

Global Voice of Gas

The background image is a night scene featuring a prominent tower with a glowing top, surrounded by trees and other structures. The scene is filled with numerous small, bright orange and red sparks or fireworks falling from the sky. The entire scene is reflected in a body of water in the foreground, creating a symmetrical effect. The sky is a deep blue, and the overall atmosphere is festive and celebratory.

BY THE INTERNATIONAL GAS UNION

ISSUE 01 | VOL 02

SECURING A SUSTAINABLE FUTURE POWERED BY GAS

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28th WORLD GAS CONFERENCE
DAEGU, KOREA 23-27 MAY



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Message from the President



Dear industry colleagues, broader energy sector partners, and all those who are reading and contributing to this now established quarterly publication by the IGU, I would like to thank you. Thank you, for your continued and growing support, making it possible to set a new standard for communication for the gas community and stakeholders worldwide. I feel more and more proud with every new edition of the *Global Voice of Gas* which was launched during the Korean Presidency of the IGU.

This is also the final issue in the Korean Presidency of the IGU. Korea's was the first presidency to be extended to four years, from the initial triennium, due to the global health crisis and postponement of the World Gas Conference, and yet the time still flew by. In just under two months at the 28th World Gas Conference in Daegu, I will be passing the baton to IGU's next Presidency of China.

As I look back at the last four years and reflect on the extraordinary times our industry has navigated, I am amazed at the flexibility, resilience, and dedication shown by the gas value chain all around the world. Having largely come out of the health crisis with its demand shocks, we found ourselves in an energy crisis with extraordinary tight supply.

The industry now faces a vast task of ensuring

continued reliable functioning of the gas markets and secure supply to consumers in all corners of the world, amidst pricing volatility, geopolitical risks, and high levels of policy uncertainty. And we are all too aware of the tragedy that is unfolding on the European continent today, which is impossible to comprehend as a human catastrophe, and which is adding major complexities to ensuring energy security.

In this final GVG note as President of IGU, I would like to reflect on where I think we are as the global gas industry and what that means for the future.

I see the gas industry today at an historically decisive moment. How we navigate our way out of the current difficulties will set the trajectory for the industry's future development. Today, the world is looking to us for solutions to the energy crisis, and at the same time our value in the long-term sustainable energy future is being questioned. The solutions we offer will have to address all vectors of the challenge, from energy security and economic vulnerabilities to getting back on track of the energy transition journey. The UN Intergovernmental Panel on Climate Change (IPCC) just confirmed that the world is about to miss the mark, and that we have a mere 30 months to achieve a halt in emissions to have a shot at the 1.5C target. And when it comes to energy systems and

I see the gas industry today at an historically decisive moment.



infrastructure, 30 months is akin to 30 seconds.

Within this context, it is critically important for energy policy discourse to be precise and pragmatic about solutions. It is imperative for the gas industry to continue to deliver the messages that gas is unique. It is imperative to continue to oppose the “fossil fuels” generalisation in energy planning discussions, because it obstructs major environmental advantages of gas and takes tangible emissions reductions off the table. It is imperative that we reiterate the advantage of gas today and in the future.

Gas today is the cleanest burning fossil fuel, with half the emissions of those from coal and immense wider environmental benefits, when it comes to air quality, water use and waste. Gas today is a sure and immediate way to reduce emissions from power, industry, and transport. Gas today is the second pillar of decarbonisation, enabling greater shares of intermittent renewable power generation and mitigating long-duration variability that exceeds current battery storage capabilities. Finally, and imperatively, gas today is itself a decarbonisation solution, thanks to its unique ability to be blended and substituted over time with renewable gas,

including hydrogen, and decarbonised gas.

However, it is up to us the gas industry and to the IGU, as its voice, to demonstrate transparently the environmental and economic case for gas. A lot of excellent work is already underway by many of our members, and we need to keep progressing and accelerating it. Now is the time for gas to demonstrate its value in the sustainable energy future.

I hope we can discuss this at length, both in the formal portion of the WGC2022 program, and in the informal interactions at the first face-to-face meeting of the global gas industry in four years. These are the questions we need to be tackling around the clock when we meet in Daegu, in plenary sessions, during coffee breaks and while attending networking events. The answers to these questions will decide the future of gas in the energy transition and beyond.

This issue of the *GVG* magazine will be the first step in setting the stage for the big discussions about a sustainable future powered by gas in Korea next month.

Welcome to the April 2022 issue of the *Global Voice of Gas* magazine and welcome to Korea’s World Gas Conference on May 23-27, 2022. ■

Editors' Note

Welcome to the seventh issue of *Global Voice of Gas (GVG)*, an International Gas Union publication, produced in collaboration with Natural Gas World (NGW), that sets a new standard in communication for the natural gas community worldwide.

Less than six months after COP26, the IPCC tells us that the world is about to badly miss the mark on capping emissions in time to meet climate neutrality targets. Countries across the world are struggling to remain on the track towards net zero, as they contend with soaring energy costs and mounting energy security risks. Despite the current situational challenges, gas can provide energy that is both affordable and secure. Most importantly, it is energy that is sustainable today and in the future, with natural gas replacing coal today to cut emissions in half immediately, and renewable gas and decarbonised gases, including hydrogen, gradually cutting the emissions in the gas itself to reach carbon neutrality in the future. But the preceding drop in supply investments, coupled with a sharp rebound in demand post-COVID, now compounded by the highest level of geopolitical energy security pressure ever seen in the gas markets, put significant upward pressure on prices making gas much less affordable than it would otherwise be.

Nevertheless, this tide will turn, as countries are looking at ways to revive investments to add the much needed liquidity. Momentum also continues to build behind low-carbon technologies including biomethane, hydrogen, and carbon capture utilisation and storage, which are integral areas of development and innovation in the natural gas industry.

In this issue of GVG, we are pleased to present a feature written by Meg O'Neill, CEO of Woodside Energy, on the contribution that Australian natural gas can make to a sustainable global energy future. Meg explains how Woodside's proposed merger with BHP's petroleum business, targeted for completion this June, also sets the stage for the company to be a more significant supplier of energy on the world stage in the years ahead, while meeting ambitious environmental goals.

GVG also touches base with Anatol Feygin, Chief Commercial Officer at Cheniere Energy, to discuss

how the LNG industry is facing up the climate challenge, and how the LNG market is evolving. The LNG supply chain needs to reduce its greenhouse gas emissions to the greatest extent possible, he explains, as this will give the industry the social licence it needs to operate.

We also speak with Guloren Turan, the General Manager of Advocacy and Communications at the Global CCS Institute, to discuss how far carbon capture and storage technology has come, where it is going, and the challenges and opportunities it faces. In addition, two leading legal experts at Norton Rose Fulbright, Dylan McKimmie and Jo Feldman, discuss how the natural gas industry needs to be alert to the risks of making statements about environmental, social and governance credentials, lest they be accused of greenwashing. We also welcome a feature from Tomas Malango, director of hydrogen at Repsol, who sheds light on SHYNE, Spain's largest renewable hydrogen initiative that the company is leading.

Furthermore, we look at the key role of natural gas in South America's and the Caribbean energy transition journey, in discussion with Luz Stella Murgas, president of the Colombian Natural Gas Association, as well as with the Regional Association of Oil, Gas and Biofuel Sector Companies in Latin America and the Caribbean. And we take look at how gas is delivering in terms of economic prosperity and sustainability in a select few countries across the world, from Egypt and Malaysia to Brazil, Peru and Trinidad & Tobago.

Finally, this issue of GVG covers the critical developments that have affected the natural gas industry in recent months, including the Europe's renewed focus on energy security and the EU's latest proposals for decarbonising energy, how Africa can meet the continent's gas needs, how Greece is advancing its gas hub plans and GIIGNL's new framework for greenhouse gas neutral LNG. ■

Tatiana Khanberg,

Strategic Communications and Membership Director

Joseph Murphy,

Editor, Natural Gas World

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The Countdown to World Gas Conference 2022 in Korea

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IGU
WGC2022
28th WORLD GAS CONFERENCE
DAEGU, KOREA 23-27 MAY

Let's take a look at how this IGU triennial event will shape critical energy conversations, help formulate policy decisions, and bring together the gas and energy industry under one roof in Daegu, South Korea, to delve into our energy future this May 23-27 2022.

With energy security coming to the forefront, decarbonisation still remains a priority for the industry, and the world must not lose sight of its pivotal energy transition targets to mitigate climate change. Will LNG save the day? What is the outlook for the global energy mix as the industry manages the twin challenges: of meeting net-zero pledges whilst ensuring energy security? What will be the impact on longer-term growth in Asia? What does the future hold for collaboration in technologies and partnerships? [The Plenary Program](#) session on the Global LNG Players' Perspective on New Investments will answer these impending questions and explore rising LNG opportunities and how we can diversify and increase LNG supplies in this fast-changing landscape.

While the world has in the past dealt with major energy crises and addressed the challenges of ensuring affordability and security of supply, doing that while staying on the path to climate neutrality is something new. In the opening, Ban Ki-Moon former Secretary General of the United Nations will share his views on how the world's energy and climate policy and industry leaders could tackle this challenge, setting the scene for the week's many discussions, meetings, and debates to shape the path forward.

The diverse conference programme will also highlight immediate shifts and trends facing the gas industry. For example, some aspects of digitalisation accelerated nearly overnight during the COVID-19 pandemic. WGC2022 speakers will also analyse the new approaches

to marketing and focus on how blockchain technologies can deliver more transparency and promote a new way of thinking within the industry. We will speak about breakthrough innovations and new technologies and products that will enable the gas sector to leverage big data.

Importantly, in the big intellectual playground provided by WGC2022, we will have a chance to address the emission reduction pledges, the adequacy of Environmental, Social and Governance (ESG), the relevance of the Internet of Things (IOT) and Artificial Intelligence, latest R&D and investment trends, and so much more.

WGC2022 will provide a timely opportunity for the industry, policy, and broader energy leaders to meet face-to-face to address the many challenges and opportunities that lie ahead.

See you at WGC2022!

“The two times when conferences are at their most effective are when they bring an industry together face-to-face to address challenges or create opportunities. With hundreds of the world’s most influential organisations and people already attending WGC2022, the question you must ask yourself is do you want to be part of the discussion in real time, or will you stay at home and read the report?”

Rodney Cox, IGU Events Director

Travelling to Korea

As of 1 April, fully vaccinated travellers entering South Korea are not required to quarantine. Before entry into the country, travellers will be required to complete a short Q-Code online form before arrival and to take a PCR test at the airport upon arrival.

For full details on travelling into South Korea, [read more here](#).





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EVENTS



LNG2023

The world's premier LNG event, LNG2023, the 20th International Conference and Exhibition on Liquefied Natural Gas returns mid-2023, at a time when the opportunities and challenges facing the industry have never been greater.

Building on more than 50 years of success, our 20th Anniversary event aims to provide cutting edge insight, thought leadership, technical expertise and knowledge sharing to the global energy industry, defining the role of LNG as truly the star of traded energies and energy security for the next era.

As an example, the Call for Abstracts covers technical, strategic and commercial themes under six key areas:

- LNG markets & advocacy - global markets, energy security, energy transition, climate change and sustainability.
- Operations & best practice - best practice and new innovations, regulations and nextgen workforce.
- Commercial stimuli - project finance, trading and pricing, and legal.
- Upstream/midstream gas production, processing & liquefaction - technology & equipment, offshore LNG and large capital project delivery.
- Shipping, marine operations & marine terminals - LNG shipping, LNG transfer, LNG terminals including FSRUs.
- Downstream infrastructure & applications - LNG regasification and cold energy, power generation including FSRUs, mid-scale facilities, transportation fuel and new uses.

If you are looking to submit an abstract or require further information on the exhibition and conference location and dates contact the IGU's Flagship Events Director, Rodney Cox, at rodney.cox@igu.org.



IGRC 2024

We are proud to say that we have already obtained sponsorship commitments from 21 companies within the gas production and delivery value chain. We continue to work hard to bring more companies on board with IGRC2024 planning.

On February 23, the Canadian organisers launched our innovation [quarterly webinar series](#) with four Canadian Natural Gas Cleantech Leaders - have a look back to hear their stories in gas innovation value for the global markets.

On March 30, the IGRC2024 team participated in the Canadian Gas Dialogues conference: Gas 360° - Natural Gas in the Evolving Energy Discourse, a major industry event featuring distinguished guests, from the International Energy Agency, Canadian government officials, and senior industry leaders.

For regular updates on technology, environment and economy as well as IGRC2024 updates visit www.igrc2024.org.

We look forward to meeting you at our Pavilion in Korea at WGC2022!



RODNEY COX

*Director of Events,
International Gas Union*



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23-27 May 2022 in Daegu, Korea

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Tom Maramba

Senior Director,
Process Specialty Engineering (LNG)

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Regional Update

North East Asia & Australasia



GRAEME BETHUNE

Chairman, Australian Gas Industry Trust, IGU Regional Coordinator

- » The energy landscape in the North Asia and Australasia region is going through some major shifts and gas is playing an important role in supporting energy security, decarbonisation and economic development. While natural gas stands out as the ideal transition fuel because of its economic viability and less polluting effects compared to other fossil fuels, its flexibility is of primary importance to the region.
- » With the region consisting of developed and developing nations, OECD and non-OECD countries, it is unique and contains a diverse range of energy pathways. According to the US Energy Information Administration, non-OECD Asia is set to become the largest importer of natural gas by 2050 to meet the needs of their growing economies; while countries like Japan are expected to reduce their reliance on natural gas as they move to hydrogen and renewables to meet their net zero commitments.
- » As the region implements its various energy affordability, energy security and decarbonisation priorities, gas – in all its forms – plays an important part of the region’s energy mix.
- » Strong demand for alternative gases is also emerging. New Zealand, Japan and Korea have prioritised hydrogen as part of their sustainable energy plans. We anticipate a continued important role for gas for decades to come. It has been reported that the key players, Japan, China, Korea and Singapore, could demand 3.8 MTPA of Australian hydrogen by 2030.

2021 regional review

- » As Asia continues to recover from COVID-19, LNG imports

by North Asian countries (China, Japan, Korea and Chinese Taipei) increased by 10.1% from 2020 to 220 MT. China overtook Japan as the world’s largest importer of LNG in 2021, with imports growing by 18.5% over the year.

- » Japan imported 27.3 MT of Australian LNG, down 9.3% from 2020. Korea saw a 15.3% increase in LNG imports up from 40.0 MT in 2020 to 46.1 MT in 2021. Chinese Taipei LNG imports increased 8.9% in 2021 and saw the greatest import price rise (79.3%) to \$10.76/mmBtu from \$6.00/mmBtu in 2020.
- » A key feature of 2021 was the surge and volatility in gas prices internationally. The Asian spot price, the Platts JKM, has been at record highs for much of 2021 with an average \$15.16/mmBtu, up from \$3.85/mmBtu in 2020. The average Asian LNG import price also rose, up more than 45% to \$10.52/mmBtu in 2021.
- » Australia delivered a new record 81 MT LNG in 2021, up 1.5% from 2020 with Australia once again ranked as the world’s largest LNG exporter.

The energy landscape in the North Asia and Australasia region is going through some major shifts and gas is playing an important role in supporting energy security, decarbonisation and economic development.

Japan: Hydrogen cities emerge

- » Japan’s latest Energy Plan calls for as many energy source options as possible including hydrogen. Japan intends to have hydrogen and ammonia account for 1% of their power generation capacity by 2030 and support domestic production of hydrogen.
- » Japan is at the forefront of developing fully hydrogen based cities for 300,000 citizens to live, work and play. Toyota and ENEOS have joined forces to fully explore the practical details of hydrogen-based lifestyles and technologies.

Korea: Coal power stations give way to gas

» In January, South Korea permanently shut its two oldest coal-fired power plants to replace them with two new LNG fired power plants and a hydrogen fuel cell power plant. Ten coal-fired power plants, out of a planned 34, have been retired since President Moon took office in May 2017 in a push to reduce air pollution. This move has boosted LNG demand which currently accounts for 25% of South Korea's electricity mix.

China: Balancing energy security and sustainability

» In line with the Chinese government's target to increase natural gas's share of energy consumption to 15% by 2030, a major deal with Russian suppliers has just been made. The 30 year contract is for the supply of 10 bcma from Russia's far east via a new pipeline and is said to be worth an estimated \$117.5bn.

» China continues to improve its environmental sustainability efforts by teaming up with the EU to develop a Common Ground Taxonomy (CGT). Once finalised, the CGT will provide more transparency and help finance houses determine green investment opportunities in both China and the EU.

New Zealand: green hydrogen pushes forward

» The New Zealand government continues its fervent

push towards 100% renewable electricity generation by 2030. It views green hydrogen as playing a pivotal role and recently invested NZ\$20mn in the Ballance Agri-Nutrients and Hiringa Energy Green Hydrogen Project. This project will decarbonise fertiliser manufacturing and provide a scale that will start the production of low cost, green or renewable hydrogen.

» A proposed 600-MW green hydrogen production and export facility planned for New Zealand's South Island has included two of Australia's most prominent energy players on the shortlist. Oil and gas giant Woodside Energy and Fortescue Future Industries are two of four shortlisted to partner with New Zealand's Meridian Energy and Contact Energy to establish a large-scale green hydrogen production and export facility using renewable energy from Manapouri, New Zealand's largest hydroelectric generator.

Australia: gas still needed for power generation on way to net zero

» A recent report by Frontier Economics investigating the role of gas in the transition to net zero power generation found that in an electricity system increasingly transitioning to intermittent renewable generation, gas powered generation is the least costly way to add capacity. This finding also holds when carbon price equal to either today's average Australian or average European price of carbon credits is included.



South & Southeast Asia



ABDUL AZIZ OTHMAN
President, Malaysian Gas Association,
IGU Regional Coordinator

Natural gas as a key source of energy in Southeast Asia Sustainable Future

South Asia & Southeast Asia combined is expected to be the region with the highest energy demand growth in the coming years. According to World Energy Outlook 2019, Southeast Asia's overall energy demand is set to grow by 60% by 2040. As the more developed regions race towards net zero emission by 2050, parts of South Asia & Southeast Asia are still facing fundamental challenges providing energy access to their nation. Besides sustainability, priorities for both regions are energy access and affordability, to balance the energy trilemma. Many are still lacking access to clean energy, with 152mn people in the region lacking access to electricity and 900mn lacking clean cooking. Natural gas is the key for an orderly transition. Complemented by emerging low carbon and renewable gases such as hydrogen and biogas, natural gas will play a significant role in energy transition and fueling a sustainable future towards low carbon future.

To meet sustainability aspirations and also meet growing energy demand, Natural gas is expected to continue to play a significant role in this regions' future energy:

» The government of Malaysia in November 2021 committed to achieving carbon neutrality as early as 2050. Natural gas is expected to be an important fuel in the long-term and comprehensive National Energy Policy 2021-2040 (NEP). As the key component to NEP, the Natural Gas Roadmap (NGR) will set the transformative path towards a vibrant and sustainable Malaysian gas industry. Complementing renewables and other biogases, natural gas has a prominent

future to drive Malaysia towards achieving its carbon neutrality aspiration.

- » Indonesia plans to convert coal into gas to substitute natural gas. The country also aims to double gas production by 2030 and to become one of the major exporters of gas in the world. It is also investing in petrochemicals projects to meet growing demand in Southeast Asia.
- » In February 2021, Singapore outlined its Green Plan 2030 to deploy cleaner energy sources in all sectors through the four supply switches, which are natural gas, solar, regional power grids and low carbon alternatives. Under the Energy Reset framework, the aim is to increase efficiency with each new generation of the gas-fired power plant to reduce carbon emissions (e.g. installing new, advanced combined-cycle gas turbines). Singapore has also set to increase its carbon tax fivefold to \$18.60/T in 2024 to help achieve climate targets by 2050. Additionally, this approach assists by producing local demand for high quality carbon credits and facilitating the growth of carbon markets.
- » Thailand has committed to supporting the growth of natural gas to reduce its air pollution. Gas is poised to dominate the country's future power production as a source of stable and lower-emission energy under the country's Power Development Plan 2018-2037. It is expected to supply 53% of Thailand's power by 2037.
- » Vietnam, under its draft power development plan (2021-2030) with a vision to 2045 (Draft PDP8), published in February 2021, is targeting an increase in the share of gas in the power mix from 15% in 2021 to 21-23% in 2030 and 24-25% in 2045.
- » India has committed to net zero emissions in 2070. The government is committed to increasing the natural gas share in the country's primary energy mix from 6.5% in 2021 to 15% by 2030.
- » With approximately 35% of natural gas contributing to the primary energy mix, the government of Pakistan is pursuing policies for enhancing indigenous gas production as well as increasing imported gas to meet the increasing energy demand. Through a 2,616-km distribution pipeline built in

- » July 2021, the country will be able to operate more LNG terminals and gas is expected to be supplied to approximately 524,000 new consumers this year compared with in 2021. To deliver on its carbon neutral pledge, Malaysia will need natural gas even more as fuel for power generation and as a partner to renewable energy.
- » Malaysia is developing the National Energy Policy (NEP) with a horizon up to 2040 that is expected to chart a low carbon pathway, putting Malaysia on track towards eventually achieving carbon neutrality as early as 2050.
- » In officiating MyGAS2021, Mustapa Mohamed, Minister in the Prime Minister's Dept (Economy) of Malaysia, said: "natural gas, combined with other low carbon and renewable gases such as hydrogen and biogas, is expected to play an important role both in the NEP and in our strategy to achieve carbon neutrality".
- » To enhance this role, Malaysia is also developing the Natural Gas Roadmap as a key component of the overall National Energy Policy to ensure a vibrant and sustainable natural gas industry and the Hydrogen Economy and Technology Roadmap to chart a long-term pathway to drive the hydrogen economy.

South Asia & Southeast Asia combined is expected to be the region with the highest energy demand growth in the coming years.



Latin America



CARLOS CORTES SIMON
Executive Chairman At Asociacion
De Empresas De Gas Natural, IGU
Regional Coordinator

- » Public perception about the use of gas and the role it will play in the energy transition over the next three decades is very diverse across the region, with a more challenging outlook in countries that are net importers.
- » Some countries across the region have committed to a net zero emission target by 2050 (Argentina, Brazil, Colombia, Costa Rica, Chile).
- » The COVID-19 pandemic has added volatility to both supply and demand, yet there have been no significant disruptions to the industry in Latin America, and operators have been successful in ensuring the continuous delivery of natural gas throughout the value chain. The recovery since the beginning of 2021 has been strongly supported with increased LNG imports in Brazil, Chile and Argentina, due to extra dry hydrological conditions across the Southern Cone and limited inland production in Argentina and Bolivia.
- » In terms of LNG, Latin America imported a record of 21.0 bcm in 2021. More than 80% of these volumes came from the US. Latin America's LNG exports in 2021 were 9.1 bcm.
- » From Q4 2021, the recovery in gas production in Argentina's unconventional fields has decreased the country's reliance on imported gas and allowed Argentina to restart gas exports to Chile (including firm supply agreements during the summer).

Argentina

- » In December 2020 a gas incentive programme was launched (Gas Plan 4/Gas.Ar), to encourage companies to reverse the

decline in gas production and stem the outflow of the central bank's currency reserves by reducing imports and facilitating exports. The results have been positive, enabling the discontinuation of LNG imports at the Bahia Blanca terminal in September 2021 following a peak of total send-out of 53.4 mcmd in July at the country's two terminals.

- » Argentina has significant gas resources that can be economically developed. Gas, and specifically non-conventional gas, is currently the most relevant energy source to enable the country's comprehensive development in the short term. The 8.7-tcm resource base estimated by the IEA at Vaca Muerta is distributed at different geological levels. The level currently being developed hosts more than 2.8 tcm, based on data from producing wells, extrapolated to wells that remain to be drilled. Argentina can harness this 2.8 tcm of gas to expand consumption, which is currently 56.6 bcma, ramp up exports to neighbouring countries from 2.8 to 8.5 bcma via pipeline and send gas further afield by building LNG export infrastructure.
- » To allow gas from Vaca Muerta to flow to Buenos Aires, Argentina's government recently launched a tender for the construction of the first stage of a new gas pipeline. This stage will consist of a 657-km pipeline with an estimated budget of \$1.6bn.
- » Argentina relies heavily on spot LNG purchases for its winter gas supply. High international LNG prices are expected to represent a big challenge this year. In 2021, LNG terminals in Argentina received 3.4 bcm in LNG.

Brazil

- » A new gas law was approved by Brazil's congress and sanctioned in April 2021, raising hopes of greater market access that will reduce Petrobras' incumbency in the gas market. Petrobras is selling its transportation and distribution assets and negotiating access to the offshore gas evacuation routes and to onshore gas processing plants. The expectation is that more gas suppliers will offer molecules to the internal market, as seen in recent auctions promoted by gas distribution companies in northeast Brazil, which resulted in around 4 mcmd of gas being offered by third party suppliers. Petrobras has also leased its LNG terminal in Bahia to Excelerate. There are now five LNG import

terminals in operation, two of which were built and are operated by private companies (GNA in the state of Rio de Janeiro and Porto de Sergipe, in the state of Sergipe).

- » Three new LNG regasification floating terminals are under construction in the Northern, South-eastern and Southern regions, and are predicted to be commissioned between the end of 2022 and the beginning of 2024. They will add around 45 mcmd of capacity, and the country will have a total of eight LNG regasification terminals.
- » Industrial, commercial and residential gas consumption is quite stable, and the current national consumption is 102 mcmd, including power generation, which is highly dependent on the availability of hydropower. When hydropower generation was significantly strained in the second half of 2021, Brazil was forced to resort to 6.4 bcm of LNG.
- » National gas production has the potential to reach 150 mcmd by 2030, on the back of development of Pre-Salt and Northeast offshore fields. However, a substantial amount of associated gas is reinjected to increase oil recovery, and there is limited availability of offshore gas pipeline infrastructure.
- » The existing national gas transportation system (around 9,400 km) is very limited taking into account the large surface area of Brazil, and it runs along the coastal areas. Substantial investment is needed to guarantee access to gas within the regions located inland.
- » Brazilian gas imports from Bolivia were reduced from 30 mcmd to 20 mcmd, after the expiry of the primary import contract at the end of 2019.

Colombia

- » Colombia, which in recent years went from having 1.9mn users to over 10mn users of gas, serving close to 37mn people, is a world example in terms of market penetration. Gas represents 20% of the primary energy consumption in the country, being its second source of energy.

- » During the pandemic, the gas industry in Colombia reconnected 28,000 families free of charge, benefited 6mn households with a discount for timely payment, financed low-income families with \$16bn interest free, and made donations of more than \$23bn.
- » Colombia continues to expand the use of natural gas vehicles. During 2021, more than 16,000 vehicles were converted to gas, bringing the total number of conversions to 639,000. In addition, the country already has 4,061 gas-fuelled heavy vehicles, which include passenger transport vehicles, trucks, tractor-trailers and dump trucks.
- » In 2021, the companies affiliated with Colombian gas association Naturgas signed the "Road to Carbon Neutrality" alliance in Glasgow, which includes the intention to consolidate and strengthen the implementation of actions and best practices.

Chile

- » In comparison with the rest of the region, Chile has relatively smaller reserves of conventional gas, but significant reserves of unconventional gas. These reserves, however, have largely not been developed. Chile imports around 80% of its internal gas consumption in the form of LNG or through one of the five gas pipelines that interconnect the country with the different basins of neighbouring Argentina. The imported LNG arrives via two entry terminals, one in Quintero (central zone) and the other in Mejillones (north of the country). In 2021, Chilean terminals received 4.0 bcm of LNG equivalent, the highest annual amount on record.
- » This summer, the shipments of gas from Argentina to Chile, committed through firm contracts, have not seen any interruptions, which is a positive sign that these imports have normalised. But LNG terminals are expected to be used at nearly full capacity during the southern winter, when imports from Argentina are expected to be interrupted. Chile is making progress in transforming its electricity mix, through the deployment of renewables and an ambitious programme to phase out coal-fired power →

by 2040. However this process has not been without difficulty, triggered by a prolonged cycle of drought that has reduced water availability to levels comparable to the driest years recorded. This has led authorities to take preventive measures to manage the shortages and mitigate the risk of rationing.

» The National Green Hydrogen Strategy that was launched in 2020 is an essential piece of the Chilean carbon neutrality plan and its commitment to sustainable development. This strategy will allow the country to produce and export products from zero carbon fuels. It will also enable the country to export renewable energy to the world in the form of green liquid hydrogen, green ammonia and clean synthetic fuels. The competitiveness of Chile in renewable energy production and the global need for clean energy carriers will open the door to the creation of an economic sector that could rival the size of the Chilean mining sector. A new bill has been sent to congress which obliges gas distributors to blend gas with up to 20% green hydrogen from 2030 onwards.

Public perception about the use of gas and the role it will play in the energy transition over the next three decades is very diverse across the region..



Tapping the potential of landfill gas

The National Gas Company of Trinidad and Tobago Limited (NGC) and its subsidiaries - together The NGC Group - are making pioneering advances into the green energy space in support of global climate action imperatives and national emissions reduction targets. Among the latest projects that The Group is exploring is the conversion of landfill gas (LFG) into a commercially viable energy source.

LFG is a natural by-product of the decomposition of organic material in landfills. It is composed of roughly 50% methane, 50% CO₂, and a small amount of non-methane organic compounds. Methane is a potent greenhouse gas that is 28-36 times more effective than CO₂ at trapping heat in the atmosphere over a 100-year period. Capturing methane and putting it to productive use as an energy source is therefore a key strategy for combating global warming.

In Trinidad and Tobago, most municipal solid waste is disposed of in four main landfills which are either close to capacity or are at capacity and still collecting waste. Latest available statistics show that the average person in Trinidad and Tobago generates approximately 1.5 kg of waste daily, with an estimate of more than 1.5 MT of solid waste generated annually. When we consider that decomposition of this waste generates a potential energy source, it makes commercial and environmental sense to explore options for mobilising and utilising this resource.

This was the justification behind The NGC Group's latest clean energy undertaking. On September 13, 2021, NGC and its subsidiaries NGC CNG Company

NGC is transforming what would otherwise be a potent greenhouse gas into an energy source.

Limited (NGC CNG) and National Energy Corporation of Trinidad and Tobago Limited (National Energy), signed a Memorandum of Understanding (MoU) with the Trinidad and Tobago Solid Waste Management Company Limited (SWMCOL) to explore opportunities for capturing and commercialising landfill gas.

Through this MoU, the Parties will identify and quantify landfill gas emissions for existing landfills, explore existing and new infrastructure requirements to facilitate transportation and commercialisation of extracted landfill gas volumes, and explore opportunities for utilisation of the derived renewable compressed natural gas as an alternative transportation fuel for vehicles. Specifically, the captured methane emissions can potentially be used to fuel SWMCOL's fleet of vehicles and other official government fleets. It is expected that this initiative will contribute to Trinidad and Tobago's energy transition journey and create new revenue streams for the country.

The NGC Group is committed to driving the local energy transformation to a zero-carbon energy future. This collaboration with SWMCOL is just one of several partnerships that The Group is embracing to address the rapidly changing energy and economic landscape and mitigate the threat of climate change. Now more than ever, renewable energy and energy efficiency initiatives are needed if we are to create a circular economy and achieve a sustainable energy future. Harnessing the power of landfill gas is a step in the right direction. ■



The role of Australian gas in a sustainable global energy future

With both the immediate supply challenges and the longer-term transition in mind, the positive contribution that Australian gas can make to a sustainable global energy future is very clear.

MEG O'NEILL, CEO, WOODSIDE ENERGY



WGC 2022 convenes at a time of heightened geo-political uncertainty and volatility in global energy markets, exacerbated by the tragic events that have unfolded in Ukraine.

There is renewed focus on the critical contribution that affordable and reliable energy makes to the global economy, with industry and governments around the world dealing with the immediate challenges of secure energy supply and market stability.

At the same time, we are in the midst of a broader global energy transition with significant and lasting implications for our economies and societies. Our industry has a central role to play in this transition

by providing the energy needed to heat homes, keep lights on and enable industry, while also supporting global efforts to address climate change and achieve decarbonisation targets.

If we consider the global energy outlook with both these immediate supply challenges and the longer-term transition in mind, the positive contribution that Australian gas can make to a sustainable global energy future is very clear.

In terms of energy security and market stability, Woodside recognises the important role we play as Australia's leading natural gas producer. Through our established operations at the North West Shelf and Pluto



LNG projects, we have a proven track record of reliable and affordable energy supply to the region. The Ukraine conflict has highlighted the central role of gas in the energy mix of many countries, with customers needing certainty that contracted supply remains available and will be delivered to schedule. In this environment, reliable supply from secure Australian projects is increasingly valuable to customers.

With regards to the broader global energy transition, Woodside has a strategy to thrive through this transition as a low-cost, lower-carbon, profitable, resilient and diversified energy producer. This strategy is underpinned by several key elements.

First, we know that a decarbonising global economy will continue to need gas, for its ability to replace higher-emitting fossil fuels such as coal, firm up renewable power generation, and for use in hard-to-abate sectors. Even in the International Energy Agency's Net Zero Emissions scenario, the forecast cumulative global investment in oil and gas needed to meet the world's energy needs is approximately US\$10 trillion by 2050.

Woodside's track record as a reliable and cost-competitive provider of LNG to North Asia will underpin our ongoing contribution as the global energy transition proceeds. This will continue through the development of →

**Woodside has
a strategy to
thrive through
this transition
as a low-cost,
lower-carbon,
profitable,
resilient and
diversified
energy producer.**

our recently sanctioned Scarborough gas project, a world-class resource in proximity to Woodside's major Asian customers. First cargoes from Scarborough are targeted for 2026, at a time of anticipated robust demand for LNG in the global market.

Second, energy customers are seeking increasingly lower-carbon sources of energy, to help them achieve both their economic and decarbonisation goals. Woodside's major target markets including Japan, China and Korea have all committed to net zero targets by mid-century. In this environment, we see Scarborough as an attractive option for major energy customers in the region. Scarborough reservoir gas contains only 0.1% CO₂ and will be processed through the efficient and expanded Pluto LNG facility, making it one of the lowest carbon-intensity sources of LNG delivered into North Asia.


Woodside's climate strategy has two key elements: to reduce our own net equity greenhouse gas emissions; and invest in the products and services that our customers need as they reduce their own emissions. Woodside has committed to near- and medium-term Scope 1 and 2 emissions reduction targets (15% by 2025, 30% by 2030), towards an aspiration of net-zero emissions by 2050 or sooner. We have also set a target to invest US\$5bn in new energy products and lower-carbon services by 2030. This includes collaborating with new and existing customers in Asia on potential international supply chains from Woodside's proposed hydrogen and ammonia projects in Australia.

Third, the energy companies that will thrive in a sustainable energy future are those with a commitment to innovation and technology, enabling them to remain cost-competitive and evolve with changing customer preferences. At Woodside, we are embracing leading-edge technologies, such as AI, digital twin, remote operations and robotics, to reduce costs and improve performance of our operations. Innovation and technology are also driving new lower-carbon energy and emissions reduction opportunities to secure our ongoing role in a lower-carbon future. Shared industry solutions such as carbon capture, utilisation and storage, or lower-carbon supply chains including carbon offset cargoes, are areas where Woodside is actively collaborating with partners in the region.

Finally, energy companies that wish to contribute to a sustainable global energy future must meet the growing expectations of customers and broader society for strong environmental, social and governance (ESG) performance.

It is why Woodside works closely with industry peers and external stakeholders to continually evolve our ESG approach, managing our activities in a sustainable way to support the wellbeing of our workforce, our communities and our environment.

For these reasons, we can expect an ongoing positive contribution for Woodside and Australian LNG in a sustainable global energy future. Our proposed merger with BHP's petroleum business, targeted for completion in June 2022, also sets the stage for Woodside to be a more significant supplier of energy on the world stage in the years ahead. The proposed merger delivers the increased scale, diversity and resilience for our company to successfully navigate the energy transition. It is a future we look forward to with confidence. ■



Our proposed merger with BHP's petroleum business... sets the stage for Woodside to be a more significant supplier of energy on the world stage in the years ahead.

A large, vibrant green leaf is the central focus, its intricate vein structure clearly visible. Inside the leaf's outline, a dark silhouette depicts an industrial landscape. On the left, several wind turbines stand tall. In the center, there are three tall, thin structures resembling flare stacks or chimneys, each with a small flame at the top. To the right of these is a large, rectangular structure that looks like a solar panel array. Further right, a ship is visible, with the letters 'LNG' printed on its side. The background behind the leaf is a dark, blurred green, suggesting a forest or garden setting.

Delivering for
a low-carbon future



CNPC

Delivering energy for a better world

Through the strength of our North American assets, we are dedicated to expanding the global use of LNG and net-zero solutions, clean power and modernized energy networks. At Sempra Infrastructure we develop, build, operate and invest in the infrastructure critical to meet the world's energy and climate needs.



Sempra Infrastructure is not the same company as the California utilities, San Diego Gas & Electric company (SDG&E) or Southern California Gas Company (SoCalGas), and Sempra Infrastructure is not regulated by the California Public Utilities Commission.

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The road ahead for LNG: Interview

Anatol Feygin, Executive Vice President and Chief Commercial Officer of Cheniere Energy, discusses with *Global Voice of Gas* how the LNG industry is facing up to the climate challenge and how the LNG market is evolving



Will the ease with which cargoes have been diverted recently to Europe and away from Asia finally bring an end to contracts burdened by destination restrictions?

Destination flexibility has been a key element of Cheniere's LNG offering to the marketplace, and recently has proven its value to aid global energy security and flexibility during a concerning and difficult time. But it is hard for us to judge the extent to which other sellers in other countries will follow suit. Cheniere will continue to offer a variety of contracts that give the buyer destination flexibility - including Free-On-Board arrangements, along with Delivered at Terminal (DAT) and Integrated Producer Marketing (IPM) options. These contracts have served our customers and suppliers well. Clearly, the ability for some cargoes to change course has helped

Europe through the winter of 2021-2022 and will continue to be a desirable option for many buyers.

Cheniere has linked most, if not all, of its recent SPAs to Henry Hub. Does Cheniere see this trend, given the liquidity it offers, expanding to other LNG producers?

For Cheniere, passing through the underlying commodity price, and collecting a fee for the liquefaction process (and shipping for delivered cargoes) makes sense. It gives our customers a 'cost-plus' construct which has remained very stable, certainly in comparison to the huge movements in LNG spot prices we have seen recently. Some of our recent agreements with US producers, however, have been marked to international indices to give them exposure to the global market, while →

giving Cheniere flow certainty. Our overall view continues to be that the optimal risk mitigation strategy for LNG customers is a diverse portfolio and HH linked supply is a key component of such a portfolio.

More and more producers are seeking to have their gas certified as responsibly-produced. Cheniere itself is developing cargo emissions tags to provide transparency related to emissions from at least a portion of the LNG value chain – and is collaborating with certain producers on the QMRV initiative. What more needs to be done by the LNG sector to ensure sustainability?

It is quite simple: the LNG supply chain needs to reduce its GHG emissions to the greatest extent possible. We believe that this is a ‘social licence to operate’ issue for the LNG industry. As part of that drive we believe that more accurate and more complete data are required, as well as greater data transparency, so that better-informed decisions can be made.

This is what drives us to take on an industry-leading role with actionable, innovative solutions like Cargo Emission Tags and our other collaborations on emissions transparency and science. For example, we are collaborating with natural gas producers and leading academic institutions to improve the overall understanding of upstream GHG emissions through quantification, monitoring, reporting and verifying (QMRV) of those emissions. This collaboration utilises multiple technologies including ground-based, drone, aerial, and satellite monitoring to establish baseline emissions levels. The initiative will also verify emissions performance and identify opportunities to reduce emissions.

The industry is just beginning this journey and has yet to figure out what equipment to use, much less what these monikers mean, but we’re determined to find effective solutions that can be deployed at scale. Cheniere will continue to drive these initiatives with transparency and science-based solutions.

Elaborate on how Cheniere is addressing those emissions directly under its control, as well as those indirect emissions linked to the supply chain?

Between 2016 and 2020, our Scope 1 GHG emissions intensity decreased by over 33% and methane emissions

intensity decreased by 52%. This was due to the addition of LNG capacity and improved efficiency and operational practices at our facilities. Our LNG facilities use a number of technologies aimed at achieving the maximum possible thermal efficiency, minimising losses and emissions. State-of-the-art aeroderivative gas turbines are capable of limiting nitrogen oxides (NOx) emissions below our strict operating permit requirements and are highly efficient, resulting in less natural gas being used in the liquefaction process per unit of LNG produced. In addition, we have managed to increase our flexibility to share load across different refrigeration compressors, leading to higher train efficiency.

However, we also understand that we have a unique opportunity to work with those along the LNG supply chain from upstream through shipping, including our QMRV projects with gas suppliers and shipowners. Another effort, beginning in 2022, we intend to provide our long-term customers with Cargo Emissions (CE) Tags that will provide estimated GHG emissions associated with each LNG cargo, from the wellhead to the delivery point. The CE Tag will be calculated using our lifecycle analysis model, which is built upon the US department of energy’s framework but is customised for our value chain, utilising data from our gas suppliers, LNG transporters and liquefaction facilities. As our CEO, Jack Fusco has said, “Collaboration with our natural gas suppliers is a key component of Cheniere’s focus on quantifying and improving environmental performance. This collaboration reinforces our data-driven environmental transparency, supports our CE Tags, and enhances our efforts with natural gas suppliers to monitor and verify emissions to maximise the climate benefits of Cheniere’s LNG.”

In addition to the QMRV process and our CE Tags, we recently worked with Shell to deliver a carbon-neutral cargo of liquefied natural gas. Cheniere and Shell worked together to offset the full lifecycle GHG emissions associated with the LNG cargo by retiring nature-based offsets to account for the estimated CO₂e emissions produced through the entire value chain. We also supported the first-ever onboard assessment of emissions from LNG vessels, which is being led by Queen Mary University of London, and have installed monitors on many of our chartered ships.

These high, volatile prices aren’t sustainable for the world and the market.

When does Cheniere anticipate market conditions to return something more typical of recent years prior to the pandemic?

The current geopolitical situation makes that a very difficult question to answer. We have been indicating for some time that we expected the LNG trade to enter a tighter period for the next few years as supply additions slow. However, the rapid rebound in gas demand we saw in 2021 tightened the global market faster than anticipated, while the tragic situation in Ukraine has provided a further layer of risk and uncertainty in Europe.

We see an abundance of natural gas resources worldwide and strong competition to monetise them, which indicates to us that we can expect prices to return to long-run marginal cost levels over the mid to longer-term as markets rebalance. While a return to pre-pandemic conditions looks unlikely before the middle of this decade, for the sake of buyers and end users we hope the market reaches lower price points sooner rather than later. These high, volatile prices aren't sustainable for the world and the market.

I will add that we target over 90% of our volumes to be committed under long-term contracts, with the steady HH-based pricing I spoke about earlier. Our long-term customers enjoy this price stability at a fraction of the current prompt market prices

It was not long ago, under the shadow of the pandemic, that many forecasters were not expecting a tight market to emerge until the mid-2020s. In such volatility, how can LNG exporters try to avoid either overinvesting or underinvesting in supply?

LNG projects are designed to run for many decades. So, the investment decision is really looking beyond the current volatility and assessing the need for additional LNG supply over coming decades. And we see robust long-term growth for LNG, despite the near-term market volatility. As we discussed earlier, even through the fog of the pandemic, we saw the first half of this decade as a period of tightness in the LNG market.

There are numerous signals that point to growing demand for LNG as economies around the globe add natural gas power generation for growth, to replace coal and to backstop renewable sources. That demand will



It is quite simple: the LNG supply chain needs to reduce its GHG emissions to the greatest extent possible. We believe that this is a 'social licence to operate' issue for the LNG industry.

underpin new investments both on the liquefaction side and the regasification side of the equation for some time. We are quite confident in growth opportunities ahead and expect to take a final investment decision on our Corpus Christi Stage III project in the summer of 2022 – a project that will add over 10 MTPA to our current 45 MTPA production capacity.

Cheniere has additional brownfield development opportunities at both Corpus Christi and Sabine Pass. Given the anticipated LNG supply gap expected to develop later this decade and persist through 2040, does Cheniere intend to pursue these brownfield opportunities?

In short, yes, as long as we continue to meet our disciplined investment metrics. Cheniere is endowed with a tremendous platform with respect to not only our scale but also our integrated business model. Corpus Christi Stage 3 is a clear demonstration of that, and we are likely to take an FID on this project around mid-year. Beyond Stage 3, Cheniere controls acreage adjacent to both facilities where we are evaluating further expansion opportunities provided we meet all of our stakeholder objectives. ■



it's only human to see progress starts with partnership

Chevron is proud to be a partner of choice in the natural gas space, helping to create economic value where we do business. Natural gas can play a role in the energy transition and help our customers diversify their fuel sources while balancing economic and environmental priorities. At Chevron, we believe the future of energy is lower carbon, and we aspire to be a leader both today and tomorrow. **Learn more at [Chevron.com/LowerCarbon](https://www.chevron.com/LowerCarbon)**

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Energy stability and affordability take centre stage in Europe

Europe needs to regear its policies to support more gas infrastructure, and tap more domestic supply to support its supply security

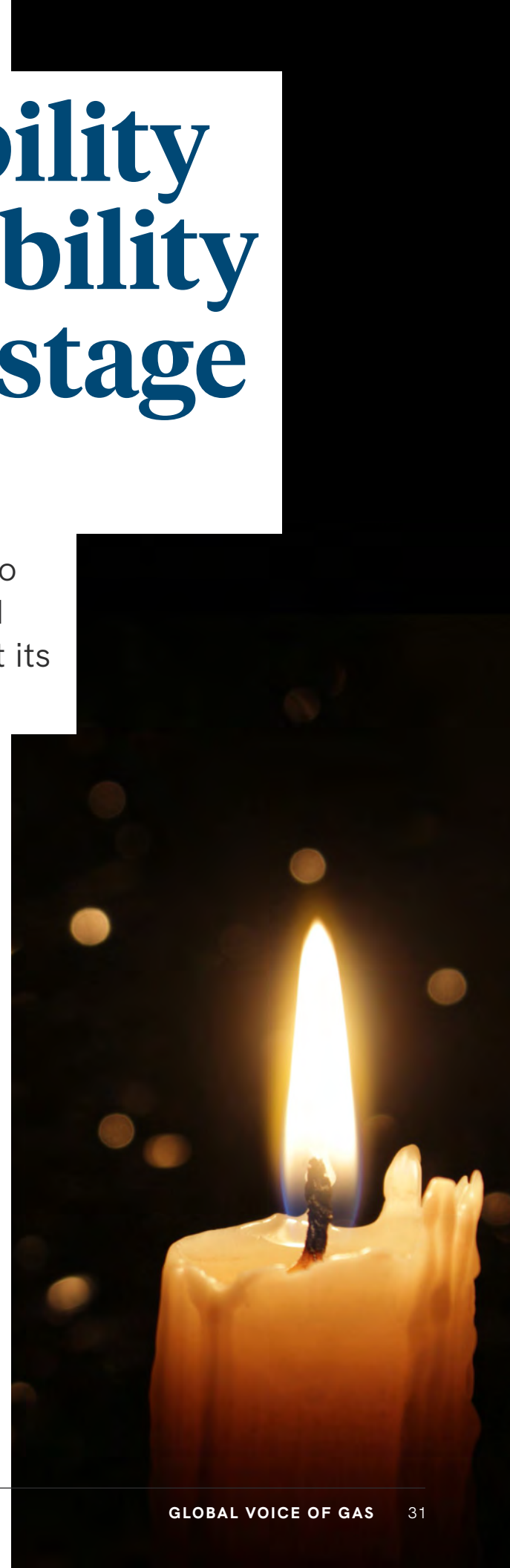
JOSEPH MURPHY

Energy security and affordability have moved to the top of Europe's agenda in recent months, as geopolitical risks have exacerbated the global energy crisis that began last year. For European leaders, the challenge is threefold. Steps must be taken to bolster overall energy supply and bring down prices, while also replacing Russian energy with alternatives as soon as possible, and ensuring that decarbonisation remains a priority.

Amid these unfavourable conditions, the European Commission is pursuing increased LNG and pipeline imports from non-Russian sources in light of Moscow's actions in Ukraine. Under its REPowerEU plan, it is striving to end Russian gas imports, which totalled 155 bcm in 2021, by 2030, partly by expanding alternative supplies and partly by cutting gas consumption by 100 bcm. It is also seeking to ramp up biomethane and renewable hydrogen production and imports.

Infrastructure

The commission recognises that gas infrastructure will have to be expanded, in order to deliver greater energy security. But it remains to be seen whether the EU will regear its policies to support this.



In the past, EU regulatory and financial support was crucial in getting large-scale infrastructure projects off the ground, including the Southern Gas Corridor, widely regarded as a key success story in the gas industry. But that level of support is no longer present. The European Investment Bank and other European financiers are phasing out funding for oil and gas, and the number of natural gas investments included in the EU's lists of projects of common interest continues to dwindle.

The right signals also need to be sent to private investors. While the commission has called for gas to be considered sustainable in its taxonomy, there are caveats. For gas-related projects to be classified as sustainable, they must comply with potentially prohibitively stringent emissions mandates and must be fully switched to renewable or low-carbon gases by the end of 2035. Energy bodies have expressed concern that these mandates could deter investors.

Meanwhile, the EU's complex and swiftly changing regulatory landscape may also make some investors reluctant to commit to new projects, even with today's soaring gas prices.

Thierry Bros, professor at Sciences Po Paris, adds that the EU's goal of scaling back consumption of gas by

100bn m3 by 2030 is also "sending the wrong signal to the market." Instead, the aim should be curbing consumption by around 10% as soon as possible to accommodate a potential disruption in Russian supply, he says, and removing coal from the energy mix.

"The market should finance the additional import capacities, but this can only be done if the commission stops predicting that demand will fall by such a great degree," Bros tells GVG.

The market should finance the additional import capacities, but this can only be done if the commission stops predicting that demand will fall by such a great degree.

Thierry Bros

Professor, Sciences Po Paris



Energy at home

The spike in energy costs has also showed how exposed Europe's domestic market is to LNG spot pricing fluctuations. Natural gas production in Europe has been in decline for decades, outpacing the drop in consumption that has been brought about by greater efficiency. Excluding contributions from Russia and CIS states, Europe's gas output amounted to only 218.6 bcm in 2020, according to BP's latest statistical review, down almost 30% from the level in 2010, and 90% of Europe's gas is now imported.

"By encouraging investments to pivot first from coal, then oil and, to a lesser extent, gas, and towards renewables, European governments have ensured a

With economies only beginning their recovery from the impact of the pandemic and critical mass still a long way off in terms of reliable supply from renewables, a more balanced approach is clearly needed.

Douglas Rycroft

Gneiss Energy

bright long-term outlook for decarbonisation," Douglas Rycroft, director at UK consultancy Gneiss Energy, tells GVG. "However, the recent pinch in supply/demand dynamics has highlighted the inherent risks for consumers that are heavily reliant on imported energy - namely significant short-term pain for consumers and exposure to price and supply volatility."

Rycroft also notes that renewables have not been immune to cost increases that have been seen across the energy sector, with costs for wind, solar and battery technologies currently rising faster than ever before.

"With economies only beginning their recovery from the impact of the pandemic and critical mass still a long way off in terms of reliable supply from renewables, a more balanced approach is clearly needed," he says.

Rycroft points not only to the economic but also the environmental benefits of leveraging native gas production.

"European regulations for safety and emissions are among the strictest in the world while local supplies can reduce our emissions footprint compared to long maritime journeys for oil and LNG," he says. "Utilising domestic gas in conjunction with carbon capture and storage and, eventually, hydrogen, presents an opportunity that the EU itself has called 'sustainable.'"

Rycroft cautions that while "there's no harm in being ambitious, pushing countries to adopt highly unlikely net zero targets is likely to lead to more confusion and volatility that may end up slowing the energy transition."

In its REPowerEU plan, the commission said it would "assess as a matter of priority whether measures and investments are needed in hydrogen-ready gas infrastructure and interconnections to overcome bottlenecks to the full use of the EU's LNG capacity." But while calling for increased biomethane and hydrogen production over the next decade, it makes no mention of expanding domestic supply of natural gas.

There are early signs that member states might take steps to bolster local production, however. Germany's government, for example, has called for increased extraction at home as part of its energy diversification plan, with its finance ministry in mid-March calling for the country to rethink its ban on new North Sea oil and gas drilling. Outside the EU, the UK is set to resume offshore oil and gas licensing later this year and is reviewing the case for onshore shale gas development.



Can Africa meet Europe's gas needs?

For Europe, African gas is a critical part of a jigsaw from which Russia is being removed, but it is not the whole solution. Upstream limitations mean enhanced pipeline imports can offset only a small proportion of Russian gas supplies, while LNG demand growth should support both innovative, fast-to-market FLNG projects and larger-scale onshore developments.

ROSS MCCRACKEN

Europe is caught on the horns of a dilemma. It needs gas to minimise greenhouse gas emissions as it transitions from a predominantly fossil fuel-based energy system to one largely powered by renewables; its domestic gas production is on a downward curve; and Russia's actions in Ukraine made untenable its dependence on Russia as the single largest source of its gas imports. In addition to reassessing the possibilities of its mature domestic gas basins, Europe must look to its existing non-Russian gas suppliers and potential new suppliers. Can Africa help fill the gap?

Pipeline gas looks problematic

Europe has four gas pipeline connections with North Africa, all with spare capacity, although one, the 11-bcma

Medgaz, which runs from Algeria to Spain via Morocco, was closed in November after Algeria severed diplomatic relations with Rabat.

The second Algeria-Spain pipeline, the 12 bcma Maghreb-Europe line, is sufficient to meet Spanish demand for Algerian gas. In any case, the utility of either pipeline in serving the rest of Europe is limited by distance and the lack of transmission infrastructure from the Iberian peninsula to the rest of Europe, despite improvements in recent years.

The 10.5-bcma Greenstream pipeline from Libya to Italy is currently under-used, but increases in supply would need political stabilisation in Libya to allow the repair of upstream assets and new investment. Although European majors TotalEnergies and Eni have both said

they are prepared to invest in the country, a return to pre-conflict levels of gas production and exports in the short term cannot be relied upon.

The most promising prospect is the 33.5 bcma TransMed pipeline, which runs from Algeria via Tunisia to Sicily and from there to mainland Italy, traversing nearly the entire length of the country to end in Slovenia. However, while the pipeline has substantial spare capacity, estimated at 41mn m³/d in fourth-quarter 2021, Algeria has also to meet a post-pandemic rebound in domestic gas demand, which has returned domestic gas consumption to its former high levels of growth.

While Algeria can boost gas pipeline exports to Europe this year to some degree, they are likely to fall short of TransMed's spare capacity.

There have been a number of proposals for new pipelines, for example the Galsi pipeline from Algeria to Italy, the Trans-Saharan gas pipeline, which would originate in Nigeria, and more recently the East-Med

This is far short of Europe's spare LNG import capacity, an indication not only of a tight global LNG market, but the opportunity for upstream investment in Africa.

North Africa is a long standing supplier of LNG, Libya's Marsa El Brega plant being the first major liquefaction facility to come into operation in 1970, followed by the initiation of Algerian LNG production in 1978 and its expansion in the early 1980s, with Egypt joining in the 2000s. However, these traditional producers have all suffered setbacks limiting further expansion.

In sub-Saharan Africa, Nigeria, which completed its first LNG trains in 1999, took 14 years from completing trains 5-6 in 2006/07 to making a final investment decision (FID) on developing Train 7. This is expected, nonetheless, to be complete in 2024 and, in addition to the new 4.2 MTPA train, will include debottlenecking and process improvements for the plant's six other trains. In

Unattractive upstream investment conditions, regional politics, social instability, security issues and the need to meet domestic demand are problematic themes which run across North Africa.

pipeline. However, existing spare capacity shows that the problem is not principally transmission capacity from North Africa.

Unattractive upstream investment conditions, regional politics, social instability, security issues and the need to meet domestic demand are problematic themes which run across the region, limiting North Africa's capacity to respond to Europe's call for more non-Russian gas.

LNG

Both the International Energy Agency (IEA)'s ten-point plan to reduce Europe's Russian gas imports this year and the European Commission's REPowerEU plan to end Russian gas imports by 2030 see more potential in the LNG market than in growing pipeline imports from non-Russian sources. The IEA plan, for example, suggests in the short term that additional pipeline imports could supply 10 bcma of gas to Europe, while the LNG market could supply 20 bcm.

total, production capacity is expected to rise from 22 to 30 MTPA as a result.

Equatorial Guinea built one train in 2007, but has so far been unsuccessful in developing the sector further, while Angola entered the ranks of LNG exporters in 2013.

FLNG

As a result, attention has broadened from traditional African LNG producers to newly-discovered resources and new development concepts, such as floating LNG. In effect, African LNG development has bifurcated into two streams, small to mid-scale FLNG and the pursuit of traditional large-scale onshore plants.

While the latter promises to bring much greater volumes of LNG to market, it is the former which appears to be making the fastest progress. The first of the FLNG ventures was Cameroon's 2.4 MTPA FLNG →

facility, which started production in 2018, leapfrogging the construction of purpose-built FLNG vessels via the conversion of an old LNG tanker.

Eni's purpose-built Coral Sul FLNG vessel looks set to be next. With a capacity of 3.4 MTPA, it arrived in Mozambique earlier this year. It should be followed by the BP-led Tortue/Ahmeyim FLNG project in 2023, which will add 2.5 MTPA of capacity and bring both Mauritania and Senegal, whose maritime borders the development straddles, into the world of LNG.

More projects are in the offering, notably New Fortress Energy's aptly-named 'Fast LNG' concept, which is an adaptation of Golar LNG's hull conversion strategy. NFE has acquired two jack-up rigs, which it intends to use as platforms to house mid-scale liquefaction trains, using a floating storage unit moored alongside to provide storage and offloading.

According to a heads of agreement signed in February with Eni, the first unit will be deployed off the coast of the Republic of Congo with a capacity of 1.4 MTPA and a potential start-up date of second-quarter 2023. New Fortress also signed a memorandum of understanding with the government of Mauritania in December, which could prove the basis for the deployment of its second unit.

Onshore LNG

Large-scale onshore LNG development in Africa is not faring so well. In Mozambique, both the under-construction Mozambique LNG and the pre-FID Rovuma LNG projects have been thrown off-course by insurgency, threatening the security of staff and the projects. TotalEnergies, which is developing Mozambique LNG, has announced that it hopes to restart construction work this year, but the delays have put back full operation from 2024 to at least 2026.

However, to Mozambique's north, a change in government has improved the prospects for Tanzanian LNG, with lead developer Shell in February reporting good progress. On the west of Africa, a string of recent discoveries off Namibia is also raising hopes of LNG potential.

Large onshore projects are critical for achieving a substantial boost in Africa's gas export capacity and thus its ability to supply gas to Europe.

The two Mozambique projects would add 28 MTPA of capacity. Indeed, at 12.88 MTPA, Mozambique LNG alone would add more capacity than all the existing and

under construction FLNG projects in Africa combined. Tanzania's discovered gas reserves suggest a single plant of similar proportions to those being built in and planned for Mozambique.

Nonetheless, while FLNG developments combine speed with relatively small volumes, the prospects for modular development suggest more is possible. BP's Tortue/Ahmeyim project is a case in point. FLNG here is designed to limit initial investment exposure and gain early revenue flow, but it could lead to a much larger development. The project has been buffeted by LNG spot price volatility and Covid-19 delays, but the long-term plan is to install a series of FLNG vessels, increasing total capacity to 10 MTPA, a size commensurate with onshore plants.

Although some FLNG projects are targeting stranded gas fields not large enough to warrant an onshore development, in other cases FLNG could prove an entry point, providing incremental early gains in African LNG output, paving the way for later, larger developments.

Attention has broadened from traditional African LNG producers to newly-discovered resources and new development concepts, such as floating LNG.

Supplying Europe

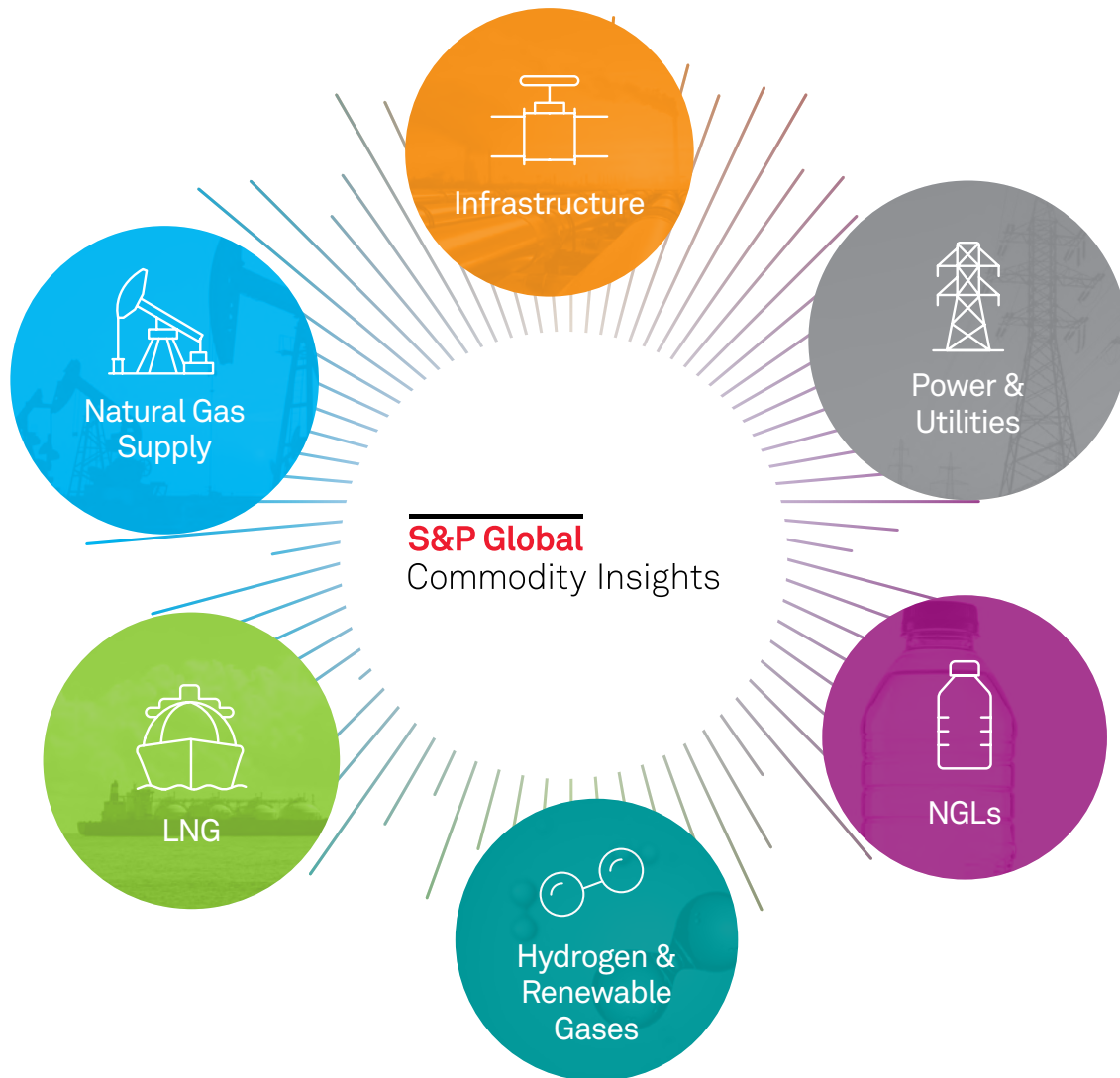
Turning away from Russian gas means Europe will become more dependent on other gas suppliers. There is no doubt that African gas can play an important role in feeding a growing LNG market and in supplying greater volumes of pipeline gas.

However, the immediate prospects for large upstream developments in Africa may be too far from Europe to warrant pipelines. Increases in LNG capacity, meanwhile, will feed into a global pool of supply, within which European buyers will have to compete with other buyers. That pool needs to grow, in any case, if Europe is to take advantage of its excess LNG import capacity.

In North Africa, this may mean more proactive engagement between governments to provide investment capital and secure upstream access on mutually beneficial terms. For Sub-Saharan Africa, securing LNG streams for European use in a competitive market will mean buyers stepping up to the plate and committing to long-term off-take agreements. ■

Why guess about the future of gas?

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Driving CCS forward: Interview

We speak with Guloren Turan, General Manager of Advocacy and Communications at the Global CCS Institute, to discuss how far carbon capture and storage has come and where is it going, as well as the challenges and opportunities it faces



What is the history of carbon capture and storage (CCS) in the natural gas industry?

Over eighty years ago, carbon capture technology was installed for the first time at a natural gas processing plant to separate CO₂ from methane. The first commercial CCS facility commenced operation in 1972 at the Val Verde natural gas plant in West Texas in the US. In 1996, the first use of CCS purely for climate mitigation was initiated at the Sleipner natural gas processing facility in the North Sea. This facility has permanently stored about 0.9 MT of CO₂ every year since.

Since then, the versatile technology, pioneered by the natural gas industry, saw its adoption steadily grow across a wide range of energy intensive sectors including cement, hydrogen, ammonia, chemical production and more. With policy evolving to match the demands and ambitions of industry, CCS has the potential to be a key driver behind the climate plans of large industrial sectors.

CCS technology provides deep decarbonisation by capturing CO₂ – often from a point source at a facility

– and storing it below the earth’s surface before it can reach the atmosphere. At present, CCS is being utilised by the energy sector in a number of ways, from supporting the growing demand for low-carbon LNG, to steering the wave of blue hydrogen.

What role will CCS play in the energy transition and how will the technology support the Paris Accord targets?

In 2021, the world saw the largest jump in CCS development in a decade. With a 32% increase in CCS project capacity in the pipeline of projects in operation and under development, this growth can largely be attributed to an emergence of private-public partnerships, supportive policy measures and increased net-zero commitments from both governments and industry. Although promising, there’s more work to be done. CCS capacity will need to increase by 100-fold by mid-century – totaling 2,000 facilities globally from the current 135 – if international net-zero climate targets are to be reached



and if industry will be able to successfully play its part.

The ongoing energy transition will play a significant role in attaining net-zero emissions by 2050, and the International Energy Agency (IEA) expects that CCS alone will be responsible for mitigating 15% of the world's CO₂ emissions. To get there, regulatory clarity – both around CO₂ storage and transport – will need to be developed and improved in all regions. Financial support and business models that incentivise private companies in stepping into the CCS ring will also be required further. Thankfully over the last decade these building blocks have begun taking shape.

How are supportive policy measures helping to shape and create CCS markets?

CCS success is evident most noticeably in North America. Globally, the US remains the front runner in CCS deployment, largely due to its decades long CCS policies. Of the 135 CCS projects established globally, 40 are in the US. Aiding this lead is financial support through policy efforts, such as the 45Q tax credit, which is expected to be closely mirrored in neighbouring Canada.

Over in Europe, financial incentives in the form of grants are gaining ground. The European Commission – who pushed forward with ambitious 2030 climate targets to reduce emissions by 55% within the next ten years – has allocated €1.1bn (\$1.2bn) towards seven climate technologies via the EU Innovation Fund in 2021, four of which are CCS projects. In 2022, the Commission plans to increase the number of projects funded by a third.

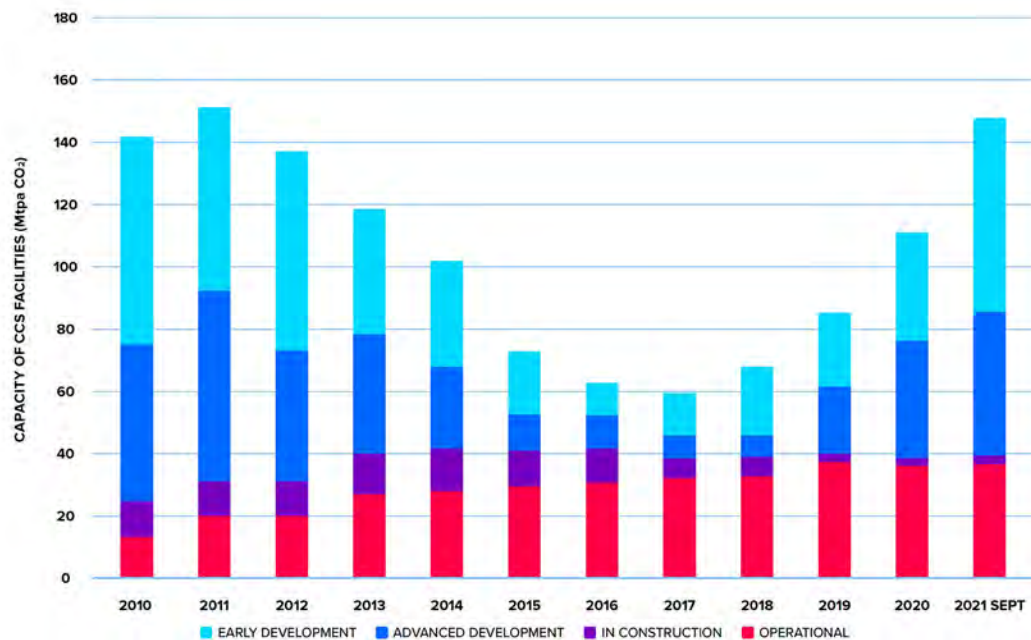
In regions such as Southeast Asia, natural gas is,

once again, paving the path towards a new CCS market. While CCS deployment is in the very early stages across the region, both Malaysia and Indonesia have announced plans to launch their first commercial-scale CCS facilities – both in natural gas processing – slated for completion in 2025 and 2026, respectively.

Can you speak about the economic opportunities and obstacles that CCS deployment faces?

As net-zero targets near, CCS' popularity will continue to grow. According to findings released by the IEA, CCS is a required variable in the equation to achieve the highest amount of emissions reductions for the lowest cost. In heavy industry, significant emissions reductions are often not possible without CCS playing a role, which is reflected in the growing CCS market today.

Along with being regarded as a key climate solution, investors are looking at the economic viability and benefits of CCS projects. While the upfront capital costs of CCS can be significant, the long-term benefit of producing low-carbon products, particularly within the energy sector, is a rising demand. In the UK – where net-zero legislation took effect in 2019 – project developers are forging ahead with CCS efforts through shared CO₂ transport and storage infrastructure amongst partners. These CCS networks not only provide economies of scale in terms of infrastructure costs, but also help to further de-risk projects. In Norway, where CCS has a long-standing history, the government has invested over 16bn kroner (\$1.8bn) to develop the Longship project, which includes a CO₂ storage site large enough to store CO₂ from across Europe. This illustrates further the →



Facilities that have not announced their capacity are not included in this chart.

anticipated growth in the CCS sector over the coming years.

With CCS facilities being large engineering projects, their design, construction, and operation will create a significant number of high value jobs. If 2050 international climate targets are to be met, around 70 CCS facilities or more will need to be built per year, creating up to 100,000 construction jobs and 40,000 ongoing operations jobs. The size of the global CCS industry could approach that of the world natural gas industry within a few decades. The roles associated with CCS further ensures that the energy transition is a just one, in terms of impacts to the job market.

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How will CCS continue to mitigate emissions in the coming future?

CCS today captures 40 MTPA of CO₂, and to date, has captured and stored over 300 MT of CO₂. As more projects get off the ground, the potential of CCS technology as a key climate solution - both in the natural gas industry and beyond - will be realised, keeping 2050 targets on track.

As the energy transition gains ground, governments are looking for ways to make low-carbon products front and centre. In Europe and North America, hydrogen strategies have been introduced in an effort to zero in on sustainable energy sources. From the beginning of CCS' long-standing history, natural gas has played a pivotal role in pioneering and diversifying the role of CCS. As the CCS market continues to scale up, it is without a doubt that the natural gas industry will help steer and lead the popularity and adoption of this much needed climate technology. ■

As the CCS market continues to scale up, it is without a doubt that the natural gas industry will help steer and lead the popularity and adoption of this much needed climate technology.



Promoting your sustainability credentials: Greenwashing in the spotlight?

In the coming year, it will be important for the gas industry to be alive to risks of making statements about ESG, lest they be accused of greenwashing.



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Trends in the US

In the last 12 months, the US' Securities and Exchange Commission (SEC) has put greenwashing and climate-related risks front and centre on its agenda. The SEC's 2021 examination priorities revealed an enhanced focus on climate-related risks, which led to the establishment of a Climate and ESG Task Force. The Climate and ESG Task Force is responsible for developing initiatives to proactively identify ESG-related misconduct, with the use of sophisticated data analysis to mine and assess information to identify potential violations. The SEC has also publicly stated it will propose a rule to require climate-related disclosures in public filings.

The US has also seen legal actions commenced against a range of organisations (including energy and resources organisations) in respect of greenwashing claims arising from the promotion of sustainability credentials. The legal actions commenced in the US include actions that seek to test claims involving the reduction in emissions, and claims in respect of climate change investments. Those claims are being defended and are still subject to determination by the courts.

We expect that during the course of this year, the regulatory adaptations in the US market will result in an increase in enforcement actions, particularly against large organisations.

Trends in the EU

The EU is also increasing its focus on ESG credentials. The European Securities and Markets Authority (ESMA) has stated that "advancing the sustainability agenda is crucial for ESMA, particularly as investor preferences shift to environmentally friendly financial products and the EU strives to meet its commitments on tackling climate change".

ESMA has released its new sustainable finance roadmap for the period of 2022 to 2024. The first priority listed by ESMA (one of three priorities) is tackling greenwashing and promoting transparency. ESMA has also started work on developing a legal definition of greenwashing to underpin enforcement actions, to assist it to grapple with this complex and multifaceted term.

Alongside this, the EU is starting to roll out new ESG disclosure requirements for companies. The Sustainable Finance Disclosure Regulation commenced in March 2021 and it seeks to enhance the sustainability transparency of certain financial products and those who sell them. However, from July 2022 there will be

a new Regulatory Technical Standards which specifies the content, methodologies and presentation of the sustainability-related disclosures required under the Sustainable Finance Disclosure Regulation.

It will be important for organisations operating in the EU to be alive to these developments as they unfold.

Trends in Australia

In Australia, we are seeing an increase in legal actions being commenced in relation to alleged greenwashing claims. Recent cases examples in Australia include:

- An Australian Competition and Consumer Commission action against a car manufacturer concerning statements about the level of emissions produced from vehicles made by that car manufacturer. In 2021, the car manufacturer was ordered to pay A\$125mn in penalties.
- An Australian court granting a shareholder of a bank access to confidential documents so that the shareholder could check whether the bank complied with its own climate change policy in lending to oil and gas projects. →





In the coming year, it will be important for the gas industry to be alive to risks of making statements about ESG, lest they be accused of greenwashing.

Why do organisations need to be alert?

The recent actions that have arisen in respect of ESG claims have demonstrated an inclination of courts to examine how an ordinary person might interpret the public statements of an organisation rather than looking at the subjective intention or industry-specific knowledge of the organisation making the statements.

Recent ESG actions have also shown that they may be commenced by a range of claimants: national regulators, consumers, shareholders, and activist organisations. The breadth of the likely claimants will also lead to a number of different forms of litigation: including single claimant proceedings, class actions and inquiries.

What does this mean for the gas industry?

In the coming year, it will be important for the gas industry to be alive to risks of making statements about ESG, lest they be accused of greenwashing. Some of the ways in which the gas industry can minimise its risks include:

- Consider reporting obligations including, for example, the International Financial Reporting Standards and Generally Accepted Accounting Principles; and any ESG reporting that is required.

- Consider the basis on which ESG or climate-related statements are made in relation to your organisation.
- Be clear on how your organisation expresses or states any claims about ESG and climate related issues.
- Be aware of other platforms on which ESG statements might be made including websites, informal industry publications, advertising, public or industry events and press statements by corporate leadership.
- Brief your board and be conscious of what your executive management is communicating to the market, including the platform on which your executive management communicates. Scrutiny will increasingly extend beyond formal annual reporting, to statements on websites, or to media or on public or industry events.
- Ensure that your media and publication teams have the support and advice of internal (and if necessary external) lawyers on publications relating to ESG and climate related issues.

Contact the authors at dylan.mckimmie@nortonrosefulbright.com and jo.feldman@nortonrosefulbright.com ■

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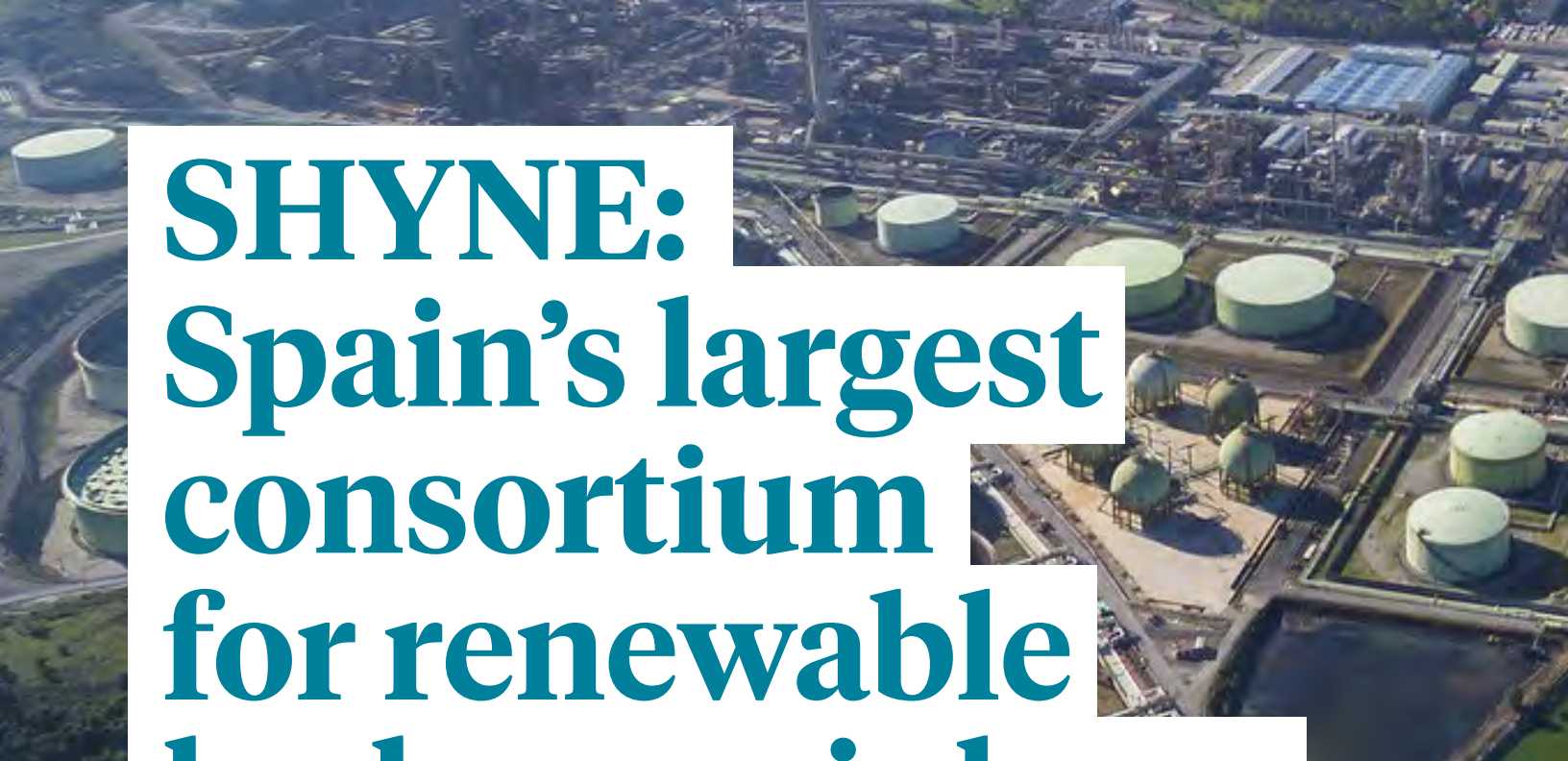
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SHYNE: Spain's largest consortium for renewable hydrogen is born

Renewable hydrogen is one of the pillars of Repsol's strategy to achieve zero net emissions, and the company is leading Spain's largest consortium to develop the fuel.

Spain is in a privileged position compared to other countries to capture the opportunities generated by the new renewable hydrogen economy, thanks to the great availability of solar and wind resources, as well as the industry's own capacity to adapt to a new economy around the hydrogen value chain.

According to Josu Jon Imaz, CEO of Repsol, "Spain has the opportunity to play a very relevant role in the European renewable hydrogen field. SHYNE will allow us to unite our skills and drive the capabilities we need from small and medium-sized enterprises (SMEs) to accelerate the decarbonisation of the Spanish economy together."

Zero net emissions

Renewable hydrogen is one of the pillars of Repsol's strategy to achieve zero net emissions by 2050. The company presented its renewable hydrogen strategy last October, which reflects Repsol's ambition is to be a leader in the production of renewable hydrogen in



TOMAS MALANGO
Director of Hydrogen
at Repsol

the Iberian Peninsula and gain a relevant position in the European market. Last July, the company announced more ambitious targets for renewable hydrogen generation, now aiming to reach a capacity of 552 MW equivalent in 2025 and 1.9 GW in 2030, compared to the previously announced targets of 400 MW and 1.2 GW, respectively. The achievement of these objectives will be made possible through the installation of electrolyzers and biogas production plants at the company's industrial complexes, as well as the development of the proprietary photoelectrocatalysis technology.

Repsol's industrial complexes, which are currently undergoing a transformation process to become decarbonised multi-energy hubs, are the true nerve centres for renewable hydrogen initiatives. They will combine the production and use of this gas to transform it into products with a low, zero, or a negative carbon footprint, such as sustainable fuels and materials for construction or healthcare, among others.

A systemic and holistic approach is required to incentivise the development of the hydrogen economy in Europe.



SHYNE, a benchmark project

Repsol leads the SHYNE (Spanish Hydrogen Network) initiative, the largest renewable hydrogen consortium in Spain, made up of 33 entities from different sectors. It brings together 22 companies and 11 associations, technology centres, and universities with the aim of promoting renewable hydrogen projects in all areas of the Spanish economy and, thus, stimulating rapid and effective decarbonisation through this energy vector that is considered one of the keys to the energy transition.

SHYNE aspires to be a benchmark project in Europe, structuring new opportunities throughout the value chain, through collaboration between companies that pursue a common goal: creating decarbonised products and services, and joining efforts and investments to achieve it. To this end, the project has six promoting partners, in addition to Repsol. All are leading companies in their sectors: Alsa, Bosch, Celsa, Enagás, Scania, and Talgo.

The SHYNE project is perfectly aligned with the objectives outlined by both the EU and the Spanish government. The latter, in the Hydrogen Roadmap published in October 2020, has set the target of reaching 4 GW of capacity by 2030. SHYNE itself represents half of this ambitious goal. For its part, the "Spain Can Plan" supports the creation of this type of consortia, especially those that are multisectoral and integrate the entire value chain and that promote public-private collaboration and collaboration with SMEs, as well as with research centres to boost the hydrogen economy.

The renewable hydrogen ecosystem

The SHYNE project aims to generate an ecosystem that connects the large regional hydrogen initiatives already underway, such as the Basque Region Hydrogen

Corridor (BH2C), the Hydrogen Valley of the Region of Catalonia, and the Hydrogen Valley of the Region of Murcia. In addition, SHYNE will promote the creation of two new innovation hubs in the regions of Castile-La Mancha and Madrid, connected to the National Hydrogen Center (CNH2) and Repsol Technology Lab respectively. Their objective will be the advancement of competitive technologies that are under development, such as photoelectrocatalysis or solid oxide electrolysis (SOEC). These technologies will help the country to maintain technological sovereignty in this new energy vector.

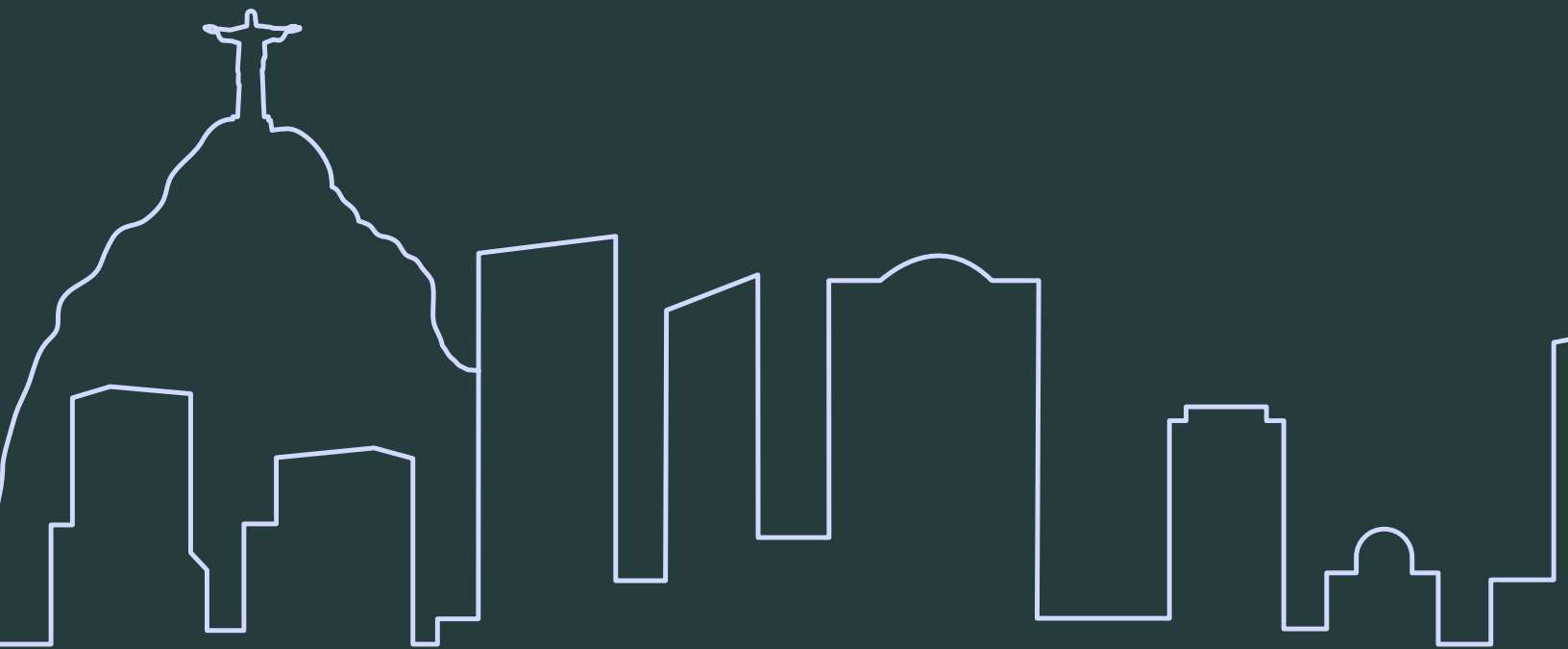
A knowledge management centre will also be created to coordinate cross-cutting actions and position the participating technology centres and universities as centres of reference in Europe. In this way, an efficient network will be created that will capture the synergies between production poles, industrial centres, and other hydrogen consumers, ensuring the competitiveness of the renewable gas and avoiding the transfer of additional costs to end users.

A project aligned with Spain and the EU's goals

In turn, SHYNE is aligned with the Strategic Projects for the Recovery and Economic Transformation of Renewable Energies, Renewable Hydrogen and Storage (PERTE ERHA) of the Recovery, Transformation and Resilience Plan launched by the Ministry for Ecological Transition and the Demographic Challenge last December.

The projects grouped in SHYNE will involve as of today an accumulated investment of €3.2bn (\$3.5bn). This investment will enable the implementation of different initiatives for the production, distribution, transformation, and use of renewable hydrogen in the industrial sector, in transport, as well as other applications, and the development of pioneering technologies. The overall project is expected to generate more than 13,000 jobs.

A systemic and holistic approach is required to incentivise the development of the hydrogen economy in Europe. The commitment of the participating entities and the sum of their capacities will place Spain at the technological forefront in the renewable hydrogen economy. The SHYNE collaboration will connect renewable hydrogen hubs, valleys and cities promoting European cross-border dimension. ■



“Natural gas is the ideal energy transition fuel for South America and the Caribbean”: Naturgas

Luz Stella Murgas, president of the Colombian Natural Gas Association (Naturgas), spoke with *Global Voice of Gas* about the prospects for gas in the Latin region and its relevance to the energy transition.





Colombia is a success story in terms of natural gas coverage. Since the end of the last century, the South American country has experienced a natural gas revolution that has allowed it to reach close to 80% coverage, mostly families in vulnerable conditions.

On the other hand, Colombia has multiplied by over 100 times the number of vehicles that use natural gas, now standing as seventh in the world in natural gas vehicles. With more than 600,000 converted vehicles and 4,000 dedicated heavy vehicles, this has dramatically improved the air quality of our cities.

Luz Stella Murgas is the president of the Colombia Natural Gas Association and she talked to us about the best practices Colombia can share with countries in Africa, the Americas, Asia, Europe and the Middle East, about increasing penetration of natural gas in energy markets, positioning natural gas as a clean fuel for transportation, and the development of favourable natural gas policy to attract investment.

GVG: You have continually spoken about the importance of this industry and have honoured the workers of the natural gas industry. What can you tell us about this?

Luz Stella Murgas: 100,000 men and women of the natural gas industry in Colombia have worked tirelessly so that, in this pandemic situation, all natural gas users have access to this clean fuel. This is an industry ready to respond to the challenge of providing energy for the recovery, advancing in the fight against energy poverty, guaranteeing the energy competitiveness of the Colombian economy and ensuring the reliability of the

energy system, in a country that already has one of the cleanest generation matrices in the world.

GVG: What can Colombia share with the region regarding this sector?

Luz Stella Murgas: Colombia has had a social revolution in the last 23 years. With more than 7,700 km of gas pipelines, we went from nearly 1,800,000 home natural gas users to more than 10,446,000, possibly achieving one of the highest penetrations in the world in percentage terms; supplying 36mn citizens, the vast majority of them in vulnerable family segments, in 757 municipalities of 23 departments.

However, we haven't finished the task. About 1.2mn Colombian families still cook with firewood, causing 15,600 deaths a year due to respiratory problems related to fine particulate matter. These deaths are mainly among rural women, children and the elderly. Regarding sustainable mobility, Colombia already has more than 4,000 heavy vehicles dedicated to vehicular natural gas, including buses and trucks, which sets an example for the rest of the world in terms of commitment to improving air quality.

GVG: COVID has left all countries struggling with difficult economic realities. How will the natural gas industry contribute to Colombia's recovery?

Luz Stella Murgas: The industry in Colombia has identified 127 projects worth over \$2.9bn, including \$1.162bn in offshore, onshore and unconventional →



upstream gas projects, and \$1.688bn in transportation and distribution projects. This will help generate employment, investments in the regions and fiscal income for the nation.

For these investments to be carried out, a realignment of public policy is essential, and regulation needs to align with market conditions.

GVG: What role do you envisage natural gas having in the energy transition?

Luz Stella Murgas: The global energy system requires growth in renewables and clean gases. It is not possible, neither in 2030 nor in 2050, to meet global energy needs exclusively with intermittent solar and wind resources. We can see that right now in Europe. That is why natural gas is a solution for covering current and future demand, and an ideal energy transition fuel for South America and the Caribbean.

GVG: Naturgas formed a decarbonisation alliance at COP26 in Glasgow. What can you tell us about this initiative?

Luz Stella Murgas: The 28 companies within Naturgas signed the “Natural Gas Sector Alliance: Path Towards Carbon Neutrality”, which is a commitment that will

consolidate and strengthen the good practices of these companies to contribute to the country’s commitments on achieving carbon neutrality.

Among the actions proposed by this alliance are the development of compensation projects, such as tree planting and forest restoration; participation in voluntary carbon markets; the implementation of hydrogen projects and carbon capture technologies, the creation of a circular economy, and the rational and efficient use of energy.

In Glasgow it was shown that while technological advances are made that make decarbonisation economically viable, natural gas will play a fundamental role. The International Gas Union (IGU) has said it well, that natural gas will help achieve 30% of emissions reductions with existing technologies and will grow to make up 25% of the world’s primary energy in 2040.

GVG: There is a significant commitment to hydrogen in Colombia. How has the gas industry made advances in this area?

Luz Stella Murgas: Several companies in the gas sector in Colombia have announced hydrogen pilot projects where natural gas will play an important role. Current natural gas transportation and thermal generation infrastructure can be adapted for a mixture of natural gas and hydrogen.



Natural gas has brought human, economic and social development everywhere it reaches. Deepening this process in other latitudes with sustainable development can avoid future migratory crises.

If carbon capture technologies are combined with biogas – the potential of which in tropical countries such as Colombia is enormous – it would be possible to generate negative carbon energy with the resulting hydrogen.

GVG: At the Naturgas Congress that will take place from October 5 to 7, 2022, in Cartagena, special emphasis will be placed on the social role of natural gas in developing countries. How can we raise our voice to make this known?

Luz Stella Murgas: Natural gas has brought human, economic and social development everywhere it reaches. Deepening this process in other latitudes with sustainable development can avoid future migratory crises.

To give an example, let us consider the case of Africa, which in 2030 will have 60% of the world's working-age population, and by itself has a development potential equal to that of China and India combined, with its overall population set to reach 3bn by the middle of the century. In other words, bringing human development and well-being today will ensure stability and avoid migratory crises in the future.

Unfortunately, not everyone is aware of this reality and the contribution of natural gas in the lives of many families. It is a duty of the entire industry and of the governments of the world to tell the success stories of

this fuel to publicise its importance to world progress.

GVG: Finally, the gas as a vehicle fuel industry has sought to encourage the use of natural gas by companies, in the mobility sector and in homes. Tell us a little about the regulatory advances in this area.

Luz Stella Murgas: Last year the Fuel Gas Law was signed, which will promote the increase of light vehicles dedicated to gas, by exempting them from certain restrictions, reducing tax and providing other incentives. This law will guarantee that, in some cases, at least 30% of the vehicles in the cargo, passenger and special transport fleets operate with dedicated gas-fuelled engines. In addition, it promotes the supply of this clean energy source in the country to expand its use in homes, industries and in transportation; prioritises projects to replace diesel with gas for electricity generation, and creates a programme to replace cooking fuels that are harmful to health. ■

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CARGO EMISSIONS TAGS

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Why does gas make sense for Latin America & the Caribbean?

Natural gas can bring great benefits to the region regarding economic development, investment, job creation, quality of life, and decarbonisation

Regional Association of Oil Gas and Biofuel Sector Companies in Latin America and the Caribbean (ARPEL)

Natural gas and the global energy transition

Natural gas will continue to play a fundamental role in the global energy transition, contributing to decarbonisation, energy security, and economic development, mainly in emerging economies.

Firstly, natural gas is the cleaner fossil fuel, as it generates 40% less CO₂ emissions than coal and 25% less than oil products when burned. Moreover, natural gas reduces to almost zero the emissions of other harmful pollutants such as particulate matter, NO_x, and SO_x, which is particularly important regarding the air quality that people breathe in large cities. Additionally, natural gas combines very well with renewable energies, providing flexibility to power generation systems or potentially coupling with low carbon hydrogen, leveraging the development of one of the most promising energy carriers in the transition. For example, natural gas can be the feedstock for producing low-carbon hydrogen (blue) or blended in distribution networks. Also, the infrastructure and knowledge are compatible, among other synergies. Furthermore, biomethane, or in other words, non-fossil natural gas, will continue growing rapidly in the next few years.

Another positive attribute that we should mention is that the technology associated with natural gas is mature and well-known along its value chain, from extraction to final consumption. In other words, natural gas is a real option, not a promise, an option that fits perfectly with the most promising technological solutions for decarbonisation, which can also leverage them to reach commercial feasibility.

Natural Gas in Latin America and the Caribbean

Latin America and the Caribbean is a vast and heterogeneous region where natural gas has excellent development opportunities. Natural gas share in the total energy supply is 31% (OLADE, 2021: 51), and it plays a critical role in the economies of several countries. The chart below shows a summary of the main market indicators in 2020.

There are currently two LNG exporting countries: Trinidad & Tobago and Peru. Both economies were significantly transformed since they incorporated natural gas value chains. Trinidad and Tobago also became one of the main ammonia and methanol world

producers and exporters, two products that are taking great relevance in the global decarbonisation journey. The other export-oriented country is Bolivia, which supplies gas to Argentina and Brazil, natural gas being the country's main export product. Additionally, Mexico, Argentina, Brazil, Chile, and Colombia have very mature and developed natural gas markets, while others are emerging or taking advantage of demand niches such as LNG-to-power. LNG has also proliferated in the region. Since the first importing terminal began operations in the Dominican Republic in 2003, 20 importing terminals have been deployed in 10 countries while many projects are now underway.

Where are the greatest opportunities in LAC?

Argentina's Vaca Muerta play:

The Vaca Muerta play in Argentina, which has world-class, non-conventional oil and gas resources, has been under development in the last few years. This play has become a reality thanks to massive investments and innovation, transforming the gas market in Argentina and the Southern Cone while helping the country to attract investment and foster economic development. Currently, most of the 57 mcmppd of shale and tight gas produced in the country are coming from Vaca Muerta, representing 46% of the country's natural gas production. The quality and abundance of its resources could transform Argentina into a prominent gas exporter, first amplifying the delivery to neighbouring countries and later integrating to world markets through LNG. However, reaching Vaca Muerta's full potential will require significant transport infrastructure development, some of which are now underway.

Brazil gas market opening and LNG

The recent opening of the natural gas market can potentially boost demand, enhancing the development of different sources of supply, both domestic, mainly in the offshore pre-salt region, and foreign. In particular, the massive drought that Brazil suffered last year, which was one of the largest in the last 100 years, boosted LNG imports to reach historical records in 2021, almost trebling the 2020 figure. This situation clearly showed the role of natural gas in providing security and flexibility, particularly in power markets that rely primarily on renewable sources. There are currently 5 LNG import terminals in Brazil, and there are also some projects →

Despite the excellent and well-documented opportunities that natural gas can bring to this region, access to finance represents today a significant challenge to develop natural gas projects, and this situation could become an important barrier.

under development. LNG is seen as one of the main opportunities in the country.

LNG-to-Power in Central America and the Caribbean

Countries with a significant share of coal or oil products as feedstock for power generation have a great opportunity to incorporate natural gas in the energy matrix. Most Central American and Caribbean countries are in this category. LNG-to-power has been the main driver in Panama, Dominican Republic, or El Salvador, so the region has a high and well-proven potential, which can take advantage of its proximity to diverse supply sources such as the USA or Trinidad and Tobago. In the case of small islands, small-scale solutions are becoming more competitive, and the maturity of the regasification infrastructure in other neighbouring countries can leverage this option. A recent small-scale LNG project developed in Ecuador which imports ISO-containers, or the Jamaican experience, can be interesting examples to replicate in the Caribbean.

Chile's coal power generation phase-out

Chile, a country that is progressing rapidly in the development of renewable energies and green hydrogen, still relies vastly on coal for power generation. This source represented 34% of the power generation share in 2021 (CNE, 2021). Chile has committed to phasing out 65% of

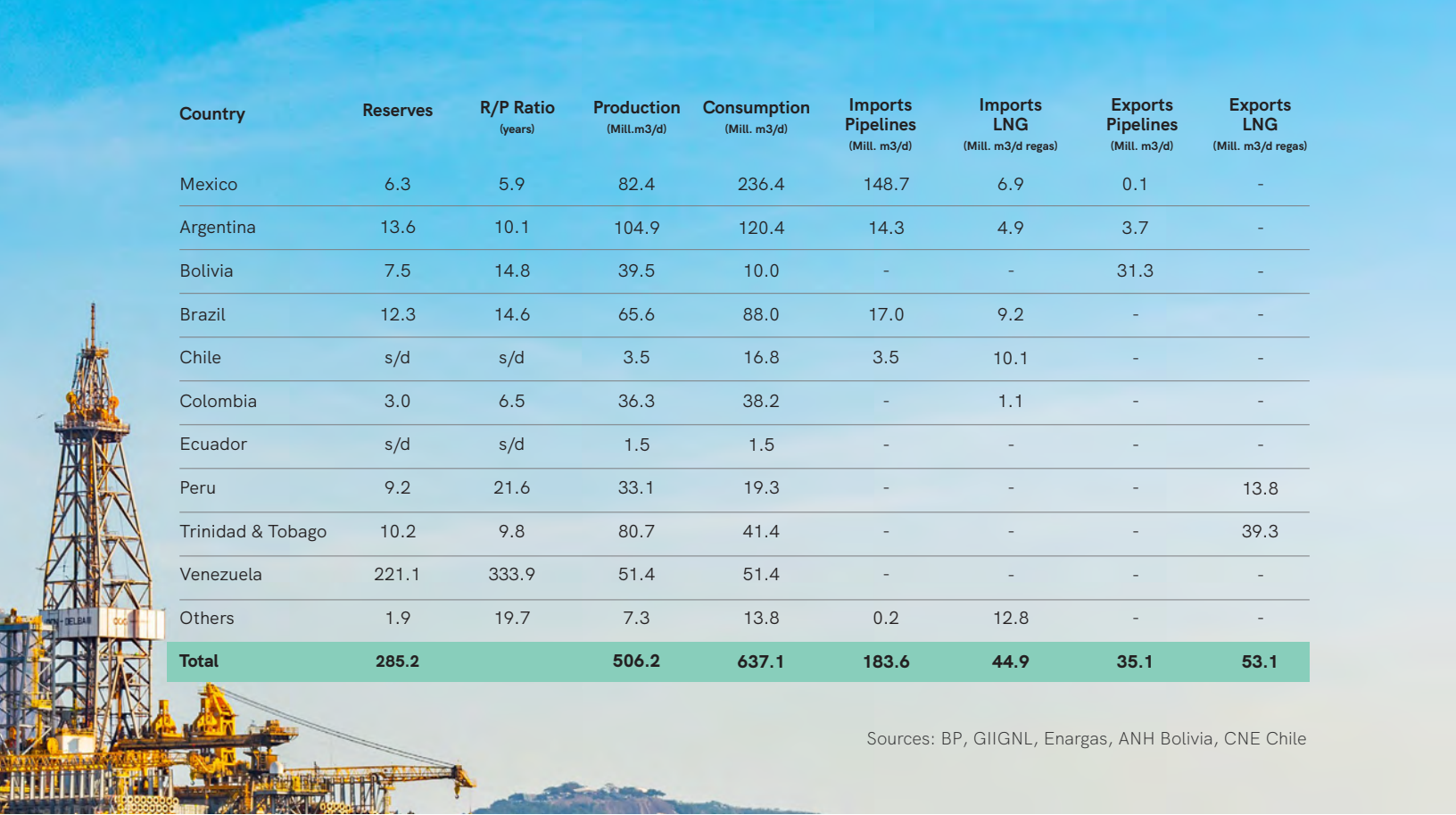
coal power plants by 2025 and 100% by 2040; therefore, it can find in natural gas, coming from Vaca Muerta or via LNG, the perfect partner for this transition.

Guyana and Suriname, the rising stars

Undoubtedly, the region's rising star is the recently discovered high-potential offshore basin of Guyana and Suriname. Guyana, which has already reached the production phase, is currently producing 120,000 barrels of light oil per day, and reasonable projections indicate that the country can reach 750,000 barrels per day by 2026. Hitting oil led to a massive economic impact in the country, as Guyana's GDP grew 43.5% in 2020; 21.2% in 2021, and it is expected to grow 50% in 2022, despite COVID-19. Guyana, the Human Development Index of which was 0.68 in 2019 (mid-level), has in its hands a unique opportunity to leapfrog in terms of economic development. Suriname, still in the development phase, is expected to follow Guyana's way. Natural gas projects will begin to happen in both countries, anchoring in monetization opportunities of associated gas and power generation needs.

Other opportunities - integration and heavy transport

The Southern Cone, a sub-region physically integrated via pipelines with idle capacity, shows excellent opportunities to deepen regional gas integration, taking advantage of



Country	Reserves	R/P Ratio (years)	Production (Mill.m3/d)	Consumption (Mill. m3/d)	Imports Pipelines (Mill. m3/d)	Imports LNG (Mill. m3/d regas)	Exports Pipelines (Mill. m3/d)	Exports LNG (Mill. m3/d regas)
Mexico	6.3	5.9	82.4	236.4	148.7	6.9	0.1	-
Argentina	13.6	10.1	104.9	120.4	14.3	4.9	3.7	-
Bolivia	7.5	14.8	39.5	10.0	-	-	31.3	-
Brazil	12.3	14.6	65.6	88.0	17.0	9.2	-	-
Chile	s/d	s/d	3.5	16.8	3.5	10.1	-	-
Colombia	3.0	6.5	36.3	38.2	-	1.1	-	-
Ecuador	s/d	s/d	1.5	1.5	-	-	-	-
Peru	9.2	21.6	33.1	19.3	-	-	-	13.8
Trinidad & Tobago	10.2	9.8	80.7	41.4	-	-	-	39.3
Venezuela	221.1	333.9	51.4	51.4	-	-	-	-
Others	1.9	19.7	7.3	13.8	0.2	12.8	-	-
Total	285.2		506.2	637.1	183.6	44.9	35.1	53.1

Sources: BP, GIIGNL, Enargas, ANH Bolivia, CNE Chile

the interesting supply and demand complementarities.

Finally, heavy transport, both land and maritime, constitutes an excellent opportunity to develop new value chains in the region. In the case of land transport, natural gas (CNG or LNG) can bring significant economies, considering that 85% of tons per km are transported via diesel-fuelled trucks. In the case of maritime transport, Panama could become a natural hub regarding LNG for bunkering because of the Panama Canal. At the same time, river transport in the Parana-Paraguay waterway represents another interesting option for the Southern Cone.

Challenges and final considerations

Natural gas can bring great benefits to the region regarding economic development, investment, job creation, quality of life, and decarbonisation. However, reaching the potential that natural gas represents for the region implies large amounts of capital and investment. Despite the excellent and well-documented opportunities that natural gas can bring to this region, access to finance represents today a significant challenge to develop natural gas projects, and this situation could become an important barrier. At the same time, the finance sector's growing demands, as well as those from the international community and

Fostering natural gas will require political decisions and appropriate energy planning that considers the specificities of the energy transition...

civil society, should lead oil and gas companies in the region to adopt strict ESG policies to report and manage their impacts more transparently.

Finally, fostering natural gas will require political decisions and appropriate energy planning that considers the specificities of the energy transitions in Latin American and the Caribbean countries while striving to advance in other technologies that show great promise in the long term. ■

How gas delivers around the world

We take a look at the ways in which natural gas works; driving economic prosperity, while also delivering sustainability gains in a selection of countries around the world.

Egypt

Gas is playing a major part in Egypt's economic development and recovery, while the country is combining growing gas production with climate commitments to reduce the use of energy and increase efficiency. It is targeting a 45% cut in CO₂ emissions by 2030 and net-zero emissions by 2050. Gas is playing a critical role in multiple areas in this strategy. Further international investment in gas will be vital to realise these goals and establish Egypt as a regional hub for energy trade, says Khaled AbuBakr, CEO of Egypt's largest energy distribution group TAQA Arabia and IGU regional coordinator for Africa and the Middle East. This in turn will help other countries that receive Egyptian LNG drive down their emissions.

Egypt went from being a natural gas importer to a net exporter in 2017, thanks to a ramp-up in exploration efforts in the previous years that culminated in the discovery of the Zohr gas field, one of the largest in the country and region. As AbuBakr notes, "the Zohr discovery acted as a magnet for investments in the country's oil and gas sector." Ninety-nine new oil and gas exploration contracts have been signed since, with a combined value of \$17bn.

Growing investment in gas supply has underpinned Egypt's Vision 2030 agenda, aimed at achieving sustainable development, using gas as a cleaner energy source. Today gas makes up 60% of the energy consumed in Egypt, and generates 84% of its power.

Egypt's LNG exports continue to rise swiftly, growing from 1.5 MT in 2020 to 6.5 MT in 2021, and they are on

track to hit 12 MT in 2022. Domestically, meanwhile, the government has expanded gas grids to hook up more residential, commercial and industrial energy users, and it has also invested in compressed natural gas (CNG) mobile technology to bring modern energy access into remote areas and improve living standards.

One such project was developed in the New Valley governorate, where Egypt's EGAS and TAQA Arabia fed CNG into a grid connecting 14,000 houses, with more to follow. It has already saved millions of Egyptian pounds in energy costs.

"Egypt has opened its market for more investments in trading, storing, selling and distributing natural gas," AbuBakr says. "Therefore, private companies started to pay a set fee for the use of public transmission facilities and pipelines, which was used to encourage investments in gas infrastructure and transportation networks."

This in turn has led to new jobs and helped rebuild Egypt's economy after unrest that ended in 2014. The gas sector contributed nearly a quarter of Egypt's gross domestic product in 2020.

Government policy has been key for supporting gas development, AbuBakr says. Egypt has made large investments in gas infrastructure, including the expansion of ports, and the construction of pipelines. It has also introduced incentives to private developers and commercial producers of gas to enhance domestic market access.

Egypt was also a founding member of the East Mediterranean Gas Forum, which supports the country's ongoing efforts to expand its exports.

The Zohr discovery acted as a magnet for investments in the country's oil and gas sector.

Khaled AbuBakr

Chairman, Egyptian Gas Association. Executive Chairman, TAQA Arabia and IGU Regional Coordinator

Moving forward, Egypt's mission is to continue delivering economic prosperity, while ensuring it keeps its emissions in check. Its track record so far is encouraging. Having made sizable investments in environmental preservation and emissions reductions, the country improved its standing in the Climate Change Performance Index in 2022 by one position from the year before. In the index's climate policy category, it advanced 20 places.

Malaysia

In the 1960s, Malaysia began an export-oriented industrialisation drive, and gas fuelled it. The discovery and subsequent development of domestic gas reserves also allowed Malaysia to curb its dependency on oil over the subsequent decades, underpinned by an expansion in internal gas infrastructure during the 1980s and 1990s. Gas industry developments and access enabled the country to shift its economy to higher-technology, capital-intensive industries from the 1990s onwards. The GDP was rising in tandem with consumption of gas between 1990 and 2010.

Today, gas is Malaysia's largest single source of primary energy supply, with a share of 41% in 2018. The natural gas industry is a major contributor to public finances, predicted to generate almost 400bn ringgit (\$95bn) in government revenues over the next decade. What is more, the Malaysian Gas Association (MGA) estimates that the gas industry has a direct, indirect and induced economic impact of over 80bn ringgit. The sector employs over 80,000 people, and for every 10 of those jobs, 25 more are created in the wider economy.

Government policy was key in realising the potential for gas in Malaysia. Most notably there was the new energy policy that the government adopted in 2010, which amended the gas supply act to enable third party access, called for the construction of regasification terminals to allow third parties to bring LNG into the country, and gradually made gas tariffs more market-based over 2011-15.

Looking ahead, Malaysia will rely on gas to deliver continued economic prosperity, while delivering further reductions in emissions on the way to its goal of achieving net-zero by 2050. The country has pledged not to build any new coal-fired power plants and wants to commission over 21 GW of gas-fired and renewable power generation by 2039, to achieve a 60% cut in power sector carbon intensity. Gas demand is poised to rise from 6.64 bcm in 2021 to around 16.5 bcm by 2039.

"Natural gas has been an important source of indigenous energy for Malaysia," MGA president and IGU regional coordinator for South Asia and Southeast Asia, Abdul Aziz Othman, tells GVG. "Since decades ago, natural gas as the cleanest burning fuel has played an important role in providing clean, secure, reliable and flexible energy which has also contributed to Malaysia's socio-economic growth."

Othman sees a long-term role for gas in providing energy access and security, and reducing the emissions intensity of Malaysia's GDP to 45% by 2030. Indeed, the Boston Consulting Group expects that gas will still constitute 39% of Peninsular Malaysia's installed power generation capacity in 2050, even as the deployment of renewables and other low-carbon energy sources such as hydrogen and biogas is accelerated.

Brazil

Brazil is striving to become greenhouse gas neutral by 2050, and while renewables, principally hydroelectricity, already account for 85% of its power mix, natural gas offers a reliable and clean option that also provides greater energy security. Greater control of deforestation, including by eliminating illegal deforestation by 2028, meanwhile represents the option with the lowest marginal cost for reducing emissions while ensuring Brazil's continued economic prosperity.

The share of natural gas in Brazil's energy mix more than doubled between 2000 and 2020, from about 5% to 12%, underpinned by growing consumption in the country's industrial sector, which accounts for half of

Since decades ago, natural gas as the cleanest burning fossil fuel has played an important role in providing clean, secure, reliable and flexible energy which has also contributed to Malaysia's socio-economic growth.

Abdul Aziz Othman

President, Malaysian Gas Association, IGU Regional Coordinator

overall demand. In this way gas has underpinned Brazil's industrialisation by providing a reliable and affordable source of energy.

The main gas consumers in Brazil are industries producing chemicals, pig-iron and steel, paper and pulp. Thermal power plants are the second biggest consumers, accounting for 35% of demand, although consumption levels vary greatly over the months and years. This is because natural gas plays a seasonal balancing role and provides backup when Brazil's hydroelectric output, its main source of power, falls in usually the winter months.

At the same time, by replacing more polluting fuels, the use of gas drives down Brazil's emissions of greenhouse gases and other pollutants, improving the environment and health, particularly in big cities. In the transport sector, for example, using gas as a fuel for buses leads to 50% less fine particulate matter compared to Euro-V diesel, and 93% less for Euro-III diesel.

Brazil's natural gas sector is undergoing major reforms, aimed at creating a more open, dynamic and competitive market. Petrobras has a binding agreement with Brazil's competition authority to help liberalise the sector, by ending its monopoly through the disposal of assets and by providing third-party access to

infrastructure. Brazil is also shifting towards more market-based prices.

Peru

Gas plays a major part in Peru's economy. Peru already has comparatively low emissions, but it is looking to further improve its credentials by expanding gas development and deploying more renewables. By exporting LNG, Peru can also provide the fuel with the best price-heat ratio to other economies across the world.

Peru's energy mix has undergone significant change since the commercial development of the Camisea gas fields in 2004. From producing around 568 mcm of gas in 2003, Peru's output has since risen to over 8.5 bcma, supporting the development of gas-fired power generation. Thermal power plants now account for 54% of Peru's energy mix, while hydroelectric plants account for a further 40% and other renewable sources 6%. There has also been a push to encourage the use of gas as an industrial, vehicle and household fuel.

Since the late 1990s, the Peruvian government has enacted several laws and introduced regulations to promote the use of gas. Law No. 27133, for example, that Promotes the Development of the Natural Gas Industry, was published in 1999, while Law No. 28176, for the Promotion of Investments in Natural Gas Processing Plants, was published in 2004. Law No. 29163, for the Promotion of Petroleum Plants, was published in 2007.

The government has also promoted build, own, operate and transfer (BOOT) concessions for establishing the necessary infrastructure to distribute natural gas, especially in the Pacific coastal regions. There are also plans for direct investments in developing distribution networks to cover seven regions.

Trinidad & Tobago

Trinidad and Tobago's commercial development of oil and gas dates back to the early 1990s, with oil helping to drive the country's early industrialisation. For decades, natural gas was only used in modest quantities, but this changed in the 1970s, when its potential to accelerate development and industrial development was recognised and harnessed following the discovery of significant reserves offshore.

The National Gas Company of Trinidad and Tobago (NGC) was founded in 1975 as a state enterprise to monetise these reserves and build up the domestic gas market. Since then, the country's economy has pivoted

away from oil towards gas-based industrialisation.

“Gas remains the mainstay of the economy and the fuel of the economy and the fuel of industry and power generation, even as the country begins to explore options for energy diversification in line with green agenda imperatives,” NGC says.

Since NGC’s incorporation, Trinidad and Tobago has experienced a period of exponential economic growth, thanks to foreign investment in its burgeoning industries, a pioneering and profitable energy pricing model and periodically favourable international market conditions, NGC says. Backed up by gas, the energy sector has generated income for infrastructural development, created thousands of job opportunities and supported an expansion in social services and other programmes.

Looking at the numbers, between 1975 and 2019, NGC is estimated to have contributed TT\$40bn to government revenues through direct taxation and dividends. But the real economic impact is orders of magnitude greater when the entire gas value chain is considered. Over the last 40 years, Trinidad and Tobago has also brought in roughly US\$11bn in foreign direct investment for metal processing, ammonia, methanol, urea, LNG and other niche downstream gas-based export sectors. In the last two decades, the LNG, petrochemical and metals sectors have contributed significantly to GDP, delivering over TT\$250bn in output. The government has provided legislative and fiscal mechanisms to make the gas sector an attractive environment for investors.

Looking forward, while many of Trinidad and Tobago’s nearshore reserves have been depleted, there is still significant potential in deeper waters.

“Although production is currently below peak levels, considerable investment has been made in exploration activity and projections point to a stable supply stream into the medium term,” NGC says. “The country’s

investment and policy interest in natural gas will remain strong not just because of its economic relevance, but due to forecasts that gas will play a significant role in the global energy transition. ”

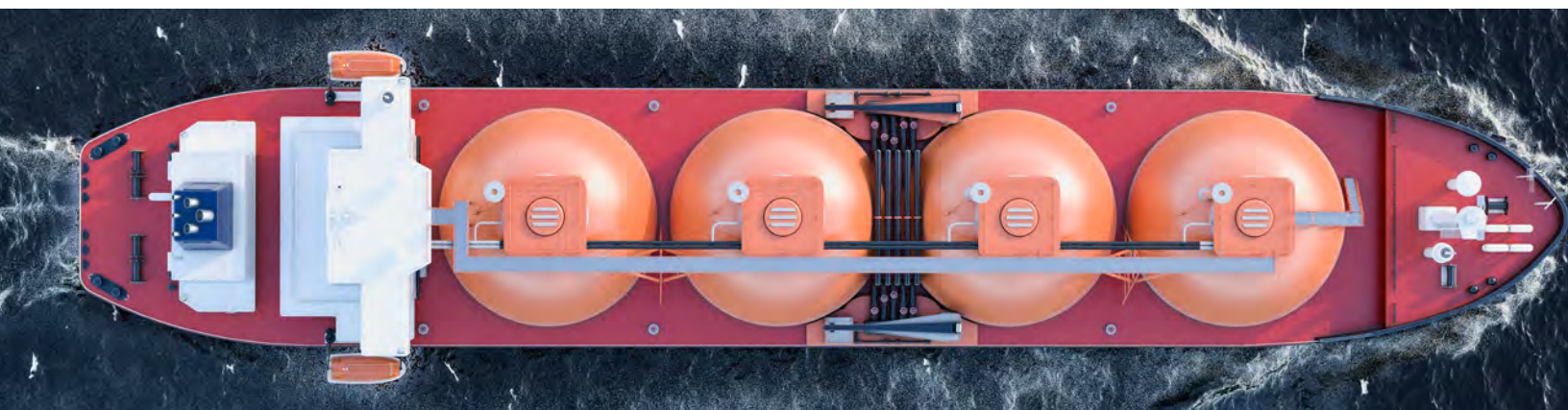
“Trinidad and Tobago can expect its gas industry to remain viable for years to come, in one iteration or another,” the company says.

To ensure that the country achieves its climate goals while maintaining economic prosperity, NGC stresses that permitting and regulations for new industry and business undertakings must take environmental, social and governance principles into account. These enterprises must be compelled to achieve greater efficiency in energy use and scale back their carbon emissions.

Education that can lead to more responsible consumption practices and encourage the needed innovation and entrepreneurship will also be key, NGC says, as well as carbon offset initiatives, including carbon capture and sequestration and reforestation initiatives for example. NGC has its own reforestation initiatives and is studying how carbon sequestration can be implemented.

“As the world pursues a net-zero emissions future based on clean energy, natural gas is projected to play a major role as a bridge fuel,” NGC says. “Countries dependent on oil and coal for power generation and as industrial fuels will be seeking energy sources compatible with their infrastructure to ease into the clean energy transition.

“Natural gas is the cleanest burning fossil fuel and a readily available energy source that can be accommodated with industrial retrofits,” the company continues. “It will therefore be an important intermediary fuel for countries in transition, especially where renewable power is intermittent or insufficient to meet energy demands.” ■





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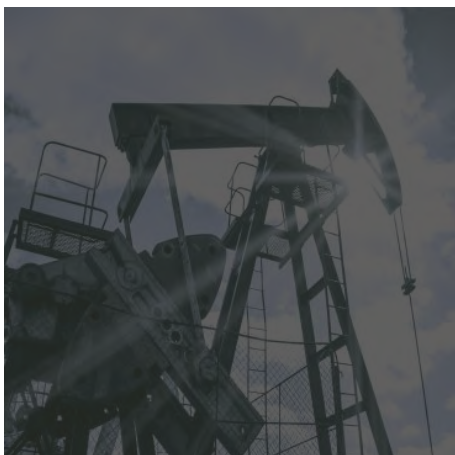
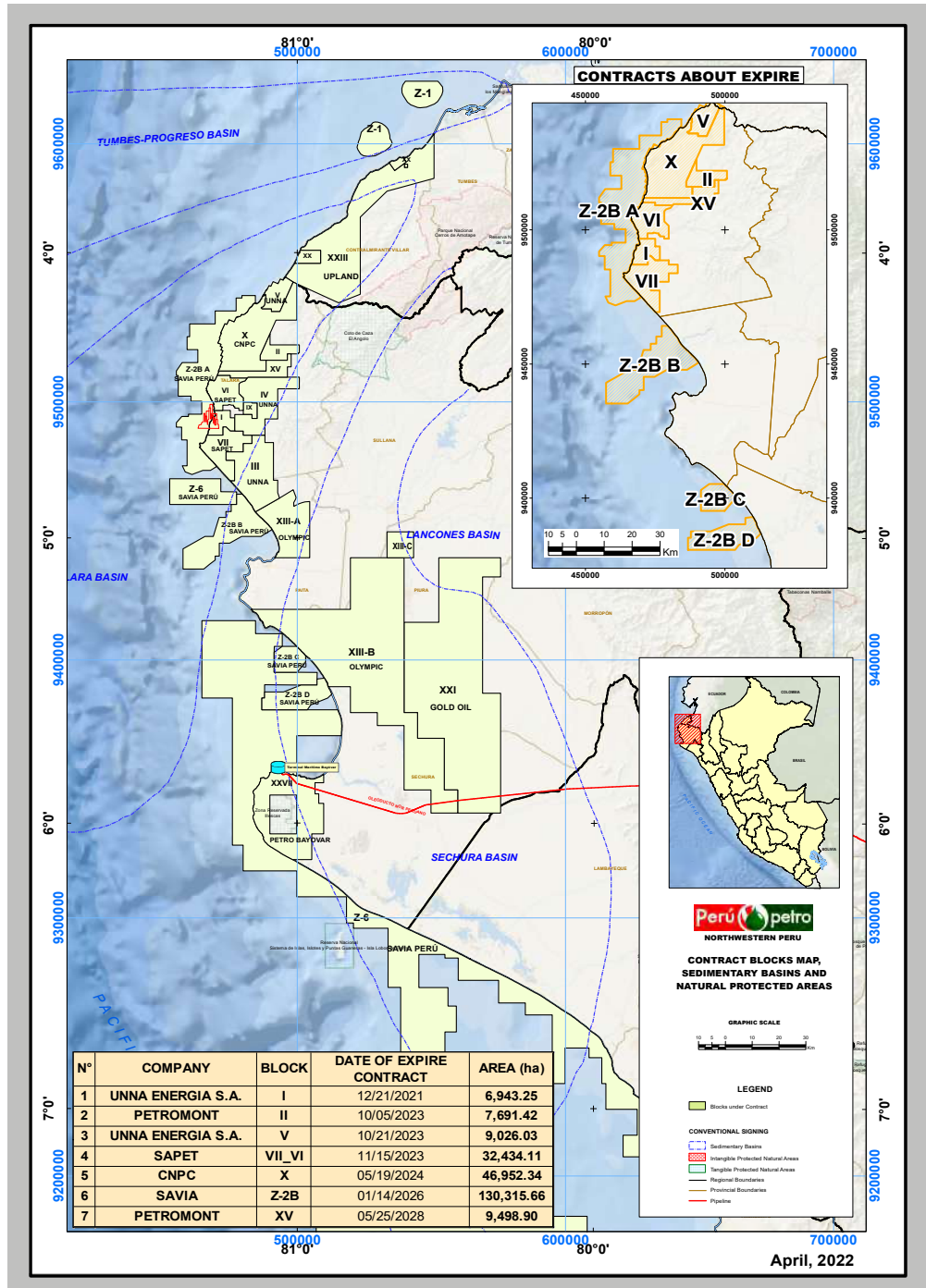
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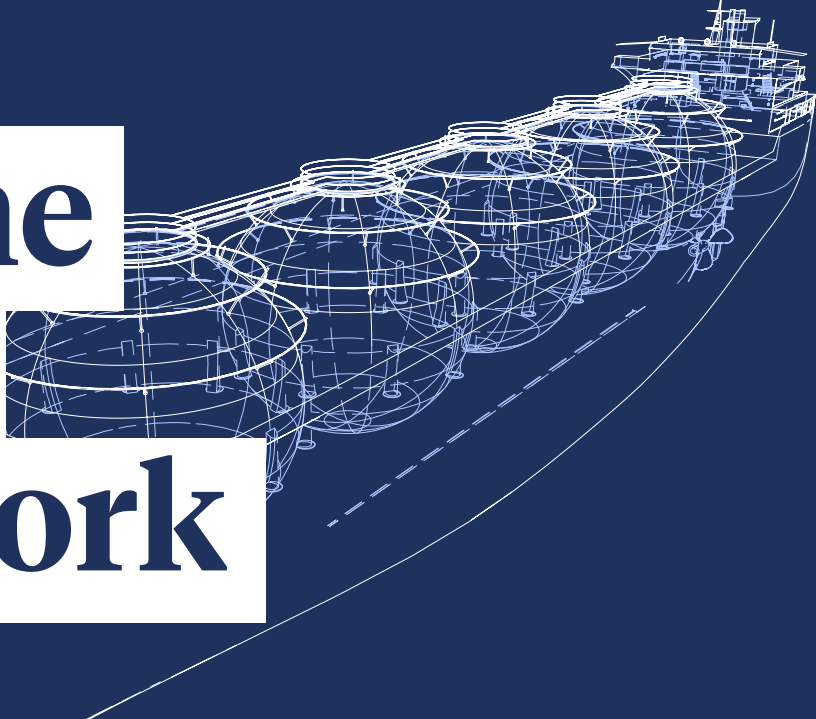
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The Northwest onshore area of Peru began its oil development at the end of the 19th century, with the participation of private and national companies.

Setting the bar high: a framework for GHG neutral LNG



GIIGNL aims to bring consistency and transparency, focused on long-term decarbonisation, to the emerging market in low and GHG neutral LNG.

ROSS MCCRACKEN

The number of companies delivering carbon neutral LNG cargoes is on the rise, driven both by their own corporate sustainability goals and demand from buyers for more climate-friendly energy deliveries. Yet, at present, there is no common, transparent means of defining a cargo as carbon neutral, limiting trust in this emerging market segment.

The International Group of LNG Importers (GIIGNL) has stepped in to address the gap by developing a coherent framework of best practices for monitoring, reporting and verifying (MRV) the greenhouse gas (GHG) neutrality of LNG cargoes.

The framework, known as the MRV and GHG Neutral Framework, sets the bar high for a claim of GHG neutrality, but at the same time allows flexibility for companies which can show significant levels of emissions reductions, through the use of different declaration pathways.

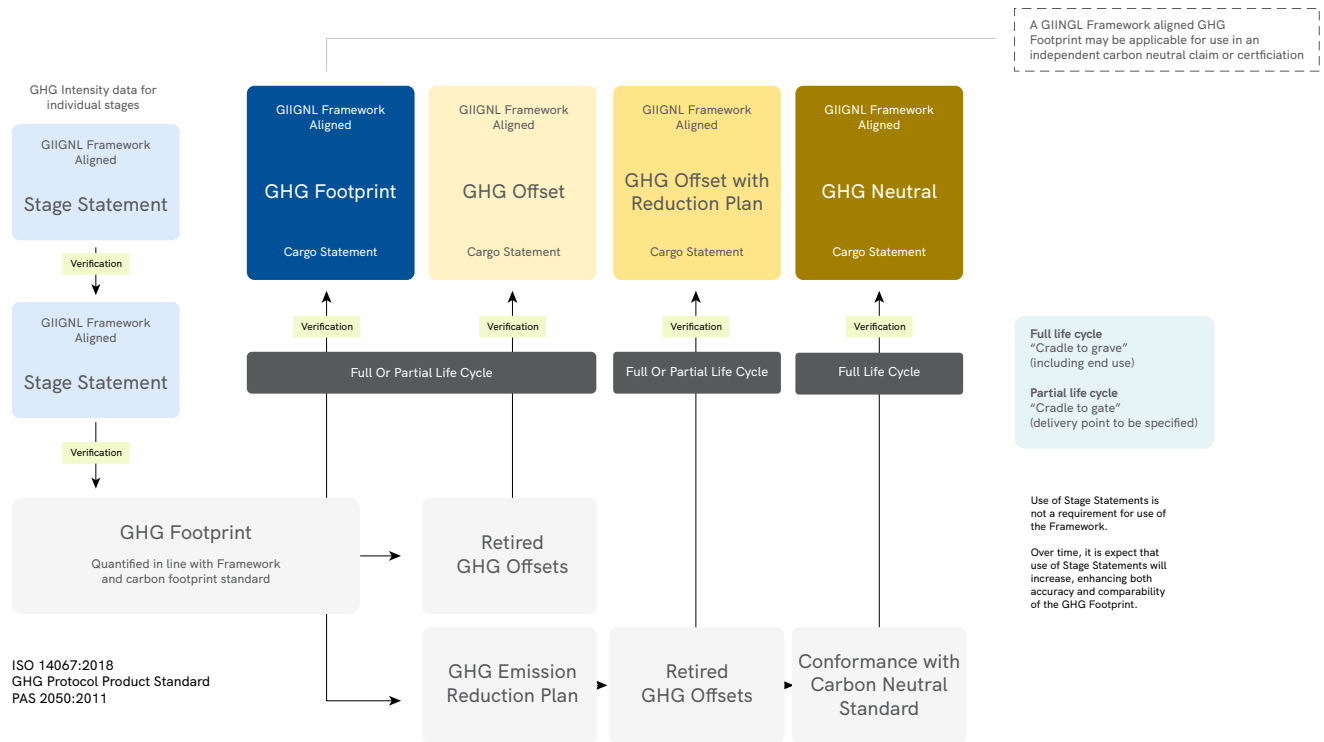
Offsets not the goal

Carbon offsets have been widely used to achieve carbon neutral LNG cargoes and to date are the primary means of doing so. However, GIIGNL's framework says they should be used only as a last resort and as a means to compensate for residual emissions then cannot be eradicated or avoided.

Rather than rely on offsets, the goal of the framework is to make emissions reduction action the primary focus of a neutrality claim. Where offsets are employed, they need to be transparently retired in a third-party registry. Companies will need to disclose the offset projects, including the number or proportion of offsets acquired from each project.

Transparency and comparability

Comparing and verifying carbon neutral claims is difficult, owing to different GHG accounting methods and the



different boundaries employed. For example, some cargoes have been traded as carbon neutral up to the point of regasification, rather than including emissions from the end use of the gas.

To address these inconsistencies, GIIGNL’s framework aims to be truly comprehensive, covering all sources of emissions, all greenhouse gases and all stages of the LNG value chain. Moreover, it aims as far as possible to maximise the use of primary data, but recognises that in many cases sellers may not have full visibility of emissions at all stages in the value chain.

All declarations made under the framework are intended to be based on a GHG footprint that matches as closely as possible the emissions associated with a particular cargo. The framework adopts the terms ‘GHG neutral’ and ‘GHG offset’ rather than using the word ‘carbon’ in order to encompass methane emissions and promote accuracy in the language of emissions reporting.

It provides a consistent approach to MRV using existing standards and methodologies developed by independent bodies. The reference standard adopted is PAS 2060:2014, a carbon accounting standard first published by the British Standards Institution in 2010 and updated in 2014.

The framework also provides additional criteria and guidance for applying existing accounting methodologies specifically to LNG cargoes with the aim of making carbon footprint assessments carried out in alignment with the framework more consistent and comparable.

Declaration of pathways

To address the emergent nature of GHG neutral LNG and different actors’ states of readiness, the framework provides a hierarchy of declaration pathways.

The first is a Framework Aligned Stage Statement. This represents a fully and independently-verified statement of emissions from a stage or stages in the LNG value chain. These statements form the building blocks for a full life-cycle assessment in which the use of primary data is maximised.

There are then four levels of ‘Cargo Statements’, with each embodying tougher criteria than the last:

- GIIGNL Framework Aligned LNG Cargo GHG Footprint is a fully-verified assessment, reflecting either a partial or full lifecycle, aligned with the framework and conforming with a defined GHG footprint standard.
- GIIGNL Framework Aligned GHG Offset LNG Cargo complements the above with verified GHG offsets that meet the criteria of the framework.
- GIIGNL Framework Aligned GHG Offset LNG Cargo with Reduction Plan builds upon the first two options by including an emissions reduction plan.
- GIIGNL Framework Aligned GHG Neutral LNG Cargo sets out the criteria for declaring a GHG neutral cargo. This requires all of the above, but accompanied by a commitment to long-term decarbonisation and verification that conforms with an internationally-accepted carbon neutral standard →

such as PAS 2060:014 or equivalent.

- GIIGNL is setting the bar high; a declaration under the framework that a cargo is GHG neutral means that a fully-verified GHG Footprint has been made across the entire value chain. In addition, any residual or unavoidable emissions must be fully offset with verified emissions certificates from projects which meet best practice principles.

Step-by-step guidance

The framework provides a simple step-by-step approach for reporters.

First off is to decide which declaration pathway to follow as this will determine the requirements needed for alignment with the framework and its associated standards, which are set out in the framework's accompanying documents. Which pathway to choose may reflect a company's energy transition readiness, the availability of data, or other factors such as a need to comply with a buyer's standards and objectives or environmentally-focused initiatives such as the EU's Methane Strategy.

Once the pathway is defined, a reporter then prepares a documented process which explains how the requirements of the Framework and its associated standards will be met.

To aid comparison, the reporter must adopt the framework's common units for GHG analysis, which are based on mmbtu on a higher heating value basis. GHG intensity must be expressed as tonnes of CO₂ equivalent per mmbtu. In addition, the most up-to-date IPCC Assessment Report for Global Warming Potentials, based on a 100-year timeline, should be used to calculate GHG emissions to be consistent with established GHG accounting practices.

GIIGNL notes that to be fully comprehensive, reporting may have to be extended beyond other reporting regimes such as the EU Emissions Trading Scheme (which excludes transport emissions, methane and nitrogen oxides) or the International Maritime Organisation's Energy Efficiency Design Index (which excludes methane). A key priority is to include all relevant sources of methane loss, which implies assessment of areas for which reporting may currently be incomplete.

'Low GHG features'

A number of LNG developers have started to include carbon capture storage and utilisation (CCUS) facilities

in their LNG development plans as a means of reducing GHG emissions, while others are considering compensatory carbon removal technologies.

The framework makes a distinction between CCUS and 'removals', pointing out that CCUS does not remove GHGs from the atmosphere, even if it does prevent their release.

Technologies such as Direct Air Capture (DAC) are therefore treated differently under the framework to CCUS. DAC creates a 'negative' emission in accounting terms, but CCUS does not, but can be reported separately as a 'low GHG feature' for the relevant stage in the LNG's lifecycle.

Allocations from carbon captured and stored must only reflect permanently-stored carbon, which would decrease the reduction contribution, for example, where CO₂ is used in enhanced oil recovery.

Low GHG features within the cargo GHG footprint include CCUS, but also many other factors, including the CO₂ content of the field gas, the inclusion of renewable gases, transport distances, low GHG emissions power supply, electric drive technology in the liquefaction plant – if run on low carbon electricity – waste heat recovery, flare and venting elimination, low emission LNG carriers and/or carriers powered by low carbon fuels.

LNG can also have indirect climate benefits, for example where it displaces a higher carbon fuel, such as coal or oil in electricity generation or transport. However, these indirect benefits are not considered features of a delivered LNG cargo under the framework.



Armed with this new tool, GIIGNL hopes that companies will adopt a more consistent and transparent approach, focused on long-term decarbonisation, that fosters widespread acceptance of the benefits of low-carbon LNG.

Above and beyond: GHG emissions reduction plans

These plans, essential to qualify a cargo as GHG neutral, need to include a commitment to GHG emissions reductions at the company level and to identify positive actions that will be taken for lowering emissions within the boundary of the cargo's GHG footprint.

The plan is intended to deliver a long-term sustainable trajectory of reduced emissions. It must go beyond existing legislation or standard business practices.

Plans are expected to address a number of emissions reduction opportunities such as changes to operating procedures, fuel switching and investment in renewable energy, or major capital investment in emission avoidance or reduction strategies. They should be accompanied by an indication of timelines and goals.

Finally, to ensure the credibility of reporting, all stage and cargo statements must be subject to independent third-party verification. The independent

verifier must be given unrestricted access to the relevant information sources and personnel to complete the process, even where internal procedures, for example emissions monitoring and measurement, are considered confidential.

The standard to be applied for verification is ISO 14064-3:2019 and can be carried out either on a cargo-by-cargo basis or on a batch basis, but in both cases validation of the Carbon Footprint Methodology and Offset Strategy must be performed before delivery.

The framework will be hosted on a website administered by GIIGNL and made available for free to any interested party. GIIGNL will also review the framework on a periodic basis to reflect emerging practices and GHG accounting obligations. Armed with this new tool, GIIGNL hopes that companies will adopt a more consistent and transparent approach, focused on long-term decarbonisation, that fosters widespread acceptance of the benefits of low-carbon LNG. ■

Greece advances gas hub plans with new LNG project

The expansion of Greek LNG import capacity will aid the regional diversification of gas supplies and support coal-to-gas switching in pursuit of emissions reductions.

ROSS MCCRACKEN



A final investment decision (FID) on the Alexandroupolis LNG regasification terminal at the end of January marks a big step forward for Greece's ambitions as a regional gas hub. It also promises to facilitate coal-to-gas switching in southeast Europe, helping to reduce greenhouse gas (GHG) emissions, and diversify regional gas supplies, a long-standing aim of the EU.

Domestic demand rising

Greece already has sufficient gas import capacity to cover demand, but domestic gas consumption hit a record high last year, rising 10.9% to 69.96 TWh, according to data from natural gas transmission system operator Desfa.

Demand from electricity generators jumped 15.79% and distribution network use rose 11.34%, although industrial and compressed natural gas use fell 16.6%. Domestic gas demand has hit record highs for two successive years, largely owing to higher gas burn for power.

Athens will also be mindful of the growing impact of its coal phase-out policy, which plays a central role in meeting its climate change targets.

In December 2019, the government set a timeline of 2028 to phase out all coal use in power generation, but subsequently brought forward to 2023 the target for closing all lignite-burning coal plants. The only exception was the newly-constructed Ptolemaida 5 plant, which is now scheduled for conversion to gas, further increasing demand for the fuel.

In 2020, coal provided 11% of the country's primary energy supply and about 20% of electricity generation, which totalled 42.6 TWh. Total generation was low, owing to a significant contraction in GDP as a result of the impact of the COVID-19 pandemic on the tourism-dependent Greek economy.

Economic rebound, as pandemic restrictions ease, and declining coal generation, suggest a need both for increased renewable energy generation and gas-fired power, if coal is to be pushed out of the generation mix. →



Greece gas imports 2021

	TWh	%
Sidirokastro (pipeline)	35.37	45.5
Nea Mesimvria (pipeline, TAP connection)	13.61	17.5
Kipoi (pipeline)	4.02	5.2
Revithoussa (Agia Triada, LNG)	24.72	31.8
TOTAL	77.72	100.0

Source: Desfa

In 2020, coal provided 11% of Greece's primary energy supply and about 20% of electricity generation.

Import capacity

Despite increasing gas consumption, Greece has still to stretch the limits of its import capacity. In fact, LNG imports last year fell by 27.55% to 24.72 TWh, amid increased pipeline imports and higher prices for spot LNG. Imports in 2020 were 2.2 MTPA, implying just 1.66 MTPA of LNG was imported in 2021.

Greece has only one LNG terminal, Revithoussa, which was completed in 2000 and expanded in 2018 to bring capacity up to 4.6 MTPA, enough to more than meet the country's entire gas import requirements. The plant is run by DESFA and has three storage tanks with a total capacity of 225,000 m³.

LNG imports in 2020 and 2019 both represented a significant step up from prior years and imports last year were still high compared with pre-2019 levels. However, imports at the main Sidirokastro pipeline entry point rose 10.4%, while imports started up at the new pipeline entry point of Nea Messimvria, which is connected to the Trans-Adriatic Pipeline (TAP).

Despite the drop in LNG volumes and increase in domestic demand, Greece was still a net exporter of 7.6 TWh of gas last year.

Regional reach

The Alexandroupolis floating storage and regasification unit (FSRU) will add to what is already surplus import capacity, allowing Greece to act as a regional entry point for non-Russian gas supplies. The FSRU will be located about 17.6 km southwest of Alexandroupolis in east Greece.

The facility will have a capacity of 4 MTPA and storage

of 153,000 m³. It will be connected to the Greek pipeline system by a 28-km pipeline and is targeted to come on stream in 2023. Developer Gastrade's focus is on regional gas exports to Bulgaria, Romania, Serbia, North Macedonia and, potentially, as far afield as Moldova and Ukraine.

Although the Alexandroupolis FSRU might be seen as competition to Revithoussa, DESFA is a shareholder in both terminals. Gastrade's other investors include its founder, Greek businesswoman Elmina Copelouzou, Greek state gas distributor DEPA Commercial, Cypriot LNG carrier operator GasLog and Bulgarian gas transmission operator Bulgartransgaz. Their investments were cleared by the European Commission at the end of November and the EU last June also signed off on a \$200mn grant for the project, demonstrating its support for the diversification of gas supplies into southeast Europe.

Regional interconnectors

Bulgarian interest is being driven by the expected completion later this year of the Interconnector Greece Bulgaria (ICGB), which will allow Bulgarian gas users to source gas from Greece's LNG terminals, as well as potentially from the Trans-Anatolian Pipeline (TANAP), which brings Azeri gas across Turkey and into Greece, connecting to TAP for onward transmission to Italy.

The ICGB will have a capacity of 3bn m³/yr, with the possibility of later expansion to 5bn m³/yr. Just over half of the pipeline's capacity has been reserved, according to the project developers, who expect first flows in July.

The 182-km pipeline will connect with the Greek national gas grid at Komotini and the Bulgarian grid in

the area of Stara Zagora. There is also a possibility of connecting the pipeline to TAP, which itself could be expanded. TAP started flowing gas in 2020. The European Investment Bank (EIB) has committed a total of €74.5mn (\$83mn) in grants and loans to the ICGB project.

Coal-to-gas switching

As in Greece, coal-to-gas switching plays an important part of these plans. Serbia is heavily dependent on coal for electricity generation, but wants to build a series of gas plants to reduce its use of the carbon heavy fuel. Bulgaria, meanwhile, has been see-sawing on its coal-to-gas switching plans, not least because of the recent large increase in European gas prices.

Serbia formerly had a single gas entry point at Horgos, which accounted for more than 80% of the country's gas consumption. Gas flows to Horgos from Russia via Ukraine and Hungary. However, at the beginning of 2021, gas from Russia's Black Sea TurkStream pipeline started to reach the country via Bulgaria.

Further integration with the Bulgarian gas network is seen as a means of diversifying Serbia's gas supplies, which would in turn provide more security for its coal-to-gas switching plans. Similarly, greater price competition in the Bulgarian system may cause the government to rethink its coal and gas generation policies.

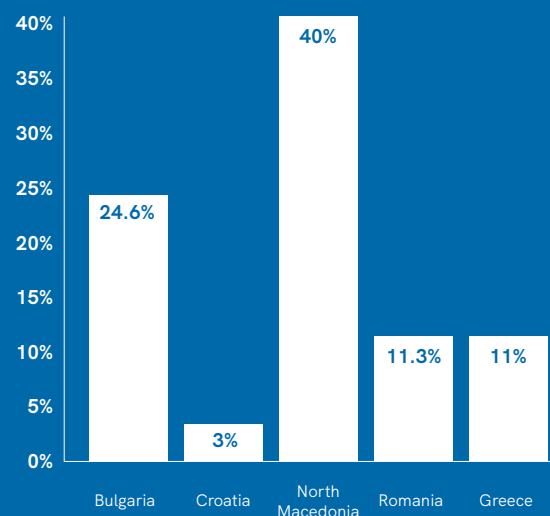
In early February, Serbian state-run gas company Srbijagas announced that it had broken ground on the 171-km Nis-Dimitrovgrad pipeline, which will provide an additional link with Bulgaria. The project, which comprises two parallel pipelines and four regulating stations, will allow Serbia to access Greek LNG and Azeri gas coming through the EU's Southern Corridor. The pipeline will have a capacity of 1.8bn m³/yr, and has attracted funding from the EU for the Hungarian section and from the EIB on the Serbian side.

The project was designated as a priority by the High-Level Group on Energy Connectivity in Central and South-Eastern Europe, which was set up by the EU in 2015. The aim of the group is to facilitate the rapid development of cross-border European projects which diversify gas supplies in the region. The pipeline is expected to come into operation in 2023.

With both the ICGB and Nis-Dimitrovgrad pipelines coming into operation, Alexandroupolis LNG will be well placed to provide an alternative to Russian gas across a wide range of southeast European countries. The new connections will reduce the price and supply risk of dependence on a single supplier, while coal-to-gas switching can support earlier coal phase-outs, reducing the emissions intensity of southeast Europe's electricity systems. Coal-to-gas switching will also provide dispatchable yet flexible generation to underpin the expansion of renewable energy in the region. ■

Coal-to-gas switching will provide dispatchable yet flexible generation to underpin the expansion of renewable energy in the region.

% of coal in primary energy consumption





The EU's energy decarbonisation push

The European Commission has proposed new measures to decarbonise the EU energy sector in line with its climate targets, while also unveiling new guidelines on what investments should be considered sustainable.

JOSEPH MURPHY

The European Commission published a raft of legislative and regulatory proposals in late 2021 and early 2022, aimed at decarbonising the EU natural gas market and the bloc's energy sector at large. The proposals have drawn mixed responses, representing a compromise between political ambitions and economic realities. They will have to go through the usual EU legislative channels before becoming bloc policy. But it is worth looking at what ramifications they will have for the natural gas industry in their present form.

Bringing low-carbon gases into the mix

In mid-December, the EC unveiled proposed regulation and a revised directive aimed at accelerating the rollout of lower-carbon gases such as hydrogen and biomethane.

In its statement, the commission said that among the main goals was "to establish a market for hydrogen, create the right environment for investment, and enable the development of dedicated infrastructure, including

for trade with third countries."

Market rules will come into force in two stages before and after 2030, covering hydrogen infrastructure access, the separation of hydrogen production and transport activities, and tariffs for low-carbon gases. The EC also proposed setting up a new governing structure known as the European Network of Network Operators for Hydrogen (ENNOH), which will oversee hydrogen infrastructure, cross-border coordination and interconnector construction. It will also set out specific technical rules for hydrogen.

The EC wants to see national network plans drawn up with electricity, natural gas and hydrogen all in mind, and based on EU climate objectives. Gas network operators will have to report on which infrastructure can be decommissioned or converted, and there will be a requirement that networks for hydrogen are planned with realistic forecasts for demand in mind.

These new rules will make it easier for renewable and low-carbon gases to enter the grid, the commission →

has said, by doing away with tariffs for cross-border interconnections and cutting tariffs at injection points, for example. The EC also calls for a certification system for renewable gases to be introduced that considers the full greenhouse gas impact of all gases, to ensure a level playing field.

Significantly, the commission also advised that no long-term contracts for unabated gas supplies should be extended beyond 2049, to prevent “locking Europe” into the fuel. But some EU member states have criticised a phase-out of long-term contracts, given that the bloc is anxious to diversify its gas imports, and these contracts may be needed to underpin the necessary upstream and midstream investments to achieve this.

The commission also said it would try to replicate provisions in the power market to enable consumers to easily switch between suppliers and get accurate pricing information, to encourage them to shift from natural gas to renewable and low-carbon gases.

On methane emissions

Following on from the release of its methane strategy in 2020, the commission also released a proposal on quantification, reporting and verification of methane emissions in the energy sector, with the ultimate aim of cutting them. Agriculture is a bigger source of anthropogenic methane emissions, but the commission has focused more on the energy industry as it argues that reductions can be achieved here more easily and at lower cost. The natural gas industry has already made significant progress here. For instance, the sector achieved a 59% reduction in fugitive methane emissions between 1990 and 2018, according to the European Environment Agency. A number of voluntary initiatives have also been created to drive emissions down further, such as the Oil and Gas Methane Partnership 2.0.

The EC wants to see operators measuring and quantifying their asset-level methane emissions at the source and undertaking comprehensive surveys to find and repair leaks. It also wants to bring an end to routine venting and flaring, and a number of gas companies have already pledged to achieve this.

Regulation of methane emissions will also be expanded to cover imported oil, gas and coal, in two stages. First, importers will be required to provide information on how their suppliers quantify their emissions. And second, a transparency database and global monitoring tools such as satellites will be employed

to show how different countries and energy companies rank in terms of emissions. Under the second phase, the commission plans to introduce measures on methane emissions associated with imported energy 2025, partly through diplomacy with key energy partners.

Positive with caveats

The gas industry has generally welcomed the EC’s proposals, but with some caveats. Specifically, many in the sector have stressed the need for technology-inclusion legislation and regulation that recognises that gas can serve as a powerful transition fuel. They also urge against an overly prescriptive approach to allow for innovation and optimising technology selection to maximize actual reduction, not just regulatory compliance.

GasNaturally, a partnership between eight associations representing the entire European gas value chain said “the review of the EU gas market system presents a clear opportunity to bring huge benefits to the whole energy system.”

“Low-carbon hydrogen and other low-carbon and renewable gases offer viable solutions for a net-zero economy and provide flexibility during the transition, leveraging the existing, well developed energy infrastructure,” GasNaturally president Dawn Summers said in a statement at the time.

GasNaturally wants to see policymakers embrace the opportunities that hydrogen and low-carbon gases represent, and “make full use of all gaseous solutions to reach climate neutrality by 2050.”

The organisation also welcomes “incentives to promote innovation and new technologies and practices in tackling methane emissions across the European gas supply chain.”

“We must be careful not to lose sight of the few relevant emission sources and avoid being overly prescriptive in policy instruments; new technologies and practices have the potential to further increase the cost-effectiveness of methane reductions over time; it’s important to retain that flexibility,” it said.

A similar stance was expressed by the International Association of Oil & Gas Producers (IOGP), which said that proposed reforms and plans for carbon management “can equip the EU with a powerful set of solutions to reach climate neutrality.”

“IOGP Europe calls on co-legislators to choose an ambitious, technology-inclusive, and affordable pathway to climate neutrality by using natural gas as a transitional →

The gas industry has generally welcomed the commission's proposals, but with some caveats.





Taking account of scientific advice and current technological progress, the commission considers that there is a role for private investment in gas and nuclear activities in the transition.

The European Commission

fuel and further incentivising and accelerating the large-scale deployment of low-carbon hydrogen and carbon management solutions such as CCUS,” the association said.

Gas technologies are the second pillar of the energy transition, the IOGP, praising the commission for looking beyond electricity as a means of decarbonising energy.”

“We still believe a stronger push on low-carbon hydrogen deployment is needed to fully exploit its potential,” IOGP said. “2030 is practically today and 2050 is around the corner. We can no longer afford to be picky with technology deployment. If the EU is really serious about climate neutrality, we need to make the best use of natural gas as a transition fuel and incentivise the production of all-carbon hydrogen production methods right now. It’s in the co-legislators’ hands now.”

The International Gas Union (IGU) added that there was a lot it could get behind in terms of both the methane emissions regulation and the decarbonised gas market package proposed by the commission. But it cautioned against “overly prescriptive, non-functional and not risk-based” regulation, particularly in such a technical industry.

“We call for further dialogue to ensure an optimal outcome; achieving impactful reductions in gas sector methane emissions and maintaining a secure, well-functioning energy market,” the IGU said. “Globally, experience has shown time and time again that technology-specific and excessively process-prescriptive regulations can lead to unintended consequences and sub-optimal outcomes, while driving up compliance costs and ultimately prices for consumers. Good regulations are cost-effective regulation, when the cost of compliance does not trump the value of the benefit.” IGU’s Group of Experts on Methane Emissions lead, Tatiana Khanberg, added.

Deciding what is sustainable

Another important development for the EU energy mix was the commission’s listing at the start of February of investments in both natural gas and nuclear as sustainable

under the EU’s taxonomy classification. The taxonomy is designed to guide investors to invest in sustainable activities. Like the earlier proposals, the EU’s taxonomy act will be debated by EU lawmakers and member states before becoming final.

The commission explained its position saying private investment in “all possible solutions” would be needed for the EU to deliver on its net zero by 2050 goal.

“Taking account of scientific advice and current technological progress, the commission considers that there is a role for private investment in gas and nuclear activities in the transition,” the commission said. “The gas and nuclear activities selected are in line with the EU’s climate and environmental objectives and will allow us to accelerate the shift from more polluting activities, such as coal generation, towards a climate-neutral future, mostly based on renewable energy sources.”

The criteria for recognising gas as sustainable is strict, however. Lifecycle emissions must be below 100 g of CO₂e/kWh, or until 2030, and where sufficient renewables are not available, direct emissions should be below 270 kg of CO₂e/kWh or, regarding electricity generation, annual direct greenhouse emissions must not exceed 550 kg of CO₂e/kW of the facility’s capacity over 20 years. The activity will only be considered sustainable if it replaces solid or liquid fossil fuels, and the activity ensures a full switch to renewable or low-carbon gases by 2035. Regular independent verification of compliance will also be carried out.

IOGP said it welcomed gas’ inclusion but warned about the “extremely demanding technical screening criteria which would exclude some of the most efficient gas-related activities to support necessary emissions reductions.”

The strict criteria could leave EU countries struggling to find a cleaner baseload replacement to coal-burning power generation, the association said, meaning they would rely more on rising intermittent renewables supply which would pose a risk to energy security. ■

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