Reaching Stranded LNG Markets –

Small Scale LNG Concept
Introduction

The Small Scale LNG concept is an effective solution for making natural gas available to energy users not currently connected to pipeline networks. The concept increases the market for natural gas by distributing LNG from either a LNG plant, LNG import terminal or directly from a LNG carrier using a combination of both sea and land based transport directly to the end-user. The concept is based on I.M. Skaugen’s unique Multigas LNG carriers of 10.000 and 12.000 cbm.

The natural geographies for this concept are industrialized but not so densely populated countries like the Scandinavian and islands nations in the Caribbean, Mediterranean and SE Asia. In short, Small Scale LNG is an innovative means of getting gas to stranded customers, and thereby making the most environmentally friendly fossil fuel available to these markets.

In addition, since the concept makes it possible to distribute LNG in smaller and medium sized parcels it will open up new markets for natural gas, like the maritime fuel market and heavy goods vehicle markets and thereby making a significant contribution to the reduction of NOx and other emissions.

This paper will cover the key features of the concept as well as the different means of distribution with focus on the shipping side. It will outline more extensively the various geographies and end-user markets that already are or potentially could benefit from the Small Scale LNG concept as well as highlight some of the challenges. Finally it will describe the Nordic LNG joint venture between the Norwegian shipping company IM Skaugen and the Stavanger (Norway) based utility company Lyse AS where the concept is put into action.

1. What is Small Scale LNG?

The Small Scale LNG concept shares much of the technology with traditional large scale LNG but there the similarities end. Large scale is about intercontinental transport of millions of tons LNG from a LNG production unit to an import terminal where the commodity product is fed into a national pipeline grid system. Small Scale LNG on the other hand is more of a regional business moving hundreds of thousands of tons from the LNG source, using various modes of transport ranging from ships to semitrailers and ISO containers, directly to end-users. Thus providing an energy supply solution previously not available. The objective is to make LNG, and subsequently the gas, as easy to access and use as any other liquid fossil fuel currently used.

Using smaller ships supplying a market with smaller demand, the receiving terminals are small as well. A terminal of the size of 20-30.000 will be more than enough to ensure efficient ships logistics allowing for full drops while at the same time maintaining a sufficient stock level. Comparing this with the “normal” terminal sizes
of 150 – 300.000 cbm, not only will a smaller terminal tie up a lot less capital but also be faster to build – and probably easier to get through the local approval process.

2. Markets for Small Scale LNG

Another way of expressing the intended end-user market for small scale LNG would be “stranded customers”. Stranded in the aspect of being too far from a pipeline system or too small to merit a pipeline extension. Gas pipelines normally cover most industrial areas but there are a number of exceptions like Scandinavia where neither the topography nor the demography make pipeline investment a top priority. In addition there are a number of islands both in the Mediterranean, the Caribbean and South East Asia who never will be connected to any pipeline system and are too small demand wise to justify a traditional large scale LNG infrastructure to be built. Now with a viable gas supply solution available through Small Scale LNG, power plants on these islands could switch from generators burning diesel or fuel oil to more cost effective and environmental friendly combined cycle gas turbines firing on gas.

The other large market opportunity for LNG supplied in smaller parcels is the marine bunkers market. Legislation for emissions from ships will become tighter and tighter, initially SOx and NOx but later surely also CO2 and particulate matter (PM). Natural gas is the only fuel that can address these issues from the source and avoid extra clean up equipment like scrubbers and SCRs. If used as a marine fuel, gas can reduce SOx to zero, reduce NOx with 80-90% and also reduce CO2 with 20-25%. The challenge will be to supply the fuel in the liquid form of LNG as bunkers. This is best accomplished by a Small Scale LNG supply chain acting in the role of bunker distribution. This market is still embryonic and mainly developed in Norway, but with Marpol VI coming into effect as of 2010 we are starting to see an increasing number of ferries, offshore supply vessels, RORO and ROPAX ships destined for ECA zones being designed with gas or dual-fuel engines.

Small Scale LNG will never compete against natural gas head on. The targeted customers will by definition be stranded and therefore gas will not be an alternative, at least not in the short term. Therefore it is wrong to compare smalls scale with large scale LNG cost wise. The relevant comparison is to other liquid fuels like fuel oil, naphtha, diesel and LPG. In addition one should compare taking into account the very tangible and also quantifiable benefits of gas used as a fuel; lower emissions, higher efficiency, easier to use (including less maintenance) and in many countries also lower taxes.
3. The Small Scale LNG supply chain.

A supply chain for SS LNG does not differ very much from similar supply chains for the fuels it competes with. From the source, be it a LNG plant or an import terminal, the LNG is moved by ship to smaller satellite terminals, preferably with an anchor customer that could make use of the boil-off from the terminal. From a terminal the LNG will be moved with standard semi-trailers to a local storage at the customer’s site where it is finally vaporized and piped to the customer’s point-of-use. See also figure 1 below. The numbers in red depicts the typical dimensions of the different assets.

The LNG has not to be sourced at a LNG plant. Any import terminal for LNG could be equally used for re-export. Additionally, as ship to ship transfer of LNG becomes more common and the required equipment develops we will surely see ship to ship transfers from larger to smaller ships. Why first load the LNG into the terminal and then later collect it?

![Figure 1 – typical Small Scale LNG supply chain.](image)

4. The Multigas carrier

One of the key components in a small scale LNG supply chain is the ship. The innovative gas carriers designed and built by I.M. Skaugen will come to the market
during 2009. They are not purely LNG carriers but Multigas carriers being able to transport the traditional products for this size and type of ship like ethylene, propylene, LPG and VCM in addition to LNG. This will make the ships more employable in a variety of markets. With type C tanks in stainless steel and a unique on-board re-liquefaction unit they can either operate in atmospheric mode or as a pressurised gas carrier. The operating mode will depend on the demand from, and design of, the receiving terminals. The re-liquefaction unit is based on a patented design developed jointly with SINTEF of Norway. It operates in cascade with the ships “standard” LPG and ethylene plants. The ships will also have a Gas Combustion Unit (GCU). The GCU will both act as a “pressure control of last resort” and as a safe method of burning cargo heel when changing grade. The ships also have both upper and lower cargo manifolds in order to be able to load at large scale LNG terminals. Currently the Multigas carriers are under construction in two versions; 10,000 cbm and 12,000 cbm. Both have two cargo tanks, either 4,000+6,000 cbm or 6,000+6,000 cbm. The cargo system permits carriage of two different products simultaneously. The type C tanks also make it possible to safely operate the ship with various degrees of filling and thus allow for part loads.

Figure 2. The first Multigas ship, Norgas Innovation being named in November 2009.

5. Challenges

Like all new business concepts under development the challenges are not few but they will be overcome. Likewise the opportunities and potential rewards for the first mover are significant. The main challenges lie in the two ends of the supply chain – not in the middle. Moving the LNG is the easy part, be it at sea or on land. Convincing the customer to switch, not only to a new fuel, but also to a new supplier using a novel supply chain concept have required some work. In addition the traditional LNG business model with very long contracts with back to back pricing and high take or pay will not fly. Adding to that, few customers will commit to buy
unless you already have committed yourself and started to build the supply chain. The latter will make financing a challenge as well. At the other end of the supply chain we have another challenge – the supply of LNG. To collect LNG at an import terminal or at a large LNG plant looks straight forward from a technical point of view but issues like fenders, mooring arrangements, gangways, pumping capacity etc. must be looked into. On top of that, for a busy terminal, time is the essence and any disruption must be avoided. The challenges on the supply side just prove that big- and small scale LNG are two very different businesses. Currently there is a high logistical bar supplying small scale LNG markets with a large scale LNG solution. Lastly, building up LNG infrastructure in geographies where there is no history of gas use or of LNG installations, the legal framework or standards do not often exist and one has to work very closely with the relevant authorities. On top of that much of the framework that does exist is related to large scale LNG and therefore not readily applicable to the small scale concept.

6. Nordic LNG

Norway has been one of the first mover geographies when it comes to small scale LNG. Nordic LNG will be the second operator building up a fully integrated LNG supply chain in the area. Currently the Norwegian small scale LNG market is about 120,000 tons of LNG per year. With Nordic LNG’s liquefaction plant of 300,000 tpy coming on stream in 2010 a large proportion of the Scandinavian and NWE markets can be supplied. The potential market, including industrial users and marine bunkers, is in excess of 3 millions tons of LNG per year.

Figure 3. The Nordic LNG plant under construction in Stavanger
Nordic LNG will make use of one 10,000 cbm Multigas vessel from I.M. Skaugen initially but when the planned train two will be built a second Multigas vessel would be added. The investment decision for Train 2 will follow the build-up of demand and the downstream distribution system including satellite terminals.

Nordic LNG is a unique partnership between Lyse AS, a Stavanger based multi utility company involved in power generation and distribution as well as gas distribution, and the shipping company I.M. Skaugen. The JV Nordic LNG will be the sales and marketing vehicle as well as the logistics operator for the supply chain. In total this whole LNG supply chain for Scandinavia will generate investments in excess of USD 500 million taking into account the investments in ships, LNG plant, terminals and customer installations. This in the midst of what could be best described as a recession.

For further information:
www.skaugen.com
www.nordiclng.com
www.lyse.no
www.skangass.no