

## U.S. shale industry in 2018 may “finally turn a profit”

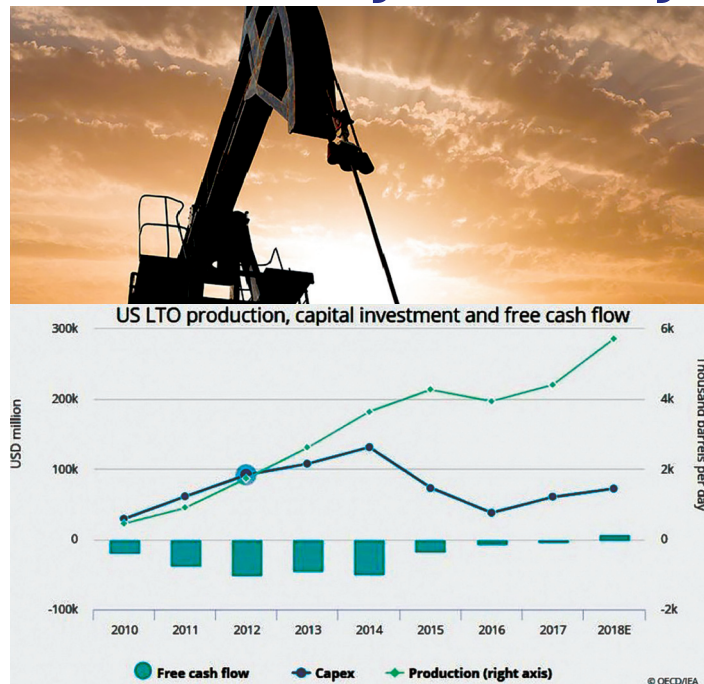
Financing models of the U.S. shale oil and gas industry – often small wildcatters – has for long been characterised by negative free cash flow as expectations of rising production and cost improvements led to continuous overspending in the sector. Over the last few months, however, IEA analysts have noticed a “notable improvement in financial condition,” though the overall health of the industry remains fragile.

“Several companies expect positive free cash flow based on an assumed oil price well below the levels seen so far in 2018 and there are clear indications that bond markets and banks are taking a more positive attitude to the sector,” said IEA senior programme officer Alessandro Blasi and IEA energy investment analyst Yoko Nobuoka.

Assessing U.S. shale drilling since its onset in 2019, the IEA sees the whole industry to “finally” become profitable this year, largely thanks to a 60% increase in investment in 2017 and, based on company plans, an estimated 20%

increase in 2018. Production is projected to grow by a record 1.3 mb/d to over 5.7 mb/d this year. Analysts stressed “this result is all the more impressive given the context of rising investment.”

Structural changes, notably the recent \$9.5 billion Concho-RSP Permian merger and rising participation of oil majors is likely to bring significant economies of scale and accelerate technology developments, including through digitalization. “Larger companies generally have a more robust financial structure and rely less on external sources of financing, so their shale investment will be less



vulnerable to future downswings in oil prices and financial conditions,” analysts said.

Risks for shale independents come from rising interest rates although the IEA says the actual impact may be small. “Most companies are highly leveraged,

benefiting from the ample availability of low-cost bond finance. However, given the high depletion rate, the time horizon of shale projects is so low that the discount rate has only a minor impact on the net present value of a given project,” they say.

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## PetroChina mulls suspending US LNG purchases this winter

Dealing a blow to US LNG aspirations, PetroChina considers suspending its US LNG purchases for delivery this winter. Location swaps of cargoes might help sort matter, with Japan and South Korea expected to step up imports of American LNG in order to sell some cargoes onward to Chinese buyers.

The US-Chinese trade war intensifies just when Sabine Pass Train 5, Corpus Christi Train 1 and Elba Island’s first micro units are slated to begin production. Energy Aspects anticipates China might well cut its US imports down to zero, but the location swap of LNG cargoes between Japan, Korea and China will cushion the impact of Chinese tariffs on the demand for US LNG.

### Destination swaps in the making

JERA, Japan’s largest LNG buyer, has boosted its trading capabilities by entering an LNG optimization and



trading joint venture with EDF of France. Though Japan does offtake substantial volumes of US gas, it takes much more from Australia under contracts with a fixed destination clause.

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Rising interest rates often coincide with tighter lending conditions, which may make it harder for companies to service their debts and refinance their operations. But this risk can be managed through asset sales to less-capital-constrained companies, such as the majors, and increased reliance on equity raising through IPOs and private equity. Cost of repaying debt, or interest expenses, are a growing burden for U.S. shale producers and had impeded many of them from generating profits sustainably. But for the first time, the overall amount of interest expenses paid by shale companies declined in 2017.

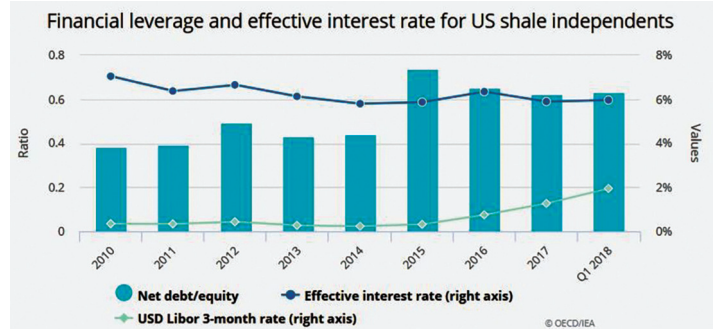
"While US shale companies remain far more leveraged (measured by the net debt/equity ratio) than traditional operators, leverage is falling from its peak in 2015 and the average interest rate paid by shale companies – currently around 6% – has been broadly stable in recent years despite rising interest rates generally since the end of 2015, though they still pay more than conventional oil producers," analysts said, concluding that "improving financial conditions mean that shale companies are able to borrow more cheaply than before."

### Passing through choppy waters

The U.S. shale industry has lived through challenging times. A consolidation phase in 2017 followed a gradual recovery in oil prices since mid-2016, amid OPEC's production cuts, had reignited confidence in the U.S. shale gas sector after a period marked by the survival of the fittest in 2015-16. At time, a price collapse caused nearly 100 bankruptcies which dried up funding from the reserve base lending structure as the value of proved reserves for collateral shrank with lower oil prices. Private equity firms stepped in the void.

Technology advances, huge efficiency gains and cost reductions, and an upward revision of the shale resource base in 2107 triggered an increase of 60% in investment last year. At the same time, the industry proved that its upstream cost structure had been re-based. It managed to offset inflationary pressures coming from overheating of the supply chain, and further cut overall costs per barrel produced.

Still, the shale sector continued to slightly over-spend the cash flow generated from its operations, with 2017 cumulative free cash flow remaining overall negative.



"Asset sales once again [like in 2010-14] became the main source of financing operations, with most transactions occurring between US independent companies. Asset sales involved mainly acreage rather than whole companies, as companies sought to do relatively small deals as a way of making gains in operational efficiency," analysts explained.

Confidence in the sector, traditionally dominated by private investors and small companies, received a boost when large US oil companies said they were intending to make substantial investments.

### Overspending in the start-up phase

In the 2010-14 period, technology developments and high and stable oil prices triggered a massive investment wave in the US shale sector. Investment more than quadrupled, leading to an eight-

fold increase in shale oil production, from 0.44 million barrels per day (mb/d) to over 3.6 mb/d - the fastest growth in oil production in a single country since the development of Saudi Arabia's super-giant oilfields in the 1960s.

The growth, however, came with a huge bill. The sector as a whole generated cumulative negative free cash flow of over \$200 billion over those five years, with companies relying on debt financing and receipts from the sale of non-core assets. Overzealous companies also tapped a reserve base lending structure - a bank-syndicated revolving credit facility secured by the companies' oil and gas reserves as collateral. This structure was used heavily by small and medium-sized companies with non-investment credit rating that did not have as easy access to the corporate bond market.

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But pressure is mounting from Japanese buyers to introduce more flexibility, so Energy Aspects is convinced "the market should have plenty of resources to facilitate a destination swap."

### Tariffs hamper 2nd wave of US LNG projects

For now, tariffs are likely to leave

demand for US LNG unchanged but these tariffs will make Financial Investment Decisions (FIDs) harder to be forthcoming for the second wave of American liquefaction projects.

"Even the threat of tariffs will likely discourage Chinese buyers from signing up for long-term volumes with US exporters," analysts warn. With China set to become the unrivalled source of much of the future global demand growth, the threat of tariffs is seen as "a serious headwind for most US LNG projects that have yet to take an FID."

### Kogas tenders for 12 winter cargoes

The lingering trade war between China and the U.S. adds tension to

an already stretched market. The prolonged heatwave in Asia is giving several buyers cause for concern about their tank storage levels heading into the winter. Eager to fill up storage, Kogas has just announced a tender for another 12 winter cargoes over October to February 2019.

Kogas' tender comes partly in response to tax reform proposals that are supportive to natural gas. The government in Seoul is taking steps to increase the tax burden on thermal coal by 28% from April 1, 2019, assuming the bill gets parliamentary approval.

### China used to import 1/6 of US LNG output

China's shift to cleaner-burning fuels in the power sector has in-

creased the country's gas demand and turned it into one of the world's largest importer of American shale gas. US LNG exports in 2017 averaged 1.9 billion cubic feet per day, according to EIA data, and of that amount, 15% went to China, making it the third-largest importer of U.S. LNG behind Mexico and South Korea.

Rapid economic growth has propelled up China's energy hunger and in recent years the Asian power house also emerged as one of the world's largest importers of U.S. crude oil, propane and petrochemicals. In February 2018, China received more American oil than any other destination. Nearly all of these crude oil exports were sent from the U.S. Gulf Coast region.

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## Mexico offtakes more US LNG amid limp demand from Brazil

One-in-five LNG cargoes setting sail from Sabine Pass are heading to Mexico this year while demand from Argentina and Brazil remains sluggish. Mexico imported 29 cargoes from the US in H1-2018, according to data from the U.S. Department of Energy (DoE).

Shipments of U.S. shale gas liquefied and exported from February 2016 through June 2018 were mostly headed for Mexico, South Korea, China or Japan. A total of 80 cargoes, carrying a volume of over 273 billion cubic feet (Bcf) of liquefied natural gas was exported to Mexico, which made up 19.8% of total U.S. LNG exports.

Second in line is South Korea, with 73 cargoes received carrying a total of 250 Bcf which amounts to 18.1% of total US LNG exports. China and Japan come in third and fourth, with 54 and 31 cargoes received, respectively.

Mexico's regas terminals include:

- Costa Azul LNG 14 miles (23 km) north of Ensenada, Mexico, Sempra Energy, opened May 2008, first one on West Coast of North America.
- Altamira LNG near Tampico, Mexico, Shell, opened August 2006
- Manzanillo LNG in Manzanillo, Colima, Mexico, Mitsui + Korea Gas + Samsung, opened 2011

As for prices, Mexico tends to get better deals than Japan. The tanker BW Pavilion Leeara, shipping on behalf of GAIL Global, has

set sail from Dominion Energy's Cove Point LNG terminal on June 19, 2018 with a cargo of 3,240,033 million cubic feet of natural gas at price at export point of \$6.59/MMBtu. In contrast, the LNG Jurojin tanker, was carrying 2,525,553 Mcf of gas to Japan from Cove Point to Japan at a price at export point of \$8.16/MMBtu.

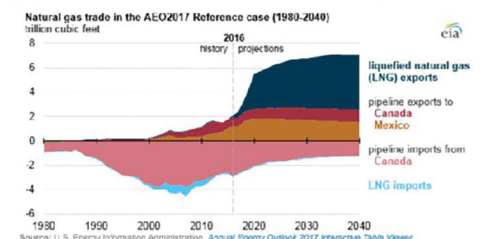
### Brazil turns to Bolivian pipeline gas

Though shipping costs to South America are significantly lower than to far-flung markets in East Asia, countries like Brazil and Argentina have reduced their offtake of US LNG as they are turning to Bolivia for more pipeline gas supplies. Brazil imported just 12 cargoes of US LNG from February 2016 through June 2018, while Ar-

gentina has offtaken 16 cargoes over the same period.

The UK, meanwhile, imported three cargoes with a total volume of 9.7 Bcf which brings Britain's percentage of total US LNG exports to 0.7%. Analyst see much upside and, in fact, the UK has often been singled out as 'the market of last resort' for US gas exports, notably in the event of reduced profit margins in Asia – either due to tariffs or policy-related demand reductions as Asian governments start to favour green energy sources. ■

Mexico's LNG regasification capacity



### Shipments of Domestically-Produced LNG Delivered

(Cumulative starting from February 2016 through June 2018)

| Country of Destination | Type of Export | Number of Cargos | Volume (Bcf of Natural Gas) | Percentage of Total U.S. LNG Exports (%) |
|------------------------|----------------|------------------|-----------------------------|------------------------------------------|
| 1. Mexico*             | Vessel         | 80               | 273.1                       | 19.8%                                    |
| 2. South Korea*        | Vessel         | 73               | 250.8                       | 18.1%                                    |
| 3. China               | Vessel         | 54               | 182.6                       | 13.2%                                    |
| 4. Japan               | Vessel         | 31               | 108.7                       | 7.9%                                     |
| 5. Chile*              | Vessel         | 26               | 79.2                        | 5.7%                                     |
| 6. Jordan*             | Vessel         | 20               | 70.3                        | 5.1%                                     |
| 7. India               | Vessel         | 20               | 69.4                        | 5.0%                                     |
| 8. Argentina*          | Vessel         | 16               | 46.9                        | 3.4%                                     |
| 9. Turkey              | Vessel         | 12               | 40.6                        | 2.9%                                     |
| 10. Brazil*            | Vessel         | 12               | 34.5                        | 2.5%                                     |
| 11. Kuwait             | Vessel         | 10               | 33.8                        | 2.4%                                     |
| 12. Spain*             | Vessel         | 11               | 32.3                        | 2.3%                                     |
| 13. Portugal*          | Vessel         | 8                | 26.5                        | 1.9%                                     |

## AES launches integrated LNG-to-power project in Panama

AES Colón – a \$1.15 billion LNG import terminal and adjacent combined-cycle power plant – has just been inaugurated in Panama. The project comprises the first LNG regas terminal in Central America and a CCGT with 381 MW capacity. Start of commercial operation is slated for September 1.

The integrated LNG import and power generation project will help reduce the dependency of Central American countries on oil-fired generation. Fuel oil, a comparatively expensive energy source, is increasingly replaced by cleaner-burning natural gas.

Built at the entrance of the Panama Canal, the AES Colón project includes a CCGT, driven by 6F.03 gas turbines, with a 10-year power purchase agreement, and a 180,000 cbm LNG storage tank and regasification facility, to supply gas to the plant.

The CCGT at the AES Colón regas and power generation venture was built in just 27 months,

and during construction, the project created more than 2500 jobs. Once fully up and running, about 200 jobs will be needed to support the plant's continuous operation.

"The inauguration of AES Colón is a significant step toward diversifying the energy mix in Central America and the Caribbean, introducing cleaner alternatives in Panama and beyond," commented AES President Andrés Gluski. "We expect that the entry of low-cost US LNG will transform the Central American energy sector, much as it has in the Dominican Republic. This facility is the latest example of how innovation is driving a cleaner energy future on a global scale."

AES Corporation is a Fortune 500 company that generates and distributes electrical power. Headquartered in Arlington, Virginia, AES is also exposed to global LNG markets through integrated regasification and power generation such as the one in Colón, Panama.

Venturing into energy storage, AES and Siemens in January 2018 formed a joint venture focusing on lithium-ion powered energy storage. So far, biggest project in Fluence's portfolio is a 100-400

MWh "power center energy storage project" for Southern California Edison at Los Alamitos, California. Other major projects comprise a 40 MW storage facility on behalf of San Diego Gas & Electric, and install six storage projects across Germany that will provide grid stabilization. ■



Render of AES Colón project



# Junker says EU will 'build more LNG import terminals'

Seeking to accommodate U.S. President Donald Trump's demands for greater LNG sales to Europe, the European Commission President Jean-Claude Juncker has said the EU would build more LNG import terminals. However, this does not mean imports will increase as the JKM-TTF spread remained wide enough over the past year for US cargoes to get a higher netback going to Asian than Europe.

Though the European Commission financially supports infrastructure projects that are deemed to be of common interest, policy makers in Brussels have limited powers to push for more U.S. LNG imports. With energy markets liberalised, the Commission has no political influence on energy imports, as the purchasing is done by private companies.



Jean-Claude Juncker

Keen to diversify Europe's energy sources and reduce dependence on Russian pipeline

gas, the Commission has been granting financial support to developers of LNG import terminals, although projects need to have sufficient private sector funds.

Four LNG regas projects with a combined capacity of 9 Mtpa are currently under development in the EUE, and are listed as priority common interest projects: the 2 Mtpa Krk project in Croatia; the 4 Mtpa terminal project in Alexandroupolis in Greece; the 0.5 Mtpa terminal in Gothenburg, Sweden; and a 2.5 Mtpa expansion of the Polish LNG terminal at Swinoujscie.

Energy Aspects cautions, however, that project development is unlikely to accelerate as the utili-

sation of existing European regas terminals remains low, having been around 20% in 2017. "It is simply the case that sufficient regas capacity is not an issue for the EU."

"It is also the case that Europe-based LNG buyers are already interested in buying US LNG, having signed up for over 27 Mtpa of supply from the US projects currently completed or under construction," analysts said.

However, as global gas markets remain tight the price spread between Asia's JKM hub and the Dutch Title Transfer Facility (TTF), the reference price for European gas, is likely to remain wide enough. ■

# South Korea plans tax cuts to boost LNG use for power generation

The Government of South Korea is planning to cut natural gas taxes by 74% and raise taxes on the use of thermal coal for power generation by 27% next year. The move is aimed at reducing the country's heavy reliance on coal for power generation and shift towards cleaner-burning gas, government officials.

Officials in the finance ministry just announced plans to lower taxes on LNG, including consumption and import tax, to Won23 (\$0.02)/kg from Won91.4/kg currently. In contrast, taxes on thermal coal will increase again to Won46/kg from currently Won36/kg. The coal tax was raised from Won30/kg to Won36/kg in April this year.

If the new tax code gets approval from the National Assembly, it will go into effect from 1st April, 2019.

"The tax revisions on LNG and thermal coal are designed to reflect the environmental costs of using the fossil fuel for power production as part of efforts to reduce air pollution," an official from the finance ministry said, adding that

the new tax rates would boost LNG's price competitiveness against coal in power production.

Coal-fired power plants account for 40% of the country's electricity supply, while LNG accounts for less than 20%. Nuclear reactors provide about 30%, with oil and renewable sources, such as hydropower, solar, wind and fuel cell, accounting for the remaining 10%.

The revised tax code is in line with President Moon Jae-In's push for energy transition from nuclear and coal to renewables and LNG. Under the long-term Basic Blueprint for Power Supply released in December last year, the use of coal in the country's power production will fall to 36.1% in 2030, from 45.3% in 2017; LNG would rise to 18.8% in

2030 from 16.9% in 2017; nuclear would decline to 23.9% from 30.3% in 2017; and the share of renewables will account for 20%, compared with 6.7% in 2017. ■

## NEWS NUDGES

### KOGAS in talks for winter LNG cargoes

South Korean state owned Korea Gas Corp (KOGAS) is said to be in talks to buy 12 LNG cargoes for delivery this winter. The company was thought to be still in discussion with sellers and is yet to award the contract, a local source told Reuters.

### Canadian FLNG plan

Wison Offshore and Marine has signed a technical service agreement with Canadian company Western LNG for a new floating project to be developed in British Columbia. Wison will come up with a basic design for the vessel and carry out front-end engineering and design. Western said its development activities are supported by certain funds of the US private equity firm, Apollo Global Management.

### Burkhardt enters cooperation with ExxonMobil

ExxonMobil and Burkhardt Compression have agreed to collaborate on delivering high performance lubricants and technical services for reciprocating compressor systems. The aim is to optimize plant reliability, increase productivity and reduce costs. ■



Kogas LNG import terminal



## US government assures LNG investors on export permits

US LNG export project investors and potential foreign importers of the fuel have been informed by the US government that non-Free Trade Agreement permits are valid for their whole 20-year terms. In a policy statement the Department of Energy (DoE) said these non-FTA permits would never be revoked as long as America believes in capitalism.

With this bold statement, the DoE seeks to disperse concerns about the DOE and its Office of Fossil Energy rescinding non-FTA export authorizations in the future. Analysts said this is a response to suggestions that trade could be affected between the US and other countries by diplomatic jousting on the international stage or by exceptional policies enacted at home that could override the rule of law and constitutional rights that have been tested in Federal courts.

To date, the DOE has issued 29 final long-term authorizations to export LNG and compressed natural gas to non-FTA countries in a cumulative volume totaling 21.35 billion cubic feet per day (Bcf/d) of natural gas, around 7.79 trillion cubic feet per year (Tcf/y). Each of these authorizations has a term of 20 years, with additional time provided for LNG export operations to commence.

The DOE-FE said it had been asked by some parties what potential "developments" in the US LNG market could rise to the level of "such significant consequence as to put the public interest at risk"

such that the DOE would unilaterally rescind one or more non-FTA export authorizations or take other action to protect the public interest.

In this policy statement, DOE-FE affirmed its commitment to all export authorizations issued under the Natural Gas Act, including long-term authorizations approving the export of LNG to non-FTA countries. "The DOE-FE stands firmly behind these factual findings and legal conclusions, many of which have been challenged and upheld in federal court," said the statement in the government's Federal Register. "Authorization holders, as well as any interested stakeholders, thus should have the utmost confidence in the validity of the DOE-FE's LNG export authorizations for the full term of each non-FTA order," it added.

"Indeed, as noted above, DOE has never rescinded a non-FTA export authorization for any reason," it said, except when one US company concerned ended its own business activities. This happened in August 2014 when the authorization to Louisiana LNG Energy LLC



was rescinded due to the company's own prolonged inaction.

The DOE said that "specifically, Louisiana LNG Energy LLC failed to participate in its on-going Federal Energy Regulatory Commission process, such that FERC terminated its pre-filing review" because the company failed to comply with its reporting obligations under the terms of its FTA order for a period of more than 18 months. The proceeding was a highly unusual scenario where all evidence indicated that the company was no longer pursuing its proposed LNG export project and had, in fact, ceased to exist as a commercial operation.

As a matter of law, the DOE

said it preserves its authority to take action to carry out its duties under the Natural Gas Act. However, it does not foresee a scenario where it would rescind one or more non-FTA authorizations. "The United States government takes very seriously the investment-backed expectations of private parties subject to its regulatory jurisdiction," the DOE stressed. There are far-ranging economic investments and natural gas supply commitments associated with these authorizations over their full term. Hence, the DOE emphasized it remains committed to the durability and stability of the export authorizations it has granted. ■

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## FERC approves commissioning of Freeport LNG Train-1

The Federal Energy Regulatory Commission (FERC) has authorized the commissioning of Train 1 and the common area utilities at both the liquefaction and pre-treatment facilities. Freeport's first three Trains are scheduled to enter service sequentially between 2019 and 2020.

The Texas project, situated at Quintana Island some 67 miles south of Houston and led by US energy entrepreneur Michael Smith, is constructing three liquefaction Trains and has filed for FERC approval to build a fourth Train.

The first Train should have begun exports in 2018. However, there were a number of delays, including on the engineering schedule that led to compensation being agreed from the main builders, CB&I of the US and Chiyoda Corp. of Japan. McDermott subsequently completed the takeover of CB&I in May 2018.

There were also delays to the Freeport venture from flooding at a site where equipment was stored during Hurricane Harvey that hit the Houston area in August 2017.

Once the Texas plant starts up its feed-gas requirements will be the equivalent of around 2.2 billion cubic feet per day of natural gas. The liquefaction technology



Construction works at Freeport LNG Train 1

being used at Freeport is the Air Products propane-pre-cooled mixed-refrigerant process.

As for LNG offtake, about 13.4 mtpa has been contracted under use-or-pay tolling agreements with a group of mostly customers, including BP, Osaka Gas, Jera Energy, Toshiba and SK E&S LNG. Freeport LNG Marketing announced an additional sales deal in June 2018 with Trafigura's Singapore-based trading

arm for 500,000 tonnes per annum of cargoes.

The FERC approval for Freeport Train-1 comes as Cheniere's Corpus Christi plant in Texas is expected to export its first commissioning cargo by the end of 2018. Additional US capacity into 2019 will also come from the Elba Island plant in Georgia, Cameron LNG in Louisiana as well as the fifth Train at Cheniere's Sabine Pass. ■

## Cheniere about to put feed-gas into Sabine Pass Train-5

Keen to accelerated the commissioning of Train-5 at Sabine Pass LNG, Cheniere Energy has filed a request with the Federal Energy Regulatory Commission (FERC) for permission to inject feed gas into the new liquefaction train "at the earliest time possible, but no later than September 6" so that it can remain on schedule.

FERC in April approved a Cheniere request to introduce feed-gas to commission gas turbine generators at Sabine Pass, activities associated with early phases of the commissioning plan. Once operational, Train-5 will take the total output of the Sabine Pass facility to 22.5 mtpa.

The Cheniere plant in Louisiana is the only export facility currently on stream on the US Gulf Coast and has exported cargoes to almost 30 nations since its February 2016 started-up of Train 1. It is currently exporting around 20 car-

goes per month from the four Trains in operation, while a sixth Train is planned.

The Louisiana facility has already exported more than 80 cargoes to Mexico during its first two

years on stream, while the other main recipients have been South Korea with 73 cargoes, China 54 cargoes and Japan 31 shipments delivered since 2016 to the end of June. ■



Sabine Pass Liquefaction Trains 1-6 Artist Rendering

## Pieridae posts loss in Q2 earnings

Pieridae Energy, the developer of the Goldboro LNG export project in the Canadian Atlantic Coast province of Nova Scotia, has posted widening second-quarter losses as it progresses with the venture that includes selling cargoes to German utility Uniper.

The second-quarter loss amounted to C\$2.71 million (US\$2.09M) compared with C\$1.57M in the year-ago quarter. For the first half the losses came in at \$5.65M versus C\$3.63M. Pieridae's total assets at the end of the second quarter amounted to C\$70.59M versus C\$74.04M in the same quarter of 2017.

The Calgary-based company said it had embarked on a strategy to consolidate natural gas reserves in key natural gas basins to develop new international markets for Canadian and US natural gas. "Pieridae Energy will continue to seek to build a long-term portfolio of natural gas to supply the Goldboro LNG Project," it said, noting that owning natural gas reserves is important to provide feed-gas for the Nova Scotia plant at Goldboro to produce 10 mtpa.

Pieridae has signed a 20-year supply agreement with Uniper for 5 MTPA of its production and is expecting German help with underwriting project financing. The company is listed on Toronto's Venture Exchange and has over 50.54 million shares outstanding. ■



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## TransCanada places in service key Mexican gas pipeline

TransCanada, a major North American pipeline operator, has placed into service the Topolobampo Pipeline at a cost of \$1.2 billion. Spanning over a distance of 348 miles (560km), the pipeline will provide export capacity of 670 million cubic feet of natural gas per day (MMcfd) from Texas to the Mexican states of Chihuahua and Sinaloa. Mexico is importing U.S. shale gas to cover rising demand from its power sector.

Mexico's energy market liberalization spurred investment in upstream and particularly in the power generation sector, with Mexican power plant operators keen to import attractively priced U.S. shale gas either via LNG shipment or via pipelines.

Robert Jones, president of TransCanada Mexico said: "We are developing the infrastructure to feed new power plants and convert existing fuel oil and diesel power plants, thereby reducing both the cost of electricity and greenhouse-gas emissions."

Topolobampo interconnects with TransCanada's Mazatlán Pipeline to create the El Encino-Mazatlán system that adds more than 870km of transmission infrastructure used to provide gas to power plants, industry and city-gas markets in northwestern Mexico. "The completion of the Topolobampo and Mazatlán

pipeline system is an important milestone for TransCanada as we continue to expand our portfolio to deliver natural gas to serve Mexico's electric generation needs," said Robert Jones, president of TransCanada Mexico.

### Construction challenges

Construction of the Topolobampo Pipeline presented some of demanding challenges, given the geography along the route, including crossing the Tarahumara mountain range near the Copper Canyon in the state of Chihuahua. To that end, TransCanada used a raised bore to cross the extreme steep cliff faces and air cranes for transporting pipes to remote locations along the route.



Over the course of construction, the project employed nearly 3,500 workers. TransCanada also worked closely with landowners and local officials, including federal government-led Indigenous consultations with impacted communities.

TransCanada's existing gas pipeline infrastructure in Mexico, in operation or under construction, covers more than 3,190 kilometres and has a transport capacity of 7.1 billion cubic feet per day. These infrastructure assets have an estimated investment volume of US\$5.6 billion. ■

## Permian gas prices fall sharply amid growing production

The spread in natural gas prices between the Permian Basin, as priced at the Waha Hub in western Texas, and the U.S. national benchmark Henry Hub in Louisiana has grown considerably. Prices at Waha are now nearly \$1/MMBtu lower than Henry hub due to growing production and pipeline constraints that limited the onward transport of the rising gas supply from the Permian Basin.

As Permian Basin oil production grows, producers must find outlets for the associated natural gas. Once pipeline capacity is fully used, choices are limited, so the widening price differential between Waha and Henry Hub indicates pipeline capacity is already somewhat constrained.

Based on estimates in EIA's most recent Drilling Productivity Report, gas production in the Permian Basin averaged 10.4 billion cubic feet per day (Bcf/d) in June

2018, which was 2.1 Bcf/d more than in June 2017. Much of this increase in production is associated natural gas, produced as a byproduct of rising output from oil-directed rigs. Crude oil production in the Permian Basin averaged 3.3 million barrels per day (b/d) in June 2018, up 0.9 million b/d year-on-year.

### Gas flaring allowed for limited time

In Texas and New Mexico, shale oil

producers may flare or vent natural gas from wells during drilling and immediately after completion but only for a limited amount of time. Thereafter, producers can only flare natural gas after receiving exemptions from a state agency.

"If natural gas production continues to grow, and natural gas prices continue to fall, some producers in the area may cease oil production to avoid producing associated natural gas," EIA analysts cautioned.

## Engineering for C.Christi Train-3 67.8% complete

Cheniere Energy is working towards having Corpus Christi liquefaction Trains 1 and 2 substantially completed in the first half of 2019, and Train-2 in the second half of next year. Engineering is still ongoing at Train-3 which is 67.8% complete, according to a FERC filing.

In its monthly progress report to the U.S. energy regulator, Cheniere noted Stage-1 (Trains 1 and 2) engineering and procurement are now 100% complete; subcontract and direct hire construction work are 78.2% and 80.7% complete, respectively; and overall project completion for Stage 1 is 91.2%.

Construction has turned 202 systems over to startup through the end of July, the report noted. At this rate of progress, Train 1 is projected to achieve substantial completion in the first half of 2019.

The second state, meaning engineering for Train 3, is 67.8% complete and procurement is 48.1% ready, while subcontract and direct hire construction work are 3.9% and 3.5% complete, respectively. In July and August work continued on Train 3 foundations, columns, and underground pipe installation.

Overall project completion for Train 3 is 30.1%, with Cheniere saying it anticipates achieving substantial completion in the second half of 2019. ■

### New pipelines to Mexico and the U.S. Gulf Coast

To monetize the rising volumes of associated gas production, two pipelines - Comanche Trail and Trans-Pecos - were completed in 2017 to export Permian gas to Mexico. Although these pipelines have a combined takeaway capacity of 2.6 Bcf/d, they are not expected to see significant flows until late 2018 or early 2019 when downstream pipeline infrastructure in Mexico enters service. ■



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# Investment in gas to overtake oil in mid-2030s

Nearly two-thirds of oil and gas sector leaders, surveyed by the Norwegian classification society DNV GL, have increased spending on gas projects in 2018; hence natural gas is expected to overtake oil as the world's primary energy source in the mid-2030s. Thereafter, the energy transition will enter its final phase-out of fossil fuels, with hydrogen and renewables set to gain momentum.

The latest DNV GL Energy Transition Outlook, launched today at the World Gas Conference in Washington, DC, singles out the global energy transition as the primary driver for investment in natural gas and LNG projects this year. Investment in gas upstream, mid-stream and power plant projects will accelerate in the early-2020s as major oil companies decarbonize their business portfolios.

The pace with which industry players are moving, however, differs by region: Just a third of survey respondents in North America (33%) say that their company is actively preparing for the shift to a lower carbon energy mix this year, compared to more than half (51%)

in Middle East and North Africa.

## Peak gas by mid 2030s

Natural gas is forecast to be the largest source of energy from around 2035 but demand will peak soon afterwards - well after the use of each of the other fossil fuels has gone into long-term decline.

"With reliable supply and affordable cost we expect solid growth of gas for the next 15 years. After peaking in the mid-2030s, gas use in the power sector is expected to decline from around 2040, by when wind and solar will dominate power supply," said Sverre Alvik, programme director for DNV GL's Energy



Transition Outlook.

In Europe, gas demand has already peaked in 2010, and will do so by 2020 in North America; but in key regions such as South-East Asia and China it will only peak in the mid-2030s.

Citizens in Asia's growing middle class are aware of how dis-

eases and death are caused by serious air pollution. According to KOGAS research engineer Kidong Kim, this has "increased people's resistance to coal thermal power plants and diesel-powered transport, including ships. We expect natural gas or LNG to replace these energy sources."

# Pre-FID planning, reduced scope makes upstream projects hit the mark

Improved execution of oil & gas upstream projects is now being achieved thanks to greater corporate discipline, more pre-FID planning and reduced project scope. This allows project delivery to finally hit the mark after a period of dismal performance on project returns, a new Wood Mackenzie report shows.

The oil & gas industry used to have a reputation for always delivering upstream projects behind schedule and over budget. But the latest trend to execute 'capital projects' has helped the industry adapt to lower prices.

Six key factors, in most recent cases surveyed by Wood Mackenzie, help enhance project execution: Spare capacity through the supply chain, leading to better performance and lower costs. Service sector collaboration and alignment on contracts, as well as improved project management. Tougher screening, more stringent hurdle rate and better pre-sanctioning of projects before taking a Financial Investment Decision (FID); and finally, reduced scope, meaning more tie-backs and brownfield projects that use existing infrastructure, less greenfield.

## Staggering scale of underperformance

The global economic downturn had forced companies to critically evaluate and improve how they manage their major capital investments. According to Wood Mackenzie figures, the top 15 project blowouts of the last decade were a cumulative US\$80 billion over budget.

"The scale of underperformance was staggering," said Angus Rodger, research director, Wood Mackenzie. "Surveying the last decade of project delivery, the average development started-up six months later than planned and US\$700 million over budget. That is a huge amount of value destruction."

## Cost overruns mostly in Arctic and Caspian region

Still, there is a growing list of mid-to large projects that have been

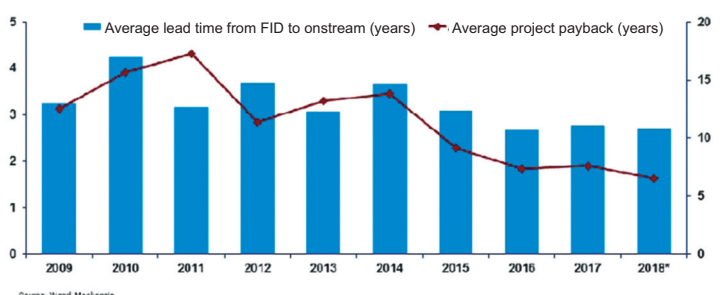
delivered on target over the past 12 months. This includes areas previously "notorious for cost blowouts," as Rodger put it, such as the Arctic and Caspian.

Examples of improved execution include deepwater (BP's West Nile Delta and Atoll, Eni's Zohr and Cape Three Points), LNG (Novatek's Yamal), shallow-water gas (BP's Shah Deniz Phase 2) and subsea tie-

backs such as Woodside's Persephone and Wintershall's Maria.

Most recently, Shell brought onstream its deepwater Gulf of Mexico Kaikias field nearly one year ahead of schedule. "Not only a quick turnaround," he commented, "it epitomises how the deepwater sector has - for now - transitioned to a simpler, lower-cost business model."

## Major project delivery becoming more efficient





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