european LNG outlook

EUROPEAN LNG MARKET INTEGRATION

14—15 October 2015  Port of Valencia
SEA TERMINALS aims to boost the evolution of the port industry towards a progressive and effective low-carbon emission operative model, integrating smart and energy-efficient technologies (hybrid machinery concepts, LNG as a fuel, electrical heavy-duty vehicles) through innovative business and energy-efficient solutions, focused on heavy-duty handling machinery and equipment.

SEA TERMINALS will demonstrate by means of real life trials in the ports of Valencia (Spain) and Livorno (Italy) an integrated and comprehensive set of prototypes based on low-carbon emission technologies implemented in last-generation port machinery and equipment. All the prototypes tested and piloted will be business and market-sided oriented, thus being demonstrated their investment feasibility. The expected successful results in the pilot actions would provide valuable information and contribute decisively to many existing PCTs’ decision-making as they would have relevant proofs of how these technologies decrease their GHG emissions whilst reducing their energy bill and increasing their productivity.

www.seaterminals.eu • Testing the Way to Real Sustainability in Ports
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8-9 September 2016
venue: Helsinki

Baltic Ports Conference
& 25th anniversary

We are looking forward to meeting you in Helsinki!

Hosts
PORT OF HELSINKI

PORT OF HAMINAKOTKA

Organizer
BPO BALTIC PORTS ORGANIZATION

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LNG TRANSPORT FORUM

October 14-15th, 2015
Port of Valencia
Spain

EUROPEAN LNG MARKET INTEGRATION

EVENT IN BRIEF

DAY I: 14.10.2015
WORKSHOPS: SeaTerminals, BPO, LNG in BSP Projects, LNG Masterplan, GAiNN4MOS
STUDY TOUR: Port of Valencia and Noatum Container Terminal – by boat
NETWORKING COCKTAIL: Clock Building

DAY II: 15.10.2015
CONFERENCE: LNG Transport Forum
TERMINAL VISIT: Sagassas Terminal visit
PRESS CONFERENCE: KANFER SHIPPING – global launching

ABOUT THE EVENT

LNG Transport Forum: European LNG market integration – the platform of communication within the LNG sector in Europe – created for the gas industry, held on October 14-15th, in the Port of Valencia, Spain.

The 2-day event brings together high-class speakers, project representatives, business and other market players, as well as market analysts, delegates and key representatives from the European transport market.

This year the LNG Transport Forum agenda covers issues regarding LNG applicability in emission controlled areas, LNG synergy possibilities and innovation in ports.

Key industry representatives will gather in Europe’s fifth-busiest seaport’s modern facility to debate on the current topics and challenges for the industry to meet. This first edition of the LNG Transport Forum will be neatly reported, summarised and distributed among the European and world LNG representatives.
EUROPEAN LNG MARKET INTEGRATION

DAY 1
EU/TEN-T PROJECT WORKSHOPS
14/10/2015, Port of Valencia

08:30-09:00 REGISTRATION

09:00-13:00 SEATERMINAL INTERNAL MEETING (Neptuno Room)
Internal meeting. Invitation only.

10:30-11:00 COFFEE BREAK

10:00-13:00 LNG IN BALTIC SEA PORTS PROJECTS INTERNAL MEETING (Venus Room)
Internal meeting. Invitation only.

13:00-14:00 LUNCH BREAK / NETWORKING

14:00-16:00 WORKSHOPS (Neptuno Room)
Synergies between different transport sectors using LNG – presenting projects and a panel discussion including project managers & stakeholders
SeaTerminals & BPO
LNG in BSP Projects
LNG MasterPlan
GAINN4MOS

Workshop moderator:
Alan Arent, Event Director, LNG Transport Forum

15:00-15:30 COFFEE BREAK

STUDY TOUR
16:30-18:30 STUDY TOUR BY BOAT
Port of Valencia and Noatum Container Terminal

19:00-21:00 Networking cocktail
Clock Building

DAY 2
LNG TRANSPORT FORUM
15/10/2015, Port of Valencia, Conference Hall

Simultaneous translation (English-Spanish-English) will be available during the event.

08:30-09:00 REGISTRATION & WELCOME COFFEE

09:00-09:30 OFFICIAL WELCOMING ADDRESSES

Conference moderator:
Mark Bell, General Manager, SGMF

Official addresses:
Ramón Gómez-Ferrer, General Manager, Port Authority of Valencia

EVENT AGENDA

SESSION I:
LNG AS AN ALTERNATIVE FUEL IN EUROPE

09:30-09:55 LNG utilisation in port terminals
• Current market for LNG as a fuel in the ports
• Is there a sound business case when introducing LNG?
• LNG in your terminal – key challenges

Francisco Blanquer, Engineering and Innovation Manager, Noatum Ports

10:00-10:20 LNG Masterplan for Rhine-Main-Danube
• The project’s objectives and scope of work
• Pilot deployments and concepts achieved
• Contribution to EU policies and lessons learned

Manfred Seitz, General Manager, Pro Danube Management GmbH and Project Co-ordinator

10:20-10:45 In search of an alternative fuel
Manuel Lage, Secretary General of GASNAM (Iberian Association of NG for Mobility)

10:45-11:10 Kanfer Shipping – global launching
Norway-based Kanfer Shipping will be launching their turnkey solution: small and medium scale LNG transportation and floating terminal during the LNG Transport Forum conference. This is a unique solution that is price competitive and robust. The speech will be followed by a press conference where media from all over Europe as well as overseas will be available.

Stig A. Hagen, Director, Kanfer Shipping

11:10-11:30 COFFEE BREAK / PRESS CONFERENCE:
Kanfer Shipping – global launching (Venus Room)

SESSION II:
LNG APPLICABILITY IN EMISSION CONTROLLED AREAS

11:30-11:55 LNG in Baltic Sea Region
• LNG infrastructure in the Baltic Sea: current status
• Overview of LNG projects within the area – challenges and opportunities
• Recent developments and impact of SECA

Bogdan Oldakowski, Secretary General, BPO

11:55-12:20 Mediterranean LNG bunkering and ship retrofitting projects
• LNG infrastructure in the Mediterranean: current status
• LNG as marine fuel for the short-sea fleet operating in the Mediterranean: opportunities, risks and challenges
• Overview of upcoming LNG projects in the Mediterranean and Portugal

Eva Pérez-García, Project Manager, GAINN4MOS
12:20-12:45 Ports of Stockholm – LNG Infrastructure and bunkering procedures – case study
- Ports of Stockholm: meeting EU environmental requirements by utilising LNG
- LNG bunkering: method statements and checklist for truck, ship and terminal reloading
- The port’s environmental incentives and continuous LNG ambitions

Sandra Gegerfelt, Public Affairs Officer, Ports of Stockholm

12:45-13:10 LNG market and supply chain
- Brief overview of the US LNG market while aiming towards LNG as a clean marine fuel
- Drivers and hurdles for end users: Economics, supply chain and environmental benefits
- Short and long term plans and objectives

Keith Meyer, CEO, LNG America

13:10-14:10 LUNCH BREAK / NETWORKING

SESSION III:
TRANSPORT & ENERGY SECTORS:
LNG SYNERGY POSSIBILITIES

14:10-14:35 Spanish gas industry and possible synergies to increase LNG demand
- Natural gas in Spain: security of supply and infrastructure
- Spanish gas market – versatility and distinctive LNG synergies
- Present key issues and opportunities for Sedigas

Marta Margarit, General Secretary, Spanish Gas Association (SEDIGAS)

14:35-15:00 Port of Helsingborg: LNG potential in the transport and energy sector – case study
- Overview of the port’s LNG projects and activities in the region
- LNG alliances: Strategic location and integration amid transport and energy
- LNG small and large scale infrastructure intentions

Per Olof Jansson, Project Leader, LNG in BSP
Roland Brodin, Project Manager, AF Consult

15:00-16:15 DISCUSSION PANEL on the forum’s hot topics
- LNG infrastructure versatility and optional downstream services
- Feasibility and key drivers for developing LNG infrastructure & supply chain
- Encouraging LNG synergies among all sectors to increase demand

Panel moderator:
José Andrés Giménez Maldonado, Energy in Ports and Safety Director, Valenciaport Foundation

Panelists:

Mantas Bartuška, CEO, Klaipėdos Nafta
Mario Dogliani, Head of Project Financing, RINA Services
Emil Arołski, Project Manager, BPO & LNG in BSP
Francesco Papucci, Head of the Innovation, Technologies & Research unit, Livorno Port Authority
Fernando Marcos, Sales Director, Marine Area, MAN Diesel & Turbo España, S.A.U.
Conor Feighan, Policy Advisor, FEPORTEVENT

16:15-16:30 CLOSING CEREMONY
Antonio Torregrosa, Director of Projects, Valenciaport Foundation

16:30 END OF THE LNG TRANSPORT FORUM

17:00-19:30 SAGGAS TERMINAL VISIT
17:00-17:30 Bus transfer to Sagunto Port
17:30-19:00 Technical visit at SAGGAS
19:00-19:30 Bus transfer to Valencia Port

ABOUT US
Founded in year 2000, Actia Forum is specialised in delivering events/meetings and consulting that match the needs of the transport & logistics industry. Actia Forum’s portfolio covers two areas – events and consulting. By firmly standing on these two legs, we can guarantee that whatever goals our clients wish to accomplish, we are there to support them in their journey.

Events. We organise both our own events (such as Transport Week) as well as 100% ready projects if you plan to launch a conference, a meeting, a seminar dedicated to the transport sector or make a spectacular opening ceremony with a twist – just name your needs and leave the logistics to us.

Consulting. Our unique reports and consultancy expertise are used to lower investment risks and make business plans more secure – all of this for you to take a fast, financially sound and responsible decision. In other words – we help to make the right choice.

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HEKLA project aims at conducting physical investments into LNG bunkering infrastructure in the Helsingborg and Klaipeda ports, which are part of the Core Network of Maritime ports located on the Scandinavian-Mediterranean and North-Baltic Sea Core Network Corridors respectively. Their development significantly advances the Global Project of developing an LNG bunkering network in the ports of the Baltic Sea region.

Activities included in the Action are:
- project management
- LNG liquefaction plant in the Port of Helsingborg
- LNG Reloading Station by Klaipedos Nafta
- LNG campaign and LNG market development

The completion of the Project will be an important step towards creating LNG bunkering network, use of which will stimulate investment into a more sustainable maritime transport.
Building the LNG momentum

The first phase of the LNG in Baltic Sea Ports project has successfully ended, delivering valuable input. And as the project came to its conclusion, its follow-up took up the baton. We talk with Emil Arolski, Project Manager of LNG in Baltic Sea Ports II, about the first part’s reception, the main differences between the projects, the follow-up’s objectives as well as an outlook for LNG.

Aleksandra Plis: The first part of the ‘LNG in Baltic Sea Ports’ project kicked off in 2012. In your opinion what has changed regarding the Baltic LNG issues over the years?

Emil Arolski: The Baltic LNG initiative, whose idea was introduced for the first time by the Baltic Ports Organization back in 2011, set off one year later in September with seven partner ports with the aim of developing a harmonized approach towards setting up LNG infrastructure in the Baltic Sea region (BSR). Thanks to numerous meetings and the so-called stakeholders’ platforms, I can say with full confidence that the LNG situation in the Baltic has matured a lot over the past several years. As a clear sign of this, we now have four new partners who have joined the project with already concrete small-scale LNG infrastructure plans. On the seaside, however, the current state of affairs lingers behind since there are only two LNG-driven ships in the Baltic, the cruise ferry Viking Grace and the Turva patrol vessel of the Finnish Border Guard, but – as the newsletter’s LNG timeline shows – more will come in the more or less distant future.

Aleksandra Plis: How has Europe recognized the final outcomes of the project’s first part?

Emil Arolski: Both parts of the ‘LNG in Baltic Sea Ports’ fit well within the EU initiative of establishing LNG bunkering facilities throughout the TEN-T network and surely the projects’ expertise and know-how will come in handy in other corners of the Community in due time. Moreover, the first project as well as its follow-up have been granted the EUSBSR Flagship Project status by the Danish Maritime Authority which heads the Priority Area on Clean Shipping of the EU Strategy for the BSR, acknowledging the projects’ high macro-regional cooperation and eco-friendly impacts. Overall, we have received recognition for our accomplishments from the side of high officials from the European Commission, TEN-T and INEA (Innovation & Networks Executive Agency), not to mention interest shown by other stakeholders like LNG America and Fundación Valenciaport.

Aleksandra Plis: In what way does the follow-up project differ from the first one?

Emil Arolski: Firstly, there are four completely new partners, of which two aren’t strictly ports as in the first part. The Sundsvall Logistikpark is a partnership company of various stakeholders focused on environmentally-friendly development, while Klaipėdos nafta is a Lithuanian oil & gas major and operator of the floating LNG terminal Independence. Secondly, the project partners have tabled many more concrete actions to be undertaken than just doing just pre-feasibility studies. For instance, the Coordinator of the follow-up, the Port of Helsingborg, is to develop an LNG bunkering vessel design, naturally for construction and operation in the future. Both Trelleborg and Sundsvall will carry out engineering and technical studies concerning the set-up of LNG infrastructure. The Port of Rostock aims at obtaining all relevant LNG bunkering infrastructure permits in order to cater to the market with a bunker station. Klaipėdos nafta will execute technological studies together with going through a full environmental procedure as well as getting other necessary permits in order to choose the best location for a bunkering facility. These are the partners’ direct objectives and according to their development reports there are no particular critical delays.

Aleksandra Plis: From your perspective, what will the LNG Baltic market look like in 10 years’ time?

Emil Arolski: I’m very optimistic to see all TEN-T core ports having LNG ship bunkering infrastructures in place by 2025. In turn, we’ll most likely experience a significant growth in LNG demand as marine fuel, not only in the Baltic, but also Europe-wide. There were, however, very optimistic estimations done by DNV GL in the past of more or less 1,000 ships running on gas by 2020, undermined nowadays to some extent by falling prices of traditional bunkers. Nonetheless, this forecasted downturn in my mind is only temporary as we’ll most likely experience a more positive development in years to come. What’s very interesting as well, is the potential upside in LNG demand on the landside. LNG is discussed more and more as a viable and cost-saving alternative fuel, be it for heavy-duty industries like power stations and refineries (Preem’s LNG terminal in Lysekil is a good example here), for overland transports (LNG-driven trucks), as part of container terminals’ vehicle fleet (LNG-powered reach stackers, tractors and dual-fuel gantry cranes) or in the overall oil-to-gas transition. Therefore, most likely the future will bring even more LNG projects and promotional campaigns supported by the European Commission as well as win-win synergies among various stakeholders.

LNG in Baltic Sea Ports II

PROJECT INFO

Project Leader: Per-Olof Jansson, Chairman of the Steering Group, Port of Helsingborg (SE)
Project Manager: Emil Arolski, Head of International Development, Actia Forum Ltd. (PL)
Partners I: Port of Aarhus (DK), Copenhagen Malmo Port (DK/SE), Port of Helsingborg (SE), Port of Helsinki (FI), Port of Stockholm (SE), Port of Tallinn (EE), Port of Turku (FI)
Timetable: January 2012-December 2014
Partners II: Port of Helsingborg (SE), Port of Trelleborg (SE), Sundsvall Logistikpark (SE), Port of Rostock (DE), Klaipėdos nafta (LT)
Timetable: January 2014-December 2015

FOR MORE INFORMATION: www.lnginbalticseaports.com

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Trans-European Transport Network (TEN-T)

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LNG in Baltic seaports and the latest on the LNG market

Since January 1st, 2015, stricter limits concerning sulphur content in marine fuels have become a fact within the Sulphur Emission Control Area (North Sea, the English Channel and the Baltic Sea). There are several options that ship-owners can implement to meet the new regulation and LNG is one of them. Widespread use of LNG as a ship’s fuel depends on many factors, among which the main are the existence of a special LNG infrastructure and the whole LNG fuel distribution system, the price of LNG and its relation to the price of alternative fuels and solutions (Maritime Gas Oil or Intermediate Fuel Oil coupled with scrubbers).

This report focuses on the main issues concerning the use of LNG as a ship’s fuel. It provides the latest overview of existing LNG infrastructure in Europe and the Baltic region, plans and projects of small-scale LNG facilities within Baltic seaports (with a special focus on the activities carried out within the LNG in Baltic Sea Ports and LNG in Baltic Sea Ports II projects), LNG fuel prices and pricing mechanisms, an overview of the world’s LNG-powered fleet, LNG synergies among energy and transport to increase demand.

The report was prepared on the basis of the Baltic Ports LNG Forum that took place in Klaipėda on April 23rd, 2015. The forum was organised within the framework of Activity 7 (Harmonisation, LNG know-how transfer & training) of the LNG in Baltic Sea Ports II project co-financed by the EU TEN-T Multi-Annual Programme. The event gathered representatives from seaports, gas infrastructure operating companies, gas trading companies, governmental institutions, transport agencies, and other companies and organisations. Other sources have also been used to elaborate this report, such as: ship-owners’ websites, websites concerning bunker fuels prices, ports’ websites, etc.

LNG ports’ infrastructure – the latest on the European and Baltic markets

Today LNG infrastructure in European ports comprises mostly large-scale import terminals. However, more and more small-scale facilities primarily dedicated to industrial users and shipping are being developed. Currently, there are 28 LNG import terminals in operation in Europe of a total annual capacity reaching around 210 bln m³ (Fig. 1). Most of them (24) are large-scale terminals (with an annual handling capacity of at least 1 bln m³), the remaining four terminals are small-scale facilities with a capacity ranging from 0.15 to 0.5 bln m³ per year. The European leader in terms of LNG import infrastructure is Spain with seven large-scale onshore LNG import terminals with a total capacity exceeding 68 bln m³. Four LNG terminals are located in Great Britain (52.3 bln m³), three in France (21.65 bln m³), three in Italy (14.71 bln m³), two in Norway, Turkey, Sweden, whilst five countries have one LNG terminal (Belgium, Netherlands, Greece, Lithuania and Portugal). In the near future European LNG import infrastructure will enlarge by eight facilities. These will be two large terminals in Spain, one in Poland, one in France and four small-scale

Photo: Höegh LNG
The Port of Trelleborg (Sweden). The objective of Helsingborg’s activity within the LNG in BSR II project is to design a multifunctional bunkering ship solution in southern Sweden. The main purpose is to identify a technical and functional solution for a bunker ship that can operate in the area. The bunker ship will be a multi-function ship that can provide LNG bunkering, MGO bunkering, as well as other ship supply services. The following shall be stated for the LNG bunker ship: size, number of fuel tanks, type of bunker fuel that the ship shall carry (the ship shall be running on LNG), type of other services that should be performed by the ship and its crew, bunkering devices and type of bunkering procedures, functional demand regarding bunkering (weather condition, wave height, safety devices, flow demands, ice class, etc). The outcome of this activity will be the technical design of a multi-functional bunker ship that will satisfy all important stakeholders in the area. It will require that the conditions in the local ports must be assessed.

The Port of Trelleborg (Sweden). The port intends to build a ferry terminal adapted to ferries powered by LNG. Within the framework of the project, the port is going to do a basic design of a berth for ships. This activity will consist of a context analysis to identify among others existing bunkering facilities in Finland. Altogether 26 other LNG import terminals are planned within the whole of Europe (Tab. 1).

Looking closely at the Baltic market, three LNG import terminals can be indicated (one large-scale and two small-scale terminals). The first LNG terminal in the region was put into operation in Nynäshamn (Sweden) in 2011. The LNG terminal in Nynäshamn is a small size terminal (0.5 bln m³/year, 20 thou. m³ of storage), which supplies LNG to a neighbouring crude oil refinery and the Stockholm gas grid. From the terminal, LNG is distributed by truck and a pipeline. In 2014 a second small-scale LNG import terminal was opened in Sweden. The terminal is located on the west coast of Sweden in Lysekil. The terminal is equipped with a storage tank of 30 thou. m³ and its capacity is 0.3 bln m³. The facility valued at EUR 83.5 mln is a joint project of Skangass and Preem. Gas from the terminal is delivered directly to Preem’s nearby refinery with the use of a pipeline. However, there is the possibility of delivering to other land-based industries by tank truck as well as to marine clients.

The first large-scale LNG terminal within the Baltic Sea region was put into operation in December 2014 in Lithuania. The central element of Lithuania’s LNG terminal is the Floating Storage and Regasification Unit (FSRU), which is permanently moored in the southern part of the Port of Klaipeda. The unit was ordered by the Norwegian company Höegh LNG, and then chartered to Klaipėdos nafta under a ten-year lease agreement signed in March 2012, which also includes an option for purchase. The FSRU is equipped with four storage tanks of a total capacity of 170 thou. m³. The maximum annual handling capacity of the terminal is 4 bln m³. Statoil is contracted to supply LNG for five years to cover the minimum operational needs of the terminal. In 2015, Statoil will supply 540 mln m³ of natural gas.

This year Baltic LNG infrastructure will be enlarged by another large-scale LNG import terminal. Currently, a large onshore terminal is under construction in Świnoujście, Poland. The terminal will have an unloading jetty for large LNG tankers, two storage tanks each of 160 thou. m³ and a regasification train. The terminal’s initial regasification capacity will be 5 bln m³ per annum with the possibility to expand to 7.5 bln m³ per annum. The Świnoujście LNG terminal will accommodate methane carriers ranging from 120 thou. m³ to 216 thou. m³ in capacity. At the end of the first quarter in 2015, the terminal was 96% ready and it is planned that construction works will be concluded by this year’s end. LNG will be delivered to the Polish terminal from Qatar.

Construction of large-scale LNG import terminals has also been considered by Estonia and Finland. Initially, it was assumed that terminals would only be constructed in one of the two countries since the European Union intended to co-finance just one LNG terminal which will serve countries located within the southeast Baltic region. However, in autumn 2014 Finland and Estonia reached an agreement to build two LNG terminals, connected by a pipeline across the Gulf of Finland by 2019. A large regional terminal would be built in Finland while Estonia would get a smaller gas distribution terminal. Finnish Gasum is planning to build an LNG terminal in Inkoo (Finland) and the Estonian terminal will probably be located in Muuga. Estonia initially had two competing locations for the regional LNG terminal, Muuga near Tallinn where the state-owned Port of Tallinn was interested in developing it, and Paldiski in north-west Estonia where Alexela Energia wanted to build it.

Many more projects and initiatives can be indicated in the field of small-scale LNG infrastructure. Activities regarding small-scale LNG infrastructure are dedicated mostly to the shipping sector as well as industrial users. In most Baltic countries there are plans to establish at least one small-scale LNG terminal. Some plans are more advanced, some less. Below is a description of small-scale LNG initiatives within LNG in the Baltic Sea Ports I and II projects, as well as other small-scale LNG initiatives within the Baltic Sea region.

**Activities in ports participating in the LNG in the Baltic Sea Ports II project**

The Port of Helsingborg (Sweden). The objective of Helsingborg’s activity within the LNG in BSR II project is to design a multifunctional bunker ship solution in southern Sweden. The main purpose is to identify a technical and functional solution for a bunker ship that can operate in the area. The bunker ship will be a multi-function ship that can provide LNG bunkering, MGO bunkering, as well as other ship supply services. The following shall be stated for the LNG bunker ship: size, number of fuel tanks, type of bunker fuel that the ship shall carry (the ship shall be running on LNG), type of other services that should be performed by the ship and its crew, bunkering devices and type of bunkering procedures, functional demand regarding bunkering (weather condition, wave height, safety devices, flow demands, ice class, etc). The outcome of this activity will be the technical design of a multi-functional bunker ship that will satisfy all important stakeholders in the area. It will require that the conditions in the local ports must be analysed.

The Port of Trelleborg (Sweden). The port intends to build a ferry terminal adapted to ferries powered by LNG. Within the framework of the project, the port is going to do a basic design of a berth for ships. This activity will consist of a context analysis to identify among others existing bunkering
possibilities; interest of customers in LNG bunkering; an assessment of safety and other regulations, containing risk assessment and a technical description of the final design for berthing incl. loading/uploading of ships and facilities to store and bunker LNG to ships. Another activity within the project concerns technical design of an LNG storage and bunkering facility at berth. The scope of this activity is to elaborate the project design, incl. existing LNG storage facilities, tank design, potential adjustment of berth, LNG demand forecast. This activity will also study the possibilities of LNG transport to the port storage facility—either by land or by sea.

The Port of Sundsvall (Sweden). The Port of Sundsvall is investigating the possibility to develop LNG bunkering infrastructure facilities in Sundsvall Logistikpark. The aim is to offer an LNG bunkering possibility for vessels. Secondly, the project will provide access to alternative fuel supplies for the logistics park and port vehicles, to offer LNG to the region’s process industries as well as being a backup to the biogas. Within the project a comprehensive LNG infrastructure planning is going to be carried out. It will include design of an LNG bunkering infrastructure facility including an LNG storage and bunkering facility for ships with a possible option for bunkering of port vehicles and trucks (size, type of storage tanks, etc., to be studied), long tubing/piping, efficient transhipment and transport, risk assessment and safety aspects related to the above and the permit process.

The Port of Rostock (Germany). Within the project, the port plans to prepare all documentation for bunkering operations; this will include all necessary permits for the bunkering procedure itself as well as preparation of the technical design for an LNG bunkering and storage plant. The following design will be undertaken in relation to the port infrastructure development of an LNG bunker station: complete technical design of an LNG-import berth for bunkering purposes, complete technical design of an LNG-bunker berth, complete technical design of a pipeline connecting the storage with the berth and the road- and rail-loading units, complete technical design of LNG storage and road-/rail-loading facilities, a safety analysis assessing the risks for the plants in the vicinity of the LNG bunkering facility location.

The Port of Klaipeda (Lithuania). Klaipėdos nafta, operator of the first LNG terminal in Lithuania, also plans to develop a small-scale LNG onshore reloading and bunkering facility. Within the project a technological design study is planned. Its aim is to perform a detailed analysis of current infrastructure and superstructure in the territory of Klaipėdos nafta in order to assess possibilities to develop new LNG infrastructure. The study will make recommendations for needed adjustments to the current infrastructure and superstructure, and would suggest the optimal area for developing small-scale LNG infrastructure in the area controlled by Klaipėdos nafta. Within the technological design study also a description of possible technologies for small-scale LNG infrastructure will be provided concerning at least: a jetty, superstructure and infrastructure, cryogenic piping, LNG storage, LNG bunkering, LNG distribution equipment (suitable for trailers, trucks) which could be installed in the area. Within the project such activities will also be done as front end engineering design and Quantitative Risk Assessment, environmental procedures and permits.

Activities in ports participating in the LNG in the Baltic Sea Ports

The Port of Stockholm (Sweden). The Port of Stockholm is the first port within the Baltic Sea region where the LNG bunkering operation is performed. The port started to offer LNG bunkering operation in January 2013, when Viking Line’s ship Viking Grace was put into service. Initially, Viking Grace was refuelled from a tank truck. However, at the beginning of April 2013 ship-to-ship bunkering started on the regular basis. The first vessel for bunkering purposes, Seagas, was formerly a passenger ferry vessel, however, it has been converted into an LNG bunker ship. The project was carried out by AGA AB in the Port of Stockholm. The bunker vessel is based in the Port of Stockholm and provides fuel to the newly

Fig. 2. Existing and planned LNG bunkering facilities within the Baltic Sea region

Source: Baltic Ports Organization

Fig. 2. Number of LNG-propelled vessels in service per vessel segment (as of May 2015)

Source: DNV GL
LNG-powered Viking Grace ferry. The project cost EUR 1.3 mln, of which EUR 261 thou. came from the European Union's TEN-T programme. The LNG-fuelling vessel is classified under the same regulations that apply to oceangoing LNG-tankers. The fuelling vessel performs on a daily basis, supplying 60-70 tn of LNG to Viking Grace. The fuelling process takes just under an hour. The natural gas used as fuel for Viking Grace comes from AGA's LNG terminal in the LNG terminal in Nynäshamn.

The Port of Aarhus (Denmark). The Port of Aarhus has developed a feasibility study, showing the suitable size, location, approximate cost and type of LNG terminal. The subsequent activity is the design of a terminal area and the process of retrieving a permit from relevant authorities. The design and the permit process is currently ongoing and is expected to be finalized in 2015. The capacity of planned tanks will be 10 thou. m³. The terminal will be equipped with several semi-pressurized tanks of about 1,400 m³ each. The main users of the terminal will be ferries; it is going to be located within ferry terminal.

Copenhagen Malmö Port (Denmark/Sweden). A feasibility study has been carried out in the ports of Copenhagen and Malmö showing the needed volumes, possible locations of an LNG terminal and approximate cost. Three locations within the Port of Malmö were investigated and one has been chosen in the northern part of the port. The recommended solution for the terminals is semi-pressurised tanks with total volumes of 10 thou. m³.

The Port of Helsinki (Finland). In the Port of Helsinki a feasibility study of LNG bunkering possibilities at the Port of Helsinki, including the South Port, West Port and the Vuosaari Harbour have been carried out. From the study it has been determined that the most practical solution for LNG-refuelling of ships is ship-to-ship bunkering. The bunkering capacity and location have not been decided yet. Currently, in the Port of Helsinki tank-to-ship bunkering is possible. Bunkering is now taking place for the Finnish Border Guard’s new LNG-fuelled offshore patrol vessel Turva. The vessel operates in the Gulf of Finland and it is possible to replenish fuels at various ports in the Gulf of Finland, such as Hanko, Hamina, Vuosaari, Turku, Pori and Raase where LNG will be delivered by Skangass by road tankers from the company’s own production plant in Porvoo.

The Port of Turku (Finland). In May 2012, Gasum and the Port of Turku signed a letter of intent to build an import terminal for LNG in the Pansio Harbour. It is assumed that the terminal will supply LNG to shipping as well as the industry in southwest Finland and neighbouring provinces. The initial stage bunkering could be done by tank truck and at a later stage, it would be possible ship-to-ship bunkering. The capacity of the storage tank is planned to be maximum around 30 thou. m³. A proposal of the local detailed plan for the Pansio LNG terminals area was accepted in June 2013. The terminal was planned to be operational in 2015, but an appeal regarding the terminal has been made to the Turku Administrative Court which has delayed the project. However, the court case has been now resolved and the LNG project is to continue further.

The Port of Tallinn (Estonia). Together with Vopak LNG and Elering, the Port of Tallinn has been studying the possibility of establishing an LNG terminal in the Muuga Harbour near Tallinn. The small LNG facility terminal would serve the bunkering market of the ships, large industrial customers and small commercial and domestic customers. This could be considered as a first phase of the larger project, as companies are investigating the possibilities to develop a large-scale import terminal.

Initiatives in other Baltic ports

The Port of Gothenburg (Sweden). The LNG terminal in Gothenburg is a joint initiative of Royal Vopak, a specialist in the storage of LNG and other energy products, and the infrastructure company Swedegas, which owns and operates the gas grid in south-west Sweden. The LNG terminal

<table>
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<td>Fjord Line</td>
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<td>Patrol vessel</td>
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<td>2014</td>
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<td>Buksér &amp; Berging</td>
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<tr>
<td>2014</td>
<td>Gas carrier</td>
<td>Veder Rederijzaken</td>
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in Gothenburg is also part of a project being run together with the Port of Rotterdam and Gasunie to create an efficient LNG infrastructure between Sweden and the Netherlands. The terminal will supply LNG to industry and shipping and will be open to all parties interested in the Swedish market. The planned storage capacity of the fully developed terminal is 30 thou. m\(^3\). The terminal is being built in the Skarvik Harbour. The facility is planned to be put into operation in 2015.

The Port of Gävle (Sweden). A small-scale LNG terminal is planned to be built in Gävle. The terminal will be built by Skangass; construction works are planned to start in 2015 and the terminal will be ready in 2017. The terminal will be equipped with one storage tank of 30 thou. m\(^3\) and will have a handling capacity of up to 500 thou. tn of LNG per year.

The Port of Hirtshals (Denmark). The project in Hirtshals is co-financed by the EU’s TEN-T Programme. The project assumes development of a 200 tn/500 m\(^3\) pilot LNG storage tank and bunkering facility, with the perspective to develop it into a larger one of 3,000-5,000 m\(^3\). The new facilities will provide LNG for ships, as well as regional consumers including road transport. The project is to be completed in 2015.

The Port of Hou on the island of Samsø (Denmark). In February 2015, the first gas-driven domestic ferry in Denmark was bunkered in the Port of Hou. The bunkering facility in the Port of Hou was delivered by Kosan Crisplant as a turn-key solution. Kosan Crisplant’s complete turnkey solution included inter alia a cryogenic transfer pump unit built into a 20-foot container, a piping system including specially designed for LNG dry couplings, two specially designed LNG road tankers, a parking ramp for road tankers, a control system including a safety system. The LNG bunkering facility makes it possible to fuel a ferry for a whole day’s operation in less than 30 minutes.

Finish ports of Tornio, Pori, Rauma and Haminakotka. Within the next few years four small-scale LNG import terminals are going to be built in Finland. In 2014 The Finnish Ministry of Employment and Economy granted a total of EUR 92.8 mln for four new LNG terminals. The terminals are going to be located in Tornio, Pori, Rauma and HaminaKotka. The terminal in Tornio will be built by Manga LNG Oy and will be equipped with an LNG storage capacity of 50 thou. m\(^3\). It is scheduled to be put into operation in 2017. The terminal in Pori will be built by Skangass Oy. The Pori terminal will have an LNG storage capacity of 30 thou. m\(^3\). It is scheduled to be ready in autumn 2016. Rauma’s terminal is going to be built by Oy Aga Ab. The combined storage capacity of the Rauma terminal’s eight LNG tanks will be 10 thou. m\(^3\). Work on the terminal is set for completion in early 2017. The terminal in HaminaKotka will be built by Haminan Energia. The Haminan Energia LNG terminal, which is scheduled to be ready in 2018, will be equipped with one LNG tank of 30 thou. m\(^3\) and facilities related to receiving, unloading, storing and delivering LNG. It is planned that all terminals will supply LNG to industry, maritime transport and road transport.

### Fig. 3. Number of vessels on order per vessel segment (as of May 2015)

<table>
<thead>
<tr>
<th>Year</th>
<th>Type</th>
<th>Owner</th>
</tr>
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<tr>
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<tr>
<td>2015</td>
<td>PSV</td>
<td>Siem Offshore</td>
</tr>
</tbody>
</table>

1 LNG carriers and inland waterway vessels are not included
2 Conversion project

Source: DNV GL
The LNG-fuelled fleet

As of May 2015 there were 63 LNG-fuelled ships in operation and 76 ships on order. Still, over 80% of all LNG-fuelled vessels in operation are only sailing in Norwegian waters and mainly represent small ships such as small car/passenger ferries, offshore ships (Platform Supply Vessels, PSVs), tugs, patrol vessels (Fig. 2). However, now there are also several larger vessels powered by LNG in operation, such as large ro-ro and ro-pax vessels, general cargo vessels, gas carriers (excluding LNG carriers).

The first large LNG-powered vessel, the ferry Viking Grace owned by Viking Line, has been in the operation since January 2013. It is the first LNG-fuelled vessel that has been put into operation in the Baltic Sea. The 57,000 GT ferry operates between Turku in Finland and Stockholm in Sweden. It has a length of 214 m, a width of 31.8 m and is able to accommodate 2,800 passengers. The ferry is equipped with four Wärtsilä dual fuel (LNG/diesel) engines, of a combined power of 30,400 kW. Viking Grace consumes about 60 tn of LNG per day and about 22.5 thou. tn per year. The ferry cost around EUR 240 mln, of which EUR 28 mln came from a Finnish Government subsidy.

Large LNG-powered vessels are also operated by Fjord Line on the routes between Norway and Denmark. Fjord Line’s two cruise ferries, Stavangerford and Bergensford, were built at Bergen Group Fosen. The first vessel entered into service in July 2013, while the second in March 2014. The 25,000 GT ferries are 170 m long, 27.5 m wide, and are able to accommodate 1,500 passengers. These vessels are the first and the largest cruise ferries in the world to sail with a ‘single LNG engine’ which means that they solely use LNG fuel.

One of the LNG-fuelled ferries that was recently put into operation (March 2015) is Samsø. The ferry was ordered by the Samsø Municipality (Denmark) and has been dedicated for a domestic Danish route, between mainland Hou (Jutland) and the island of Samsø. The ferry is an LNG double-ended ferry with dual fuel engines built in Remontowa Shipbuilding, Poland. The vessel is 100 m long and is able to carry 60 personal cars, or 16 lorries as well as 600 passengers.

As of May 2015, there were 76 LNG-powered vessels on order worldwide. Most of these vessels are dedicated for the European and American markets (Fig. 3). It can be indicated that among the ordered ships, the largest part constitutes four types of vessels: container ships, car/
In the case of car/passenger ferries, five out of 13 orders are dedicated for European routes, and the rest for Canadian routes. Among these seven ferries are two ships ordered by the German ferry owner AG Em, and scheduled to be delivered in 2015. The first order is a conversion project. The existing ship, Ostfriesland, is being retrofitted with Wärtsilä’s 20DF engines and an LNGPac. The ship is being rebuilt and its length will increase from 78.7 m to 92.7 m and will accommodate 1,200 passengers. The second ship, Helgoland, is a newbuild that is scheduled to be delivered in summer 2015. The cost of the new vessels is estimated at EUR 30 mln. The ships are dedicated for domestic German routes.

In the case of liner vessels, there are also four ro-ro ships, two car carriers and two ro-pax ships ordered. Among the ro-ro ships one is dedicated for the Norwegian market and the others for the American and Australian markets. The ro-ro ship dedicated for the Norwegian market was ordered by Nor Lines AS, a Norwegian logistics and shipping company. The 5,000 dwt vessel is being built by Tsuji Heavy Industries (Jangsu) in China and was scheduled for delivery before summer 2015. This is the second ship of its kind ordered by the ship operator, the first one was delivered in February 2015.

Two car carriers have been ordered by United European Car Carriers (UECC). The vessels will be 181 m long with a 30 m beam, able to take on-board approx. 3,800 standard sized cars across 10 decks. Both vessels will be dual-fuel, capable of operating on LNG or Intermediate Fuel Oil/ Marine Gas Oil. According to UECC, its new car carriers will have the possibility to complete a 14-day round voyage in the Baltic using solely gas (incl. the main engine and auxiliary power generation). Deliveries of both new units are scheduled to take place in the second half of 2016.

Each of the ro-pax ships was ordered by Rederi AB Gotland. The new ferry will be chartered to Destination Gotland, one of Rederi AB Gotland’s subsidiaries, and put on its Nynäshamn-Visby line, replacing two smaller and older high-speed crafts, Gotlandia (700-passenger capacity) and Gotlandia II (780 passengers). The investment (approximately EUR 160 mln) was placed in the Chinese GSI shipyard. The new 1,650-passenger capacity vessel is scheduled for delivery in the first half of 2017. Most recently Rederi AB Gotland placed a twin order, to be delivered one year after the initial LNG ferry.

Another LNG-fuelled ro-pax ship was also ordered by Spanish operator Baleària. The LNG propulsion will be installed on-board the existing ferry Abel Matutes which operates between Barcelona and Palma de Mallorca.

**LNG fuel prices**

To build an overview of the LNG price issue, we will look a little bit closer at the prices of LNG on major global markets. As it can be seen in Figures 4 and 5, the LNG prices vary widely by region. The reasons for these differences is that the international gas market is fragmented by legal and regulatory requirements, it lacks international transparency and benchmarks, and there are different approaches to contracting. Generally, there are three major pricing systems in the current LNG contracts worldwide. First, oil indexed contract used primarily in Japan, Korea, Taiwan and China. Secondly, oil and oil products indexed contracts used primarily in Europe. And thirdly, market indexed contracts (price driven by supply and demand) used in the USA.

The highest prices for LNG are observed in the Asian Pacific market, which is currently dominated by long-term contracts indexed to oil prices. As a result, when oil prices were high, so were LNG prices (Fig. 4). In March 2013 Asian customers paid between USD 15 to 20 per mmBtu of LNG. The dramatic drop in oil prices across the globe due to weaker demand and increased supply (which started in the mid-2014), had its reflection in the decrease in LNG prices. In April 2015, LNG prices on the Asian Pacific

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**Table: DNV GL**

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<th>Type</th>
<th>Owner</th>
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Source: DNV GL
market were at around USD 7-8 per mmBtu. The lowest prices for LNG have always been paid in USA, where the gas price is driven by supply and demand and further set by gas-to-gas competition. In March 2013 in USA one mmBtu cost around USD 3-3.5, while in April 2015 the price ranged between USD 2.5-3.5 per mmBtu. In Europe where the LNG gas price mechanism is linked to the crude oil and oil products prices, LNG prices are mostly somewhere in between the USA and Asian prices. In March 2013 the price for mmBtu of LNG was at around USD 15 (Spain) and USD 10 (the UK and Belgium), whilst two years later, in April 2015, it was around USD 7 per mmBtu, which means that the LNG prices in Europe were comparable with the Asian prices.

LNG as a bunker fuel has already been available in some locations within the North and Baltic Seas. Currently, there is a possibility to deliver LNG to maritime clients in southern Norway, southern Sweden, southern Finland and in all of Denmark by Skangass. Bunkering of LNG-powered sea-going vessels is also possible in the Port of Zeebrugge and Rotterdam by the Dutch LNG supplier, LNG Europe. In some locations in Europe there is also the possibility to bunker inland-going vessels, and the possibility of sea-going vessels is investigated (for example: Amsterdam, Antwerp). However, still the LNG bunkering market is a niche market. LNG as a ship's fuel is sold on a small-scale to a few customers from shipping sectors, each ship-owner is treated individually and the prices are settled individually according to a customer's needs. Today, two main LNG fuel pricing mechanisms exist, namely LNG fuel price index to Hub prices or LNG fuel price index to MGO prices.

For example, Skangass is able to index the LNG price to HFO prices, MGO prices or Gas Hub prices, the choice depends on its clients' preferences. Generally, after discussions with one of its client from the maritime sector, it usually ends up with the gas index price. Skangass offers both spot supplies and long-term contracts. Spot supplies are...
popular among PSV vessels operators in Norway. In agreements with these operators there are no fixed volumes, and the company delivers LNG to the vessels when they need it. The other company that is able to deliver LNG to maritime clients, LNG Europe, quotes LNG at the Zeebrugge Hub price. They mainly focus on long-term relations but are also open to other forms of cooperation.

In the first half of 2014, the price of the LNG index to MGO, was generally 30% to 80% higher than the LNG index to Hub prices. The situation started to change in the second half of 2014, when prices for MGO began drifting down significantly, which was related to the drop in oil prices across the globe. As a consequence, the price for the LNG index to MGO and price of the LNG index to Hub became comparable and in some cases it was possible to get a lower price indexed at MGO than the Gas Hub price (Figure 19). The lower prices for MGO made the LNG index on Hub less competitive than it was before the decrease in prices of bunker fuels.

When LNG is indexed to MGO, it means that some discount to the price of MGO is made, to compete with LNG. When LNG is indexed to the Hub price it means that the whole price includes the LNG price at Hub and additional costs connected to the LNG fuel supply chain, such as costs of storage, cost of transhipment to local port facilities and further to the end user. Generally, the more steps the LNG fuel supply chain include, the higher the final price is. Hence, it is indicated that the lowest price possible to offer import terminals or large liquefaction plants depends on the access to cheap gas. The final price also depends on the LNG bunkering solution (ship-to-ship, track-to-ship, onshore installation). Different
solutions generate different costs, which affect the final LNG fuel price. Moreover, the future LNG fuel price levels depend on a series of different factors which are characterized by high uncertainty. The most important among these factors are: the level of demand, the level of supply, the oil-gas price relation, development of alternative fuels, and geopolitical developments.

Additionally, analysing the prices of LNG, two different sources of LNG have to be indicated, which can have an impact on the final price for the shipping sector. In the first model the basic supply chain link is the LNG import terminal. From the terminal LNG is transported to the place of bunkering via tank trucks or bunker vessels or LNG from a hub is transported to a smaller scale LNG terminal, where it is unloaded to the storage tanks and then loaded onto bunker ships or tank trucks that carry LNG to the place where bunkering operations are performed. In addition, small LNG terminals may be constructed in the vicinity of the quay where LNG-powered vessels are moored. In such case, the bunkering operation can take place from fixed onshore tanks via a pipeline system.

The second model assumes that LNG terminals for bunkering purposes are supplied from the land side and not from the sea side (in such case the supply chain does not include a hub terminal). In this case, gas is sent via a pipeline system to the liquefaction plant, which is connected to an LNG bunker station. This supply chain is characteristic for Norway. In most European countries the first model will be dominant.

**LNG synergies among energy and transport**

More and more often possible LNG synergies between energy and transport are indicated. Generally, it would be more beneficial to create synergies between different users in one particular area rather than concentrate on one market segment with a wider regional focus. This would be beneficial for both LNG terminal operators (optimisation of operational cost) and users (improvement of LNG pricing). Besides maritime transport, terminals’ capacities can also be used by land transport users, industry and gas systems.

Today LNG as a fuel for land transport applies mainly to the heavy on-road trucks and busses (especially city busses). All major truck manufacturers offer natural-gas engines, either as dedicated (mono-fuel) Otto-cycle engines or as Diesel-cycle engines. While dedicated Otto-cycle engines run exclusively on 100% natural gas, dual-fuel engines run on methane-diesel mixtures with diesel substitution rates of 50 to 95%, according to the German Energy Agency DENA. The following operators are already using an LNG-powered fleet: Rolande, DHL, UPS, Coca-Cola, Tesco, ASDA, Simon Loos, and VOS Logistics. The average fuel consumption of a typical LNG-fuelled truck equipped with a dedicated mono-fuel engine of power 200-250 kW can be at around 26-28 kg/100 km.

In Europe LNG-fuelled trucks are already operating successfully in the Netherlands, Spain, the UK and Sweden. It seems that the leader in the number of LNG-fuelled road vehicles is the Netherlands. In June 2014, 231 LNG-fuelled trucks were running in that country (which accounts for about 0.3% of the total truck fleet). It is forecasted that in 2020 there will be approximately 40 thou. such vehicles. Today (as of October 2014) there are eight filling stations for trucks. In Spain, approx. 150 trucks use this fuel at the moment, but forecasts suggest that about 5,000 LNG-powered vehicles could be on the Iberian Peninsula by 2028, 3% of the total fleet. In the case of LNG-powered busses it seems that Poland is the pioneer. In October 2013 Gazprom Germany and Solbus introduced Europe’s first 11 LNG-city busses in the Polish city of Olsztyn. In the first quarter of 2015, five LNG-fuelled busses were in the Polish capital of Warsaw.

Today, the use of LNG as a fuel in land transport is limited by the low number of refuelling points. However, according to an EU Directive on the deployment of alternative fuels infrastructure an appropriate number of LNG refuelling points accessible to the public should be put in place by December 31st, 2025 at the latest, at least along the TEN-T Core Network existing at that date and, after that date, on the other parts of the TEN-T Core Network where these are made accessible to vehicles. The Directive indicates that the necessary average distance between refuelling points should be approximately 400 km. This allows for the assumption that in the future LNG becomes a more and more popular fuel for land transport.

In the future LNG can also be used by port terminals to power ports’ handling equipment such as terminal tractors, reach stackers, empty container handlers and RTG. Currently, LNG fuel terminal tractors have been used for example in USA. In Europe, within the framework of Sea Terminals which is coordinated by the Valenciaport Foundation, the prototypes of Eco-RTG based on duel LNG/diesel fuel (SEA-RTG Dual Fuel) will be developed.

LNG from the terminal can also supply land-based customers. The main land-based customers that may generate the most significant demand for LNG are first of all industrial customers such as power plants, refineries, chemical industry, and steel manufacturers. Further comes the potential demand from households or non-households application such as hospitals, schools, hotels, etc. LNG to the final users can be transported by tank truck in liquid form, if the user has his own LNG storage and regasification facility or by pipeline infrastructure, especially if the user is located in the vicinity of the terminal as such infrastructure is built. Moreover, the terminal can also supply the port’s town gas grid.

Analysing the market of potential clients from land-based sectors of the proposed LNG terminal, boil-off gas should be taken into account. Boil-off gas is formed during the transfer and storage of LNG. LNG is handled at an ultra-low-temperature of -160°C, partial gasification due to natural heat input from the outside cannot be avoided in LNG facilities. Generally, the boil-off gas rate is about 0.05% of tank volume per day. Boil-off gas can be re-liquefied and returned to the storage or compressed and sent as natural gas, for example, to the city’s gas companies or industrial consumers of gas located nearby the terminal.

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**Fig. 8. LNG pricing mechanisms**

![LNG pricing mechanisms](image)

*Source: Sund Energy*

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By Monika Rozmarynowska, Consultant at Actia Forum

Monika Rozmarynowska is a Researcher at the Gdynia Maritime University’s Department of Transport and Logistics. She also works as a Consultant at Actia Forum, a company established in 2000 which is specialised in delivering events/meetings and consulting that match the needs of the transport & logistics industry.
With such a bleak scene in Asian demand, the question is, can we see Europe as an alternative hub? Can Europe be the game changer?

This article discusses that the recent fall in oil prices has made LNG competitive to piped gas which in turn will create more demand for LNG in European countries as they try to diversify their supply base. However, a growing preference for renewable sources of energy and weakening domestic gas consumption will cap any major surge in LNG demand in Europe, thus leaving Asia as the hub for LNG demand and trade.

Global LNG trade slowing down

The LNG market is changing swiftly as new countries continue to join the importers’ club. The latest entrant is Egypt, which started its first Floating Storage & Regasification Unit in April and became the 31st LNG-importing country. Nevertheless, the changing market also brings in new challenges as once a supplier-driven market, LNG is no more the same. The supply of cargo has been increasing gradually as new plants come online in Australia, but demand is unable to keep pace with the rising supply. Global LNG trade has remained stagnant around 240 mln tn over the last four years after a strong compound annual growth rate (CAGR) of about 9% during 2006-10.

The onus of poor growth can primarily be attributed to European countries, where LNG demand declined at a CAGR of -18% during 2011-2014. Although, Asian imports increased at a CAGR of 5.4% during the same period, the pace of growth slowed down drastically from 11% during 2006-11, with Japanese demand stagnating after the peak in 2011. With a steep decline in European imports, the region’s share in global trade declined from 27% in 2011 to just 15% in 2014. However, the share of Asian imports increased during this period from 63% to 73% compensating for the decline in European trade.

Is the Asian demand outlook bleak?

Although Asian countries currently drive the majority of LNG trade, we are not so optimistic about future demand growth in the region. Let us first start with Japan, which at present is the biggest buyer of LNG in that region. The enormous increase in Japan’s LNG demand since 2011 was spurred by the shutdown of nuclear power plants. However, imports have remained more or less stable in the last three years, as the gas-fired plants are already running at high capacity. Going forward, with re-start of its nuclear reactors (one reactor at Sendai nuclear plant has already started) the demand for LNG is expected to fall. Meanwhile, South Korea has brought back all of its nuclear reactors that were shut down last year due to a fake certificate scandal. LNG imports by China, which has also been a major driver of global LNG trade in the last five years as its imports have grown at a CAGR of 21%, could also slow down due to the weakness...
in its economy. The slowing economy might impact LNG demand as almost 50% of gas in China is consumed by the industrial sector.

Can European countries provide a new impetus to LNG trade?

Gas consumption in the EU is highly skewed with almost 80% of consumption coming from seven western European countries, primarily Germany, UK, Italy, France, the Netherlands, Spain and Belgium. With continued progress in energy efficiency and greater preference to renewables in the energy mix, gas consumption in the EU has been declining after peaking in 2010. Low carbon prices have also kept the coal-intensive industries and power utilities from showing a major shift towards gas. Thus, poor demand for gas was reflected in lower LNG imports.

The other major factor, which determines the extent of LNG imports, is the competitiveness of LNG vis-à-vis natural gas. After the Fukushima disaster, the surge in demand by Japanese buyers bolstered the LNG prices in Asia, popularly referred to as the Asian premium. As a result, LNG became very expensive in relation to natural gas in Europe, thereby hampering the demand for the former. Traders after seeing the hefty premium in the Asian market preferred to sell cargoes to Asian countries, thereby reducing the cargo send out to European countries.

The lower price of competing fuels is also hurting European LNG imports. Coal is still the preferred choice of fuel by many power utilities in Europe owing to its low price, and since the carbon price in the current Emission Trading System is so low, utilities do not find any major incentive to move towards cleaner burning gas. Moreover, pipeline is still a major source of European gas supply as almost 87% of the EU’s gas imports are through pipelines. Russia and Norway are the biggest suppliers of pipeline gas to EU Member States. Russia supplied almost 42% of EU gas imports in 2014, while Norway supplied almost 38%. At a time when gas demand is falling in Europe, high pipeline imports have also been driving down LNG demand. A well-developed pipeline infrastructure and the low price of piped gas has been supporting pipeline trade.

With large importing capacity and declining LNG imports, the utilisation rate of terminals is declining. Currently, nine EU Member States have large-scale LNG import infrastructure with a combined capacity of 132 mln tn per annum. A further 15 mln tn/year of capacity is under construction. In 2014, more than half of the technical regasification capacity of each country remained unutilised. Thus, in order to improve the terminal utilisation rate, terminal operators are providing additional services such as reloading, truck loading, small ship loading, and bunkering.

The outlook for Europe’s LNG demand suddenly looks brighter and the prime reason is the continuing standoff between the West and Russia since the Ukrainian crisis. European countries are looking to diversify their supply sources in order to strengthen their energy security. The other major reason for increased interest in Europe’s LNG demand arises from the fall in LNG prices. As mentioned earlier, the divergence between Asian LNG prices and Europe’s gas prices has led to a large number of cargo being exported to Asia. However, as the Asian gas premium has almost been fully eroded after the fall in oil prices, people are speculating on the revival of LNG demand in Europe. We believe that the recent fall in LNG prices will motivate European buyers to buy more LNG, as they are trying to diversify their supply sources. Since the Asian demand is also not showing any major growth, traders and aggregators might also like to find markets in Europe.

However, dwindling gas consumption in most of the European countries is expected to restrict the growth in LNG imports by European countries. In addition to this, pipeline supply of gas from Russia would also cap the region’s LNG imports as we believe that the Russian pipeline supply is and will remain a major source of gas to European countries. The first reason is that many countries especially in Eastern Europe do not have any LNG import infrastructure and the second
reason is Russia keeping the gas price competitive so that it does not lose too much of its market to LNG. While countries such as Finland and Poland are building LNG infrastructure to reduce their dependency on Russian supply, we believe the LNG import infrastructure is mainly meant to increase the bargaining power of the countries and will not completely drive away the Russian supply. For example Lithuania, which started its first import terminal last year, was seen diverting LNG cargoes as Russia reduced the price of piped gas. So, even in the future, LNG trade will be determined by economics and not politics.

So the only country which is showing greater potential for LNG demand is the UK. The carbon floor price in the country was recently doubled from USD 10.78 to USD 20.43 per tonne of CO₂, and this has substantially eroded the attractiveness of coal-fired power generation. This is leading to increased gas demand and the country’s imports surged by 62% in the first half of the current year, over the last year.

Challenging times ahead for LNG shipping

As of now, it is quite clear that Asian countries will remain the top players within LNG trade in the near future. But since LNG demand from Asia is also showing signs of weakness, immediate challenges to LNG shipping exists. The rates have already come down drastically from the highs of 2012 due to weakening demand and rising fleet supply. In August 2012 a Dual Fuel Diesel Electric vessel was earning USD 150,000 per calendar month (pcm) in the spot market, whereas now its earnings have lowered to as little as USD 30,000 pcm.

At present around 30-40 vessels are sitting idle, while 23 more vessels are expected to join the fleet this year in addition to 42 next year. Drewry expects no improvement in rates anytime soon despite the huge liquefaction capacity coming online in Australia, expected to reach around 49 mtpa within the next two years. Almost 75% of the above capacity has been contracted by Asian buyers and that too mostly by the big three – Japan, South Korea and China. Last year, these countries bought almost 38 mln tn of LNG from the spot market.

The Middle East, which was previously their major source for spot cargo, helped in providing substantial employment to LNG vessels. However, at a time when Asian demand is not rising, contractual supply from Australian projects will substantially reduce the dependency of Asian buyers on the spot market. Moreover, since the Far East is nearer to Australia than the Middle East, the tonne-mile demand for shipping LNG will decline. We believe 50 vessels will be sufficient (assuming two days for loading and discharge time) to carry the entire supply from Australia. So importers in Asia, in addition to their own vessels, can easily take vessels from the long list of uncommitted vessels in the spot market without having any major impact on rates.

**Fig. 5. EU LNG versus coal imports**

**Fig. 6. Regasification capacity**

**Tab. 1. LNG imports forecast (million tonnes)**

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This article is based on excerpts from Drewry’s recent publication – Drewry LNG Forecaster, published quarterly. Data on trade and shipping have been sourced from www.lngoneworld.com. LNGOneWorld, a wholly owned subsidiary of Drewry Shipping Consultants, is an established brand within the LNG market place. LNGOneWorld for over a decade has been providing industry professionals with rich and in-depth coverage on the LNG value chain helping them keep abreast of the trends in the industry. It provides the latest news, editorials along with the latest trade and shipping data. LNGOneWorld’s subscriber base includes oil & gas majors, ship-owners, shipyards, terminal operators, traders, risk managers, analysts, and industry leaders.

Shresth Sharma is a Senior Research Analyst with Drewry. He is the lead author for the globally acclaimed Drewry LNG Forecaster. He is also the lead author of LPG Forecaster, published quarterly, which has a comprehensive coverage of global and regional LPG shipping and trade markets. His views on LNG and LPG shipping and trade gets regular coverage in the business media. Shresth has a post graduate degree in Economics.
The outlook for Europe’s LNG demand suddenly looks brighter and the prime reason is the continuing standoff between the West and Russia since the Ukrainian crisis. European countries are looking to diversify their supply sources in order to strengthen their energy security.

As a part of Europe’s consumers the Baltic region is a brand-new market for LNG suppliers. In this respect it is an evidently growing market with unfolding potential. Lithuania plays a leading role in developing a regional gas market foremost by launching the first full-scale LNG terminal in Klaipėda port in December 2014, and secondly – by developing small-scale LNG activities such as vessel bunkering and inland truck LNG distribution right now. It is a big step in cutting off dependency from gas monopolies and a visible makeover for energy sources in the region. Therefore, in general, the LNG supply outlook is positive. LNG trading created a competition that has already affected traditional natural gas suppliers and prices. The Baltic market is about to grow rapidly within the coming few years as several mid- and small-scale LNG terminals are being planned or are already under construction. What’s more, market liberalization in the region is also moving forward and increasing demand is foreseen in the industry sector. Shipping is also one of the key factors promoting gas consumption since the Baltic Sea is a low sulphur emission zone. As such more shipping companies and ship-owners see natural gas as a viable alternative fuel source, given the abundance of supply and the relatively stable prices.

Of course, we should keep in mind that it will take time to develop the Baltic gas market and make it flow into the “wider waters”, but there is a favourable outlook for LNG demand taking into account that a lot of investment-related LNG promotion has been made recently, especially in the transport sector.

The European Sea Ports Organization (ESPO) considers LNG as a very promising alternative fuel for shipping with great potential to reduce harmful exhaust emissions and reduce greenhouse gases. As such, European ports are actively engaged in projects making LNG a reality. Cleaner transport and the transition to a low carbon energy landscape is a high priority for the European Union. It is clear that LNG has to play an important role to achieve this goal. The European Commission has taken different initiatives to boost the use of LNG in transport, ranging from the Directive on deployment of alternative fuels infrastructure, the creation of a Sustainable Transport Forum to the financing of projects on alternative fuels under the Connecting Europe Facility. These initiatives will certainly incentivise the deployment of LNG in the transport sector, but more is needed.

In general terms, one can state that energy, like transport, relies on a network. Consequently, the alternative energy network can only work efficiently if there is a “network” and if many are using it. So I do believe that Europe alone cannot be the driver of LNG trade. Therefore, strong international cooperation is needed involving all industry stakeholders. Even if the short-term outlook is “bleak”, we should look a little bit further: the demands in energy in the long-run, the sustainable energy policy targets in the US, etc., could change the demand for LNG very rapidly. A sudden rise in oil prices could be another game changer. For European ports, which are to become hubs for demand and trade of LNG, and their investors, it remains in any case a big challenge to cope with these realities.

Maciej Mazur
Communications Manager at Polskie LNG
Lately, the most dynamic development across the global gas market was observed on its Liquefied Natural Gas (LNG) part. LNG is anticipated to substantially contribute to EU’s energy security and improve competition on the gradually consolidating energy market. The forthcoming years will be also pivotal for the development of the LNG market in Poland. The LNG import terminal in Swinoujście is one of the greatest Polish energy projects in recent years and it has been recognized by the Polish Government as strategic for the country’s energy security. This facility will allow for receiving natural gas delivered by sea from almost every direction in the world. By acquiring access to the global LNG market, Poland will be able to improve its security by the means of fuel supply source diversification. The newly established natural gas receiving system may be used not only to ‘fuel’ the domestic market, but also contribute to the development of the Baltic Sea region as well as other countries of Central and Eastern Europe.
Clean air, fresh water and healthy food have been always indispensable conditions for the healthy existence of all entities. Tens of thousands of ships are sailing every day emitting and discharging harmful substances. One of the biggest pollutants is fuel oil. The global consumption of fuels by ships is estimated to exceed 330 mln tn annually. Over 80% of this amount is Heavy Fuel Oil (HFO) with a high content of sulphur.

Requirements

Since the beginning of the 1970s, pollution has been restricted by a number of regulations introduced to shipping. The International Maritime Organization (IMO), the UN maritime agenda in its MARPOL convention, limits pollution in water with oil and air pollution respectively in Annexes I and VI.

Discharge of oil to water has been completely outlawed, with a few minimal exceptions. However, emission to air can’t be completely eliminated, therefore, IMO and different administrations have introduced several restrictions to air pollution. Presently, there exists a global limit of sulphur content in ship fuel of 1.5%. A 0.5% global limit will be obligatory from the beginning of 2020 (with the possibility of postponement till 2025 – to be decided in 2018). The EU Commission has decided not to postpone implementation of the new limit for ships on European waters.

The IMO has also established special Emission Control Areas (ECAs) on some sea waters. The one in Europe covers the North and the Baltic Seas as well as the English Channel. There, the present limit to the sulphur content in exhaust gasses from ships is max. 0.1%. Emission of nitrogen oxides, NOx, from marine engines is also limited. Ships built after the 1st of January 2016, when sailing on ECA waters, will have to cut such emission by 80% compared to the present level.

MARPOL set mandatory measures to reduce emission of greenhouse gases (GHG), e.g. CO2, from international shipping. Presently, the new ships of specific types and sizes have to reduce GHG emission by 10%, in 2020-2025 by up to 20%, and after 2025 – by 30%.

Most likely, quantities of the emitted CO2 will be measured, reported and verified (MRV) onboard all ships sailing on European waters starting in 2018. Two years later, the requirement...
should be global. Other possible limitations, e.g. on black carbon (soot) and volatile organic compound (VOC; gases emitted from cargo and fuel) regulations will follow after 2015.

**Solutions (at hand)**

What can be done to comply with the above requirements if sea trade is not to be reduced, especially within the ECAs? Presently, 85% of the world's transport is realised on waters, mostly at sea. Globally, ships emit 2-3% of the total utilisation of CO₂ produced worldwide, 10-15% of NOₓ (the high percentage is a result of wide utilisation of high pressure diesel engines on-board ships) and 4-9% of SO₂ (due to burning HFO).

The following technical solutions are possible. Firstly, light low sulphur content oils (MGO – Marine Gas Oil) are used as ship fuel. Such fuel should contain less than 0.1% sulphur when in Sulphur Emission Control Area (SECA). From 2020, a maximum of 0.5% sulphur will be allowed in fuel burnt on-board elsewhere. This option requires minor modifications of the machinery due to the decreased viscosity of fuel. In some cases cooling installations might be required instead of heaters, installed for more heavy fuels. Also modifications of fuel systems and tanks are necessary when other fuel is used outside the areas of controlled emission. The MGO fuel price has presently almost doubled when compared to HFO. However, this option is the most popular one in shipping within SECAs despite the fact that no other emission restrictions except the sulphur limit are met.

Secondly, installation of exhaust gas scrubbers. So far ship-owners have insufficient long-term experience, but devices may remove even 90% of SO₂ and PM from the exhaust gases (but not the other pollutants). This solution is relatively expensive, increases fuel consumption by 2-3%, requires space for the scrubber and creates problems with a ship's stability (additional weight put at a height) and with the removal of liquid and solid contaminants. A significant increase in scrubber installations on-board ships built prior to 2016 is expected around year 2020 when the 0.5% sulphur limit is introduced.

Thirdly, selective catalytic reduction (SCR). Nowadays SCR is the only feasible solution for the exhaust emission into air at least while at sea. Electric batteries may be charged while a ship is at its berth (so-called “cold ironing”) or by fuel cells using “clean” fuel such as e.g. hydrogen, methane, methylene, etc. Battery-powered propulsion is already used on-board small ships. The bigger ones with so far the biggest maritime battery installation of 2.7 MWh capacity are supposed to work in hybrid propulsion installations. A significant growth in the hybrid ships’ size and number might be expected in the coming years among vessels operating as harbour tugs, offshore service and relatively small car and passenger ferries. High cost – presently even 1,000 USD/kWh including installation and integration and a short operating period of up to 10 years are important disadvantages. Fortunately, the price of Li-Ion battery cells is expected to drop by 60% or even 70% by 2025 compared to 2013.

And finally, Liquefied Natural Gas (LNG) propulsion which appears to be the most promising fuel solution for ships and above all for the newbuilds. LNG fuel is technically verified and operationally safe, has been in marine use since 2001 without any reported accidents. There is no other fuel (except hydrogen) which can compete with LNG on the least emission of burning products in the exhaust. Its use reduces emission of SO₂ by 100% since there is zero sulphur content in LNG (sulphur is eliminated during the liquefaction process). NOₓ may be reduced by 40-85%. The first result is reached by low speed, two-cycle Diesel engines. In this case however the SCR and EGR (exhaust gas recirculation) systems are to be used for the 80% reduction to be reached. An over 85% reduction in NOₓ can be achieved by running low pressure engines in Otto cycle on lean LNG/air mixture. There is an increased content of air and a more homogeneous solution compared with oil fuel reducing the burning temperature of the mixture, cutting the amount of NOₓ production down. The quantity of CO₂ produced by engines may be decreased by at least 20%, and up to 30% compared to HFO. This result can be achieved by LNG fuelling the high pressure engines. Such engines are additionally less sensitive to LNG fuel quality. Emission of PM and soot is reduced by 95-100%.

The use of gas as a fuel in shipping is a young technology, with not a lot of engines burning LNG. The current, worldwide numbers of LNG-fuelled vessels reach about 70 ships in operation and about 80 ships on confirmed order. Presently, 81% of ships operate in Norway, 11% in Europe and 3% in America. The remaining 5% of ships operate in Asia and the Pacific. The situation is changing rapidly. The orderbook shows a different picture where 16% of ships will be built for Norway, 45% for Europe, 33% for America and 5% for Asia and the Pacific. This clearly indicates an increasing interest in the shipping industry’s worldwide use of LNG as a fuel, mainly among operators of ships trading in ECAs for a significant period of time. The first LNG distribution terminals already exist in the ECAs, including the Baltic and there are plans for their further construction. The EU Commission suggests 10% of the European ports to have LNG bunkering facilities in the several nearest years.

It is worth mentioning that the present, low level of crude oil price has put the LNG vessels’ ordering rate into slow motion. Definitely, it will recover and an increase in oil fuel prices will resume, even though the decision to install LNG equipment for LNG fuel raises the investment by 10-15% in the case of four stroke, low pressure engines and 20% in the case of two stroke, high pressure engines. However, the payback time of LNG compared to MGO is the right measure for checking its attractiveness. The payback period compared to fuel switched to MGO at e.g. 60% parity of the LNG price seen as a percentage of the cost of MGO (per unit energy) could be seven years at 50% of time spent in ECAs and three years at 100% of the sailing time in the areas of the restricted emission.

Undoubtedly, all of us will benefit from the introduction of clean fuel used on ships, which produces a minimised amount of air and water pollution. LNG seems to be the most optimal choice considering its impact on the environment during its production and utilisation.
By reducing the authorized ships’ bunker sulphur content to 0.1% in the Emission Control Areas (ECA), 2015 is the first of the important milestones for the enforcement of regulations on exhaust gas emissions. Bull’s eye investment timing is everything for ship-owners and operators since we’ll see more ECAs in the future. The question remains: Which solution to choose?

It is planned to have the 0.5% global application in five years’ time, however, this date may be postponed to 2025, as it was already schemed since the creation of the sulphur calendar. This delay was quite easy to forecast: When one has two deadlines, the latter is usually preferred except if there is a significant benefit to choose the earlier one. Is this the case of the 2020 ECA? Rather not, instead time is needed in order to allow the different stakeholders to make up their minds.

All these signs bring the future closer to us, hence the wide-spread use of LNG as marine fuel is just a question of time. But here the chicken and egg dilemma pops up. The egg takes its time to grow up to become a hen (the decision-making process of LNG ship conversion/order, in other words) as well as the chicken to lay an egg (namely to develop a gas bunkering facility). Nevertheless, the riddle is apparent; when the market will reach a certain critical maturity mass, nobody will remember who – the chicken or the egg – solved the dilemma.

We at GTT have been watching and actively supporting this process since 1964, be it offshore (floating LNG) production sites, deep-sea gas carriers, the development of very large tanks for land storage as well as very small tanks for local supply chains, set-up of harbour facilities and most recently – construction of gas bunker ships and LNG-fuelled vessels.

Benchmarking different ECA solutions

A 14,000 TEU capacity Asia-Europe trade lane container ship spends around 20% of its time in an ECA which is roughly 2,000 NM (five days en route together with a whole week in harbours) counting from the entrance to the British Channel through the Baltic Sea and back. To be compliant in the existing ECAs, the vessel can run on Heavy Fuel Oil (HFO) coupled with a scrubber exhaust gas cleaning system, burn distillates such as Marine Diesel Oil (MDO), Marine Gas Oil (MGO) or ultra-low sulphur heavy fuel (or practically anything, incl. hybrid bunkers, that ensures 0.1% ECA compliance) or utilise LNG on-board (either stored in a C-type or GTT membrane tank).

Let’s then start with the first solution, i.e. scrubbers. Here the capital expenditure still remains fairly high (between USD 10 mln and 15 mln, depending on auxiliary engines’ power source – HFO in ECAs or a shift to MDO), but the operational expenditure is pretty good (as long as oil prices remain relatively low and the HFO-distillates split is profit-yielding). Indeed, except the maintenance of the equipment itself, there are no more fees included. Therefore, scrubbers look like a good sulphur solution at first glance. But there are opinions saying that this equipment definitely remains a short-term solution, or even voices like the one expressed by the German NGO NABU which does not beat about the bush proposing to reject scrubbers as they do not solve the pollution problem, but sweep it under the rug. All because the scrubber technology is a
specific 0.1% SO\(_2\) solution; to meet the IMO Tier III NO\(_x\) limits applicable in ECAs from January 1\(^{st}\), 2016), a vessel fitted with scrubbers must also be equipped with a Selective Catalytic Reactor, in general an additional expensive and heavy equipment to be mounted in the funnel, thus generating extra issues for storage on-board and disposal of waste products.

Next, the MDO way out. Burning diesel remains the smallest CAPEX and the easiest technical stop to retrofit a ship (only some additional piping and dedicated storage tanks are required). The fuel changeover procedure has to be well-defined and rigorously followed by the crew in order to save the fittings, particularly engines and boilers, due to different ignition and combustion characteristics, viscosity, density, heating values and lubricity. One major difficulty is the temperature variation from hot HFO to cool MDO (up to 100°C). In order to achieve a safe temperature gradient of less than 2°C/min., the changeover procedure can take about an hour. Furthermore, to avoid cold corrosion in the slow speed engines, the ships using two grades of fuel will also need to use two types of cylinder oil. Several Loss of Propulsion (LOP) issues have been reported in North America and the EU since January 1\(^{st}\) of this year (about one every three days on average!) due to fuel injection pumps blocking. Last, but not least, MDO remains a fine cylinder oil. Several Loss of Propulsion (LOP) issues have been reported in North America and the EU since January 1\(^{st}\) of this year (about one every three days on average!) due to fuel injection pumps blocking. Last, but not least, MDO remains a fine solution to be mounted in the funnel, thus generating extra issues for storage on-board, and disposal of waste products.

When to say ‘Yes’

All things considered, due to LNG and relevant technology prices, jumboisation is more attractive than other solutions. Now, the main headache is to identify the most eligible vessels to be upgraded. A too old one would deserve to be retrofitted with the smallest CAPEX, but what about the youngest, those to be operated for a further 15 years or more? Indeed, time is needed to make the right choice at the right time.

Considering both the CAPEX and the gain of TEU, the payback period is estimated to be less than two years for the jumboisation solution.

Taking into account a possible fuel price scenario of Brent returning to the level of USD 80/barrel by the end of 2016, the bunker prices delivered on-board could be around USD 12/mmBTU for HFO, a little bit more for LNG (USD 13/mmBTU), and USD 18/mmBTU for MDO.

**By Geoffroy Beutter, GTT**

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**GTT (Gaztransport & Technigaz)** is a worldwide specialist in cryogenic membrane containment systems used for the transport and storage of LNG. For over 50 years GTT has been offering technologies which allow to optimize storage space and reduce the construction and operation costs of ships or tanks. GTT operates across the LNGCs (Liquefied Natural Gas Carriers), VLECs (Very Large Ethane Carriers), multi-gas carriers, FLNGs (Floating Liquefied Natural Gas units), FSRUs (Floating Storage and Regasification units), onshore storage tanks as well as the use of LNG as a fuel sectors.

**Geoffroy Beutter** is in charge of the business development of GTT in Africa and Middle-East since November 2014. He joined GTT for the development of Small Scale projects and LNG as fuel applications in October 2013. Graduated in Mechanical Engineer from Ecole Polytechnique Universitaire de Lille in 2007, he worked two years as Naval Architect at ALLAIS Shipyard. He joined Bureau VERITAS as Machinery Surveyor in 2009. Between France and Korea, the experience made him dealing with a large scope of retrofitting and new-building projects (VLCC, LNGC, FPSO, jack-up). In the meantime, he graduated in MBA from IAE-La Sorbonne.
Liquefied Natural Gas for bunkering has been discussed at length over the past few years as a potential win-win game for both producers and ship-owners. Today, a steady increase can also be noticed in the attention paid by large LNG producers to small-scale LNG. Ruthless competition from coal in power generation has made wholesale LNG prices less attractive in many regions, and the higher margins of retail small-scale LNG can no longer be ignored.

Opening the black gas box

LNG is a relatively new product for the shipping world and in order to make it interesting for a ship-owner, the business case needs to be attractive, clear and honest. This is one reason why the majority of ship-owners and operators have chosen the simple solution of switching to MGO to reduce sulphur emissions rather than taking a long-term leap into gas.

The problem with LNG for bunkering is that the pricing of it is a black box for most potential buyers. LNG sellers have been slow to adapt to buyers’ needs, pushing for long-term agreements with complex pricing formulas inherited from the traditional gas world.

In the early days, the small-scale LNG sellers were primarily offering a cost-plus price, including the expense of feed-gas (oil-linked first and later some hub-indexed), cost of liquefaction and transportation, plus of course a margin. Alternatively, the retail price would be linked to the competing fuel, MGO, with a 10-20% discount. Such rebates were intended to compensate consumers for the conversion costs of engines.

Both models were relatively attractive in the high oil price environment, offering room for an emissions as the main incentive in Norway and later to new and stricter regulations which enforced the set-up of the 0.1% Sulphur Emission Control Areas (SECA). As a result, some infrastructure is now in place in many countries and there is even some competition.

Nonetheless, to this day I’m surprised to see that, with some exceptions, the LNG bunkering game is chiefly played on the eco-benefits pitch, whilst the commercial case is often being overlooked. Even worse, I’ve countless times seen graphs comparing Henry Hub (the US benchmark price) to Marine Gas Oil (MGO), concluding that LNG is an attractive bunker fuel in Europe! This kind of misleading approach only harms market development.

A part from the small pioneers in the small-scale LNG game like Gasnor (now Shell), Skangass and AGA, today we also have heavyweights like Statoil, Gazprom and many others looking into this market. We at SUND Energy are encouraged to see that more diverse and numerous players are finally taking small-scale seriously. However, there are some solutions needed for LNG to grab a firm foothold as the easy to use marine bunker.

The good, the bad and the ugly

Using LNG for bunkering has, so far, been a promising segment, due to the strong environmental drivers, first thanks to reduced NOx emissions as the main incentive in Norway and later to new and stricter regulations which enforced the set-up of the 0.1% Sulphur Emission Control Areas (SECA). As a result, some infrastructure is now in place in many countries and there is even some competition.

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LNG bunker pricing

By Sergiu Maznic, Senior Consultant at SUND Energy AS
LNG bunker pricing market is pricing in a recovery and some of the losses of last year have already been regained. A contango market indicates that the trend for strengthening prices could continue.

Secondly, lower wholesale LNG prices. Running counter to what we have seen in recent years, the global gas market is now facing an oversupply of LNG. With the additional, uncommitted supply arriving over the coming years, we are in a ‘buyer’s market’, and increasingly we are seeing more LNG being sold at ‘low’ gas-hub price levels. More of this cheap LNG will reach the small-scale market in step with the development of break-bulk facilities, where higher margins are possible than in the wholesale market/hub.

Thirdly, increased competition. The small-scale LNG market has gradually attracted more players from different parts of the value chain. Greater competition should only bring benefits to gas buyers, as the market becomes more efficient, bringing with it transparency and eliminating the excessive profit margins seen when the market was more closed. And, last but not least – infrastructure costs. Competition and innovation have had a positive impact on reducing cost on the small-scale LNG market. Today we see more standardised technical solutions coming at a much lower cost than just a few years ago. This comes together with an increase in demand volumes creating a ‘virtuous circle’ – more volumes, more infrastructure, lower costs, more volume. We are seeing an increasing interest from the deep-sea segment for LNG as bunker fuel as well, and that could bring a significant demand-driven push to the market that today relies primarily on LNG demand from the side of ferry companies (although the world’s first LNG dual-fuel cruise ships order recently placed by the Carnival Corporation may somewhat break the ‘regional barrier’ of gas-powered vessels operating only across particular strings).

**LNG strikes back**

There’s a set of factors to be considered by every shipping company individually, and future pricing is a significant one, especially in light of the tough times ship-owners are currently finding themselves in. The unpredictability of oil prices, opaqueness of the wholesale LNG price and complexity of the small-scale LNG end-user price tag, they all increase the complexity of the ‘go-for-gas’ decision.

Nevertheless, it would by all means be a jumping and unfair conclusion to call LNG a dead business case. There are several aspects making the shift worth considering.

Firstly, oil prices. After a long period of backwardation we are now seeing a contango on the forward curve, where forward periods are priced higher than near periods, or spot. Without trying to predict the oil price, it seems that the market is pricing in a recovery and some of the

**Like in a gas station**

In conclusion, fuelled by environmental drivers, LNG as a marine fuel is starting to win its share of the bunker market. After mainly ferries and short-sea, we now see deep-sea/long-distance ships being built ‘LNG ready’. Transparency would drive demand further forward and I believe that this should be the main focus for small-scale market players. LNG sellers need to learn to adapt even more to this changing market.

What buyers want is flexibility, price discovery and competition in order to make business decisions simpler. Even with a positive outlook for the small-scale LNG market, it will still take several years until it will be possible to buy LNG in the same way as traditional bunker fuel today, i.e. available in any port and at a transparent price. Until that time, there is still a great number of opportunities, but the key for any buyer is to understand the market fundamentals, be tough in negotiations, and figure out the best options that fit their companies.

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**Fig. 1. LNG vs. other fuels bunker prices [USD/million British thermal unit]**

Source: SUND Energy AS

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