

# LNG INDUSTRY

July 2016



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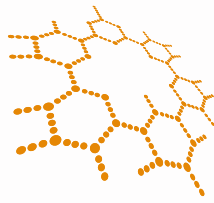
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## COMMENT



In early June, *LNG Industry* exhibited at the CWC World LNG & Gas Series 14<sup>th</sup> Americas Summit in Houston, Texas, alongside a number of familiar faces. However, some of you may be surprised to learn that representatives from NASA were exhibiting next to our stand. Researchers from Glenn Research Center (GRC) – one of ten major NASA centres, whose primary mission is to design, develop and test innovative technology for aeronautics and spaceflight – were on hand to discuss the current design and concept for a one-year exploration mission of Saturn's largest moon, Titan.

Back in 2005, data from the Cassini-Huygens mission (a cooperative project of NASA, the European Space Agency and the Italian Space Agency) revealed that Titan resembles a frozen version of Earth, with seas of methane and ethane, which are replenished by rain from hydrocarbon clouds.

Now, NASA is preparing for arguably its most daring mission yet: to send a submarine to explore Kraken Mare, Titan's largest northern sea. The plan is for the submarine to dive below the surface of the cryogenic sea to investigate oceanographic phenomena including the chemical composition of the liquid, surface and subsurface currents, as well as tides, wind and waves. The sub will also sample the silt that has been resting at the bottom of the sea for thousands of years. Ultimately, the mission may hold the answer as to whether extraterrestrial life exists in the galaxy. Scientists currently believe that some sort of liquid is essential for life. As the only other place in our solar system that is known to have liquids flowing across its surface, Titan is a prime candidate for such life.

The fact that Titan's liquid methane seas are quite similar in composition to LNG found here on Earth means that the project represents a unique design and development opportunity for the LNG industry. As Dr Jason Hartwig, NASA GRC, explained in an email to *LNG Industry*: "All of

the components on the sub must be LNG-rated; everything from simple valves and compressors, to the ballast system, shell and propellers." He continues: "If the sub goes through standard tech maturation as any other vehicle or space hardware, there could be plenty of development work and opportunities for LNG companies to partner with us, run tests of their own, perform analysis, [become a] co-investigator on future proposals, help us with demonstration tests, etc."

The project is still in its infancy and there are plenty of engineering challenges to overcome, including the fact that there is a little more nitrogen dissolved in Titan's seas, due to the higher atmospheric pressure on the moon. This has led to concerns that the submarine's radioactive-isotope power supply could warm the seas and cause the nitrogen to 'fizz', which may interfere with sonar measurements. However, there is still plenty of time for these concerns to be ironed out, with launch not expected until some time in the 2030s. Dr Hartwig added: "We went to the conference to basically introduce the sub and make the stakeholders aware of what is coming. Who knows, it could be LNG companies who end up building the submarine."

In the meantime, there are plenty of extreme challenges currently facing the LNG industry back on planet Earth. This issue of *LNG Industry* includes a special new 'Extreme' feature starting on p.33, which puts the spotlight on some of the most challenging projects in our industry; from safe and reliable transportation of LNG through Arctic waters, through to burst detection systems in harsh operating environments and fire safety practices on floating LNG (FLNG) vessels.

If you have your own 'Extreme' story to tell, please get in touch. And if you'd like to learn more about NASA's Titan Submarine project, visit: <https://www.nasa.gov/content/titan-submarine-exploring-the-depths-of-kraken/#.V3E5nXquPTA> **LNG**

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## Panama

### Expanded Panama Canal officially opens

The newly expanded Panama Canal has now officially opened. The Expansion Program is the largest enhancement project since the Canal's opening in 1914. It is expected to provide greater economies of scale to global commerce and will introduce new routes, liner services and industries, including LNG.

The expansion included the construction of a new set of locks on the Atlantic and Pacific sides of the waterway and the excavation of more than 150 million m<sup>3</sup> of material, creating a second lane of traffic and doubling the cargo capacity of the waterway. The expanded locks are 70 ft wider and 18 ft deeper than those in the original Canal.

Panama Canal Administrator and CEO, Jorge L. Quijano, said: "More than 100 years ago, the Panama Canal connected two oceans. Today, we connect the present and the future [...] It is an honour to announce that [...] we did it together: providing this great connection to the world. This is the beginning of a new era."

The neo-panamax *COSCO Shipping Panama* vessel was the first to use the passage. It is currently en route to Asia.

Quijano added: "We are thrilled that we currently have 170 reservations for neo-panamax ships, commitments of two new liner services to the Expanded Canal, and a reservation for the first LNG vessel, which will transit in late July."

## Australia

### APLNG commences exports to Kansai Electric

Australia Pacific LNG (APLNG) has announced that its first LNG shipment to Kansai Electric Power Co. (Kansai Electric) departed Curtis Island, Australia, on 29 June 2016.

The *LNG Fukurokuju*, which was recently built to fulfil Kansai Electric's contract with APLNG, is bound for Japan. Under the Sales and Purchase Agreement (SPA), which was signed in 2012, Kansai Electric will receive approximately 1 million tpy of LNG for 20 years.

APLNG CEO, Page Maxson, said: "The departure of Kansai Electric's first cargo under the SPA represents another significant milestone in Australia Pacific LNG's history and highlights the strong partnership between our two companies. It also demonstrates the important role our business plays in delivering a cleaner form of energy to the global market."

"This shipment to Kansai Electric marks the 27<sup>th</sup> shipment by Australia Pacific LNG since exports began. We have been pleased with our operations from Train 1 and we expect to deliver the first cargo from Train 2 by the end of 2016."

Australia Pacific LNG is a joint venture between Origin (37.5%), ConocoPhillips (37.5%) and Sinopec (25%).

## Poland

### PGNiG takes delivery of first LNG and announces plans to set up a London trading office

Polish Oil & Gas Company (PGNiG SA) has announced that the first shipment of LNG has recently been delivered to the President Lech Kaczyński LNG Terminal in Świnoujście.

The *Al-Nuaman* LNG carrier delivered 206 000 m<sup>3</sup> of LNG from Qatar. Under a long-term contract with Qatargas, approximately 1.3 billion m<sup>3</sup>/yr of gas (after regasification) will be supplied from Qatar.

On 25 June 2016, the first LNG shipment bought on the spot market was delivered to the LNG terminal. Approximately 140 000 m<sup>3</sup> of LNG was supplied from the Norwegian port of Melkøya by the *Arctic Princess* vessel. The delivery from Statoil is the effect of proceedings

carried out by the PGNiG Group in May 2016. The Group plans to purchase LNG on a spot basis in addition to regular deliveries under its long-term contract with Qatargas.

PGNiG has also announced plans to set up an LNG trading office in London, UK. The office, which will open in January 2017, is set to reach its full operational capacity by the end of 1Q17.

Maciej Woźniak, Vice President for Trade, said: "We will be buying LNG at competitive prices for our own needs, but will also start trading it on global markets. That is why we are opening an office in London, the gas trading hub for Europe."



# LNG NEWS



## Pakistan

### Qatargas signs long-term SPA with GEIL

**Q**atargas has signed a long-term Sale and Purchase Agreement (SPA) with Global Energy Infrastructure Ltd (GEIL). Under the terms of the agreement, Qatargas will supply 1.3 million tpy of LNG to Pakistan for 20 years, with provisions allowing the volume to increase to 2.3 million tpy.

The LNG will be supplied from Qatargas 2, a joint venture between Qatar Petroleum, ExxonMobil and Total. The first cargo is expected to be delivered to Pakistan in 2018 by Qatargas-chartered Q-Flex vessels.

Saad Sherida Al-Kaabi, Chairman of Qatargas Board of Directors, said: "We are proud to support countries in their desire to enhance their energy security. This new agreement reinforces our confidence in Pakistan as an energy market and in its potential."

Khalid Bin Khalifa Al-Thani, Chief Executive Officer of Qatargas, added: "Qatargas is delighted to announce a 20-year deal with GEIL for the supply of LNG into Pakistan. I am particularly pleased to strengthen our relationship with Pakistan, which continues to grow as an important market in the LNG industry. I would also like to welcome GEIL to Qatargas' expanding client portfolio, and I look forward to our respective teams working together as we safely and reliably supply LNG to Pakistan."

## Germany

### Iveco and Uniper open Germany's first LNG fuelling station for trucks

**I**veco and Uniper have announced that they have opened Germany's first LNG fuelling station for trucks in Ulm. The station will be used for endurance tests in trials of innovative engine concepts for long-haul transportation.

Eckhardt Rümmler, the Chief Operating Officer of Uniper, said: "The construction of this fuelling station in Germany represents a first, important step in the development of innovative, environmentally friendly fuelling alternatives in long-haul transportation. Working in further partnerships, we want to build a fit-for-purpose network of LNG fuelling stations in Germany and selected neighbouring countries in the next few years. We are thus making an important contribution toward improving environmental performance and noise reduction in road transportation."

The Business Director at Iveco Magirus AG, Sascha Kaehne, added: "We are pleased to join forces with Uniper in taking the first step toward a true alternative to diesel in Germany at the Ulm development site. The Stralis is now the first LNG vehicle in Europe that is fully capable of long-haul transportation from the perspective of drivers and business owners."

## News Highlights

- ▶ LNG Motion project awarded grant
- ▶ Elengy considers new LNG truck loading facility
- ▶ The impact of Brexit on the energy industry

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# LNG NEWS



## USA

### SCT&E LNG signs binding supply agreement

**S**CT&E LNG Inc. has announced that it has signed a binding 20-year fixed price natural gas supply agreement to support its future LNG facility to be constructed on Monkey Island in Cameron Parish, Louisiana, US.

In May 2015, SCT&E LNG signed a non-binding Memorandum of Understanding (MoU) with a natural gas supplier for a 20-year fixed price on natural gas from commencement of operations at its LNG export facility. In recent months, SCT&E LNG has been negotiating with its natural gas supplier to convert the MoU into a binding gas supply agreement.

SCT&E LNG's Chairman and CEO, Greg Michaels, said: "I am very pleased to announce we have successfully completed the negotiations and now have a contractual method to offer this unique natural gas supply structure to our LNG offtakers. Together with our upstream supplier, we have essentially created a 25-year hedge on natural gas for our customers, and the LNG offtake community is responding positively."

This 20-year fixed price natural gas supply offering is a first of its kind among US LNG export projects. The SCT&E LNG export project is currently scheduled to produce a total of 12 million tpy of LNG with shipments starting in 2022.

To date, SCT&E LNG has signed four offtake MoUs for a total of 4.7 million tpy of LNG.

## France

### RasGas inks LNG SPA with EDF

**R**asGas Company Ltd has announced that Ras Laffan Liquefied Natural Gas Company Ltd (3) (RL 3) has entered into a new LNG Sales and Purchase Agreement (SPA) with EDF SA.

Under the terms of the SPA, RL 3 will deliver up to 2 million tpy of Qatari LNG into EDF's new terminal in Dunkerque, France, starting in 2017 and over the medium-term.

This deal is in addition to three existing long-term SPAs between RasGas ventures and EDF Group subsidiaries, for delivery of up to 4.6 million tpy to Edison in Italy and up to ~3.5 million tpy to EDF Trading in Belgium.

Marc Benayoun, EDF Group Senior Executive, Vice President Gas & Italy and CEO of Edison, said: "This agreement with RasGas reflects EDF's growing interest in the LNG markets. The Group is proud to add this significant contract to its global LNG portfolio and to reach a new important milestone in the excellent relationship with RasGas, who already delivers LNG cargoes to the Group under long-term contracts in both Rovigo and Zeebrugge terminals. At a time when Dunkerque LNG is due to receive its first commissioning cargo early July, this new contract demonstrates Dunkerque LNG's outstanding position in the North West European gas markets."

#### 06 - 08 September 2016

##### FLNG

London, UK  
[finance.knect365.com/flng](http://finance.knect365.com/flng)

#### 06 - 09 September 2016

##### SMM

Hamburg, Germany  
[www.smm-hamburg.com](http://www.smm-hamburg.com)

#### 12 - 15 September 2016

##### 45<sup>th</sup> Turbomachinery & 32<sup>nd</sup> Pump Symposia

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[tps.tamu.edu](http://tps.tamu.edu)

#### 20 - 23 September 2016

##### CWC World LNG & Gas Series: Asia Pacific Summit

Singapore  
[asiapacific.cwclng.com](http://asiapacific.cwclng.com)

#### 07 - 10 November 2016

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# LNG NEWS



## France

### GTT and Endel sign Technical Assistance and License Agreement

**G**aztransport & Technigaz (GTT) and the Endel company – a subsidiary of the Energy Services branch of the ENGIE group – have signed a Technical Assistance and License Agreement (TALA) for the construction of GTT membrane containment systems. The deal reaffirms their collaboration in the area of LNG as a marine fuel. In the framework of this agreement, Endel created a mock-up of a Mark III type GTT membrane system.

GTT said that the partnership reinforces the companies' product offering, and benefits clients wishing to equip their vessels with LNG membrane tanks adapted to all types of vessels, such as liners, container vessels, bulk carriers, and RoRo vessels.

The collaboration makes it possible for shipyards to free themselves from having to acquire the necessary know-how for the construction of GTT membrane tanks, by relying on the expertise of the Endel company.

Philippe Berterottière, Chairman and CEO of GTT, said: "I am convinced that the market for LNG as a fuel has a great future, and that the collaboration with Endel will make it possible to convince ship owners of the attractiveness of going to LNG as a fuel, and of opting for the membrane tank technology."

GTT confirmed that it is building strategic industrial partnerships with key actors, "in order to enrich its product offering and respond to the needs of customers wishing to equip themselves with membrane containment systems. In a continuously innovative approach."

## Indonesia

### BP confirms FID to expand the Tangguh LNG facility

**O**n behalf of Tangguh Production Sharing Contract Partners, BP has announced that the Final Investment Decision (FID) has been approved for the development of the Tangguh Expansion Project in the Papua Barat Province of Indonesia.

The Tangguh Expansion Project will add a third LNG process train (Train 3) and 3.8 million tpy of production capacity to the existing facility, bringing total plant capacity to 11.4 million tpy. The project also includes two offshore platforms, 13 new production wells, an expanded LNG loading facility, and supporting infrastructure.

In a statement, BP said that the Tangguh Expansion Project will play an important role in supporting Indonesia's growing energy demand, with 75% of the Train 3 annual LNG production sold to the Indonesian state electricity company PT. PLN (Persero). The remaining volumes are under contract to Kansai Electric Power Co. in Japan (the other foundation buyer for Train 3).

Bob Dudley, BP Group Chief Executive, said: "The Tangguh Expansion Project demonstrates BP and its partners' continued confidence in Indonesia and our commitment to work closely with the government to meet the country's energy needs, while creating thousands of jobs."

The Tangguh Expansion Project will also bring a positive contribution to Indonesia and the Papua Barat Province starting in 2016, supporting economic growth and providing 10 000 jobs spread over the project period.

Awards for the project's key engineering, procurement and construction (EPC) contracts are expected in 3Q16 with construction to begin thereafter. Operation is expected in 2020.

## Italy

### Adriatic LNG receives milestone cargo

**A**driatic LNG, the operator of a regasification terminal located off the Veneto coastline, Italy, has announced the arrival of the 450<sup>th</sup> LNG carrier at the terminal.

The *Ejnan* LNG carrier, which arrived at the terminal 12 days after it left the Ras Laffan port in Qatar, delivered approximately 145 000 m<sup>3</sup> of LNG.

The Adriatic LNG terminal started operations in

October 2009. In that time, more than 37 billion m<sup>3</sup> of gas has been delivered to the national grid.

A statement from Adriatic LNG read: "Crossing the line of the 450<sup>th</sup> LNG carrier proves once again the efficiency and reliability of [the] Adriatic LNG regasification terminal."

The LNG terminal said that it expects to welcome its 500<sup>th</sup> LNG cargo in early 2017.



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# Africa

## in focus

**Mark Adeosun, Douglas-Westwood, UK,**  
explains why Africa will play a significant  
role in the future of the LNG market.





The background of the page is a photograph of a savanna at sunset. The sky is a deep orange and yellow, with the sun low on the horizon. In the foreground, several wildebeest are silhouetted against the bright light, grazing on the grass. The overall mood is serene and natural.

**L**NG has become an important part of the global energy mix. However, Africa remains a region with plentiful gas reserves that is yet to fully utilise LNG technology to diversify and meet its growing energy needs.

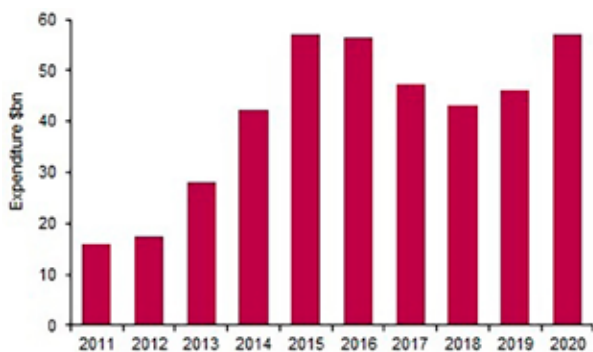
After the commissioning of the Arzew GL4Z LNG (Algeria) and the Marsa el Brega LNG (Libya) projects in 1964 and 1970, respectively, the construction of liquefaction plants over the past 10 years has been limited to Bonny Island Train 5 – 6, Angola LNG Train 1, Gassi Touil (GL3Z LNG) and Skikda GL1K Phase 2 Replacement. Over the same period, import facilities have been practically restricted to floating units. The use of LNG for power generation in the region has been significantly limited. However, in decades ahead, the construction of both export and import terminals is expected to increase as a result of massive gas reserves in the remote East African basin.

The global population growth is one of the most important drivers of future energy demand. Meeting this continued upsurge in demand has led to widespread exploitation of the world's fossil fuel reserves.

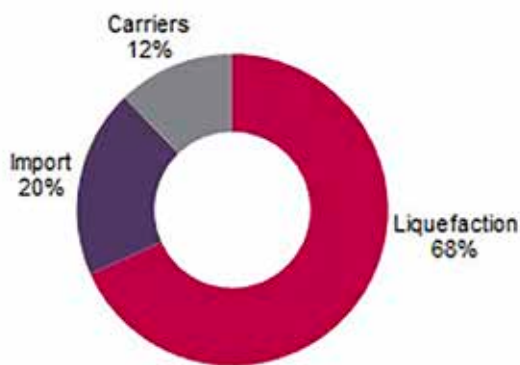
However, emissions from the burning of fossil fuels have become an increasingly important consideration in recent decades. Climate change has emerged as key policy issue and, consequently, natural gas is seen by many as necessary to support the transition to low carbon energy. Proven to emit half of the greenhouse gases (GHG) of coal, natural gas provides a mechanism to rapidly reduce emissions and will see the highest fossil fuel demand growth to 2040. In 2015, the COP21 agreement outlined a clear roadmap to the reduction of GHG emissions. This is expected to be a key driver of changes to energy policy and growth in gas use. Beyond environmental concerns, seasonal gas demand is also a clear driver of LNG in Western Europe, Latin America and the Middle East. In these regions, rising LNG demand is often due to declining local gas production and not necessarily overall gas demand growth.

Globally, many basins with relatively low extraction costs have matured. Consequently, exploration and production (E&P) companies have been forced to develop higher cost plays, notably deepwater, heavy oil and oil sands. Conversely, the gas market has enjoyed a period of booming production underpinned by the advent of shale gas in North America and coal bed methane (CBM). This previously stranded gas is now being transported to consumers via LNG technology.

A combination of plummeting oil prices and a sharp fall in the economic growth profiles of many Asian countries has, in recent months, caused the LNG spot price to fall substantially. Asia is a key region of demand growth, yet pricing has struggled. In April 2016, Japan's LNG spot price averaged US\$7.75/million Btu – a 24% decline compared to the same period 12 months prior. Sustained low oil price remains a concern for the LNG market, as most LNG contracts are linked to oil price. Furthermore, various LNG



**Figure 1.** Global LNG expenditure 2011 – 2020 (source: Douglas-Westwood (DW), World LNG Market Forecast).



**Figure 2.** Global expenditure by LNG facility type 2016 – 2020 (source: DW, World LNG Market Forecast).

developments are vulnerable to capital constraints from the decline in oil price, given that liquefaction projects are very capital intensive.

## Market overview

CAPEX on LNG facilities has been predominantly driven by large liquefaction facilities in Australia over the 2011 – 2015 period. Over the next five years, CAPEX will be driven by numerous projects in North America and a handful of projects in Africa. Owing to the number of projects that are currently under construction and those approaching Final Investment Decision (FID), Douglas-Westwood (DW) forecasts expenditure on global LNG facilities to total US\$250 billion between 2016 and 2020. This represents a 56% increase compared to the preceding five year period.

Over the forecast period, all regions are expected to experience steady growth in CAPEX, with the exception of Australasia, where the LNG construction boom looks to be coming to an end. Several Australian mega-projects, such as Gorgon LNG, Ichthys LNG and Wheatstone LNG, are expected to be fully operational by 2018. Furthermore, FID has not been taken on any Australian LNG project since 2012. With commodity prices depressed, future LNG projects in Australia are uncertain. Those currently in the front end engineering design (FEED) stage are struggling to make economic sense in the low price environment.

Over the next five years, there will be a significant shift in expenditure to North America for the construction of new LNG facilities. Despite the long-winded approval process in the US and Canada, the North American region will account for 24% of total expenditure on LNG facilities over the 2016 – 2020 period. Projects such as Sabine Pass LNG Train 1 – 4, Freeport LNG Train 1 – 3, Cameron LNG Train 1 – 3 and Bear Head LNG will drive expenditure in the region over the forecast period. By far the largest proportion of global LNG expenditure will be attributed to liquefaction projects. This accounts for 68% of spend over the forecast period. Import facilities will constitute 20%, whilst spend on LNG carriers will represent 12% of total expenditure between 2016 and 2020. It is pertinent to state that the Asian shipyards are expected to service nearly all carrier shipbuilding contracts over the next five years.

## Africa in focus

During the preceding five year period, activity on liquefaction developments was limited, with a handful of projects, such as the Skikda GLIK Phase 2 Replacement, Angola LNG Train 1 and Gassi Touil (GL3Z LNG), all becoming operational over this time. However, Angola LNG was temporarily shut down in 2014 after a ruptured pipe. The facility has a capacity of 5.2 million tpy and represents a significant project for the Angolan energy sector. However, the facility has experienced significant delays and production only resumed in June 2016.

Over the next five year period, DW forecasts expenditure on LNG facilities in Africa to grow at 103% CAGR, with spend totalling US\$21 billion – an overall increase on the previous five year period of 26%. Despite delays, such as to the seventh train in the Bonny Island project, Engie's Cameroon LNG project and the Ethiopia – Djibouti LNG project will account for the majority of expenditure in the near-term. The significant growth in CAPEX seen by the end of the forecast period is as a result of the commencement of construction activity on the proposed Afungi LNG Train 1 and 2. This project is expected to contribute a total of 12 million tpy of liquefaction capacity when completed. However, despite progress made, with FEED studies already completed, the absence of infrastructure, lack of skilled personnel and regulatory uncertainties might cause delays to the



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development of this project. The low price environment continues to affect the commercial viability of LNG projects worldwide and Africa is not an exception. Price uncertainty will continue to cause delays to FIDs, as companies attempt to redesign and re-engineer development concepts. In the case of the Afungi LNG project, DW expects it to be in operation by 2021.

There are limited opportunities for the development of import facilities in Africa. However, there are promising signs for the development of Morocco's LNG import terminal near EL Jadida. The facility is expected to start operation in 2020. The country depends heavily on imports to meet its energy requirements.

Beyond the forecast period, there are 16 planned expansion projects and 12 proposed new projects, which are expected to add 143.4 million tpy in capacity for the region. New liquefaction

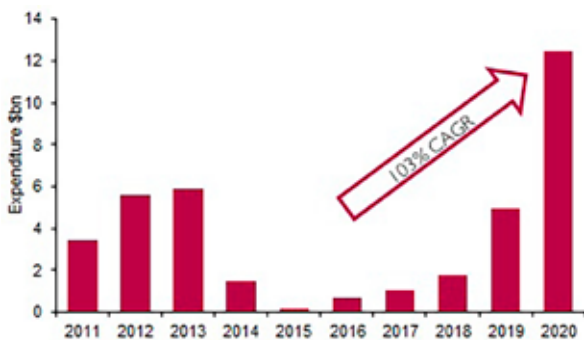
developments will primarily occur in Equatorial Guinea, Nigeria, Libya, Mozambique and Tanzania.

East Africa is poised to become the LNG hub for Africa. However, there are still boundless opportunities in West Africa. Nigeria ranks in the top 10 of global gas reserves, yet the majority of these remain untapped. Undoubtedly, there are a number of challenges, such as security uncertainties in the Niger Delta, impeding development. However, some positive steps have been taken to improve security. Daman Shipyard, for instance, has delivered four ballistic-protected security patrol vessels to provide escort services for LNG carriers calling in and out of Nigeria's Bonny LNG terminal.

## Conclusion

The past 18 months have been difficult for the LNG industry. A number of capital-intensive projects failed to pass the economic break-even point. Furthermore, in recent years, pricing has been challenged: US gas production from thousands of unconventional wells drilled in shale basins has led to a precipitous drop in LNG spot prices due to oversupply.

Despite near-term concerns, natural gas will play an increasingly important role in meeting the world's energy demand over the long-term. Significant gas reserves discovered in the East African gas basin will support the development and expansion of LNG facilities in Africa. Additionally, with the COP21 Paris agreement aiming to limit global temperature increase to 1.5°C, investment in further LNG projects may become inevitable. Gas is likely to act as a bridge fuel to viable sources of renewable energy. **LNG**



**Figure 3.** LNG expenditure 2011 – 2020 – Africa (source: DW, World LNG Market Forecast).



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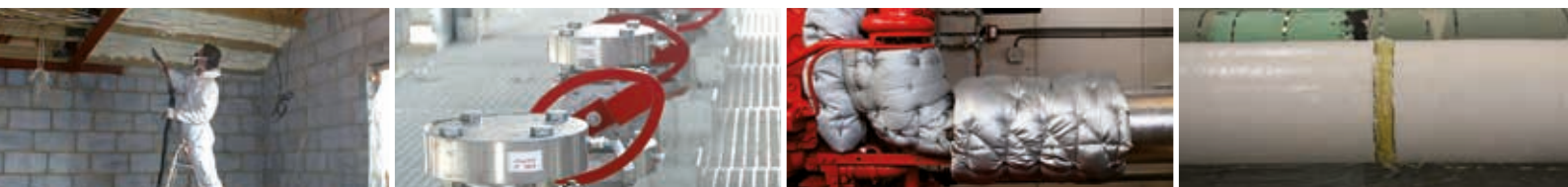
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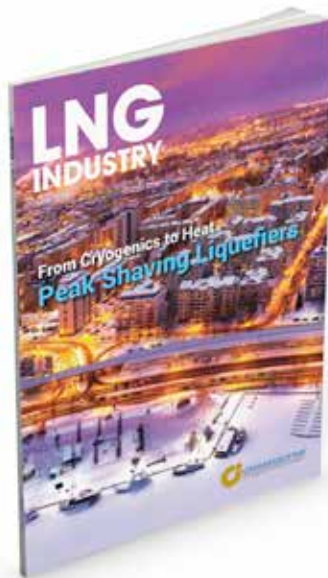


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