

PRODUCED



PART OF THE:



WORLD LNG SERIES



CWC

4TH LNG FUELS SUMMIT

MARINE • ROAD • INDUSTRIAL

22 - 23 MAY 2018

AMSTERDAM, NETHERLANDS



EXECUTIVE SUMMARY

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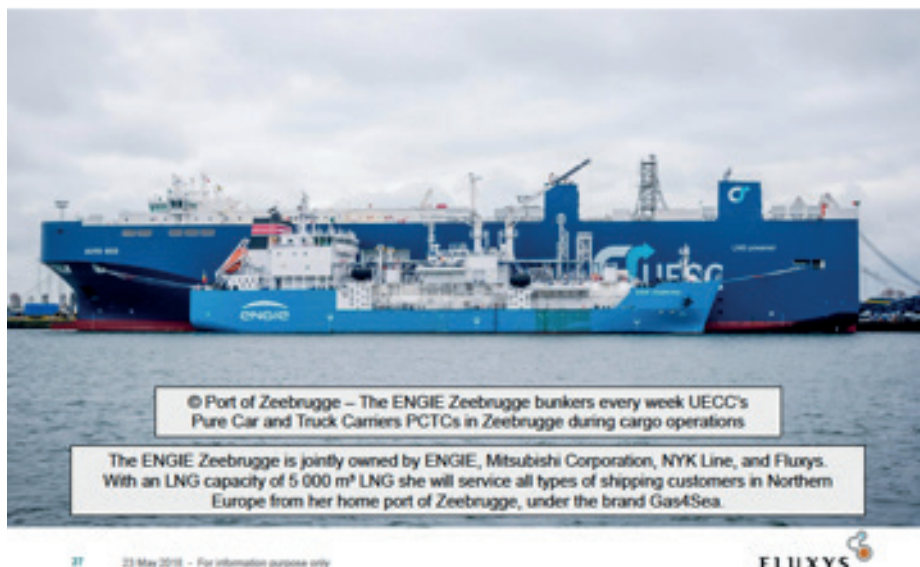
‘2020 is tomorrow’**‘Ask not if LNG is ready for you, ask if are you ready for LNG’¹****‘Air pollution is the world’s largest single environmental health risk’²**

The fourth CWC LNG Fuels Summit was held in Amsterdam 22-23 May 2018. The conference was largely made up of delegates from the marine bunkering and European road transportation sector, with some delegates from outside the region. Delegates came to give their views on how to grow an industry in transition network, learn about LNG for fuels, and to network. The sector has changed over the past twelve months from one of “planning” to “action and implementation”. That said, concerns were expressed that even though it is clearly growing, it needs to grow faster.

The key words used by many presenters from this year’s conference were collaboration, compliance and sustainability. Another was Bio LNG, which many in the industry see as the next stage in the decarbonisation of the LNG industry. A clear message is that, in Europe, politicians and some customers expect Bio LNG to be available sooner than many suppliers expect. There was considerable discussion as to whether LNG is the bridging fuel to Bio LNG, hydrogen or electric trucks, but the view was that the only 100% carbon free fuel available today, with the current technology, is Bio LNG and this is not available in large quantities.

As in previous years, Day 1 focused on the ship bunkers sector for inland barges, small regional shipping and large ocean vessels and Day 2 on LNG for bunkers, and road transport, from large, long distance vehicles to smaller delivery vehicles. At the end of Day 2 pricing and trading of small-scale LNG and the birth of independent indices for LNG for road transport was discussed. During the conference several audience polls were carried out and the results of these will be referred to in this conference report and are summarised in the attachment.

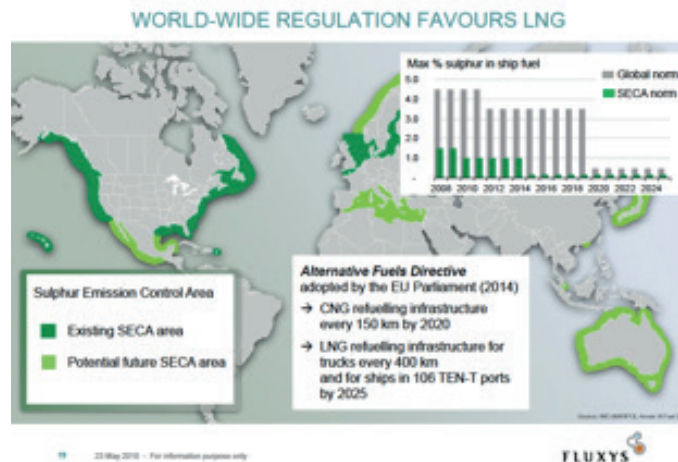
ENGIE ZEEBRUGGE 1ST SHIP-TO-SHIP LNG BUNKERING IN ZEEBRUGGE



¹ Quotes from two conference presenters.

² World Health Organisation 2014.

LNG for ship bunkers



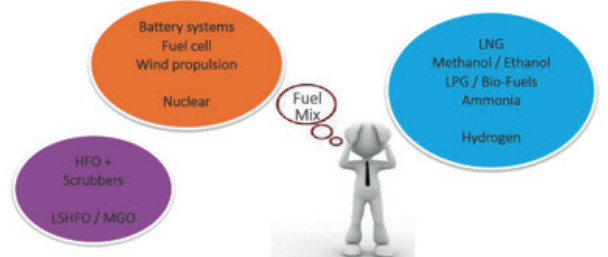
As a stark reminder, one presenter noted that shipping emits ~1000 million ton CO₂ annually and is responsible for about 2.5% of the global greenhouse gas emissions. The deadline to meet the International Maritime Organisation (IMO) maximum 0.5% sulphur emissions from ships by 2020 is approaching fast (see Fluxys slide). One presenter said “2020 is tomorrow” and clearly conference delegates were of the view that it is necessary to act now, as there is no spare time. Another presenter said “If you have not started getting ready for LNG for 2020 then it is too late” (to switch to LNG) and the only option, therefore, will be to switch to low sulphur gasoil (at higher cost) as that is all that may be available. The Society for Gas as a Marine Fuel (SGMF) saw several challenges and drivers that the industry has to face if it is to meet these emissions limits (see slide).

IMO 2020 Sulphur Cap Compliance What are the Challenges & Drivers...



IMO 2020 0.5% worldwide Sulphur cap is potentially a game changer but... What are the Options...

From 2020, 269 million tonnes⁴ of fuel will be consumed each year

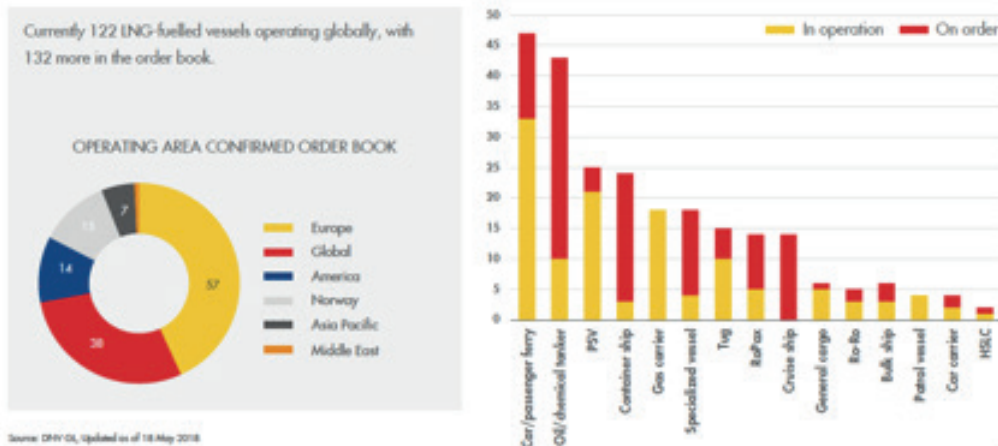


Shell identified that there are 122 LNG fuelled vessels operating and 132 on order. This is out of a global shipping fleet of 50,000-60,000 ships. Shell's chart identifies that the car and passenger ferry and the oil and chemicals sectors make up just over a third of these vessels. Speakers noted that it is the shipping container sector that needs to make a commitment to LNG as a bunker fuel in order to see a larger growth in LNG demand for ships use. The November 2017 announcement by CMA CGM that it had placed an order for nine new build container ships, the first container line to run an ultra-large container ship on LNG, was seen as a vote of confidence in LNG as a clean marine fuel. This order was referred to by several speakers during the conference in a positive manner.

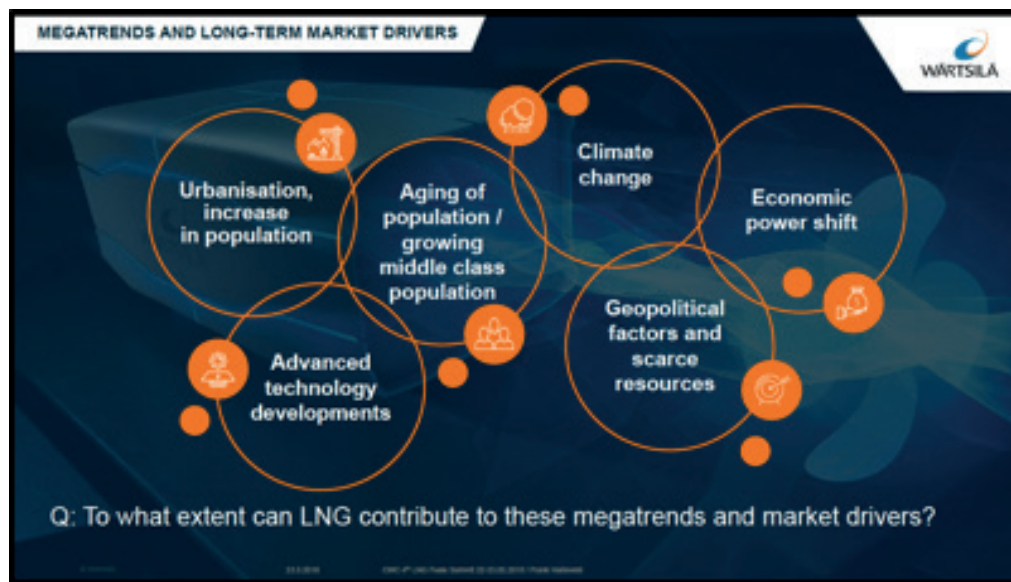
⁴ 3rd IMO GHG study.

⁵ IMO has also set 'levels of ambition' to reduce total GHG emissions for international shipping by at least 50% by 2050 compared to 2008, while, at the same time, pursuing efforts towards CO₂ neutral.

ORDERS FOR LNG-FUELLED VESSELS ARE GROWING



Wartsila set out the long-term market drivers that will determine the pace of growth of the global economy energy demand and the potential growth of LNG for ship bunkers and challenged the conference by asking “To what extent can LNG contribute to these megatrends and market drivers?” Speakers were of the common view that LNG is the cost competitive fuel, a cleaner burning fuel (thus helping to lower local exhaust emissions and global greenhouse gas emissions), that uses proven and reliable LNG engine technology and, importantly, is available and safe and can be supplied through reliable supply chains. SEA/LNG, a multi-sector industry coalition, noted that they are seeing new ship owners looking to convert to LNG in order to meet the IMO emissions regulations.



That said, less than 1% of bunker fuel used today is LNG. Carnival, with 106 ships, has ordered 9 LNG powered vessels out of 18 vessels under order - with the first one planned to enter service in November 2018. It was of the view that ports are getting ready to supply LNG but regulations still need to be harmonized (see below). Carnival also noted that, in addition to LNG being a cleaner fuel than HSFO, experience should hopefully show that the vessels are quieter and the period between maintenance will be extended, so reducing operating costs.

There was considerable discussion as to whether LNG is the only solution to achieve the IMO emission limits. The conference was pragmatic and, as one speaker said, the need to reduce emissions is so large “it will need all solutions to achieve it”. In an audience poll, 35% felt it was the narrow oil/gas spread and 30% the lack of understanding of LNG, that was preventing ship owners switching to LNG. In a second poll, over half the audience said that ship owners were switching to LNG due to regulations with only 20% switching for cost reasons (to differentiate themselves from the competition made up the balance 25%).

On regulatory compliance, through another audience poll, 70% believed that ship owners will adhere to the regulations (others in audience said it will be nearer to 100%). Some argued that fines are so low in some countries that it may need a bigger “stick” to force compliance. One speaker noted that regulators are not really ready to force compliance and that policing will cost money that may not be available. Also, regulations are not clear. If a vessel has scrubbers then it can burn HSFO, but who will check what equipment a ship has and give the necessary approvals to bunker HSFO?

Several speakers referred to the varying quality of the LNG, especially the methane number, which can cause problems for ship owners. Gas quality is important but LNG supply varies as the sources of LNG into the supply terminals vary.

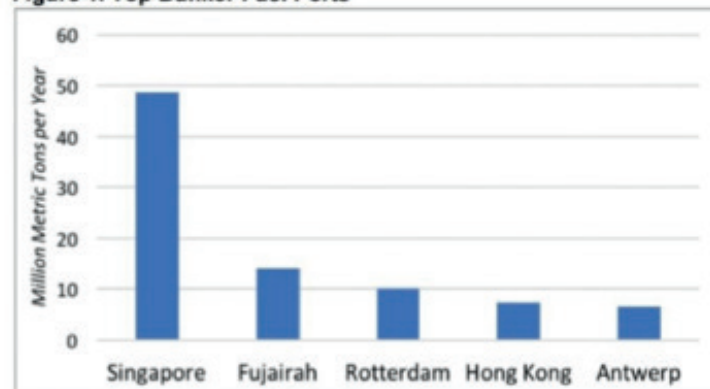
Infrastructure

As at previous conferences, there was considerable discussion over the availability of infrastructure and about the “chicken and egg” – which comes first infrastructure or LNG demand. This year the general consensus was that infrastructure should be in place. Shell was of the view that, in future, 150 ports should be able to supply LNG, but what is needed are bunker vessels. Another presenter noted that by 2025, 30 bunker vessels are expected to be in operation globally (there are currently seven in operation and five on order). Currently, 30% of roughly 300 mtpa oil bunkers sold annually, is sold through five ports (see chart). Interestingly, with the price of LNG being different to oil in ports globally (due to having different supply sources), competitiveness of LNG will be different to oil bunkers in these ports, so the ranking major bunker ports may change in the future.

Current bunker fuel supply

Of the roughly 300 million metric tonnes (MMT) per year of bunker fuel currently consumed globally, 30% is handled through just five ports: Singapore, Fujairah, Rotterdam, Hong Kong, and Antwerp.

Figure 1. Top Bunker Fuel Ports



Source: 20|20 Marine Energy best estimate

In another interesting presentation that brought an Asian perspective, the Port of Yokohama noted that, in Japan, local municipalities cannot afford investments in port infrastructure to enable LNG to be supplied as bunkers so the government has had to intervene with grants and other financial support.

Other speakers were of the view that grants are needed for pioneers and initial investments, but when a business matures then it must become economic. Several presenters noted that long-term contracts (5-10 years) may be required to underpin the economics and support infrastructure investments.

Gasunie made a presentation on its proposed new 5Bcm regasification terminal in the Port of Hamburg. It was noted that in order for the project to take FID⁶ the project would need long-term capacity agreements in place (~ 15 years), which will need to be underpinned by clear market demand which is expected due to reduced nuclear power generation and coal to power in Germany. It was noted that reduced gas supply from the Netherlands (~20% gas imports have been from the Netherlands) and increased Russian supply, which impacts on security of supply, supports the likelihood of the terminal going ahead. Gasunie confirmed that their recent open season confirmed that demand is in place and the project is targeting a 2023 start date. In a separate presentation Fluxys also noted its role in security of supply to the Belgium market – a key role of LNG regasification terminals.

Innovation

In several presentations, different companies gave examples of how innovation is enabling them to maximise the use of LNG. Wessels explained how they had retrofitted an existing container ship to use LNG as a fuel. Confirming the environmental benefits of LNG, Wessels said there were lots of challenges but the biggest was the retrofitting cost and securing financing. In questioning, it confirmed that without financing it would have been difficult for the project to proceed.

Kosan explained how innovative solutions have enabled larger volumes of LNG to be supplied by lorries simultaneously to meet LNG demand from ships (it can have 4+ lorries discharging into a manifold then to the ship). Eesti gas explained how, to date, it has carried out nearly 1000 bunkering operations to the M/S Megastar that operates the Helsinki to Tallinn (a route that carries nearly one million passengers per year). Carefully monitored logistics, night-time operations and clear staff training has enabled the operations to go ahead effectively and safely. It expects to increase its operations and replace the truck operations by a bunker barge by late 2020. This highlighted a trend of starting bunker operations using trucks then, when a critical mass has been achieved, moving to a marine supply solution. Titan also noted the use of a “T piece” to simultaneously bunker from two trucks and also said how it was building a capex light flex fueller bunkering pontoon (with no engine but can be pushed around the harbour and between ports using a tug/boat), which will be available by end December 2018.

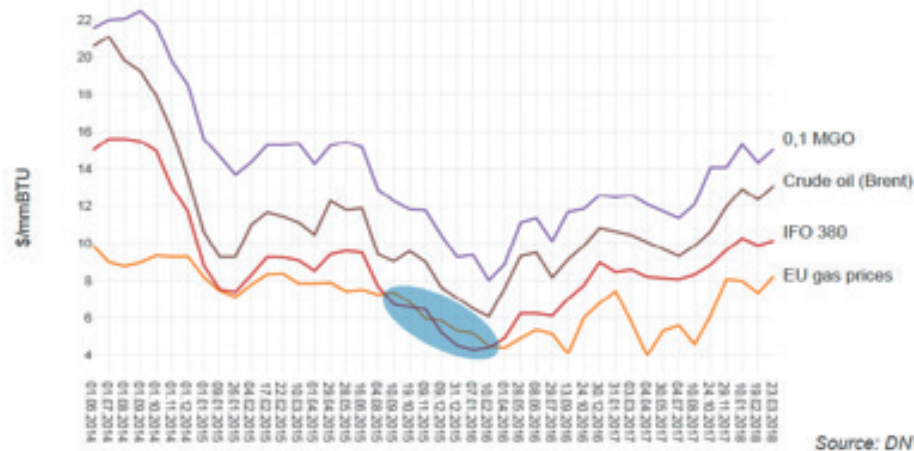
Grain LNG likewise showed its innovative way of adapting a large ship jetty to take small-scale tankers (1000-20000 M3 vessels) through using a floating loading unit (FLU), and an adaptor barge. Interestingly Grain noted that they have been considering an investment to load smaller tankers at the Isle of Grain for some years, but could only decide to go ahead once the fuel-oil/gas spread was at a wide enough level to support the investment. As the graph shows, in Q3 2015-Q1 2016 period the spread narrowed (the shaded part of the chart), since then it has widened again supporting the economics to invest in the new infrastructure.

⁶ FID-Final investment decision.

Why don't we have a break bulk facility yet?

nationalgrid

Low oil price = market inertia. Global SOx cap a tipping point?



4 Grain LNG

All these innovations show how important it is to adapt and change to meet the specific requirements of customers as companies move to use LNG for bunkers.

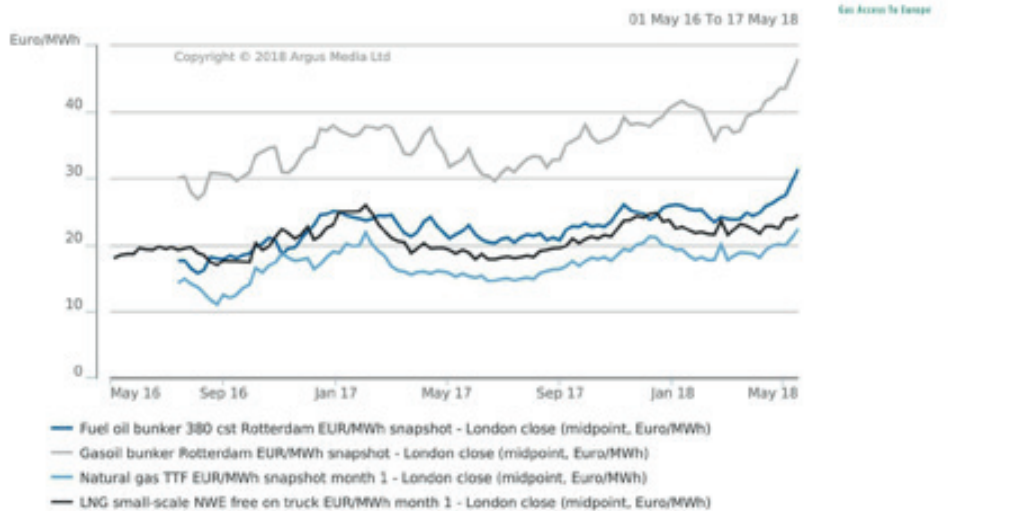
Pricing

In a poll of the conference 40% said that the price (or price spreads oil/gas) was a “blocker” to the growth of LNG for marine fuel. To manage the risk, LNG sellers such as Shell sell LNG on different pricing bases. One presenter noted that a key factor for buyers is to secure similar terms to their competition and to secure LNG priced at a discount to marine gasoil. Another LNG buyer said that it buys on different bases but expects to see a different market in five+ year’s time. In one panel, two price-reporting publications both confirmed that they are considering developing bunker price indices. There were several calls for price transparency and that the terminal fees and logistics costs, that are a considerable premium over price of the fuels, should not be bundled into the price. Speakers also referred to the price spread risk between LNG/gas prices and the price of alternative fuels.

In a pragmatic comment, one presenter said that the owner/charter/fuel supplier triangle has to work to ensure the growth of LNG as a bunker fuel. In an interesting comment during its presentation, Gate Terminal suggested that a widening gasoil/HFO price spread could financially reward non-compliance.



The cheating incentive



Regulation

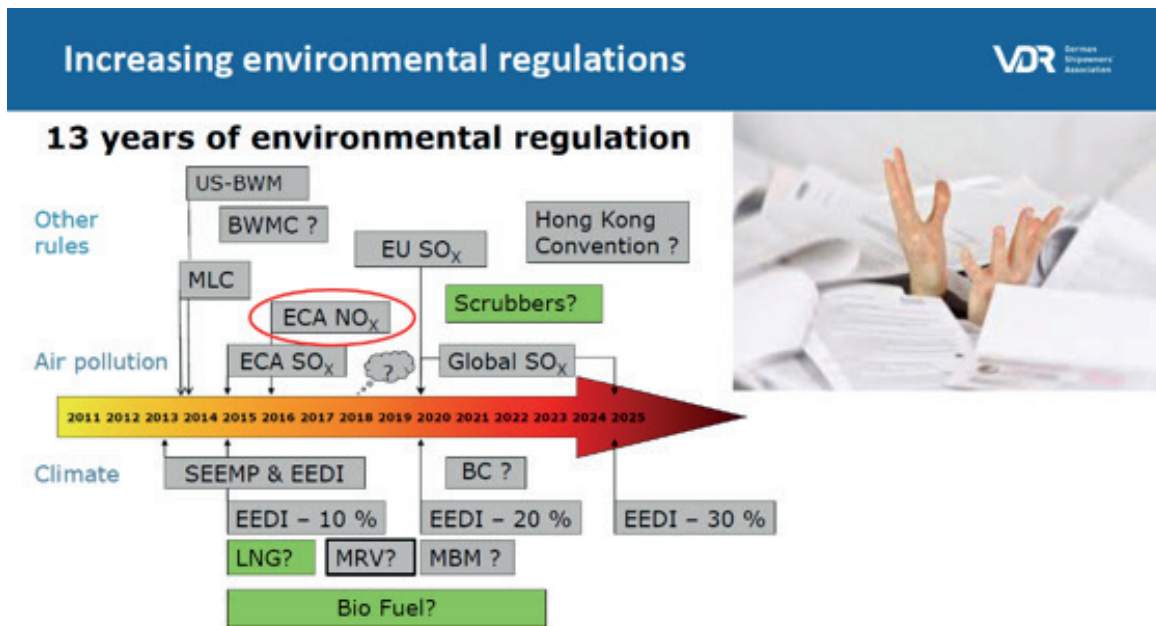
The fuel switch in 2020 is the biggest change ever made by the shipping industry. The view of the conference was that the industry wants to be compliant – that is why it has asked for the carriage ban on the use of non-compliant fuel without a scrubber – but it may need an additional six months beyond the 1st January 2020 effective date to ensure more ships will be ready.

There was a clear common message from several speakers – regulations need to be harmonised across the EU and in country to give a level playing field. All ports have got different criteria and they must be harmonised. Standardisation of procedures is necessary to ensure efficient LNG bunkering. The checking of LNG safety regulations with harbourmasters, which can happen on a cargo-by-cargo basis, is not efficient; for example safety distances, and ports using different modelling techniques. Standardisation on bunkering procedures is required and the Society of Gas Marine Fuels (SGMF) confirmed that it is coordinating the development of such procedures.

Uncertainty over changing regulations is resulting in shipowners delaying their decisions as to how to comply with IMO regulations. Shipowners are worried that scrubbers will become non-compliant. One speaker was clear - only one thing is certain in maritime: regulation – regulation is here to stay and has driven change in the maritime fuels sector. There was considerable discussion on how to implement regulations. Should regulators use “carrot” or “stick” i.e. incentives to comply or fines for non-compliance.

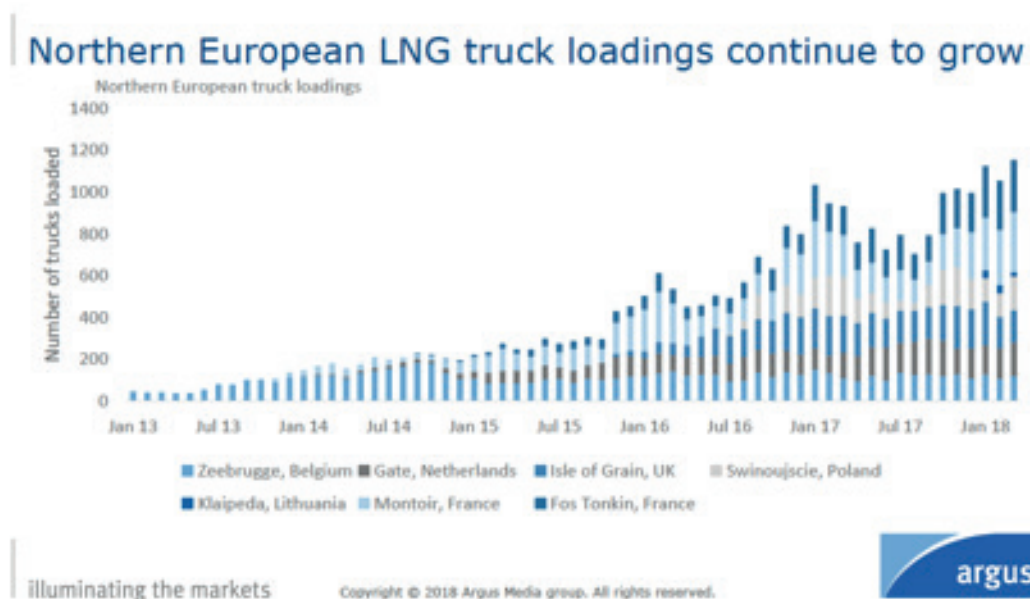
Environment

There was extended discussion about the announcement by the IMO in April 2018 that there should be an 80% reduction in greenhouse gas emissions from 1990 levels by 2050 (40% emissions cuts by 2030 and a 60% emissions cut by 2040). It was viewed that this creates additional uncertainty as shipowners commissioning new ships now are having to decide what fuel to use and even though gas reduces emissions it does not cancel them altogether. This led to considerable discussion over the use of Bio LNG as the end product for decarbonisation. Speakers were of the view that the IMO’s 80% target will make LNG a transition solution for the marine sector, though there was some kick-back on these views by those who noted that gasoil and fuel oil are the transition fuels not LNG. There was also a view that, even though hydrogen may not be the economic solution today, new technologies will be developed to support the IMO’s decarbonisation targets.



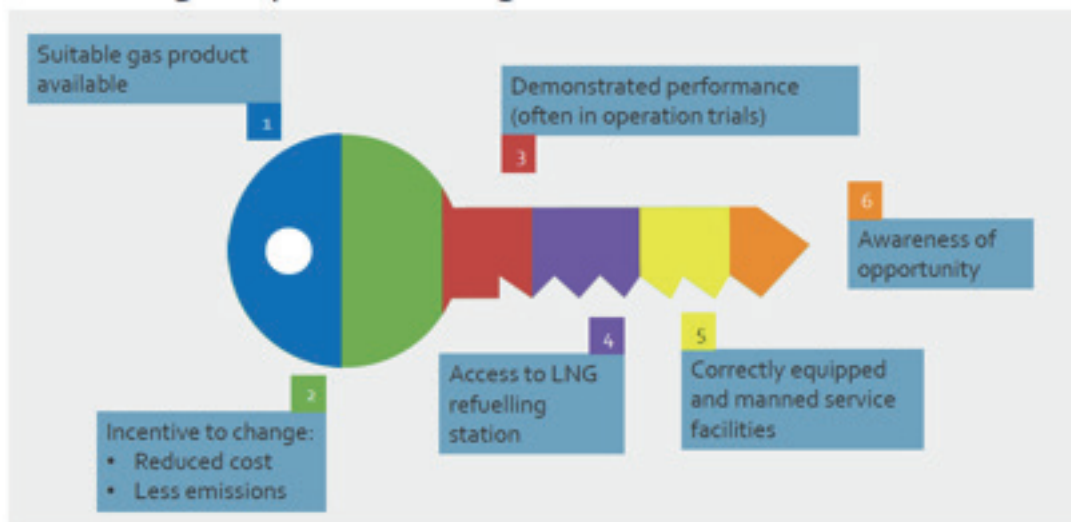
ROAD TRANSPORT

The volume of LNG trucks loading from European LNG terminals has increased dramatically as can be seen in Argus's chart below. These trucks are loading LNG for several uses; to move LNG to industry, to supply bunkers to small ships, and to supply LNG refuelling stations. Grain LNG noted that it has seen a 50% increase in its utilisation in 2017 vs. 2016. It also said that it is transporting LNG using trains, as part of a truck/train/truck LNG chain using ISO containers. This is for economic as well as logistical reasons. Moving ISOs by sea, it noted, can further reduce costs.



In an interesting presentation, Gasrec presented a “key for unlocking the potential for gas” (see slide below), arguing that what is needed is: product; an incentive to change (costs and lower emissions driven by regulation); proven LNG supply, and the infrastructure to be in place and operated safely. Users must also be aware that there is the opportunity to use LNG to reduce emissions.

Unlocking the potential for gas



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May 2018

4

Gasrec also presented a case example as to how regulation, duty incentives and the availability of suitable three axle trucks has underpinned the growth of LNG in trucks in the UK. Italian logistics company Codognotto said that it is currently growing by 15% per year, and believes that it has a sustainable approach to the company - a young fleet with vehicles changed every three years with all its trucks Euro 6 compliant. It also teaches its drivers to “drive green” and it targets 80% of its fuel from renewable sources. It would like to start using Bio-LNG now, but there are no big suppliers.

Most speakers were of the view that, due to the high start-up costs in an infant industry, company collaboration and partnerships will be required. Such partnerships will also support the high cost of developing new innovative solutions.

Is LNG the replacement for diesel?

The use of diesel in cars and trucks is becoming increasingly emotive (supported by manufacturer scandals such as VW). “Diesel kills”, with photos, is now being reported in the papers. Public opinion is therefore against diesel, but gas is seen by the industry as the only real alternative.

As with bunkers, there was a lot of discussion over the question “what does a truck owner replace diesel with?” Is LNG the best solution or should companies jump straight to hydrogen or electric powered trucks? What are the alternatives? Speakers were of the view that selecting a suitable energy source will depend on the application the energy is required to drive - right technology for the right application. Hydrogen has a low energy density, so not enough energy can be stored for long distances, and is therefore a suitable fuel for buses. Batteries are too heavy and consequently lose too much payload. Long distance electric trucks are being tested and, in the future, could become an option. CNG is suitable for short distances but LNG is currently the only available

solution for long distance trucks. The trouble is that politicians do not understand that hydrogen is not necessarily available today and that LNG, even though it is a hydrocarbon fuel, is the only real currently available solution on the road to decarbonisation. It was noted that there seems to be an obsession with electric vehicles, but this is not a viable solution for longer distance vehicles. Also 50% of the world's batteries are made in China due to tax incentives so there is a security of supply issue as well. IVECO set out the alternatives in a useful chart.

Replacement candidates

		Alternative technologies				
		Full Electric	Parallel Hybrid	Plug-in Hybrid	CNG Bio CNG	LNG Bio LNG
Missions	Urban	+++	+	+++	+++	+++
	Regional	Impractical	No benefit	+	+++	+++
	Off-Road	Impractical 10 years +	No benefit	+	+++	+++
	National	Impractical 10 years +	No benefit	No benefit	+++ Rigids only	+++
	Long Haul	Impractical 10 years +	No benefit	No benefit	Difficult	+++

IVECO

8

In a fascinating presentation non profit organisation (NGO), Client Earth, presented how it is using the legal system and courts to force government to develop and implement clean air strategies. It estimated that, in Europe, there are 400,000 premature deaths each year due to exposure to particulate matter and 75,000 from exposure to nitrogen dioxide (NO₂). It saw vehicle charging to enter clean air zones as the only technical solution to comply with air quality targets as the best way to reduce emissions with accountability and fines to help the transition to cleaner fuels. Other presenters noted that business wants a transition but need a short-term and long-term road map not just a blanket cut in diesel vehicles.

A stated fact was that well to wheel, LNG gives a 15% carbon dioxide (CO₂) reduction vs. diesel. In the Netherlands, however, the view is that LNG does not achieve the “zero emissions” requirement and therefore there needs to be a better solution. Politicians do not support gas as much as they used to and believe that the zero emissions target cannot wait until 2030, it needs to come in to force well before that. A cross industry commission is looking into this. This major move could have a huge impact on LNG for trucks in the country and, if an economic and Bio LNG alternative is developed, it will have an impact on the rest of Europe as other countries seek to copy what the Netherlands is doing.

One presenter noted that “LNG is the fuel of the day not the future”, supporting Bio LNG as the end of the fossil fuel era for trucks. Bio LNG can use the same infrastructure as the LNG chain, but production volumes are small and currently costly. Costs need to fall and one way to do this could be to start blending Bio LNG and normal LNG to at least achieve some environmental benefits. Rolande LNG was clear that the message it seeks to develop is, “the journey to a cleaner planet”.

The conference agreed, “we need to sell sustainability along the value chain” with the end game being hydrogen use in road transport and, potentially, shipping. That said, Bio LNG should be

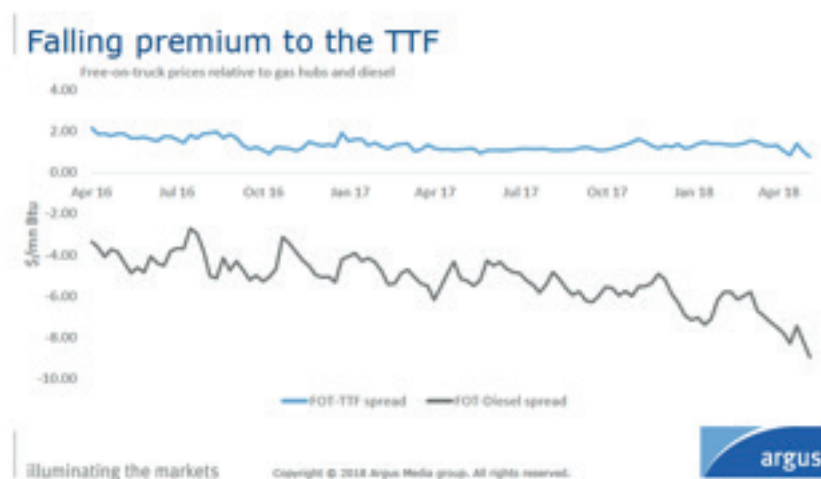
compared with electrical and other sustainable technologies not LNG, and only then be developed if there is a business case.

Demand

The conference agreed that securing more LNG demand for use in road trucks is a priority. Finding new pockets of demand will take time and to achieve that truck owners will need security of regulation/duty as well as an economic case to support investments in LNG trucks that are more expensive than the diesel alternatives. In a poll of the audience, 52% of delegates believed that the main reason road transport companies are switching to LNG for fuel was to achieve cost savings while only 19% was for environmental reasons and the balance (27%) was to differentiate themselves.

Price

The pricing of LNG for trucks varies on what buyers want, some contracts are priced on a diesel basis, others based on a gas hub basis. During a pricing panel, Argus presented its “Free on Truck” (FOT) assessment vs. diesel and Title Transfer Facility (TTF) since the assessment started in April 2016. It is interesting to note how, as the volume of LNG for trucks increases, so the LNG FOT/TTF spread narrows.



Argus also noted that the LNG FOT price can be influenced by Asian spot LNG prices as, when LNG is “pulled” from Europe, it means less LNG is available in tank for European truck loadings. Also, there is a clear seasonality of the LNG FOT price, which is due to the seasonality in LNG and gas prices. Argus was of the view that the rapid growth of LNG truck loading will further reduce the affect of price seasonality.

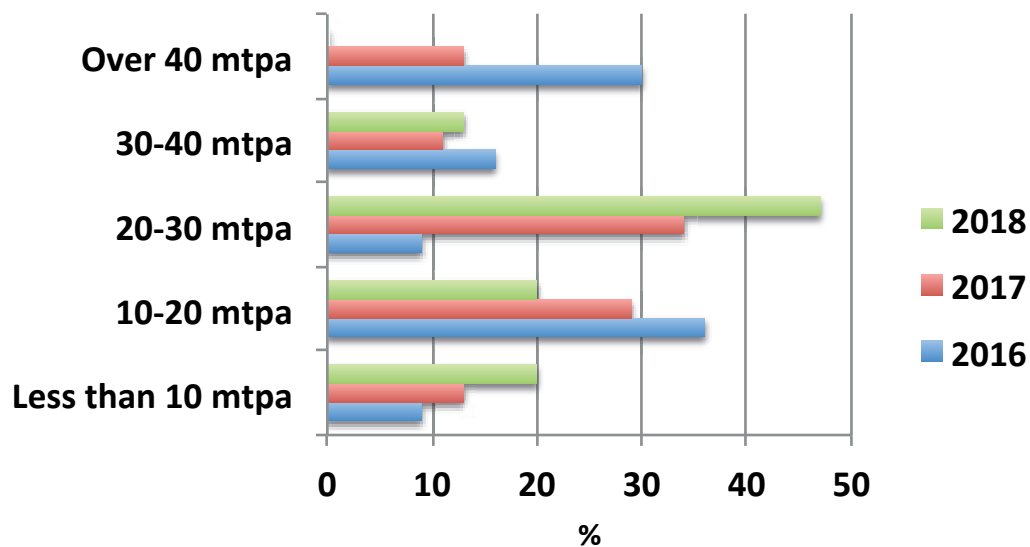
Potential volumes of global LNG for bunkers and road transport

In an audience survey it was viewed that by 2025 LNG for bunkers and road transport could amount to 20-30 mtpa LNG demand and by 2030 this could rise to 30-40 mtpa. Interestingly, comparing the polling results from previous years, the possibility of a volume of 40+ mtpa by 2025 was seen as less likely (while at the same time a volume of less than 10 mtpa was more likely) but from 2030, higher volumes were expected, except for 2040 which remained roughly the same, and no one felt that there would be less than 10 mtpa uptake.

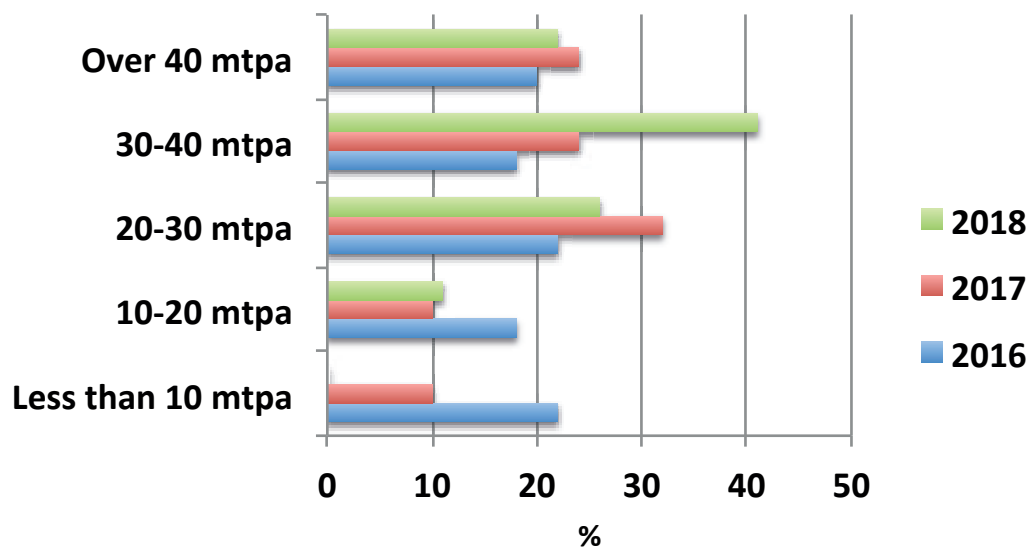
Polling Results

NOTE: NOT ALL QUESTIONS ASKED EACH YEAR

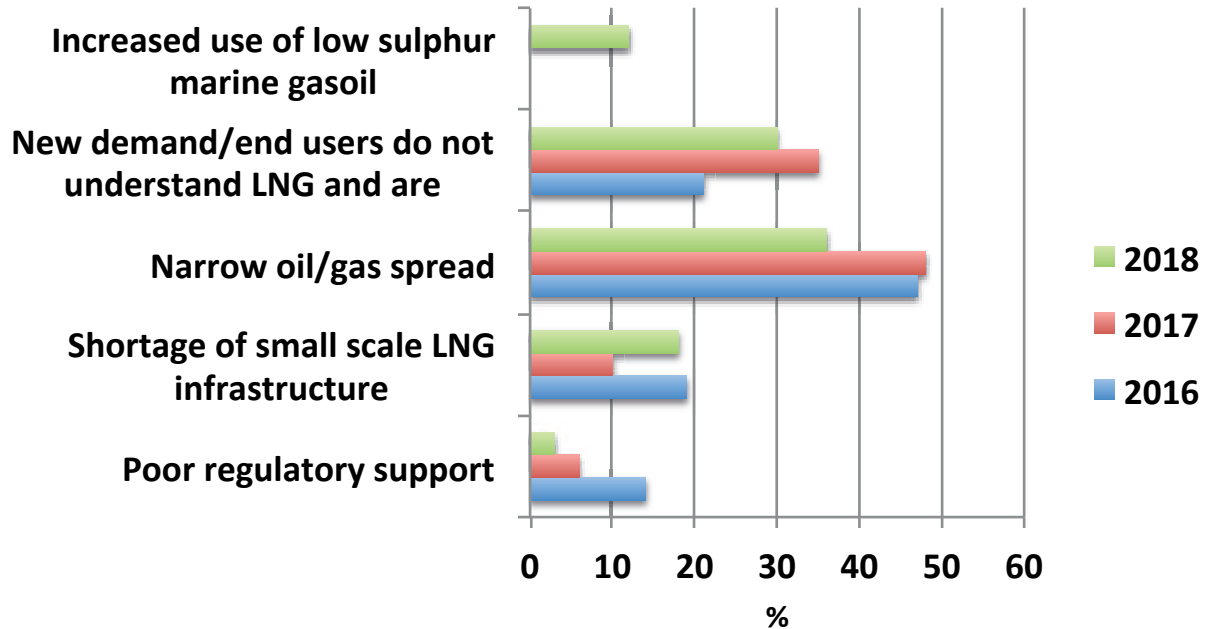
How large will the global LNG from LNG bunkers and road transport be in 2025?



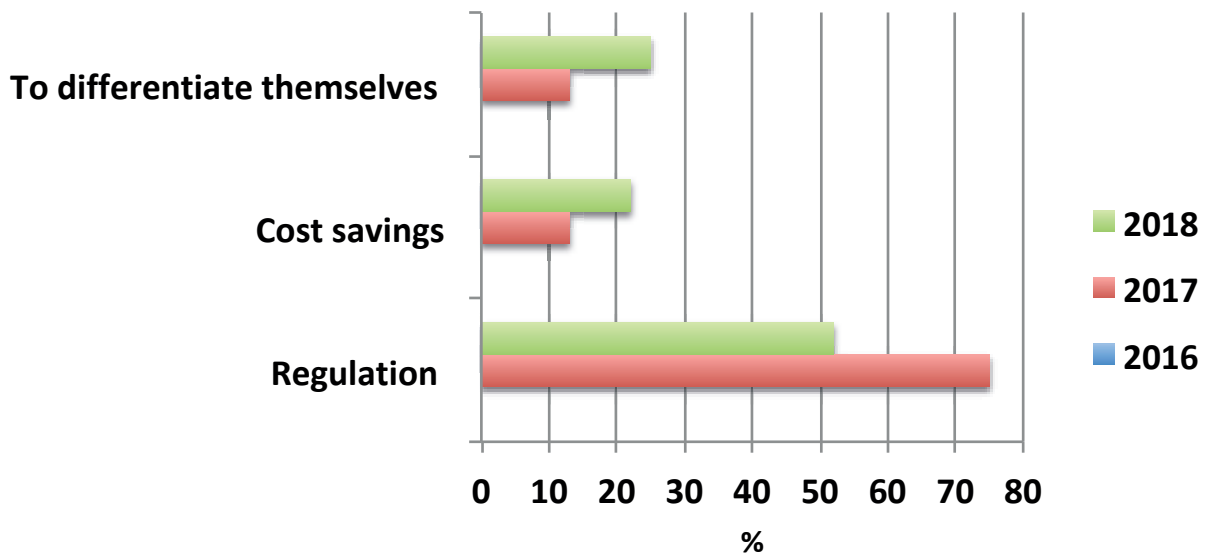
How large will the global LNG from LNG bunkers and road transport be in 2030?



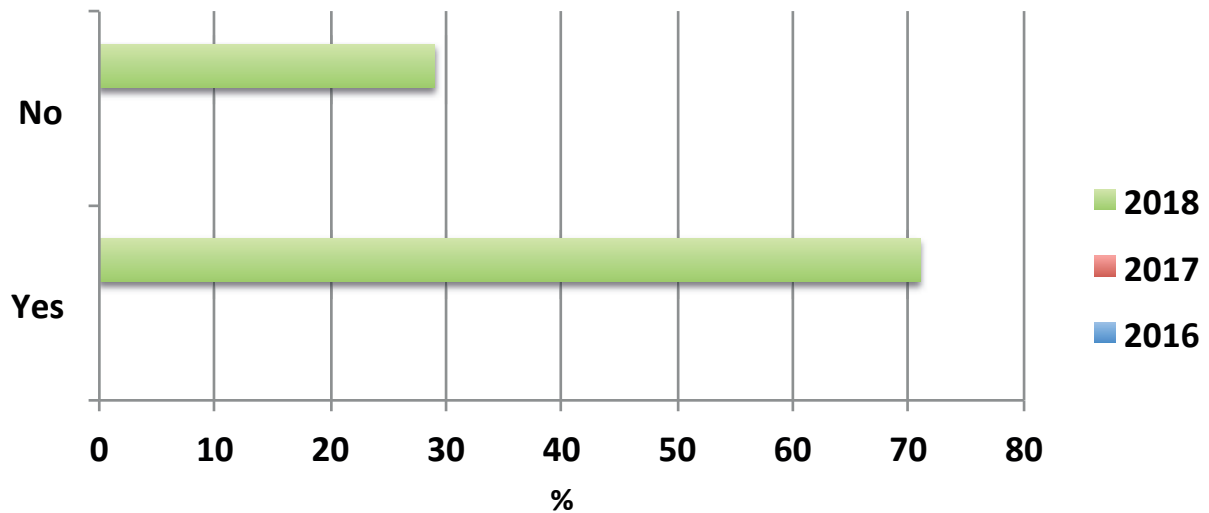
What is the main factor that will slow down the growth for the use of LNG as a fuel?



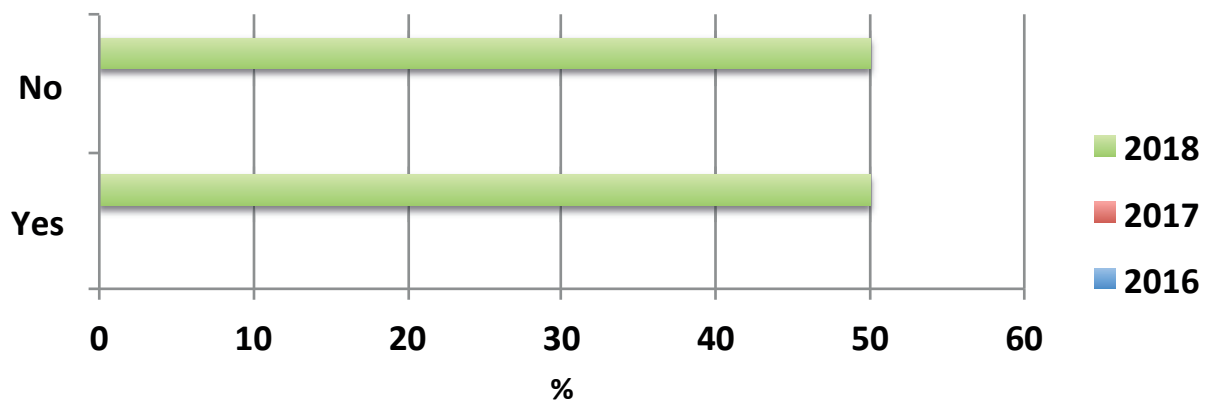
Why are shipowners switching to LNG for bunkers?



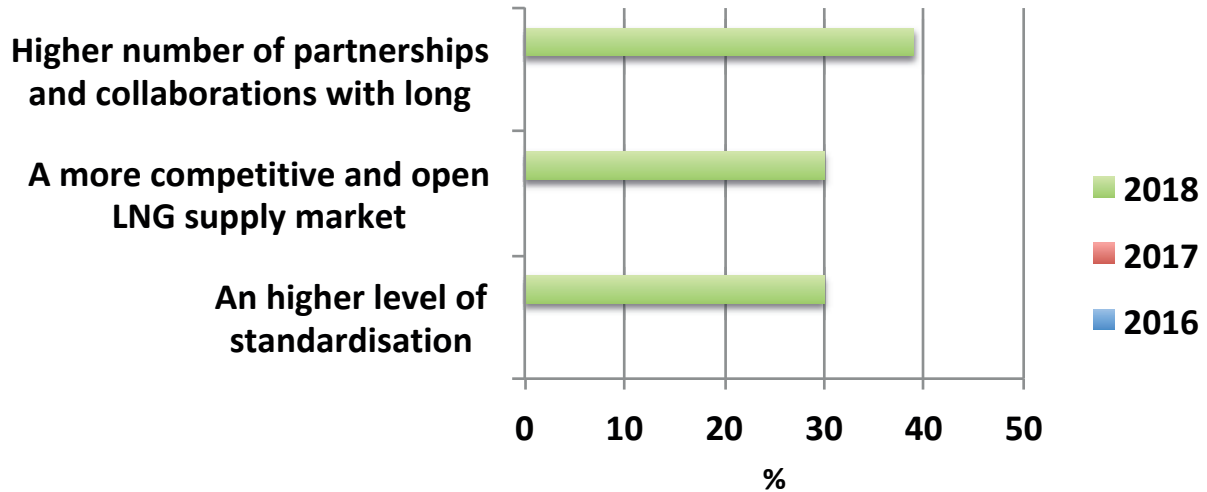
Will ship-owners adhere to the 2020 emission regulations?



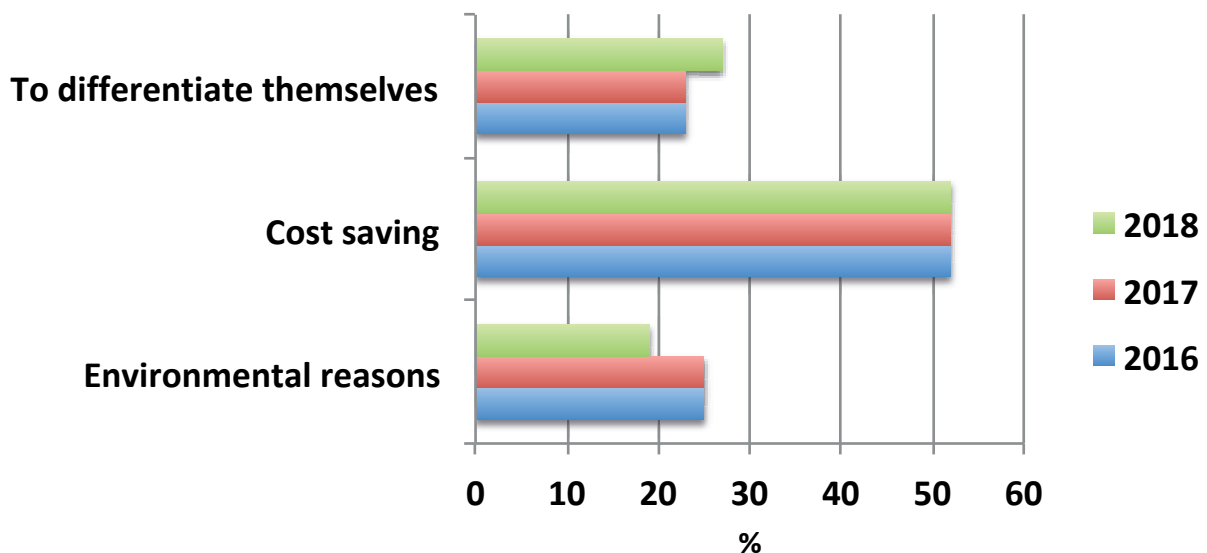
Is the slow development of the LNG supply infrastructure still the main factor to hold back the wider and faster adoption of LNG as marine fuel?



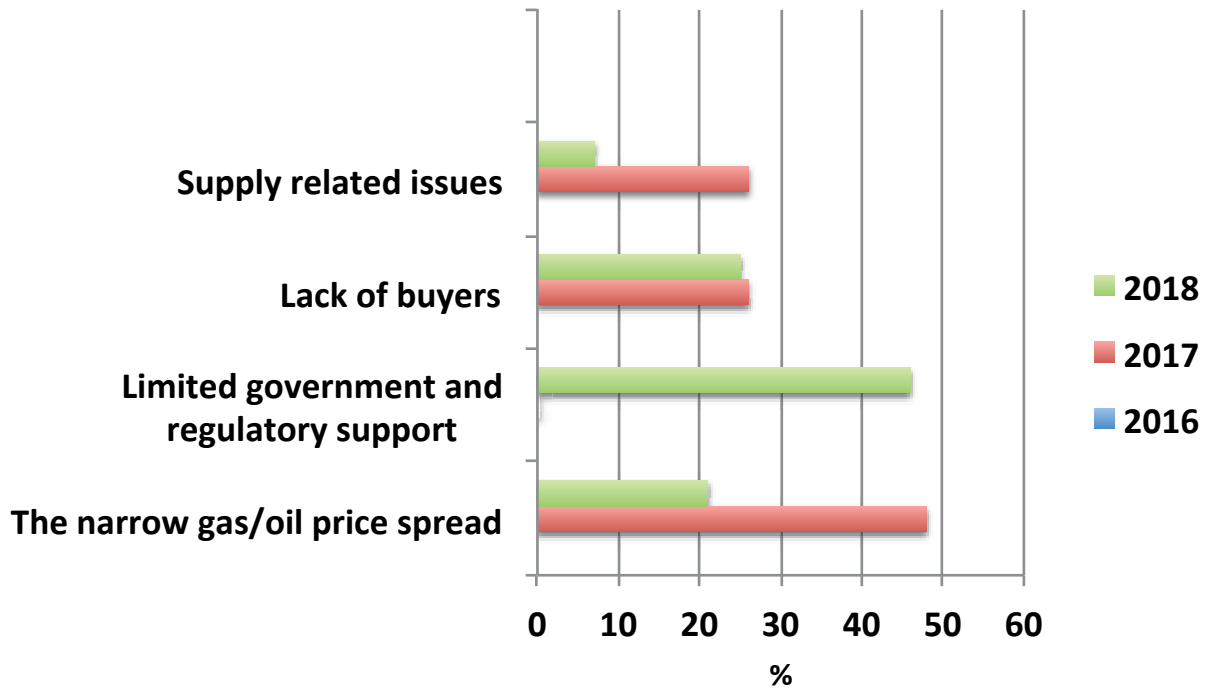
What do you believe would more effective for reducing the logistical costs of the LNG supply distribution?



Why are road transport companies switching to LNG for fuel?



What is preventing the growth of LNG as a fuel?



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