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Characteristics, Drivers of Emerging Carbon-Neutral LNG Market

The LNG industry is at a crossroads: despite LNG's carbon benefits over coal and petroleum products, it is being reconsidered by governments, financial institutions, and NGOs as a "transition" fuel to a lower-carbon economy. LNG players are responding by sourcing responsibly-produced gas, purchasing offsets, and planning on-site carbon capture and storage to mitigate or fully eliminate lifecycle GHG emissions. Carbon-neutral transactions are forecasted to quadruple in 2021 amid a rising ESG focus.

As emissions mitigation strategies are deployed globally, the LNG sector enters a new era of opportunities and risks. Despite the numerous advantages and flexibility that natural gas offers in meeting growing global energy needs, it's no longer a given that LNG will be perceived as a "transition" fuel to a lower carbon economy.

Central banks have issued mandates that significantly increase the cost of borrowing, if not eliminate financing altogether, for fossil-fuel related projects, including gas-fired power plants and other infrastructure.¹ A recent World Bank directive² would halt financing for LNG bunkering infrastructure and the International Energy Agency released a net-zero roadmap³ that calls for the end of fossil fuel investment.⁴

In the US, pressure is building for new liquefaction projects to show net carbon benefits. The newly appointed Federal Energy Regulatory Commission (FERC) Chairman, Richard Glick, has dissented in past decisions⁵ to authorize new LNG projects that do not consider the global impact of liquefaction facilities on GHG emissions. As Commissioner Chatterjee's term concludes and President Biden nominates a Democrat to the seat, the scrutiny on net GHG benefits will likely increase, possibly impacting future development.

¹ <https://www.wsj.com/articles/central-banks-jump-into-climate-change-policy-fray-11621166402>

² <https://www.worldbank.org/en/news/feature/2021/04/15/charting-a-course-for-decarbonizing-maritime-transport>

³ <https://www.iea.org/reports/net-zero-by-2050>

⁴ <https://www.worldbank.org/en/news/feature/2021/04/15/charting-a-course-for-decarbonizing-maritime-transport>

⁵ <https://www.ferc.gov/news-events/news/commissioner-richard-glick-dissent-regarding-gulf-lng-liquefaction-company-llc>

It's against this backdrop that companies in the US and abroad are navigating regulatory risks and seizing market opportunities through unilateral actions, such as sourcing responsibly-produced gas, purchasing offsets, and planning on-site carbon capture and storage that, in combination, mitigates or fully eliminates lifecycle GHG emissions.

Carbon-Neutral LNG Market and Outlook

The number of bilateral carbon-neutral transactions this year has already exceeded 2020 levels – six through April 2021 versus five in 2020, according to FTI tracking. While the volumes are small relative to the overall LNG market – on pace to represent approximately 1 percent of expected 2021 shipments – the breadth of companies (over 15 different buyers and sellers) seeking such neutrality assurances indicates quickly building momentum. Carbon-neutral is not always a clear term, but, based on the International Group of Liquefied Natural Gas Importers' (GIIGNL) definition,⁶ it means fully mitigating a cargo's Scope 1, 2, and 3 carbon emissions. Scope 1 and 2 represent direct combustion emissions and indirect energy emissions, respectively, whereas Scope 3 represents the upstream and downstream emissions (value chain emissions). In quantifying those emissions, most point to the UK Government GHG Conversion factors, which put Scope 1-3 GHG emissions for a cargo of 175,000 cubic meters at roughly 250,000 tons of CO2 equivalent emissions.⁷

For the most part, carbon-neutral LNG cargos have been delivered to Asian buyers, with roughly half the transactions executed with LNG heavyweight Royal Dutch Shell as the seller from its Asian supply portfolio. In these transactions, the associated full cycle emissions have been offset via Shell's portfolio of nature-based projects, which include forest- preservation and reforestation projects.⁸ Beyond Shell and its various counterparties, other companies that have initiated fully carbon-neutral LNG transactions include Total, Gazprom and Mitsui.

Across Asia, Japanese, Singaporean, South Korean and Chinese firms have all purchased carbon-neutral LNG cargoes in Q1 2021, with each delivery's carbon dioxide profile reduced via offsets.

Elsewhere, Gazprom delivered a first carbon-neutral LNG cargo to the UK in March from Yamal, and Cheniere transacted its first carbon-neutral US cargo with Shell to a European buyer. The costs of the offsets have been borne by both parties, with Cheniere offsetting the Scope 3 emissions associated with the upstream and liquefaction and Shell the Scope 1 and 2 portions associated with the transport, regasification, and combustion.

Some cargos, though, have been partially offset for various reasons, including the inability to control, quantify, or monitor the emissions for one or more elements of the value chain. In these cases, companies have chosen instead to offset that which they can reasonably measure. In the three partial offset scenarios FTI has tracked, two covered Scope 3 emissions while the other one covered Scope 1 and 2 emissions (see table below).

Table 1: Carbon- Neutral LNG Cargoes 2019- to date

Year	Month	Seller	Source	Project	Buyer	Destination	Verification/ Offsets	Scope
2019	June	Jera*	UAE	Das Island	Petronet	India	UNFCC	1,2
2019	July	Shell	Australia	Queensland Curtis	Tokyo Gas	Japan	Shell Portfolio	1-3
2019	July	Shell	Australia	Queensland Curtis	Tokyo Gas	Japan	Shell Portfolio	1-3
2020	March	Shell	Russia	Sakhalin	CPC	Taiwan	Shell Portfolio	1-3
2020	Sept.	Total	Australia	Ichthys	CNOOC	China	VCS	1-3
2020	Nov.	Shell	Nigeria	NLNG	CPC	Taiwan	Shell Portfolio	1-3
2020	Dec.	Shell	NA	NA	CNOOC	China	Shell Portfolio	1-3
2020	Dec.	Shell	NA	NA	CNOOC	China	Shell Portfolio	1-3
2021	March	Gazprom	Russia	Yamal LNG	Shell	U.K.	VCS	1-3
2021	March	Mitsui	Russia	Sakhalin	Hokkaido	Japan	Mitsui Portfolio	1-3
2021	March	RWE*	Australia	Pluto	Posco	Korea	Gold Standard	3
2021	April	Cheniere	US	Sabine Pass	Shell	Europe	Shell Portfolio	1-3
2021	April	Pavilion*	NA	NA	Pavilion	Singapore	VCS, CCB	3
2021	April	Diamond Gas	US	Cameron	Toho Gas	Japan	Diamond Gas Portfolio	1-3

* Partial Offsets

Sources: FTI, Company Reports, Bloomberg, Reuters, Platts

⁶ https://giignl.org/sites/default/files/PUBLIC_AREA/giignl_ing_carbon_offsetting_061820.pdf

⁷ <https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2020>

⁸ Certified by the UN Framework Convention on Climate Change, Certified Emission Reductions credits are the most widely used type of credits in offsetting LNG cargo emissions. Also used are VERs- Verified Emission Reduction- credits certified by various international entities.

Assessing the Cost of Carbon

Many factors contribute to the cost of carbon for a given cargo, including the upstream production profile, the age or type of liquefaction plant as well as the type of tanker used to transport the cargo. On the downstream/ combustion end, which accounts for the bulk of the carbon emissions, offset costs also vary considerably. Full cycle cost estimates range from \$0.60/MMBtu to \$1.70 /MMBtu.⁹ The 2020 GIIGNL study on carbon-neutral cargos estimates the global average add-on cost of Scope 1-3 carbon neutrality at \$0.60/MMBtu or around \$2.5 million per cargo.¹⁰

At today’s JKM pricing of roughly \$10/MMBtu – unusually high for the second quarter shoulder season – this amounts to only 8 percent of the cargo’s value, but under more normal 2Q JKM pricing, the price for carbon neutrality edges closer to 20-40 percent. Due to cost, carbon-neutral LNG cargos will likely remain a premium as opposed to a standard product. Pricing in the cost of carbon emissions will serve the goal of making fossil fuel alternatives such as hydrogen and ammonia slightly more competitive and at the same time, could render the move from coal to LNG in power generation in some developing countries prohibitive.

Nonetheless, we forecast a quadrupling in such carbon neutral cargo transactions this year as more buyers and sellers jump into the fray, cementing an important trend. How large the market could grow depends on the demands of buyers who ultimately will bear the costs. Japan, the largest LNG importer, is behind roughly 30 percent of the carbon-neutral cargos sold to date, followed by China with 21 percent. With such a wide disparity of buyers, projects, and verification systems, the evolution from point to point deals to an independent, transparent, tradable market also remains to be seen.

Adoption of CCS Technology

The establishment of a bona fide carbon-neutral LNG cargo market goes well beyond purchasing offsets. Several LNG projects globally have Carbon Capture and Storage (CCS) facilities attached to their respective projects: Gorgon in Australia, Snohvit in Norway and Qatar’s Ras Laffan. This amounts to roughly 17% of global capacity for 2021. Adding in what is proposed on existing capacity brings the total to 38% of global capacity. A number of proposed projects, many in the US, have announced plans to add CCS to their liquefaction operations with announcements to date amounting to 67 million metric tons per annum (MTPA) or 9 bcf/d of carbon-mitigated liquefaction.

Table 2: LNG Projects with CCS- Existing and Proposed

CCS Status	Project	Company	Country	Trains	Capacity (MTPA)
CCS Existing	Snohvit	Equinor	Norway	1	4.5
	Ras Laffan	Qatargas	Qatar	14	77.0
	Gorgon	Chevron	Australia	3	15.6
<i>Subtotal</i>				<i>18</i>	<i>97.1</i>
CCS Proposed for Existing Projects	Yamal	Novatek	Russia	3	17.5
	Sabine Pass	Cheniere	US	6	27.0
	Corpus Christi	Cheniere	US	3	13.5
	Cameron	Sempra	US	3	12.0
	Calcasieu Pass	Venture Global	US	18	10.0
<i>Subtotal</i>				<i>33</i>	<i>80.0</i>
CCS Proposed for Proposed Projects	Qatar NFE	Qatargas	Qatar	4	32.0
	Rio Grande	Next Decade	US	2	14.0
	Port Arthur	Sempra	US	2	8.0
	Louisiana	G2 Net Power	US	10	13.0
<i>Subtotal</i>				<i>18</i>	<i>67.0</i>
Total Existing and Proposed CCS				69	244.1

Sources: FTI, Company Reports

⁹ <https://www.spglobal.com/platts/en/market-insights/latest-news/natural-gas/091020-carbon-neutral-lng-to-increase-costs-of-natural-gas-production-consumption>

¹⁰ https://giignl.org/sites/default/files/PUBLIC_AREA/giignl_lng_carbon_offsetting_061820.pdf

Earlier this year, Qatar pledged to add CCS on 32 MTPA of the first phase of its 50 MTPA expansion project, and Russia’s Novatek announced that it is exploring CCS technology for its operating 17.5 MTPA Yamal LNG project in addition to future export projects in the Arctic. QP estimates its GHG reductions resulting from the proposed CCS technology will register ~25% below current global levels at similar operations.¹¹

In the US, Next Decade, is seeking to become the world’s greenest LNG producer¹² via its planned Rio Grande facility. The company, with final investment decision expected this year, has pledged to power the facility with renewable energy, deploy carbon capture, and procure certified responsibly sourced gas¹³ as it targets carbon neutrality. More specifically, Next Decade has outlined the CCS technology it plans to utilize: Mitsui Heavy Industries KM CDR process, a proven technology which has been in use over the past 15 years. Making use of critical tax credits, Next Decade estimates the additional cost of adding CCS to its¹⁴ liquefaction facility to be between \$0.05- \$0.09/MMBtu.

Also in the US, Venture Global, which is set to commission its 10 MTPA Calcasieu Pass terminal this year, announced at the end of May that it will add up to 1 MTPA of CCS capacity for all of its existing and planned LNG export projects. In terms of active LNG exporters, both Cheniere¹⁵ and Sempra¹⁶ have indicated in Q1 investor¹⁷ meetings that they are looking at CCS for their respective existing and proposed LNG export projects in the US Gulf.

We expect global LNG supply to increase from 356 MTPA in 2020 to 709 MTPA in 2040,¹⁸ with most new supply emerging from the US, Canada, Qatar and Russia, and if recent trends hold, carbon neutral cargoes could account for a significant percentage of that growth. As companies, particularly in the US, look to expand market share or make FID, the emergence of carbon neutral cargoes is a clear sign of the material need for best-in-class environmental performance, as we expect market dynamics to continue progressing in favor of carbon neutrality.

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¹¹ <https://qp.com.qa/en/MediaCentre/Pages/ViewNews.aspx?Ntype=News>

¹² <https://www.next-decade.com/esg-environment/>

¹³ <https://www.projectcanary.com/responsibly-sourced-gas/>

¹⁴ <https://investors.next-decade.com/static-files/5341eedf-522f-4e07-a86c-4918491b692b>

¹⁵ <https://www.fool.com/earnings/call-transcripts/2021/05/04/cheniere-energy-inc-lng-q1-2021-earnings-call-tran/>

¹⁶ <https://www.fool.com/earnings/call-transcripts/2021/05/05/sempra-energy-sre-q1-2021-earnings-call-transcript/>

¹⁷ <https://venturegloballng.com/press/venture-global-launches-carbon-capture-and-sequestration-project/>

¹⁸ <https://fticonsulting.com/en/rough-seas-or-calm-waters/>

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