value of the additional NGL product and therefore we call it free LNG.'

'If you are taking for example field gas or flare gas, you could potentially have the 2 markets, LNG and NGL, if your gas is associated gas (condensates and natural gas),' Joe Bradford added. 'SANCUS/SST are building now a process facility that can manage both scenarios simultaneously, where the gas is associated, hence we extract the liquids then convert the methane gas to LNG to support the local drilling industry. LNG would never be free but it will enhance the client ROI significantly depending the GPM of the associated gas.'

A breakthrough in China

Small-scale LNG business is developing much faster in China, where the political leadership is determined to replace diesel with natural gas.

'China already plays a huge role and is probably ahead of most with the installation of smaller scale LNG. China fits this mold since they have many smaller cities and industries scattered throughout the country. Our old partner company supplied 7-9 small scale LNG plants to China and today we purchase certain components for our process from China and work with Chinese companies to supply our liquefaction process, joint effort,' Bradford explains.

China has become a preferred partner for equipment suppliers. Linda has licensed its popular StarLNG technology for that country only. 'We supply the rest of the world with EP or EPC solutions,' Assmus says.



GE has been also unable to find a better partner than China's HongHua. In May the companies signed a three-year agreement on supplying gas-fed engines Waukesha VHP for drilling rigs. HongHua is the world's second largest manufacturer and exporter of this equipment after another Chinese company, BOMCO (a unit of CNPC).

GE is also going to manufacture cryogenic equipment in China. Its Salof Companies subsidiary had formed a joint venture with Beijing-based Maison Engineering, enCryo Engineering Co. Ltd. Now GE holds 50% of the JV.

'Quite frankly the developments occurring in that market are extraordinary,' Campbell says. 'China has seen an unbelievable uptake of LNG fueled trucks, buses, and now marine vessels. They're now in the process of looking to LNG as a fuel for things like drilling rigs as well, which has been a popular option here in the United States. A lot of this has been possible because of a) very strong government support for LNG fuel and b) the cheap cost of LNG fueled units.'

He believes that the low price of China-made equipment will remain the most attractive factor. 'Simply put, the tremendous cost associated with this equipment has made the economic case for LNG fuel difficult for some in North America. However, China's huge adoption has been, in part, possible simply thanks to dramatically cheaper components (some as cheap as 10-25% of the cost of similar American components). If this can bring the costs of LNG fuel equipment down, it will have tremendous ramifications on the number of users adopting the fuel, which will in turn drive demand for small scale liquefaction units.'

If China actually makes a breakthrough on this market by making small-scale LNG commercially acceptable by many clients, Russian drillers may soon find it convenient to power their rigs with gas produced from a nearby field.

'This will not be replicable in all countries unfortunately,' Campbell concludes, 'as few states have the same government control of economic forces. However, in ones with cheaper natural gas and the desire to make use of cheap natural gas as a vehicle fuel, doing so is absolutely possible, though perhaps not at quite the same scale.'