

LNG Review August 2021 - Recent issues and events -

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Introduction

As of the beginning of September 2021, the U.S. Henry Hub Futures was priced over USD 4.5 per million Btu for the first time since December 2018. While the higher price was reflection of market fundamentals in the United States, closer linkage to the international LNG markets has been a factor, too. The upward trend of the global gas prices was further reinforced in August to realise over USD 17 of the assessed spot LNG prices in Northeast Asia and European spot gas prices (TTF and NBP) all per million Btu, by the end of the month.

There have been a few corporate asset deal announcements in the LNG industry. Australia's Woodside and BHP announced in the middle of August that they had agreed in principle to combine their respective natural gas and oil assets. Australia's Santos announced at the beginning of the month that the company and Oil Search had reached agreement on the merger conditions.

There have been more initiatives to make LNG cleaner. The shareholders of Indonesia's Tangguh LNG project announced at the end of August that the country's upstream business regulatory agency had approved a plan of carbon capture utilization and storage (CCUS) at the project. Cheniere Energy of the United States announced in early August the publication of an LNG life cycle assessment (LCA) study toward improved greenhouse gas (GHG) emissions assessment.

The global LNG market witnessed more carbon-neutral LNG and carbon/GHG-offset LNG deal announcements in August. Malaysia's PETRONAS announced in the middle of the month that it had completed the delivery of its maiden carbon neutral LNG cargo to Japan's Shikoku Electric Power. Eni announced earlier that the company and CPC Corporation, Taiwan, reached an agreement for the delivery by Eni of a carbon neutral LNG cargo to CPC. At the beginning of September Japan's INPEX and Shizuoka Gas announced their carbon-neutral LNG transaction.

* The writer belongs to Gas Group, Fossil Energy and International Cooperation Unit. Some information pieces that some readers may consider very important may not be included due to different reasons.

[Asia Pacific]

JERA announced on 26 August 2021 that it had received a notice of grant to conduct a demonstration project of hydrogen utilization at an LNG thermal power plant from the New Energy and Industrial Technology Development Organization (NEDO). The project will switch a portion of the LNG fuel used to generate electricity at JERA's LNG thermal power plant to hydrogen and evaluate the resulting operational and environmental characteristics over a period of approximately 5 years from October 2021 to March 2026. Based on the results of a feasibility study to be conducted early in the project period, JERA aims to construct hydrogen supply facilities and other related facilities at its LNG thermal power plant, to install combustors capable of co-firing hydrogen and LNG in its gas turbines, and to switch approximately 10% of the LNG used for electricity generation (by heating value, equivalent to approximately 30% of volumes) to hydrogen by fiscal 2025.

Shizuoka Gas and INPEX announced on 1 September 2021 their carbon-neutral LNG transaction. The LNG shipment is scheduled to arrive at the Sodeshi LNG Terminal operated by Shimizu LNG Co., Ltd. on 4 September.

INPEX and Iruma Gas announced on 31 August that they entered into a carbon neutral gas sales and purchase agreement.

Hiroshima Gas announced on 31 August that the company had been granted a support from Japan's Ministry of Internal Affairs and Communication for a program of demonstration projects of local 5G networks. The company plans to conduct a demonstration program to upgrade safety operations at the Hatsukaichi LNG receiving terminal through utilisation of the local 5G network in facility inspections, in collaborations with partner companies including Fujitsu, starting in December 2021.

Mitsui O.S.K. Lines (MOL) announced on 3 August that it had reached an agreement with Shin Kurushima Dockyard Co., Ltd. and Nihon Shipyard Co., Ltd. to build four 7,000-unit capacity car carriers using LNG as their main fuel. The vessels are slated for delivery in succession starting in 2024.

MOL announce on 17 August 2021 that the company and Korea's Daewoo Shipbuilding & Marine Engineering Co., Ltd (DSME) had carried out the demonstration test of the "Cryo-Powered Regas" System for FSRU at DSME's Okpo shipyard. In the past, LNG's cryogenic energy had not been utilized in FSRUs and was released. By installing the system, such cold energy will be transferred to another heating medium, and the generated steam will be sent to a turbine to generate electricity, which results in reducing FSRU's fuel consumption and CO2 emissions.

MOL and its group company Nihon Tug-Boat Co., Ltd. announced on 2 September that the Nihon Tug-Boat-operated LNG-fueled tugboat Ishin was supplied with Carbon

Neutral LNG (CNLNG) fuel by Osaka Gas Co., Ltd. and Daigas Energy Co., Ltd. on 1 September. This marks the first use of CNLNG as vessel fuel in Japan. The CNLNG was supplied from a tank-truck to the ship at the wharf in Sakai Senboku Port, Osaka. Daigas Energy and Nihon Tug-Boat had signed a memorandum of understanding (MoU) for supply of CNLNG over several years.

Mitsubishi Shipbuilding, a part of Mitsubishi Heavy Industries (MHI) Group, announced on 26 August that it had initiated a feasibility study with TotalEnergies for development of a liquefied CO₂ (LCO₂) carrier.

Korea's presidential committee on carbon neutrality announced on 5 August three policy road maps to achieve the goal of eliminating greenhouse gas emissions by 2050.

According to local reports, Korea's POSCO said that it had teamed up with Korea Shipbuilding & Offshore Engineering Co. and partners to develop a carrier of LCO₂.

Japan's Shizuoka Gas announced on 6 August 2021 that it would enter the industrial natural gas supply business in Thailand in 2022.

Thailand's B.Grimm Power announced on 23 August 2021 that it had formed with PTT a 50:50 joint venture B.Grimm Power LNG JV to explore opportunities related to the LNG value chain domestically and internationally. B Grimm in 2020 won permission to import and trade up to 650,000 tonnes of LNG in Thailand per year from 2022. It plans to import LNG to fuel its small power plants.

Acteon, a marine energy and infrastructure services company, announced on 3 August 2021 that the company had secured an integrated project with Atlantic, Gulf & Pacific Company (AG&P) for the development of an LNG regasification terminal in Batangas Bay, called Philippines LNG (PLNG). The AIS (Acteon Integrated Solutions) team will be responsible for the full construction of the jetty and all the marine works.

McDermott International announced on 18 August that its CB&I Storage Solutions business had been awarded a contract by Atlantic Gulf and Pacific Company (AG&P) for the engineering, procurement and construction (EPC) of a second LNG storage tank for AG&P's Philippines LNG import terminal in Batangas Bay, Philippines. CB&I Storage Solutions was awarded the first LNG storage tank by AG&P earlier in 2021.

According to the "China Natural Gas Development Report (2021)" released by the National Energy Administration (NEA) on 21 August 2021, the country's "national network" has taken shape, as during the "13th Five-Year Plan" period, a total of 46,000 km of long-distance pipelines were built, with the total distance reaching 110,000 km. During the same period construction of gas storage facilities accelerated. As of the heating season in 2020, the storage capacity reached 23.4 bcm, or 7.2% of annual consumption.

Eni announced on 6 August 2021 that the company and CPC Corporation, Taiwan,

reached an agreement for the delivery by Eni of a carbon neutral LNG cargo to CPC at the Yung An receiving terminal. The LNG will be sourced from the Bontang plant in Indonesia.

bp Australia announced on 11 August the findings of its study into the feasibility of an export-scale green hydrogen and ammonia production facility in Western Australia. The study found that the production of green hydrogen and green ammonia using renewable energy is technically feasible at scale in Australia.

Woodside announced on 4 August 2021 that the company had finalised technical work to support execution readiness and completed an update of the capital expenditure requirements for the Scarborough development. The updated cost estimate is USD 12.0 billion (100% project, nominal), comprising USD 5.7 billion for the offshore component and USD 6.3 billion for the onshore component. The cost estimate is approximately 5% higher than the previous cost estimate announced in November 2019 and incorporates: An approximately 3% cost increase in the onshore component, including modifications to Pluto Train 1 to enable processing of Scarborough gas; An approximately 8% increase in the offshore component, including an increase in offshore production capacity from 6.5 to 8.0 million tonnes per year of LNG and an additional well. The integrated Scarborough and Pluto Train 2 development has a globally competitive cost of supply of approximately USD 6.8/million Btu to North Asia and is targeted to deliver the first cargo in 2026.

Woodside announced on 11 August 2021 that it had been granted environmental approval of the State waters (nearshore) component for the Scarborough development by the Western Australian Minister for Environment, following assessment by the Western Australian Environmental Protection Authority. The approval authorises the installation of an approximately 32-km section of the Scarborough trunkline within State waters.

Woodside and BHP announced on 17 August that they had entered into a merger commitment deed to combine their respective natural gas and oil business portfolios. The proposed merger would create the largest energy company listed on the ASX, with a global top 10 position in the LNG industry by production.

MAN Energy Solutions and Woodside announced on 26-27 August that they had signed a cooperation agreement aimed at commercialising an innovative solution for small-to-mid scale LNG production. Known as Factory LNG, the technology combines Woodside's intellectual property and LNG experience with MAN's project-execution expertise. The concept involves a nominal 0.05 million tonne per year unit, the size of 40-foot ISO shipping container, that can be transported via standard heavy-lift shipping and trucking logistics.

The Australasian Centre for Corporate Responsibility (ACCR) announced on 26 August 2021 that on its behalf lawyers from the Environmental Defenders Office (EDO) challenges Santos' claims that natural gas provides "clean energy" and that it has a "credible

and clear plan" to achieve "net zero" emissions by 2040 in the Federal Court of Australia. The court case challenges the veracity of Santos' net zero emissions target and viability of carbon capture and storage (CCS) and the environmental impacts of blue hydrogen.

Santos announced in late August 2021 award of the FEED contracts for the Floating Production, Storage and Offloading (FPSO) facility to Altera Infrastructure (Altera) and for the Wellhead Platform (WHP) to Sapura Energy, respectively, for the Dorado project, in the Bedout Sub-basin, offshore Western Australia. Santos has an 80% interest in the Dorado project and is operator. The remaining interest is held by Carnarvon Petroleum. Dorado is an integrated oil and gas project which is planned to be developed in two phases. The initial development involves the production of oil and condensate through a WHP and FPSO. Gas will be reinjected in the initial phase to enhance oil and condensate recovery, followed by a planned future phase of gas production to backfill Santos' domestic gas infrastructure.

Malaysia's PETRONAS announced on 18 August that it had completed the delivery of its maiden carbon neutral LNG cargo to Japan's Shikoku Electric Power. The cargo was delivered from the PETRONAS LNG Complex (PLC) in Bintulu and was received on 17 August at the Sakaide LNG terminal in Shikoku.

Sarawak Shell Berhad (SSB) announced on 30 August 2021 that it had taken a final investment decision (FID) on the Timi gas development project with its partners PETRONAS Carigali Sdn Bhd (15%) and Brunei Energy Exploration (10%). The Timi field is situated 200 km off the coast of Sarawak, Malaysia. The Timi development features SSB's first wellhead platform in Malaysia that is powered by a solar and wind hybrid renewable power system.

The shareholders of the Tangguh Production Sharing Contract Partners announced on 30 August 2021 that SKK Migas (Special Task Force for Upstream Oil and Gas Business Activities Republic of Indonesia) had approved the Plan of Development (POD) for Ubadari Field and Vorwata Carbon Capture Utilization and Storage (CCUS) at the Tangguh LNG Project in Papua Barat, Indonesia. The Vorwata CCUS development will see 25 million tonnes of CO₂ injected back to the Vorwata reservoir to eliminate carbon venting and provide incremental gas production through enhanced gas recovery (EGR). The CO₂ injection will remove nearly half of the Tangguh LNG CO₂ emissions. The Front-End Engineering and Design (FEED) for Ubadari field development and Vorwata CCUS will start in the middle of 2022 with an estimated project start up in 2026 subsequent to a final investment decision.

INPEX said on 11 August 2021 that at its Abadi LNG Project in Indonesia survey work at the planned plant construction site had been suspended due to the spread of COVID-19. The company also said that it had plans to consider ways to realize the project in line with the changing external environment through initiatives including introduction of CCS/CCUS.

Indonesia's Pertamina announced on 31 August that its affiliates PT Perusahaan Gas

Negara (PGN) and PT Perta Arun Gas (PAG) as the operator of Arun LNG Receiving, Regasification, and Hub Terminal had signed a Terminal Use Agreement with TotalEnergies related to the utilization of the Hub in 2021. TotalEnergies plans to use the Arun LNG Hub to store its LNG volumes from international sources. The Arun Hub has four LNG tanks with a total capacity of 508,000 m³. The first shipment from Angola is expected in early September.

Australia's Santos announced on 2 August that the company and Oil Search had reached agreement on the merger ratio under the proposed merger and additional terms. Oil Search shareholders will own approximately 38.5% of the merged group. Santos said the merger would create a regional champion of size and scale.

[North America]

Cheniere said on 5 August 2021 that Train 6 at Sabine Pass would come online in 2022. The train was 90% complete and began early commissioning activities in July 2021. Cheniere expects to reach a final investment decision (FID) on the proposed Stage 3 expansion at Corpus Christi LNG in 2022.

Cheniere Energy announced on 5 August 2021 the publication of an LNG life cycle assessment (LCA) study for improved greenhouse gas (GHG) emissions assessment. The analysis utilizes GHG emissions data specific to Cheniere's LNG supply chain from natural gas production through LNG shipping. The use of supply chain specific data provides an improved methodology for GHG emissions accounting and estimates a lower GHG intensity for Cheniere's LNG relative to other studies utilizing generic data. A case study is presented for Cheniere Energy's Sabine Pass Liquefaction (SPL) LNG supply chain from production in the United States and delivered to China. GHG emission intensities are estimated to be 30% - 43% lower than other analyses employing national or regional average emission profiles. The Cheniere LCA is intended to be the foundational analytical tool to estimate GHG emissions to be included in Cheniere's Cargo Emissions Tags (CE Tags).

The first liquefaction train of the Golden Pass LNG plant in Texas, a joint-venture of Qatar Petroleum (QP) and ExxonMobil, is scheduled to come online by 2024, according to a webinar hosted by the USQBC (US-Qatar Business Council).

The United States Court of Appeals for the District of Columbia Circuit ruled on 3 August 2021 that the FERC (Federal Energy Regulatory Commission) must further review the impacts of the Texas and Rio Grande LNG export projects in Texas to better understand climate change and impacts on residents living near the projects. Although the court ruled that FERC violated the National Environmental Policy Act (NEPA) with deficient environmental analyses, the court did not vacate the order.

Summit Oil and Shipping Co. Ltd. (SOSCL) announced on 2 August that it had

signed a Memorandum of Understanding (MOU) with Commonwealth LNG to collaborate in the supply of LNG to Asia, including Bangladesh. The scope of the MOU includes SOSCL potentially contracting for 1 million tonnes per year of LNG offtake, for a term of up to 20 years, from Commonwealth's 8.4 million tonne per year facility under development in Cameron, Louisiana. SOSCL's associated companies have 3 GW of gas-to-power electricity in operation or development within the Indian subcontinent. SOSCL operates an FSRU (Floating Storage and Regasification Unit) and LNG terminal under Summit LNG Terminal Co (Pvt) Ltd (SLNG) in Moheshkhali, Cox's Bazar, Bangladesh.

Talos Energy announced on 25 August that, along with its partner Carbonvert, Inc., was the sole winning bidder partnership for the Texas General Land Office's (GLO) Jefferson County, Texas carbon storage site located near Beaumont and Port Arthur, Texas.

Crowley Maritime Corporation announced on 1 September that it had signed a long-term time charter with Shell NA LNG, LLC, providing for the building and operation of a new LNG bunker barge built in the United States. The barge will be the largest Jones Act-compliant vessel of its kind.

Canada's Irving Oil announced on 3 August the divestiture of its 25% ownership interest in Canaport LNG, with full ownership to be assumed by Repsol.

Sempra said in its Q2 2021 Earnings Call that the Energía Costa Azul LNG export project is expected to come into the company's planning period in the second half of 2024.

Mexico's CF Energía (CFE) announced on 30 August 2021 that it was asking companies expressions of interest to build and operate a natural gas pipeline and floating LNG (FLNG) terminal. The 0.5 bcf/d pipeline would span from Chinameca, Veracruz, to Salina Cruz, Oaxaca, supplying gas to a 3 million tonne per year FLNG unit.

[Middle East]

The Abu Dhabi National Oil Company (ADNOC) announced on 3 August 2021 that, in partnership with Fertiglobe, it had sold its first cargo of blue ammonia to Itochu in Japan, for use in fertilizer production. Fertiglobe, a 58:42 partnership between OCI and ADNOC, will produce blue ammonia at its Fertil plant in the Ruwais Industrial Complex in Abu Dhabi for delivery to ADNOC's customers in Japan.

Técnicas Reunidas announced on 24 August that it had been selected by Qatar Petroleum (QP) to participate in the expansion of Qatar's LNG production. QP has awarded Técnicas Reunidas an engineering, procurement, and construction (EPC) project for the expansion of onshore facilities located associated with production from the North Field. The initial scope of the project is for the completion of an "EPC-3 package" required for the expansion of liquid products storage and loading. The EPC-3 package includes the

construction of liquid products rundown lines, lean gas pipeline for delivery into the domestic gas grid, the expansion of the Ras Laffan Terminal Operations (RLTO) product storage and loading facilities, Monoethylene glycol (MEG) storage and transfer facilities expansion, and CO₂ sequestration pipeline and associated facilities at CO₂ injection wellheads.

[Africa]

Air Products announced on 2 August 2021 that it had signed an agreement with SCD, a joint venture of Saipem, Chiyoda and Daewoo, for the Nigeria LNG (NLNG) Train 7 project. Air Products will provide the main cryogenic heat exchangers (MCHEs) and the process technology. Air Products previously provided the MCHEs and process technology for the first six trains for NLNG at Bonny Island.

[Europe / Russia]

The European Environment Agency published on 1 September 2021 a report on EU shipping emissions. According to the report, ships carrying 77% of external trade and 35% of intra-EU trade are much more emissions efficient than land and air transport. Still, the maritime sector accounts for 13% of the EU's greenhouse gas emissions. In the medium term "conventional and low carbon fossil fuels are expected to continue being used," it said.

According to Germany's think tank AG Energiebilanzen (AGEB), the country's natural gas consumption during the first half of 2021 increased by 15.6% year-on-year. For the first time gas took the first place among other primary energy sources.

Norway's Equinor announced on 30 August that on Friday 27 August at 21:25, production started from the Troll phase 3 project in the North Sea. The project has a break-even price below USD 10 dollars and CO₂ emissions of less than 0.1 kg per barrel oil equivalent. The new wells are tied into the Troll A platform and Troll phase 3 will extend the platform's life past 2050. Recoverable volumes from Troll phase 3, which will produce the Troll West gas cap, are estimated at as much as 347 bcm of gas.

Spain's Iberdrola announced on 24 August 2021 that it had signed a Memorandum of Understanding (MOU) with several partner companies to undertake the project to convert the Apennine railway to green hydrogen. The railway line is more than 300 km long, part of which has not been electrified.

Gazprom announced on 2 August 2021 that during the first seven months of the year, Gazprom's gas exports to the Far Abroad countries reached 115.3 bcm, increasing year-on-year by 23.2%, or 21.7 bcm.

Gazprom announced on 30 August 2021 that its Chairman and Hungary's Minister of Foreign Affairs and Trade discussed in St. Petersburg prospects of cooperation in the gas

sector, including gas supplies to Hungary.

Gazprom lost a German regional court case to avoid EU-rules separating production from transportation, according to Germany's Handelsblatt.

Russia's Gazprom Neft announced on 12 August 2021 that construction of Russia's first LNG bunkering vessel had been complete. The vessel will provide ship-to-ship LNG refuelling at ports throughout the Gulf of Finland and the Baltic Sea.

According to local reports, a floating storage unit arrived off Gazprom LNG Portovaya (Газпром СПГ Портовая) in the Gulf of Finland.

China's Wison Offshore & Marine announced on 26 August 2021 that it had completed the first train module for Russia's Arctic LNG 2 project at its Zhoushan yard.

Japan's Mitsui O.S.K. Lines, Ltd. (MOL) announced on 2 September that it had signed a Letter of Intent (LOI) with Russia's "State Transport Leasing Company" (GTLK) for the potential acquisition of total 49% shares of the FSU (Floating Storage Unit) owner companies, which are currently 100% owned by GTLK, in relation to the LNG transshipment projects in Kamchatka and Murmansk. The FSU owner companies have entered into bareboat charter agreements with Arctic Transshipment LLC (joint venture of NOVATEK and TotalEnergies), that will provide transshipment services to NOVATEK's LNG projects by reloading LNG cargoes from ice-class LNG carriers to conventional LNG carriers. Two (2) FSUs with a storage capacity of 360,000 m³ will be placed at each of Bechevinskaya Bay in the Kamchatka Territory and Ura Bay at Murmansk. The two FSUs are being constructed at Korea's Daewoo Shipbuilding & Marine Engineering Co., Ltd. (DSME).

Russia's NOVATEK and the Japan Bank for International Cooperation (JBIC) announced on 2 September that they had signed a Strategic Cooperation Agreement on low-carbon projects to produce hydrogen and ammonia, carbon capture, utilization, and storage technologies, as well as renewable energy projects in Russia, including ammonia and hydrogen production projects in the Yamal Peninsula.

[South America]

New Fortress Energy (NFE) announced on 11 August 2021 that it had executed two Gas Supply Agreements with Unigel Participações to supply natural gas to the Unigel Agro-BA and Unigel Agro-SE fertilizer plants in the Brazilian states of Bahia and Sergipe, respectively. NFE expects to supply Unigel with up to 41 Tbtu of natural gas (0.8 million tonnes) per year for a 5-year term beginning in Q1 2022.

Reference: Company announcements

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