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LNG MARKETS PERSPECTIVE

March 2015

LNG BUNKERS – TROUBLED WATERS

The LNG Bunker market has established itself in Europe and the USA, spurred by the new ECA constrictions, but uptake has been slower than hoped for. This 4th annual issue of LNG Bunkers Perspective suggests three reasons apparently prevail.

The dramatic fall in oil prices, triggered by sluggish demand and an expanding supply, due in part to the surge in US shale oil and gas, has led to oversupply. But this will re-balance and faster than many expect. The slowdown in China is being addressed by a monetary stimulus initiative that will restore demand. OPEC's decision not to tighten oil supply may, in part, be an attempt to undermine the shale advance. This will not work. The USA today is the world's largest energy producer and is predicted to be a major exporter by 2020. Meanwhile, burgeoning population growth in the Middle East, combined with higher living standards expectations, could see Saudi Arabia become a net energy importer by 2030. The current price-inspired delay, or postponement in FID on gas projects could lead to tightening of gas supply and shortages from 2019/20.

The "Chicken and Egg" syndrome, where ships are chasing LNG bunker ports and vice versa, remains a challenge. But, there is a big difference in approach either side of the Atlantic to addressing this. In the USA, private enterprise is picking up the baton based on specific opportunities and specific routes. But there is little general port development. Meanwhile, the European Commission's Trans European Transport Network (TEN-T) programme calls for all major European seaports to offer LNG bunkers by 2020 and inland waterway ports by 2025, providing significant funding already towards this end.

The current mix of LNG bunkering codes and regulations is diverse, sometimes contradictory and involves too many parties and authorities. This has proven to be frustrating and time-consuming for LNG aspirants on both sides of the Atlantic. The reason that large aircraft are able to refuel across the world is that they conform to international standards. Such international conformity, co-ordination and co-operation is needed urgently in the LNG bunkering world.

__LNG Markets Perspective__ is a periodic paper looking at key issues and events.

Developments in the LNG market are discussed in more depth in our LNG Brief and quarterly LNG Markets Updates

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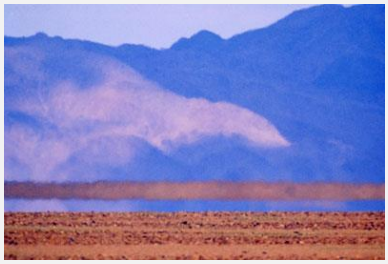
THE LOW PRICE MIRAGE

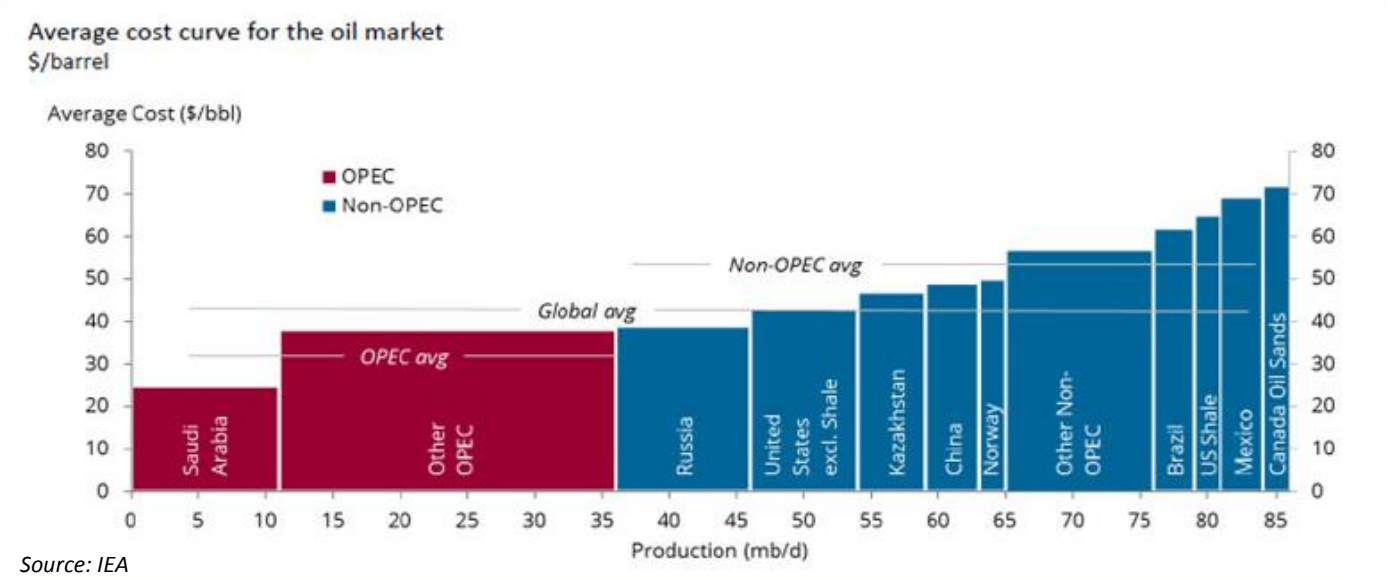
Much has appeared in recent media reports about the prospect of a world returning to cheap energy. This is misguided and naïve. Investment decisions based on this premise, are both myopic and are the harbinger of future problems.



The prospect of a return to long term cheap energy is a mirage.

Future gas demand will outpace oil demand growth by more than double year on year, with annual gas demand, currently around 3,500 billion cubic feet (bcf) and rising to 4,500 bcf by 2025 and over 5,000 bcf by 2035. Cutbacks in future supply, based on decisions made now, will see tightening in gas markets starting from 2019/20.

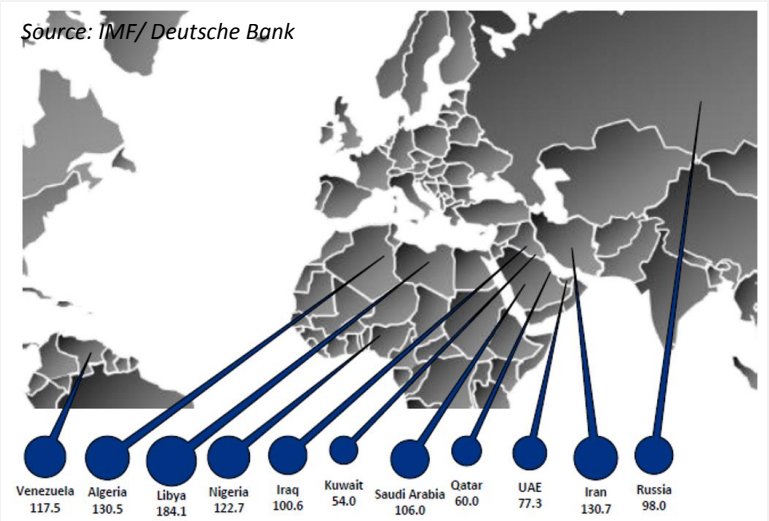
Energy prices linked to an oil price of $40/bbl mean that half the world's current oil production is sold at below full cost, clearly unsustainable in the long term, except for the few.



Source: IEA

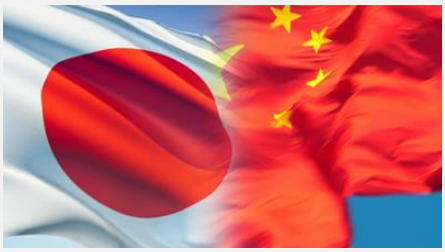
At $40/bbl, half of global oil production in uneconomic

More significantly, the oil producers, needing high prices to balance their books, listed adjacent, have growing populations, with the possible exception of Russia. The Saudi Arabian population is growing around 1.9% pa and Iran 1.3% pa. But energy demand is not proportional. After the "Arab Spring", people in the Middle East expect and demand a higher standard of living, with fridges, air conditioning, washing machines etc., so energy demand growth runs exponential to population growth. With maturity in the traditional oil fields, the oil price needed to sustain these oil-dependent economies can only rise.



Oil price needed to meet fiscal commitments ($/bbl.)

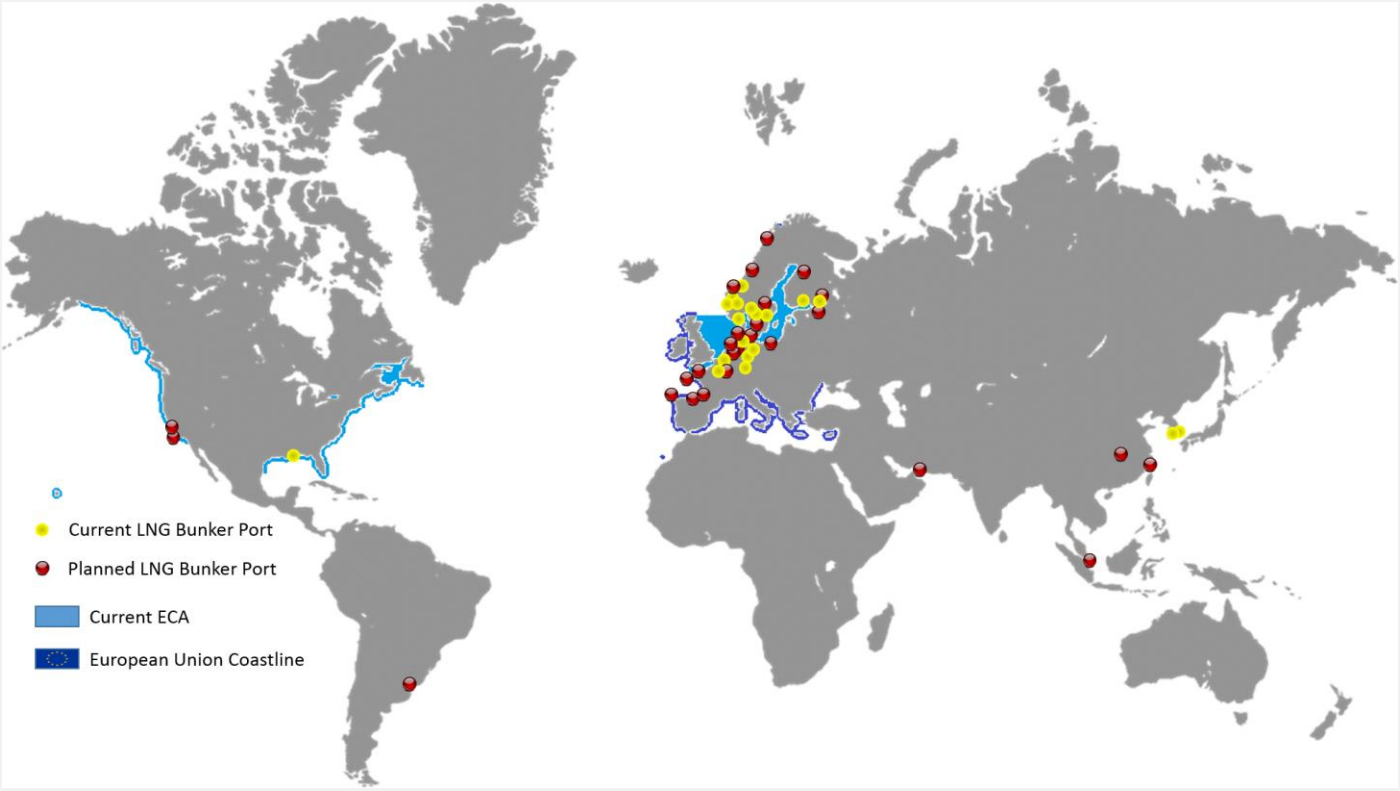
Low prices have also stimulated demand. The International Energy Agency (IEA) and the Organization of the Petroleum Exporting Countries (OPEC) have raised by at least 200,000 barrels per day (bpd) their estimates of demand for OPEC crude in 2015.



The biggest card in the game, China, has not stood by idly watching its economic growth stagnate. In January 2015, the China Central Bank introduced a programme of quantitative easing, injecting 1 trillion Yuan ($162 billion) into its economy to stimulate new growth. With an increasing public clamour to deal with catastrophic air pollution, we can also expect to see the Chinese energy mix shifting and demand for gas rising at the expense of coal and oil. And Japan, still predominantly in a post-Fukushima nuclear shutdown, is beginning to see its fortunes rise after a decade of slump, boosting gas demand.

INFRASTRUCTURE - WHERE ARE WE NOW?

There are around 8,000 seaports located in around 200 countries. Of these, 46 ports are LNG hopefuls and a mere 15 open for general LNG bunker business today.



World ECAs and LNG Bunker Ports 2015

WORLD LNG BUNKER PORTS 2015

Europe				Asia		America	
1.	Aarhus, DK	19.	Kristiansund, NO	**1.**	**Busan, SK**	1.	Buenos Aires, AR
2.	Amsterdam, NL	20.	Le Havre, FR	2.	Fujairah, AE	**2.**	**Port Fourchon, US**
3.	**Antwerp, BE**	21.	Lübeck, D	**3.**	**Incheon, SK**	3.	Long Beach, US
4.	**Bergen, NO**	22.	Lysekil, SW	4.	Nanjing, CN	4.	Los Angeles, US
5.	Bodø, NO	23.	Mongstad, NO	5.	Singapore, SG		
6.	Bremerhaven, DL	24.	Nynäsham, SW	6.	Zhoushan, CN		
7.	**Brunsbüttel, DL**	25.	Oslo, NO				
8.	Copenhagen, DK	26.	Oulu, FI				
9.	Ferrol, ES	27.	Roscoff, FR				
10.	**Florø, NO**	28.	Rotterdam, NL				
11.	**Fredrikstad, D**	29.	Santander, ES				
12.	Ghent, BE	30.	Stavanger, NO				
13.	Gijón, ES	31.	Stockholm, SW				
14.	Gothenburg, SE	32.	Talinn, EO				
15.	Hamburg, D	33.	Turku, FI				
16.	**Helsinki, FI**	34.	Wilhelmshaven, D				
17.	Hirtshals, DK	35.	Zeebrugge, BE			*planned	
18.	**Karmøy, NO**	36.	Zwijndrecht, NL			* **existing**	

A TRANS-ATLANTIC DIVIDE

The global distribution of available and planned LNG bunker ports is highly skewed towards Europe. There are two reasons for this. With an environmentally sensitive political ethos, a geography that lends itself to significant transport by sea and an abundance of offshore gas, Norway led the way with the North Sea and Baltic Sulphur Emission Control Area (SECA) coming into force in 2005. It remains the national leader in LNG fuelled vessels and seaports. Inspired by Norway's progress, the European Commission put its money where its mouth was under the Trans European Transport (TEN-T) Network, allocating €26 billion of investment from 2014 to 2020 to cover a variety of land and sea based initiatives. Under the scheme, all major European Union seaports are expected to offer LNG bunkers by 2020 and Inland River and canal ports by 2025.

The North American ECA came into force in August 2012. Since then, it has been left to private enterprise to develop LNG bunkering infrastructure. Predictably, this has led to developments by noteworthy pioneers, projects and specific routes, some of whom are happy to share their infrastructure, but little, so far, dedicated to general shipping. The message is clear. Accelerated LNG bunker port development is directly related to state or regional funding availability.

THE AMERICAS

A SOUTHERN BELLE

Port Fourchon in Louisiana, USA has made the news recently, for hosting the USA's first LNG bunkering operation. Port Fourchon is the largest offshore supply base in the USA, servicing over 90% of the Gulf of Mexico's deepwater oil production with over 600 platforms in a 40 mile (64km) radius. Little surprise then that New Orleans based Harvey Gulf decided to build a dedicated, road-fed static LNG bunkering terminal to service its growing fleet of "*Enviro*" LNG dual-fuelled offshore support vessels (OSVs) in Port Fourchon.

Port Fourchon is the largest offshore supply base in the USA

Harvey Gulf's road-fed static LNG bunkering base in Port Fourchon, LA

Harvey Gulf "Enviro" OSV

Harvey Gulf's "Enviro" OSV fleet has adopted a "cradle to grave" environmental approach, including an energy efficient hull design and build from reusable materials.

Meanwhile, in 2012, TOTE Maritime ordered two of the world's first containerships to run on LNG. The ships, known as the "Marlin Class", are now nearing completion at the General Dynamics NASSCO shipyard in San Diego, California with the first ship expected to enter Jones Act service between Jacksonville, Florida and San Juan, Puerto Rico later this year, followed by the second in early 2016.

TOTE Maritime's Marlin Class box ships to serve the Jacksonville – Puerto Rico route

As with the Viking Grace, LNG fuel is stored in two Type C poop deck mounted bullet tanks. TOTE will also retrofit its "Orca" Class CON-RO ships serving the Tacoma-Anchorage route with Wärtsilä duel fuel engines. TOTE has ordered the US's first LNG bunker barge for Tacoma and Florida's Jaxport is likely to offer LNG bunkering in the near future.

Crowley's "Commitment" Class CON-RO vessel

Jacksonville based Crowley will also put 2 new "Commitment C"' LNG dual-fuelled box ships on their Florida-Puerto Rico route. Unlike TOTE, Crowley is reported to have opted for 3 Type C LNG bullet tanks mounted beneath the accommodation, offering reduced impact on cargo capacity.

Debate continues on the wisdom of locating gas tanks beneath accommodation and good ventilation is certainly a must, but the concept is gaining acceptance.

Crowley recently announced it will consolidate operations in Jacksonville's Jaxport. It will be interesting to see whether Jaxport decides to develop bespoke or general LNG bunkering capability.

A Rebounding Europe

Although early days, northern Europe, appears to be headed out of the doldrums, buoyed by a low Euro, boosting exports and a €1.1 trillion ($1.3 trillion) quantitative easing in the Eurozone by the European Central Bank (ECB). The Maritime Sector is being boosted additionally by the European Commission TEN-T programme. Initiatives are plentiful and some examples are provided.

Seeking enhanced energy independence, Lithuania's Klaipedos Nafta has taken recent delivery of a LNG Floating Storage Regasification Unit (LNG FSRU) from the Hyundai yard in Ulsan, South Korea. The 170,000m^3 vessel has been named, poignantly, "Independence" and now, moored in Klaipeda, is undergoing fabrication of the regasification unit by Germany's Bomin Linde LNG. Bomin Linde will also work, together with the terminal's operator, to operate as a regional break-bulking hub and to develop the use of LNG as marine fuel in the Baltic Sea. An import deal for US LNG is under negotiation.

Additionally, Lithuanian LNG importer, Litgas, has said it was considering a co-operation with Norway's Statoil in developing bunkering services in the Baltic Sea.

Lithuania's New 170,000 m^3 LNG FSRU, "Independence"

The European Gateway

Gate LNG Import Terminal

The Gate LNG terminal in Rotterdam has announced that it is modifying its jetties to be able to offer transhipment services in the second half of 2015. LNG will be unloaded at one jetty and loaded at the other jetty without the LNG passing by the storage tanks with a flow rate of 1000 up to 12500 m^3/h. Both jetties can serve LNG carriers from around 5000 m^3 up to Qatar-max type of vessel.

Gate terminal has increased its services to include truck loading, reloading and acceptance of small vessels. A dedicated small scale third jetty is also under construction. Gate aims to strengthen its role in linking large scale and small scale LNG markets in North West Europe.

Shell's planned first 6,500m^3 seagoing LNG bunker vessel

Supported by Gate Terminal's initiative, Shell has commissioned its first sea-going bunker vessel, to operate out of Rotterdam. According to Shell, the 6,500 m^3 vessel will be LNG-powered and will feature an innovative LNG transfer system, enabling it to use both large and small scale LNG terminals.

Shell's oil and chemical tanker river barge "Green Rhine"

Shell is also rumoured to be planning to increase its fleet of LNG powered river barges to four vessels. The first have been a success. The vessels were built by Peters Shipyards of Kampen, Netherlands. The first "Greenstream" has recently been awarded the prestigious KNVTS Ship of the Year Award at the recent Maritime Awards Gala.

ASIAN ENIGMAS

Asia, generally, has been slow to wake up to the potential for LNG as a marine fuel, based, in part, on high LNG pricing. But the biggest blocker is undoubtedly a tendency to procrastination and indecision. Even the world's biggest bunker port, Singapore, two years after opening its first LNG import terminal, does not currently offer LNG as a marine bunker option. But, there are two notable exceptions, South Korea and China.

Road fed LNG refuelling capability is provided by KOGAS to Asia's first LNG-powered passenger ship "Econuri" in Incheon. The Port of Ulsan can also offer equivalent services and is now actively considering installing permanent facilities. Although there is no direct state involvement, the players are all state owned organisations with access to funding needed to keep South Korea ahead of the game.

KOGAS refuelling LNG into the "Econuri" in Incheon

LNG bunkering is also growing in China. China is set to own up to one quarter of the world's commercial fleet by 2030, increasing its carrying capacity from 9 billion tonnes to between 19-24 billion tonnes a year. Since 2010, Chinese shippers have commissioned 30 dual fuel vessels at a rate of 10 per year, including the world's first tugboats operated on diesel-LNG engines. Commercial LNG bunkering is already available at the Yangtze River ports of Zhoushan and Nanjing.

Asia will continue to be the world's busiest shipping region for many years.

Chinese consumers, alarmed by poor air quality levels, particularly in big cities, are becoming increasingly vocal in their concerns. Whilst power generation and especially coal fuelled stations are the main culprit, shipping concentrations are coming increasingly under the spotlight. The Chinese government has already encouraged the adoption of LNG as a fuel on the Yangtze River, a major transport artery running through China's heartland, in response to concerns about air pollution from river-borne traffic.

Concern by Hong Kong citizens has encouraged the authorities to adopt new emissions controls in Hong Kong waters. Logically and with a number of LNG import terminals planned or built, we can predict that LNG as a marine fuel will be encouraged in the near future.

Japan is not immune from the China phenomenon. Of total airborne emissions in the Japanese port of Kobe, 10% is marine derived. It can reasonably be assumed the similar levels are found in other major port regions such as Tokyo Bay. Japan is currently the biggest LNG importer in the world, twice the size of second placed South Korea. Inevitably, that set for use in marine transport will grow over the coming years.

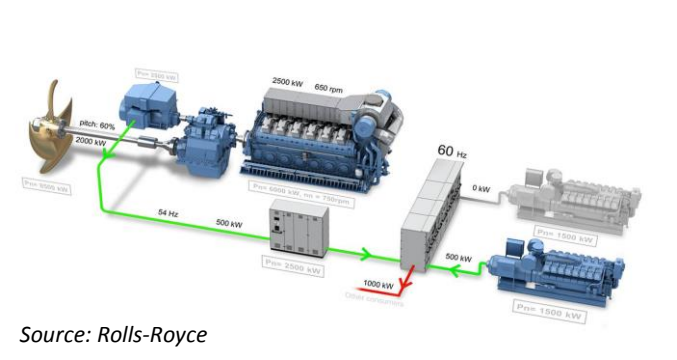
Following in the footsteps of United Arab Shipping Company (UASC) in 2014, Japan's Mitsui O.S.K. Lines has announced recently that the company has signed a deal for construction of six "LNG Ready" 20,000 TEU containerships with Korea's Samsung Heavy Industries to serve its Asia-Europe routes. Such type of increasing demand will stimulate ports and service providers into offering LNG bunkers. It will also create demand in other parts of Asia and the world's container arteries, such as the Malacca Strait, the Suez Canal, the Mediterranean (especially with extended ECA type regulations applying to the European Union coastline by 2020) and the Panama Canal.

Mitsui O.S.K. Lines has recently ordered six 20,000 TEU "LNG Ready" containerships

TECHNOLOGY

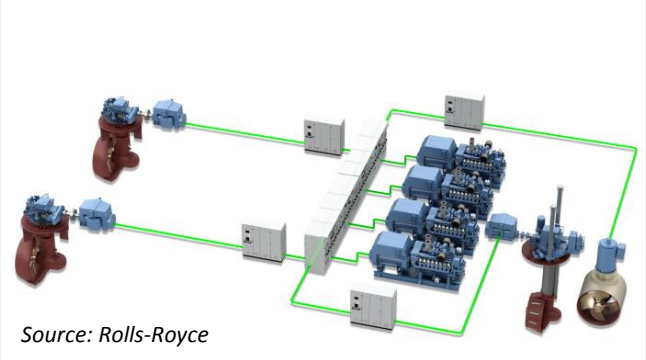
ROLLING FORWARD

Rolls-Royce Marine has been busy preparing a range of new power and propulsion offerings, developing a range of geared prop shaft drive with partial take-off (PTO) electrical generation and the increasingly popular hybrid diesel-electric drive. Engines are available as diesel or pure-gas versions.



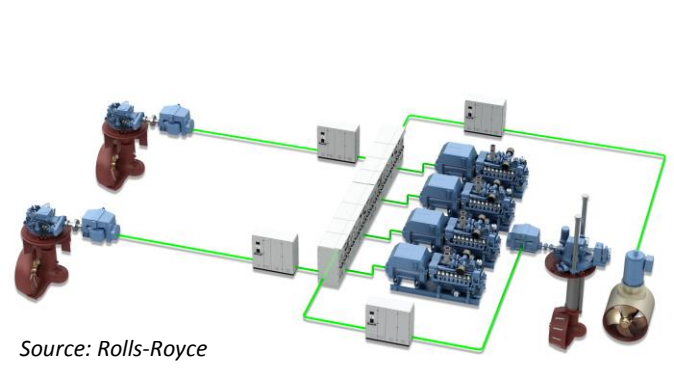
Source: Rolls-Royce

SAVe Hybrid

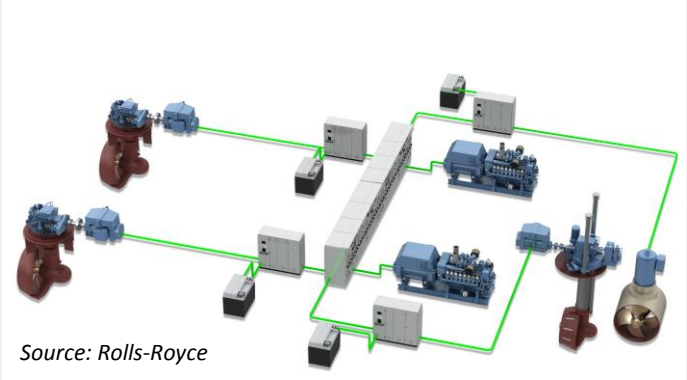


Source: Rolls-Royce

SAVe Cube



Source: Rolls-Royce



Source: Rolls-Royce

Source: Balearia.com

Balearia Barcelona-Palma de Mallorca ferry "Abel Matutes"

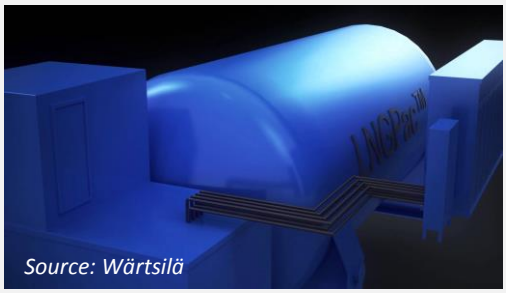
Source: Rolls-Royce

Rolls-Royce Bergen C26:33 L6 AG pure-gas auxiliary engine

The 29,670 GRT ROPAX ferry, delivered in 2010, will use a retrofitted pure gas LNG-fuelled Rolls-Royce Bergen C26:33 L6 AG auxiliary engine to generate 1,560kWe of clean power, reducing emissions during port stays in Barcelona and Palma de Mallorca. According to Rolls-Royce Bergen, the gas engine technology will lead to an annual reduction of almost 4,000 metric tons of CO_2, over 60 metric tons of NOx and 6 metric tons of SOx.

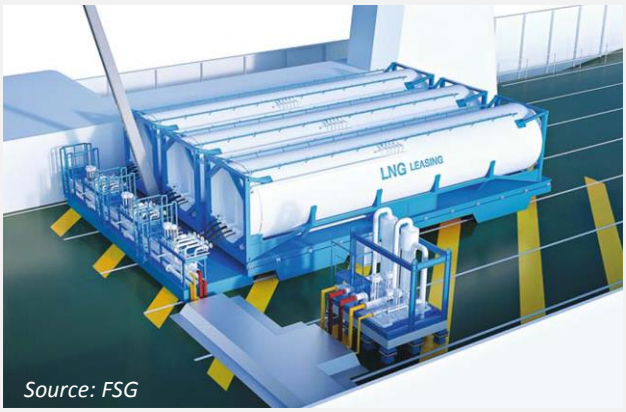
WÄRTSILÄ

Finland's Wärtsilä has updated its successful LNGPac system, making it more compact and thermally efficient. The new solution has removed the heating media skid and its pumps, and includes an improvement to the Wärtsilä Cold Recovery solution. The heating media skid, a complete circuit of heat exchangers, pumps and piping, used to evaporate LNG for pressurising the storage tank and to provide the engine with the correct gas temperature. Instead, the new system directly utilises the engine's cooling water, resulting in fewer interfaces and less installation work for the shipyard. Eliminating electrical consumers for efficiency, Wärtsilä features an integrated airlock and control cabinet, a more compact bunkering station and an enclosed or integrated gas valve unit, maximising available LNG storage volume.



Source: Wärtsilä

Wärtsilä's 2nd generation LNGPac system



Skid-mounted LNG tanks are becoming increasingly popular for RO-RO vessels with fast port turnaround times

Such systems can also complemented by a 3rd Party range of portable, skid-mounted LNG Type C "bullet" isotanks that can be transported by road and then parked aboard RO-RO vessels, adjacent to dedicated connection points to route the LNG into the propulsion fuel system.

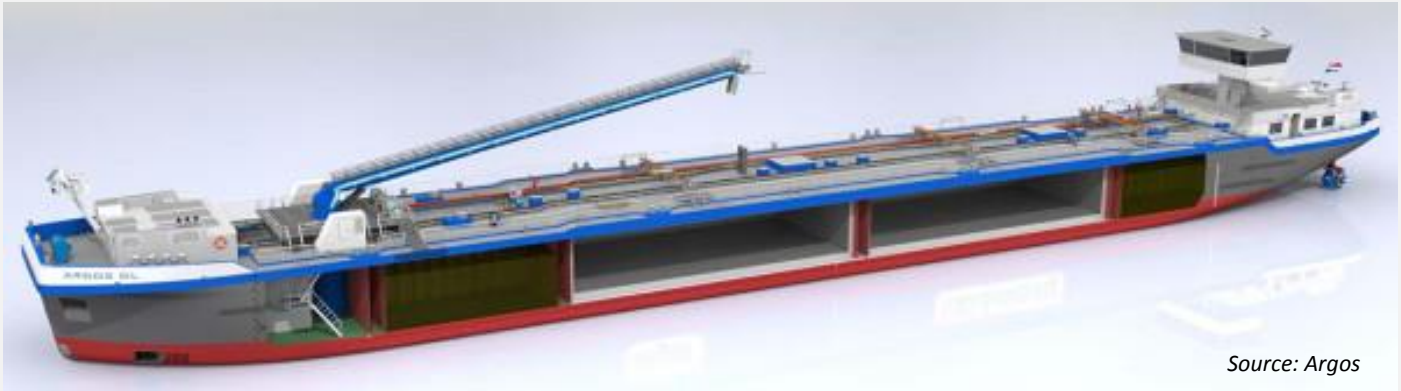
This is an increasingly popular method of LNG refuelling for vessels operating with fast turnaround times in port, without compromising safety.

FUELGARDEN LNG™ BRIDGING THE GAP

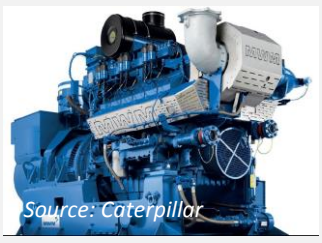
With experienced staff in the space, Norway based Fuelgarden entered the market in 2014, focussed on a range of portable LNG refuelling solutions. This includes the "High Lift" option, whereby a full 50m^3 isotank can be placed and secured directly onto the deck of a suitable vessel in exchange for the empty one.

Fuelgarden's portable LNG tank offerings include a "High Lift" option

Wärtsilä has also teamed up with Dutch tank and regasification systems manufacturer, Cryonorm, to deliver a range of modified LNGPac systems for use on European waterways.



Argos' novel LNG/gasoil bunker barge for use in ports and inland waterways



Caterpillar MWM TCG 2016 V08C engine

Dutch independent oil trader, Argos, has entered the LNG bunkering market with the commissioning of its first LNG fuelled gasoil/LNG bunker tanker, for use in the ports of Amsterdam, Rotterdam and Antwerp. Boil-off LNG will be used for electric propulsion and generation. Pilot operations will start in Q3 2015.

With GTT Mark III membrane LNG tankage, to optimise LNG storage space, power is provided by Caterpillar's dedicated-gas TCG 2016 V08C engine from Caterpillar's MWM unit and is intended to run primarily on LNG boil off gas.

In a similar move, Dutch firms VEKA and Deen Shipping have teamed to develop the small scale LNG market under the name VEKA DEEN LNG and to build an innovative ship design for the first inland LNG carrier. The new tanker has a length of 90 metres and will be able to transport 2,250 m^3 of LNG. VEKA was the first Holland based shipyard to deliver a seagoing LNG carrier with LNG propulsion (Pioneer Knutsen). Deen Shipping developed, and operates the world's first LNG propelled inland tanker (Argonon).

VEKA DEEN's new inland waterway LNG carrier

Swedish Oil/Chemical tanker "FURE WEST" after conversion

In an innovative joint-industry collaboration, JIPCONV, a technology sharing group, co-funded under the European Commission TEN-T project, has been founded and developed the "Zero Vision Tool (ZVT)", a methodology signalling Red, Yellow and Green actions that each Joint Industry Projects / Joint University Projects for safer, more environmentally sensitive and energy efficient transportation by sea. A roadmap will be developed for actions within the Baltic Sea Green Technology platform. Regulations and financial issues will be jointly looked at, when appropriate, among Baltic nations.

The agenda includes: development of an engine upgrade kit, a study of LNG tank concepts, vessel design, safety assessments, class approval of drawings and documents, design and manufacturing of LNG tanks, vessel conversion, procedures for handling LNG components and vocational training. The first project will convert the main engine on the existing Swedish oil/chemical tanker "FURE WEST", the first of its kind for this type of vessel. A pair of Type C LNG tanks will be secured to the fore deck. The objectives for this exercise include: to convert and run a main engine on LNG to show environmental benefits (+ identify pros and cons if converting auxiliary engines too), to lead the path to reduced operational costs, identify and to evaluate the workflow of the engine conversion to generate new technology development, to identify if new gas driven vessel solutions are needed, to generate lessons learned and identify education needs, to identify and solve safety risks and combine with environmental winnings and implement ISO 5001 with eventual add-ons, to show simulations and investigate the total energy efficiency.

Source: AS Tallink

Tallink's new LNG-fuelled, high-speed, shuttle ro-pac ferry will serve the Tallinn-Helsinki route from 2017, with a 17 knot service speed

Estonia's AS Tallink and Finland's Meyer Turku have signed a €230m ($257m) shipbuilding contract for the eastern Baltic's second LNG fuelled car-passenger ferry. The 212m-long, dual-fuelled, high-speed vessel, to be delivered in 2017, will be used for Tallinn-Helsinki route shuttle operations, carrying up to 2,800 passengers. The new-build will have a gross tonnage of 49,000 tonnes and be capable of cruising at 27 knots. An innovative hull form will minimise the flow resistance and ensures that the ship operates well in ice conditions.

Helsinki already offers LNG bunkers.

THE REGULATORY JUNGLE

When presented with the challenge in 2013 of permitting the "Viking Grace", en-route from Turku, Finland, to refuel LNG daily in Stockholm Harbour via a bespoke ship-to-ship transfer, the Swedish Transport Agency was presented with the elephantine and unprecedented task to construct an acceptable regulatory framework in Sweden. They found almost no useful precedents to work from. Previously the Viking Grace had been fuelled in port via truck. The only help was offered through the International Maritime Organization's (IMO) "RESOLUTION MSC.285 (86) - Guidelines for safe operations of gas fuelled ships and a year's experience". This did not offer much help.

The conversion of the LNG bunker vessel "Seagas" from a former car ferry has been carried out in accordance with the IMO Resolution msc.285(86), Class Rules and both Safety analysis and Crew training and education to the satisfaction of the Swedish Transport Agency (STA).

m.v. Seagas refueling LNG into the Viking Grace is Stockholm

But this was only the beginning. The STA had experience with the Swedish flag "Bit Viking", a 20,000 dwt LNG fuelled chemical tanker that had been operating and refuelling along the Norwegian coastline since 2011 and with no reported problems. But this did not constitute a regulatory framework.

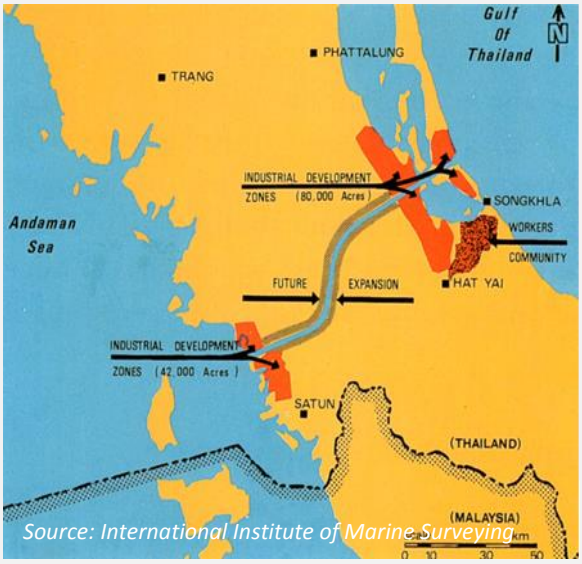
Eventually, although the STA held overall responsibility, it was obliged to co-ordinate and collate feedback for the safety analysis with the Swedish Civil Contingencies Agency, The County Administrative Board, The Swedish Coast Guard, the Greater Stockholm Fire Brigade and the Swedish Maritime Administration.

The SMA reports that, whilst it delivered the desired result to the satisfaction of all, it was an extremely time and effort consuming exercise. The subsequent Technical Requirements, derived from the Operational Requirements, were thus, easier to formulate. Two key decisions were made. Firstly concurrent LNG bunkering, RO-RO and passenger embarking and disembarking operations would be allowed. Secondly, refuelling hoses must be fitted with dry cryogenic couplings and self-sealing break-away couplings. Flanged couplings are not allowed.

A Mann Tek dry cryogenic coupling

This regulatory complexity story is also present across the Atlantic. It is clear there is an urgent need for a single co-ordinating body and both harmonised and globalised standards to meet the future needs of a global LNG fleet and to expedite its welcome.

THE NEXT BIGGEST BUNKER PORT IN THE WORLD



The Kra-Canal would bypass the Strait of Malacca, shortening shipping distances to NE Asia by 1,200 nm

In 1677, the French engineer De Lamar made a study, ordered by the Siam king Narai, to look at building a canal across southern Thailand, linking the Andaman Sea with the Gulf of Thailand (then Siam). Many other studies followed, including one in 1882 by the engineer of the Suez Canal, De Lesseps.

The Kra-Canal would shorten shipping distances by 1,200 Nautical miles, by-passing peninsular Malaysia and Singapore, also avoiding a piracy risk. The Strait of Malacca is one of the busiest shipping lanes in the world, with 60,000 passages annually. According to a recent study by The Maritime Institute of Malaysia, the Malacca Strait traffic is expected to be over-saturated in 10 years. Reportedly, without change, by 2025, there will be around 140,000 vessels passing through the strait, but it can only safely accommodate about 122,000 ships.

It was always the vision to construct a sea-level canal capable of accommodating vessels up to 500,000 dwt with two lane traffic and a transit speed of 7 knots (international navigational speed standard). This will require a canal depth of 33m and base width of 500 metres.

At the narrowest part of the Kra Isthmus, the width is 44 kilometres, but with a mountain stretch reaching 75m above sea-level, most proposals vary between 50-100km, to minimise the excavation needed.

Today, it remains questionable if the construction of the Kra-Canal would justify the effort, investment and possible environmental impact to save 1,200 Nautical miles. Projects of this magnitude usually take several years' gestation to Final Investment Decision (FID). This part of Southern Thailand faces an ongoing civil conflict, at times violent, bringing additional security worries.

The Kra Isthmus is 44 km wide at its most narrow and rises to 77m above sea-level

But, there is another picture. The Kra-Canal could offer massive economic benefit to Thailand, especially in the South, where higher unemployment is a source of social disaffection. Longer term, the Kra-Canal could become an important focal point for trade between the Pacific and Indian Oceans. With a planned industrial zone for heavy industry, dry-docks and ship-building and a deep-sea port at the canal entrances, the Kra-Canal could develop into the major transhipment port for Asia, comparable to Europoort in Rotterdam and, like Rotterdam a global LNG bunkering and shipping hub. Simply put, it could make the Kra-Canal, possibly Songkla, the next biggest bunker port in the world, with much of that future being LNG bunkering and LNG fuelled shipping services.

Despite regional opposition, especially by those set to lose out preferring the status quo, the Chinese stepped into the breach in March 2014 when the China Daily Mail reported: "China's huge, state-owned LiuGong Machinery Co. Ltd, XCMG and private Sany Heavy Industry Co Ltd have taken the lead to set up a preparation group for the construction of Kra-Canal".

The Kra-Canal project will go ahead, eventually. It will take around 10 years to complete, cost $20-25 bn and employ around 30,000 workers, making it one of the biggest construction projects in the world. The Chinese may have jumped the gun and it will be interesting to see if the putative ASEAN Economic Community (AEC) chooses to step into the frame. Either way, the Kra-Canal is a closer reality today than it has ever been. And for shipping, it will change the world.

CONCLUSIONS

- Despite the current energy price gymnastics, oil demand growth is past its heyday and will become an increasingly expensive addiction. The gas price advantage and environmental dividend over oil will prevail.
- Investment decisions postponed now, based on today's energy prices, will be viewed as increasingly inappropriate as prices rise.
- Most oil dependent economies today cannot cope long-term with today's low prices. With burgeoning populations and greater expectations, oil revenue dependent nations will either have to negotiate new credit lines to meet their fiscal obligations, cut production to raise oil prices, or witness their GDP/capita decline, with the political consequences that follow.
- The link between state and regional aid and LNG bunkers infrastructure and LNG shipping development is irrefutable. Governments must start to look at subsidies and incentives, not as a "nice to have", but as an imperative, if they want to be on the transport LNG map.
- There is a pressing need to establish a LNG bunkering presence in South East Asia. The vessels are coming. Whoever is first will anchor their place in the LNG bunkering world. Those that miss this boat will be bypassed.
- United Arab Shipping Company (UASC) early lead with large "LNG Ready" container vessels is now being followed by Japan's Mitsui OSK Lines. Lower operating costs that follow will be a source of competitive advantage over oil-fuelled rivals.
- The LNG industry has an excellent safety record, much to the credit of our industry predecessors. But, LNG as a transport fuel brings different challenges and is still subject to public scepticism, albeit much unfounded. But LNG is still a hazardous material and the absolute for a "zero accidents" mentality must never be taken for granted.
- For those establishing LNG bunkering infrastructure, the current regulatory maze is too complex, at times contradictory and too time-consuming. A single global standard and streamlined approach, replacing existing ad-hoc approaches, covering safety and operational parameters, is needed now to facilitate the fast introduction of LNG bunkers infrastructure.
- Looking forward, gas remains the most plausible and sustainable fuel for ships, with more than 200 years' supply in the ground. This will cover us until mid-2100s, when we can expect to be moving towards zero carbon energy options. In the short-term, other limited options, such as scrubbers or alternative fuels make sense where residual and replacement vessel values exceed the alternatives. But they are suboptimal. As such vessels age and the shipping market evolves, replacement with LNG fuelled tonnage will be an economic essential.

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