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# Insight

December 2018

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## Insight

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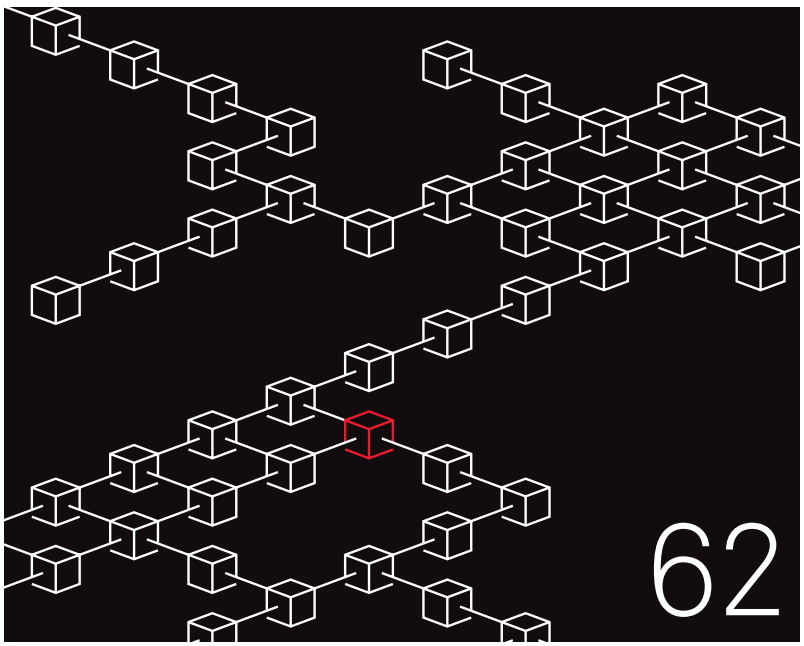

# Editor's Note

**Mark Pengelly**

Editor

In an increasingly fast-paced industry, the end of the year still offers time for reflection. What do this year's events mean for commodities markets, and what will be the key themes to watch in 2019? In our lead article, Martin Fraenkel, president of S&P Global Platts, seeks to provide some answers (see page 8).

Perhaps unsurprisingly, several of those answers are closely related to politics – a force that has reasserted itself dramatically in commodities markets this year.

Shortly before Insight went to press, viewers across the world were closely watching the results of November's US midterm elections – the first major electoral test for the administration of President Donald Trump. The results amounted to a score-draw, with opposition Democrats forming a majority in the US House of Representatives and Republicans retaining control of the Senate.

Beyond the headline numbers, voters in some US states made decisions on a number of significant ballot measures, including proposals to limit oil and gas exploration, levy carbon and gasoline taxes and deregulate power markets. Our analysis of some of the most interesting results starts on page 18.

The resurgence of politics isn't limited to the US. As a direct result of political intervention, European carbon prices have soared in the past 12 months – a spike that will have lasting effects on the energy sector and carbon-intensive industries (see page 24). And on page 32, Stuart Elliott notes that economics now often takes a back-seat to politics when it comes to decisions regarding Europe's gas market. He concludes it may well take a change in global politics before economics resumes its role as the main driver of energy markets.

Another theme looming large for 2019 is technology. This issue is replete with examples of how technology is changing the business – from the most efficient, cutting-edge LNG vessels to the strategic opportunity of geospatial data, the development of power-to-gas technology and small-scale nuclear generation. This wouldn't be complete without a mention of electric vehicles; the degree to which lithium-ion battery technology is set to affect the worlds of energy, transport and metals is touched upon by S&P Global Platts Analytics on page 54.

Then there's blockchain. Even blockchain's biggest cheerleaders admit the technology was somewhat overhyped in its early years. However, its promise is real – as can be seen from the way it is increasingly being put to work across commodities. By bringing greater transparency, ease and speed to processes previously dominated by phones and paper trails, blockchain has the power to lower barriers to entry and forge more efficient markets (see page 62).

This issue also contains details of the winners of this year's S&P Global Platts Global Energy Awards. This includes our inaugural Energy Transition Award, developed to recognize the leadership of power companies in the transition to a low-carbon economy. The finalists for this category were determined by our colleagues at Trucost, part of S&P Global, and you can discover more about the rationale behind their decision on page 91.

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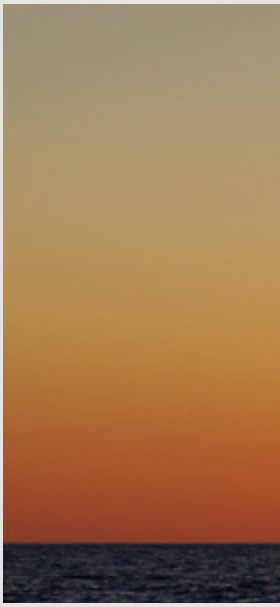
# Five commodity themes for 2019

As the curtain closes on 2018, what will be the five themes to watch in energy and commodity markets during 2019? Martin Fraenkel delivers his verdict



After a year of seismic shifts in policy, geopolitics and trade, 2019 could be eventful. The landscape for commodity markets is also changing rapidly. During the last few years, the fundamentals of supply and demand were the main drivers for commodity markets. However, as was the case during the 1970s, geopolitics is now increasingly influencing decision-making across all parts of the resources industry from the well head to the trading floor.

Although trade flows remain an important driver for commodity markets to focus on, we see factors such as technology disruption, policy change and trade barriers increasingly influencing prices.

Despite the world's growing demand for oil, which is expected to average 100 million b/d for the first time ever, concerns over climate change and the energy transition in mobility will remain in the background. Looking ahead, heightened levels of risk, new disruptive technologies and political uncertainty could make 2019 a year when the unpredictable becomes the norm.

## Geopolitical risk: the only certainty is uncertainty

Geopolitical tensions in some of the world's major resource-producing regions could intensify in 2019. The Middle East will be at the forefront of these risks as US sanctions bite into Iran's crude exports.

Saudi Arabia – the region's largest producer of oil and its biggest economy – could also emerge as a concern if social reforms backfire. The actions of Riyadh's political elite have come under increasing international scrutiny. How the kingdom reacts to these challenges could be a major factor driving oil prices in 2019 and beyond.

Meanwhile, traders will continue to closely monitor the Middle East's key oil export routes through the Strait of Hormuz and Red Sea for any potential disruptions.

Russia's evolving relationship with the US could be another major geopolitical narrative in 2019. The world's largest producer of energy and commodities has increasingly clashed with the biggest consumer of crude in a way not seen since the Cold War. This bilateral relationship is a key driver for commodity markets. Moscow is increasingly encroaching on traditional areas of US influence in the Middle East. The Kremlin also faces the prospects of tightening sanctions and ongoing condemnation.

Of course, commodities markets could also shrug off all of these concerns in 2019. Greater co-operation between OPEC and partners outside the producer group led by Russia is a source of optimism. The grouping – which controls 45% of global oil supply – has shown discipline in reducing the global stocks overhang and looks increasingly aligned on policy despite political tensions. Maintaining its discipline will be crucial to supporting prices in 2019, especially in such a fraught geopolitical environment.

Offsetting these geopolitical concerns is the continued strong performance of North American shale producers. The US is currently producing 11 million b/d and output is forecast to climb even higher, ensuring markets are well supplied in the event of shocks.

## Trade wars: US and China lock horns

Deteriorating trade relations between the world's two largest economies has already had a visible impact on energy flows. Oil prices have been dampened due to concerns of a slowdown in demand, but LNG markets could also face significant long-term headwinds from their ongoing trade war.

China is Asia's biggest oil consumer. Before trade tensions escalated, crude flows from the US to China had almost tripled through both term contracts and spot market purchases. In June, US exports to China hit 450,000 b/d, accounting for 5% of the country's total crude import bill. However, US shipments have been falling since June on escalating trade tensions, with more US crude being diverted to other customers in Asia. S&P Global Platts sees consumers in Southeast Asia buying more US crude and this trend could become more visible in 2019.

Simultaneously, Chinese refiners are actively looking to diversify their spot exposure by securing volumes from wide-ranging destinations, including Europe, Africa, Canada and Latin America. Meanwhile, Beijing imposed a 10% tariff on US LNG exports in September. Chinese customers are looking to the Middle East, Nigeria, Southeast Asia and Australia for alternative LNG supplies.

Nevertheless, China's demand for LNG will continue to grow and losing Asia's biggest consumer as a buyer would be a blow for US producers in 2019. If America's trade war with China intensifies then disruptions already being felt in oil and LNG markets will increasingly become apparent across the full spectrum of commodities.

## Protectionism: disruptive forces in metal markets

Protectionist policies are having a significant impact on metals markets and this trend is set to continue in 2019. One example is the US administration's decision to impose 10% tariff on aluminum imports, which hit the domestic market by pushing up prices. Sanctions imposed on Rusal – the world's largest aluminum producer – drove prices up further.

Trade policy aside, there have been some US initiatives which have boosted metals demand. Tax and regulatory reforms have energized the US manufacturing base to the point where the National Association of Manufacturers' monthly index reached an all-time high in June 2018 of 63.6 points. In October, the NAM's Outlook Survey, which indicates the percentage of small-to-large manufacturers that are upbeat about their own company's outlook, stood at 92.5% — after posting an all-time high of 95.1% in June. It is a robust indicator of US manufacturing's ability to absorb commodity price fluctuations.

## New frontiers: national oil giants eye trading

National oil companies are becoming more involved in traditional trading as direct participants, or joint venture partners, in an effort to boost their profitability.

Middle East-based companies are at the forefront of this emerging trend. Oman Trading International (OTI) was the first regional

player to venture into trading via its joint venture with Vitol and S&P Global Platts now sees it is increasingly active in a range of Asian markets, from oil and refined products to petrochemicals.

Aramco Trading Company (ATC) has opened a Singapore office and voiced intentions to move into crude trading. Iraq's SOMO and Russia's Litasco set up a joint venture last year and it is clear the Baghdad-based oil marketing company is looking at how it can be more active in international trading markets. Abu Dhabi National Oil Company (ADNOC) has created a new trading arm in order to maximize returns on every barrel for its stakeholders.

The landscape for traditional players is also evolving. Various trading regimes and market changes have boosted spot activity and created new opportunities in areas such as LNG.

More changes in the trading industry could materialize in 2019.

## Technology: commodities 2.0

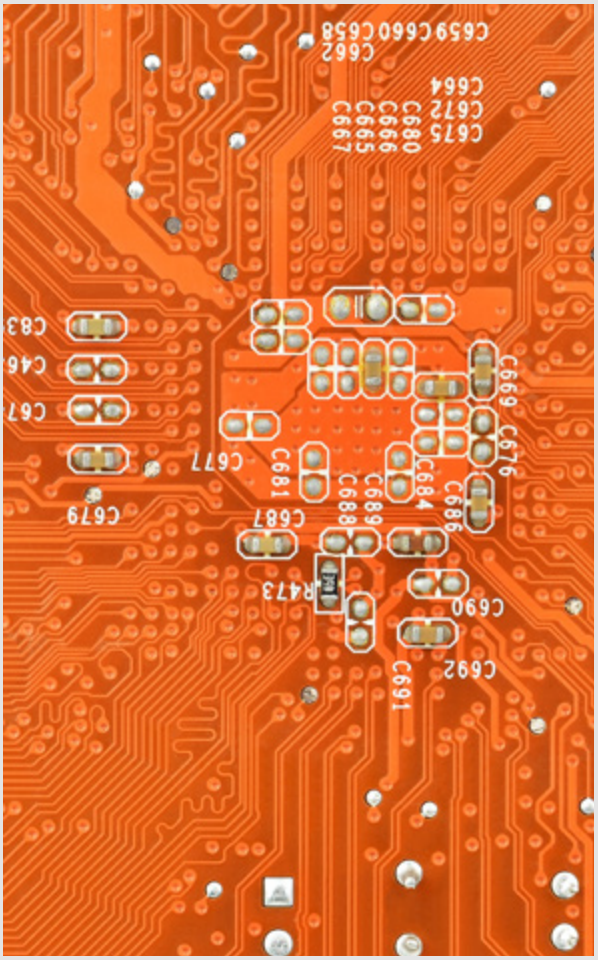
New technology is increasingly bringing efficiencies to all corners of the commodities industry. Blockchain is at the forefront of this trend changing the nature of our markets, where smart contracts are already a reality.

The reconciliation and physical documentation of trade can all now be streamlined securely through an encrypted digital ledger, helping companies to maximize the value of their data and talent. Attendees at the S&P Global Platts Digital Commodities Summit this year saw the seriousness of these efforts to harness the power of blockchain.

Digital processes replacing people, phones and paper trails could significantly reduce trading costs. Blockchain can also reduce the settlement risk and in some instances remove the need for central clearing authorities. Faster know your customer (KYC) processes thanks to more secure, individual and corporate identity management makes it easier to trade with new counterparties. More real-time and interconnected supply chains, with corresponding digital invoicing, shorter payment times and more ways of sharing transaction data may also change the intracompany risk profile and appetite.

Smaller industry players can now benefit from these efficiencies by experiencing fewer barriers to entry, potentially trading without fees, settlement risk, clearing costs, or intensive capital requirements. However, it is still early days for the technology and the pace of its widespread uptake is far from clear.

Data manipulation and interpretation in commodities will also play an increasingly transformative role in 2019. For




decades, successful trading has been focused on nimble operations and scale, but tighter margins have made participants look closer at accessing faster data, instead of operating scale, to gain an advantage.

Fast access to data such as geospatial imagery, smart metering, or better visibility of tankers on water are increasingly giving traders an edge. S&P Global Platts sees data science playing an increasingly core role in multiple decision-making ranging from cross-regional arbitrage to daily stock management. These technologies will increasingly shape our markets in 2019. ■

*Martin Fraenkel is President of S&P Global Platts*

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# Nigeria's power struggles

Nigeria's oil sector is mired in economic stagnation, stalled reforms and a risk of rising militancy. But the appeal of its light sweet crude may yet herald a brighter future, writes Eklavya Gupte

"We are ready to bring it down. It won't drill a barrel of crude," tweeted Mudoch Agbinibo, the leader of the militant group Niger Delta Avengers, which in 2016 brought Africa's largest oil producer to its knees with brazen attacks on the Delta's oil facilities.

The tweet referred to the floating production storage and offloading unit of the 200,000 b/d Egina field, which is due to start up later this year, pushing up Nigeria's oil output by over 10%.

Mudoch's tweet came in February, as the Egina FPSO first reached the shores of Nigeria via a South Korean shipyard. This also happens to be the last time Agbinibo appeared on social media. The Niger Delta Avengers, a group of which little is known, have basically been dormant since then, barring for some apocalyptic threats.

Despite this hibernation by the group, the din in the Delta is gradually growing and the chances are high that the Avengers, along with a handful of other militant groups, will plan attacks on oil infrastructure. The government has so far also pledged to prevent fresh outbreaks of militancy and violence in the Niger Delta. It has found ways to keep the militants quiet through a cluster of promises on money and development, and a shaky amnesty program.

The amnesty program began in 2009 by former President Umaru Musa Yar'Adua was meant to fight militancy in the Niger Delta by offering incentives to young people to give up on oil theft and sabotage. It briefly worked, but critics argue the program has now morphed into a money-for-peace model that is unsustainable. New militants have emerged over the past decade to replace the old ones, and the Delta remains just as fragile.

Nigeria's oil industry can best be described as mercurial. It produces probably the best quality crude in the world, yet this oil has created deep fractures in its society fueling militancy, corruption and mistrust that has thrived in a country beset by economic and regulatory uncertainty.

## 2019 elections

Now, the country faces a fresh challenge as it heads into a volatile presidential campaign season ahead of its February 2019 elections.

Popular export grades like Bonny Light and Forcados have been riddled with pipeline sabotage issues this year, but Nigeria has managed to restore some production after it fell to 30-year lows in 2016. Nigeria's crude and condensates output, which plummeted to 1.1 million b/d in mid-2016 due to renewed militancy in the Delta, has been climbing gradually and averaged just over 2 million b/d in September.

Maintaining production at full capacity of 2.2 million b/d has been a struggle for any government in the past decade, and it isn't going to get any easier. The quandary for President Buhari is that his political rivals have found common cause with militants in undermining Niger Delta security. Most analysts expect disruptions to Nigerian oil output of around 300,000 b/d leading up to the elections.

"While large attacks of oil infrastructure remain unlikely, the volume of oil theft and minor disruption is likely to increase... and may push IOCs to declare force majeure on Nigerian crude streams," consultancy Rapidan Energy said in a recent note.

Nigeria needs to find innovative ways to market its crude to new buyers, particularly countries or regions where oil demand is on the rise, such as China

The attacks are also likely to fan the flames between the Christian south and Muslim north, reinforcing a popular narrative that Buhari is doing more to grow the oil sector in the north rather than in the Delta, which remains the heart of the oil sector. This narrative has been supported by recent announcements by the Nigerian National Petroleum Corporation that it will start oil exploration in the Lake Chad basin, along with plans to build a new refinery near the Niger border.

Despite the oil potential in the north, the region remains dominated by the Boko Haram insurgency, limiting these prospects. Supported by Vice President Yemi Osinbajo and oil minister Emmanuel Kachikwu, Buhari pushed for a 30% increase in amnesty program payments this year, along with a sizable increase to the budget of the Niger Delta ministry – part of a charm offensive to keep militants on side.

In the past two years, President Buhari and his government have found ways to keep the militants quiet through promises of development, money and the amnesty program. But they face a stiffer challenge as the country heads into a volatile presidential campaign season.

## Light and sweet

Despite all the unrest, the appeal of Nigeria's crude, which is light and sweet, and of high quality, could face a brighter future. This crude is largely low in sulfur and yields a generous amount of diesel, jet fuel and gasoline, which are the profit-making products for global refineries.

The Nigerian light sweet barrel – until almost a decade ago, every refiner's most sought after barrel – was one of the biggest casualties of the US shale revolution. US shale oil is extremely similar in quality to light sweet Nigerian crude, and as more and more shale basins were discovered in its own backyard, the US, which used to be the largest buyer of Nigerian crude, did not need any more oil from Africa's largest producer.

But the country's light sweet crude could stage a comeback, as the International Maritime Organization's 0.5% sulfur cap on marine fuels comes into effect in 2020. The regulation is expected to drive demand for lower sulfur products, triggering stronger demand and increasing the profitability of crudes that are low in sulfur.

A big focus for Nigeria's government and oil marketers is to broaden the popularity of Nigerian crude. Currently, the bulk of Nigerian crude goes to Europe and India. Europe's oil demand is largely stagnant and it is awash with so many different types of crudes that it is tough to compete with cheaper, heavy sour varieties. So Nigeria needs to find innovative ways to market its crude to new buyers, particularly countries or regions where oil demand is on the rise, such as China, the world's largest crude oil importer.

The West African country has taken some steps to broaden its customer base, but these are not enough. NNPC's 2018/2020 crude oil term contracts, which came out earlier this year, were handed to more than 60 recipients – the largest list Nigeria has ever allocated. Officials have cited this as a demonstration of NNPC's efforts to broaden its customer base and include more domestic companies, which may help Buhari ahead of the elections.

Many of the winners of the coveted contracts were domestic Nigerian companies that are new to the world of international oil trading. A lot of these firms have no experience in oil trading and will be transferring their allocations to bigger trading companies that have greater familiarity with end-consumer markets. The allocations might mean there is a larger pool of people involved in Nigeria's crude oil term contracts, but it also means the murky oil business, already riddled with corruption, could get messier, especially ahead of the elections.

## Reforms needed

Nigeria's oil sector is in urgent need of a complete overhaul, but this looks unlikely to happen given the current political climate and February elections.

The Petroleum Industry Governance Bill is intended to bring order to the country's oil sector. It seeks to change the way upstream agreements, fiscal terms and production sharing contracts are handled, while splitting NNPC into three different entities: an upstream and downstream company, as well as an independent regulatory commission.

Given the level of corruption in Nigeria, the passage of the PIGB has been looked on as the first step for the country to overhaul its industry and achieve its long-term oil production targets. However, it has been stuck in parliament for more than eight years, held up by political wrangling and objections from foreign oil companies that have said the significantly higher fiscal terms envisaged in recent drafts were unacceptable. Most recently, Buhari withheld his assent of the bill in August and sent it back to the National Assembly for review.

A provision of the PIGB includes curbing the powers of the Nigerian president and oil minister to award lucrative contracts on a discretionary basis and also to run the three new entities to be created from the state-owned NNPC. This is cited as one of the reasons Buhari has stalled the progress of the bill, showing how central oil is in Nigeria's corridors of power. Some steps to address these issues will need to be a priority for the next administration.

Despite these challenges, Nigeria remains one of the key crude oil exporters globally, and the nature of its vast oil and gas reserves means it will continue to be a crucial player in energy markets. ■

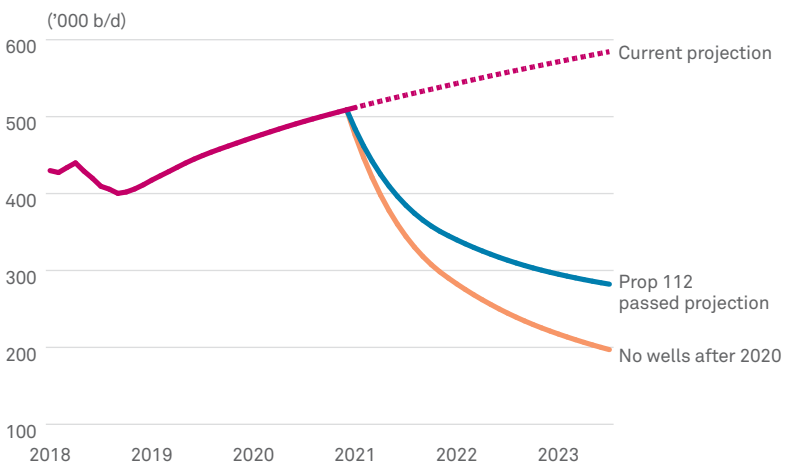
*This article is forthcoming in Oxford Energy Forum, the quarterly journal of the Oxford Institute of Energy Studies*

# What do the midterms mean for energy?

From ballot measures to statehouses, what do the results of November's US midterm elections mean for oil, gas and power markets? Kate Winston and Maya Weber report

On November 6, US voters shied away from key statewide environmental initiatives that would have imposed near-term costs on oil, gas and traditional utility interests. But they backed candidates, including nine new Democratic governors, with aggressive renewable energy and environmental goals. Advocates may now look to states fully under Democratic control, such as Nevada, New Mexico and Colorado, to take quick action on clean energy, since divided government at the federal level lowers prospects for this in Washington.

**Proposition 112 estimated impact to DJ Basin oil production**




Source: S&P Global Platts Analytics

## The defeated

Several green ballot initiatives offered critical test cases, and their defeat could discourage other states from pursuing similar measures. Washington's carbon fee and Colorado's drilling setback were seen as bookending what is politically possible at the moment.

Washington Initiative 1631 would have been the first carbon fee in the US. If passed, it would have set a carbon fee of $15/mt starting in 2020 and boosted costs for oil refineries, gas-fired power plants and other large users of fossil fuels.

Colorado Proposition 112 would have increased oil and gas drilling setbacks on non-federal land from 500 feet to 2,500 feet. The measure, strongly opposed by the oil and gas sector, could have reduced oil production in some basins by more than 50% by 2023.

If the Colorado measure had passed in a state that leans heavily on industry revenue, it could have been copied elsewhere. The failure of the Washington measure in a state with low carbon intensity suggests it could be a heavy lift elsewhere.

"We viewed both states as litmus tests for potential policy contagion," ClearView Energy Partners said in a post-election note. "In Colorado, where proceeds from a fast-growing oil and gas industry fund schools and local governments, voter support for a de facto drilling ban could have pointed towards emulation by other, less-revenue-reliant producer states," the note said.

## Carbon tax

Scott Segal of Bracewell said Washington state has a balance of urban and rural voters, and of conservative and liberal voters. As a result, there were two well-funded sides battling over a fairly aggressive carbon tax. "It in many respects was a test case for the politics of the carbon tax on what I would call neutral ground," he said in a post-election webinar.

But Tom Steyer, founder of the nonprofit NextGen Climate Action, pushed back against the narrative that the failure of the Washington initiative means a carbon fee would be politically infeasible at the national level. "I don't think that for a second because obviously the largest, most populous state in the United States is California and we have a comprehensive plan," Steyer said at a post-election event.

Environmental advocates blamed the defeat of some initiatives on industry spending. Advocates spent $15 million backing the Washington initiative while opponents spent about $30 million to defeat it. Proponents of the Colorado initiative spent $1 million and opponents spent $30 million.

Industry groups countered that some initiatives failed when put to the test by voters. "Where energy bans were on the ballots, many of them failed when it was put to a vote of the people," said Benjamin Marter, communications director for the American Petroleum Institute.

Elsewhere, Alaska voters also shot down Ballot Measure 1, which would have strengthened permitting regulations for any activity that could affect salmon habitats. Oil and gas producers said the rules could delay projects and increase costs, potentially prohibiting developments on the state's North Slope and elsewhere.

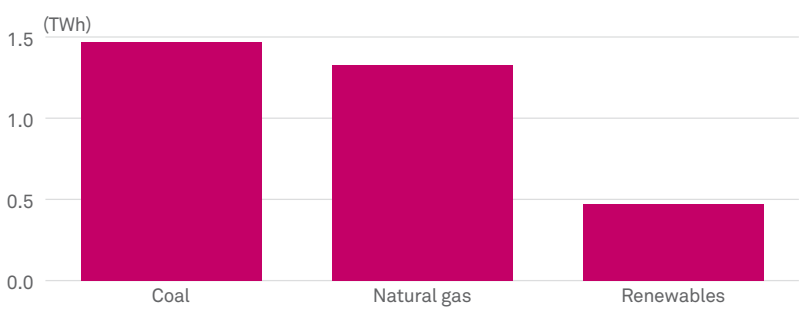
## Renewable gains

While several high-profile ballot initiatives disappointed environmental groups, their policy goals gained ground in governors' mansions. Seven switched to Democratic hands.

The League of Conservation Voters tallied nine new governors who committed to move their states toward 100% clean energy: Tony Evers of Wisconsin, Gretchen Whitmer of Michigan, J.B. Pritzker of Illinois, Janet Mills of Maine, Jared Polis of Colorado, Kate Brown of Oregon, Gavin Newsom of California, Steve Sisolak of Nevada and Ned Lamont of Connecticut.

*Continues on page 22*

**New Mexico electricity generation by source, July 2018**

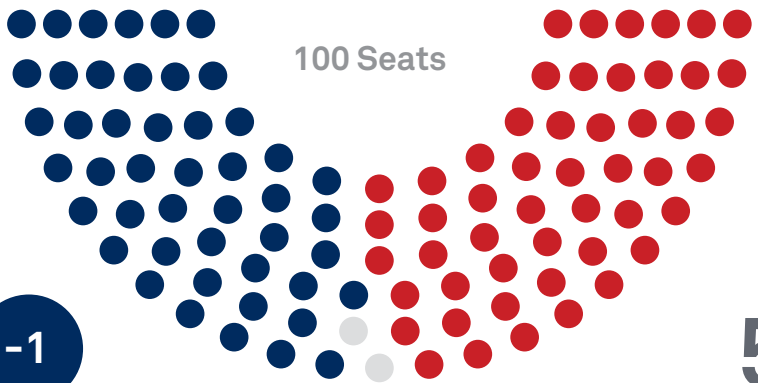



Source: Energy Information Administration

# Midterms 2018: Fractious election yields mixed results for energy

## Control of Congress

### Senate Results




47 -1
Democrat

Undeclared

51 +1
Republican

## Energy ballot measures

ALASKA
**BALLOT MEASURE 1** ☒ 63%
Oil and gas producers in Alaska will not face more onerous permitting requirements for development. The measure was intended to protect salmon habitats.

ARIZONA
**PROPOSITION 127** ☒ 69%
Arizona utilities will not have to supply half of their power from renewable sources by 2030. The 15% by 2025 renewables mandate remains in place.

CALIFORNIA
**PROPOSITION 6** ☒ 56%
Motorists will continue to pay the 12-cent/gallon gasoline tax and 20-cent/gallon diesel tax this measure would have repealed. The proceeds will help fund mass transit and infrastructure projects.

COLORADO
**PROPOSITION 112** ☒ 55%
The oil and gas drilling setback requirement will remain 500 feet, not be extended to 2,500 feet, with this so-called "de facto drilling ban" defeated.

FLORIDA
**AMENDMENT 9** ☑ 69%
With a single amendment, Florida banned both oil and gas drilling in state waters and indoor vaping. There is currently no hydrocarbon production.

MISSOURI
**PROPOSITION D** ☒ 54%
Motorists will not pay 2.5 cents/gallon more gasoline tax each of the next four years with the tax rising to 27 cents/gallon in 2022.

NEVADA
**QUESTION 3** ☒ 67%
Nevada will continue to be served by vertically integrated electric utilities rather than transitioning to a competitive, market-based structure.

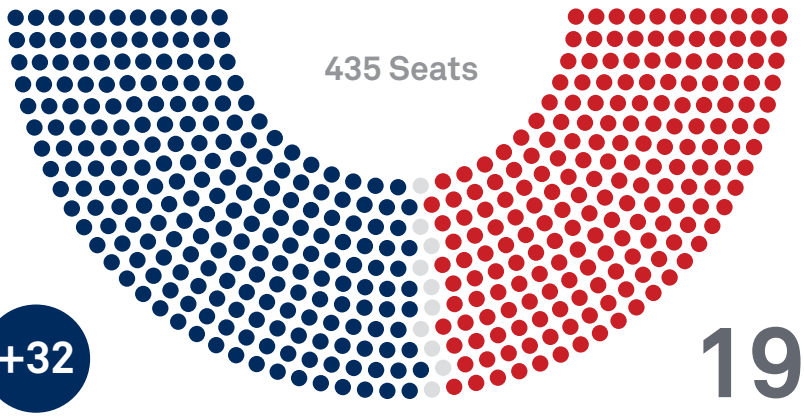
**QUESTION 6** ☑ 59%
Nevada electricity suppliers will be mandated to supply 50% of their electricity from renewables by 2030, requiring the build-out of new solar capacity.

WASHINGTON
**INITIATIVE 1631** ☒ 56%
This first of its kind in the US carbon emissions fee would have increased operating costs for oil refineries, natural gas-fired power plants and other carbon emitters.

Note: Election results as of November 13 at 2pm EST
Source: RealClearPolitics, State Reports, S&P Global Platts

After the dust settled on an unusually contentious US midterm election November 6, Democrats had taken control of the House of Representatives, Republicans had held their control of the Senate, and voters had their say on a plethora of races and ballot measures with significant implications for oil, natural gas and power markets. In California and Missouri, gasoline tax increases were rejected, while Colorado voters rebuffed new limits on oil and gas drilling and Washington voters denied a carbon tax. The election brought mixed results for renewable energy-related initiatives and gubernatorial candidates who backed ambitious clean energy goals.

## House Results




227 +32 Democrat

Undeclared

198 -32 Republican

## Key State Races

### GOVERNOR RACES

COLORADO

52.3% to 44%

GOVERNOR JARED POLIS

**Jared Polis (D) defeats Walker Stapleton (R)**

Polis's election brings promise of 100% renewables by 2040 and more stringent controls on development of public lands.

MICHIGAN

52.8% to 44.3%

GOVERNOR GRETCHEN WHITMER

**Gretchen Whitmer (D) defeats Bill Schuette (R)**

Whitmer has vowed to shut down Enbridge's aging 540,000 b/d Line 5 pipeline, which transports crude oil and NGLs from Canada's oil sands.

NEW MEXICO

56.9% to 43.1%

GOVERNOR MICHELLE LUJAN GRISHAM

**Michelle Lujan Grisham (D) defeats Steve Pearce (R)**

Lujan Grisham is more likely to implement drilling restrictions including methane emissions regulation in the No. 3 top oil-producing state.

NEW YORK

59% to 36.8%

GOVERNOR ANDREW CUOMO

**Andrew Cuomo (D) defeats Marc Molinaro (R)**

Cuomo will continue to make natural gas pipeline permitting more challenging, and the state's now left-leaning Senate could bring life to more aggressive renewables targets.

### US SENATOR RACE

TEXAS

50.9 % to 48.3%

SENATOR TED CRUZ

**Ted Cruz (R) defeats Beto O'Rourke (D)**

Cruz is expected to continue his defense of the oil and gas industry in the US Senate, including opposition of the Renewable Fuel Standard. Texas' production has surged over 40% in the last year.

**"The strong Republican showing in the Senate suggests that a green agenda will face headwinds at the federal level for a while to come, even as Democratic pickups of state-houses suggest that more states will become active in this space."**

**— Roman Kramarchuk, S&P Global Platts Analytics**

*Continued from page 19*

Michelle Lujan Grisham in New Mexico, another Democratic governor pickup, is expected to tighten venting and flaring requirements for oil and gas production, in addition to backing 50% renewables by 2030 and 80% by 2040.

Governor-elect support for clean energy goals overlaps with six states in which Democrats moved from divided control to holding the governorship and both chambers of the state legislature: Colorado, Illinois, Maine, New Mexico, New York and Nevada. The combination increases the likelihood of measures advancing.

That makes a difference in places like Colorado, where Senate Democratic control combined with the election of a governor who has backed 100% renewable energy by 2040 and favors tighter regulation of the oil and gas industry.

The New York state Senate flip to Democratic hands also could give life to more ambitious renewables goals than embraced by Democratic Governor Andrew Cuomo. The push for a higher concentration of renewables "will be baked into the nationwide platform approaching 2020 and beyond" in the Democratic Party, said Rob Rains of Washington Analysis.

Dan Lashof, director of the World Resources Institute–United States, said after the election he sees Colorado, Nevada and New Mexico as poised for quick action on renewable standards. Wisconsin experienced the biggest ideological shift, Lashof said, with Democrat Tony Evers unseating Republican Governor Scott Walker, while Michigan and Illinois governors-elect could strengthen the existing goals on renewables.

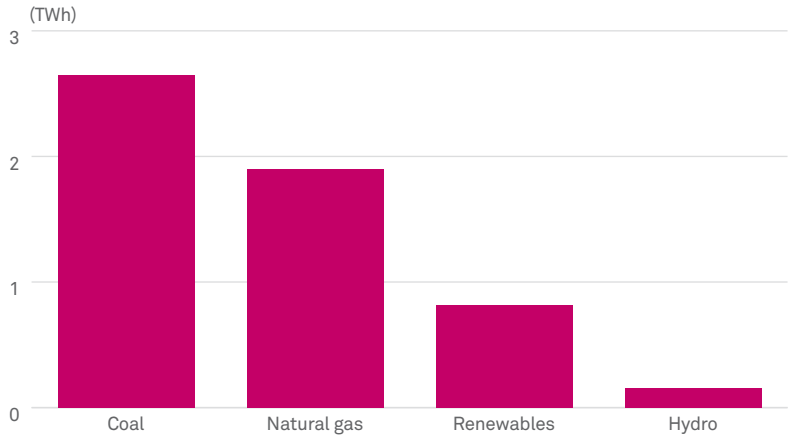
With no action on climate legislation at the federal level, many environmental groups are focusing on state-level and sector-specific progress, Michael Brune, executive director of the Sierra Club said. "The commitments on 100% clean energy coming from these governors, we feel will be deeply transformative."

Going in a different direction, Ohio elected Republican Attorney General Mike DeWine, improving prospects for efforts to relax renewable mandates.

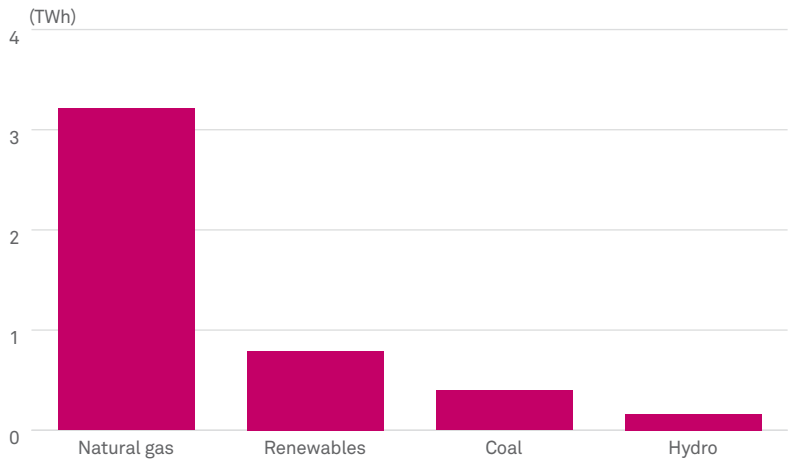
Results were mixed for ballot initiatives to raise renewable energy targets. Arizonans rejected a ballot initiative to require electric utilities to get 50% of their power from renewables by 2030. Arizona Public Service fought the measure, saying it could force the 3.9 GW Palo Verde nuclear plant to retire early.

A Nevada initiative to increase the state's renewable portfolio standard to 50% by 2030 won easily with 60% of the vote, despite the state's utility remaining neutral on the issue. While the initiative needs to pass again in 2020 to go into effect, environmental groups hope the state legislature will pass a law making that mandate binding even sooner. Prospects are improved by the election to governor of Sisolak, who ran as a clean energy advocate combating climate change. ■

**Colorado electricity generation by source, July 2018**




**Nevada electricity generation by source, July 2018**




Source: Energy Information Administration

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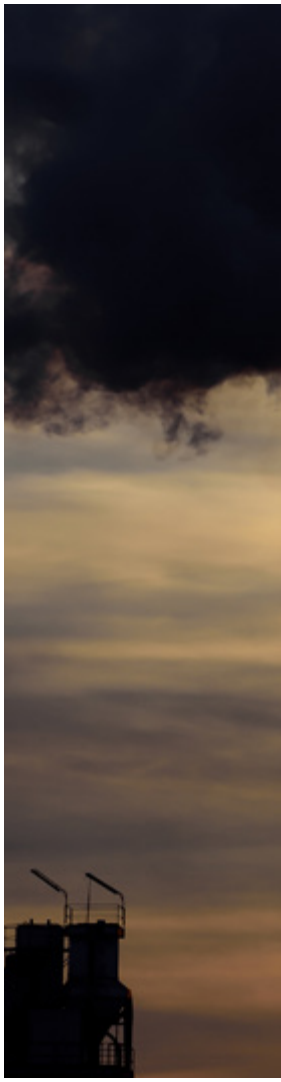


# Carbon's big comeback

After years in the doldrums, the European carbon market rebounded dramatically in 2018 and now looks set to play a key role in the energy market going forward. Frank Watson reports

The carbon market in Europe made a big comeback in 2018 after years of stagnation, with prices of European Union allowances more than quadrupling to above €20/mt ($23/mt) after lawmakers overhauled the system's rules for the period after 2020.

Higher carbon prices are likely to boost the profitability of companies operating nuclear, wind, solar and hydro-electric power plants, driving further growth in renewable energy capacity in Europe. They also signal a long-term drop in the use of the most emissions-intensive fuels for power generation, hard coal and lignite, and provide a stimulus for innovation in low-carbon industrial goods and processes.

After years of being flooded with surplus carbon allowances, sharp supply cuts starting in 2019 look set to reposition the EU Emissions Trading System as the principal tool to decarbonise Europe's economy over the long term.

The overhaul of Europe's carbon market not only tilts the economics of electricity generation away from fossil fuels and towards cleaner power, but it also puts wind in the sails of carbon markets in general. That sends a clear message to other regions grappling with the same pervasive energy trilemma: making energy secure, sustainable and affordable.

## The road to 2019

The road to 2019 has not been an easy one. The very idea of carbon markets came close to redundancy along the way, as low prices persuaded some EU member states to go it alone on carbon pricing policies.

From a pre-financial crisis high of over €30/mt in 2008, carbon prices crashed during the downturn that followed. That's because the supply of carbon allowances was fixed under the scheme, while demand was linked to actual CO2 emissions, which fell as demand for electricity and CO2-intensive products collapsed. Carbon prices dipped to as low as €3/mt in

**From a pre-crisis high of over**

**€30/mt**

**carbon prices crashed in the downturn that followed**

2013 in the wake of a second economic slowdown in Europe, threatening to make the ETS irrelevant as a driver of decarbonization.

This problem of excessively low carbon prices was not just the result of global economic conditions. It was further compounded by overlapping EU energy and climate policies, including targets for increasing renewable energy and energy efficiency for 2020 and 2030. Far from pulling in the same direction, some of these energy and environmental policies directly undermined the price signal produced by the ETS.

Under a cap-and-trade system, CO2 emissions fall as a result of a declining annual carbon cap, not as a function of the carbon price. In a free market for rights to emit CO2, the environmental benefit is delivered through the cap, with the price determined by market forces. Still, for the European carbon market to send meaningful investment signals, a better balance was needed between supply and demand.

## Major interventions

A series of major market interventions followed as Europe's lawmakers tried to avoid a complete collapse of the system. Early examples of this included "back-loading," a move to postpone the release of 900 million EUAs in government auctions from 2014 to 2016. While this measure avoided carbon prices falling to zero, it only addressed a symptom, not the underlying problem: prices are vulnerable in a market in which supply cannot react to demand.

Brussels authorities understood that to make the ETS future-proof, ad-hoc supply-side interventions would not be enough – the market needed a mechanism that would make it resilient to future demand shocks by controlling supply automatically.

Cue the second major intervention: the Market Stability Reserve. The MSR is a mechanism to withhold surplus EUAs from the market, reducing any current

or future oversupply. The MSR was agreed by the EU's co-legislature in 2015 and strengthened under legislation passed in 2017. It is set to curb the volume of EUAs in circulation, which represents 1.655 billion mt of CO2 equivalent, by 24% per year starting in January 2019. Going forward, the MSR is expected to react to any factor that might increase the volume of carbon allowances in circulation by withholding a fixed proportion – 24% of the surplus – from government auctions in the following 1–2 years.

The MSR's expected impact on supply has led some analysts to forecast a supply crunch in 2019–2022, as net supply in the market falls below the volume needed for power generators to hedge forward power sales, forcing CO2 abatement. Anticipating this cut to supply, buyers increased their activity in 2018, while sellers had little reason to offload volume. This pushed carbon prices to well above €20/mt by August, and the gains were further compounded as the looming supply cuts attracted financial players back into the market following a long absence.

In addition to the MSR, EU lawmakers agreed on other changes for the period 2021–2030, including a steeper 2.2% reduction in the annual carbon cap, as well as other rule changes including more targeted free allocations for companies in trade-exposed sectors. The EU's carbon market legislation also includes provisions that allow for a future review, opening the way for further intervention to ensure the market functions as intended.

**EU carbon prices recover as legislation tightens supply**

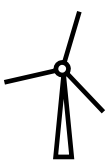

Graph shows EU Allowance (EUA) carbon prices under EU Emissions Trading System
Source: S&P Global Platts, European Energy Exchange

## Looking ahead

What does the future hold for the European carbon market? In the power sector, it has widely been assumed that coal-to-gas switching would arise as a result of higher carbon prices – but as 2018 demonstrated, this hasn't always been the case (see box).

In general, higher carbon prices have several implications: expect to see renewable energy taking a bigger slice of the electricity market in Europe; higher wholesale power prices; a long-term drop in the use of hard coal and lignite for power generation; greater innovation in low-carbon industrial processes; and increased investment in energy storage and energy efficiency.

While the MSR will tighten the supply side of the carbon market, demand-side factors could yet weigh on carbon prices and keep any severe price increases in check. "The MSR itself does not raise EUA prices, but it makes the market shorter," said Jeff Berman, director of emissions and clean energy at S&P Global Platts Analytics. "This should lead to higher EUA prices, but if emissions reduction costs fall, then EUA prices could also remain low," he said.



**Higher carbon prices are likely to see renewables taking a bigger slice of Europe's electricity market**

On the demand side, Germany – the largest power market in Europe – has appointed a commission to work on ways to move away from coal and lignite. This is expected to result in a managed closure process for its most CO2-intensive power plants.

However, Germany cannot achieve this goal quickly. The country is already phasing out low-carbon nuclear power for other environmental and safety reasons. This means any move away from coal must happen on a gradual timeline, allowing renewable energy to fill the gap left by nuclear, keeping coal in the mix for several years to come. Other downside factors include a potential fall in natural gas prices, which could allow coal-to-gas fuel switching to happen at a lower carbon price, thereby cutting CO2 emissions and demand for allowances.

There are also other potential challenges for the carbon market in the wider international context: if other countries outside Europe fail to press ahead with ambitious climate policies, high carbon costs in Europe could become problematic for the EU to sustain. Clever diplomacy and careful rule-making may be required to avoid European businesses facing undue competitive distortions.

But could the carbon market again suffer a major price crash – for example, if another economic crisis occurred? That's unlikely. When drafting the MSR legislation in 2017, EU lawmakers designed the reserve to react automatically to quantitative demand-side fundamentals. In effect, the MSR future-proofs Europe's carbon market by controlling the volume of allowances available to regulated companies. This makes it very unlikely that a future carbon price crash could occur, and is a key reason why banks and other financial players become confident enough to move back into the market on the buy-side in 2018.

That the carbon market has survived political opposition among some industries and EU member states, as well the global financial crisis, is remarkable. But it is also testament to the resilience of the core idea: Europe wants to build a low-carbon economy by the second half of this century without breaking the bank. This long-term effort needs coordinated policies that can deliver emissions reductions at the lowest cost. It also requires long-term price signals that have the power to shift capital investment on to a sustainable track at scale. Overcoming the tension between those two goals has been a fundamental issue for the EU carbon market since it became operational in 2005.

After years of oversupply and prices that were too low to be meaningful, the carbon market has now been strengthened and positioned to play a key role in achieving the EU's goals. The direction of travel is clear. ■

## High gas prices fuel coal demand

When used for power generation, natural gas emits less than half the CO2 of coal per unit of power generated, depending on power plant efficiencies.

As the available supply of European Union allowances tightens, this means prices may rise to levels that prompt coal-to-gas switching in the power sector over the long term.

However, higher carbon prices don't necessarily have the impact that might first be assumed.

Coal-to-gas switching has not been happening so far in 2018, quite the opposite. European gas prices were high in late 2018 due to volumes going into storage ahead of winter, declining Dutch production and strong Asian markets for LNG. Those high gas prices squeezed profit margins on gas-fired power plants, helping keep emissions-intensive coal-fired plants ahead of gas-fired units in the merit order for power generation.

In effect, instead of coal-to-gas fuel switching, the European power market has been experiencing coal-to-renewables switching. Wind power is increasingly pushing coal plants off the grid on windy days, while coal plants come back onto the grid on cold, still, winter days when heating demand is high and wind fails to materialise.

This trend is likely to become more pronounced as solar and wind capacity increase across Europe, with weather playing a larger role in pushing older coal and gas units out of the money.

Meanwhile, aside from the direct effect of higher carbon prices, politics continues to hold sway, with Germany, the UK, the Netherlands and other countries committed to phasing out coal from power generation using a combination of the carbon market, domestic carbon taxes and other unilateral policies.

# Insight Conversation: Jeffrey Currie

Jeffrey Currie, global head of commodities research at Goldman Sachs, sits down with Paul Hickin to discuss the bank's call on oil prices and the commodities impact of the US–China trade war

**The big question on everyone's lips is whether we are going to see a return to oil prices at $100/barrel and beyond. Where do you think the market is going?**

We're not saying $100/barrel oil cannot happen. It's not our base case, nor do we think it's very likely. To get a $100 price spike, you need to have a sustainable loss in all of Iran's exports for an extendable period of time... The key point here is yes, if you had a sustained outage you could see a spike of that magnitude, but in no way is it our base case. Our base case is for a modest decline in inventories in the fourth quarter, which will likely keep prices somewhere around $80/barrel. But the faster and sooner the Iranian barrels are lost, the greater the upside potential, because it's harder and more difficult for the non-Iranian producers in OPEC to respond to that kind of disruption.

**The key question is spare capacity. Can Saudi Arabia, OPEC and Russia deliver and make up what's lost from, not just Iran but also Venezuela, if it experiences further falls in production?**

It's all a question of time. Always, when we ask this question, how much spare capacity does Saudi Arabia and OPEC have, it's all a question of how long you are willing to give them. The longer you give them, the more rigs they put into the field, and the greater the spare capacity. In the last four months, we have seen a 20% rise in drilling in Saudi Arabia. You have already lost 700,000 b/d of Iranian exports and inventory built, which tells you there is a lot more oil in the market.

If we were to lose all of those Iranian barrels really quick right now, it would likely create a big problem, because we don't think it will have the Partitioned Neutral Zone [estimated at 500,000 b/d] and other fields up and running until you get into the first quarter of next year. And then let's not forget that the Permian has huge pipeline capacity expansions coming online in the third quarter of next year. So the longer we wait, the higher the probability of seeing global spare capacity increase to be able to accommodate almost any type of disruption. Now a $100/barrel price spike would likely require not only Iranian barrels being out on a sustainable basis, but something along the lines of Venezuela happening that would create further upside. So the short answer to your question: readily available spare capacity we would put at 800,000 b/d, remember that we have already lost 700,000 b/d, and Saudi Arabia is already at 10.7 million b/d. As you get into the first quarter that [spare capacity] begins to grow to the 1.5 million b/d range, and as we look further out into the second half of next year, there's not an issue.

**Goldman Sachs has a very bearish view on oil in 2019. Please explain your thinking.**

Fast-cycle capital, as well as production, has fundamentally altered the way the oil market trades. What do I mean by fast cycle? Let's think about deepwater: that's what we call long cycle. You make an investment today, and it's 5–10 years before you get the output. You make an investment in shale, and you get it almost immediately. That fast-cycle nature changes the response the industry has to a lack of spare capacity. Another way to say it is that it's taking out oligopolistic market structure and turning it into a competitive market. That hasn't changed.

Once we debottleneck [pipeline and midstream infrastructure] in the second half of next year, we think we will see very rapid growth in shale production, which will push us back into the new oil order or that

"When we think about a lot of the [US] goods that were targeted by the Chinese, they were very fungible goods"

"lower for longer environment." Our target for oil prices at the end of next year is $70/barrel on a Brent basis, and then $60/barrel in the long term.

**Earlier this year, you said you were at your most bullish in a decade regarding commodities demand. How has that view changed?**

We've only reduced our demand expectations modestly, and when we think about the core behind the "most bullish in a decade" view, it was driven by three observations. First, strong robust late-cycle global demand growth, which we are seeing across the commodity complex. Second, supply curtailments in places like OPEC, as well as China: remember they cut back due to the anti-pollution and anti-corruption issues. And third, pipeline constraints in the Permian. Those were the core factors.

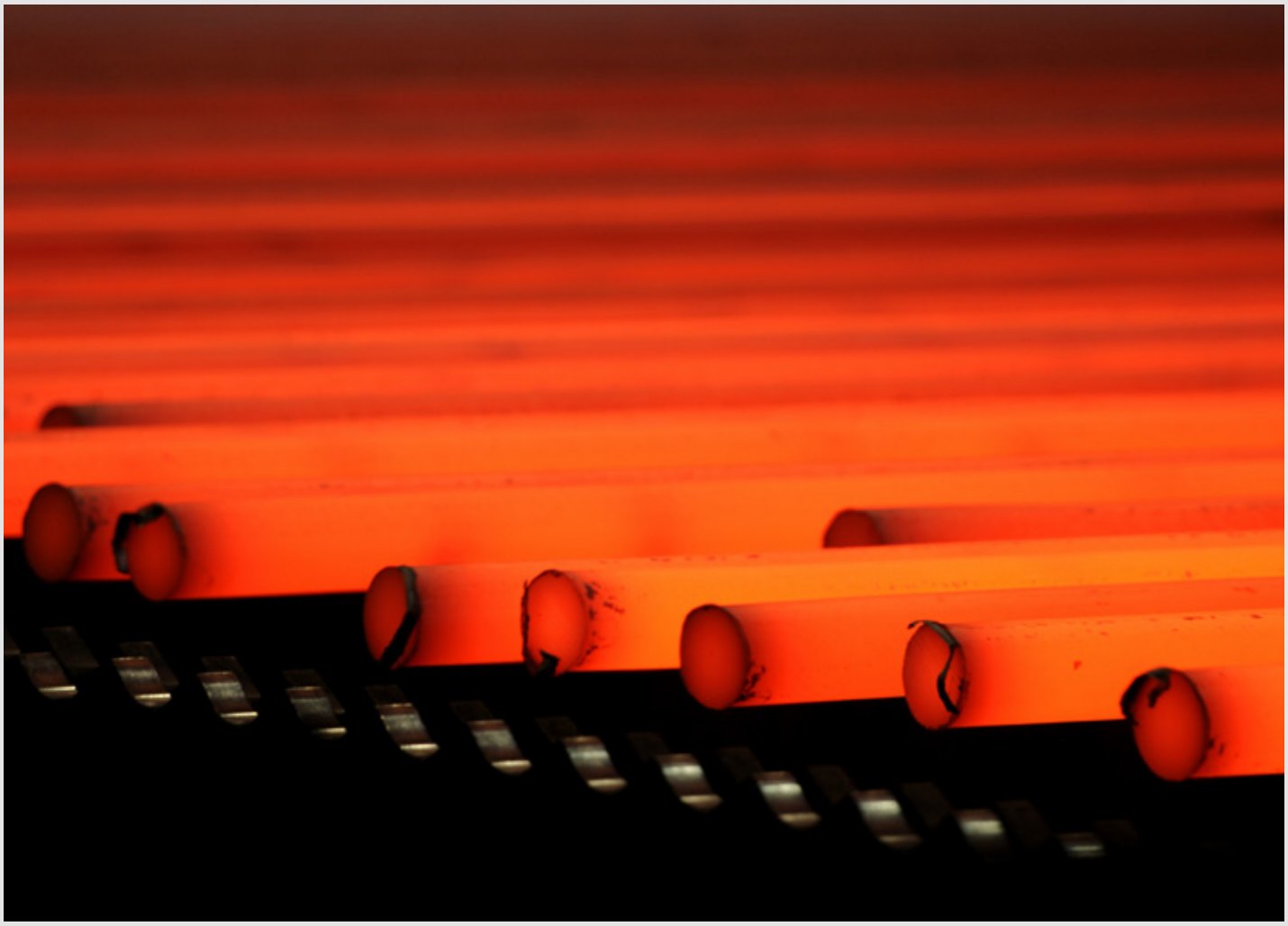
If we look at the demand component, I want to go over why late cycle really matters. And if there is one point I want to emphasize, it's that commodities are driven by demand levels, while financial markets are driven by demand growth rates. Let me go over why that's the case. We have the level of demand at 100 million b/d right now. It took the entire business cycle for the demand level to continue to grow to that level, and when demand gets up to that high level, it begins to stress the ability for the system to supply. So it's the level of demand exceeding the level of supply, which creates a bullish market for commodities. Financial markets care about the growth rates, because they are expectations about the future: if the growth rate is good, it tells you to have a positive outlook in the future. So when we think about the current environment, with a late cycle the demand level gets really high and you draw down your inventories – that creates the bullish backdrop.

This is why commodities like oil give you a negative correlation against other asset classes. When demand begins to slow as interest rates rise, like we are seeing right now, you still have a situation in which the demand level exceeds the supply level, which stresses the ability of the system to supply and creates the upward price spike.

So what have we done with our demand growth rates? We had an expectation in oil of 1.75 million b/d when we wrote that report you are referring to. It's now 1.6 million b/d. We took down emerging markets by 250,000 b/d, but increased the US in the developed markets by 100,000 b/d. So we have the US exceeding expectations, which is putting upward pressure on the dollar. The higher dollar is increasing funding costs in emerging markets, which is slowing growth expectations in those parts of the world, which is why we are reducing them. And you go back and you think about this: we are raising the US and reducing emerging markets, the exact opposite of what we did in the 2000s. In the 2000s, month after month I was taking down US oil demand and raising Chinese and emerging market demand. We had a very weak dollar backdrop over that time period. You had a robust China that needed to consume oil and other commodities, so the US was that marginal consumer who had to make room for the Chinese consumer, and you had a really weak dollar to achieve that redistribution of oil. Today it's a similar dynamic, not as strong obviously as we saw before. The US is the engine of global growth right now and the strong dollar is making room for the US to continue to move forward. Put it all together, and it's not that we have really taken down our demand forecast, it's really that we have made room for the US.

**What about about the US-China trade spat. How does that play out for commodities in general?**

So far [the impact] has been relatively small. Our economists estimate the impact on China at 20 basis points on GDP growth – and in a 6.5% GDP growth environment it's not that large – and then on the US they estimate it at below 5 basis points. So it's relatively small, less than a 100,000 b/d when thinking in terms of oil demand.



Now to understand why it's not having a big impact, let's think about two bookend commodities: oil and soybeans. Oil was left out of the Chinese retaliation, but let's use it as an example. Oil is completely fungible – it can be redistributed and moved around the world. Soybeans are not.

Overall, global soybean production comes out of China, the US, Brazil and Argentina, so there aren't really any options for China to substitute away from the US, but Brazil and Argentina... Brazil cannot replace those US exports.

When we think about a lot of the goods that were targeted by the Chinese, they were very fungible goods, in which what we'll likely see is a redistribution of supplies to avoid consumption of either Chinese or US goods that are going into either one of those countries. You will still get an inflationary pressure because you still get goods coming in, like soybeans, and that will have an impact on inflation in China and the US. However, I think the key takeaway here is that it's modestly inflationary. It reinforces the inflationary trends already in place... but the impact on growth is relatively modest.

**Do you feel the same about the metals side, given the tariffs on steel and aluminum?**

With metals, it has definitely had an impact in the US on pricing – you can see it in the physical premium in aluminum as well as steel. Now in terms of it creating a supply response, it's still relatively small and modest at best, which means it's likely to be more inflationary than it is to be stimulative to supply. I think the one that has been hit the most is copper. When we look at copper right now, global demand growth is running at around 2.8%, so it has not been hit significantly. But the market itself was short copper a few weeks ago, which is an indication that people are quite bearish about global growth prospects. I think a lot of that is to do what's going on with the trade war. ■

# European gas: feeling the pressure

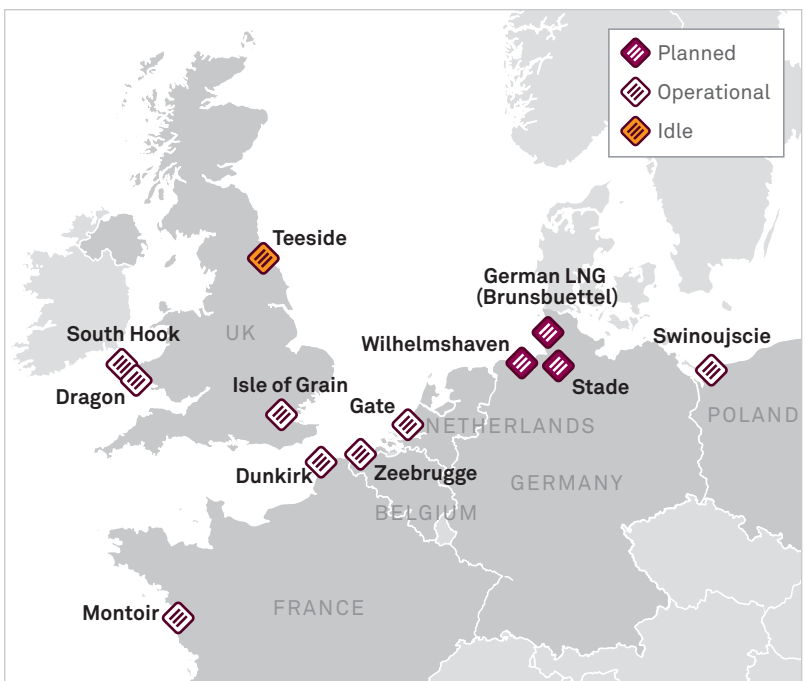
Whether as a result of cooling relations with Russia, security of supply or environmental concerns, key decisions about Europe's gas market have become increasingly driven by politics, writes Stuart Elliott

While politics have always played an important role in the energy sector, over the past few years a trend toward a new class of energy-related decision-making seems to have emerged with non-economic or sub-economic policies increasingly in evidence.

European gas in particular is likely to be impacted by more protectionism-driven policies – from the US, the UK, Russia and others – as the application of national security goals in energy policy increases in significance, which in turn is having an impact on gas infrastructure investment, trade flows and prices.

The increasing politicization of European gas will inevitably lead to decisions on infrastructure – especially around LNG import facilities and pipelines – that will see shifts in European gas flows and gas price evolution, with infrastructure costs passed on into gas network charges and energy bills.

**German LNG project plans**




Source: S&P Global Platts

## German LNG ambition

One country currently in the center of the politics-economics dichotomy is Germany. Europe's biggest gas consumer with demand at around 90 Bcm/year, Germany has found itself in the middle of a political quagmire, with the US and Russia pulling at Berlin on either side and even Qatar making a play to impact Germany's gas supply.

The German government's support for an LNG import terminal, in particular, is questionable. Germany is possibly the best connected country in Europe in terms of gas supply, with direct links to Norway, Russia, the Netherlands and now southern Europe after Italy completed its reverse flow initiative in September. In addition, it can access LNG imports easily through northwest Europe's chronically under-utilized facilities – such as Gate in the Netherlands, Zeebrugge in Belgium and France's northern terminal at Dunkirk.

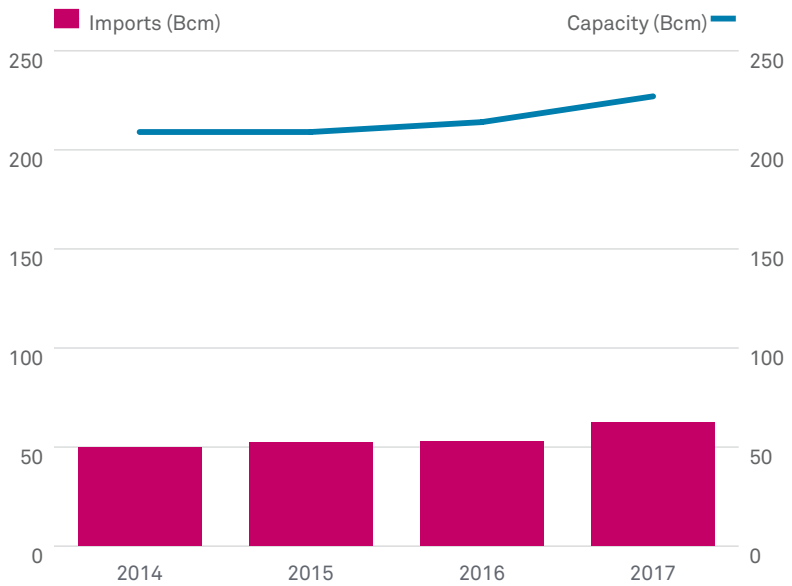
Germany's economy minister Peter Altmaier in September went as far as to say that a German LNG import terminal would be a "gesture" to the US, which wants to help Europe wean itself off Russian gas by turning instead to US LNG. This is tantamount to admitting that Germany does not need an LNG import terminal when Europe's existing plants are used at just one quarter capacity, according to S&P Global Platts Analytics data.

It could be argued that Germany would be better off with its own LNG import facility, giving German companies increased flexibility around renegotiating pipeline gas supply contracts with Russian gas giant Gazprom. And it might mean Germany can say it has a more diversified import mix following criticism from US President Donald Trump that Germany is "captive to Russia."

Enter Qatar, which said it would be interested in supplying a future German LNG import terminal, perhaps in an attempt to find a foothold in Europe's most important gas market.

Jonathan Stern, leading gas analyst from the Oxford Institute for Energy Studies, sees limited value in having an LNG import terminal in Germany. "The economic value is dubious," he said. Germany had decades-old plans for an LNG import facility at Wilhelmshaven, which Stern said was arguably a much more commercially justifiable project at that time than the current scheme. "If it didn't make economic sense then, I don't see why a new project should now," he said.

**European LNG imports vs capacity**




Imports to Belgium, France, Greece, Italy, Lithuania, Malta, Netherlands, Poland, Portugal, Spain, Turkey, UK
Source: S&P Global Platts Analytics

Poland's plans to build the Baltic Pipe to import Norwegian gas via Denmark are also "economically crazy," Stern said, and are solely based on Warsaw's determination to become independent from Russia. Poland's PGNiG has also signed a number of deals with US LNG suppliers to boost its import portfolio.

But just because you have an LNG import terminal doesn't mean cargoes will come. In fact, European gas prices do not seem to be attracting US LNG despite low Henry Hub prices, with the increase in European gas demand met mainly by Russian gas imports over the past two years. LNG flows instead are following price signals from China and other Asian buyers, which are likely to have incrementally higher demand in the coming decades.

## Spy story

The Russian "threat" has also led the UK to make some uneconomic noises with regard to gas supplies. Prime Minister Theresa May said the UK was "looking to other countries" for gas supply amid worsening relations with Russia triggered by the poisoning of ex-spy Sergei Skripal in the UK in March this year.

Estimates of Russian gas sales in the UK vary, but a closer look at import flows suggest that the UK needs Russian gas to some extent – physical flows are estimated at around 6 Bcm/year, all centered on the winter months, according to S&P Global Platts Analytics.

"There is a lot of geopolitical argy-bargy around Russian gas, with a lot of people trying hard not to say the real reason which is that they don't like or trust president Putin and therefore they don't want Russian gas," Stern said.

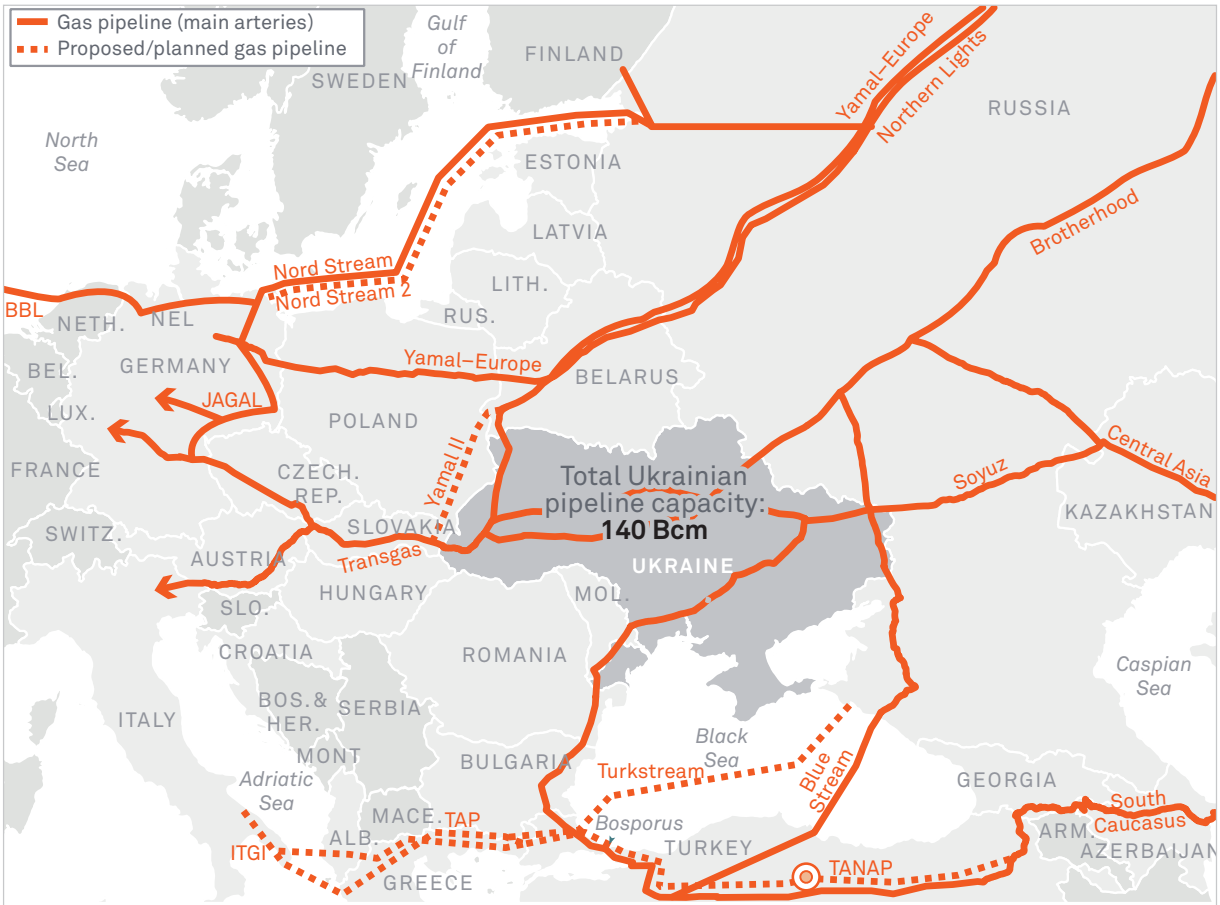
In the meantime, the UK almost fell foul of US sanctions against Iran given that one of the UK's key gas producing assets, Rhum, could have come under the renewed measures from Washington. As it happened, the US gave the BP-operated field – co-owned by Iran's state-owned NIOC – an exemption from sanctions through to October 2019.

"There is a lot of geopolitical argy-bargy around Russian gas, with a lot of people trying hard not to say the real reason"

Russia also remains a target of US foreign policy, with the recent accusations of meddling in the 2016 US presidential election leading to the threat of further sanctions against Moscow. There is a risk that if more evidence comes to light of Russian political interference abroad, or if Moscow makes any more aggressive moves toward its neighbors, that the US – and the EU – would be forced to act to penalize Moscow's energy sector further.

BP CEO Bob Dudley warned in October that any escalation of sanctions targeting Russia's major oil and gas companies – such as Rosneft, Lukoil or Gazprom – would "shut down" Europe's energy systems. Given the interdependence between Russia and Europe on gas supplies, it might require a serious shift in the political relationship to trigger any action, but anything is possible.

**Europe's gas pipeline ties to Russia**




Source: S&P Global Platts

The role of the US is more nuanced. Washington – as it has done for decades – continues to attempt European gas market interventions with regard to Russia, with the difference that now it has its own LNG to sell. When it threatened sanctions against the Nord Stream 2 pipeline it prompted a particularly strong reaction from Germany and Austria, whose governments urged Washington to basically mind its own business.

The issue of Nord Stream 2 – the planned 55 Bcm/year pipeline from Russia to Germany bypassing Ukraine – has become extraordinarily political and has effectively divided Europe. Brussels and most of the countries of eastern Europe are dead against the project, while the home nations of its western European financial backers – Anglo-Dutch Shell, France's Engie, Austria's OMV and Germany's Uniper and Wintershall – have been more tight-lipped on the issue.

The European Commission has also urged Moscow to commit to continuing transit via Ukraine to retain gas source and route diversity.

Russia remains intent on sidelining Kiev from its European gas transit arrangements, while the recent arbitration awards from the Stockholm court left Ukraine's Naftogaz $2.6 billion better off. Not that Gazprom believes it should have to pay up. In the meantime, talks are being held at technical level between the energy ministries of Russia and Ukraine, and the EC, about what future Russian gas transit via Ukraine to Europe would look like.

It seems inevitable that some kind of deal will be reached – not least if Nord Stream 2 is delayed past its planned end-2019 startup – given how high the stakes are for both players. Ukraine has a good negotiating position – Gazprom has legally binding supply

**Shah Deniz 2 links in with Southern Gas Corridor infrastructure**


Source: BP, S&P Global Platts

## The issue of Nord Stream 2 has become extraordinarily political and has effectively divided Europe

contracts in place with customers and if it cannot get the gas to them, it would be in breach of those contracts and face stiff penalties.

### Italian job

Pipeline politics are also being played out elsewhere, with Italy at the center of the most recent controversy. Against all expectations, Rome has emerged as an unlikely stumbling block to the completion of the Southern Gas Corridor to bring Azeri gas to Europe.

There have been question marks over whether the new Italian government, which came to power in May, would look to block the TAP project, with environment minister Sergio Costa dismissing the pipeline as "pointless" and questioning its economic viability. Any delays to the construction of the pipeline infrastructure off- and onshore Italy could push back the timeline for TAP past its 2020 start date.

Political moves of a different kind are under way in Romania, meanwhile, where the ruling Social Democratic Party (PSD) is trying to push through new legislation that would see at least 50% of new Romanian offshore gas production reserved for the domestic market. Producers – including ExxonMobil and Austria's OMV which are hoping to develop the 84 Bcm Neptun gas field in the Romanian sector of the Black Sea – have said they would find it difficult to move to final investment decision under such conditions.

The PSD wants Black Sea gas output to predominantly be used for Romania's "re-industrialization" and economic development. But Bucharest could be cutting off its nose to spite its face if it doesn't give companies enough incentive to invest – no gas production at all is no good for anyone.

European gas prices and demand are also to some degree at the mercy of developments in other commodities – and politics and oil go hand in hand. Higher oil prices, in particular, tend to filter through to the broader energy complex and LNG prices in particular. The emergence of President Trump's use of social media in a bid to put pressure on oil producers, especially OPEC, is a staggering development. And the recent bull run in oil is due mainly to the US reimposition of sanctions against Iran.

**Impact of political decision-making on gas prices**

| Bullish | Bearish |
|---|---|
| Nord Stream 2 opposition from EC, US | Environmental policy: renewables subsidy |
| Escalation of US sanctions against Russia | Russia-Ukraine gas transit: favorable outcome |
| Environmental policy: nuclear, coal phase-out | Rhum gas field exempt from US sanctions |
| Russia-Ukraine gas transit: deadlock | Qatar targeting Germany for LNG supply |
| US trade war with China: LNG inefficiencies | US trade war with China: demand impact |
| Italian opposition to TAP pipeline | UK decision to back new nuclear |
| Romanian protectionist policy on gas | UK review of gas storage leads to new support |
| Oil price rise on re-imposition of Iran sanctions | |

Source: S&P Global Platts

Other political decision-making is making its impact felt too: the US-China trade war is expected to have a dampening effect on global energy demand, while the specific move by Beijing to impose a 10% tariff on US LNG is expected to lead to more inefficiencies in the global LNG market, dragging up prices and raising questions over the economics of the second wave of US LNG projects.

Government policy on nuclear power is also a key factor in gas demand evolution. In the UK, the government's decision to back the mega-expensive Hinkley Point nuclear power station despite strong opposition and limited economic value raised many eyebrows given the 3.2 GW project is expected to cost more than £24 billion ($31 billion) through its lifetime.

Meanwhile, the possibility of a rise to power in the UK of a Labour government – which has pledged to renationalize the UK energy sector – would be representative of politics outweighing economics in the most extreme of examples.

## Environmental motivation

Other political decisions on energy are driven by more reasonable aims – such as environmental protection or supply security. The Dutch government has forced Shell and ExxonMobil to halt production at the giant onshore Groningen field by 2030, but likely much before then, leaving some 450 Bcm of gas in the ground.

Gas demand will also be buoyed in the future once the phase-out of coal in power generation across numerous countries in Europe takes full hold later in the 2020s. France's plans to reduce dependence on its huge nuclear fleet could be revised with the country's energy future linked to whichever administration is in power. A pan-European carbon price would also incentivize gas over coal, while renewables subsidies across Europe would impact gas demand to the downside.

So what of the future? It seems clear that the shift toward political decision-making in energy policy is here to stay for a while yet. New infrastructure – even if it is arguably in the wrong place or with questionable motivation – would likely be bearish for wholesale gas prices as it adds flexibility and optionality, but the costs will be passed on into network charges and energy bills.

Trade flows will shift – particularly on the back of increased LNG import capacity and a pick-up in US LNG imports – while the routes taken by Russian pipeline gas to Europe may look very different in a couple of years depending on political decisions.

Energy policy remains an important issue for voters, and with the rise of the populist governments in key countries, it is not altogether surprising to see such a change. It may require a change in the current state of global politics before economics can again take its place as the key driver of energy markets. ■

# Presidents and prices: revisited

Almost two years since it began, what has been the impact of the administration of US President Donald Trump on commodity prices? Joe Innace takes a look

If higher commodity prices reflect US presidential campaign promises kept, then President Donald Trump has already delivered on three fronts as he approaches two years in office.

The president campaigned hard on promises to help directly the US coal and steel industries and American manufacturing. It worked. Trump won key steelmaking, mining and manufacturing states like Ohio, Pennsylvania, West Virginia, Michigan, Indiana and Wisconsin.

It took a good year or so for Trump to settle in. Until November last year, most commodity prices had struggled to see their averages match, or surpass, the levels on the last day President Barack Obama held office. But with the passage of US tax reform legislation, an "America First" trade agenda in place and on full global display, manufacturing expanded and the domestic economy saw 4.2% GDP growth in the second quarter of 2018. In turn, this created more demand for energy commodities.

A group of 13 commodity benchmarks has been used by S&P Global Platts to track pricing performance during Trump's term versus Obama's eight years in office. Although fundamentals and a range of other factors have greater influence on commodity prices than US presidential policy alone, the exercise is intended to shed light on how prices and politics often intersect, where they've been, and perhaps to get a handle on where they might be going.

## Ferrous, coal set the pace

After a slow start for most of 2017, steel, aluminum and coal benchmark prices were all averaging higher for the Trump period (January 20, 2017–September 30, 2018) than during Obama's two terms in office. Largely because of an aggressive trade policy marked by the imposition of tariffs on steel and aluminum imports to the US, prices of both metals in the US market are up considerably compared with their average during the Obama years.

It's not a stretch to acknowledge the metals price increases as a "Trump Premium."

The price of US-made steel hot-rolled coil averaged $722/short ton through September 2018 under Trump, while it averaged $598/st during Obama's two terms – a boost of nearly 21%.

The "all-in" price of primary aluminum in the US market is up almost 11% since Trump became president. This includes both the underlying, global London Metal Exchange price plus the S&P Global Platts US Midwest Premium that reflects regional supply/demand fundamentals and local logistics costs. It averaged $2,353/mt through September 2018 under Trump, compared with $2,127/mt under Obama.

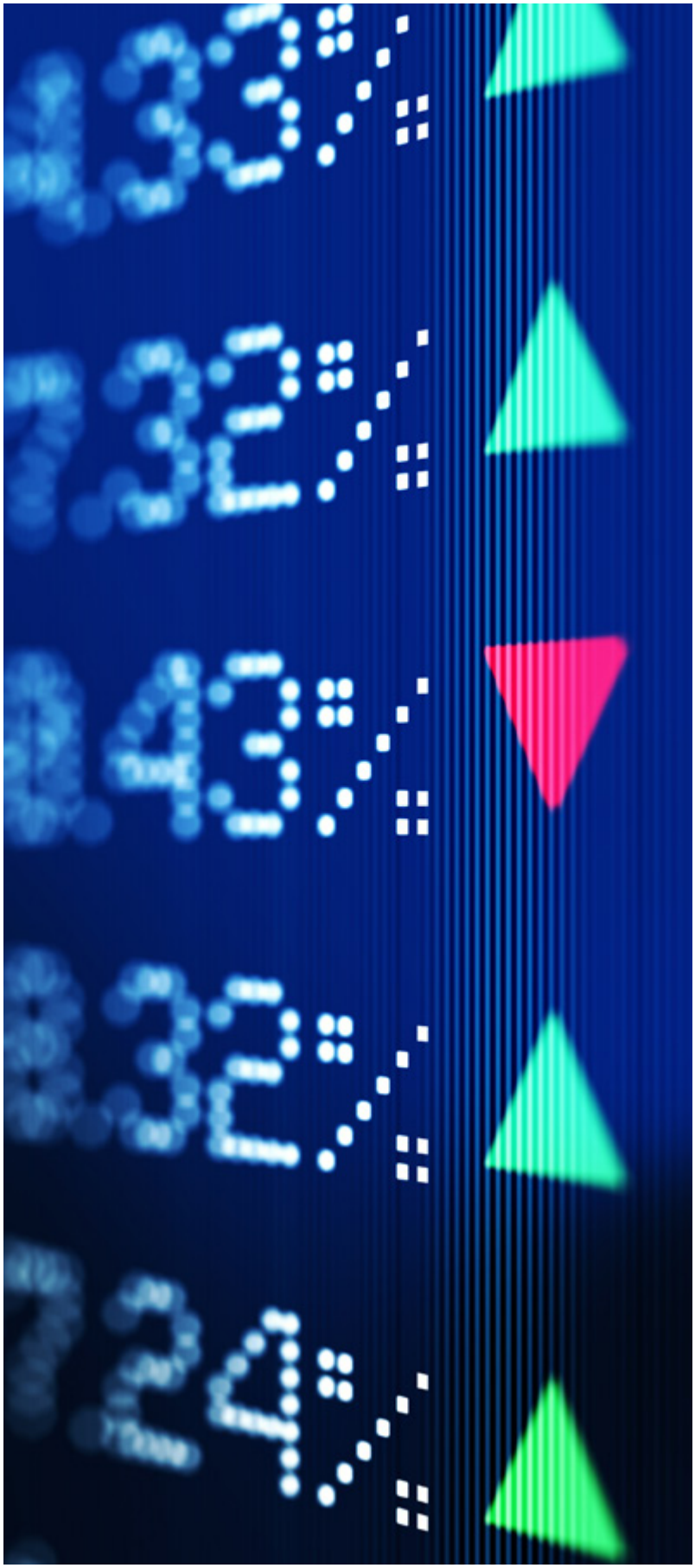
And while coal prices in the US have not benefited from such direct trade policy as the tariffs implemented for steel and aluminum, the commodity has been buoyed by a president who embraces a pro-coal ideology. The benchmark price of railed Central Appalachian thermal coal through September 2018 has averaged nearly $60/st while Trump has been in office, compared with an Obama-era average of $56.41/st – about 6% higher.

## Surging energy prices

Most energy prices with Trump in office still lagged the average prices posted during the Obama years by about 22% at end-September 2018. But energy prices started to gain during Trump's second year –with the exception of natural gas – to the point where they had reached about 18% higher on average than the day before Trump took the oath of office.

Unlike the Trump premium in coal, steel and aluminum, however, these other commodities in the US market went along for the ride – more recently getting swept up by strong economic growth and manufacturing activity.

Leading the way — to the chagrin of American drivers — is CBOB gasoline, Chicago. From January 2017 to September 2018, this benchmark was up more than 21% to an average of 174.07 cents/gal. This compares with the day before Trump took office, when Obama left it at 143.45 cents. Chicago gasoline, however, averaged



**Average commodity prices during Trump and Obama presidential terms**

| | Price on 19 Jan 17 | Unit |
|---|---|---|
| Oil, Dated Brent | 53.31 | $/b |
| Fuel oil, NY 3% | 47.03 | $/b |
| Jet fuel, NJ Buckeye pipeline | 153.38 | ¢/gal |
| Gasoline, Chicago CBOB | 143.45 | ¢/gal |
| Ethanol, Chicago terminal | 145.25 | ¢/gal |
| Natural Gas, Henry Hub TDt Com | 3.22 | $/MMBtu |
| Coal, thermal CAPP rail (CSX) | 61.75 | $/st |
| Aluminum P1020 transaction delivered US Midwest | 2030.41 | $/mt |
| Gold, COMEX | 1216.10 | $/oz |
| Iron ore, IODEX 62% | 80.65 | $/dmt |
| Steel, US hot-rolled coil | 630.00 | $/st |
| Wheat, CIF Turkey** | 190.50 | $/mt |
| Dry bulk freight, met coal Alabama to Italy, Panamax** | 14.00 | $/mt |

*Running average to end-September 2018
**Series started in Obama's second term
Source: S&P Global Platts

230.22 cents/gal during Obama's eight years, so it remains 24% lower under Trump.

With Trump as president, New York fuel oil through September 2018 was averaging $53.94/b, up nearly 15% since the day before he took office. But it also lags the Obama two-term average of $67.52/b by some 20%. Similarly, jet fuel (New Jersey Buckeye pipeline) is up 19.5% since Trump became president to an average for his term through September of $183.22 cents/gal, up from the 153.30 cents/gal contrails of Obama's last day as president. Jet fuel pricing, nonetheless, averaged 226.41 cents/gal during Obama's eight years, so recent Trump-era pricing still lags by about 19%.

Average prices for ethanol and natural gas through September 2018 under Trump have yet to exceed Obama-era pricing, mostly owing to abundant supply. But going forward, ethanol will be one to watch because Trump has directed the US Environmental Protection Agency to authorize year-round E15 sales. E15 is gasoline blended with 15% ethanol, currently restricted in the summer months because of gasoline volatility rules. The EPA aims to adopt final rules for fuel economy standards by March and year-round sales of higher ethanol blends by May 2019.

## 2019 growth in doubt

The US economy's 3.5% GDP growth in the third quarter follows 4.2% growth in the second quarter, which was loudly trumpeted by the Trump administration. Steel and other commodities benefit from such a rate of economic expansion. Steel demand, for example, tends to increase substantially when GDP grows at a rate greater than 3%.

"You're seeing GDP and now wage growth; this drives consumer demand and gets you in a virtuous cycle, and that's where we want to stay," said Thomas Gibson, president and CEO of the Washington-based American Iron and Steel Institute.

But staying there may prove tricky in 2019, as the trade tensions of 2018 have the potential for a delayed reaction on the downside in a global economy. The International Monetary Fund in October lowered its forecast for US growth in 2019 to 2.5%, while leaving its projection for this year unchanged at 2.9% – after factoring in the potential impact of tariffs imposed by the US and retaliatory actions by other nations.

S&P Global Market Intelligence reported on the IMF forecast, noting the organization's view that short-term

| Trump* | % change from Jan 17 | Obama | Trump premium or discount | % change Trump vs Obama |
|---|---|---|---|---|
| 62.11 | 16.5% | 83.63 | -21.52 | -25.7% |
| 53.94 | 14.7% | 67.52 | -13.58 | -20.1% |
| 183.22 | 19.5% | 226.41 | -43.19 | -19.1% |
| 174.07 | 21.3% | 230.22 | -56.15 | -24.4% |
| 144.81 | -0.3% | 208.14 | -63.33 | -30.4% |
| 2.96 | -8.1% | 3.55 | -0.59 | -16.6% |
| 59.82 | -3.1% | 56.41 | 3.41 | 6.0% |
| 2353.10 | 15.9% | 2126.95 | 226.15 | 10.6% |
| 1297.38 | 6.7% | 1325.79 | -28.41 | -2.1% |
| 69.92 | -13.3% | 108.99 | -39.07 | -35.8% |
| 722.24 | 14.6% | 597.78 | 124.46 | 20.8% |
| 211.46 | 11.0% | 214.37 | -2.91 | -1.4% |
| 12.84 | -8.3% | 12.09 | 0.75 | 6.2% |

risks to the financial system had increased, and that those risks could increase significantly if vulnerabilities in emerging markets and global trade continued to rise.

## It's the economy, stupid

There are eight full years of commodity price data for Obama's two terms, compared with just two years for Trump. The past two years, many would agree, have been far more tumultuous than tranquil. Will we have like-period price data sets to continue comparing? Trump will indeed run for re-election in 2020, and many pundits are already citing Bill Clinton's campaign advisor James Carville's oft-quoted phrase, "it's the economy, stupid," as the determining factor.

Trump's executive actions to impose import tariffs on steel and aluminum are likely to remain in place – although there may be country- and product-specific deals negotiated between now and the next presidential election, as he continues to use the trade hammer to forge new pacts. This America First trade and manufacturing policy played well on the campaign trail in 2016 among many voters in the Midwest states where steel and aluminum is produced and consumed.

Ensuing tax, trade and regulatory reform energized the US manufacturing base to the point where the National Association of Manufacturers' monthly index reached an all-time high of 63.6 in June 2018. But it has been slipping ever so slightly since then. Might this reflect some waning enthusiasm on the part of steel and aluminum end-users that have seen their manufacturing costs rise – either by paying tariffs or higher prices for domestic material? "The tariffs are starting to take a bite out of profitability," one purchasing manager in the chemical sector said.

In October the NAM's Outlook Survey, which indicates the percentage of small-to-large manufacturers who are upbeat about their own company's outlook, stood at 92.5%, after posting an all-time high of 95.1% in June. That's still a strong positive indicator, despite some very minor erosion.

The early consensus is that if the US economy remains strong in 2019–2020, growing at a rate of 3% or more, then Trump should win another term. But sustaining such an economic growth level – or anything close to it – over the next 23 months ahead of the November 3, 2020 election is a big ask.

As such, US commodity prices will be among the interesting indicators to keep watching. ■

# Kinks in the supply chain

2018 has been a year of acrimony in the container shipping market, amid disputes over who should pay for higher bunker fuel costs. And it's only going to get worse, write Jack Jordan and Andrew Scorer

The container market is in a fractious mood. Crude prices rose by more than 15% in the first half of the year, driving a similar increase in fuel bills, and the suppliers and users of container shipping have fallen out in spectacular fashion over who should foot the bill.

Under normal circumstances, in most markets, this would be a simple dispute to resolve — transparent contractual terms agreed in advance would set out who was responsible for an unexpected jump in bunker prices. But this year's fight has come at the end of a decade-long structural shift that has left the pricing mechanisms for container shipping in a more nebulous state.

The market is bracing itself for an even more complicated situation in 2020. The International Maritime Organization's lower global sulfur limit for marine fuels, coming into force that year, will fragment the bunker market with a wider range of fuel options for ship operators to choose from.

So how did the container market get here, and what might happen next?

## EU liner conference ban

The current muddle in the container market can be traced back to a decision by the European Union a decade ago. In October 2008, a European Commission ban on liner shipping conferences came into effect, preventing container liners on routes to and from the EU from acting collectively to set prices and regulate capacity. Routes elsewhere in the world were unaffected at first, but the removal of the European-related conferences left the remainder much less influential in the global price formation process. The rest of the conferences have steadily been phased out in the ensuing decade, with the last major one — the Transpacific Stabilization Agreement — finally ceasing operations in February this year.

The old system was archaic, opaque and vulnerable to uncompetitive behavior by the shipowners. But it was also unarguable – no one was in any doubt

**2014 bunker price collapse at Rotterdam**


**North Asia to North Europe box rates**


**2018 bunker price rise at Rotterdam**


**North Asia to North Europe bunker charge**


Source: S&P Global Platts

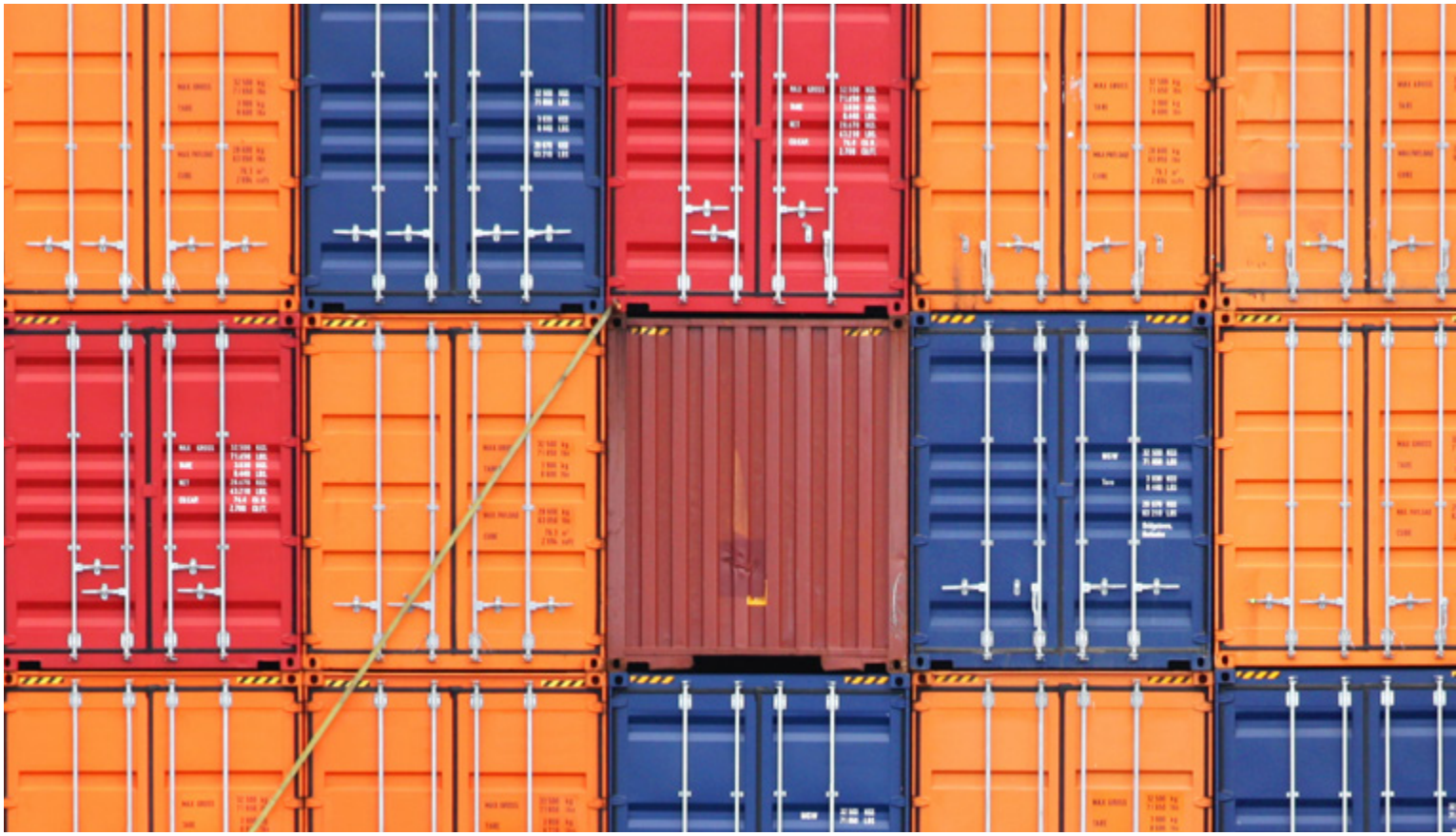
over where the responsibility for changes in bunker prices lay. What has emerged since then is more haphazard. Container contracts are typically arranged on an annual basis. Bunker costs are charged to the customer using the bunker adjustment factor (BAF), a floating part of the freight charge that is adjusted according to the movements of bunker price indexes like those assessed by S&P Global Platts and its competitors.

Under the conference system, BAF rates were set by the liners collectively, with no room for argument from the shippers. Since the collapse of those structures, each shipping company now sets its own rates. In theory, the BAF system should itself account for any moves in the bunker price, with the BAF rate being raised or lowered in tandem with fuel price assessments and the resulting cost being passed on to the shipper. But changes in the structure of how the rates are calculated have complicated matters in recent years.

## Change in BAF timing

The 2014 collapse in the price of crude oil delivered a sharp drop in fuel costs for the shipping industry. Brent prices halved over the year as OPEC failed to reach agreement on production curbs in the face of weak demand and rising US supply, and the high sulfur 380 CST bunker price at Rotterdam dropped by 52%.

Up to that point, the liners had mostly been arranging their BAF rates on a monthly basis, taking the average bunker price for the preceding month and using it to calculate the rate for the next month. But that year, several firms started to shift their customers to a regime of calculating the rates quarterly — a more advantageous system for the shipping company at a time of rapidly declining prices, as it allows the previous higher BAF rates to be charged for longer.



Fast-forward to this year, and the quarterly calculation is no longer looking so favorable to the liners. Sinking Venezuelan crude output and sanctions on Iranian exports have sent Brent prices back to around $70/b, and Rotterdam bunker prices have jumped by almost 50% since the end of 2017. With BAFs being calculated on a quarterly basis, the liners are forced to charge the old lower rates for longer, putting more pressure on their profit margins. Maersk's profit in its ocean segment sank by 15.1% on the year in the first half of 2018 despite rising revenues, as its bunker costs jumped by 53.6%.

S&P Global Platts spot container pricing for this year puts the problem for the liners in sharp focus. The box rate from north Asia to the north of Europe was at $1,450/FEU by the end of July, $50/FEU lower than where it started the year.

But the bunker charge for the same route — a bunker fuel cost metric for the container market priced in dollars per FEU, calculated from S&P Global Platts marine fuel assessments — jumped by 18.6% over the same period, from $251.89/FEU at the start of the year to $298.70/FEU by the end of July.

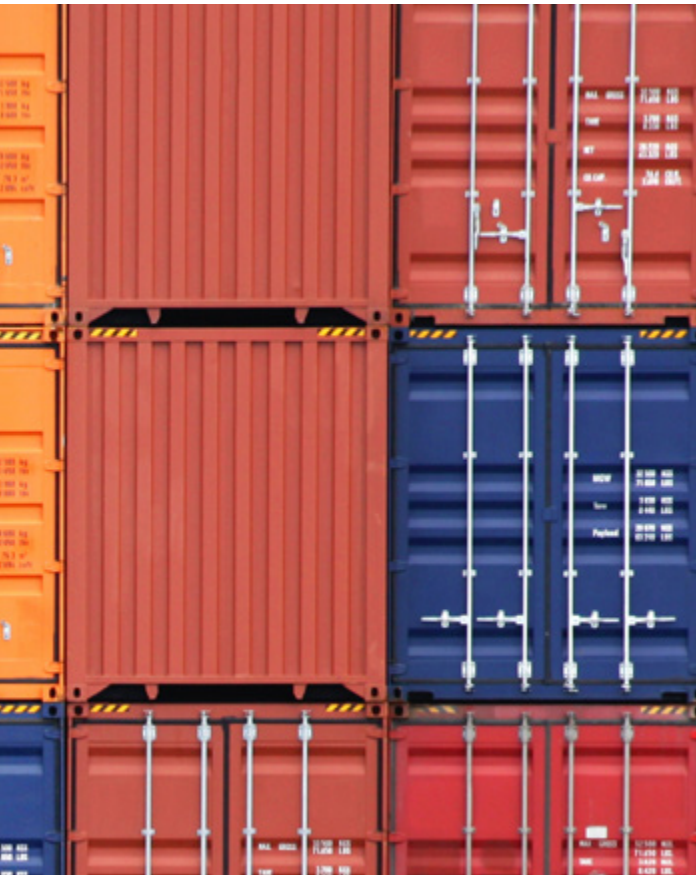
It's this failure by the liners to fully account for bunker cost rises in the box rates they charge shippers that has caused this year's disputes.

## Emergency bunker surcharges

Liners, however, had another tool at hand to recoup their costs: the emergency bunker surcharge. In late May, CMA CGM, ZIM, the Mediterranean Shipping Company (MSC), Hapag-Lloyd and Maersk all announced to their customers that they would be imposing emergency surcharges, citing the rapid climb in bunker costs in the previous months.

CMA CGM announced a $55/TEU surcharge for dry cargo, ZIM introduced surcharges ranging from $18-65/TEU and Maersk announced a $120/FEU surcharge for dry containers and $180/FEU for refrigerated cargo.

"The situation is no longer sustainable without emergency action," MSC said in a notice to customers announcing its emergency surcharge May 21. "This last-resort measure is essential to ensure that we navigate these challenging economic conditions in a steady and sustainable way."



> "There is a risk attached to doing business, which we accept, and which we expect that our suppliers accept too"

Maersk said it would double its surcharge if the high sulfur 380 CST fuel oil price at Rotterdam rises above $530/mt, but would reduce it to zero if the price dropped below $370/mt. "The emergency bunker surcharge is a necessary action to ensure a continued sustainable service to our customers, and will only cover the extra costs," Lars Oestergaard Nielsen, president of Maersk Line in Latin America and the Caribbean, told S&P Global Platts in June. "We are following the market trends closely, and will adjust the tariffs as soon as the fuel price drops below the beginning level of the year."

## Backlash from shippers

The liners' customers have balked at the decision. "The use of emergency surcharges is a none-too-subtle attempt to impose non-negotiable charges on customers," Chris Welsh, secretary general of the Global Shippers' Forum, said in May. "It is incumbent on container carriers to provide their customers with full transparency regarding bunker surcharge costs, and to explain why an emergency surcharge is warranted on top of existing bunker surcharge mechanisms."

Some have pointed out they have signed contracts relatively recently with the liners, and resent the rise in bunker prices being treated as unforeseeable.

"I have sympathy for the carriers' challenges, but refer to the agreements we and many other beneficial cargo owners have only very recently entered into, both parties with eyes wide open," said Bjorg Vang Jensen, vice president for global logistics at home appliance manufacturers Electrolux. "These agreements include specific clauses around bunker prices, and we expect that the carriers will respect those."

"There is a risk attached to doing business, which we accept, and which we expect that our suppliers accept too," he added.

But on a technical level, the liners have the law on their side. The BAF section of a container contract typically contains language leaving room for an emergency change to the BAF charge in the event of a rapid change in the bunker price.

Here is the wording from one example sent to S&P Global Platts by a liner: "If during the first quarter of the contract period, the average bunker price fluctuates by 10% or more, we reserve the right to review the BAF portion and amend the freight rate in accordance with our BAF formula."

That appears to leave little room for maneuver for the liners' customers when they complain. And it's telling that shippers have thus far not launched mass lawsuits against the liners this year in response to the surcharges; the legality of the situation does not seem to be in serious dispute.

What's under debate is more the attitude taken by the liners, and the risk that surcharges imposed on an apparently largely arbitrary basis will make an already complex market even less transparent. "It is likely

such an approach will be seen very negatively by the shippers, serving not only to undermine necessary efforts to get compensated for fuel increases, but also make it even more difficult for the carriers to implement cost-based surcharges in the future," consultant Lars Jensen wrote in May.

"It is very clear that carriers need to be able to adjust their prices to reflect changes in fuel prices," he added. "What is needed is a re-introduction of a truly enforceable bunker surcharge mechanism which fairly represents fuel price change outside the control of the carriers, but with these 'emergency' actions we seem to be headed more in the direction of illogical short-term fixes and away from a more sustainable long-term solution."

The market is largely clear that the container liners need to be able to pass on the cost to their customers when bunker prices rise sharply, as they have done this year. But the shippers need the process to be as transparent and predictable as possible, and the suspicion is widespread that this year's emergency bunker surcharges have been an attempt to recover money lost elsewhere as overcapacity continues to plague the market.

Debate on this issue continues, and for now seems relatively even-sided between the shippers and the liners. In a poll of S&P Global Platts Bunkerworld readers in June, 55% said the container lines were justified in their use of emergency bunker surcharges this year, while 45% said they weren't justified.

## IMO 2020 complications

After this year's fights, the market is now anticipating further complications just over a year from now as the IMO's global marine fuels sulfur limit drops from 3.5% to 0.5% at the start of 2020.

The shipping industry will mostly no longer be able to rely on the cheap high sulfur fuel oil that has been its staple for the past century. There is no single universal means for shipowners and operators to comply with the new rules. A wide range of options are on the table: marine gasoil, one of several planned new 0.5% sulfur fuel blends, alternative fuels like LNG and methanol, and the installation of scrubber systems to clean the emissions on board and continue using fuel oil. Some may opt to ignore the new rules altogether in some parts of the world in the hope of not being caught.

The most important consequence of this regulatory change for the container market is that bunker demand will be fragmented across the various options. In contractual discussions, shippers and their customers will no longer just factor in the high sulfur 380 CST fuel oil price as their bunker cost. In discussions for 2020 and beyond, both sides will need to consider which of a wide range of fuels their ship may be burning.

Maersk has so far said it will not use scrubbers, and intends mostly to rely on the new 0.5% sulfur fuel blends and marine gasoil. CMA CGM made a high-profile announcement last year that it was ordering nine LNG fueled vessels, but has released little detail about its plans for the rest of its fleet. MSC has retrofitted part of its fleet with scrubbers.

But none of these options will necessarily apply all the time. A vessel with a scrubber may still be forced to burn a 0.5% sulfur blend, if it is calling at a port where high sulfur fuel oil supply is more limited after 2020. Similarly, ships that usually buy 0.5% sulfur blends may be forced to use gasoil or another product on occasion; their preferred blend may not be universally available, and the ones on offer may sometimes be incompatible with what they have in their fuel tanks.

What's clear is that a one-size-fits-all BAF charge — already something of an anachronism — will become completely divorced from the reality of the bunker market in 2020 and beyond. The costs of all the various fuel options will not move in tandem, as supply and demand disparities in the immediate term after 2020 are likely to leave prices highly volatile in relation to one another.

Under these circumstances, the uncertainty around how the supply chain pays for fluctuations in fuel costs will become more intense, and arguments more frequent. The stressed market in 2020 is likely to bring casualties, and a container industry already struggling with overcapacity will be sorely tempted to turn again to the murky system of emergency surcharges. Until the container industry settles on a more transparent mechanism for how it charges for its services, and how bunker price rises are accounted for, the controversy over who foots the bill can only become more rancorous. ■

# Locating competitive advantage with geospatial data

By Nate Haskins

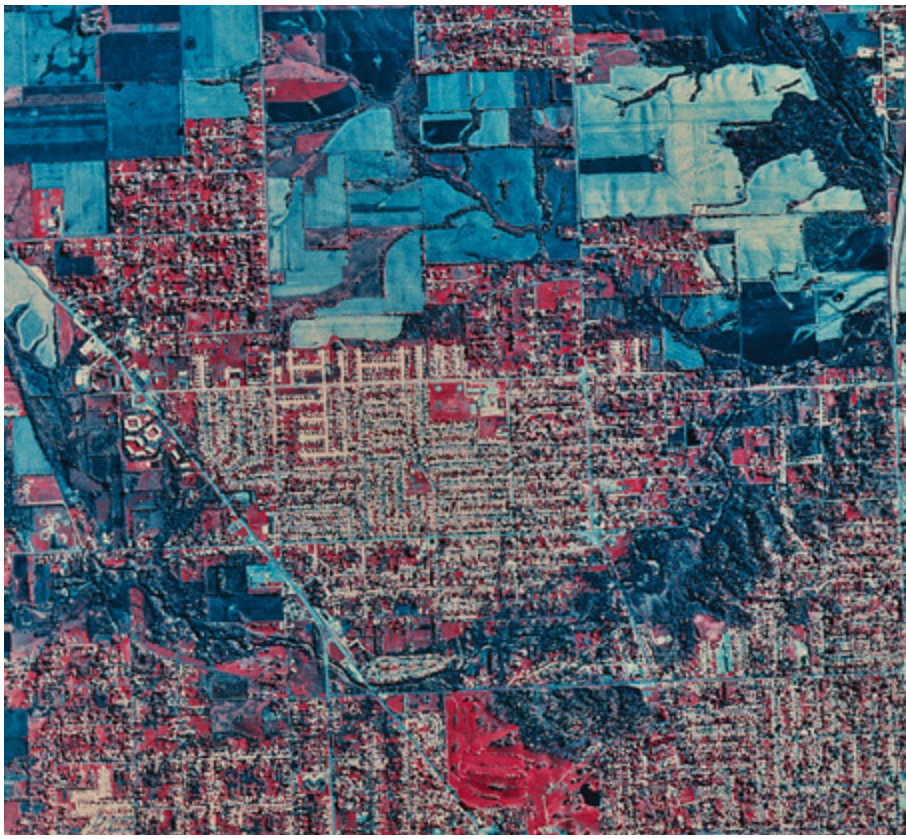
Geographic information systems (GIS) offer a framework for understanding information in relation to its physical location in space. GIS technology today takes us far beyond traditional cartography to providing key dimensions of location and interconnectivity to every data point. New GIS tools and techniques help organize layers of spatial data with related attributes, empowering users to better understand the physical world.

Of course, businesses and investors have long employed data to inform decision making. And for the majority of that history, primary analysis was performed by interrogating clues from the recent past, from the rearview mirror. What were profits like last year? What was the yield from the last production run? Which suppliers delivered for us last quarter? Those who best quantified outcomes exploited an information advantage and were rewarded.

Today's technology produces data that reveals far more rich, detailed insight into both economic activity and financial results than ever before – much of it with a spatial component.

Connected devices track our location and behaviors; internet-of-things sensors are infiltrating commercial and consumer goods; more satellites are launched every year, with increasingly powerful imaging capabilities. Pair this explosion of data with the plummeting cost of storage and awesome processing power delivered through cloud computing, and there is massive potential for the creation of new information advantages.

GIS technology today takes us far beyond traditional cartography to providing key dimensions of location and interconnectivity to every data point. But data in isolation has limited value. It's when disparate data sets are combined that new, actionable insights are delivered. Data science techniques such as machine learning and deep learning are being used to correlate massive, previously intimidating data sets, allowing them to be used in new and creative ways – often, ways that were not necessarily intended when the data was produced. Operators and investors alike are now



GIS technology today takes us far beyond traditional cartography to providing key dimensions of location and interconnectivity

using data in alternative ways to create predictions and inform decisions. Those who harness the best predictions in their operations will find an edge, and data is the fuel.

Nowhere has technology had a larger influence on what is possible than in the field of GIS. Bryce Space & Technology recorded a 53% increase in satellites launched between 2012 and 2016, with an average of 144 launches per year. Advances in imaging and radar deliver higher resolution outputs and three-dimensional renderings, in some cases independent of cloud cover. As a result, we can now understand the location of ships, levels of reserves in oil terminals, forest health, construction progress, impact of natural disasters, car and foot traffic, and much more, in near-real time.

What advantages can be created using this new data? Let's look at a few examples applicable to energy companies and other sectors.

## Understanding oil supply

Businesses are using new data to understand the massive, complex global oil markets. Machine learning techniques can be used on imagery to estimate weekly crude oil inventories otherwise not reported, while monitors on tankers reveal proximity to ports and refineries.

Together with an understanding of refining capacities, this data offers a timely view into global supply. Layering on advanced demand forecasts accounting for weather, economic growth and consumption trends, traders are gaining new predictive insights into the future price of petroleum products.

## Maximizing the impact of renewables

Advances in photovoltaics, wind turbine efficiency and large-scale battery storage efficiency have increased the viability of renewable power sources. GIS data is being employed to inform site selection to maximize impact.

For example, imagery can be used to identify areas with high recurring solar exposure, suitable slope and terrain, and proximity to low-voltage transmission lines, roads and populated areas, while avoiding conservation areas. Machine learning algorithms can be used to identify the pitch and surface conditions of commercial roofs, identifying the best candidates for rooftop commercial installations.

Similar conditions apply to the siting of wind farms using factors such as typical wind speeds and directions. All of those are helping bring down the cost of renewable power and accelerating the shift to clean energy sources.

## Improving insurance underwriting

Savvy insurance companies are improving their underwriting practices using detailed imagery. An understanding of changing climate, as well as forestation and underbrush levels, helps predict the likelihood of wildfires. Detailed topographical analysis dramatically improves upon ancient or incomplete flood zone maps previously used to price flood insurance products.

In both cases, GIS is becoming an intrinsic part of risk modelling which gives insurance companies the knowledge to price the policies according to the risk they are undertaking.

## Mastering local markets

Businesses now use GIS to answer the question of "what do my markets look like?" by building custom demographic tapestries within drive time areas around their locations.

Demographic information, including historical and projected data, combines with road infrastructure and traffic data to define detailed trade areas for analyzing market potential, market penetration, and competitive threats. Gaps and overlaps in market coverage drive decision-making for closing or opening additional locations.

# Every industry is now a technology industry, and every company a technology company

Every industry is now a technology industry, and every company a technology company. Your grocer, your cabbie and even your local pizza shop all use data to tailor and promote services, identify prospects, and inform their strategy. If you run into a company not thinking of itself that way, my guess is that it won't be around for long.

Those who master this information first will be rewarded. Are you leveraging data fully, or are you destined for irrelevance? ■

*Nate Haskins is Chief Data Officer at S&P Global. This article originally appeared in CIO Review*

# Insight Conversation: B. Anand

B. Anand is CEO of Nayara Energy, the owner of India's Vadinar refinery and a top buyer of Iranian oil. He speaks with Sambit Mohanty about the company's crude purchases and wider strategy

**There are two major themes affecting the market right now: US sanctions on Iran and the US–China trade war. How will those two factors impact the dynamics of crude flows into India?**

As you know, India and Iran have been very robust partners as far as crude supplies are concerned. India has been the logical market for much of the Iranian crude to flow and Nayara has been relying a lot on Iranian crude. It's a logical fit. There is a great relationship that we share, which I am sure other refineries in India also do. So the US sanctions on Iran will definitely have a massive economic impact, as far as India is concerned.

We are keenly watching the developments and how the replacement happens, should there be a complete embargo on Iranian crude. Those are the kind of uncertainties everyone is talking about. As far as we are concerned, fortunately the kind of refinery that we are, it offers us plentiful choices to look at alternate crudes. More importantly, [we are fortunate in] the shareholders that we have, both in terms of Rosneft and Trafigura... Both have substantial footprints, or if you like to use the word, access points. This will help us get crude from all over the world and we will rely a bit on that to combat the situation.

**Would Nayara be open to buying US crudes?**

What drives our decision is the economic value of the crude. We are probably one of the very few refineries that has the ability to process crudes with a range of APIs, from the light to the heavies. Having invested substantially in a coker and other related secondary facilities, it means the lower the API, the more margins you make. US crude is very much on the table for one to evaluate and to look at. I'm sure that, with all the geopolitical gyrations that are happening, we may see

some different kind of economics emerge which may not have been there before. So for us the short answer is that we will definitely consider US crudes to the extent that they are viable for us.

**Looking from a global supply perspective, do you think the market is ready for the shortfall of up to 2 million b/d that everyone is expecting because of the sanctions on Iran?**

The challenge is not just Iranian replacement. There are also issues around declining production in some of the other mature markets – be it in Venezuela or some other parts of Latin America, or the challenges of many of the OPEC countries to step up their production. So we are steering towards a bit of an uncertain environment in terms of how these barrels will get replaced. Everyone is in the wait-and-watch zone.

I'm sure there are a lot of requests made to some of the OPEC producers to step up their production. I'm sure Russia is doing their bit in terms of stepping up production and I am sure there is sufficient crude being produced, even back in the US. So it's to be seen how the balance gets matched.

**India's retail oil prices have been rising, with prices of gasoline and diesel hitting record highs in the past few months. What are the options for the government? Do you think this might impact demand?**

In countries like India and other emerging markets, high fuel prices have cyclical ramifications in terms of inflation. The ramification straightaway straddles back to your currencies in terms of the depreciation they have to go through. And of course, [there are] associated industry-related ramifications which come alongside it, let alone the emotional ramifications which come from the people.

In India, rising fuel prices is a matter of massive concern for the government. You keep hearing about rising prices in the news and the concerns of the common man. So I generally believe that at some point in time you will start noticing some demand destruction. We haven't noticed that yet, but there will definitely be a point in time when you will know that this is not going to sustain itself.

Coming back to what are the choices the government has in terms of how it will manage this: clearly, one of the great initiatives the government took a couple of years back was to deregulate prices. On those premises, players like us have made substantial investments in the retail fuel space. There is a strong initiative from the government to get more and more private partners into the supply and distribution side. So we believe and we are hoping that there won't be any change in the progress of policies the government has undertaken.

The only tool the government has, considering that we rely substantially on imported crude, is to evaluate the tax structure. Tax revenues play an important role in the recovery of the current account and fiscal deficit. But in the past, the government did not necessarily pass on the benefit of low prices to the consumer. I'm

assuming the government may look at that and try to give some relief to the Indian consumer if the trend is going to be rising prices.

**As the CEO of the company, could you give us a brief overview about your crude and product strategy and your vision for Nayara Energy?**

For us, the most important thing is to ensure that we run the refinery at its optimum. The refinery has in the past demonstrated ability and flexibility to digest different crudes and producing products to meet the needs of the market. In this context, the vison is to further diversify that basket. We would like to diversify the entire gamut of what we can use, including condensates that can come into the game along with stable crude. We are looking to develop ourselves to have the flexibility of looking at different energy sources as well, while producing these hydrocarbons.

On the products front, there are two interesting developments. One is the government's initiative to be more environmentally friendly and move to BS-6 [Bharat Stage 6] fuel norms, which are equivalent to the Euro 6 emission norms. I think we have our investments in place and we hope to play a leadership role in building up that product basket. The second is the huge opportunity coming our way when the IMO 2020 regulations set in. It will become our priority to make sure that we have the right set of crude and products.

As far as the product distribution strategy is concerned, our barrels have traveled to far, far places.

> "The challenge is not just Iranian replacement. There are also issues around declining production in some other mature markets – be it Venezuela or some other parts of Latin America"

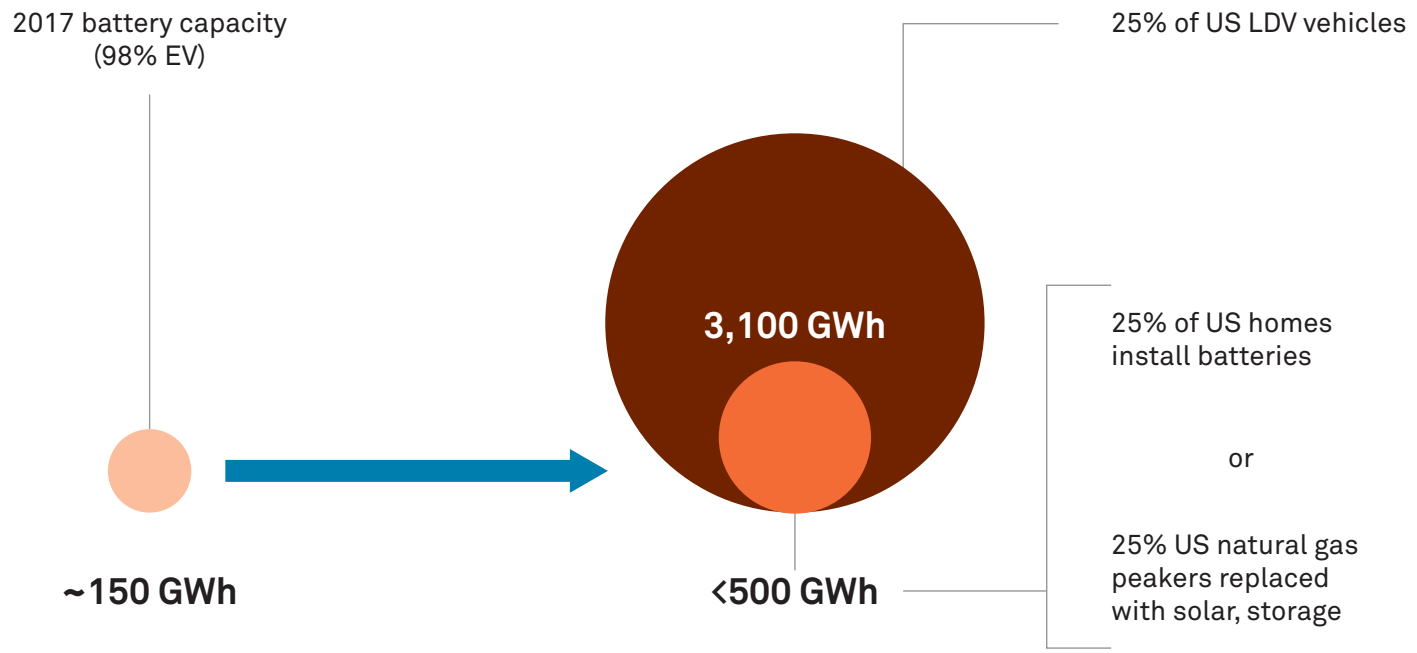
So we clearly understand how to make inroads into different markets from where demand can emanate. The strategy also embraces the fact we have built a very robust on-ground fuel retail network. There is a clear ambition to reach 7,500 retail stations in the next two to three years, with a clear focus towards enhancing throughput and embracing India into the energy scene, which you know has challenges of penetration.

So that's how we will blend it. I think we will eventually have a strategy on products that will leverage our global reach and the reach of our shareholders Rosneft and Trafigura, and our own focus on India from the domestic side. ■

# Lithium-ion batteries: in the fast lane

An accelerating need from transport is expected to drive demand for lithium-ion batteries during the coming years. Felix Maire and Roman Kramarchuk of S&P Global Platts Analytics outline the issues around the technology, as well as the sourcing and substitution of key metals

**EV battery demand significantly larger than power storage market**




Source: S&P Global Platts Analytics, US Census, IEA

Both the transportation and power industry have been facing significant changes, driven by a combination of policy and technological factors, and S&P Global Platts Analytics sees lithium-ion batteries playing an instrumental role in these transformations.

When it comes to batteries, there have been and will continue to be synergies of power storage and transport sector battery technology. In the power sector, large deployments of wind and solar photovoltaics will increase the need for storage to manage their intermittency. Recently, the US has seen several RFPs in which developers have bid projects combining solar PV assets and lithium-ion batteries – a trend discussed recently in S&P Global Platts Analytics' *U.S. Power Storage Outlook*.

Because of the often-siloed nature of the energy sector, there is a need for some perspective regarding the relative size and importance of the sectors. The fact is that energy sector applications of batteries are and will continue to be dominated by uptake in the transport sector (see chart, above).

Intuitively, this should not be surprising, as batteries provide for the full energy transport needs of an electric vehicle, but they only play a supporting role to other generating sources in the power sector. Globally, there is currently only 2–4 GWh of lithium battery storage installed in the power sector, according to the International Energy Agency, whereas batteries in electric vehicles account for 140 GWh.

The right-hand side of the chart gives a sense of the relative size of battery demand under some strong battery storage penetration scenarios. On the transport side, assuming 25% of light-duty vehicles in the US were EVs (with a 60 kWh battery) this would imply 3,100 GWh of battery needs. On the power side, assuming 25% of all US households installed home batteries (sized at 13.5 kWh), the total need would be <500 GWh. This is about the same level of battery

needs under a scenario in which 25% of US natural gas fired peaking generation plants are replaced with a combination of solar and storage. As can be seen, the potential on the power side is clearly much smaller in scale – and the power sector can also choose from a wider range of non-lithium ion alternatives.

## The role of transport

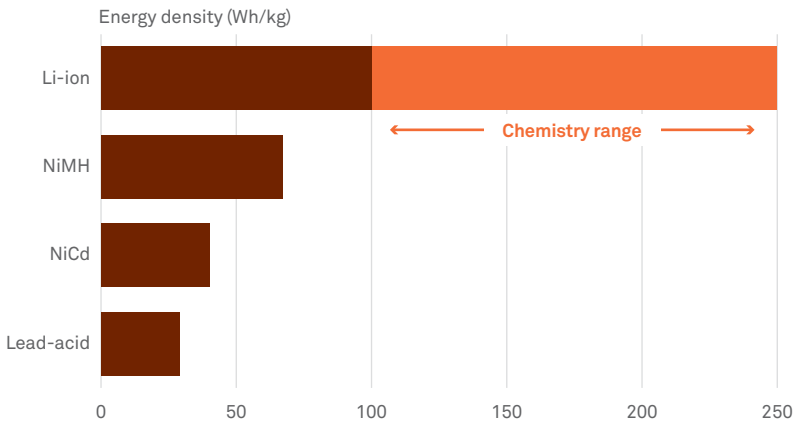
The electrification of the transport sector is seen as a potential solution to reduce local air pollution and potentially also greenhouse gas emissions (depending on factors such as the carbon intensity of the power sector). Developments in battery technology have been critical to this.

Research on lithium-ion batteries began in the 1970s. In 1991, Sony commercialized the first lithium-ion battery to increase the battery capacity of its video recording devices. However, it took much longer for the transport sector to adopt lithium-ion batteries, despite its ability to store much more electricity by unit of weight or volume than older technologies. Early EV designs from the 1960s relied mostly on nickel-cadmium batteries. And for a while, lithium-ion batteries were too expensive to be used in transportation applications while nickel-cadmium (NiCd) or nickel-metal hydride (NiMH) batteries were too heavy to provide EVs with adequate ranges. In contrast, electric hybrid vehicles needed less battery capacity and were able to utilize the relatively inexpensive NiMH batteries. The earliest Toyota Prius hybrid had a battery capacity of less than 1 kWh, while the Tesla Model 3 houses a 75 kWh battery.

While EV sales are increasing, they remain a small fraction of new car sales and the total vehicle fleet. EVs will account for 2.5% of total 2018 passenger vehicle sales, according to the latest S&P Global Platts Analytics *Electric Vehicle Sales & Policy Scorecard.* Cost will be a key determinant of further uptake. The purchase price of EVs is expected to remain higher than that of gasoline or diesel vehicles, largely due to the high cost of batteries. S&P Global Platts Analytics modelling indicates that savings in the costs of fuel and maintenance will not be sufficient to make EVs competitive on a total-cost-of-ownership basis for a while. However, we do expect further EV cost reductions and technology improvements over time. We estimate that passenger EV sales will continue to accelerate, reaching 24 million in annual sales in 2030.

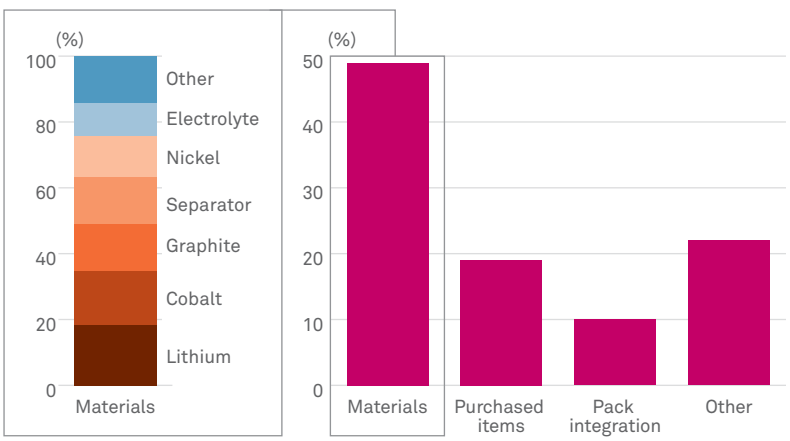
This fast ramp-up of EV sales will significantly raise demand for raw materials such as lithium, cobalt, manganese and nickel. Development of new mines

**Lithium-ion batteries have a clear advantage over other batteries for electrifying transportation**




Source: S&P Global Platts Analytics, specific energy at the cell level

**Will raw materials drive battery cost trajectory?**




Source: S&P Global Platts Analytics, assumes future improvements in NMC 622 chemistry, based on ANL BatPac model

and intermediate conversion and processing plants takes time, raising concerns that supply will not be able to keep up with demand, and that shortages will raise battery prices and slow down the price competitiveness and uptake of EVs.

## Material world

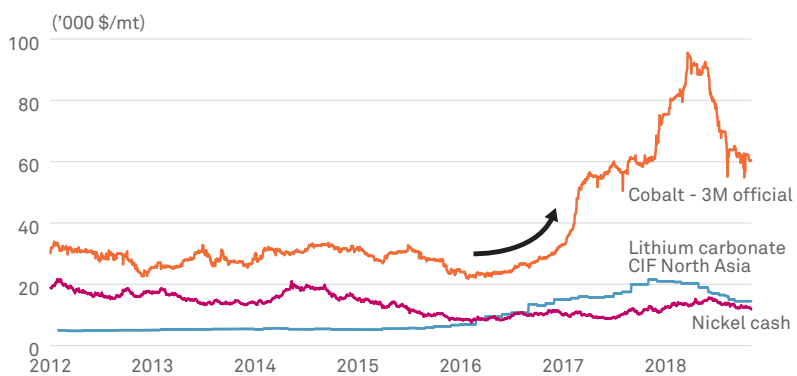
Materials currently account for nearly 50% of the total battery cost, among which cobalt, lithium, nickel and graphite are the most expensive, accounting for 30% of total cost. Process and chemistry improvements and pack engineering advances will lower battery prices, all else being equal. In turn, the battery cost exposure to metal price risks will increase as these key raw materials account for a larger share of the battery price.

How this ramp-up in demand for metals plays out will depend in part on developments in battery chemistries. The industry has developed a wide range of lithium-ion battery types, varying in capacity, chemistries and performance. There is no commercially available ideal lithium-ion chemistry suitable for all applications. The choice of chemistry is typically a trade-off between energy density, power density, safety, life and cost requirements, and the metal needs vary.

Energy density is critical for the electrification of transportation. Within the industry, the concept of "range anxiety" has been widely discussed as one of the factors limiting customers' interest for EVs. Increasing battery capacity is the primary option for increasing vehicle range. However, as there is a limit to how much battery capacity can be installed due to vehicle space and weight limits, high energy density is key to achieving long-range EVs.

In addition, the feasibility of heavy-duty vehicle electrification will partly depend on future increases in energy density. Electrifying long-range heavy-duty trucks with current lithium-ion batteries would shrink the amount of goods trucks can transport over long distances.

**Battery metal pricing**




Source: S&P Global Market Intelligence, S&P Global Platts

However, energy-dense chemistries are also the ones that use expensive raw materials, such as cobalt. While some early EVs sold outside China relied on low-energy density batteries – for instance, the first Nissan Leaf used the cobalt-free lithium-ion manganese oxide (LMO) chemistry – automakers use high energy density batteries in their latest EV models to achieve higher

Lithium spodumene and brine volumes are coming to market in increasing numbers from places such as Argentina

vehicle ranges. Tesla has been the main proponent of the lithium nickel aluminum cobalt oxide cathode (NCA). Other manufacturers use the lithium nickel manganese cobalt oxide (NMC) chemistry.

Since 2016, prices for cobalt traded on the London Metal Exchange more than quadrupled to reach a peak of $95,500/mt in March 2018. Similarly, the price of lithium carbonate more than doubled since 2016, but has been decreasing recently. Since the launch of S&P Global Platts battery-grade lithium carbonate assessment on May 4, the seaborne price has fallen significantly from its opening assessment of $18,000/mt.

Longer range EVs use the NMC and NCA chemistries, which favour the use of lithium hydroxide instead of lithium carbonate. Despite the growing demand, prices for lithium hydroxide have been dropping recently, highlighting ample lithium supply. Indeed, concerns over lithium supply have shifted towards concerns about lithium conversion capacity, which is needed to upgrade raw material to the carbonate and hydroxide needed in batteries.

Lithium spodumene and brine volumes continue to come to the market in ever-increasing numbers from Australia, Chile, Argentina, Bolivia and China. While Chinese brine and spodumene is largely seen as lower quality it can be upgraded to battery-grade quality. Weakening S&P Global Platts battery-grade lithium carbonate assessments for the seaborne as well as Chinese domestic market suggest easing concerns over near-term supply, with all four assessments down from where they were assessed when first launched.

## Ensuring a steady supply

Automakers have tried, with varying success, to lock-in raw material supply of cobalt and lithium. Earlier this year, Gangfeng signed a deal with LG Chem to supply lithium for the period 2019–2025 and signed a contract with Tesla for a two-year supply, with an option for three additional years. However, Volkswagen failed last year to secure long-term cobalt supply after asking for 10-year contracts. Cobalt also faces a concentration risk, as most of the production and reserves are located in the Democratic Republic of Congo. On the

contrary, lithium reserves are more widely spread, but Chile and Australia account for almost 80% of 2017 production.

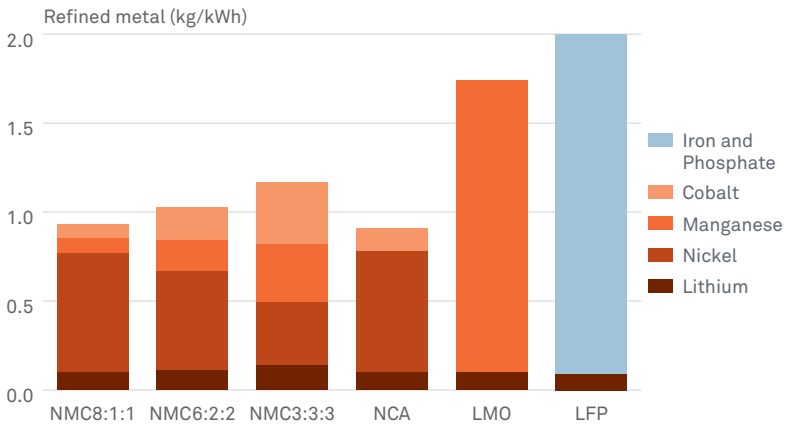
It is important to note that there is currently no real alternative to lithium for the batteries used in the transport sector. While the battery industry is using different forms of lithium – lithium carbonate or lithium hydroxide – the need for lithium is relatively comparable among all the different lithium-ion battery chemistries. Finding a good replacement would not be an easy task for the industry. By 2025, S&P Global Platts Analytics expects a 10-fold increase in lithium demand from passenger EVs.

Technology development will be instrumental in reducing cobalt exposure. Battery manufacturers are partly replacing cobalt with nickel in new batteries to reduce cobalt needs and increase energy density. The battery of the first BMW i3 used the NMC 3:3:3 chemistry (with three parts nickel, three parts cobalt and three parts manganese). A doubling of cobalt prices would lead to a 13% increase in battery cost for this chemistry. However, the industry is moving towards the NMC 6:2:2 (with six parts nickel, two parts cobalt and two parts manganese). This would cut the cobalt need, limiting the battery price increase to 8% if cobalt prices double (see chart, upper right).

Research is ongoing to further reduce cobalt content in batteries, and possibly even to eliminate it. The industry expects the commercialization of the NMC 8:1:1 within the next few years, though safety concerns due to lower cobalt content may delay this.

While several companies are working on cobalt-free chemistries, technology advances generally take a long time in the battery space, as time is measured in decades. Cobalt provides stability to lithium-ion batteries and is difficult to remove completely while keeping high energy density. New technologies, such as solid-state batteries, may decrease the need for cobalt, but are still many years away from mass commercialization. New cobalt supply will still be needed in the interim, as the scale of the expected growth in EVs will outpace such technological developments.

**Battery chemistries can vary**




Source: S&P Global Platts Analytics

Finally, battery recycling will become a critical topic, as EVs reach new segments and take up an increasing share of new vehicle sales. It is likely that governments will play a key role in supporting recycling driven by waste and sustainability concerns, as well as the risk of raw material scarcity. Automotive manufacturers typically guarantee batteries for 100,000 miles or eight years, but batteries' capacity degrades with use and they ultimately need to be replaced. There are increasing discussions about the second use of batteries, with some OEMs investigating the reuse of EV batteries for power storage applications. ■

## S&P Global Platts pricing and analytics

S&P Global Platts has been working to better understand the implications of changes in the battery metals sector through an increased focus on analytics in this space, and by launching four new battery-grade lithium price assessments in the past year.

S&P Global Platts Analytics provides research and data on the global commodity markets, and covers the transformations the power and transport industries are currently facing.

Our battery-grade lithium assessments are available to view in our *Metals Daily* newsletter or on Platts Metals Alert Page 8888.

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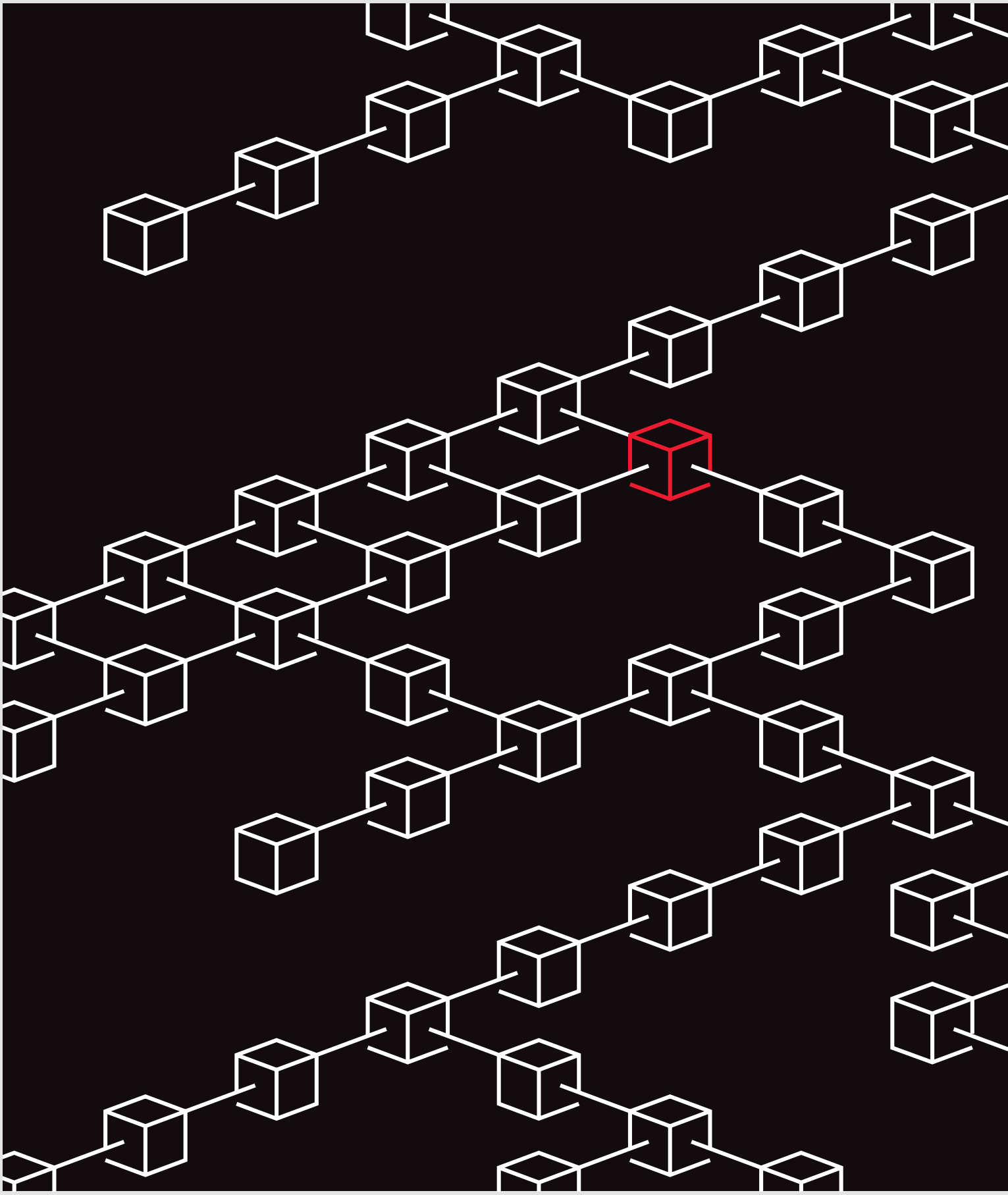


# Unlocking the potential of Blockchain

Blockchain has the potential to make commodity trading simpler, faster and cheaper. In the following pages, S&P Global Platts explores the impact it could have on power markets, how permissioned blockchains can help solve reporting requirements, and the influence regulators will have on the pace of change

# Power to the blockchain

Some of Europe's largest energy companies are partnering on a project that could see power and gas trading take place on a peer-to-peer basis with blockchain technology, writes Henry Edwardes-Evans

Europe's Enerchain project aims to enable large-scale peer-to-peer trading for wholesale natural gas and power – making it unique among blockchain pilots for its focus, size, and disruptive potential.

More than 35 companies are involved in the project, including big European gas and power traders such as E.ON, Enel, Iberdrola, and Vattenfall. The volumes these big beasts could bring to a new marketplace could disrupt the business model of the brokers and exchanges that facilitate wholesale power and gas trading today.

The project also embraces smaller, regional players – those grappling with a boom in distributed energy that want to trade without the fees, settlement risk, and clearing associated with the conventional market.

German technology company Ponton came up with the Enerchain idea in 2016, and demonstrated a first test trade on a prototype blockchain in November of that year. It set up a small early mover group of companies to work on the idea and, by February 2018, it was able to carry out several live trades using the Enerchain software powered by open source blockchain engine Tendermint.

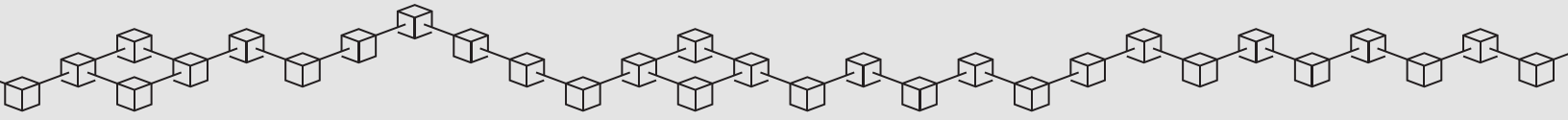
The trades involved Endesa and Gas Natural Fenosa, Energie AG and Stadtwerke Leipzig, and Verbund and Salzburg AG, and demonstrated proof of concept. But, with no fixed launch date set for commercial trading, Enerchain's challenge to the existing order remains a vision for the future.

As of mid-2018, the companies involved still had to agree to governance, form a legal entity, and then actually start trading in earnest. The software itself is evolving and has limitations in transactional speed. Several participants are there to observe and learn, and it remains to be seen which of the big beasts are really serious.

**More than**

**35**

**companies are involved in the Enerchain project**



Participants are believed to be setting up a registered not-for-profit cooperative, similar to a Genossenschaft in Germany or a Stiftung in the Netherlands. This entity could carry out commercial operations for the benefit of its members if those operations reduce barriers to entry and are in the public interest.

While some participants say their interest in Enerchain is more about understanding the potential for blockchain, not spearheading a revolution, others are genuinely keen to turn concept into reality. "The potential of blockchain technology lies in disintermediation," E.ON's Thorsten Kuehnel told S&P Global Platts. "This creates true disruption; everything else is incremental innovation or optimization. Enerchain is one of the very rare projects, outside the financial sector, which has real potential for disruption."

## Speed restrictions

For blockchains to work, computers or nodes on a peer-to-peer network check each transaction using a consensus algorithm to agree the transaction is valid. Verified transactions are then added to other transactions to create a new block of data that is added to the existing chain, creating a permanent data entry.

A key issue for participants is how fast the Enerchain software can add transaction data to the blockchain.

This means the type of trades to which the technology is applied must "suit the software," Ponton's Rex Kempcke said. "This is a young technology, with a block-building time of one second [per block]. There are restrictions with regards to speed of transaction, and we need to build trust within organizations – they are not going to trade all their assets over new technology."

The potential is there to boost block building time to more than 100 per second, and perhaps as high as 300, depending on how much computing power is available. While 100 blocks a second is not fast enough for high frequency spot trading, it is enough for many, if not all, the forward and specialist load curve contracts that several Enerchain participants have in mind for the platform.

Enerchain is focused on testing and offering physical spot and forward power and gas products for any European delivery zone, including standard and non-standard products. But there is scope to extend this to post-trade reconciliation services. Once a deal is executed on Enerchain, it is pushed to the electro-technical information model systems of the company, from where it goes down the traditional reconciliation cycle.

"We've started at the front end because there is less integration with legacy systems," said Kempcke. "Once the blockchain framework is in place, however, it can be extended along the trade cycle."

The idea is for Enerchain to cover the entire cycle from pre-trade through reconciliation, with third-party platforms or services (such as screen vendors) linking to the blockchain infrastructure.

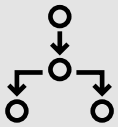
## Lower risk

One of the benefits of blockchain is reducing settlement risk, removing the need for clearing. The moment a transaction is executed, value is transferred using a digital currency or token. This makes it easier for smaller players to join a private blockchain, like Enerchain, because of lower collateral requirements.

"Fiat currencies, like the euro and the pound, are not digital yet – you can't transfer euros or pounds via the blockchain, so you need a cryptocurrency token," Kempcke said.

A trustee issues the token and holds the equivalent in a fiat currency in trust. The transfer and settlement are done by the token currency. In the longer term, fiat currencies themselves may have digital versions, although central banks are proceeding with understandable caution. ■

**A key issue for participants is how fast the Enerchain software can add transaction data to the blockchain**

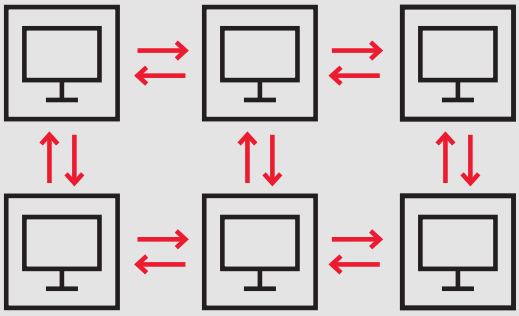


**One of the benefits of blockchain is reducing settlement risk, removing the need for clearing**

# How transactions are recorded on a blockchain

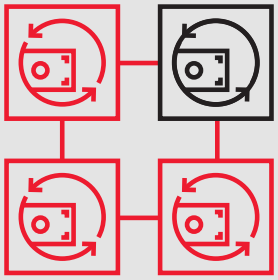
1. It starts with a transaction request.

2. The request is sent to a peer-to-peer computer network for verification.



3. The verified transaction is then combined with other transactions to create a new block of data.

4. This new block is added to the chain of existing data blocks in a way that is permanent and cannot be changed.



5. The transaction is complete.

Source: S&P Global Platts

# Taking stock

By James Rilett

Permissioned blockchains are restricted to participants who have permission to join them, and the data on them can be shielded from both other participants and the blockchain administrator.

This solves the problem of how to share information to produce an anonymous aggregate figure without revealing individual positions to external parties, such as database administrators. Potential uses include anything needing secure data submission with adaptable privacy options and a clear audit trail. It could be particularly useful for complying with regulatory requirements to make market fundamentals – like stock levels – more transparent while protecting commercial confidentiality.

One example of this is the S&P Global Platts blockchain project at the Port of Fujairah in the United Arab Emirates, which launched in February 2018. Platts uses a permissioned blockchain to collect and publish weekly aggregated data on oil terminal stock levels on behalf of the Fujairah Oil Industry Zone authority and data committee FedCom.[1]

Publishing stock level data – a key supply data point for traders – is part of FOIZ and FedCom's efforts to develop Fujairah as a trading venue, not just a physical hub. The oil terminal operators submit the data, and the blockchain replaces a more laborious method involving spreadsheets and email chains with a quicker, more transparent, and secure process. The project shows how blockchain can be used to create networks for natural partners – like trusted trading counterparties, regulators, and publishers – to securely share potentially confidential information.

This could include using blockchain to run auctions and electronic tenders for physical bulk commodities like crude oil and agricultural products, for example. These are often done now with sealed bids through email, and processed manually by the counterparties.

Blockchain is still a very new option – the S&P Global Platts project at Fujairah was one of the first live commercial applications in the energy sector. Regulators and market participants around the world are still in a factfinding phase, with some entities more interested than others. But the basic technology is proven, particularly for relatively simple tasks such as aggregating inventory data.

How quickly it gets taken up for these tasks will depend on costs, regulatory attitudes and market reactions. ■

*James Rilett is Global Director of Innovation at S&P Global Platts*

**S&P Global Platts is using a permissioned blockchain to publish weekly aggregated data on oil inventories**

**Blockchain could be used to run auctions and electronic tenders for physical bulk commodities like crude oil and agricultural products**

1 Available at: https://fujairah.platts.com/fujairah/

# Keeping an eye on blockchain

Some firms are highly enthusiastic about the changes blockchain could bring to commodities trading, but the approach of regulators will be critical to whether it takes off. By Jared Anderson and Siobhan Hall

From giving power trading prosumers special privileges to removing requirements to use paper documents, regulators will play a key role in developing digital trading.

The Brooklyn microgrid in New York is a good example of how blockchain-based peer-to-peer trading can work in practice, having allowed participating households to generate, store and trade electricity locally since 2016.

The project was only possible with a regulatory waiver, and the developer, LO3, is talking to the New York Public Service Commission about rule changes to allow smaller volumes of power to be traded, LO3 founder and CEO Lawrence Orsini told S&P Global Platts.

The challenge is that regulation around the world is not usually set up for decentralized peer-to-peer trading. In most US markets, for example, only approved providers can sell power, and in retail-choice states, like New York, you have to register as an energy service company to do so.

"So are neighbor A and neighbor B going to do that? Probably not," Benjamin Tejblum, an associate at law firm K&L Gates, told an industry event in March.

Neighbors cannot trade freely with one another without a utility involved, he said.

At the large commercial and industrial consumer level, LO3 launched a project with Direct Energy Business in April in Texas to enable micro-level energy hedging. The developers were attracted by Texas's strong historical energy focus and its "pretty progressive regulator," Orsini said.

Over in California, however, blockchain project developers want more support from regulators. Demand aggregator Leap plans to supply 90 MW of demand response capacity to Southern California Edison and Pacific Gas and Electric in 2019 through a traditionally contracted aggregation program.

"We want to aggregate devices [for demand response] and could use smart contracts to verify identity without using a traditional contract," Leap CEO Thomas Folker told S&P Global Platts.

**The Brooklyn microgrid allows participating households to generate, store and trade electricity locally**

Using the blockchain platform Ethereum could allow Leap to scale from hundreds of participants now to millions. Leap would need a waiver from the state utility commission to do peer-to-peer transactions.

Most US regulators Folker speaks with look favorably on blockchain. For example, the California Air Resources Board has a low-carbon fuel credit program, but it's challenging to track. Tokenizing and digitalizing their credit register could improve what is currently a "vague and inefficient market" and CARB may look at that in 2018, he said.

## EU cares and shares

EU regulators are also interested in blockchain's potential, and the European Commission set up an observatory in February 2018 to monitor projects, share information and make recommendations. Its draft list of topics to research includes: energy and environment use cases; financial services use cases; the legal status of blockchain registries and smart contracts; scalability, interoperability and sustainability; and cybersecurity.

The EC could have a role in setting EU standards to ensure interoperability between platforms and programs, and across borders, according to Peteris Zilgalvis, head of the EC's digital innovation and blockchain unit in its digital department. Any potential EU legislation will be technology-neutral and not specifically about blockchain, he told a digital energy event in Brussels in February 2018.

"We should move away from legislative requirements for paper records ... and do smart contracts need to be made legally binding across borders?" he asked.

European power sector trade body Eurelectric has urged regulators to offer startups and project developers "regulatory sandboxes" – a controlled space to test ideas under regulatory supervision without fear of costly compliance breaches.

"One of the greatest frustrations for companies testing pilot projects is when they can't replicate them in different countries because of different legal rules," Eurelectric's innovation advisor Anna Dimitrova told the event.

## Planning a new market

Singapore is one market where there has been a flurry of interest in using digital technology to transform commodities trading (see box, next page). Overseeing these attempts at digitalization are the Monetary Authority of Singapore and the Singapore Exchange. There is also a plan to build a cross-border trading system with Hong Kong and industry bodies are looking to create new digital standards for the industry.

The MAS plans to build a multi-tiered market that will complement existing commodity exchanges, giving startups the flexibility to launch new decentralized trading platforms and new products with minimal regulatory hurdles. This is expected to pave the way for blockchain-based businesses and cryptocurrency exchanges, a pioneering move for an Asian regulator.

The move has been prompted by new business models emerging in trading platforms, such as using blockchain technology, or peer-to-peer trading without intermediaries, which lower the entry cost for market participants that do not pose a systemic risk, according to law firm Allen and Gledhill.

Singapore's existing laws on securities trading and corporate governance provide enough guidance to set up and run a disruptive business venture, said Yvonne Zhang, co-founder of trade financing platform Aquifer Institute. But they may not yet accommodate the new asset classes, instruments and business models that the disruptive ventures are working toward.

"MAS and SGX Regulation have been working actively with the market participants to come up with new ways of regulating up-and-coming market places, as well as adapt to new asset classes being created," she said. ■

**The EC set up a blockchain observatory in February 2018 to monitor projects, share information and make recommendations**

**Singapore is one market where there has been a flurry of interest in using digital technology to transform commodities trading**

## Strategic Singapore

Digital startups see opportunity in Singapore's position as the largest trading hub in Asia, as well as the lack of digitization in physical commodities trading, a business that has not changed in decades. Some shippers still fax bills of lading to each other.

When Singapore decided to deregulate its power sector and introduce electricity trading on its stock exchange, it was one of the first countries in Asia to do so. Most other Asian countries still operate government-controlled power utilities and grids.

Businesses in Singapore can already pick their source of electricity supply from a laundry list of retailers, and, by the end of 2018, small consumers like households will also be able to do so. The problem is that there is no common platform where this can be done.

Enter Electrify, a local startup that raised $30 million through initial coin offerings to create an online marketplace for buying electricity, and executing the trade through smart contracts. It is backed by cyptocurrency exchange OmiseGo's CEO Jun Hasegawa, Ethereum co-founder Wendell Davis and Japanese venture capital firm Global Brain.

Electrify's blockchain platform for small scale peer-to-peer power trading is called Synergy. Using blockchain introduces security and transparency, automates the contracting and settlement process, and cuts transaction times and service costs by as much as 30%, said Electrify's co-founder and CEO, Julius Tan.

Synergy is currently undergoing testing in Singapore with a select group of consumers and prosumers, Electrify said. The company plans to launch the platform in the second quarter of 2019.

Another commodities trading platform planning to use blockchain is SourceSage, a homegrown startup that began as an app to crowd-fund prices of palm oil and its products in Southeast Asia. It then evolved into an online platform to match buyers and sellers in a very fragmented industry spread across Malaysia and Indonesia.

"We are in the process of utilizing blockchain in the areas of document generation, trade financing and also verification of suppliers and buyers," SourceSage co-founder Sim Jian Min said.

Sim said it all started with a simple request from his father, an old school petrochemicals trader, to build a website for his trading business.

## Multiple options

Startups in Singapore have been adamant that blockchain is not the only solution.

TradeCloud, an online platform created by a group of ex-Trafigura executives for the metals and minerals space, is designed to connect traders, match bids and offers and even standardize and share contracts. Co-founder Simon Collins considers it "the Airbnb" for commodities trading. He said TradeCloud's first challenge is to bring commodities trading into the digital space, before even attempting to introduce technologies like blockchain.

"We see multiple areas in commodities trading where they [distributed ledger technologies] can be leveraged, and TradeCloud will use more than one type of blockchain – applying each where it is most appropriate," cofounder Justin Wilson said. ■

*By Eric Yep*

**Digital startup Electrify sees an opportunity in Singapore's decision to deregulate its power sector**

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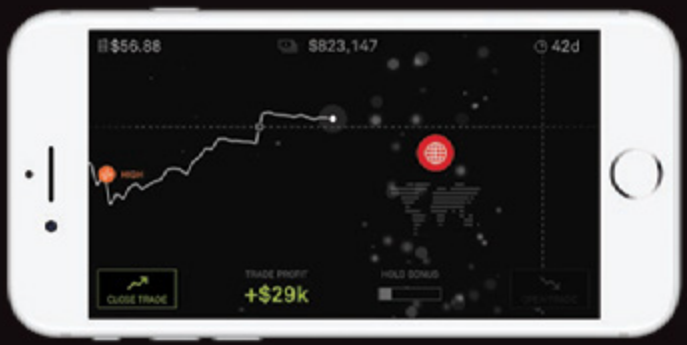


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# Small reactors, big ambition

The nuclear industry is bullish about the prospects of a new class of very small reactor, although some industry critics question its viability.
By Oliver Adelman, Jim Ostroff and William Freebairn

Recent expressions of support by the US and UK governments have highlighted a new class of very small nuclear power reactors.

Microreactors, sometimes defined as reactors of less than 15 MW, have been identified as potential recipients of development funds by the UK government as part of its search for an "advanced modular reactor" for near-term deployment, while the US Congress passed legislation in July asking the Department of Energy to develop a report on the potential deployment of such units at military or energy facilities.

Small modular reactors have received attention in recent years as a potential solution for the problems of small grids and remote locations while benefiting from faster factory-like manufacturing. Advocates for microreactors say their diminutive size allows for an expanded range of siting options and functions.

Critics wonder, however, whether the tiny reactors have much of a market outside a few remote Arctic communities, as well as highly specialized defense and resource extraction facilities.

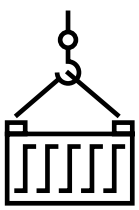
## Growing interest

Some established and newcomer reactor vendors have developed such designs, initially in secret, and report growing interest for the product category. Westinghouse is looking to build a demonstration unit of its eVinci reactor, while US start-up Oklo has engaged for more than a year with NRC on fuel and licensing plans for its design. The UK's U-Battery is developing a microreactor design, as are other global companies.

The units could be small enough to fit inside a standard 40-foot shipping container, vendors have said.

"In terms of their role in the nuclear industry, they would be broadening the range of applications for which nuclear technology can be applied," said Jonathan Cobb, a senior analyst with the World Nuclear Association. "Some microreactors also have the ability to load-follow, which could have applications in balancing supply," he noted in an email.

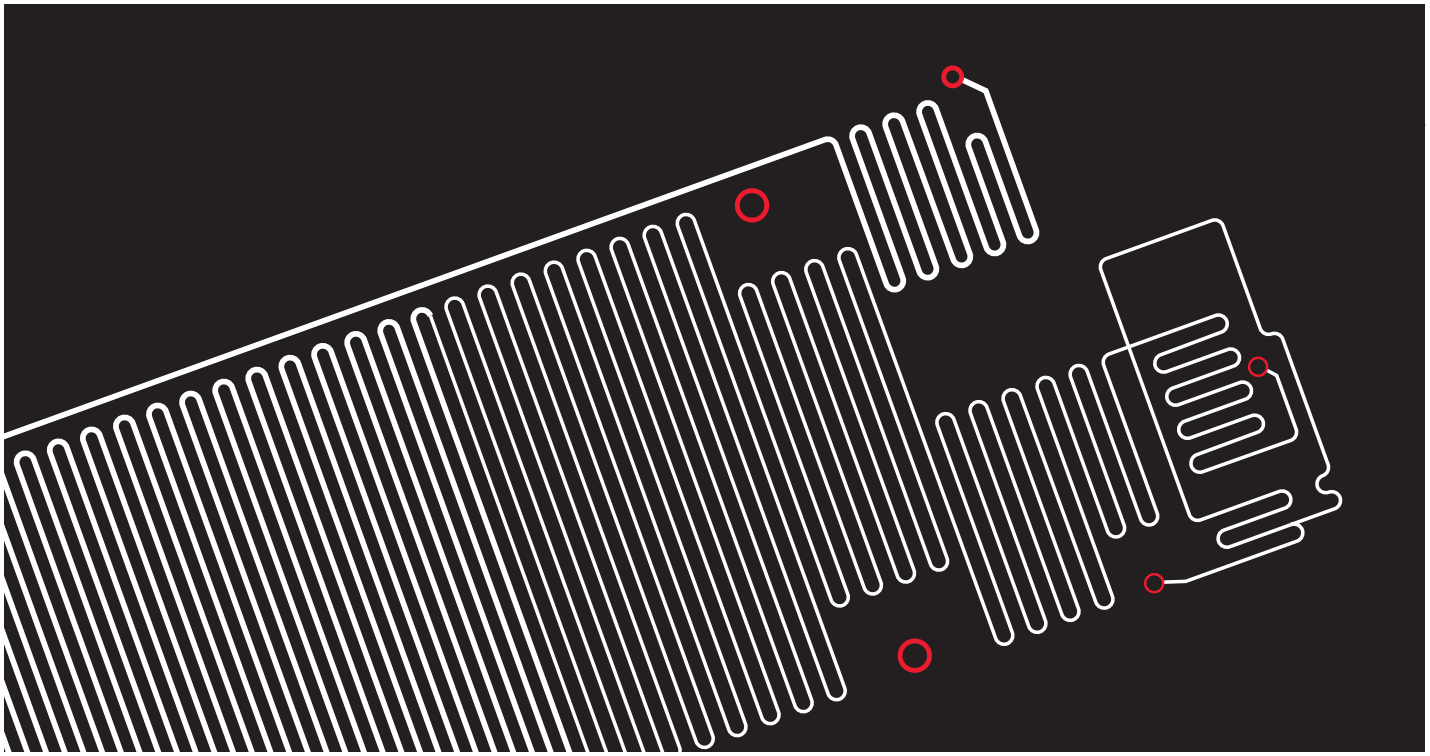
Art Wharton, vice president of market development for Studsvik Scandpower, said there are "potentially attractive economics" for locating microreactors in isolated communities, noting remote communities in Alaska and Canada are paying $1 per kilowatt-hour for electricity produced by diesel generators. By



**The units could be small enough to fit inside a standard**

**40-foot**

**shipping container**



comparison, he said, customers in US and Canadian cities and towns, where electricity is produced by large coal, gas or nuclear plants, pay 6–9 cents per kWh.

Another consideration that favors microreactors in such locations, Wharton said in an interview, "is their ability to operate off the grid in these areas, where building transmission lines" to connect to a regional grid would be prohibitively expensive.

Everett Redmond, the Nuclear Energy Institute's senior technical advisor for new reactors and advanced technology, said that a key attribute of microreactors is their "ability to offer resilience and reliability."

"In remote locations, the bottom line is that if the electricity goes out they are in serious trouble and in a life-threatening situation," Redmond said.

Microreactors could be useful for a variety of industrial applications, he said, and could be downsized to the point they become portable – enabling them to displace diesel generators that are brought to industrial or work sites for specific periods of time.

Studsvik's Wharton said that the heat, rather than electricity, generated by microreactors could be a cost-effective product of the units. The reactors would substitute for other generating sources, such as natural gas, to produce heat for chemical processes, the extraction of oil from tar sands, and sea water desalination or district heating in towns and cities. Such reactors could be the primary source of electricity generation in small African towns, he said.

However, Stephen Thomas, an energy professor at the University of Greenwich in London, is skeptical about the need for new nuclear construction. "After 40 years of observing the nuclear industry, my gut-feel is that this is just the latest nuclear technology rabbit-out-of-a-hat that will lead nowhere but might attract a little public funding and will give hope to nuclear enthusiasts that the industry has a future," he said.

## Regulatory regime

Some microreactors could be unstaffed, with operators monitoring them remotely, vendors have said. The WNA's Cobb said the use of microreactors in certain settings would "require a different regulatory regime to that to which the current large nuclear reactors are subject."

The NEI's Redmond said he "does not see barriers" at NRC for staff to review microreactor design approval applications, noting the agency "is doing a lot of work to educate staff on various advanced technologies, such

**Microreactors may require a different licensing regime to more conventional nuclear technology**

as high-temperature gas-cooled, molten salt and liquid metal" reactor design concepts.

Some advanced reactor developers believe the standards for microreactors may be more comparable to those for nuclear materials licensees, which use radioactive sources for industrial and medical purposes.

William Reckley, a senior project manager in NRC's Office of New Reactors, said during a meeting to discuss advanced reactor licensing July 26 that the agency is considering whether additional regulatory options are needed for microreactors. Even the new framework being considered by NRC to streamline the licensing of advanced reactors and small modular reactors – those under 300 MW of capacity – still might not be suitable for the unique features of microreactors. "We're looking to say, do you reach a point where it is so fundamentally different — and I'll get in trouble for this — but at some point does a reactor even though it's commercial power, look more like a radiographer than a Vogtle? Obviously that's an exaggeration," Reckley said.

The expansion of Georgia Power's Vogtle plant in the US features two 1,150-MW AP1000 units.

"At some point, is it so fundamentally different that we need to totally change how we're viewing it in terms of how it should be regulated based on the potential consequences and risks associated with the machine?" he asked.

## Fuel, enrichment issues

To achieve efficient, cost-effective generation, Studsvik's Wharton said microreactors would use high-assay, low-enriched uranium, meaning levels from 5% U-235 enrichment to just below 20%. Almost all existing power reactors use fuel enriched to below 5% U-235.

However, he said a common element shared by microreactors is "they have smaller thermal loads and less decay heat that needs to be dealt with."

Wharton said he could not estimate the cost to license and build a microreactor, noting the first prototype unit could be built by the late 2020s at a US national laboratory site.

Technological and cost-efficiency improvements "will be made by engineers in the next few decades," he said. "Twenty years from now," Wharton said, it is likely "we'll see some of these [microreactors] available for substantially lower costs," although he could not estimate a dollar amount.

**Studsvik's Wharton said microreactors would use high-assay, low-enriched uranium, meaning levels from 5% U-235 enrichment to just below**

**20%**

**Advocates of microreactors say they can provide cheaper electricity and heat to remote communities**

Edwin Lyman, senior scientist, global security, with the Union of Concerned Scientists, was more skeptical about the economic viability, security and demand for microreactors. Noting that the idea of installing small-size nuclear reactors on military bases has been "discussed and dismissed" for many years, Lyman said microreactor developers "are going after the same remote communities in the Arctic and how big a market is this, realistically?"

"We'll see a dozen companies all chasing after a tiny market segment with a product that is looking for a use," he said.

Although he could not estimate any electricity production cost for microreactors, Lyman said, "the one thing you can say [about] the economics is that the smaller the plant, the more expensive the cost of electricity will be," because of economies of scale. "That's why reactors, which started off small, have consistently become larger," he added.

Lyman took issue with comments by microreactor proponents such as Wharton, who said "the concept is that you can push the on-button and walk away for 10 to 12 years before having to refuel" the reactor.

"If something goes wrong," Lyman said, "you will have to have a team of nuclear engineers on site to fix the problem." In addition, he said "novel reactor designs will raise safety concerns," especially since these systems will use high-assay LEU.

Procuring this material likely will be a problem, he said. There is no commercial supply of high-assay LEU, Lyman said, noting that "DOE has about 1.5 tons" of the material that it makes available each year "for research reactors around the world."

He noted that Urenco's New Mexico uranium enrichment facility could make high-assay LEU, but "it would need a license amendment to do this, requiring much research." Existing centrifuges would have to be reconfigured, he said. "On a commercial basis, [no enricher] would do this unless it knows the demand will be there, but demand is greatly uncertain, and so you have a chicken-and-egg situation."

Nonetheless, Oklo, Urenco and Westinghouse are pressing ahead with their microreactor designs (see next page).

Other companies working on microreactors include Ultra Safe Nuclear Corp., which is developing a high-temperature gas-cooled unit of 5 MW-10 MW, LeadCold Nuclear, which is pursuing a molten lead cooled 3-MW concept, and StarCore Nuclear, which has a 10-MW high-temperature reactor design. All have engaged with the Canadian Nuclear Safety Commission about reviewing their designs. ■

## Urenco's U-Battery

The U-Battery microreactor, produced by the Urenco subsidiary of the same name, is likely to be initially used for power generation either in remote locations, likely in Canada, or for industrial applications in the UK, said Steve Threlfall, the general manager of U-Battery.

The company says each unit of its modular reactor has a capacity of 4 MW electric and 10 MW thermal. There are a large number of industrial applications in the UK for which the reactor could be used, such as in glassmaking, ceramics and petrochemicals, Threlfall noted.

U-Battery says it is pursuing a twin development approach in both Canada and the UK, having registered with the Canadian Nuclear Safety Commission for a vendor design review, or VDR, and by its participation in the UK's advanced modular reactor competition.

Threlfall said there are a number of commercial options for the U-Battery, including licensing the design for manufacture by an outside party.

He noted that Bruce Power in Canada wished to operate a "fleet of U-Batteries across Canada," but that Urenco, the enrichment services company that is U-Battery's parent, wanted to establish its technology in the UK first.

Consequently, the microreactor design was submitted earlier

**The UK's advanced modular reactor competition involves a total award of**

**£3 million**

**of government funding**

this year in the UK government competition for funding to develop an advanced modular reactor design. The competition involves a total award of £3 million ($3.91 million) of government funding to six companies for feasibility studies of their designs, with the studies to be delivered in early 2020.

For the purpose of the competition, the UK defined advanced reactor designs as modular units with a capacity of up to 600 MW that could be used for multiple purposes.

The U-Battery is gas-cooled with helium in the primary circuit and nitrogen in the secondary circuit. The unit will be powered by Triso uranium nuclear fuel, which the company says acts "in combination with low absolute power" and absence of water to eliminate the need for multiple backup safety systems.

Threlfall said that U-Battery had always assumed its design would have go through a full generic design assessment regulatory approval process in the UK, but noted that the unit was "much simpler than a PWR-type reactor design." He said the company hopes the review process can be streamlined to take around four years instead of the usual four and a half. ■

## Westinghouse's eVinci

About two years ago, Westinghouse began working on its microreactor design, known as eVinci, said Yasir Arafat, a senior engineer for the company. The work was done quietly, and information about the project was not disclosed even within the industry until last year, he said during a webinar June 26.

"We kept everything hush-hush," he said of the work to develop a new reactor design, which is modeled after reactors used to provide power to spacecraft.

With the demand for large reactors essentially flat, Westinghouse sees opportunity for revenue in the microreactor category, which is potentially "disruptive" in the market for small generators, Arafat said.

The high-temperature reactor features a solid core with heat "pipes" through the core that provide cooling. Reactor control is provided by a control drum, which includes a crescent-shaped neutron absorber, said Jurie Van Wyk, a principal engineer on the project.

The 5-MW eVinci reactor is a transportable power generating system designed to replace diesel generators and to require minimal oversight, Arafat said. "These generators have to be so safe and so secure that we do not necessarily need to rely on operators and security staff," he said.

The 22-foot reactor core is encapsulated in a block of steel which makes the design more proliferation resistant, Arafat said. Channels in the core include fuel pellets, a hydride moderator and heat pipes filled with a cooling fluid, Van Wyk said.

Such a reactor could provide heating and cooling as well as potentially hydrogen generation using reactor heat, Arafat said.

**The eVinci design would be scalable from as little as**

**200 kW**

**to as much as**

**15 MW**

A factory-built fully fueled unit would be transported to a site and then be replaced after about 10 years of operation, he said. The design would be scalable from as little as 200 kW to as much as 15 MW, Arafat said. It would use fuel enriched to 19.75% U-235, Van Wyk noted.

There are no safety-related moving parts and no coolant pumps, he said.

The Westinghouse engineers declined to provide more detail on the coolant, fuel and moderator to be used in the design.

Westinghouse has begun work building a demonstration unit that would operate using electrical heat instead of a nuclear reaction for testing, Van Wyk said. That unit will be completed by the end of 2019. A nuclear demonstration unit would be built by the end of 2023 and a commercial unit as soon as 2024, he added.

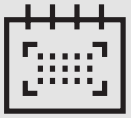
Westinghouse received a $5 million grant this year from the US Department of Energy to advance the technology behind a self-regulating solid-block core. The company has begun interacting with the US Nuclear Regulatory Commission about the potential licensing approach for the eVinci design, Arafat said. It is also seeking a review by the Canadian Nuclear Safety Commission, the regulator said on its website. ■

## Oklo's fast reactor

Everett Redmond, the Nuclear Energy Institute's senior technical advisor for new reactors and advanced technology, noted that Oklo is developing a 2-MW microreactor and has held preliminary meetings with the US Nuclear Regulatory Commission.

"There might be a [design approval] application from Oklo within the next few years," he said.

Jacob DeWitte, CEO of Oklo, based in Sunnyvale, California, said during an interview September 26 that his company's fast neutron reactor design could provide 1–2 MW of electrical output, but could also provide heat. Some potential buyers have said they are interested in high temperature steam for industrial use or heating.



**The Oklo reactor would be able to operate for as long as**

**20 years**

**without refueling**

The Oklo reactor is planned to be about the size of a standard shipping container and could operate for as long as 20 years without refueling, DeWitte said.

Oklo, formerly known as UPower, has held a series of meetings with NRC, including some focusing on the use of fuel-related data from the Experimental Breeder Reactor II, a sodium-cooled fast reactor that used metallic fuel and operated from 1965 to 1994 in Idaho. The company's microreactor would use metal uranium-zirconium alloy fuel similar to that used in EBR II, Dewitte said at a US Senate hearing in 2016.

Oklo has submitted a core design technical report, an initial licensing plan and proposed design criteria for the reactor to NRC, although the documents have been withheld from the public because they discuss proprietary information. The regulator has drawn on lessons from licensing the first small modular reactor design recently, and "they've become much more efficient and cost-effective," DeWitte said. ■

# Bigger and better: the LNG fleet in 2019

The LNG shipping fleet expanded rapidly this year, becoming more technologically advanced and diversified in terms of ownership. What does this mean for 2019 and beyond? By Eric Yep and Abache Abreu

The global fleet is set to undergo its largest expansion ever in 2018. This will be vital for it to support the development of spot pricing, meet growing demand – largely driven by rising US LNG flows to Asia – and serve the new wave of supply expected from post-2020 export projects awaiting final investment decision (FID).

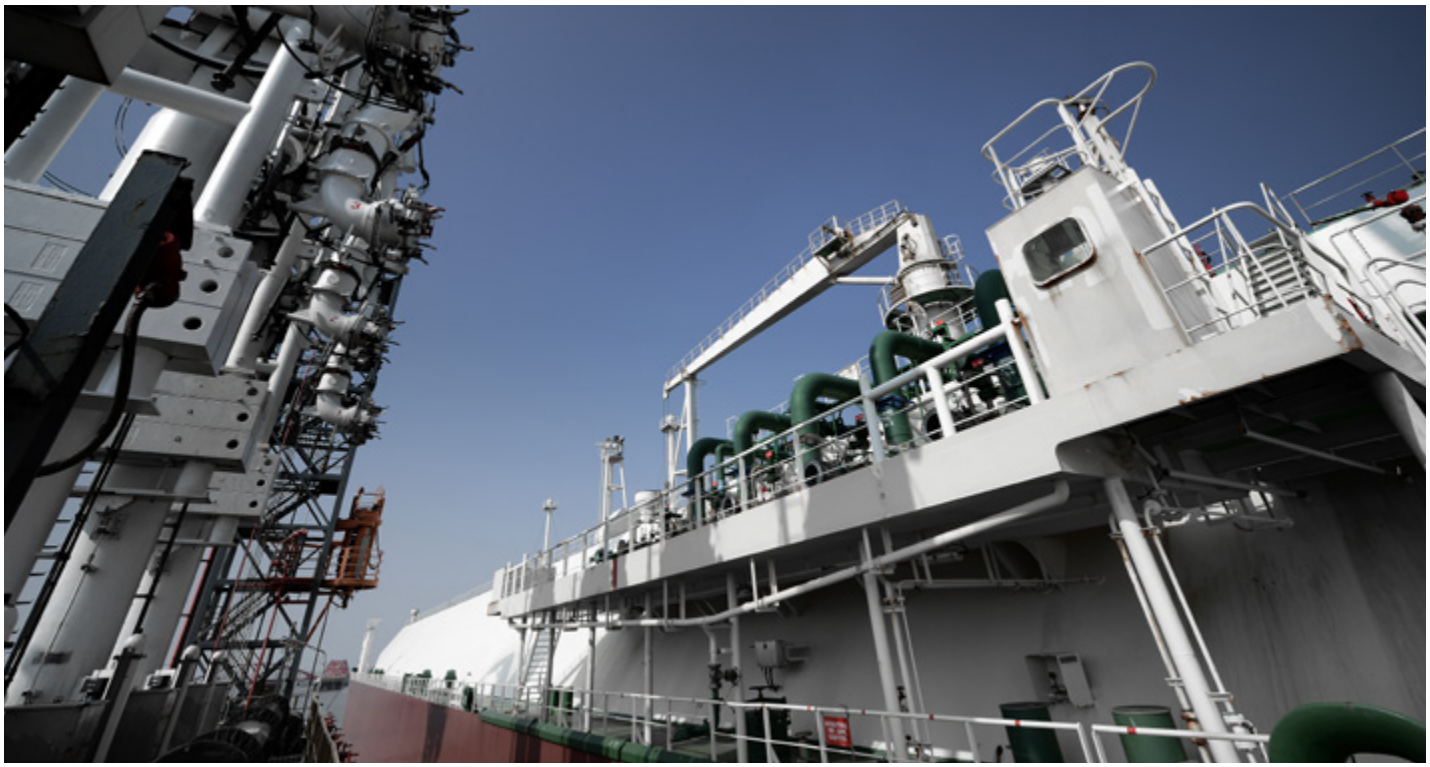
LNG shipping technology is evolving fast, bringing greater efficiencies in trading, helping extend supply chains into new areas of demand and allowing LNG to become more commoditized. The profile of LNG shipping ownership is also becoming more diversified, as reduced earnings visibility forces traditional owners to look for co-investors, and new market players try to expand their fleets to take advantage of an increasingly liquid trading space.

The ramp-up of US liquefaction capacity through 2020 will continue to be a key driver of demand and spot shipping prices, while China's growing gas appetite and LNG terminal expansion will likely result in additional demand and greater seasonality, making shipping flexibility even more necessary.

However, the delicate balance of LNG shipping is by no means certain, and will depend on the sector's ability to respond to shifts in supply and demand, including potential trade disruptions emerging from rising tensions between the US and China and the pace at which pre-FID export projects are delivered after 2020.

## Expansion

Despite a decline in ship finance and rising interest rates, LNG shipping continues to attract investment, ensuring that shipping capacity growth meets demand projections and freight rates are kept at sustainable levels.



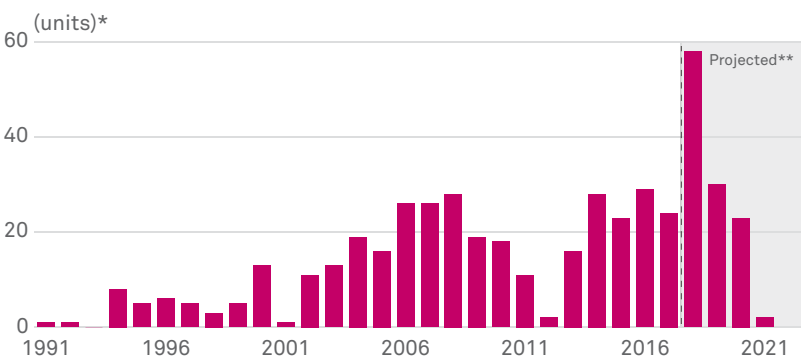
The global LNG shipping fleet will see its biggest expansion in 2018, with the delivery of more than 70 new LNG carriers and one of the largest order volumes in a given year. This expansion will equate to more than 8 million cu m, versus 4.1 million cu m in 2017.

"The pace of deliveries in 2018 and 2019, which now hold together 94% of the order book in unit terms, will shape the industry for many years to come," said Ralph Leszczynski, the head of research with Italian ship brokerage Banchero Costa.

In the first seven months of 2018, 28 large LNG carriers were ordered, more than the 26 ships ordered in 2016 and 2017 combined. The record for new orders was set in 2014, with 62 large gas carriers in a single year.

Most of the existing LNG fleet will be operational for decades: the average age of the fleet is only 10.8 years, versus a shelf life of more than 40 years.

**2018 will set a record for new LNG carrier additions**




*Data does not include vessels scrapped
**Projected deliveries after accounting for slippages
Source: Vessels Value

## Shipping technology

LNG shipping technology is evolving fast, making LNG ships bigger and more efficient.

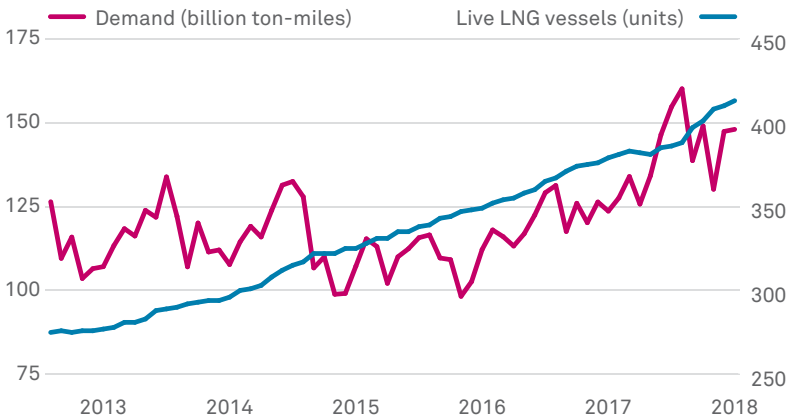
New propulsion technologies like the MEGI (M-type, Electronically Controlled, Gas Injection) are bringing greater efficiencies in trading. Better insulation is helping reduce the amount of gas that evaporates during the voyage, known as "boil-off," while the growth of floaters, small-scale LNG and LNG bunkering are helping to extend LNG supply chains into new areas of demand.

Floating storage and regasification units, in particular, have helped facilitate growth of the LNG market by reducing the cost and time of entry for new LNG importers, and the need to commit to permanent onshore facilities, which previously had to be idled for months or years when market conditions changed.

The evolution of propulsion technologies is redefining LNG shipping optionality. The LNG fleet has already shifted from traditional steam turbine propulsion to dual and tri-fuel diesel electric (DFDE/TFDE), which are 35% more fuel efficient and command higher freight rates. The next generation of MEGI LNG vessels are even more fuel efficient than TFDEs by 25% and allow excess boil-off to be reconverted to LNG.

Oil majors are leading several groundbreaking initiatives. Shell and Total, the world's largest LNG sellers by volume, are using advanced analytics around wind speed, ballast usage and sailing speeds to ensure optimized shipping and maximum profitability, according to analysts at Bernstein Research. Standard LNG voyages result in delays costing around $80,000 per trip. At the median level, that can touch $350,000 per trip – with potential industry-wide losses of $800 million.

**Ton-mile demand for large LNG carriers spiked in late 2017**




Note: The large outstanding orderbook is concerning, but the rise in ton-mile demand has been robust as well and has led to a finer balance between the demand for ships and the supply available
Source: VesselsValue

## Diversified ownership

The profile of LNG shipping ownership is also changing, with more participants such as traders and power utilities becoming ship owners, as the LNG trading space becomes more liquid and diversified, and the breakdown of long-term LNG contracts forces traditional ship owners to look for co-investors.

The LNG shipping fleet has been typically concentrated among large shipping owners, such as Malaysia's MISC, South Korea's K-Line, Qatar's Nakilat and Japan's Mitsui OSK Lines and Nippon Yusen Kabushiki Kaisha Lines. The 12 largest owners still control about half of the trading fleet and account for around 30% of the order book, according to Banchero Costa.

This is the legacy of two separate factors: a traditional LNG business model based on point-to-point bilateral long-term contracts between a small number of suppliers and buyers, and shipping banks' preference for concentrating capital among a few established low-risk ship owners at relatively low interest rates.

As legacy long-term LNG contracts are being displaced with shorter, more flexible deals, earnings visibility is also reduced, and this is forcing traditional ship owners to share their investments with new market players seeking to take advantage of greater returns from an increasingly liquid trading space with enhanced shipping optimization capabilities.

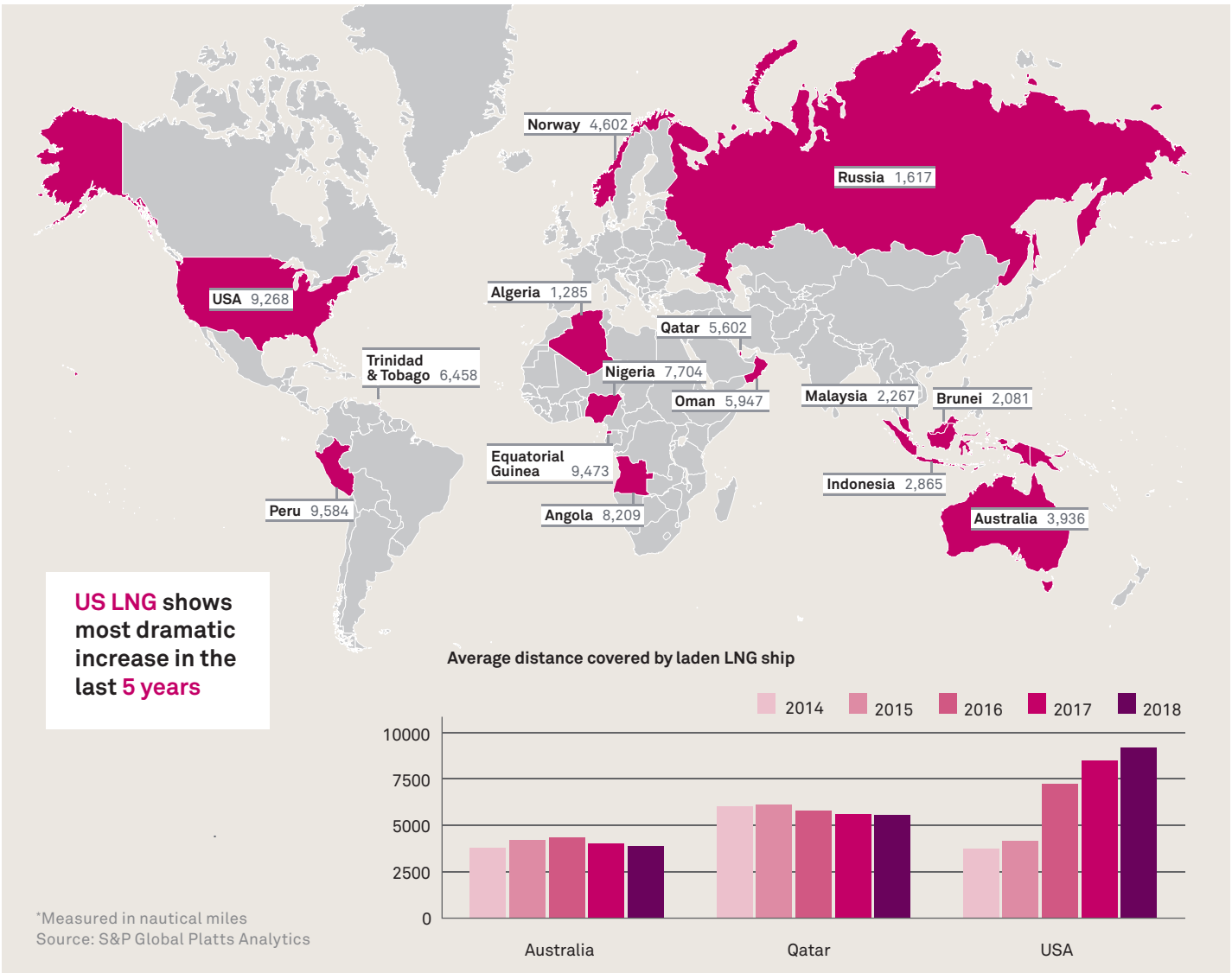
"As the US represents a greater and greater percentage of global supply, the weighted average shipping distance should also start to trend upwards"

## Market balance

The balance of the LNG shipping market through 2020 will largely depend on the equilibrium between the fleet's expansion and the rate of demand growth as measured in ton-miles – or the laden distance travelled multiplied by the volume of cargo carried.

The growth in ton-mile demand is likely to be driven primarily by more US LNG making its way to Asia. US LNG requires far more shipping resources than its Indo-Pacific competitors to reach the key Asian markets. More than 40% of total US supply went to Asia in the first half of 2018, compared with about 19% in 2017, according to S&P Global Platts Analytics. This trend is set to continue, as US liquefaction capacity is currently only about one third of a projected 2020 capacity of more than 55 million mt/year.

## Average distance traveled by an LNG vessel on a single voyage by country of production*




"As the US represents a greater and greater percentage of global supply, the weighted average shipping distance should also start to trend upwards," said Jeff Moore, head of Asia LNG analytics with S&P Global Platts.

An overall increase in average shipping distance and voyage time could have major implications for spot shipping prices, as the limited number of LNG vessels would serve longer and longer voyages, he added.

So far, the ramp up in average shipping distance out of North America has been largely offset by declines in average shipping distance from the Middle East and Pacific regions, which have become more self-sufficient as export projects in Australia ramp up and Middle Eastern demand increases.

## Enter the dragon

One of the biggest markets tapped by US LNG has been China, where economic growth, industrial recovery and coal-to-gas switching policies have helped offset stagnant demand growth in Japan and South Korea.

China imported more than 30 million mt between January and August 2018, up by nearly 50% year on year. The country's dependence on inter-basin LNG inflows is also on the rise, partly supported by declining supplies from Southeast Asian legacy producers and limited spot availability from eastern Australia, where rising domestic gas prices have led to political opposition to LNG exports.

**China imported more than**

**30**

**million mt between January and August 2018, up by nearly**

**50%**

**year on year**

"If China continues its drive to reduce pollution, ton-mile demand could surprise to the upside, rewarding those who ordered ships in the past five years or acquired modern units through sale and purchase activity," Court Smith, shipping analyst at VesselsValue, said.

China imported more than 2 million mt from the US from January–August 2018, versus 1.6 million mt during the whole of 2017. The commissioning of new LNG terminals in the country's northeast coast is set to increase consumption and the seasonal nature of purchases.

However, it remains to be seen how the delicate balance of the sector will be affected by potential disruptions, including the uncertain timeline of new FIDs and the threat posed to US–China LNG trade by tariffs.

The US-China trade war has raised some concerns about a contraction in shipping demand as Chinese buyers realign their purchases of spot US LNG cargoes, and replace them with LNG from sources closer to Chinese ports.

On September 24, China began to levy a 10% tariff on LNG as part of retaliatory tariffs covering an additional $60 billion of US imports. This was in response to announcements by the White House affecting $200 billion of Chinese goods, including various aluminum and steel items that had been left out of earlier tariffs imposed in March.

The risks to US–China LNG trade were exacerbated by US commitments to make it easier for European countries to buy American LNG by reducing trade barriers, in recent announcements from Washington, DC. Shipping distances between the US and Europe are shorter and the NATO alliance has a vested interest in reducing Russia's grip on Europe's gas supply.

However, the potential readjustment of trade flows resulting from China's tariffs on US LNG could also increase the role played by intermediaries such as LNG traders, and the need for shipping optionality, which could have an upward impact on ton-mile demand and LNG shipping rates in 2019. ■

**In September, China began levying a**

**10%**

**tariff on US LNG**

## S&P Global Platts LNG shipping methodology

The increased sophistication of LNG trading requires greater precision and transparency in the shipping markets. For instance, ship owners have now begun to seek payments from charterers to position and re-position their ships, plus ballast bonuses equal to 100% of the fuel and hire rate.

This unprecedented development is the basis for the latest methodology change for S&P Global Platts LNG shipping assessments.

S&P Global Platts has added port costs for each loading and discharging point to its freight cost calculations, and introduced two new ballast rate assessments – one each for the Atlantic and Pacific basin – to assess the cost of the return leg of voyages.

## What is a ballast rate assessment?

These assessments reflect the value typically charged by ship owners to charterers for the time and fuel used to position vessels for a spot voyage. Ballast rates, sometimes known as a "ballast bonus," are assessed using all available data from the spot markets, including lump sum amounts. The rates replace the old practice of assuming round-trip economics at 100% of day rates for all voyages.

## Why is S&P Global Platts assessing ballast rates?

Increased LNG shipping market seasonality and a growing number of spot fixtures have increased the market's need for greater ballast rate transparency and accuracy on a $/MMBtu basis. This increases the precision of freight costs and netback calculations.

# Insight from Washington

By Meghan Gordon

US energy abundance underpinned the Trump administration's case for rolling back federal vehicle fuel economy standards, a policy the government aims to adopt by March.

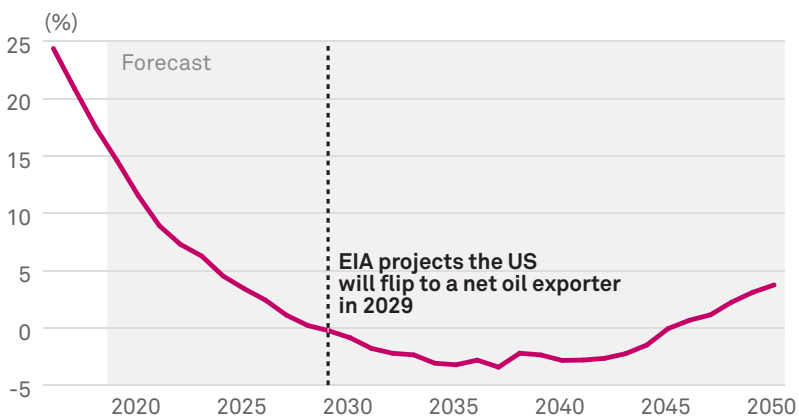
The US is producing enough oil "to satisfy nearly all of its energy needs and is projected to continue to do so," the administration argued in the proposal that would freeze fuel efficiency for cars and light trucks at the 2020 target of 43.7 miles per gallon. Booming domestic output has "added new stable supply to the global oil market and reduced the urgency of the US to conserve energy," it said.

However, this newly abundant supply has not shielded US drivers from global price risks, as recent volatility has shown. And the US has not become less exposed to global market forces as it pumps more crude and exports it around the world.

"The idea that the imperative on conservation is gone because you have abundance is just exceedingly short-sighted and not strategic," said Sarah Ladislaw, director of the Center for Strategic & International Studies' energy and national security program.

"That's where people really take issue with an articulation of that position, because it seems to fundamentally misunderstand the history of oil markets," she said. "You can have all the supply that you want, but if it can't get to where it's going, your reliance on it is still a strategic vulnerability."

**Falling US oil import dependence**




Source: US Energy Information Administration

## Import dependence

US oil import dependence has fallen sharply from a peak of 60% in 2005 to 21% in 2017, according to the Energy Information Administration. The EIA projects it will average 17.5% for 2018 and keep falling steadily until 2029, when total crude and refined product exports will overtake imports for the first time.

This figure – which EIA calls the net import share of product supplied – reflects the dramatic shift toward US energy abundance that the Trump administration rightly praises. The fact that this figure is on a clear path toward zero does not mean the US is "producing enough oil to satisfy nearly all of its energy needs."

The US still imports about 7.9 million b/d of crude and 2.2 million b/d of refined products. Those volumes are projected to fall, while US exports of crude and products keep rising.

Even when the US becomes a net oil exporter, US producers will still rely on export markets to find the best home for their particular crude, while US refiners will rely on imports for feedstock. Gulf Coast refineries were built to process heavy crudes from Saudi Arabia and Venezuela. Some of this capacity will be reconfigured to take advantage of the light sweet crude streaming out of West Texas, but not enough to say the US can become self-sufficient when it comes to producing and refining all the oil it consumes.

"The idea that the amount that you're producing equals self-sufficiency is wrong," Ladislaw said. "If you look at what's happening in the US oil market, we're getting more deeply integrated into global oil markets because we're trading and we need to trade to make sure we can optimize our own energy system from the upstream all the way to a downstream perspective."

Congress created the first US fuel economy standards in 1975 to protect against price shocks and supply shortages like those seen during the 1973 oil embargo. The first rule aimed to double the average fuel economy of the new car fleet to 27.5 mpg by model year 1985. Fast forward to the Obama administration adopting standards for 2012–25 model years to get the fleet-wide average to an equivalent of 54.5 mpg, which would have been 49.6 mpg in actual efficiency gains plus offsets.

The Trump administration said the US no longer needed such ambitious targets because of rising domestic oil production and the US consuming a smaller share of global supply. In addition, a greater diversity of both suppliers and consumers in the oil market since the 1970s had made it less likely a single actor or group like OPEC could harm consumers. "The global oil market can, to a large extent, compensate for any producer that chooses not to sell to a given buyer by shifting other supply toward that buyer," the administration said in the August proposal.

## Pointing the finger

Despite this line of reasoning by his administration, President Donald Trump has spent much of 2018 blaming OPEC for high US gasoline prices. "The OPEC monopoly must get prices down now!" he said September 20 in one of half a dozen tweets devoted to high gasoline prices and OPEC.

Easing the vehicle efficiency standards is expected to increase US oil demand by 500,000 b/d. The proposal says the economic impact of this extra 2–3% of oil demand is dwarfed by cost savings for auto buyers.

The proposal acknowledges that rising US production and falling import dependence cannot entirely insulate consumers from the effects of price shocks. "But it appears that domestic supply may dampen the magnitude, frequency, and duration of price shocks," it said. "As global per-barrel oil prices rise, US production is now much better able to (and does) ramp up in response, pulling those prices back down. Corresponding per-gallon gas prices may not fall overnight, but it is foreseeable that they could moderate over time, and likely respond faster than prior to the shale revolution." ■

# Insight from Brussels

By Siobhan Hall

Could using low-carbon electricity to turn water into hydrogen and other gases keep the EU's gas industry relevant in an increasingly CO2-constrained future? The EU gas and power sectors are certainly interested in testing such technology at scale, as it could help them both with their different challenges going forward.

Natural gas and LNG suppliers are facing an expected dramatic decline in demand for their fossil fuels as the EU works to decarbonize its energy sector by 2050, while gas grid operators could see their assets stranded. At the same time, the power sector will have to integrate ever-increasing shares of renewable power, mostly variable wind and solar, creating huge demand for flexibility options to keep the grid balanced.

Coupling the two sectors through power-to-gas technology, known as P2G, would allow excess electricity in the system to be used to turn water into hydrogen or, in a second step using CO2, into synthetic methane, for example.

If the electricity used is renewable or zero-carbon, then the gases produced are also renewable or decarbonized. These gases can be used directly, for example in industrial processes or for transport. Or they can be injected into the EU's extensive natural gas grid (within limits for hydrogen), and stored or transported as needed.

## Small scale, high cost

Europe's power and gas transmission system operators argue that this coupling would provide both the extra short-term flexibility and seasonal energy storage that will be needed to balance the power grid as more variable renewable power comes online. EU policy is driving this change, with a new binding target to source 32% of the EU's final energy demand from renewables by 2030. This is likely to push renewables' share of electricity demand to around 50%, with even higher shares expected by 2050.

P2G plants can help by taking excess renewable and low-carbon power on the grid and using it to produce renewable, decarbonized gases. The problem is that such gases are currently much more expensive to produce than their fossil equivalents. This is in part because it is a high capital cost activity being done on a very small scale in plants under 10 MW.

The EU's formal gas TSO body ENTSOG wants to see a tenfold or greater increase in P2G capacity to around 1 GW by the early 2030s. This is to have enough capacity to test how this technology could support power grids with high renewable shares. It said it wants to work with all stakeholders "to build a business case for P2G to attract investors."

That includes policy-makers, who have been rewriting the EU's power market rules to help integrate

renewables more efficiently. “If the market does not deliver the investments in P2G facilities to scale them up to the EU industrial scale, some support schemes need to be designed,” ENTSOG said.

European gas suppliers’ group Eurogas has also called for an EU framework for supporting renewable and decarbonized gases, including harmonized national support schemes, as well as a specific EU investment fund. It wants the EU to set itself a binding target for using renewable and decarbonized gases, with the aim of enabling them “to reach technology maturity and scale.”

## Crowded market for flexibility

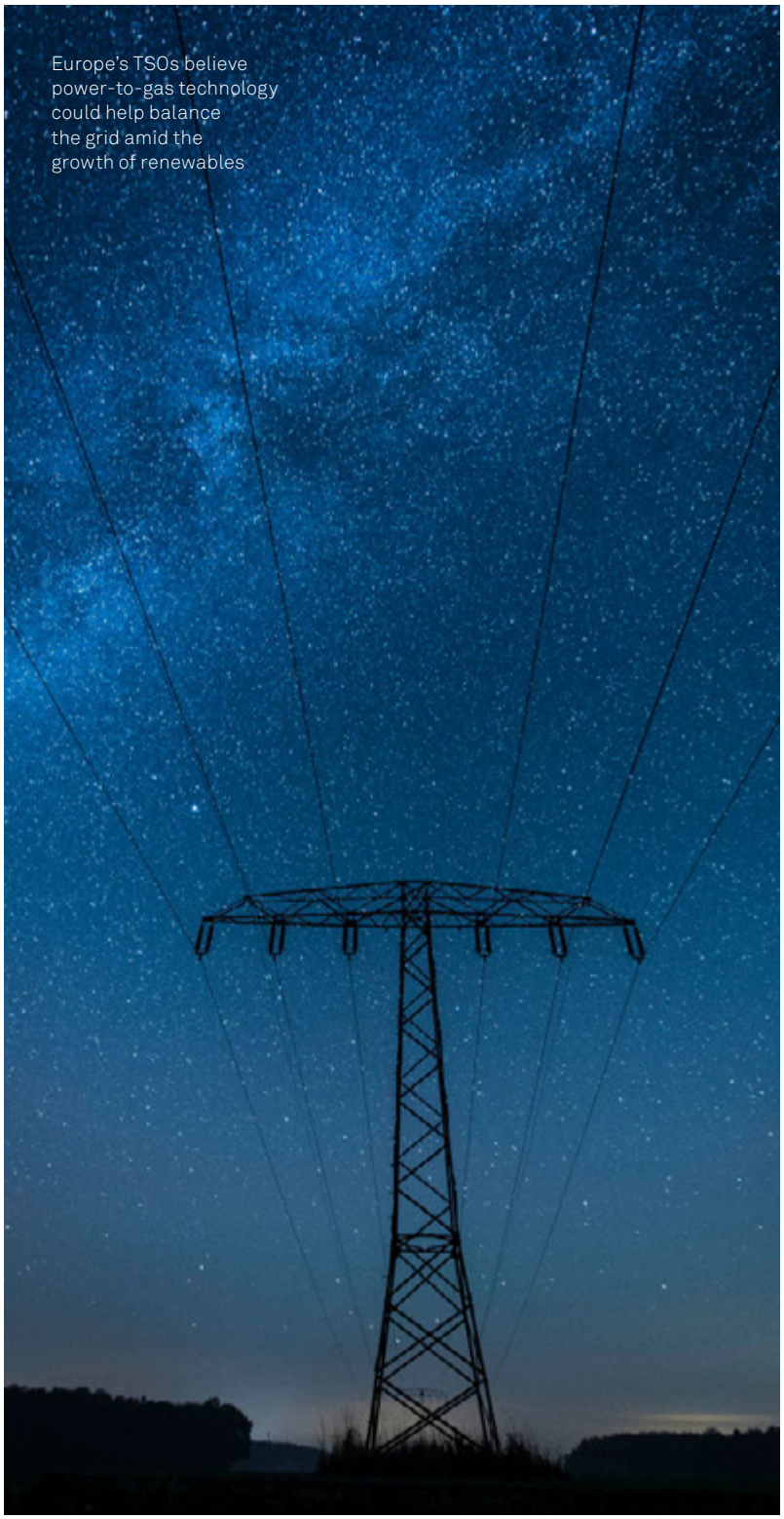
The debate about whether to give renewable gas the same kind of preferential treatment that renewable electricity enjoyed during its early development is likely to continue into next year and beyond.

The European Commission is already exploring the options as part of planned updates to the EU’s gas market legislation. The formal proposals are expected toward the end of next year, after the new set of politically-appointed EU commissioners take office in November 2019 for five years.

A recent external study sponsored by the EC found that national tariff and grid access rules for renewable gas should be adapted as needed to encourage using it to gradually replace natural gas, while avoiding market distortions. The study cited support schemes and priority dispatch as options, both of which the EU has already used successfully to promote renewable power generation.

A key technical challenge for P2G will be developing large capacity electrolysers flexible enough to ramp up and down as needed in response to the amount of renewable power available.

The economic challenge will be to make this flexible operation profitable. P2G will have to compete with other sources of power grid flexibility, including demand-side management, electric vehicle batteries, and other power storage technologies. It will also have to compete with biomethane, a renewable gas made from purified biogas produced from organic matter.



Europe’s TSOs believe power-to-gas technology could help balance the grid amid the growth of renewables

The EU’s push to cut carbon is not just about the climate. It is also keen to reduce its fossil fuel imports, and developing all these new technologies could transform its political relations with its current energy suppliers, including Russia. ■

# Insight from Shanghai

By Sebastian Lewis

The Shanghai International Energy Exchange's crude oil futures contract has got off to a good start.

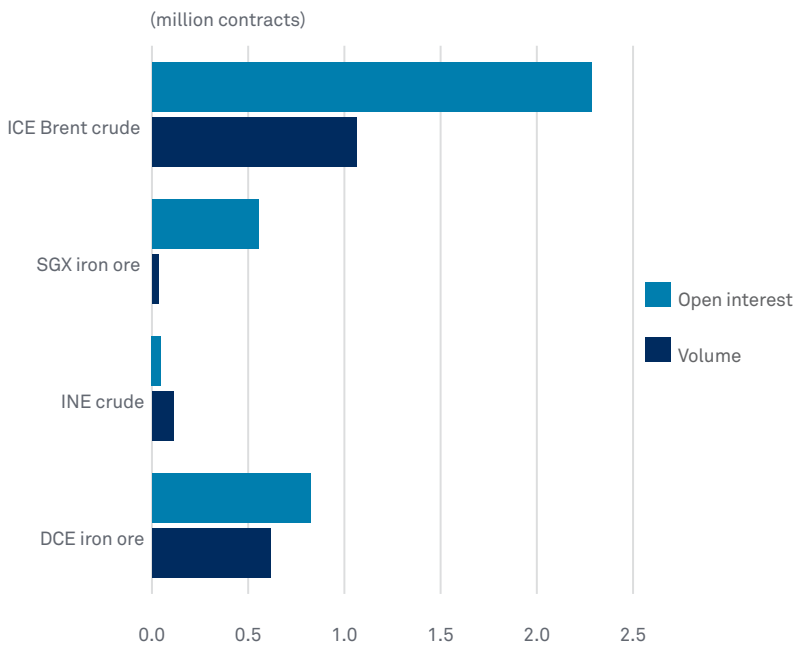
The contract's first expiry at the end of August marked another step on the road to developing a crude futures contract that China hopes will one day stand alongside ICE Brent and NYMEX light sweet crude.

The launch of the Shanghai contract on March 26 this year also coincided with the "internationalization" of other Chinese derivatives. Less than two months later, the Dalian Commodity Exchange's well established iron ore contract was also opened up to international investors.

In actual fact, foreign companies have been able to trade Chinese commodity futures onshore for some time. But to do so requires setting up a domestic Chinese entity, with all the associated costs and approvals operating a company in China requires. By internationalizing futures contracts and making it easier for overseas capital to participate directly in price formation in China, the hope is that local exchanges will vie for international influence with incumbents like the Chicago Board of Trade, Intercontinental Exchange and the London Metal Exchange, which host many global agriculture, energy and metals benchmarks.

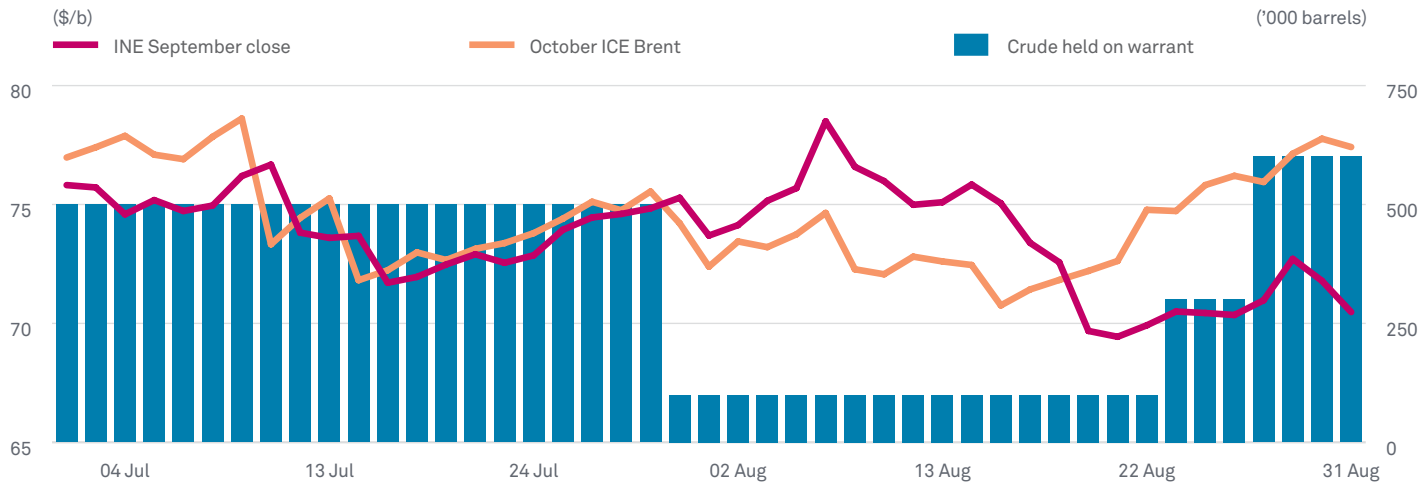
China's leaders hope not only that Chinese exchanges will become international centers of price discovery, but also that prices discovered on these venues will become the benchmarks that are used to price commodities sold to China. Should this happen, these contracts will support another government objective: the internationalization of China's currency, the yuan.

**International and Chinese contracts compared**




Source: ICE, INE, SGX, DCE (data as of September 25)

**Brent, Shanghai crude futures and INE inventories**




Source: INE, ICE (all prices converted to US dollar)

## Good start

Volumes for the Shanghai contract have steadily grown, with 3.4 billion barrels traded in August, a fifth of the volume for ICE Brent during the same month. ICE Brent marked its 30th anniversary this year; the Shanghai crude contract has only been in existence for six months.

However, liquidity is rarely a problem for Chinese futures exchanges, which host a number of well-established metal and agriculture derivatives. Many of these have higher trading volumes than international benchmarks hosted on platforms like CBOT and LME. Outside China, institutional investors and companies hedging physical exposure tend to be the main users of commodity derivatives. In China, retail speculators dominate.

This can clearly be seen by looking at exchange statistics. Open interest – positions held open at the end of the day and a measure of the contract's use for physical hedging – is typically significantly larger than daily trading volume for contracts such as ICE Brent. This is because many traders are holding positions to expiry to hedge physical positions. In China, the presence of significant numbers of retail speculators trading in and out of positions boosts daily volume, which can at times exceed open interest.

At times, these speculators exacerbate price volatility, rushing into the momentum of a rising market only to exit just as quickly as the market turns. Allowing overseas capital to play a greater part in price formation could improve price discovery and reduce the influence of domestic speculators, as foreign players arbitrage away differences in price between Chinese and overseas venues.

## Supply vs. demand

Existing crude benchmarks tend to reflect the price of oil close to the source of production or distribution. For example, Brent and Dubai are widely used to price light sweet and medium sour crudes. They represent the price of crude loading on ships from the North Sea and oil fields in the Middle East. WTI, on the other hand, reflects the price of crude delivered to Cushing, Oklahoma, a small town that sits at the nexus of a myriad of pipelines connecting producers with refiners across the US.

The Shanghai crude contract reflects the price of crude oil held in tanks at one of eight approved storage sites. These are located up and down the coast close to refining centers.

The contract can be settled by physical delivery. Normally, this is by transfer of a warrant – a receipt that allows the holder to take delivery of oil held in a

specific tank – from the seller to the buyer. The seller chooses the grade and location of the crude they wish to deliver. This mechanism is similar to the established system of warehouses used by the LME and Shanghai Futures Exchange for the delivery and storage of base metals like copper and aluminum.

The price of crude oil benchmarks like Brent and Dubai depends on a wide range of factors. These include the strength of global demand, inventories, production expectations, macroeconomic factors like interest rates, and geopolitical factors that might pose a risk to supply.

In the case of the Shanghai crude contract, the level of inventory held in INE-approved, as well as non-exchange storage, is also a factor influencing price. If the market believes there is insufficient oil in storage to settle open positions, prices can become volatile, as the market prices in this uncertainty. A fall in INE inventories at the end of July to just 100,000 barrels likely contributed to the volatility of the contract in August ahead of its expiry at the end of the month. Prices had previously been moving in line with other futures like ICE Brent, but rose and fell sharply as oil was removed from and returned to INE storage.

## Long road

Chinese buyers currently have to bear exchange-rate risk and costs when they buy commodities priced in dollars. These would be eliminated if they were able to price them in yuan. Should other countries also use the yuan as the basis for pricing their sales and purchases of oil and other commodities, it could provide significant support for the internationalization of the Chinese currency.

But even if the Shanghai contract proves a runaway success, there is a long way to go. Among other things, it would require the Chinese government to liberalize its financial institutions and remove the restrictions that currently stop the free movement of capital in and out of the country.

In the first quarter of 2018, slightly under two-thirds of reported foreign exchange reserves were denominated in dollars, according to the International Monetary Fund. The yuan accounted for 1.4% of total holdings, lower than the equivalent figure for the Australian dollar. So it may be some time yet before the yuan challenges the hegemonic status of the US currency. ■

# Inside the shortlist: the Energy Transition Award

This year's Energy Transition Award was developed to recognize the leadership of power companies in the transition to a low-carbon, sustainable economy, write Drew Fryer and Grace Kao of Trucost, part of S&P Global

The commitments of governments, regions and cities across the globe to reduce carbon emissions are creating transformative times for industries, and few are facing more change than the global power sector. Power companies must meet growing demand while transforming business models to deliver on the clean energy promise.

For the first time, the Energy Transition Award recognizes companies at the forefront. Those that are leading the way in reporting and reducing carbon risks, those that are publishing robust targets to improve performance, those that are aligning with global energy transition commitments – and those that are demonstrating true leadership in innovative ways.

## Award criteria

No nominations were accepted for this award. The list of 10 shortlisted finalists was identified by Trucost, part of S&P Global, by assessing the public disclosure of global power companies included in the S&P Global LargeMidCap Index[1], captured by Trucost's annual research engagement program[2]. Since the award is for energy transition, consideration was given not only to how companies are performing today, but also the evolution of performance over recent history, defined for these purposes as the past five years for which reporting was available for all companies, as well as published goals to address future climate impacts. Each company was ranked across 10 indicators of energy transition, feeding into an overall ranking for each company. This overall ranking determined the 10 shortlisted finalists for the Energy Transition Award.

1 Data as of June 29, 2018: https://us.spindices.com/indices/equity/sp-global-largemidcap-usd

2 Data as of December 31, 2016: https://eu.spindices.com/documents/additional-material/the-trucost-research-process.pdf

## Award criteria

### Shortlisted companies:

Power utilities were ranked on a series of 10 quantitative criteria measuring their readiness for a low carbon energy transition.

### Award winner:

In addition to the below criteria, companies' public reporting will be evaluated for signals of innovation and transformative change aligned with global decarbonization needs, and assessed for alignment with the recommendations of the Task Force on Climate-related Financial Disclosures (TCFD[3]), including climate-related:

- Governance structures
- Strategy
- Risk management
- Scenario analysis

| Indicator | Type | Focus |
|---|---|---|
| Comprehensive public reporting of greenhouse gas emissions | GHG | Disclosure |
| Reduction in GHG, 2012-2016 (%) | GHG | Recent trajectory |
| GHG intensity of power generation (tCO2e/MWh) | GHG intensity | Point in time |
| Reduction in GHG intensity of power generation, 2012-2016 (%) | GHG intensity | Recent trajectory |
| Zero and near zero GHG power share in 2016 (% of MWh from renewable & nuclear power) | Green-brown share | Point in time |
| Growth in zero and near zero GHG power share, 2012-2016 (%) | Green-brown share | Recent trajectory |
| Publication of targets to reduce GHG and/or increase renewable power generation | GHG reduction targets | Forward looking indicator |
| Targets cover a material share of the company's operations (%) | GHG reduction targets | Forward looking indicator |
| Published science based target or commitment to Science Based Targets Initiative[4] | 2°C alignment assessment | Forward looking indicator |
| Historical alignment of GHG pathway with limiting warming to below 2°C (Sectoral Decarbonization Approach methodology[5]) | 2°C alignment assessment | Recent trajectory |

3 The TCFD is a body set up by the G10 Financial Stability Board to develop voluntary, consistent climate-related financial risk disclosures for use by companies in providing information to investors, lenders, insurers, and other stakeholders.

4 The SBTI is a collaboration between CDP, the United Nations Global Compact (UNGC), World Resources Institute (WRI), and the World Wide Fund for Nature (WWF), set up to champion the setting of corporate emissions reduction targets in line with the level of decarbonization required to keep global temperature increase below 2 degrees Celsius.

5 The SDA is a method for setting corporate emission reduction targets and assessing emissions trajectories in line with climate science.

## Summary results

The 10 shortlisted finalists for the Energy Transition Award are:

Contact Energy
Duke Energy
E.ON
Électricité de France
Exelon
Iberdrola
Ørsted
SSE
Sempra Energy
Verbund

While these 10 companies are finalists for their own unique reasons, they share in the following traits:

- Exemplary performance among peers in terms of current carbon performance
- A trend in reducing their impacts over time
- Published goals to continue reducing impacts to meet the objectives of the Paris Agreement to keep a global temperature rise this century well below 2 degrees Celsius above pre-industrial levels.

## Shortlisted companies reduce carbon impact, as peers increase impact

In addition to each finalist being found to generate lower greenhouse gas emitting power than their sector peers, they further presented an improving five-year trend (Figure 1). This strongly outperforms the five-year trend of the wider peer group, for which GHG intensity was flat over the same period.

Not only have the GHG intensities of the finalists fallen over time, their absolute emissions have fallen as well. The finalists have an average five-year trend emissions reduction of 52%, during which the rest of the companies in the sector have on average increased their GHG emissions by 8%.

**Figure 1: GHG intensity trends**

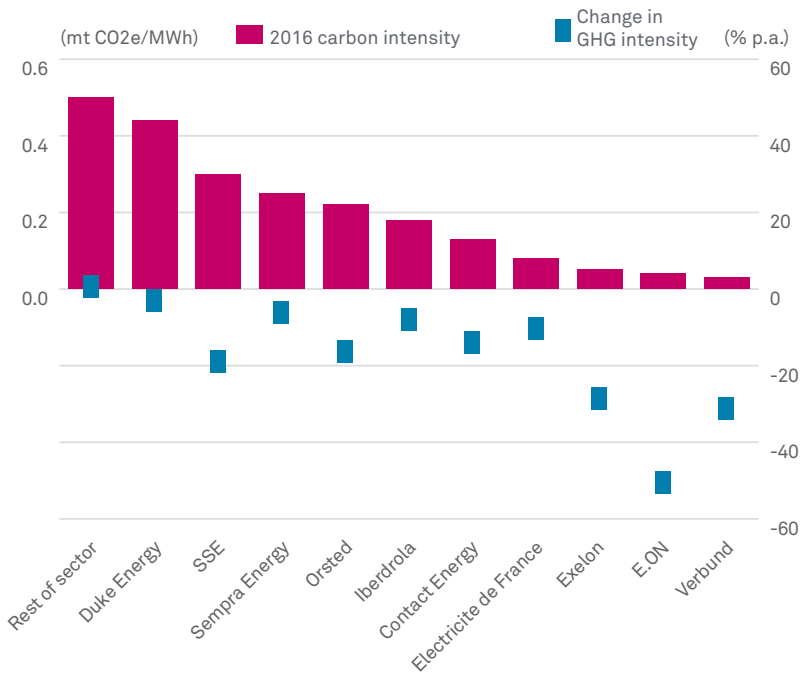
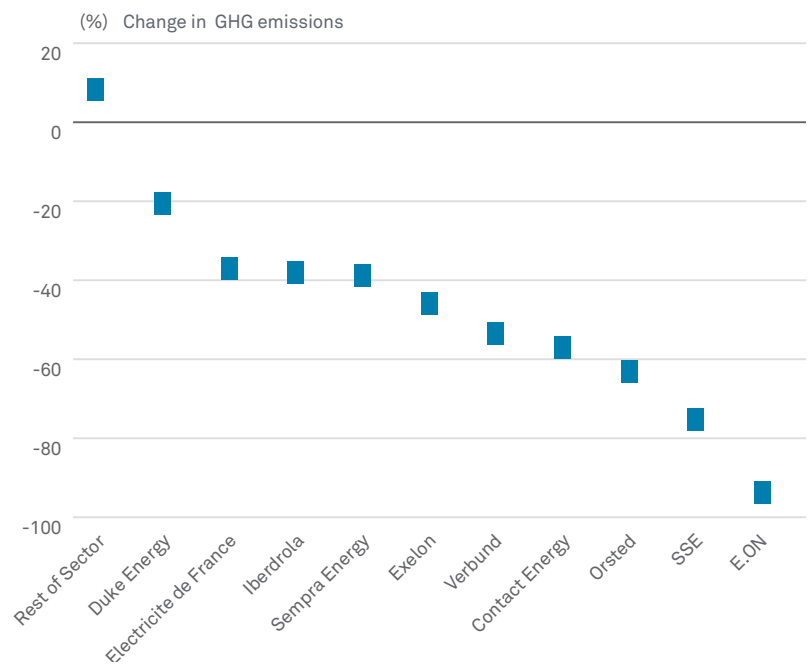



**Figure 2: GHG emissions trends**



## Shortlisted companies increase green power generation faster than peers

The shortlisted companies were found to increase their share of zero and near zero GHG power generation from 45% to 65% (on average), as other industry peers achieved 30% to 35% (on average) over the same period.

## Shortlisted companies outperform on target setting

Nine out of the 10 shortlisted finalists reported a GHG emissions reduction target to CDP[6], with seven companies reporting multiple targets encompassing both intensity and absolute reduction targets. In contrast, just half of their sector peers had set reduction targets.

Five companies in the assessment group have set a science-based target, assessed by the Science Based Targets Initiative (SBTI) as being in line with the Paris Agreement, to keep global temperature increases well below 2°C compared to pre-industrial levels. Two of these companies made it on to the shortlisted finalists list. Three other finalists have committed to setting a science-based target in future.

## Shortlisted companies achieve highest rated energy transition trajectories

Finally, the historical emissions trajectory of each company was examined, where possible, to determine if a company's emissions pathway over the past five years is consistent with limiting warming to 2°C, based on the Sectoral Decarbonization Approach typically used by the SBTI to assess the sufficiency of decarbonization pathways. All of the finalists had emissions trajectories aligned with less than 1.75°C of warming assessed over the five-year period beginning 2012, which is the highest rated trajectory scored.

**Figure 3: Share of green power generation**

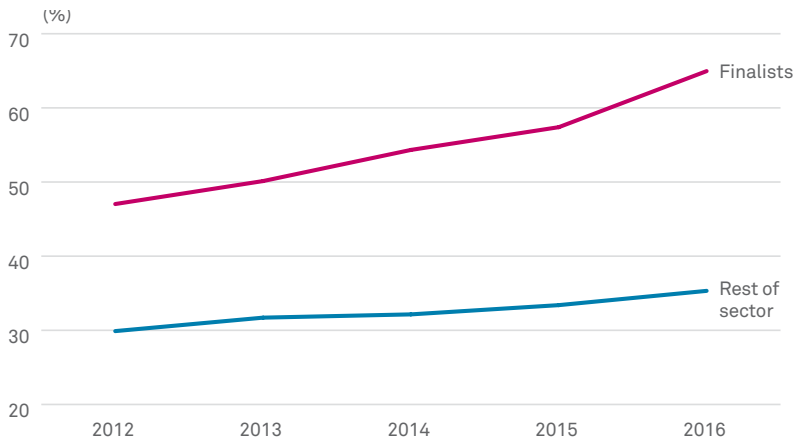
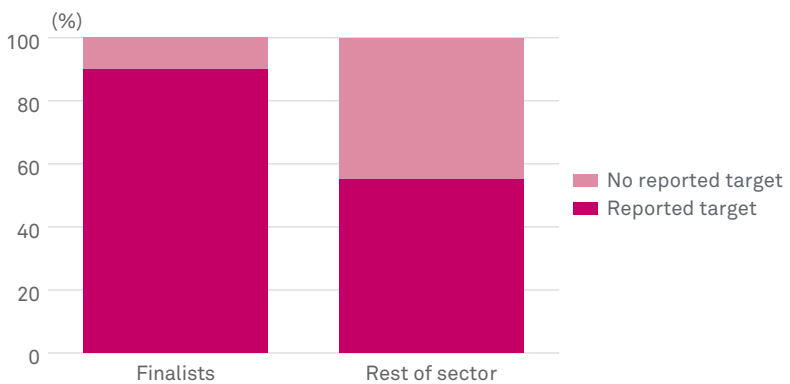



**Figure 4: GHG emissions reduction targets**




## Evaluation notes

Highlights of each finalist's performance are presented below. While on average, the 10 shortlisted finalists outperformed their sector peers in the categories assessed, not every finalist outperformed in every category. However, the 10 finalists had the best overall performances across the award measures of energy transition. ■

6 CDP, formerly the Carbon Disclosure Project, runs a global disclosure system that enables companies, cities, states and regions to measure and manage their environmental impacts.

## Highlights from shortlisted finalists

**Contact Energy** reduced its operational emissions by over 50% since 2012, during which its emissions intensity fell by over 45%. Contact produces the majority of its energy, over 80%, from zero or near zero emissions sources. While the company has not yet declared an emissions reduction target, it has committed to setting a science-based target.

**Duke Energy** had better than average five-year trend emissions and emissions intensity reductions, amounting to a reduction of 25 million tonnes CO2. Duke produces 38% of power from zero and near zero emissions sources with plans to increase this to 80% by 2030[7], and has an ongoing program of retiring coal-fired plants[8]. It has strong forward-looking targets, including 40% emissions reduction and 45% emissions intensity reduction targets by 2030.

**E.ON** has undergone a complex transformation from a conventional fossil fuel power utility to a specialized energy networks and retail services-focused utility. First, in 2016 it separated the fossil fuel power assets that had been central to its operations into a new entity, Uniper, and spun off a 53% stake, before selling its remaining interest in mid-2018. Also in 2018, E.ON took a controlling interest in Innogy, including purchasing RWE's stake, as well as undertaking asset swaps which left RWE focused on renewable and conventional power generation and E.ON focused on networks and final energy consumers. Leading up to the latest stage of its transformation in 2018, E.ON had reduced its operational GHG emissions and emissions intensity by over 90%.

**Électricité de France.** From 2012 to 2016, EDF reduced its absolute carbon emissions by 30 million tonnes, over 35%, while also reducing its carbon intensity by over 30%. The company generates 88% of its power from zero and near zero emissions sources, rising to 96% in its France division where it had closed 10 coal-fired plants by 2016[9].

**Exelon.** Over the last decade, Exelon has closed or sold all of its coal-fired power assets and now produces 90% of its power from zero or near zero emissions sources[10]. This underpinned a strong carbon intensity reduction, achieving one of the lowest carbon intensities in the peer group, while its operational emissions have also halved.

**Iberdrol**a achieved a one-third reduction in its emissions intensity and generates almost 60% of its power from zero and near zero emissions sources. The company had shut 15 coal power plants since 2001 with plans to shut the remaining two in the coming years[11]. Targets are published to continue to reduce emissions in absolute and intensity terms, as well as increase renewable power use, including plans to reduce emissions intensity 50% by 2030 and become carbon neutral by 2050

**Ørsted.** In its rebranding to Ørsted in late 2017, the company recognized that it had rapidly outgrown its heritage as DONG Energy, originally Danish Oil and Natural Gas. In 2017 it sold its upstream oil and gas business, and announced a phase out of coal-fired power generation by 2023, focusing instead on renewable energy. Ørsted is the world's largest offshore wind company, and has constructed more than a quarter of the world's offshore wind capacity[12]. Over the period examined, its emissions intensity has halved, and its emissions fallen by two-thirds. By 2023, it seeks to have reduced GHG emissions by 96% per kilowatt-hour produced compared with 2006, a target validated by the Science Based Targets Initiative as consistent with limiting warming below 2°C.

**Sempra Energy** exhibited strong rates of improvement within its wider peer set. It sharply increased zero and near zero power generated from 6% to 37% of its total over the five-year period examined, while having a generation portfolio with no coal-fired power assets. Its absolute GHG emissions fell by 39% and its emissions per unit of power generated fell by 24%.

**SSE** has reduced its GHG emissions by 35 million tonnes or three-quarters, and its emissions intensity by more than half over the period examined, driven in large part by an early shutdown of its coal-fired power stations ahead of the UK's mandated 2025 phase-out of coal-fired power not fitted with carbon capture and storage. The company has also committed to setting a science-based target.

**Verbund** reduced its GHG emissions intensity, already one of the lowest in its industry, by three-quarters, while its emissions dropped by more than half in absolute terms over the five-year period examined. More than 95% of its power is generated from zero or near zero emissions sources. The company has published a science-based target, including objectives to reduce its emissions by 90% by 2021 and achieve carbon neutrality by 2050. It intends to exit thermal generation by 2020.

7 https://sustainabilityreport.duke-energy.com/downloads/2017-DukeSR.pdf

8 https://www.duke-energy.com/_/media/pdfs/our-company/shareholder-climate-report.pdf

9 https://www.edf.fr/en/the-edf-group/our-commitments/corporate-social-responsibility/doing-even-more-to-reduce-co2-emissions

10 http://www.exeloncorp.com/sustainability/Documents/dwnld_Exelon_CSR%20(1).pdf

11 https://www.iberdrola.com/wcorp/gc/prod/en_US/corporativos/docs/IB_Sustainability_Report.pdf

12 https://orsted.com/en/Investors/Orsted-at-a-glance

Highview Power

# Liquid Air Energy Storage (LAES) the coolest technology to store energy generated from renewables

**Long-Duration Energy Storage:**
From 4 hours to 8 hours to 12+ hours
Fully scalable without any size limits

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with no performance degradation

**Zero Emissions**
and benign materials

**Proven Technology**
with established supply chain

**30+ Years Lifetime**
with mature components

**Making a 100% renewable energy future possible today!**

www.highviewpower.com

Authentix®
The Authority in Authentication

**Kevin McKenna**
Chief Executive Officer

# Authentix

As the authority in authentication solutions, Authentix helps you thrive in supply and distribution chain complexity. We provide advanced authentication solutions for governments, central banks and commercial products, ensuring local economies grow, banknote security remains intact and commercial products have robust market opportunities.

Specifically, we offer the following services and solutions:

**Governments:** Authentix works with governments to ensure authentic products are sold in-country to benefit law abiding citizens – not criminals. Fuel marking and tax stamp solutions enable governments to collect more excise taxes without raising taxes for the benefit of citizens and legitimate industries.

**Central Banks:** Authentix develops and implements advanced, Level 3 authentication technologies and high-speed sensors. These solutions safeguard banknote security and support quality initiatives, providing central banks greater flexibility to maximize control and increase efficiencies in their operations.

**Commercial Products:** Authentix's multi-layer product authentication solutions protect manufacturers in the pharmaceutical, agrochemical and consumer product industries, including fuel, from crude to refined petroleum products. These solutions mitigate risks to promote revenues and gain competitive advantage, protecting both the brand and product in complex supply and distribution chains.

Our customers find that Authentix services and solutions offer valuable advantages. Specifically, we help customers:

**Thrive in Complexity:** Authentix thrives in the most complex environments – from multi-national fuel programs to pharmaceutical regulatory compliance to the global currency trade. We understand the systems, processes and nuances, increasing decision confidence to protect both investments and consumers.

**Grow Revenue:** Through Authentix's advanced authentication solutions, you can mitigate the risks associated with fraudulent losses to extract your full revenue potential. Consistent authentication programs result in increased consumer confidence, loyalty and brand value, which can bolster future earnings.

**Gain Competitive Advantage:** Competitive advantage can be found in Authentix's comprehensive solutions. As we anticipate and identify issues within supply and distribution chains, we enable government, brand and product protection.

Authentix offers a unique experience within the authentication industry. We understand a proactive approach to authentication innovation is required as competitive threats and counterfeiting capabilities increase at alarming rates. Our expertise enables us to design, build and implement the most effective solutions possible. Our proven public and private sector expertise and collaborative customer partnerships ensure the programs implemented are comprehensive, technologically advanced and professionally executed. Our customers experience exemplary quality and flexibility with our services and solutions and, when combined with the integrity and responsiveness of our people, you will gain the Authentix advantage.

## Statistics

| **Authority in Authentication Solutions:** |
|---|
| Leader in covert fuel authentication programs in 22 countries |
| Operating programs on 5 continents |
| Protect the brand integrity of 5 of the top major oil companies |

| **Trusted by** |
|---|
| Largest Spirits Distributor |
| 7 Top Pharma Customers |
| Largest Agchem Company |
| 8 Leading Central Banks |

**Guillermo Turrent**
Chief Executive Officer

**Javier Gutierrez**
Chief Operating Officer

# CFEnergía S.A. de C.V. a leading energy company.

Prior to Mexico´s Energy Reform in 2013, Comisión Federal de Electricidad ("CFE") only relied on one single supplier and did not participate actively in the fuel's markets. Now CFE through its affiliate companies participates in an increasingly competitive market.

The need to be more attuned to market requirements made CFE to set up two wholly-owned affiliate companies: CFEnergía, S.A. de C.V. ("CFenergía") and CFE International LLC ("CFE International"); whose purpose is to work with integrity, productivity and responsibility to effectively achieve the best energy solutions for their customers. CFEnergía was created in 2014 through a CFE´s board Agreement and started operations in 2016, its main purpose not only remains in supply CFE´s needs but also to optimize processes of supply and transport of fuels for CFE´s power plants, independent power producers and for the private industry. CFEnergía has become one of the most relevant participants in the global market, procuring fuel for Mexico´s domestic demand.

The Energy Reform offered CFE and its affiliates the possibility to become central players in this market. Mexico as one of Latin America's emergent economy has become the most important actor in the region with CFEnergía being the vehicle to make this possible.

Mexico´s demand of coal and liquid fuels to produce electricity has decreased as the demand of natural gas keeps increasing in an average annual rate of 7.1%. CFEnergía is constantly innovating to solve the fuel´s problematics in México, with emphasize in natural gas. Our biggest challenge is to transform the company around our principal clients' demands. With the upcoming infrastructure that will allow Mexico to increase its daily natural gas importation, CFEnergía will optimize its own and client´s portfolio using existing infrastructure to make efficient and economize the customer´s demand. This will lead CFEnergía to become an important partner for the United States natural gas market and position CFEnergía among the best energy companies in the world.

## Statistics

During October 2017- August 2018 CFEnergía has provided approximately **1.3 million tons** of thermal coal to CFE.

During 2017-2018 in average CFEnergía supplied **138,024 barrels per day** of fuel oil and 8,999 barrels per day of diesel.

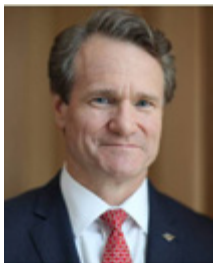
During 2017-2018 CFEnergía has supplied approximately **2.7 bcf per day** of natural gas and liquefied natural gas.

CFEnergía awarded **116 LNG cargos** from February 2017 to December 2018.

In 2017 CFEnergía had a revenue of **3.8 billion US dollars** where **56% corresponds** to the commercialization of natural gas and LNG.

Bank of America Merrill Lynch

**Brian Moynihan**
Chief Executive Officer



**Tom Montag**
Chief Operating Officer

# Bank of America Merrill Lynch

**Company Overview**

Bank of America is one of the world's leading financial institutions, serving individual consumers, small and middle-market businesses and large corporations with a full range of banking, investing, asset management and other financial and risk management products and services. The company provides unmatched convenience in the United States, serving approximately 67 million consumer and small business clients with approximately 4,400 retail financial centers, approximately 16,100 ATMs, and award-winning digital banking with more than 36 million active users, including nearly 26 million mobile users. Bank of America is a global leader in wealth management, corporate and investment banking and trading across a broad range of asset classes, serving corporations, governments, institutions and individuals around the world. Bank of America offers industry-leading support to approximately 3 million small business owners through a suite of innovative, easy-to-use online products and services. The company serves clients through operations across the United States, its territories and more than 35 countries. Bank of America Corporation stock (NYSE: BAC) is listed on the New York Stock Exchange.

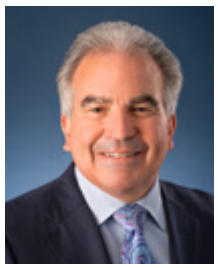
**Bank of America Environmental, Social and Governance Approach**

At Bank of America, we're guided by a common purpose to help make financial lives better, through the power of every connection. We're delivering on this through responsible growth with a focus on our environmental, social and governance (ESG) leadership. ESG is embedded across our eight lines of business and reflects how we help fuel the global economy, build trust and credibility, and represent a company that people want to work for, invest in and do business with. It's demonstrated in the inclusive and supportive workplace we create for our employees, the responsible products and services we offer our clients, and the impact we make around the world in helping local economies thrive. An important part of this work is forming strong partnerships with nonprofits and advocacy groups, such as community, consumer and environmental organizations, to bring together our collective networks and expertise to achieve greater impact. Learn more at about.bankofamerica.com, and connect with us on Twitter at @BofA_News.

## Statistics

| |
|---|
| World's best bank for Diversity & Inclusion, Euromoney |
| No. 1 bank set to change the world, Bloomberg |
| World's best bank, Euromoney Awards for Excellence 2018 |
| Protect the brand integrity of 5 of the top major oil companies |
| Most innovative investment bank of the year from North America, The Banker |
| Top global bank on the 2018 Change the World list, Fortune Magazine |

CHENIERE



**Jack Fusco**
President and CEO

## Cheniere Energy

Cheniere Energy, Inc. (Cheniere) is the leading producer and exporter of liquefied natural gas (LNG) in the United States, reliably providing a clean, secure, and affordable solution to the growing global need for natural gas. Cheniere is a full-service LNG provider, with capabilities that include gas procurement and transportation, liquefaction, vessel chartering, and LNG delivery. Cheniere has one of the largest liquefaction platforms in the world, consisting of the Sabine Pass and Corpus Christi liquefaction facilities on the U.S. Gulf Coast, with expected aggregate nominal production capacity of 36 million tonnes per annum of LNG operating or under construction. Cheniere is also pursuing liquefaction expansion opportunities and other projects along the LNG value chain. Cheniere is headquartered in Houston, Texas, and has additional offices in London, Singapore, Beijing, Tokyo, and Washington, D.C.

### Statistics

More than **4,000** employees

**$1.2 billion** annual investment in Ontario labour income

**25 years** of construction to renew our units

**$2 million** invested locally through our various community-based programs

**90 per cent** of the spending to extend the life of the Bruce Power units will stay in Ontario

Powering more than **3 million** homes and businesses across Ontario

**Paula Gold-Williams**
Chief Executive Officer

# CPS Energy

CPS Energy has been in the business of powering Greater San Antonio and the dreams of our customers for more than 158 years. We've proudly served the Alamo City for more than half of its 300-year history, taking important steps along the way to meet the energy demands of our growing community. Headquartered in the heart of the Alamo City, we are the nation's largest community-owned electric and natural gas company.

In addition to our core business of providing electric and gas services, we form powerful relationships with our customers by providing personal, superior customer experiences. We offer a wide array of products and services, and alternative energy resources to give our customers choices, convenience and more control over the energy they use.

Through our vertically-integrated business model, we provide safe, affordable, and reliable electric and natural gas services to more than 1 million customers. We generate power for our community with one of the most diversified energy portfolios in the nation, including traditional fossil fuel sources like coal, nuclear and natural gas and renewable sources such as wind and solar. We are among the top municipally-owned wind energy buyers in the nation and rank number one in Texas for solar generation.

We maintain the vast infrastructure of our own electric system, which includes more than 7,800 miles of overhead lines, about 5,610 miles of underground lines and more than 1,500 miles of transmission lines —not to mention poles, transmission towers, and substations. We also provide gas services to our community, operating and maintaining more than 5,400 miles of gas distribution mains and 89 miles of transmission mains.

Under the leadership of our President & CEO, Paula Gold-Williams, our ***People First*** philosophy propels our 3,200 team members to go beyond the power plants, poles, wires and gas lines to improve the quality of life of the people we serve. Caring for our community is at the heart of what we do every day. Our employees truly have a heart for service, and our hard-working and dedicated employees work diligently and tirelessly 24/7, 365 to put ***People First.***

We are born and raised in San Antonio, Texas. We work here. We live here. And we enjoy serving customers who are also our neighbors. With our ***People First*** philosophy running deep through our core, we acknowledge the human value of our customers and our employees, and how our products and services help them achieve their dreams, whether big or small.

EAGLE LNG PARTNERS

**Dick Brown**
Chief Executive Officer

## Eagle LNG

Eagle LNG is using small-scale LNG to develop affordable, efficient and clean-burning energy for marine bunkering as well as remote power in the Caribbean and Central America. Eagle LNG was the first company in the U.S. to bunker LNG on a container ship using fixed, permanent infrastructure. As the LNG market is changing, new opportunities are emerging for clean-burning energy using small-scale LNG infrastructure. In less than 5 years, Eagle LNG has become a global leader in small-scale LNG infrastructure.

Eagle LNG has three strategically located small-scale LNG facilities in Jacksonville, Florida. They enable it to supply clean-burning LNG to international markets, each in various stages of development. They include the first of its kind, on-water Talleyrand LNG bunkering depot, the inland Maxville Liquefaction Facility, and the on-water Jacksonville Export Facility, currently under development. These ground-breaking facilities represent 13.5 million LNG-gallons (over 50,000 cubic meters) of LNG storage. Eagle LNG is also working with Ports on the various coasts while engaging with major shippers as it develops infrastructure, logistics and cryogenic solutions for shippers bunkering within these Ports.

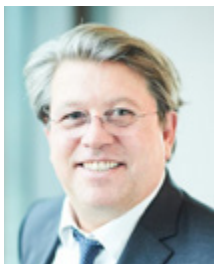
Talleyrand is the first of its kind in the world for its size and special purpose LNG bunkering application. It encompasses a 2,000-cubic meter (~500,000 LNG Gallons) LNG storage and marine bunkering terminal on a modest, 2-acre footprint in the Port of Jacksonville and fuels Crowley's newest Con/Ro vessels. Since Talleyrand's commissioning in July 2018, Eagle LNG has delivered LNG weekly for Crowley ships from its state-of-the-art facility, transferring LNG through a Mobile Transfer Unit during simultaneous operations – all U.S. Coast Guard approved.

Talleyrand receives LNG daily, via trucks, from Eagle LNG's Maxville facility. Commissioned in March 2018, Maxville has nameplate capacity to liquefy 200,000 LNG gallons per day with an initial production train of 90,000 LNG gallons per day. Maxville LNG has 1,000,000 LNG-gallon storage capacity on site and is located approximately 30 miles from Talleyrand.

Eagle LNG supports the international community's move to clean-burning fuel while offering innovative LNG fueling solutions that will aid shippers in achieving the IMO 2020 marine fuel sulfur cap. LNG from the Maxville facility may also be loaded into ISO containers and is currently transported to Talleyrand for export to a number of international markets. It's authorized by the U.S. DOE to export LNG in ISO containers to both FTA and non-FTA countries. Since Maxville's opening, Eagle LNG has been shipping LNG in ISO containers to Puerto Rico for distributed power generation.

In 2019, Eagle LNG is scheduled to receive FERC's Notice to Proceed for their new Jacksonville Export facility. This facility will produce up to 1 million tons per annum of LNG by 2021. It will provide marine bunkering and supply small-scale exports to markets in the Caribbean and Central America. It will have three liquefaction trains for a build out capacity of 1,650,000 gallons per day (6,245 M3/d). Each train will have 550,000 gallons per day nameplate capacity. It will also have 12,000,000 LNG-gallon (45,000 m3) storage on site, with associated marine access. The Jacksonville LNG facility design is being built to respond to changing export and marine markets while continuing Eagle LNG's commitment to provide an affordable, efficient and clean-burning energy source.

Eagle LNG is a wholly owned subsidiary of Ferus Natural Gas Fuels LP and a privately held and operated portfolio company of The Energy & Minerals Group (EMG), in Houston, Texas.



**Edouard Neviaski**
Chief Executive Officer
Global Energy Management
Business Unit

# ENGIE

We are a worldwide energy and services group which is structured around three key businesses: the production of low-carbon energy, particularly from natural gas and renewable energies, energy infrastructure and customer solutions. Motivated by our ambition to contribute to harmonious progress, we are addressing the main global challenges such as combating global warming, access to energy for all and mobility, and offer our individual, business and community customers solutions for producing energy and services that reconcile individual interests with collective challenges. Low-carbon in nature, our integrated, efficient and sustainable offering harnesses digital technologies. Besides the energy issue, they are facilitating the development of new uses and promoting new ways of living and working. Our ambition is being realized every day by each of our 150,000 employees in 70 countries. With our customers and our partners, they constitute a community of imaginative builders who are today imagining and building solutions for the future. In 2017 we achieved 65 billion euros revenues.

**ENGIE Global Energy Management**

ENGIE includes energy management activities developed by Global Energy Management (GEM) experts. 1,300 employees located in 12 offices develop this business segment in more than 50 countries. With five cross-continental trading platforms, we cover the full energy mix, serving clients throughout the value chain: producers, distributors, financial institutions, investors, energy project developers, state entities, infrastructure operators. Our global reach and strong local presence enable us to stay attuned to the very specific needs of our clients and to fast-changing energy trends, whether in mature or emerging markets.

Our offer includes a wide range of services, such as physical supply, offtake, cross-border trading, physical and financial risk management, market access, and M&A facilitation for energy producers.

Actively supporting our ambition to lead the Energy Transition worldwide, our experts deliver several green solutions such as Coporate green PPAs, Demand-Side Management, power optimization for renewable producers, battery storage services for grid operators or local smart grids optimization.

## ENGIE Global Energy Management 2017 key figures

| | |
|---|---|
| **Employees** | 1, 300 |
| **Counterparts** | 800 |
| **17,530 TWh energy equivalent volumes traded** | – Gas: 8,900 TWh<br>– Electricity: 1,600 TWh<br>– CO2 emissions: 306 MTON<br>– Oil & products: 2.72 Bn BOE<br>– Bulk commodities: 179 MTON |

**Fernando Calvillo**
Chairman of the Board

**Manuel Calvillo**
Chief Executive Officer

# Fermaca, the second largest operator of natural gas infrastructure in Mexico.

Over the last 7 years, Fermaca has won four competitive CFE sponsored bids which has created a backbone for the private gas network in Mexico. The Fermaca Joint Venture with ONEOK -Roadrunner pipeline- interconnects the Mexican network to the very liquid Waha hub, giving access to this attractive gas source to Mexican offtakers.

Fermaca has the most advanced real-time monitoring and control system in Latin America, providing best-in-class control and monitoring 24/7/365. The Fermaca SCADA system (Supervisory Control and Data Acquisition) enables supervision, control and analysis of data in real time. This world class facility ensures the safety and integrity of the system can be monitored and that service is uninterrupted.

**El Encino -La Laguna Project**

In 2014, Fermaca won the Federal Electricity Commission sponsored tender and was awarded the construction and operation of the El Encino - La Laguna pipeline. This pipeline runs from El Encino in the state of Chihuahua to the municipality of Lerdo in the the state of Durango. Extending 476 km in length, the El Encino – La Laguna pipeline completed construction in April, 2018.

This project is strategic for the gasification of the most populous areas Mexico. Supporting the transition of Mexican power generation from heavy fuels (diesel and coal) to a much cleaner, more efficient energy source is critical to the country's mission to become 'greener'. Furthermore, it provides access to cheap clean energy that will enable further industrial investments in Mexico thus, growing adding jobs, foreign capital and supporting the continued growth of the Mexican economy.

Fermaca has the best track record for development, construction and operations of gas pipelines in Mexico. We are the market leader in project delivery. The EELL project was extremely complex from both a land acquisition and construction project. It was one of the only projects to be delivered on time and on budget across the energy industry in Mexico.

The El Encino compression Station, also part of this system, is unprecedented in terms of size, complexity and efficiency not only in Mexico but across the globe. Three massive 80-ton Siemens 750 gas turbines stand poised to help power this new energy revolution forward. Each of the power trains formed by the turbines and 80-ton gas compressors will push the natural gas with a total installed power of 120,000 HP. The project's scale and the precision of the El Encino Compression Station are unprecedented in the energy industry.

The completion of the 476km transport system, allowed Fermaca to connect its in-service pipeline that runs from the US border to Chihuahua City. This meant that Fermaca would now have close to 1,220km of continuous large diameter pipelines interconnected from the Waha basin to a very important pipeline interconnection point in northern Mexico which will allow natural gas to flow to high consumption areas in central and western Mexico.

GLANDER INTERNATIONAL BUNKERING
EST. 1961

**Carsten Ladekjær**
Chief Executive Officer

# Your Global Fuel Partner Since 1961

Established in 1961, Glander International Bunkering is one of the largest, oldest and most respected bunker trading and brokering firms in the world. With a rich shipping legacy, our company is recognized worldwide for our integrity, professionalism and enduring business relationships.

Serving all majors ports, at every time zone, on any day of the week, Glander International Bunkering has easily been positioned as a global fuel partner. This is a result of empowering our valued clients and suppliers with a team of industry experts, in-depth knowledge and end-to-end services.

On our mission to fuel the global shipping industry, we have become more than a market leader, but also a value leader. Our clients and vendors rely on Glander International Bunkering to provide quality products and cost-effective solutions that keep them moving ahead of the rest.

Our success stems from our strict adherence to our core values since the very beginning. In addition to our responsiveness to meet every eventuality with an appropriate and swift solution, our flexibility enables us to understand the ever-changing scenarios in our industry and quickly adapt to fulfill any request. Our consistency and transparency in our actions, methods and principles are at the core of our business strategy, giving us the privilege of our business partners' trust. This trust remains long-lasting due to our commitment to deliver quality supplies and services on time.

Not only has our expertise in the market led to our success, it is our personal relationships with both clients and suppliers. These long-standing relationships enable smoother routes and minimal cost fluctuations for our clients and strong business for our suppliers. With nearly 90% of world trade happening at sea, it is our role to keep the global economy moving. Through our team of bunker experts, we make sure that seaborne business happens effectively while relieving stress off our partners, so they can focus on their core businesses.

Through our unique approach, our vision for Glander International Bunkering is to continue expanding our client and supplier base in addition to our industry expertise. Steering towards the future, Glander International Bunkering is proud to be your global fuel partner.

## Statistics

| | |
|---|---|
| **Year Founded:** | 1961 |
| **Locations:** | Florida, Dubai, Singapore, Mumbai, Geneva, Norway, Spain |
| **Headquarters:** | Dubai |
| **Languages Spoken:** | 32 |
| **Nationalities:** | 18 |
| **Services:** | Brokering & Trading, Marine Fuel & Gas Supply, Marine Lubricants Supply, Vessel Services, Laboratory Testing, Quality & Quantity Surveys, Credit Facilities, Advisory Services, Risk Management Solven |
| **Turnover for Last Fiscal Year:** | USD 1.66 billion |
| **Solvency Ratio:** | 20.5% |

**Dr Kenneth Pereira**
Managing Director
and Co-founder

# Hibiscus Petroleum - Scaling Up, Aiming High

Hibiscus Petroleum Berhad (Hibiscus Petroleum) (Bloomberg: HIBI.MK) is Malaysia's first listed independent oil and gas exploration and production company. Our key activities are focused on efficiently monetizing producing oilfields and growing our portfolio of development and production assets in areas of our geographical focus: United Kingdom, Malaysia and Australia.

As an operator of offshore oil and gas producing fields, our efforts are concentrated on enhancing operational efficiencies to safely deliver high-margin production from our assets. Our growth strategy in the current oil and gas market is to leverage on opportunities within our existing portfolio of assets and make quality acquisitions on a selective basis to achieve consistent earnings, thus delivering sustainable returns to our shareholders.

We are committed towards upholding high standards of safety management and corporate governance, whilst expanding our business on strong technical and commercial foundations.

Our profitable operational management of mature oilfields requires the nurturing of a work culture that demands our team to relentlessly pursue a variety of small gains over a wide spectrum of initiatives safely. The work culture we promote and processes we utilize encourage rigour, diligence and debate. Attention to detail by a team willing to multi-task across technical disciplines has paved the way to cost optimization and oilfield life extension.

Three other components complete our operating philosophy:
- Challenging the norms;
- Detailed historical data review; and
- Identification of key controllable KPIs and setting of performance driven incentives.

The United Kingdom continental shelf is home to Hibiscus Petroleum's first producing asset - the Anasuria Cluster, a group of producing oil and gas fields and associated infrastructure. Our jointly-controlled entity, the Anasuria Operating Company, is joint-operator of this revenue generating asset. Recently, we expanded our United Kingdom footprint by acquiring a 50% participating interest in two discovered offshore oilfields in production license P.198 (Blocks 15/13a and 15/13b), located in the Central North Sea.

In 2018, we successfully acquired a 50% participating interest in the 2011 North Sabah Enhanced Oil Recovery Production Sharing Contract - our first Malaysian asset. Our wholly-owned subsidiary, SEA Hibiscus Sdn Bhd, is the operator of this producing asset, with Petronas Carigali Sdn Bhd as our non-operating partner.

In Australia, we have a 100% operated interest in the VIC/L31 license which consists of the West Seahorse discovered field. We also have an effective 78% operated interest in the VIC/P57 exploration permit which holds additional exploration opportunities.

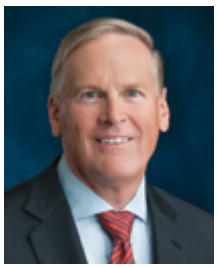
In summary, we are:
- Recognized for being innovative and pioneering;
- Trusted for high levels of transparency and governance;
- Known for our resilience;
- Focused on delivering shareholder value; and
- Acknowledged through industry awards for safety performance.

Hibiscus Petroleum is headquartered in Kuala Lumpur, and our shares are listed on the Main Market of Bursa Malaysia Securities Berhad. Hibiscus Petroleum shares have been classified as Shariah-compliant securities by the Shariah Advisory Council of the Securities Commission of Malaysia.

## Statistics

| | |
|---|---|
| **Market Capitalisation:** | US$432.54 million |
| **Shares Issued:** | 1.59 billion |
| **Warrants Outstanding:** | 317.65 million |
| **Net Assets:** | US$238.28 million |
| **Net Cash:** | US$32.54 million |
| **Net 2P Oil Reserves:** | 46.0 mmbbls |
| **Net 2C Oil Resources:** | 68.5 mmbbls |
| **Average Net Daily Production Rate:** | 8,545 boe/day |

Kiewit



**Bruce Grewcock**
CEO & Chairman of the Board

# Kiewit

Kiewit is one of North America's largest and most respected construction and engineering organizations. With its roots dating back to 1884, the employee-owned company operates through a network of subsidiaries throughout North America. Kiewit offers construction and engineering services in a variety of markets, including power; oil, gas and chemical; transportation; building; water/wastewater; industrial; and mining.

**Jobs Done Well**
A leader in the power industry, Kiewit has expertise across gas- and coal-fired generation, power delivery and renewable energy project delivery. Our diversity represents more than 120,000 MW of installed capacity, consistently ranking Kiewit among the top five power contractors in North America, according to Engineering News-Record.

In the past 10 years, Kiewit has completed nearly $20 billion in power-related work. By focusing on safety and client satisfaction, we've demonstrated that we can deliver challenging, complex projects of all sizes, on time and within budget.

**Full Project Delivery**
As one of North America's largest EPC providers, Kiewit brings in-depth expertise to the delivery of power projects. From concept to commercialization, we offer clients a full suite of EPC and start-up services that set industry standards for quality design and superior functionality. We have completed some of the largest and most complex power projects, leveraging technologies that optimize plant performance and cost, while achieving the needs of our clients. No job is too large or too small — we deliver world-class solutions to projects of every size.

**The Kiewit Difference**
*Our people*
Kiewit is one of the largest employee-owned firms in North America. In fact, we're 100 percent owned by active employees — a legacy that goes back over 70 years. All of our projects are led by employee-owners, which promotes accountability, an entrepreneurial spirit and a greater drive for success in all aspects of our work.

*Self-perform*
We self-perform the vast majority of the work on our projects, especially the components on the critical path — typically over 80 percent of the work. We create project advantages through our direct-hire capabilities, especially in areas such as civil, structural, mechanical, piping, electrical and instrumentation. Kiewit's success is self-driven; by performing most of the scope ourselves, we retain control of the outcome of our projects.

*Financial stability*
In 2017, Kiewit had revenues of $8.7 billion. With no operational long-term debt, our strong balance sheet offers clients the assurance that their projects will get completed.

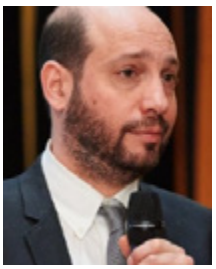
**The Kiewit Commitment**
*Safety: Nobody Gets Hurt*
Safety comes above all else. To us, nothing is more important than the safety of the men and women on our project sites and the surrounding public. No excuses. No shortcuts. Nobody Gets Hurt.

*Quality: Right the first time*
We stake our reputation on it. Kiewit's formal quality program enables us to build work right the first time and challenges us to continuously improve, while meeting or exceeding our clients' expectations.

*Environmental: What we do matters*
Our employees know they have a responsibility to build our work like the corporate citizens that we are — and with the highest regard to environmental compliance.

## Statistics

| | |
|---|---|
| **2017 Revenue** | $8.7 billion |
| **Workforce** | 22,000 employees |
| **Equipment fleet** | 14,200 units with a replacement value of $2.3 billion |
| **2018 ENR rankings** | – No. 1 in Fossil Fuel<br>– No. 4 in Power<br>– No. 5 Overall Top Contractor<br>– No. 5 Design-Build Firm |



**Jared Lazerson**
Chief Executive Officer

# MGX Minerals: A Circular Solution for the Energy Transition

MGX Minerals is a cleantech resource company bridging the gap between conventional and new energies through its rapid lithium extraction technology, which unlocks new sources of lithium from an unlikely source: oilfield-produced water.

This first-to-market rapid lithium extraction technology greatly reduces the capital expenditure, geographic limitations, water usage and environmental footprint of conventional lithium extraction processes (solar evaporation and hard rock mining). For industrial businesses, including operators of oilfields, MGX's system treats produced water on site while filtering out minerals, generating recycled water for reuse and recovered lithium for resale.

As clean energy technologies proliferate, the demand for lithium is rapidly growing – it's expected to reach 650 percent by 2027.

MGX's technology, developed in partnership with subsidiary PurLucid Treatment Solutions, creates a potential new revenue source for oil companies. It recovers lithium from a broad range of brines, including wastewater from hydraulic fracturing, conventional oil and oil sands (bitumen) production, geothermal brine and other brine sources such as lithium-rich mine and industrial plant wastewater in addition to traditional sources. These brines were previously considered un-processable due to their composition or geographic location.

MGX's process also offers significant cost savings, supports regulatory compliance and reduces the risk of environmental contamination — all critical benefits to the oil and gas industry, which produces nearly 900 gallons of wastewater annually.

Under the leadership of Jared Lazerson, the company's chairman and chief executive officer, MGX Minerals was awarded the 2018 Global Platts Metals Award for Base & Specialty Metals Industry Leadership and recognized as a finalist for two 2018 Global Platts Energy Awards for Rising Star - Company and Emerging Technology.

MGX Minerals is a diversified clean energy and mining technology company. Through direct research and development, strategic partnerships and acquisition of promising assets and technologies in battery commodities, extraction processes and clean tech for the oil, gas and mining sectors, MGX is fueling tomorrow's clean energy economy today.

## Statistics

Lithium demand, driven by companies that produce the batteries to power electric cars, laptops and other high-tech devices, is expected to increase **650 percent by 2027.** (Mining.com, June 2018)

The United States generates **900 billion gallons** per year of wastewater from oil and gas production (Air & Waste Management Association, 2017)

**Steve Neely**
President & CEO

# Noil Petroleum Corporation

For over 60 years, Noil Petroleum Corporation has served clients nation-wide, offering a broad range of services including the supply of a full line of refined petroleum products, low-risk financing, fuel management and many other industry-specific solutions. Our industry experience, financial strength, diverse supplier relationships and commitment to service and excellence, make Noil Petroleum Corporation one of the most reliable refueling partners in the US.

**Wide Range of Products**
We specialize in distributing elite level diesel and gasoline fuel services to all parts of the country. We have a range of products that serve a variety of business types and industries. Noil Petroleum Corporation supplies Low Sulfur Diesel, Ultra-low Sulfur Diesel, K-1 Kerosene Heating Oil, Non-road Locomotive and Marine Diesel, Winter Blend Diesel, Boiler Fuel, High Sulfur Heating oil and E85 Ethanol, as well as Aviation Kerosene's and Lubricants.

**Nationwide Distribution Network**
It does not matter which part of the country you are in; we are never too far. Our many petroleum industry relationships allow us to carry the highest quality fuel to you more quickly than our competitors.

**Fuel Management Program**
Petroleum product prices fluctuate. When there is no way to get fuel at affordable prices, we help our customers with our efficiently designed fuel management program. With our help, you could save thousands of valuable dollars every year.

**Safety First**
Safety is our top priority, whether it is for you or for our employees and vendors. With 100% compliance with US regulations, we operate our business with highest safety and compliance standards, providing you with risk mitigation and peace of mind.

**24/7 Customer Service**
Provision of positive customer experience is an integral part of our business ethics. We are available to you 24 hours a day/ seven days a week. Whether you are looking for quick refueling or professional advice on fuel and price management, contact us at any time.

**Mobile Solution**
With our mobile application, we give you the power to place your order on your mobile device, customize your loads for better cost management, have quick overview of your past purchases and receive current updates on petroleum market movements. We are doing our best to put the power in your hands and make refueling hassle-free.

**Tried and Trusted**
In the B2B community, it is trust that matters the most. We fully understand that business owners don't make impulsive purchases. When fuel runs the wheel of your business, your goal is to establish a long-term relationship and solution. Trusting new companies for something that's such a crucial part of your business i.e. fuel, can be a risk you never want to take. With Noil Petroleum Corporation, you are bonding with a business that has been tried for six decades and trusted by thousands of satisfied customers.

**Ethics and Honesty**
At Noil Petroleum Corporation we believe in ethical and honest work and business. When you do business with us, we don't bring you any unwanted and unexpected surprises. Through the life of our relationship, we will keep you informed of anything that affects you and your budget. If you like to work that way, we look forward to hearing from you.

**Progress for Everyone**
We work hard to provide you with the highest quality fuel, and refueling solutions, at the best prices, and want you to have full trust in Noil Petroleum Corporation. Contact us at 1-844-427-7877 or visit our website www.noilcorp.com for any queries related to your refueling needs. We would love to answer your questions and lay the foundation of a strong relationship with you for years to come.

NorthernStar Energy Corporation

**Juan Miguel T. Delgado**
Chief Operating Officer

# Northern Star Energy Corporation Finalist, Rising Star Company Category, S&P Global Platt's Global Energy Awards 2018

Northern Star Energy Corporation (Northern Star) is a rapidly growing multi-branded petroleum marketer in the Philippines that targets underserved markets and powers communities in growth areas outside major urban centers. Northern Star addresses the need for quality petroleum products for retail and commercial & industrial customers, particularly in communities dependent on agriculture and fisheries. These provinces trail in reliable energy supply, and retailing fuel using unsafe bottles and containers is still prevalent.

From just 17 service stations in 2012, Northern Star now has 60 with plans to reach 100 by end 2020. Its retail business has grown on an average of over 23% year-on-year over the last six years, not just through new-to-industry sites but also through Northern Star Convenience Hubs. These one-stop Convenience Hubs provide local communities with easier access to fuel, quick eats, hot and cold beverages, groceries, medicines, auto care facilities, and financial services.

Similarly, Northern Star started its commercial & industrial (C&I) operations in remote and underserved provinces where the lack of oil terminals and port facilities made product distribution difficult. Northern Star identified and partnered with key tanker vessel and storage operators for reliable, safe, and efficient distribution of petroleum products. To further enhance this, it invested in GoPetrol, a wholly-owned subsidiary responsible for point to point transport of fuels with an initial fleet of seven trucks in 2017 that has grown to 41 by the end of 2018. These strategic initiatives resulted in a year-on-year sales growth of 120% in its C&I business.

Northern Star contributes to moving the country's economic growth forward by being one of the few domestic traders in the Philippines supplying large public and private corporations in critical industries such as power, transport, mining, construction, and leisure.

As a quality, health, safety, and environment-driven corporation, Northern Star complies with the stringent guidelines of ISO 9001:2015 and ISO 14001:2015 to deliver on its commitment to its retail and commercial & industrial customers. It serves its clients without sacrificing quality, the health and safety of its customers and staff, and the environment where it operates.

Sikap, Tulong, Sulong (Strive, Help, Forward), Northern Star's social investment program, aims to create a lasting legacy in communities where the company operates with activities in education and environment. These initiatives are in line with the United Nations Sustainable Development Goals to be achieved by 2030: ending poverty, promoting prosperity and well-being for all, and protecting the planet. To reach and touch more beneficiaries, Northern Star maximizes synergies by partnering with major corporate entities such as Chevron Philippines, Inc. and non-profit organizations like the American Chamber Foundation and Renovate to Educate.

In the past six years, Northern Star's expansion resulted in an average sales growth of over 50% year-on-year, and its customer base increased by over 400%. This was made possible by a highly qualified team that grew from just eight employees in 2012 to over 110 professionals composed of regular and contractual staff and consultants by the end of 2018. All share in the Company's focus to provide quality products and services that are responsive to customer needs.

In growing its business in the future, Northern Star looks to extend its physical reach to other regions in the Philippines and continue to contribute to national development by providing energy to move everyone forward.

**Juan Carlos Mendez**
CMI Energía Operations
General Director

## CMI Energía – Corporación Multi Inversiones

Corporación Multi Inversiones, also known as CMI, is a family business and multilatin corporation with Central American origin and headquarters in Guatemala.

The energy business unit of CMI is expanding and committed to renewable energy generation. We are passionate and committed with the sustainability and development of our social, economic and environmental context, to the extent that these drivers have made us a benchmark for other energy companies in the region and have become a transformation agent within the areas where our plants operate. Believing that Sustainable Development is key to a better future and better business.

In the economic and social aspects of our business we have undertaken a huge endeavor and social intervention that generates benefits for the local indigenous Qeqchi communities. Working hand in hand with local government and communities, social progress has been achieved and improved.

With an installed power capacity of 262MW we are the largest private renewable energy generator in Guatemala. In Central America we have achieved technological and geographical diversification reaching 656MW of hydraulic, wind and solar power operating facilities and an additional 105MW in construction which will make of us one of the top three renewable energy generators in the region.

**Nikhil R. Meswani**
Executive Director
and Member of the Board

## Reliance Industries Limited

Reliance Industries Limited (RIL) was founded by Sh. Dhirubhai H. Ambani and incorporated in 1973. RIL is India's largest private sector company on all major financial parameters. RIL's energy businesses are diversified across refining, petrochemicals, and exploration and production. RIL is also rapidly expanding its presence in organized retail and digital services sectors.

RIL's refining and marketing business houses world's largest single-location refinery at Jamnagar. With 1.24 MMbbl/d of crude processing capacity, Jamnagar has now transformed into "Refining hub of the world". Further, it is amongst the most complex refining assets globally with a Nelson complexity index of 12.7.

RIL is amongst the world's leading producer of petrochemicals with global scale capacities across polymers, polyesters, fiber intermediates and elastomers. RIL has ten manufacturing locations in India and three in Malaysia. RIL is amongst the top 10 global producers in a number of products.

RIL has strong capabilities in offshore exploration and has built expertise in unconventional areas such as CBM and shale gas. KG-D6 fields were the first greenfield deep-water oil and gas production facility developed in India.

True to its vision, RIL's potential value in the energy business has been further ameliorated through ROGC, Gasification and Ethane cracking projects.

WEST INDIES PETROLEUM

**Charles Chambers**
Chief Executive Officer

## West Indies Petroleum – Importer & distributor of fuel in Jamaica & the Caribbean

West Indies Petroleum is a Jamaican fuel supplier operating in the Caribbean since November 2013. At its inception, the company recognized that a large part of the local market was going unserved because of the limited fuel available from the local refinery. Consequently, it started positioning itself to solve a logistics puzzle which would give it the ability to serve customers, primarily by acquiring land in strategic locations through which it would be able to build storage.

Today the Company has significantly expanded the domestic bunkering business and controls about 90% of the market. The Company owns and operates a 600,000 barrel terminal on the south coast of Jamaica and smaller 65,000 barrel terminal on the north coast where it is about to open its first ex-pipe bunkering terminal in a cruise shipping port in Jamaica Additionally, it also owns and operates a fleet of five vessels and collectively it uses these assets to trans-ship barrels in the shipping, retail, mining and power generation spaces in Jamaica, the Caribbean and Central America.

S&P Global
Platts

# Platts Land Activity Monitor

## Analyze hydrocarbon activity by basin and formation

Platts Land Activity Monitor is a weekly dataset that delivers well-level information, delineated by an oil or gas classification, on the US onshore drilling market. This data provides an insightful view into upstream activity that will help subscribers understand details about the well, play and formation as well as a forward look at future hydrocarbon supply.

### Benefits:

- Analyze where drilling activity is being targeted
- Better understand relationships between E&P companies and contracted drillers with updated drilling contractor data
- Analyze data by basin and formation or drill down to state and county, or even well-level, for targeted and precise analysis
- Identify rigs in demand that are best suited to a particular play, field or depth
- Keep up with competitors and general industry trends with well type marker data

### What makes Platts Land Activity Monitor unique?

While permit filings are a useful way to understand future upstream activity Platts Land Activity Monitor goes a step further. It uniquely delineates well classification into oil or gas for higher quality analysis of the impact of activity on future hydrocarbon supply.

### Searchable data points include:

- Basin and field
- Well orientation
- Rig specifications
- E&P company and permit data
- Spud date and well ID number

### Who can benefit by using this data?

- Traders can better understand future supplies of oil and gas
- Analysts use this data for better forecasting and trend analysis
- Investors can identify the players and their position in the market
- Business Development teams can better identify targets for service and equipment needs

### Subscriptions available for individuals or multiple users

For more information call **800-371-0083**
or email **CustomerService.RigData@spglobal.com.**

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# 2018 S&P Global Platts Global Energy Awards

## Disruptors, dealmakers and new developments

*By Murray Fisher*

Now in its 20th year, the S&P Global Platts Global Energy Awards honor organizations and individuals dedicated to achieving excellence in the energy industry.

The sector has changed dramatically since the awards began in 1999, as the industry faces the challenges of energy cost, availability and consumption. The 2018 program applauds decisive action, executing complex solutions, uncovering diverse opportunities and directing the course of the industry's future.

This year brought record participation in the awards program, eliciting nominations from more than 40 countries. Notably, the effects of technology resonated in nearly every category this year, and fierce competition marked the Upstream, Midstream, Grid Edge and CEO categories.

Judging was conducted by an impartial panel of international energy experts with backgrounds in regulation, policy-making, corporate leadership, trading and strategic consulting. S&P Global Platts commends the 20th anniversary class of Global Energy Awards for their accomplishments and continued commitment to sustainable progress.

## ENERGY COMPANY OF THE YEAR

**CHENIERE ENERGY, INC.**
*United States*

The Energy Company of the Year stands above its peers, demonstrating all-round excellence in executing a total energy strategy. Judges select the winner from the entire field of Global Energy Awards nominees. Cheniere Energy, returning as winner of the Award of Excellence: LNG, displayed "extraordinary" performance as it continued to both "dominate and disrupt" the status quo in the energy markets.

"This was Cheniere's year," extolled a judge. The US became a net natural gas exporter in 2017 for the first time in almost 60 years, due in part to Cheniere's leadership as the nation's leading LNG producer and exporter. The company is now expanding its Sabine Pass LNG facility in Louisiana and has begun commissioning on a second liquefaction facility near Corpus Christi, Texas. By 2020, when both projects are complete, Cheniere expects to be a top-five global supplier of LNG.

Judges hailed Cheniere's "fast growth." Since its first export left Sabine Pass in early 2016, it has delivered more than 400 cargoes of LNG to more than two dozen countries and regions on five continents. This disruptor is also focused on diversification: it is exploring the use of smaller midscale liquefaction trains as a new option for its customers, and is engaged in upstream development through its 200-mile Midship Pipeline, which will help deliver natural gas from Oklahoma to support its export facilities and serve demand on the US Gulf Coast.

Cheniere's success story continues, as the company generated $5.6 billion in revenue in 2017, achieved Fortune 500 status, and claimed the 2018 fastest growing company in the S&P Global Platts Top 250 Global Energy Company Rankings. As a new gas order emerges, this Energy Company of the Year is leading the industry towards what the International Energy Agency calls "a more flexible, liquid, global market."

# The Judges

**Charles E. Bayless**
Former CEO, Illinova Corporation

**Paul Browning**
Former Manager, International Crude Trading; VP & Director, ExxonMobil Sales and Supply

**Gregory H. Laughlin**
Former Member, United States House of Representatives

**A. Bjarne Moe**
Former Director General, Norway's Ministry of Petroleum and Energy

**François-Xavier Saint-Macary**
Chairman and Co-founder, Ingenesis

**Dr. UD Choubey**
Director General SCOPE

**Clare Spottiswoode**
CBE, Former United Kingdom Gas Regulator

## CHIEF EXECUTIVE OF THE YEAR

**Thomas Fanning**
**Southern Company**
*United States*

Southern Company

In a notably tight race, judges sought "a consistently powerful leader" who is well versed in transforming and empowering organizations. Tom Fanning of Southern Company emerged from the debate as the champion for his "thriving portfolio and track record of success," as well as his profoundly positive impact on the direction of the industry.

Fanning's "astounding body of work" stems from intimate knowledge of one of the largest US energy providers, developed over more than 35 years at the firm. His expertise across 15 positions in eight business units gave him what judges deemed a "flexible outlook" that helped diversify Southern Company into a company with "a renewable-focused future." Fanning has led the charge to diversify the company's generation fleet, investing more than $20 billion in developing low-carbon and carbon-free resources since taking over as CEO in 2010. Fanning encourages his employees to "look around the corners of the future." Under his leadership, the firm has established a corporate innovation center and conducts a company-wide competition seeking ideas to improve the business.

Fanning's drive to maintain "an environmentally conscious renewable focus" at Southern Company has earned the industry's profound respect. He serves on the board of the Federal Reserve Bank of Atlanta, chairs the Conference of Chairs of the Federal Reserve Banks and is the immediate past president of the Edison Electric Institute.

Judges applaud Fanning for "tackling seemingly insurmountable obstacles" to achieve "significant accomplishments in and out of his organization." Following Southern Company's impressive legacy of Global Energy Awards including 2016 Energy Company of the Year, judges look forward to Fanning's next podium visit.

## LIFETIME ACHIEVEMENT AWARD

**Ron Corio**
**Array Technologies, Inc.**
*United States*

ARRAY TECHNOLOGIES

The solar industry was nascent in 1989 when Ron Corio founded Array Technologies and built the first solar tracker, enabling panels to follow the sun. With his industry now growing at a record pace, the innovator known as the "Godfather of Solar" receives Lifetime Achievement honors for his long-term stewardship of the industry.

Judges observed that Corio "started with a great idea and executed it flawlessly." He applied for his first solar tracker patent in 1993 and has continued with a series of groundbreaking inventions that helped pioneer the development of large-scale solar power plants. Throughout his career, Corio has remained committed to creating systems that yield high performance and are low- maintenance, able to withstand extreme weather conditions and reliably deliver power at a low cost – attributes that set a new standard for the solar industry.

Corio led Array as it evolved from a startup to one of the leading manufacturers of solar tracking systems globally, with systems that can boost energy output 20–30% over fixed-tilt systems. The company now has utility, residential and commercial installations in all 50 US states and approximately 20 countries.

Corio, commended by judges for being "always far ahead of the field," recently stepped down from his position as CEO to become Array's Chief Innovation Officer. His newest product is an optimization technology that intelligently adjusts trackers in response to weather and site conditions, learning as it goes; he is also exploring storage as a means to advance further adoption of solar energy. Judges salute Corio as a "true visionary" who has changed the economics of solar and helped it rise as a true competitor to fossil fuel.

## RISING STAR AWARD: COMPANY

**Limejump**
*United Kingdom*

Smart energy firm Limejump has rocketed onto the global energy scene with a big data approach and a bold goal: to disrupt conventional operations in a market dominated by a short list of big suppliers. Judges dubbed this rising star "a leader in grid utilization" that is "providing balance to many moving parts."

Judges appreciated that Limejump is "fighting to succeed in a crowded and competitive space." Like many pioneering energy companies, Limejump aims to lead the transition to sustainable energy. The company's innovative Virtual Power Plant (VPP), comprised of its software, optimization engine and Smart Box, integrates batteries and other assets to offer price arbitrage, ancillary services and real-time opportunities for optimization. Limejump's VPP offers financial rewards to businesses for participating, engaging customers in the process and acting as a powerful balancing tool by using big data and cloud-based innovation.

"Limejump is growing and maturing very fast," remarked a judge, pointing to the company's recent entry into the UK Balancing Mechanism market, a tool used by National Grid to balance supply and demand in real time. Limejump's entry enables smaller generators such as wind and solar to directly compete with large power plants in a £1 billion ($1.3 billion) market. As part of its growth strategy, the company is also "linking up with technology companies and creating solid partnerships," claiming over 260 customers to date, as well as a host of respected technology investors and an experienced advisory board.

Limejump's "innovative ideas and major accomplishments" captivated judges. They noted the company claims the two most important criteria for a Rising Star – "a unique approach and a solid, substantiated plan" – helpful attributes as the company eyes expansion of its customer base and continued commercialization of its groundbreaking VPP.

## RISING STAR AWARD: INDIVIDUAL

**Christoffer Berg Lassen**
**Bunker Holding**
*Denmark*

This year's Rising Star has injected a youthful, performance-oriented leadership style and energy into the vital world of ship fuel. Christoffer Berg Lassen is chief commercial officer at Bunker Holding, founded in 1876 and headquartered in Lassen's hometown of Middelfart. He aims to advance the company as the global leader in bunker trading through his "flexibility and strong resolve."

Lassen joined Bunker Holding subsidiary Dan-Bunkering as a trainee at age 20, ascending to its CEO spot 13 years later. Within a year, Lassen was promoted to the executive board of the parent company, where he oversees the group's 43 businesses in 26 countries.

In addition to a heroic work ethic, Lassen possesses in-depth knowledge of customer behavior, value chain optimization and industry trends. He takes these standard values, which he calls part of the company's DNA, and enacts them with new-school techniques: using small, agile task forces and quickly enacting radical organizational change. Despite his youth, he is considered a veteran at transforming strategy into operational and commercial success, having shepherded three M&A transactions in less than four years. "He is a true dealmaker," marveled judges.

Lassen has launched several new technology initiatives to ensure the company's competitive performance, including efforts to increase transparency across Bunker Holding. He also initiated a successful trainee program aimed at developing the best performers and supporting their long-term careers, toward the continued development of success stories like his own.

As Bunker Holding reports increased sales in a decreasing market and a rise in global market share, judges feel this Rising Star is well positioned at the company, and they eagerly await the next chapter in his captivating story.

## DEAL OF THE YEAR: FINANCIAL

**Capital Dynamics**
*Switzerland*

Facing competition from several sizable deals, the Deal of the Year winner in the Financial category carried the day with an agreement that married "enormous size" and "sheer complexity." In mid-2018, asset management firm Capital Dynamics' Clean Energy Infrastructure (CEI) private equity platform closed a $1.7 billion acquisition of solar energy generation firm 8point3 Energy Partners, which the company claims as the largest pure-play solar acquisition in 2018. By adding 14 US solar projects across 54 facilities as well as long-term agreements with 12 off-takers, the deal made Capital Dynamics the second-largest owner of solar assets in the US.

Judges took particular note of CEI's deft hand in managing "a competitive deal with a long list of participants." More than 130 potential buyers, including several highly sophisticated and reputable competitors, participated in early rounds of the auction process. Before advancing, CEI had to quickly and comprehensively perform due diligence on the deal's 14 projects, which included nine at utility scale, four commercial and industrial projects and an extensive portfolio of residential rooftop installations spanning nine states. Judges noted that the intricate transaction also included not only a take-private but also a take-under of the publicly traded company; "they bought below the stock market price," a difficult move requiring extensive negotiation.

The company called the deal "a significant milestone in the growth and momentum of our clean energy infrastructure team," positioning it as one of the largest acquirers of renewable energy projects in North America. Judges noted that the transaction is part of Capital Dynamics' long track record of investing in the sector and praised these skilled negotiators for "having the tenacity" to accomplish this sophisticated deal.

## DEAL OF THE YEAR: CORPORATE

**California Resources Corporation**
*United States*

Judges hailed a "standout entry" from California Resources Corporation (CRC) for executing a deal with strategic significance and impact. As the largest oil and natural gas exploration and production company in California on a gross-operated basis, CRC completed a midstream joint venture and equity investment that accomplished two goals: "improving their financial health and diversifying their operations portfolio."

In the agreement, a portfolio company of the Private Equity Group of Ares Management invested $750 million for certain common and preferred equity interests in the venture. In addition, the Ares-led investor group purchased 2.34 million shares of CRC's common stock for $50 million in cash. CRC has the option to redeem Ares' equity interests at any point during the first 7.5 years of the joint venture.

The joint venture now owns the 550-MW Elk Hills natural gas fired power plant, which is situated on the largest natural gas and natural gas liquids field in California and generates over half of the state's production. The joint venture also owns California's largest cryogenic gas processing plant, a state-of-the-art facility that processes 200 million cubic feet per day. As part of the deal, CRC agreed to a long-term commitment to purchase power and gas processing from the joint venture. The move impressed judges: "They solidified the security of their supply of power."

"Joint ventures provide an opportunity for CRC to prudently build on its solid track record of performance and accelerate sustainably profitable initiatives," said the company in a statement. Judges agreed, applauding the immediate synergies and tremendous long-term development opportunities of a deal that positions CRC favorably for future growth.

## AWARD OF EXCELLENCE: UPSTREAM TRANSFORMATION

**GlassPoint Solar**
*United States*

While many upstream companies vied for category dominance this year, the judges' ultimate winner epitomizes the changing relationship between conventional and renewable energy as the two move from competition to convergence. GlassPoint Solar, the global leader in solar energy for the oil and gas industry, impressed judges as a "large, impressive organization driving diverse partnerships within the upstream sector."

GlassPoint shares a goal with its fossil fuel partners: to produce today's energy at lower costs and with less environmental impact. Its unique solar technology, designed specifically for oilfield deployment, offers a zero-emissions source of thermal energy for extracting heavy oil, which is typically abundant but energy-intensive to recover, requiring huge volumes of steam pumped underground. Instead of burning natural gas to create steam, GlassPoint employs large mirrors to concentrate sunlight and boil oilfield water. To protect its mirrors from the elements, GlassPoint uses greenhouses to create an indoor, zero-wind environment – enabling significant advantages in cost and performance over exposed solar designs.

The company's drive to "transform the upstream space" with its "carbon-free emphasis" has attracted many partners including backer Royal Dutch Shell. Major projects include Miraah in Oman, built with the country's largest oil producer, Petroleum Development Oman. When complete, it will be one of the largest solar plants in history, producing 1,021 MW of peak thermal energy. GlassPoint is also working with Area Energy on California's largest solar energy project, the Belridge Solar plant.

GlassPoint's solar technology fulfills the promise it showed in 2011 as Commercial Technology of the Year. Today, judges see continued broad potential for GlassPoint across multiple upstream operations, and commended this "environmentally conscious winner" for "bringing solar and fossil fuels together."

## AWARD OF EXCELLENCE: MIDSTREAM

**BP marketing and trading**
*United States*

The perennially competitive Midstream category was marked by outstanding nominations and particularly tight competition this year. The ultimate winner, BP Marketing & Trading, proved a "formidable contender" as a "notable" arm of a respected industry leader.

The midstream team at BP "accomplished a lot globally" with emphasis on Mexico, where the group made investments following the historic deregulation of the country's fuels market. Drawing upon its experience in the region, BP successfully navigated a tricky compliance landscape, overcoming regulatory and logistical challenges to make BP Energía México one of the first private companies to supply the country's customers with natural gas. 2017 also saw BP become the first global brand to open a fuel station in the country; 1,500 more are expected to follow in the next five years.

BP's midstream team was working hard in the US as well. "The Permian pipeline completion was impressive," noted one judge. In 2017, EPIC Pipeline signed an agreement with BP to anchor a new 650-mile natural gas liquids pipeline linking producers' reserves in the Permian and Eagle Ford Basins to US Gulf Coast refiners, petrochemical companies and export markets, supporting long-term growth in the region.

Judges liked that BP's midstream group also "invested in low carbon futures" in 2017. Already a leading supplier of renewable natural gas, or biogas, to the US transportation sector, BP solidified its leadership by acquiring the upstream portion of Clean Energy's RNG business and signing a long-term supply contract to support Clean Energy's downstream RNG business.

Despite 2017's market uncertainty, professionals in BP's midstream operations continue to impress the judges with "consistent execution" of projects on a global scale.

## AWARD OF EXCELLENCE: DOWNSTREAM

**Reliance Industries**
*India*

Judges know Reliance Industries both as India's largest private sector company and as a past recipient of multiple Global Energy Awards; it is a "perpetually strong winner." It "rises above its peers" by displaying "advanced and impressive optimization, sophistication and scale" at its "state of the art" Jamnagar refinery and petrochemicals complex.

The Jamnagar refinery is the world's biggest, with a processing capacity of 1.24 million b/d. Reliance viewed its large, high-value capacity as an opportunity to expand into value-added petrochemicals. In early 2018, the company commissioned the world's largest refinery off-gas cracker complex (ROGC) with a unique configuration: the cracker uses off-gases from the Jamnagar refineries as feedstock. Ethylene produced by the ROGC is used in its downstream plants to produce critical raw materials for industrial applications including mono-ethylene glycol and polyethylene, and ROGC propylene is used in Jamnagar's existing polypropylene plants to produce high-value copolymers.

"Advanced facilities give Reliance a solid lead in optimization," admired one judge. The company configured its "amazingly efficient" plant to manage variations in feedstock, monitor possible contaminants, and coordinate communication among multiple control rooms as gas exchange takes place. In addition, Reliance synchronized the entire operation and built in appropriate flexibility. Remarkably, Reliance reports its ROGC was built in record time and at approximately 40% lower capital cost compared with similar projects globally, calling it "incident-free and flawless, from concept to commissioning."

Reliance's new ROGC increases its ethylene capacity, lowers its fuel cost and improves profits. Judges were inspired by the company's enduring ability to innovate on a grand scale while maximizing value from crude refining, a skill that brings it once again to the Global Energy Awards stage.

## AWARD OF EXCELLENCE: LNG

**Cheniere Energy, Inc.**
*United States*

Last year's LNG champion returns to sweep the category and claim Energy Company of the Year honors. Cheniere Energy was "consistently growing and expanding" as it recorded "another successful year." Judges valued the company's ability "to use the competitive advantage of being a full service provider." It sources gas for its facilities, transports the gas, and enables customers to load cargoes at its LNG facilities or receive them at regasification facilities around the world.

Cheniere's recent agreements highlight its ability to deliver to customers, many of whom are "significant industry players." In February 2018, it entered into two 25-year LNG sale and purchase agreements with CNPC, the first ever long-term contract to supply US LNG to China. Judges appreciated Cheniere's active participation in trade discussions to lay groundwork for the deal, as the companies signed a memorandum of understanding during a US-China trade mission the previous November.

The CNPC milestone was followed in August by a 25-year deal to supply Taiwan's CPC Corp. Judges noted both the length of the contracts and the rapid timeline for deliveries, signifying available volumes from Cheniere's marketing portfolio. These deals helped support the May 2018 final investment decision to build Train 3 at its Corpus Christi liquefaction project, the first positive FID on liquefaction capacity in the US since 2015.

Judges rewarded Cheniere for its tireless efforts to maintain its lead as the top US LNG exporter, establish itself as a leading global provider, and create a more flexible, responsive global LNG trade. The judging panel declares Cheniere to be "a company with a very bright future."

## AWARD OF EXCELLENCE: POWER

**ENGIE**
*France*

2017's Energy Company of the Year, Rising Star employer and Midstream champion adds to its inventory of Global Energy Awards. ENGIE, with a firm-wide focus on low-carbon power generation and a global presence in 70 countries, manages simultaneously to be "nimble and unafraid of long-term risks," and "a large-scale company that executes very well."

ENGIE operates in electricity, natural gas and energy services as well as risk management and trading through its Global Energy Management (GEM) group. These experts manage an impressive asset portfolio of 1012.7 GW installed power capacity, of which 19.5% is renewable; and a 1,082 TWh gas supply portfolio. They deliver a range of green solutions centered on the company's ambition to lead the energy transition worldwide.

ENGIE is "doing great things to deliver power" through a series of "distinct global partnerships" demonstrating a "long-term commitment to renewables." It has executed an impressive series of long-term power purchase agreements including in Italy, for a fixed-price supply of photovoltaic renewable electricity; in Norway, where it manages a 208 MW onshore wind installation; and in Spain, where it plans to develop nine wind farms. The company has also joined forces with other major cross-sector energy players by participating in the European InterFlex smart grid project; established a presence as one of the top three biomass suppliers in Asia; and partnered with a US industrial gas manufacturer on an electricity supply contract that uses blockchain to ensure traceability of green energy products.

Judges are pleased to see ENGIE continuing its run of strong performance and industry leadership. As the company "remains focused on an enduring, solution-based plan," judges expect continued dominance from this energy powerhouse.

## GRID EDGE AWARD

**Greenlots**
*United States*

As the electricity market becomes increasingly decentralized, many grid edge companies are reinventing the way power is generated and delivered. Greenlots, "a diverse company with big upside and huge growth potential," ultimately prevailed in this "difficult and competitive" category by tackling an important issue: how to best balance the grid in the face of ever-increasing electric vehicle charging around the world.

Greenlots, a provider of EV charging software and solutions, aims to maintain a balanced grid as more EVs plug in and cause spikes in energy demand. The company has built a software platform that manages activities between the grid and EVs, EV chargers, and distributed energy resources such as solar and battery storage to enable a cleaner, more efficient and dynamic energy system, effectively "combining EV batteries to provide balance to the grid." Judges appreciated that the open-standards software offers customers the ability to manage their charging while ensuring that grid operators can balance activity in their regions, enabling control from "both sides of the power story."

Judges liked that Greenlots, with its ability to assist utilities in overseeing their current EV charging infrastructure and planning for future development, is already a "utility-supported organization." Its partners include Avista Utilities, Southern California Edison, AEP Ohio, Southern Company, BC Hydro and Pacific Gas & Electric. The company has also partnered with automotive EV makers including BMW, Ford, Nissan and Kia Motors and currently operates in 13 different countries.

Judges salute Greenlots for its pioneering work on the grid edge, finding it uniquely positioned to scale EV charging networks to meet global demand.

## CORPORATE SOCIAL RESPONSIBILITY AWARD

In a year marked by a significant increase in CSR nominations, the judging panel selected two distinct programs: Targeted and Diversified.

## CORPORATE SOCIAL RESPONSIBILITY AWARD: TARGETED PROGRAM

**Oil Search**
*Papua New Guinea*

Oil Search operates in Papua New Guinea, a developing country that presents numerous social, political and economic challenges. In its response to a devastating natural disaster, the company earned a CSR prize for exhibiting "impressive, immediate execution on a broad scope."

Established in 1929, Oil Search is the largest company and investor in PNG, operating all of the country's producing oil fields. In early 2018, a magnitude 7.5 earthquake struck the PNG highlands, followed by a series of aftershocks. Approximately 544,000 people were affected, with half requiring immediate lifesaving assistance.

Only one company held both the community's respect and the robust infrastructure necessary to assist with the unfolding humanitarian crisis. Oil Search immediately became a "home base," orchestrating a response "ahead of the government" by offering its facilities, people and aircraft to supply urgent aid and medical support to stranded communities in the highlands.

Foreign aid and supplies were flown to the company's airfield, where its helicopters and workforce distributed donated food, water, shelter, medicine and supplies across the affected provinces. Its employees opened roads and conveyed food, fuel and restoration equipment to affected areas.

In total, Oil Search donated approximately $5 million towards relief efforts, delivered more than 200 tons of food and supplies, and treated nearly 2,500 medical cases. The UN estimates that in the first four weeks following the earthquake, Oil Search delivered approximately 80% of total food supplies to affected areas.

As recovery continues into 2019, Oil Search continues to support the community in the "most needed and impactful" ways. Judges praised the company's "immediate and comprehensive" response, and applauded it for "prioritizing people over profits."

## CORPORATE SOCIAL RESPONSIBILITY AWARD: DIVERSIFIED PROGRAM

**Complejo Hidroeléctrico Renace /CMI Energía**
*Guatemala*

Across the world from the Targeted CSR winner, one of Central America's top producers of renewable energy exhibits a diversified approach to serving Guatemala's indigenous population. CMI Energía's Renace Hydroelectric Power Complex, located in the Cahabón Riverbed, operates under an important principle: "There cannot be successful companies in failed societies." Facing "difficult external circumstances," the company aims to be a positive force for sustainable change in the region's social and economic dynamic through its "community-first approach."

The Renace project is located in a rural area comprised of 21 communities with a population of approximately 21,000 Q'eqchi, an indigenous ethnic group. Concerned by the area's underdeveloped social and economic indicators, CMI Energía "took charge without a safety net or external support" to improve living conditions for people of the region.

The company focused first on main necessities. It reported impressive results for its programs tackling

food security, resulting in a 14% reduction in chronic malnutrition; education, boosting re-enrollment 15% in primary and basic education; and health education, reducing child pregnancies by 11%. The company's employment programs reported 15,000 jobs in the region and encouraged the development of entrepreneurship. CMI Energía also focused on the community's infrastructure. The organization states that it undertook nearly 60 projects including schools, health centers and meeting spaces, as well as 93 kilometers of roads to enable faster access to these facilities, all adding immeasurably to the quality of life of the community's residents.

Judges marveled at the "massive coordination and logistics effort" required to accomplish the company's important CSR goal: to act as a socially responsible company by assuming leadership with purpose.

## CONSTRUCTION PROJECT OF THE YEAR

**Hess Corporation**
*United States*

Judges know Hess Corporation for its extensive E&P activities both onshore and offshore. The firm dominated the Construction Project category with its "big, complicated and expensive" Stampede project, a deepwater oil and gas development in the Gulf of Mexico. Judges agreed that Stampede showcased Hess' remarkable execution skills: despite difficult market timing, Hess completed this $6.2 billion project six months ahead of schedule and $800 million under budget.

The Hess team harnessed its extensive project-management skills to tackle this "huge project with large-scale challenges." The Stampede field is one of the deepest in the Gulf of Mexico. It is located in approximately 3,500 feet of water with a reservoir depth of 30,000 feet, approximately the height of Mount Everest. In these extreme depths, the Hess team knew that understanding and predicting the reservoir's behavior was key to the project's success.

The team studied the project's key issues – reservoir compartmentalization, stratigraphic complexity, and fluid contact uncertainty – and created a "base case" development plan. Stampede's subsurface manager said "there were surprises on each well, but our team worked through them." Among Hess' many innovations, it was the first at this depth to employ dual-zone "smart well" technology, akin to having two wells in one wellbore. It also successfully installed the Gulf's first tension leg platform in four years.

"The engineering and project management was incredibly well-executed," marveled a judge. Despite technical challenges, Hess safely achieved first oil in early 2018, just over three years after project sanction. The judges applaud Hess for "world class execution" of Stampede, a sound investment that positions it well for continued success.

## ENGINEERING PROJECT OF THE YEAR

**Royal Dutch Shell**
*Netherlands*

Previous judges called it "the best technical oil company in the world," and this year's panel found that the honorific still applies. Shell adds to its previous Engineering Project awards with a "solid nomination" that made them the "clear winner." The company again proved its engineering prowess with Kaikias, an "efficient" Gulf of Mexico deepwater project employing an innovative subsea tieback design.

Shell discovered the oil and gas reservoir at the Kaikias field in 2014, estimating that it contained approximately 100 million barrels of oil-equivalent recoverable resource. The company moved forward on Phase One of Kaikias' development in early 2017. Phase One of the project produces oil and gas from three wells, conveyed back to Shell's nearby Ursa production hub via a single flowline. Shell minimized the need for new drilling by redeveloping existing exploration and appraisal wells for production.

The development's simplified design resulted in an estimated 30% cost reduction versus initial estimates, an achievement reached despite the project's inclusion of the longest well ever drilled by Shell.

Beyond cost savings, the connection between Kaikias and Ursa helped accelerate the timeline. The two project teams worked together to safely complete all necessary topside modifications during Ursa's planned maintenance downtime, contributing to a faster turnaround and ensuring that Kaikias did not negatively impact Ursa's existing operations. Ultimately, Shell brought Kaikias to production in May 2018, nearly one year ahead of schedule.

Judges appreciate that Shell "made good use of nearby facilities to minimize distribution of its investment." The company's "price-conscious project focused on efficiency and balance" shows the world what "outstanding engineering" looks like.

## COMMERCIAL TECHNOLOGY OF THE YEAR

**XL**
*United States*

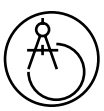
The Commercial award honors the practical application of new technology. XL, which provides vehicle electrification solutions for commercial and municipal fleets in North America, earned judges' respect by identifying a market opportunity and offering an elegant, scalable solution, earning "an impressive return both economically and environmentally."

XL's systems enable commercial and municipal organizations to add greener vehicles to their fleets and immediately save money on fuel while meeting their sustainability goals. Founded in 2009, XL aims to provide simple, sustainable electrification solutions to the commercial fleet market, a previously untapped space populated by a large number of low-mileage, high-emissions vehicles.

The company's electric drive systems install directly onto factory trucks, vans and buses, turning "existing platforms" into hybrids and plug-in hybrids, with no negative impact on vehicle performance. Judges appreciate that not only do factory warranties remain completely intact, but XL also adds a three-year, 75,000-mile warranty on its XLP powertrain.

Judges liked the company's strategic partnerships; XL's hybrid electric drive system is currently available on fleet vehicles from Ford, General Motors and Isuzu. They noted that though XL is a young company, "the technology is already being implemented." XL reports that its customers have collectively surpassed 75 million total miles driven with vehicles powered by its systems, saving nearly 1.5 million gallons of fuel, reducing CO2 emissions by 13,000 metric tons, and adding 11,700 hours of driver productivity to their fleets.

As XL's technology is currently in use by prominent customers including The Coca-Cola Company, Verizon, Yale University, the Cities of Boston and Seattle, judges believe XL is ahead of the game as the global automotive industry moves toward electrification.



## EMERGING TECHNOLOGY OF THE YEAR

**Naturgy**
*Spain*

This year's Emerging Technology winner is Spain's largest integrated gas and electricity company. Naturgy has opened new markets through its revolutionary method of supplying LNG to small- and medium-scale users, "improving economy and affordability" by enabling them to take advantage of this clean and cost-efficient energy source.

Naturgy's DirectLink LNG is a revolutionary floating LNG ship-to-shore system that is more economical than traditional fixed infrastructure and minimizes environmental impact. The complete solution includes a multi-buoy mooring system to anchor the LNG tanker, a berthing system, a portable floating platform

between the ship and the shore, and a modular onshore regasification facility, capable of vaporizing the LNG to supply natural gas to nearby end users. The scalable, easy-to-implement system is well suited to locations where traditional supply schemes are not economically or environmentally viable.

Naturgy's DirectLink LNG system debuts a series of industry innovations. It is the world's first floating commercial LNG transfer system, featuring the first use of an offshore automatic vacuum attachment, making transfers quick and safe, as well as the first floating cryogenic hoses, which prevent damage to the sea bed. DirectLink LNG is compatible with most existing LNG carriers and existing terminals, and offers cost savings of up to 80% over traditional infrastructure such as ports and jetties, a figure that attracted judges' attention. "Its cost upside and flexibility give it a broad range of applications," suggested one.

Naturgy created DirectLink LNG in response to the company's analysis of market needs and manufactured the initial system in just six months. Judges predict that potential partners worldwide will see the value in this pioneering initiative as part of a cleaner, more sustainable future. ■

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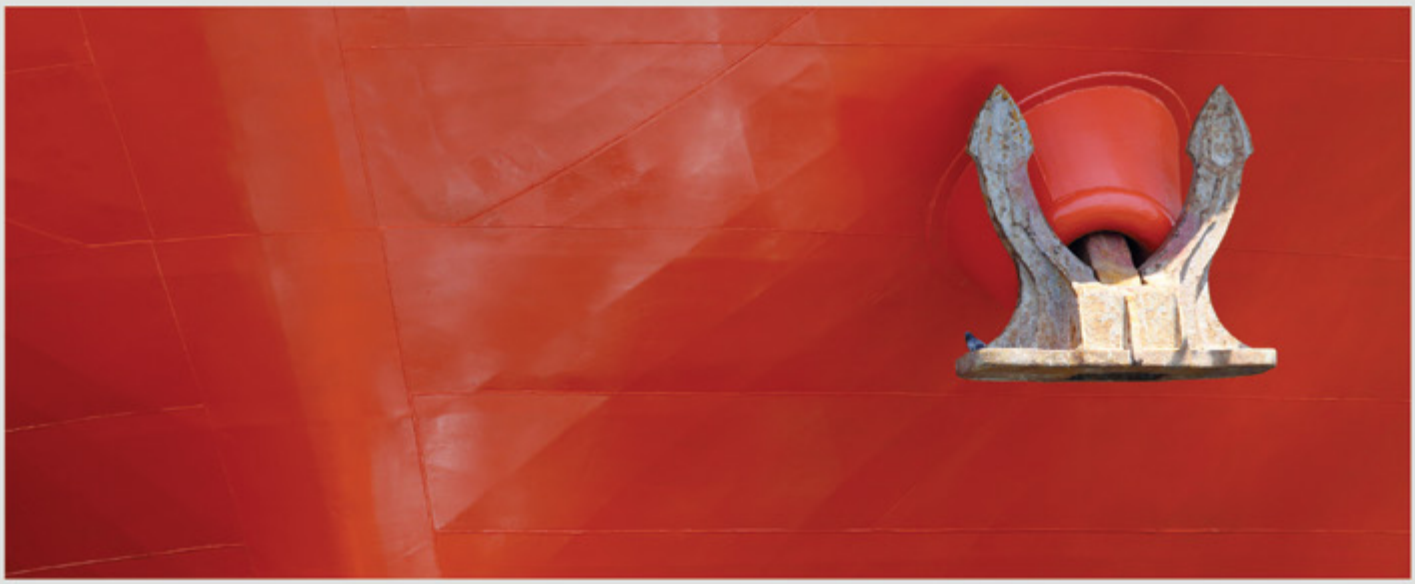

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