Niche and Retail LNG, future growth markets for LNG

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Introduction

In the recent years the LNG industry has been discussing about the emergence of LNG as a dominant fuel, transported through specific chains: the Small Scale LNG. Alongside the traditional LNG chains, new markets seem to shape up and they require smaller volumes for specific uses, that cannot be accommodated by the traditional, large scale LNG chains. 2 market segments are analysed:

- the "Niche LNG" markets: small/remote markets (overseas or inland) to be supplied with small LNG tankers (less than 20,000 m^3) or LNG barges or LNG trucks;
- "Retail LNG" or "LNG as fuel": LNG to be used as fuel for ships of for road vehicles.

These 2 markets have specific drivers (regulation, alternative fuel prices, CO2 emissions) but also specific hurdles (costs, technical innovation, supply risks, logistical issues, safety and training requirements).
The inland "Niche LNG chain" have been used for decades (development of peakshaving in West Virginia in the 30s – 40s), when pipeline gas was considered as uneconomic because of:

- the distance and the landscape (mountains in Norway) between source and the consumption area;
- The level and the scattering of the natural gas demand and the pipeline network needed to fulfill it;
- Environmental impact of pipeline construction;

The paper finishes with a costing analysis of the various segments, and with a rough estimate of the market sizes and dynamics in the future.

I. Overseas "Niche LNG" a promising market in the long term?

The aim of the overseas Niche LNG market is to supply LNG to small/remote islands with small LNG tankers (less than 20,000 m^3).

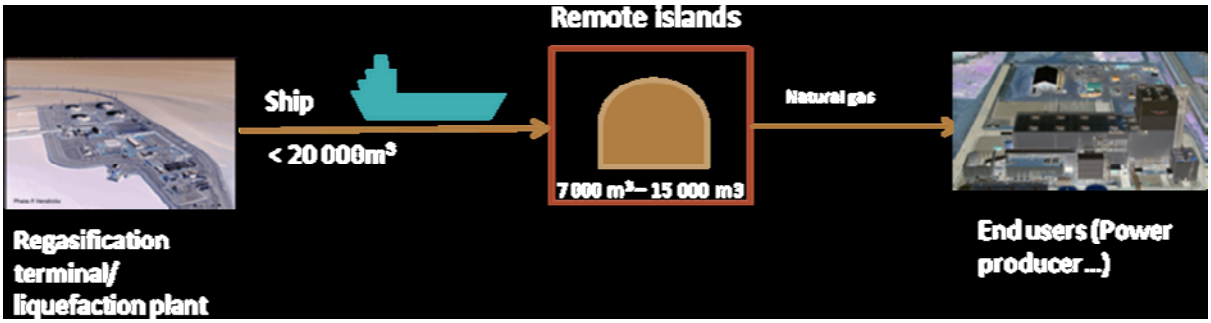

Figure1: overseas Niche LNG chain.

The characteristics of these potential overseas Niche LNG markets are:

- Heavily dependent on liquid fuels for power generation;
- Sensitive to the upward trend of petroleum prices;
- In the case of some islands: environmental sensitivity and desire to switch to cleaner fuels;
- Remoteness from gas sources.

The potential overseas niche LNG market is sizeable, and can be estimated at about 12-15 million tons of LNG per year (about 230 conventional LNG cargoes) if we take the assumption that 20% of the market should be developed economically. A quick overview of this market is given hereunder. The figures are simply obtained by summing up the capacity of some prospective new projects and/or the potential conversion to LNG of existing power plant.

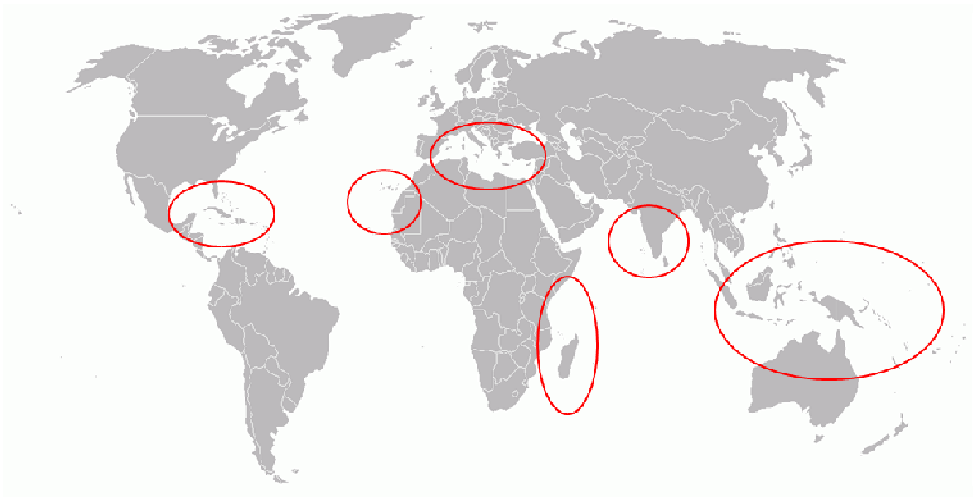

Figure 2: potential overseas Niche LNG areas

European / Mediterranean	MMTPA	Caribbean / Central America	MMTPA	Indian Ocean	MMTPA	Asia	MMTPA
Crete	**	Panama	**	Reunion	*	Sri Lanka	***
Gran Canary	**	Jamaica	***	Mauritius	**	Philippines	***
Tenerife	**	El Salvador	**	Seychelles	*	New Caledonia	*
Madeira	*	Aruba	**	Madagascar	*		
Cyprus	***	Martinique & Guadeloupe	**	Kenya	**		
Malta	**	Puerto Rico	***				
Mallorca	**	Dominican Republic	***				

*	0.1-0.2 million tons
**	0.3-0.5 million tons
***	0.5-1.5 million tons

Tableau 1: potential overseas Niche LNG demand

Today we can list few concrete realizations despite a lot of attempts by various players to develop small chain concepts in the Caraibs, Mediterranean Islands and South East Asia. The main realizations are intra-country coastal transportation from large regasification terminals or small LNG production plants (Japan, Norway).

Despite a sizeable potential market, few obstacles are slowing down the development of this chain:

- Absence of economies of scale. The total cost without the cost of the gas itself, is quite high ($8.5-11.5 per mmbtu) based on the following assumptions:
  - currently, we estimate the cost of small scale liquefaction (< 1 million tons per annum) at $3-4 per mmbtu
  - cost of small LNG carriers: a limited number are in operation. However a 5,000-m^3 tanker on a 10-day return trip, then transportation cost is $3-4 per mmbtu, depending on boil-off rate and valorization of boil-off
  - Cost of regasification should be approximately $2.5 to 3.5 per mmbtu assuming a very simple case (small tank, no vaporizer, unloaded through flexible hoses, to be supplied every 10 days with 5,000 m^3 LNG carrier)

- Access to LNG regasification/liquefaction terminal to load. Even if one can in theory arrange to purchase LNG from a third party in some LNG regasification terminal / liquefaction plant, loading the LNG can be challenging. Slots in regasification terminals are not always under third party access regime. Tariffs to access regasification terminals are better than those for small scale liquefaction but still expensive (if one assumes a regasification slot of typically $1m comprising a berthing right of $150,000 then the cost of such berthing right for loading a small 5,000-m^3 tanker comes to about $1.25 per mmbtu). The contracts and tariffs that would allow third party small tankers to berth and load at adequate cost barely exist: some degree of innovation is required here, but LNG infrastructure operators are tied to long term contracts and priority is given to large size tankers. The liquefaction plants are also designed for large scale vessels.

- Need to design specific small LNG infrastructures (floating units, etc.). Operators have a conservative approach, and innovations are implemented in the infrastructures: for example a special jetty can be added. These new designs call for safety concerns.

Today, the overseas Niche LNG industry is still in a chicken and egg situation for many reasons:

- The costs are expensive, but efforts are being made by equipments manufacturers and contractors to reduce them along the chain;
- Even if one is ready to invest, sourcing remains an issue;
- The cheapest sourcing solution – west of Suez at least – seems to be the reloading in a regasification terminal… but berthing slots cannot be guaranteed;
- Existing terminal and plant owners/operators are reluctant to invest in dedicated small scale LNG infrastructure, as long as the market has not first developed significantly;
- No upside potential given the isolated situations.

II. Inland Niche LNG: a mature technology and steady growth

Inland Niche markets have a continuing development since several decades. This LNG chain allows a wide distribution of small natural gas volumes in remote areas (far from the transportation network)and in a short timeframe. It allows an early distribution of natural gas in areas which are not connected to the gas transportation grid. End users have their own LNG storage tank.
The main segments of market are

- Peakshaving facilities
- Satellite storages
- Industrial end users

Figure 3: inland LNG niche chain

This LNG chain have been used in Boston (US), Tokyo (Japan), Portugal, Australia…
If we take the New England's case, the Everett Marine Terminal (EMT) has been essential to the region's energy supply: there is no underground gas storage in New England. EMT supplies LNG via truck to nearly all of the 47 customer-owned LNG storage tanks in region (majority of customers are Local Distribution Companies').
EMT opened in 1971 as a peak shaving facility, predominantly designed to supply LNG to peak shaving facilities via truck. More than 100 trucks can be loaded each day, which represents about 200,000 ton per year. Over 250,000 trucks have been loaded at the facility since 1971. Since the last five years an average of more than 10,000 trucks per year have loaded in the terminal. Of these there has never been a release of LNG as a result of a vehicle accident

According to GIIGNL, the global tonnage of LNG transported overland was 1.9 million ton in 2009 against 0.6 million ton in 1998 (3-fold increase). Total annual distance traveled was 30 million km in 2009, twice as much as in 1998. Europe continues to be the largest market for the overland transportation of LNG, produced locally (UK or Norway) or imported from Spanish terminals. Japan is the only country utilizing rail.

The success of the development of overland transportation to Niche Markets can be explained by the current pricing spread between alternative fuels such as Diesel, Heating Oil, Propane, etc.. Furthermore the costs are stable and well known:

- A filling station at the regasification terminal costs between $250,000 and $2,000,000 per unit depending on capacity.
- Typical tariff in Europe (Spain, Belgium) is between ¢50 and ¢75 per mmbtu.
- The costs of a trailer are between $250,000 and $300,000 per unit (cost of tractor to be added). Road transport costs (all-included) between $1 and $4 per mmbtu depending on distance.
- End-user station: from $500,000 upwards according to storage capacity and vaporization and pressurization equipment. Typical cost is about $2.5 per mmbtu.

Total cost (European case) is between $4 and $7.25 per mmbtu. Several suppliers exist for most of the equipments.

III. LNG as fuel for ships: Limitations on sulfur emissions should be a booster

The International Maritime Organization (IMO) has laid down pollution rules in the Marine pollution (MARPOL) convention which has set limits on NOx and SOx emissions from ship exhausts. 2020 or alternatively 2025 – decision in 2018 – has been selected as the deadline to cut the amount of sulfur burnt by the world fleet. The aim is to reduce sulfur content in marine fuel to 0.5%. This can be met by burning cleaner fuels like diesel oil or marine gas oil (middle distillates). More stringent requirements are applicable in Emission Control Areas (ECA): in particular Baltic Sea and North Sea in 2015, as well as the coasts of the United States.

The targeted market should be sizeable as consumption of ships worldwide is approximately 300 mtpa (all type of bunkers). A number of buyers are currently expressing their interest for an LNG solution (preferred solution against diesel oil or investment in a scrubber). The main reason is the likely surge of diesel oil / marine gas oil prices in the coming years. LNG is cleaner and cheaper than marine gas oil and will take its share of the market of marine fuels. Following several scenario on the demand for LNG as bunker fuel, the forecasts are hghly dependant on the political decisions to implement the new production rules in various parts of the world. The forecasts vary therefore quite widely:

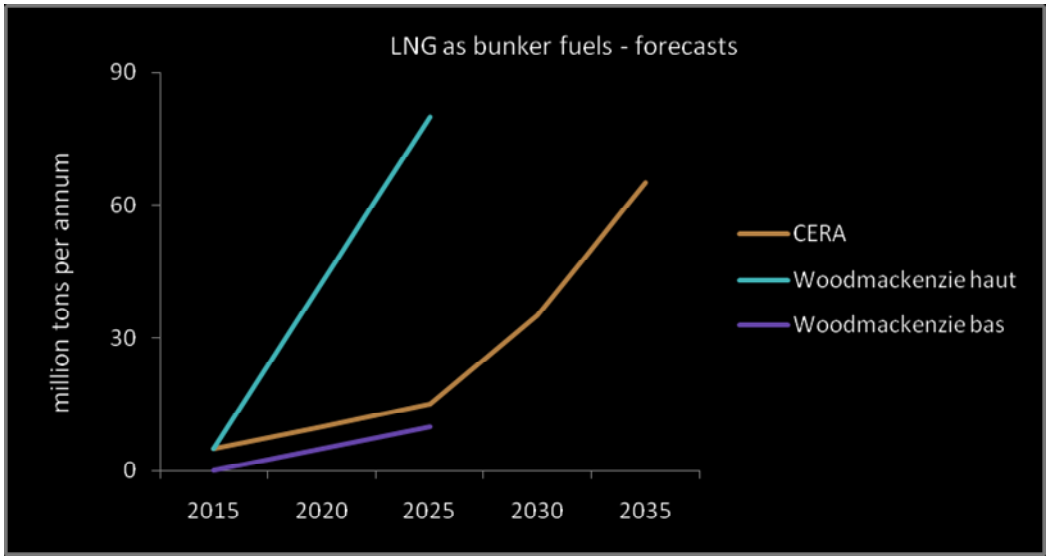

Figure 4: LNG as bunker fuels forecasts

A conservative 10% of the world market sets the additional demand for LNG at about 30 million ton/year (about 455 conventional LNG carriers) in 2020-2025.
Based on econometric correlations between Brent price ($ per barrel) on the one side and Heavy Fuel Oil and Marine Gas Oil in $ per mmbtu on the other side :

- Heavy Fuel Oil with 3.5% sulfur is valued at approximately 12% Brent – 0.5 $/mmbtu (High Heating Value)
- Marine Gas Oil /Diesel Oil with 0.1% sulfur is valued at approximately 23% Brent – 1 $/mmbtu (HHV)

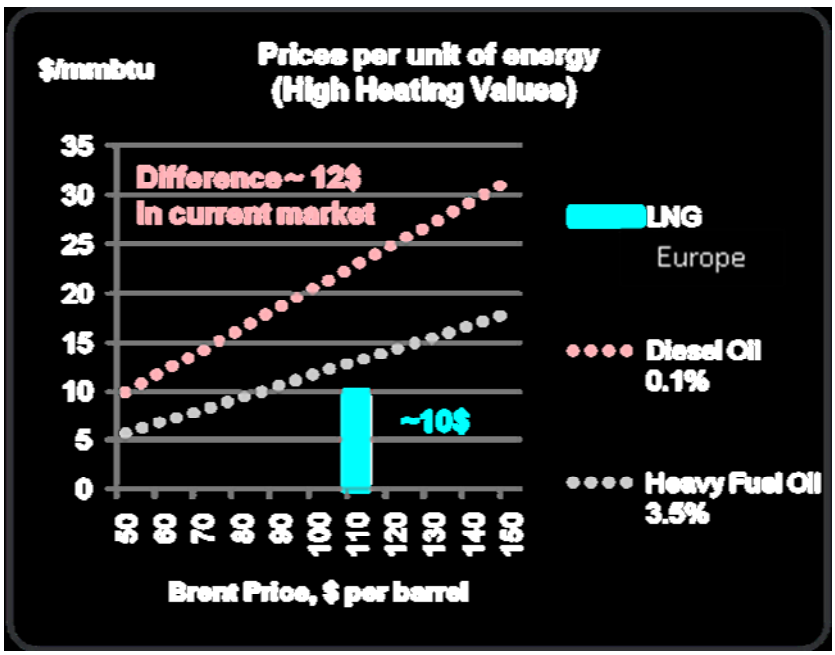

Figure 5: fuel for ships prices comparison (source: GDF SUEZ)

The spread between marine gas oil and LNG ($12 per mmbtu) should be large enough to allow the development of bunkering schemes, by road (trucks) or by sea (barges)
In the case of Europe, the main assumptions for a supply scheme by trucks are:

- Price of LNG in Europe at $10 per mmbtu
- Filling the trailers would cost between ¢50 and ¢75 per mmbtu

- Road transport to a satellite storage in another port would cost between $1 and $4 per mmbtu depending on distance
- Satellite storage would cost about $2.5 per mmbtu

Then total cost of LNG delivered should be between $14 and $17.25 per mmbtu, to be compared with the current price of diesel oil at $22 per mmbtu. The spread between the cost of LNG delivered to the ship and the price of marine gas oil should be enough for the ship owner to pay the extra investment of a dual fuel engine and for the LNG seller to make a profit. But today, some issues on taxes, safety and training requirements, need to be raised.

IV. LNG as fuel for trucks: a part of the fuel mix

In the US, President Obama declarations in January 2012 mentioned natural gas and LNG as fuel for transport in the US Energy Strategy. The plan includes tax credits to encourage changing truck engines to run on natural gas, and the creation of additional natural gas corridors on heavy trucking routes (where trucks will refuel with LNG).

Focusing on the European side, the EU Commissioner for Transport has unveiled on March 29th Europe's comprehensive strategy called "Transport 2050" for a cut in carbon emissions in transport by 60%. This strategy lays in 3 objectives:

- No more conventionally fueled cars in city centers by the middle of the century
- 40% cut in shipping emissions
- 40% use of low carbon fuels in aviation

Europe is concentrating on itself the strongest environmental objectives. With a 25% greenhouse gas emission savings and an energy density of 60% of that of diesel fuel, LNG should be part of the solution mix. However, an important parameter will be the level of sales tax on LNG for transportation, completely unknown as for now. The potential demand in Europe is huge.

Road	Rail	Inland waterways	Pipelines	Sea (Europe to Europe)	Air	Total
1 878	443	145	124	1 498	3	4 091

Tableau 2: Freight transport in 2008 in Europe-27, split by mode, in billions of ton.km. Source: European Commission

In a first step, LNG can be proposed to the trucks as they amount to 46% of freight transport activity inside Europe. As a start long haul freight on predefined corridors can be implemented. We can take the assumption that LNG can be used by 10% of freight market (provided price of LNG vs diesel is attractive enough). According to the European Commission, total freight inside Europe-27 is expected to be 3,000 billion ton.km in 2030. Fuel consumption equivalence for an LNG truck in the 20 to 40-ton range can be set at 30 kg LNG per 100 km (vs 33 liter diesel per 100 km), hence an average consumption of 7,5 g LNG per ton.km. Thus a potential magnitude of demand for LNG as fuel for trucks could be:
10% * 1,878 billion ton.km * 7,5 g LNG per ton.km = 1.4 million ton per year (about 21 conventional LNG carriers).
As for the LNG as fuel for ships segment, some points on safety and training requirements need to be solved.

Conclusion

These segments represent a strong development potential and the LNG industry is looking into specific hurdles:

- Overseas Niche LNG: still major costs and infrastructure issues, and a limited upside.
- Inland Niche LNG: a mature market in OECD countries, and a potential in developing countries still unclear.

- Retail LNG: a significant market, especially for ships. Regulations and infrastructure costs could impact strongly the chains. Retail LNG is truly global (North America, Europe, Asia) and could call for significant volumes.