



## LNG ‘PART OF MIX’ IN ‘WILD WEST’ OF FUTURE FUELS

LNG is a key part of the mix in decarbonising shipping as the industry moves towards hydrogen-based fuels as the long-term zero-emission solution, according to Shell's new shipping chief, Karrie Trauth. Shell Shipping & Trading senior vice president Trauth said that for the sector to decarbonise now, it has to start with the lowest carbon fuel available today. She made the comments while speaking about decarbonisation with DNV Maritime chief executive Knut Orbeck- Nilssen at the 13th Annual Capital Link Shipping & Marine Services Forum. Trauth, who has been in the job for just six weeks after moving from Houston to London to take up the role, said she did not know how long LNG's role would last. "I think it is a key part of the mix," she said, adding that the industry is seeing more uptake. "Today, we calculate that you could potentially reduce, just using LNG, up to 80% of greenhouse gas versus a 2008 baseline." But for some, the uncertainty over future fuelling options had created a "wild west" market for shipowners looking to invest in tonnage. International Seaways president and chief executive Lois Zabrocky, who was speaking in a debate about sale-and-purchase and newbuildings, said some investors are willing to support more innovative investments and tanker owners will increasingly invest in greener options. But she said owners constantly need to be kept updated on the latest technology. "All of these different areas for owners are available," she said. "It's a little

of the wild west. We have to consider how do we pivot and make sure that in five years' time we are still in the pack, leading the pack in that hunt of — as the world decarbonises and we are moving energy — how we compete?” Zabrocky said LNG is “quite pricey” as a fuel at present. She said newbuilding decisions are not just about the capital expenditure. International Seaways has ordered three of the 10 LNG dual-fuelled VLCCs chartered by Shell at the start of this year. Zabrocky said the owners behind these were “lucky with Shell’s timing”, ordering the ships at \$96m each at the end of 2020. source : [www.tradewindsnews.com](http://www.tradewindsnews.com)

## **FIRST FSRU TAKES NSR WESTBOUND TO REACH SABETTA**

A first floating storage and regasification unit is heading through the Northern Sea Route (NSR) as a wide range of vessels brave the Arctic passage for the 2021 season. Kpler data shows the 170,000-cbm FSRU Marshal Vasilevskiy (built 2018) is moving westbound through the NSR. Sources said the Arc4 ice-class ship started its voyage on 10 September and is heading to Yamal LNG’s terminal at Sabetta to load a cargo. They said it is the first FSRU to move through the NSR. But the vessel, which was contracted at the dedicated regas unit for Russia’s exclave of Kaliningrad, is trading as an LNG carrier as it is only needed at its designated base in times of emergency if pipeline gas supplies are threatened. This is the summer season for the Arctic route, when sea ice is usually at its lowest extend and Arc4 LNG vessels are able to call at the Yamal facility. Two other Arc4 LNG carriers — the Dynagas-owned, Novatek- chartered, 161,870-cbm Clean Horizon (built 2015) and 162,000-cbm Clean Vision (built 2016) — have also been spotted on the NSR by Eikland Energy data service iGIS/LNG.

### **Busy summer**

The 5,800-cbm LNG bunker vessel (LNGBV) newbuilding Dmitry Mendeleev is currently off Vladivostok. Sources said the small vessel is being lined up to transit the NSR en route to its new area of operation in the Baltic Sea. It would be the first LNGBV to take the Arctic route. Similarly, Russian LNG producer Novatek is using the NSR to ship the topside modules for the gravity-based structures (GBS) that will serve as the liquefaction units for its Arctic LNG 2 project. The heavy lift vessel GEO Grace left Wison Offshore & Marine’s yard in China on 19 August taking the NSR to Murmansk in Russia where the liquefaction GBS units are being assembled. A second batch of topsides departed the yard on the same route last week. The Northern Sea Route Administration (NSRA) has already received more than 1,008 applications to sail on the NSR this year.

### **Ship traffic**

To date, 979 vessels have been granted permission. In 2020, the NSRA received 1,033 applications. Russia wants to see the NSR open to year-round navigation between 2024 and 2030, and increase cargo turnover to 80m tonnes by 2024. The government is rolling out a plan, which runs through until 2035, to develop infrastructure along the passage. This is being overseen by Russia’s state atomic energy corporation Rosatom. source : [www.tradewindsnews.com](http://www.tradewindsnews.com)

## VIETNAM TO START MAIDEN LNG IMPORTS IN 2022

Vietnam aims to begin importing its first liquefied natural gas (LNG) cargoes in 2022 as part of a longer-term plan to maintain stable natural gas supply and meet rising demand for power, the country's Minister of Industry and Trade Nguyen Hong Dien said. "With the goal to start importing LNG in 2022, import demand will increase to about 5 million tonnes of LNG in 2025, 10 million tonnes by 2030 and 15 million tonnes by 2035," Dien said in a pre-recorded video address ahead of the Japan-hosted 10th LNG Producer-Consumer Conference on 5 October 2021. Vietnam, which is experiencing economic growth rates of 6% per year, largely relies on hydro, coal and oil, to meet energy demand, which is expanding at 10% per year, added Dien. But these fuel sources are showing signs of decline and Vietnam is now targeting more renewable energy and imports of LNG to boost energy security. Vietnam also produces natural gas, but output is waning. Dien said the country plans to import LNG and in parallel develop more domestic sources of natural gas. He added that Vietnam is accelerating developments of LNG import terminals and associated infrastructure. The government is also creating a legal framework for the LNG sector. Vietnam is seeking foreign investment to help build its LNG sector. source : <https://www.energyvoice.com/oilandgas/>

## REPAIR WORK ON LNG TERMINAL TO CUT SUPPLIES

Engro's liquefied natural gas (LNG) import terminal is scheduled to shut down for four days (Tuesday-Friday) for repair and maintenance work and the suspension is expected to halve LNG supplies to power plants, CNG stations, commercial, industrial and residential consumers. LNG supply from the terminal will remain suspended for the first two days of repair work, which is being undertaken to replace temporarily installed floating storage and regasification unit (FSRU) Sequoia with a permanent one, Exquisite, which had gone to Qatar for overhaul in June. "Engro Elengy's own FSRU Exquisite is on its way to Karachi (Port Qasim) and good news is that it will not be empty, rather, it will be loaded with LNG," an Engro Corp official told The Express Tribune on Monday. The FSRU had gone to Qatar for dry docking (repair and maintenance), he said. He revealed that supplies from the terminal would resume from the third day of repair and maintenance (Thursday). These would be gradually ramped up and would normalise by the fourth day (Friday). The terminal has an installed capacity for the supply of 630 million cubic feet per day (mmcf) of LNG, he said. Almost all the supplies from Engro's LNG terminal go to Punjab where two large LNG-fired power plants (having capacity of 2,600 megawatts) and hundreds of compressed natural gas (CNG) filling stations are located. The planned shutdown will partially disrupt the life in Sindh, Balochistan and Khyber-Pakhtunkhwa. "Due to gas shortage, there may be some chances of low pressure complaints in certain parts of Karachi," Sui Southern Gas Company (SSGC) said in a statement. At present, only two LNG import terminals are functioning in the country. The second LNG terminal, owned by Pakistan LNG Limited (PLL), will continue to work and ensure supplies to the priority consumers, including residential consumers and power plants. The terminal is owned by the state and has installed LNG handling capacity of around 600 mmcf. The share of gas supplies from the two import terminals is calculated at around 26%, or 1,200 mmcf, of the total gas available in the system, which is estimated at 4,600 mmcf. Pakistan produces 3,400 mmcf of gas from local fields. "The supply of LNG to Sui Southern Gas Company will drop by half to 75 mmcf over the next four days (September 14-17) compared to 150 mmcf in normal days owing to dry docking of Engro LNG terminal," SSGC announced in the statement.

SSGC supplies gas to consumers in Sindh and Balochistan while Sui Northern Gas Pipelines Limited (SNGPL) transmits gas to consumers in Punjab and Khyber-Pakhtunkhwa. “In order to ensure uninterrupted gas supplies to domestic (residential) and commercial customers, SSGC will manage gas load by halting gas supplies to all CNG stations across Sindh and Balochistan from September 14, 2021 (midnight between Monday and Tuesday) for four days,” the SSGC statement read. “Gas supply to CNG stations will be restored on Saturday (September 18) at 8am.” Moreover, gas supply to K-Electric, Sindh Nooriabad Power Company and Fauji Fertiliser Bin Qasim will fall marginally. If these reductions were unable to cover the gas shortfall for the priority customers, “gas supplies to non-export industries will be curtailed (as well),” it said. source: [www.tribune.com.pk](http://www.tribune.com.pk)

## **ABS, HUDONG-ZHONGHUA SHIPBUILDING AND WÄRTSILÄ LAUNCH JOINT DEVELOPMENT PROJECT FOR IMO 2050 CII-READY LNG CARRIER**

ABS, Hudong-Zhonghua Shipbuilding (HZS) and Wärtsilä are to develop a flexible, future ready and modular concept for a future multi-fuel electric Liquefied Natural Gas Carrier (LNGC) vessel. Using advanced multi-physics modeling and simulation, the joint development project (JDP) will apply various decarbonization technologies and solutions to the vessel design and operation models to investigate its performance against the International Maritime Organization’s (IMO’s) Carbon Intensity Indicator (CII) up to at least 2050. The LNGC will be highly flexible, and the entire vessel design will be optimized around a compact, electrified, integrated and efficient propulsion power solution that will deliver a significant CO<sub>2</sub> reduction immediately and be ready to efficiently integrate new technologies in the future in order to stay ahead of the requirements of CII. The project will unite specialists from the ABS Global Simulation Center and Global Sustainability Center in Singapore, Houston and Athens with HZS’ R&D team and Wärtsilä’s Integrated Systems and Solutions experts. “The evolving demands of the CII mean vessels will need to be ready to continuously improve their efficiency rating to remain viable for the duration of their operational life. Advanced multi-physics modeling and simulation techniques enable development of a vessel with a strong CII profile at launch that is also equipped to take advantage of future decarbonization technologies as they mature,” said Patrick Ryan, ABS Senior Vice President, Global Engineering and Technology. “ABS is a leader in the application of multi-physics modeling and simulation at sea and we are excited about the potential of this technology to drive shipping’s decarbonization ambitions and meet IMO 2050 objectives.” “We are very glad to closely work together with Wärtsilä and ABS to develop the new generation of LNG carriers that offer a low-carbon footprint and low OPEX cost,” said Mr. Song Wei, R&D Deputy Director of Hudong-Zhonghua Shipbuilding. “This state of the art hybrid solution will be developed to power the future LNG carrier, enabling dual-fuel engines running always at best efficiency and providing flexible power supply modes to adapt to various load demands.” Shipowners are currently faced with unprecedented challenges and uncertainties as they attempt to plan their fleets in order to meet the IMO’s Carbon Intensity Index (CII) carbon reduction trajectory of -70 percent by 2050. What is certain today is that owners must plan now to safeguard a future-proof newbuild vessel design. By installing and optimizing the vessel design around a compact, electrified and hybridized propulsion system, owners can obtain today a highly optimized and flexible asset that maintains remarkably high efficiency across a broad range of vessel speeds and power nodes – making it highly suitable to

accommodate needed vessel speed and voyage optimizations in the future. “The modular and hybridized nature of this smart propulsion system provides the correct foundation for the introduction of new and potentially highly intermittent low-carbon energy sources and propulsion energy-saving devices both in the newbuild phase and also later as potential retrofit solutions. We are honored that ABS and Hudong-Zhonghua have invited us to contribute to the development of this new LNGC design that will leverage ABS’ long experience in LNGC development and simulation expertise as well as Hudong-Zhonghua’s rich design and construction experience of large LNGCs,” said Mr. Stefan Nysjö, Vice President, Power Supply, Wärtsilä Marine Power. source : [www.xindemarinenews.com](http://www.xindemarinenews.com)

## **DSME WINS ORDER FOR 4 LNG CARRIERS**

South Korean shipbuilder Daewoo Shipbuilding & Marine Engineering (DSME) has secured an order for four liquefied natural gas (LNG) carriers, exceeding its 2021 order target. On 14 September, DSME said it signed a KRW 990 billion (\$846 million) shipbuilding contract with an unnamed Asian shipowner. The units will be built at Okpo Shipyard and delivered to their owner by 31 October 2024. As informed, the 174,000 cbm LNG carriers will be equipped with a dual-fuel propulsion engine (ME-GA) and a more advanced re-liquefaction system. “It is an eco-friendly, high-efficiency vessel (type) that can respond to stricter greenhouse gas emission regulations by significantly reducing gas emissions to the atmosphere,” the shipbuilder said. With the latest deal, DSME has so far this year won orders amounting to \$8.04 billion, achieving about 104 percent of its target of \$7.7 billion. Doing so, it joined compatriot shipbuilding giant Korea Shipbuilding & Offshore Engineering (KSOE) which also surpassed its annual order target in mid-July. As explained, this is the first time that the shipbuilder exceeded its order target since 2014, after which orders plummeted due to a deterioration in the shipbuilding market. DSME also noted its order backlog stands at \$22.2 billion and will keep its shipyards busy in the coming two years. This year, DSME received orders for a total of 46 vessels, including 16 containerships, 11 very large crude oil carriers, 9 super-large LPG carriers, 6 LNG carriers, 1 wind turbine installation vessel (WTIV), 1 submarine, and 2 offshore plants. source : [www.offshore-energy.biz](http://www.offshore-energy.biz)

## **AUSTRALIAN LNG EXPORTS CONTINUE TO CLIMB**

Australian LNG exports almost hit a record high in August, boosted by more shipments to China, Japan and Taiwan, according to EnergyQuest. In August, Australian projects shipped in total 7.18 million tonnes or 105 cargoes, higher than July, and just short of the record of 7.2 million tonnes or 105 cargoes in March, the consultancy said in its monthly report. Compared with July, Australian projects delivered 14 additional cargoes to China, Japan and Taiwan in August, but four fewer cargoes to Korea, Malaysia and Singapore, it said. Shipments from the west coast increased to 5.3 million tonnes in August, with 76 cargoes in August compared to 72 in July. A year ago, the west coast shipped 70 cargoes or 4.9 million tonnes. The consultancy noted that Chevron’s Gorgon and Shell’s Prelude are now operating at full capacity. As previously reported by LNG Prime, east coast shipments increased to 1.9 million tonnes in August with 29 cargoes, compared to 27 in July, and 26 cargoes a year ago. The east coast projects operated at 87 percent of nameplate capacity during August, EnergyQuest said. There were four spot LNG cargoes from the east coast in August and five spot cargoes from the west coast. This represents some 9

percent of total shipments, the consultancy said. Energy Quest said Australian LNG exports remain unaffected by the record spot LNG prices. Significant growth in gas demand post-Covid-19 in both North Asia and Europe has created competition for LNG cargoes, particularly from the US and Qatar, pushing up gas spot prices to record levels for this time of the year, it said. Asian LNG spot prices have surged past \$20/MMBtu in September this year, with the S&P Global Platts JKM for October delivery assessed at \$25.075/MMBtu on September 15. "Australian LNG is relatively unaffected, with most projects already operating near capacity and with revenue largely linked to oil prices rather than spot prices, Source : [www.lngprime.com](http://www.lngprime.com)

## LNG BUNKERS PROMISING OPTION AMONG MANY ALTERNATIVES

LNG as a marine fuel presents a viable and immediate solution to expedite decarbonization as shipping explores other options like biofuels, ammonia and methanol to meet stricter environmental regulations, experts said at an industry event. "For many alternatives, we have not done life cycle analysis and that adds a tremendous amount of uncertainty ... What is [future] regulation going to look like? That's why we're seeing an emphasis on LNG right now," Peter Keller, chairman SEA-LNG, said at the virtual Ship Energy Summit 2021 organized by Petrosport Sept. 7-8. The LNG bunker market is poised for maturity, with many shipowners mulling or undertaking forward long-term contracts in this space, Keller said. This year has seen a flurry of new LNG dual-fuel ship construction contracts, and the trend is expected to continue as shipping progresses toward net-zero. LNG-fueled ship orders are approaching 30% of gross tonnage on order, representing a substantial part of shipping's overall capacity when these are delivered, SEA-LNG said in a statement Sept. 7 citing Clarkson Research Services, adding that it is anticipated that more than 90% of the new Pure Car and Truck Carriers that will enter the market in the coming years will be LNG dual fuel. Likewise, containership owners and operators are moving to LNG-fueled tonnage, with orders for LNG-fueled liners increasing fivefold since January 2020. Tankers and bulkers are also following suit, with increases of sevenfold and twofold, respectively, over the 18-month period, SEA-LNG added. "LNG has had a long history in cargo trading. I think LNG is the most viable choice today along with biofuels," Nacho de Miguel, head of business development, Peninsula Petroleum, said at the same event. The company launched its LNG bunkering business in February. "We are fortunate to have deep relationships with many customers, either already operating LNG-powered vessels, or in the final stages of delivering new ships for service. Building our LNG proposition around customer needs is a natural progression for us," Victor Morales, Peninsula's global head of sales & marketing, had said in a statement that month.

### ***Other alternatives***

"When we go to other alternative fuels, we see a lot of interest in methanol but question who would supply," said Dag Lilletvedt, CEO and founder of Powerzeek, a company that provides a fuel digital platform. For biofuels, shipowners are interested but there is a lot of uncertainty shrouding its widespread adoption, he said. "It's more like a bilateral market that is not very transparent and [then] there is also a question -- how do you make that biofuel," Lilletvedt said. Then are other hurdles around many alternative fuels, such as developing a supply chain, getting the product to ship, and training seafarers around their uses, Keller said. But as far as LNG was concerned, the infrastructure is readily available globally, said Christoffer Berg

Lassen, COO at Bunker Holding. "We can take it [LNG bunkers] in the same tank, same ships and we can burn it in the same engine. And that's a challenge for methanol and ammonia," he said. Chris Chatterton, COO of the Methanol Institute, told S&P Global Platts separately in a recent interview that methanol is set to play a "sizable role" in the global bunker fuel mix by 2050, but its short-medium term prospects had also received a boost after A.P. Moller-Maersk announced plans to have eight large ocean-going containerships capable of being operated on carbon-neutral methanol. When asked how hydrogen and ammonia stacked up versus methanol as zero carbon fuel options, Chatterton said both hydrogen and ammonia are zero-carbon fuels on a tank-to-wake basis, but are actually more carbon intensive than methanol on a well-to-wake, unless produced through a green platform such as renewably powered electrolysis. Additionally, on a net greenhouse gas or CO2 equivalent basis, methanol performs better than hydrogen or ammonia. Methanol is a superior carrier of hydrogen than hydrogen itself in either gas or liquid form, he said. However, to provide impetus to methanol as a marine fuel, there is a need to push policy that fully supports decarbonization as ships are already on the water with more being ordered, Chatterton added. In the end, the transition to alternative fuels is a good opportunity to make the market more transparent, Berg Lassen said. When prices rise for alternative fuels, the need to secure more information from clients will also increase, facilitating more transparency in the industry, he said. With the new fuels, clients will likely be more interested to enter contracts rather than rely on the spot market. So, there will be more liquidity in the market and for the same purpose, continuous bank support is required, he added. source : [www.spglobal.com](http://www.spglobal.com)

## US LNG EXPORTS DECLINE SUBSTANTIALLY

US federal data from September 16 show total exports of natural gas in the form of LNG declined significantly in the seven days ending September 16 compared with the previous week, likely due to storm activity in the Gulf of Mexico. The US Energy Information Administration (EIA) reported that 16 vessels laden with LNG left export terminals during the week ending September 16, carrying 56bn ft3 of gas in liquid form. For the week ending September 8, EIA reported gas exported as LNG totalled 74bn ft3, which was a 1bn ft3 increase from the week prior. Five of the vessels for the current reporting period left from the Sabine Pass terminal and two left from Cameron, both in Louisiana. From Texas, four left from Corpus Christi and three left from Freeport, the latter of which suffered a brief power outage this week due to the impact of Tropical Storm Nicholas. Operators at Cameron in a statement sent to NGW said earlier this week that they took the necessary precautions to ensure its personnel and its plant were safe, but the storm had no impact on its operations. Outside the region, one vessel laden with LNG left the Cove Point terminal off Maryland and one departed from Elba Island off the coast of Georgia. Piped exports of natural gas to Mexico also declined during the reporting period, from 5.9bn ft3 to 5.5bn ft3. Imports, meanwhile, increased. Canada sent 4.8bn ft3 to the US market during the week ending September 15, a 0.3bn ft3 increase from the previous reporting period.

source : [www.naturalgasworld.com](http://www.naturalgasworld.com)

**FORTISBC TRIMS TILBURY LNG EXPANSION**

BC utility FortisBC said September 14 it had filed a detailed project description (DPD) for its Tilbury LNG Phase 2 expansion with regulatory authorities, reducing both the incremental liquefaction capacity and the additional storage contemplated for the project. The DPD follows by about 18 months the initial project description (IPD), and incorporates learnings from early engagement activities carried out since the IPD was filed in March 2020. Ultimate incremental capacity from the Phase 2 expansion has been reduced to 7,700 metric tons/day from 11,000 mt/day in the IPD, reflecting the result of early-stage engineering. New capacity will be added in stages in response to market demand; at full build-out, the expanded Tilbury LNG facility will be able to produce about 10,460 mt/day of LNG, including 60 mt/day of capacity from the terminal's base plant – built in 1971 – which FortisBC says will be retired once Phase 2 is complete. Additional storage capacity in Phase 2 has been reduced to 142,400 m<sup>3</sup> from 162,000 m<sup>3</sup>, reflecting early engineering and planning work in 2020 that enabled the utility to more accurately estimate the amount of new storage it would need to provide required system resiliency improvements. Total storage capacity at the expanded facility will be 216,400 m<sup>3</sup>. What hasn't been reduced is the estimated cost of the project: FortisBC is still estimating the total cost at C\$3-\$3.5bn. About 6,000 fulltime-equivalent (FTE) jobs will be created during construction, with 110 FTE jobs created in the operating phase. Source : [www.naturalgasworld.com](http://www.naturalgasworld.com)

**JAPAN'S MOL SIGNS CHARTER DEALS FOR 4 NEW LNGCS WITH NOVATEK**

Japanese shipowner Mitsui OSK Lines (MOL) said on September 14 it had agreed to charter out four newbuild LNG carriers to Russia's Novatek. The 174,000-m<sup>3</sup> membrane-type vessels will be constructed by South Korea's Daewoo Shipbuilding & Marine Engineering Co., and are slated for delivery in 2024. The LNGCs are equipped with the Man Energy Solutions engines, which offer major improvements in fuel efficiency, MOL said. They also have a new design that generates less boil-off gas from cargo tanks through the use of the re-liquefaction unit on board and a shaft generator system that uses the rotating propeller shaft for power generation. These vessels are considerably more environmentally friendly than current LNGCs in service, the company added. Source : [www.naturalgasworld.com](http://www.naturalgasworld.com)

**IEA SEES LOWER LNG IMPORTS THROUGH JUNE**

The International Energy Agency (IEA) reported September 14 that total exports of LNG in the first six months of this year improved versus the level a year earlier, though imports did not follow suit. This year through June, OECD members took in a total of 146.9bn m<sup>3</sup> of natural gas in liquefied form through June, a 5.7% decline from the same period in 2020. Elsewhere, the IEA reported that Algeria saw imports improve 4.7% from June 2020 to 10.2bn m<sup>3</sup>. In late July, Algerian state oil and gas company Sonatrach returned its Skikda liquefaction plant to normal operations after a 45-day outage. Russia too saw imports increase, with the 16.4bn m<sup>3</sup> through June representing an 8.4% increase over the level in the corresponding period of 2020. The IEA reported few other major national gains in LNG imports. For exports, the IEA reported that volumes increased 0.8% from the previous year through June 2020, to 396bn m<sup>3</sup>. The UK led the pack with a 68.5% increase, reaching 11.7bn

m<sup>3</sup> through June 2021. Exports from the Czech Republic increased 16.8%, while US exports of LNG improved by 12.5%. Source : [www.naturalgasworld.com](http://www.naturalgasworld.com)

## WARTSILA TO WORK ON IMO2050 CII-READY LNGC

Wartsila on September 13 said it will collaborate with the American Bureau of Shipping (ABS) and China's Hudong-Zhonghua Shipbuilding (HZS) to develop "a flexible, future-proof, and modular LNG carrier (LNGC) vessel concept". The design approach for the multi-fuel electric vessel is intended to deliver immediate CO<sub>2</sub> savings, and to be ready for the adoption of future decarbonisation technologies to support the marine industry's ambitions towards zero-emission shipping, the company said. Wartsila said it is working alongside specialists from ABS Global Simulation Center and Global Sustainability Centre in Singapore, Houston and Athens and HZS' R&D and LNGC design team in Shanghai to evaluate the vessel's performance against the IMO's carbon intensity indicator (CII) up to at least 2050. The LNGC will be highly flexible and the entire vessel design will be optimised around a compact, electrified, integrated, and efficient propulsion power solution that will lead to a significant reduction in CO<sub>2</sub> emissions immediately, Wartsila said, adding that the design will also be ready to efficiently integrate new technologies in the future in order to stay ahead of the requirements of CII. Source : [www.naturalgasworld.com](http://www.naturalgasworld.com)

## COLD ENERGY RECOVERY CAN REDUCE LNG'S CARBON PROFILE

An LNG cargo carries with it not just the concentrated energy of liquefied gas, but a big parcel of cold energy. Chilled to -162°C for economic transportation, this temperature must be maintained in the specialised tanks onboard an LNG carrier (LNGC) until arrival at the receiving terminal. The LNG is then pumped into storage tanks before vaporisation and transmission as natural gas directly to consumers or into a distribution grid. Vaporisation usually involves using seawater or air to heat up the LNG, although waste heat, if available, and gas burners, can also be employed. The temperature difference between the super-cooled LNG and the ambient environment is large, but the cold energy embedded in the LNG is generally lost in the process, dissipating into the environment.

### Embedded energy

Liquefaction consumes a considerable amount of energy usually provided by burning gas to generate electricity to run compressors. This gas could otherwise be liquefied and burning it for power creates CO<sub>2</sub> emissions. The latest generation of LNG plants are going 'all-electric', sourcing power from the grid. If the electricity supply is renewable, this will reduce LNG's carbon footprint and increase the amount of feedstock gas for liquefaction. An example is the under-construction LNG Canada plant, which will source much of its power from Canadian electricity utility BC Hydro. Nonetheless, whether natural gas or renewable electricity is used as the primary source, significant energy is expended in the process - 2,900 kJ/kg of LNG, according to the paper *Thermodynamic and heat transfer analysis of LNG energy recovery for power production*. The majority of this energy, about 2,070 kJ/kg, is dissipated as heat, but the remainder, 830 kJ/kg, becomes 'cold energy' and is transported to the receiving terminal embedded in the liquefied gas. According to the study, about 0.23 kWh/kg of this energy could theoretically be recovered. As the throughput of LNG terminals can run to millions of metric tons/year, this is a significant

amount. Moreover, while carbon emissions may have been generated in producing the cold energy, there need be no further emissions relating to its recovery. Any cold energy recovery, regardless of the energy source used in the liquefaction process, should result in lower carbon emissions across the LNG supply chain. The direct economic benefits of cold energy recovery accrue to the terminal owner and associated industries, depending on the cold energy use, but the carbon benefits are in a sense a common good, aiding both consumers and producers' decarbonisation efforts.

## Recovery solutions

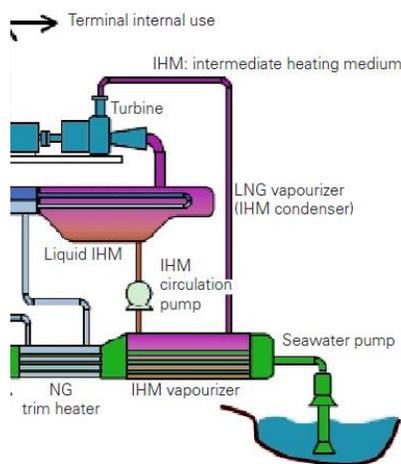


The applications for cold energy recovery include power generation, air separation, material freezing, air cooling, dry ice production, cryogenic CO<sub>2</sub> capture, seawater desalination and refrigeration.

The recovery possibilities are diverse – power generation, air separation, material freezing, air cooling, dry ice production, cryogenic CO<sub>2</sub> capture, seawater desalination or refrigeration, for example. Much

enic power generation system mediate heating medium

Source: Osaka Gas



research has focused on cryogenic power generation, which has looked at various methods such as direct expansion cycle, Rankine cycle, gas expansion cycle (Brayton cycle) and combined cycle systems. These all involve a thermodynamic cycle using the LNG as the cold 'side' and ambient or higher temperatures as the hot side. The reason for the focus on cryogenic power generation is that the electricity produced can offset terminal power consumption or be transmitted to other users by wire, while there may not be suitably located industries which can make use of other cold energy recovery options. Air separation is another popular choice as the cryogenic liquids produced can easily be transported to customers. In a direct expansion cycle, the LNG is regasified through an evaporator by seawater and the vapour produced is used to drive

a turbine. This is a simple system, but the gas pressure falls to levels only suitable for local gas distribution and only a relatively small amount of the cold energy is recovered. An alternative method is a Rankine cycle which uses an auxiliary fluid as the expansion medium. The auxiliary fluid is condensed by the LNG, which is then pumped to an evaporator heated by seawater and then passed to a turbine to generate power. In this case, the LNG does not expand and the send-out pump can be set to the required pipeline pressure, allowing long-distance transportation of the gas. Organic rankine cycle (ORC) systems, using different configurations or cascades using multiple auxiliary fluids can raise the energy recovery to over 200 kJ/kg, compared with about 20 kJ/kg for direct expansion cycles, according to research papers. Japan has led the way in developing cryogenic power generation in combination with its many LNG terminals. Osaka Gas started operation of its first unit with power output of 1,450 kW as far back as 1979 at the Senboku 2 LNG terminal, but globally the installation of cold energy recovery facilities has been seen as a fairly limited opportunity.

### **Recovery potential**

A study, *Cold Energy Recovery Performance Study for Liquefied Natural Gas (LNG) Regasification Process*, published in 2020, based on data from the 3.5mn mt/yr Pengerang regasification terminal in Malaysia, estimated potential cold energy recovery at about 43 MW with the efficiency of the open rack vaporiser system considered at 60–95%. Vaporiser efficiency depends largely on the flow rates of LNG and seawater, the study found. The report used a value of 200 kWh of cold energy produced in the regasification of 1 mt of LNG and was based on six months of continuous data collection. Another study, *Cold Energy Utilization in LNG Regasification System Using Organic Rankine Cycle and Trilateral Flash Cycle*, also published last year, estimated that deployment of small cryogenic propane-ORC-based power plants, if installed at all LNG regasification terminals under construction and planned for the period 2020–2023, could result in total recoverable power of 320 MW. The study assumed total new regasification capacity at the time of 97.6mn mt/yr across 26 terminals. There was considerable range, from 1.7 MW for the under-construction 0.5mn mt/yr Niihama LNG terminal in Japan to 6.5 MW for the recently completed 1.9mn mt/yr Krk facility in Croatia. Potential at the 22mn mt/yr capacity Kuwait Permanent LNG Import Facility, which received its first LNG cargo in July, was estimated at up to 75 MW.

### **Truck distribution**



*Any cold energy recovery, regardless of the energy source used in the liquefaction process, should result in lower carbon emissions across the LNG supply chain.*

Regasification does not take place only at coastal regasification terminals. The onward transportation of LNG by truck and rail means that LNG (and the cold energy) is travelling further inland. Even though trucks have much smaller volumes than LNGCs, they may still offer recovery options. Some companies have proposed mobile recovery systems, which transfer the cold energy from LNG to a higher temperature coolant or fluid. A drawback is that

demand for the cold energy, for example refrigeration, and natural gas are often not in the same place and they can be hard to coordinate both geographically and in time to create a high efficiency system. UAB Valcon estimates cold energy recovery of between 0.77–3.51 MWh<sub>e</sub> from a single LNG truck, depending on the temperature of the LNG.

### **Alternatives uses**

Power generation is not the only possibility and not necessarily the most economically viable. A study published in the Indonesian Journal of Science and Technology last year, *Optimization of LNG Cold Energy Utilization via Power Generation, Refrigeration, and Air Separation*, looked at cold energy recovery for power generation, the propylene refrigeration cycle and air separation. It found that air separation yielded the highest profit. The study was based on Malaysian state oil and gas company Petronas' 3.8mn mt/ye LNG terminal at the Melaka Refinery Complex in Malaysia. In air separation, the LNG is used as a cooling medium for the air pre-cooler to reduce temperatures to about -150°C. The cold air intake allows the Air Separation Unit (ASU) to run on minimum power, reducing costs and emissions. Propane is employed as a refrigerant in a number of chemical applications. For a propylene refrigeration cycle, the LNG is used to bring the warmed propylene back to lower temperatures (-35°C) for reuse without the aid of an energy-intensive compressor. The study found that any cold recovery use had to be within 10 km of the LNG terminal to minimise pipe outlay and energy losses from pipeline transmission.

## Liquid air energy storage (LAES)

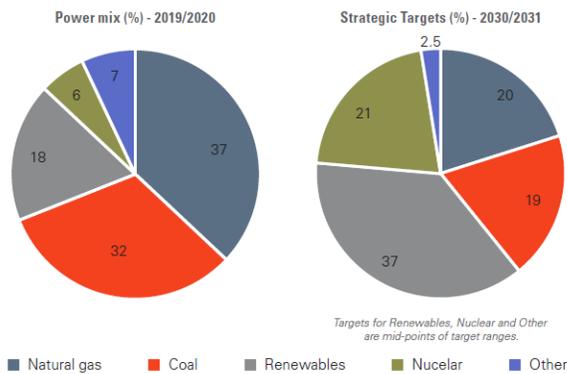
Other studies suggest new ways to use LNG’s cold energy. One, *Progress of liquefied natural gas cold energy utilization*, published in 2019, says LNG use in ASUs leaves the LNG at a temperature of about  $-100^{\circ}\text{C}$ , which means much of the cold energy has not been recovered. LNG use in freeze seawater desalination faces a similar problem in that the cold energy temperature use region is  $-2^{\circ}\text{C}$ , the point at which seawater freezes, compared with the much lower temperature of LNG. The mismatch in temperature use is a problem with many applications, including cryogenic power generation and cold storage, limiting cold energy recovery. A potential solution proposed by the authors is to use LNG as a coolant for LAES. Based on traditional compressed air energy storage, LAES involves cooling the air until liquefied, which increases storage density, reducing storage volume and enabling atmospheric pressure storage. It also has the beneficial effect of decoupling liquefaction from the air re-warming process. The temperature range of air liquefaction matches the LNG gasification temperature zone. To date, cryogenic power generation and ASUs are the most widely used applications for cold energy recovery, but many LNG terminals have ignored the possibilities altogether. As the impetus to lower LNG’s carbon footprint intensifies, wider deployment of, and novel approaches to, cold energy recovery, look like a promising means of environmental performance improvement.

Source : [www.naturalgasworld.com](http://www.naturalgasworld.com)

## JAPAN MAY BE OVERREACHING ON 2030 GAS TARGETS

**FIGURE 1** Japan’s power mix in 2019-2020 and strategic targets for 2030-2031

Source: METI



While Japan’s plans to reduce LNG in its power mix have made headlines, the longer-lasting implications of such targets on the wider gas market may be relatively mild. The Ministry of Economy, Trade and Industry (METI) published its draft sixth strategic energy plan in July and the headline figure for gas market watchers was the government’s goal of reducing the share of LNG in the power mix (*Figure 1*) from 37% in financial year 2019–20 to 20% by 2030–31. METI said non-hydrocarbon fuels would account for 56–60% of power generation, with renewables set to see their share jump from 18% in 2019–20 to 36–38% and nuclear reclaiming 20–22% of the mix from 6%. The draft serves as the

government’s roadmap towards delivering on its October 2020 pledge to achieve net zero carbon emissions by 2050. The nearly halving of LNG’s share of the power mix is eye catching, but represents a continuation of government efforts to reduce the country’s dependency on foreign energy supplies. Moreover, while growing demand from buyers throughout the region is likely to absorb any lost Japanese demand, market observers speculate that Tokyo’s goals may be unachievable in the first place.

## **Targets challenged**

Tokyo's power sector targets gained added significance owing to the country's heavy dependence on LNG, which spiked in the years immediately following the Fukushima nuclear power plant (NPP) meltdown in March 2011. The country turned to LNG after it mothballed all 54 of its reactors in the aftermath of the nuclear disaster. Since then, the country has brought nine units back online leading to a slide in LNG demand. Imports totalled just 74.5mn metric tons in 2020, down from the 77.3mn mt of LNG imported in 2019 and far short of the record 88.51mn mt of imports recorded in 2014. As such, the government is understandably banking on further restarts to help drive imports even lower. Whether the country can bring enough nuclear capacity back online to reach Tokyo's 2030 target is a matter for debate, however, with industry watchers arguing that heightened safety regulations and stiff public opposition could derail efforts. Wood Mackenzie principal analyst Lucy Cullen told *NGW* that it was "highly debatable" whether the government could hit its targets. She added: "Over-optimism on targets, particularly for nuclear, could undermine the government's ability to reduce the fossil fuel share of the mix, in turn reducing the downside risk to LNG demand." Wood Mackenzie estimates that successfully reaching the targets would represent an up to 10mn-mt decline in the country's LNG demand compared with the previous target. Rystad Energy's vice president of gas and power markets, Xi Nan, was similarly cautious about the country's chances of delivering on its nuclear power targets. She told *NGW* that only 5mn mt of demand could realistically be taken off the market in 2030, representing a 15mn-mt decline compared with 2020 levels. She added: "We think the plan is challenging to implement, given widespread opposition to nuclear power and the very aggressive renewables targets." Regardless of whether the government reaches its target, however, the amount of lost demand is unlikely to weigh overly on LNG prices, given other regional buyers are expected to absorb the volumes.

## **Regional demand**

While Japan's energy transition agenda may involve paring back gas consumption, the fuel is set to remain a key pillar of other Asian economies' energy transition strategies. Japan's hydrocarbon demand has been in decline for a number of years, driven by an ageing demographic and a government-driven energy efficiency agenda. The same is not true for most of the rest of the region, however, with demand from China, India and emerging South and Southeast Asian economies expected to grow rapidly. New import capacity is being built across the region as governments seek to feed projected robust economic growth while curbing their countries' carbon emissions. Cullen noted: "Downside risk to long-term Japanese LNG demand is not a new story for LNG project developers. And risks associated with energy transition will already be factored into project development decisions." If anything, shifting supply trends rather than demand side changes could lead to price volatility later this decade. While only 3mn mt/year of new capacity was sanctioned in 2020, this followed the record breaking 71mn mt/yr that reached a final investment decision (FID) in 2019. Moreover, 45mn mt/yr has also been approved so far this year. Cullen said: "This new capacity will bring a new wave of supply to the global market from the latter half of the 2020s, driving the next price cycle." Echoing this sentiment, Nan said: "If another wave of projects is sanctioned in 2022-2023, we see some downside risk to prices around 2027 onwards that may trigger more consumption in price sensitive regions like



Japan mothballed all **54** of its nuclear reactors in the wake of the 2011 Fukushima nuclear disaster, causing LNG demand to spike. But it has since brought nine back online.

India and Southeast Asia.” Even though Japan aims to place less emphasis on gas as part of its energy transition strategy, the fuel still has an important role to play in supporting the country’s energy transition ambitions.

### **Role to play**

Japan’s new targets may have highlighted a fresh urgency in the country’s energy planners to drive down the country’s carbon emissions, but the country will need dispatchable power in the years ahead as it builds out its renewable and nuclear capacities. LNG unquestionably remains Japan’s cleanest option to provide the country with energy flexibility and security, limiting energy planner’s longer-term options when looking to for an affordable replacement. Nan said reducing gas’ share of the power mix beyond the already “aggressive” target of 20% would require a step change in battery storage or other renewables deployment, while adding that technologies such as carbon capture and storage could allow gas to contribute to the power mix even amid a wider push towards net zero by 2050. Renewables are set to continue expanding their market share, but maintaining grid security will remain a priority for energy

planners anxious to avoid potential blackouts. Cullen said: “Until long-duration battery storage gathers sufficient scale and technology matures to allow long enough cover, gas is the cleanest burning fossil fuel currently available for ensuring grid reliability and security.” Source : [www.naturalgasworld.com](http://www.naturalgasworld.com)

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## **CYGNUS ENERGY**

### **GAS & OIL**

118 CONNAUGHT RD W, SAI YING PUN, HONG KONG  
[SANDP@CYGNUS-ENERGY.COM](mailto:SANDP@CYGNUS-ENERGY.COM) (SALE N PURCHASE)  
[GAS@CYGNUS-ENERGY.COM](mailto:GAS@CYGNUS-ENERGY.COM) (GAS PROJECTS)