

S&P Global Platts

Insight

December 2019



S&P GLOBAL PLATTS
GLOBAL ENERGY AWARDS

Five commodity themes
for 2020

US utilities race to
cut emissions

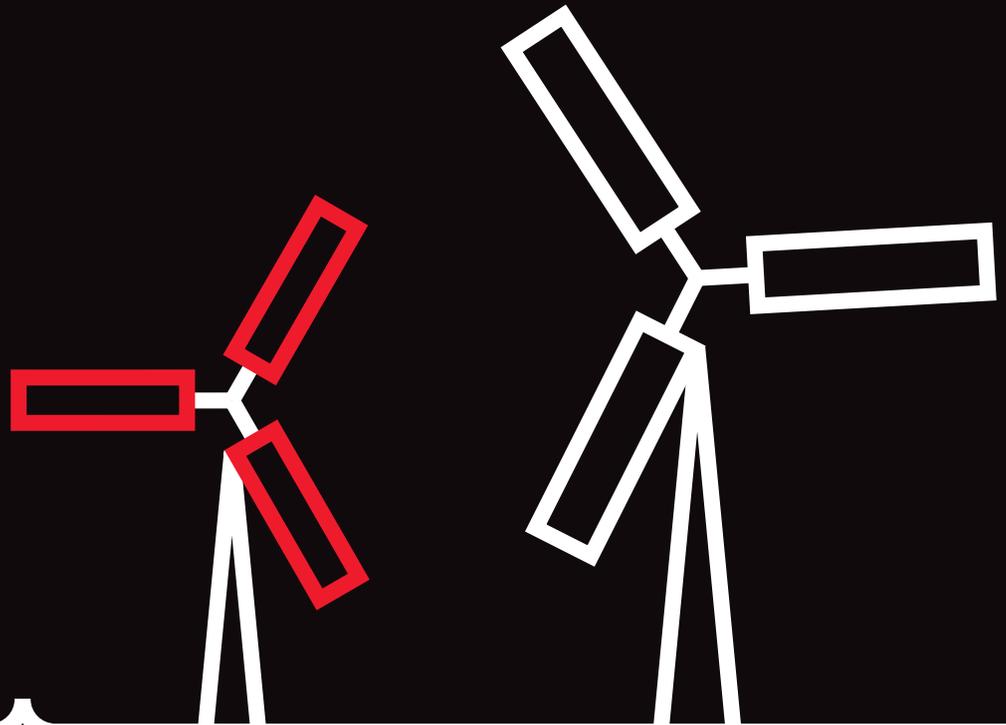
China shakes up
EV policy

Technology,
sustainability and
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Energy markets evolve



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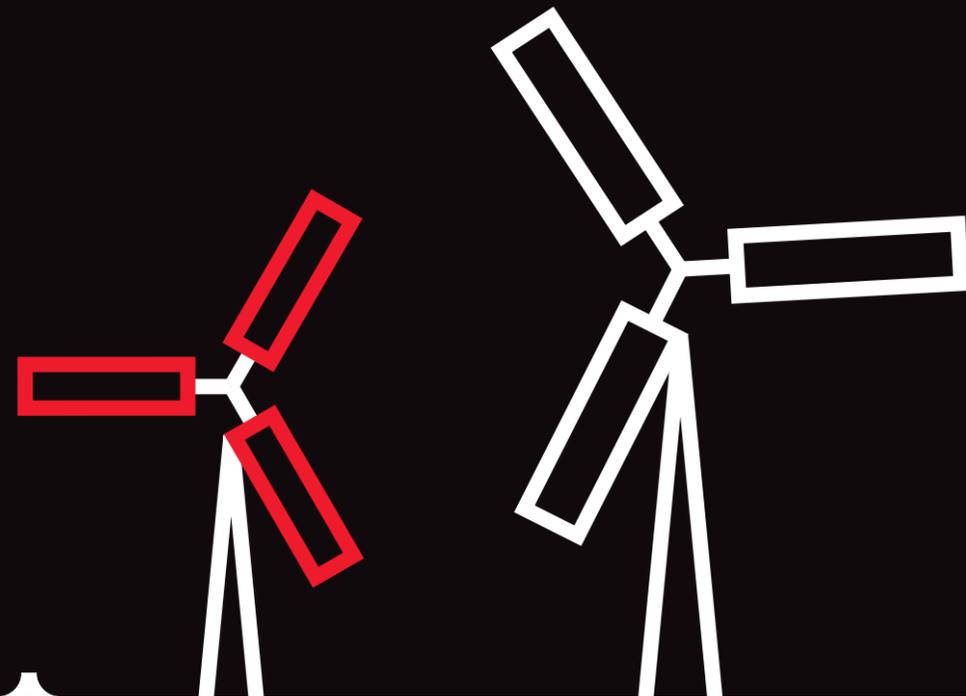
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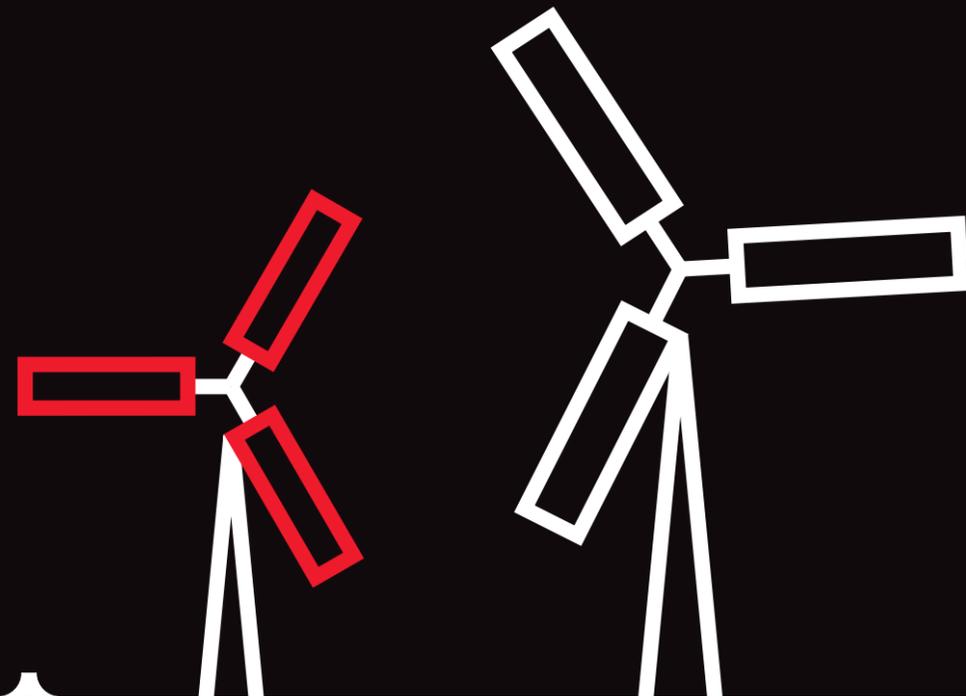


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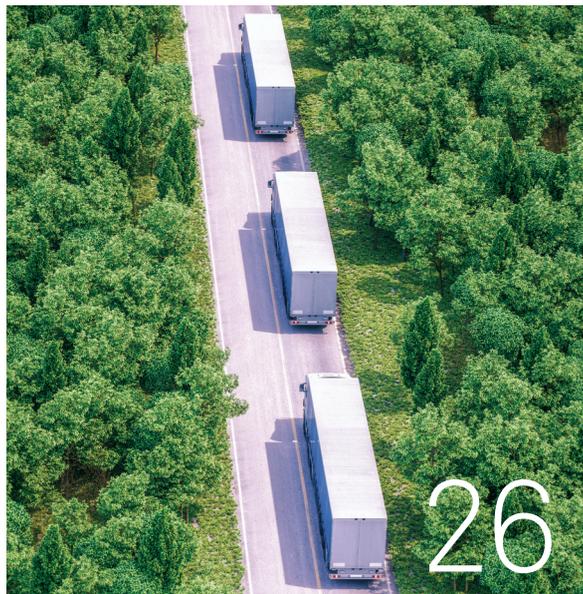


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Read more about this year's winning companies and individuals, recognized for their contribution to the energy industry, from services to finance to technology

Editor's Note



Emma Slawinski

Editor

This year has been full of geopolitical drama, as well as clashes between citizens, states and corporations on flashpoints including the environment and the economy.

Energy and commodities are highly exposed to these influences, and while for some market participants volatility can be a good thing, others may be hoping that 2020 will offer greater stability and clarity, allowing them to plan for the future with more confidence.

We kick off this edition of Insight with a look at the year to come, and S&P Global Platts President Martin Fraenkel offers his view on the themes that will dominate the energy and commodities spheres in 2020 (page 8). Global director of analytics Chris Midgley also shares a longer-term outlook on the role technology will play in our evolving energy systems (page 26).

Zooming into individual markets, there are fascinating changes taking place. The growth of Guarantees of Origin certifying electric power from renewable sources, the emergence of an Asian spot LNG hub, and the shifting strategies of national oil corporations are covered in the special section of the magazine, *New wave*, from page 34.

Consumer pressure is having a growing impact on the way companies approach sustainability and energy transition. One of the most high-profile examples is the boom in environmental, social and governance (ESG) reporting among corporates. From page 50, Jeffrey Ryser shows that this is having a tangible effect on US utilities' strategies, as they publicize more precise and ambitious goals for CO₂ emission cuts, implying an ever-faster shift towards renewables.

The global war on plastic waste continued to be a major focus this year, and Ben Brooks and Luke Milner look at how the EU is taking the lead when it comes to plastic recycling (page 58). They find that while there are cost challenges involved for manufacturers, consumer pressure is pushing in one direction only – greater recycled content and less virgin material.

We are also two years into a dispute over trade terms between the US and China, and S&P Global Platts metals editors assess the impact on the US steel and aluminum sectors, delivering a mixed verdict (page 72). Meanwhile, US oil exports continue to make inroads in Asia, as other countries have been keen to step in even as Chinese appetite for American barrels has waned, Gawoon Philip Vahn reports (page 64).

Finally, in this edition we celebrate the winners of this year's S&P Global Platts Global Energy Awards. This includes for a second year the Energy Transition Award, which recognizes the efforts of power companies to transition to a low-carbon economy. You can learn more about all of this year's awards and the judges' verdicts on the winning entries from page 88.

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Best of the Rest

Our website spglobal.com/platts contains an extensive selection of free news, videos, podcasts and special reports about energy and commodities. Here's a small selection of recent highlights



Special report Plastics recycling

Europe and the region's PET sector in particular are leading the way when it comes to plastics recycling. As well as the latest developments in the EU, this special report looks at how the US and Latin America are approaching the sustainability challenge in plastics.



Infographic North Sea oil fights back

Following the start-up of the 2.7bn billion barrel oil field Johan Sverdrup, in October 2019, this infographic looks at how the North Sea oil sector is changing in terms of output, crude quality profiles and export destinations.



Podcast Interview with Formula E's Mark Preston

S&P Global Platts talked to Mark Preston, team principal of the Techeetah Formula E racing team, about battery technology and innovation in electric vehicle racing as well as mass-market EVs.



Video National oil companies evolve

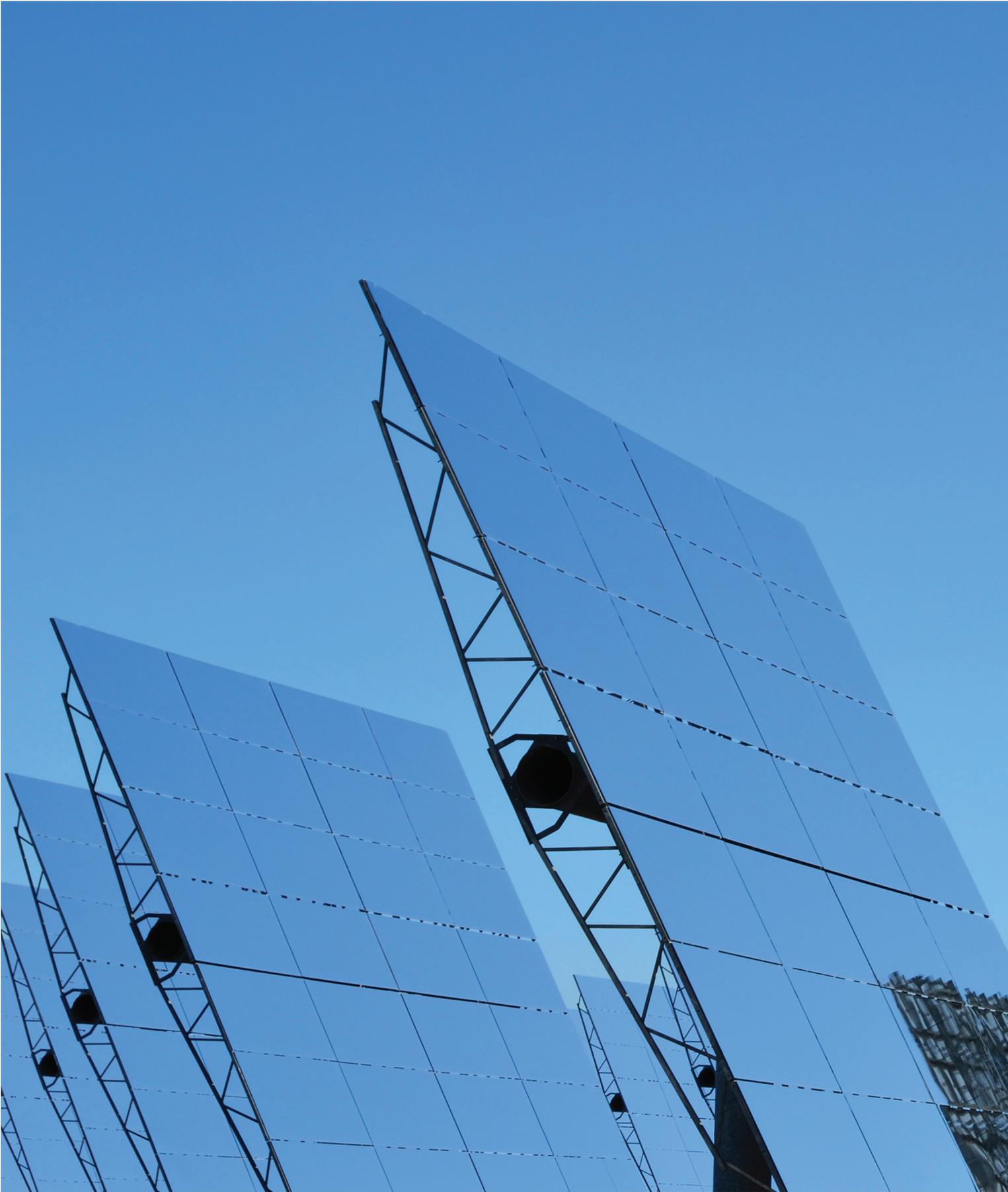
National oil companies are adapting their strategies to the changing global energy market. S&P Global Platts senior editor Robert Perkins discusses how these national champions are investing in areas such as refining and petrochemicals, growing in size and sophistication.



Podcast Global solar outlook

Electricity generation is undergoing a transformation. In this podcast, power analytics and pricing experts from S&P Global Platts discuss the global and US solar outlook, drivers of solar PV capacity additions and the impact of solar penetration on power markets.





Five commodity themes for 2020

What will be the biggest drivers and concerns for global energy and commodity markets in 2020? S&P Global Platts president Martin Fraenkel shares his outlook





This year has been marked by a tug of war between geopolitical tensions and macroeconomic concerns, rangebound commodity prices and – perhaps most importantly – rising consumer awareness of climate change. As we look ahead to 2020, we think the year will bring some of these themes into even sharper focus.

The upcoming US presidential election, a decelerating Chinese economy and rapidly evolving technology will once again keep commodity markets unpredictable, even for the most seasoned observer.

Here are my personal five commodity themes to watch during the coming year.



Energy transition

Energy transition is going to be ever-present, driving discussions and strategic planning in 2020. World leaders in both politics and industry are under mounting pressure from consumers – particularly in the West – to deliver increased energy produced with dramatically lower emissions and in more sustainable ways.

Heightened awareness by the Extinction Rebellion movement and the activist Greta Thunberg has put both governments and companies on notice of people's expectations that action must be taken to keep the global average temperature rise at no more than 2 degrees Celsius.

While it is certain that this shift will require huge investment, the way forward is still emerging. Numerous technologies and solutions are vying for the same investment dollars that are already shifting away from traditional higher-carbon intensity industries. There will likely be a heavy reliance on subsidies, which in turn are dependent on policy. No one single approach is likely to win out, at least in the short term.

In terms of transportation, the focus has been predominantly on electric vehicles, while there is also increased investment and research into the use of hydrogen for heavy duty and long-distance transportation. But biofuels look set to take center stage in 2020,

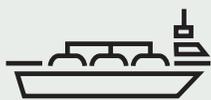
as favorable economics and the consumer-led call for immediate action have revitalized support for the fuel, particularly in Europe.

Biofuel blending looks to be the fastest route to reducing emissions, with consumption expected to increase in 2020, eating into gasoline and diesel's share of the market and adding renewed pressure on oil refiners.

With more than 1 billion conventional cars in the global fleet, road transport currently accounts for 20% of global carbon emissions, a number that is not likely to fall without a bigger solution for infrastructure. Based on this trend, S&P Global Platts Analytics forecasts that global oil production will need to increase to meet rising demand from road transport over the coming years.

In the US, the situation is more complex, with tensions apparent between federal and regional policies. At the same time, natural gas is cheap, putting pressure not only on coal use for electricity production, but also on cleaner nuclear, renewables and energy storage.

Of course, the race to renewables alone will not be enough to meet aggressive carbon reduction targets. To deliver these significantly lower emissions, every type of energy and product needs to reduce its carbon intensity – we will need carbon capture and storage and consumers will need to be more energy efficient.



Economic slowdown in China

Tariffs and trade wars will continue to dictate global pricing and trade flows for multiple commodities in 2020, but the consequences of the ongoing dispute between China and the US, particularly, are now rippling out into the economy, sparking fears of another recession.

The dispute – now in its 21st month – has exacerbated a change in local Chinese policy that aims to wean state-owned enterprises and banks off stimulus packages. The combined effect is that the rate of China's economic growth has slowed to a pace not seen since 1992.

The effects of this domestic slowdown and weaker fuel demand growth have resulted in increased gasoil, gasoline and jet fuel exports, putting pressure

on Asian commodity prices and refinery margins.

Platts Analytics expects that exports of gasoline, gasoil and kerosene in 2019 will reach an estimated 54.5 million mt (1.17 million b/d) if no more rounds of export quotas are released by the year end. This is nearly a tenth of the country's crude imports, which is roughly equivalent to Saudi Arabia or India's refined exports – both regions where refineries also cater heavily to export markets.

This figure is likely to rise in 2020, with the significant growth in new refineries resulting in total capacity reaching 18.71 million b/d, with another 320,000 b/d still under construction.

China's crude imports have remained robust in 2019 as a result, surging 17% year on year to hit a historical high of 10.76 million b/d, or 45.51 million mt in October. Sinopec, the largest refiner in the country, forecasts that imports could reach 500 million mt in 2019.



The rise of new markets

Despite strong electric vehicle production, the slowdown in Chinese demand following the government's decision to reduce state subsidies on EVs in July is weighing heavily on the market (with sales down 50% year on year).

While many are hopeful that EV sales could be poised to rebound in 2020, significant costs associated with buying an EV and limited infrastructure remain a barrier to entry for many. Although leading manufacturer Tesla has moved back into the black this year, costs in the sector as a whole are expected to come into parity around 2022-23, while 2025 is widely touted as the year when sales may take off globally.

Similarly in the petrochemicals market, the transition from virgin to recycled plastics is under way,

with many brand owners making global commitments on the back of European policies. However, virgin polymers and feedstock monomers are expected to remain more competitively priced into the mid-2020s, and this is challenging traditional discounts for recycled material. It remains to be seen whether the consumer push can be sustained despite unfavorable economics, and manufacturers will have to test consumer appetite to bear the cost of increasingly recycled packaging.

Investments are under way globally, but as with all nascent markets, infrastructure that makes industries truly scalable and markets commoditized will take time to develop.



Weather-driven market events

Weather-related demand swings have always been a feature of commodity markets, particularly natural gas and electricity, but the cycle of significant climate events is increasing.

In the spring of 2019, US farmers were unable to plant crops on 19.4 million acres in the Midwest. This was the largest number of so-called “prevent plant” acres since the government began tracking this type of data in 2007. In 2018, the number was 1.9 million acres.

The cause of this was flooding due to an accelerated snow melt in the spring, which was caused by record rainfall at the time. Over

14 million acres that were intended for corn, soybeans and wheat went unplanted, sending corn and soybean prices to multi-year highs.

As agriculture and biofuel demand grows, these swings in demand will get larger as will the demand for heating fuels, as growing populations get access to domestic gas or LPG, making the demand for these commodities increasingly vulnerable to weather conditions.



Beyond blockchain

2020 could be the year of the centralized ledger, but potentially without Blockchain technology itself.

Blockchain has huge advantages for security and encryption, with some early adopters using the software in North Sea oil contracts. But speed, cost and energy intensity mean it is currently difficult to scale for many players in the commodity markets.

Smart contracts that offer a similar level of security are already a reality, albeit with centralized ledgers using the similar reconciliation and physical documentation of trade but

without the need for simultaneous record keeping, thereby reducing the energy, latency and cost. These efforts could significantly reduce costs and lower barriers to entry across commodities markets.

Platts has already leveraged this technology, launching Platts Trade Vision in November 2019, a cutting-edge tool that allows price submissions into Platts US Natural Gas benchmark indices. Already nearly half of our data is being submitted through Trade Vision after just a few weeks.

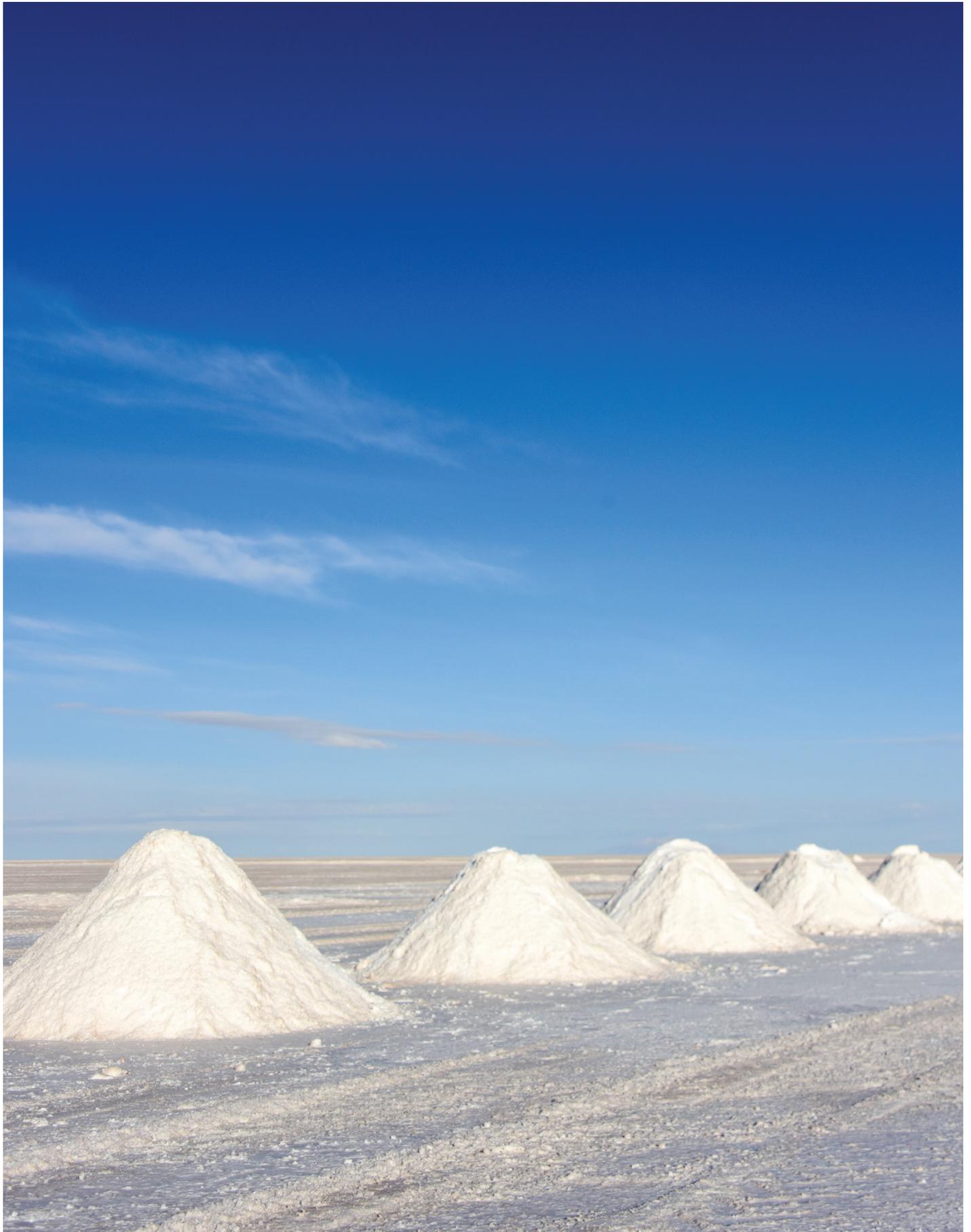
Data automation and artificial intelligence will play an increasingly transformative role in 2020.

Successful trading has always been focused on nimble operations and scale, but tighter margins and increased competition have made participants look at accessing faster, broader datasets to gain an advantage.

In a world where data is now more valuable than oil, the seriousness of efforts by companies – including Platts – to harness the power of data and technology cannot be underestimated. ■

Costs in the EV sector as a whole are expected to come into parity around 2022-23, while 2025 is widely touted as the year when sales may take off globally





Lithium sector looks for equilibrium

A slump in the price of lithium could deter investment, leading to a tight market further down the line as battery demand soars.
By Emmanuel Latham, Ben Kilbey and Abdulrhman Ehtaiba

Lithium prices plummeted in 2019, as the market tipped into oversupply and EV growth slowed. Production of the battery metal is set to almost triple by 2025 to more than 1.5 million metric tons, but there are concerns that a fall in upstream investment could flip the market into undersupply further out.

Lithium is an integral component of batteries for electric vehicles. As EV purchases have rocketed – over 2 million vehicles were sold in 2018 alone, according to S&P Global Platts Analytics – so has the need for batteries, in turn fueling lithium demand.

On the expectation of further fast growth, investment has flowed into the lithium supply chain at a brisk pace over the past few years. However, prices have dropped this year, dampening enthusiasm for new projects.

One project facing difficulties is Nemaska Lithium's Whabouchi mine in Quebec, Canada. Nemaska recently announced layoffs as it attempts to ensure optimal cash flow for the continuation of the Whabouchi project.

Another is China's Tianqi Lithium's plant in Western Australia, which began lithium hydroxide production in September. Alongside the start of operations, Tianqi announced the postponement of the second half of the 48,000 mt/year project, citing poor global lithium prices for the delay to the plant, which was initially expected to be commissioned in full by the end of 2019.

At the same time, industry participants warn that the headline fall in prices does not tell the full story. They argue that the present situation is short term, with demand for higher-quality grades set to recover, while the mismatch between lithium spodumene supply and processing capacity bottlenecks in China, a factor in current price weakness, will be shortlived.

Nevertheless, the weak market has led to greater caution among investors and suggests potential for a tighter supply picture in the later part of the next decade. The industry will have to adjust to the new conditions and straighten out the kinks in the supply chain, in order to achieve a sustainable supply that can fuel the unfolding transport revolution.

Output rises

Lithium is mainly sourced from either spodumene or brine. Australia is home to the majority of hard rock (spodumene) mines, while brine production is concentrated in South America, mainly in Chile and Argentina.

Despite the press attention garnered by South American brine operations in the past few years, it is Australia where supply has grown rapidly, with shorter project lead times of only 3-5 years seeing a flurry of hard rock mines pop up. In contrast, brine projects can take 7 years to go into production.

Lithium carbonate and lithium hydroxide are the two lithium compounds employed for battery cathode production, with carbonate currently making up the bulk of usage. In brine production lithium chloride

is extracted from alkaline brine lakes before being converted to carbonate.

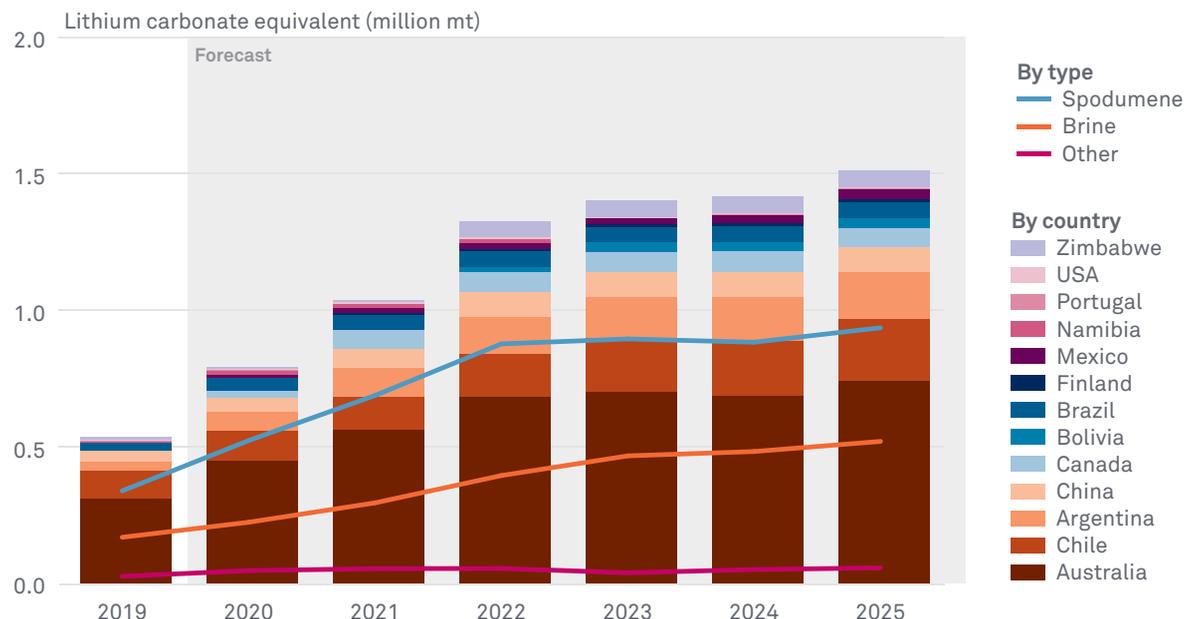
The spodumene produced by hard rock mining requires further processing to produce carbonate – a particularly energy intensive, and therefore costly, process.

Lithium hydroxide, favored for newer cathode technologies, specifically higher nickel chemistries, can be produced from either spodumene or brine. When starting with brine, an extra conversion step from lithium carbonate is required. Hydroxide is typically priced at a premium to reflect this, although this margin has been coming under pressure as production straight from spodumene has increased.

New mines and increased production have brought a glut of material to market, hammering lithium prices. The S&P Global Platts assessment for lithium spodumene concentrate with 6% lithium oxide content (SC6) fell from \$640/mt FOB Australia in January 2019 to \$520/mt in October 2019.

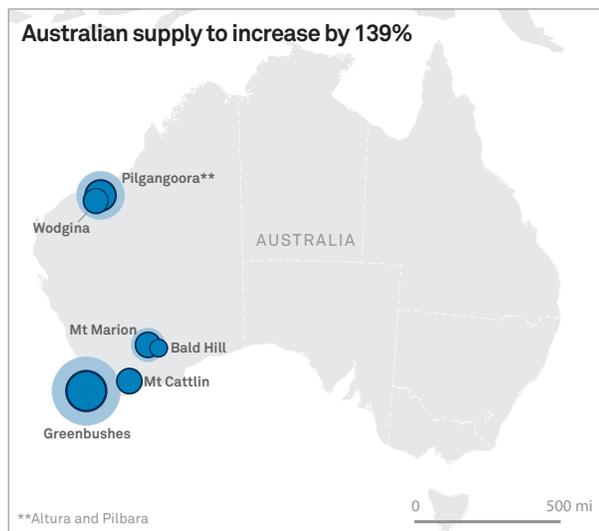
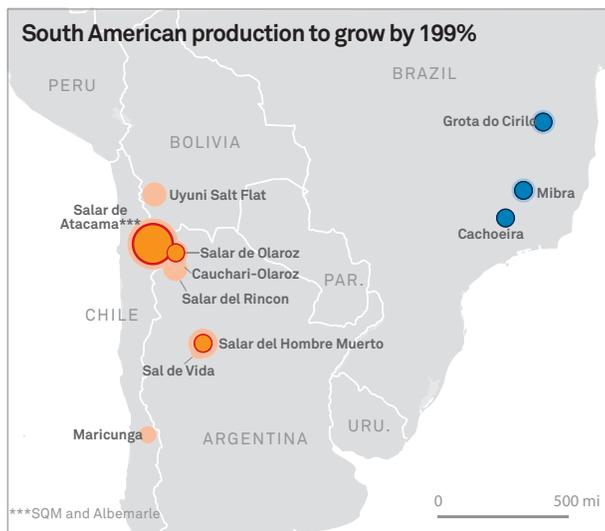
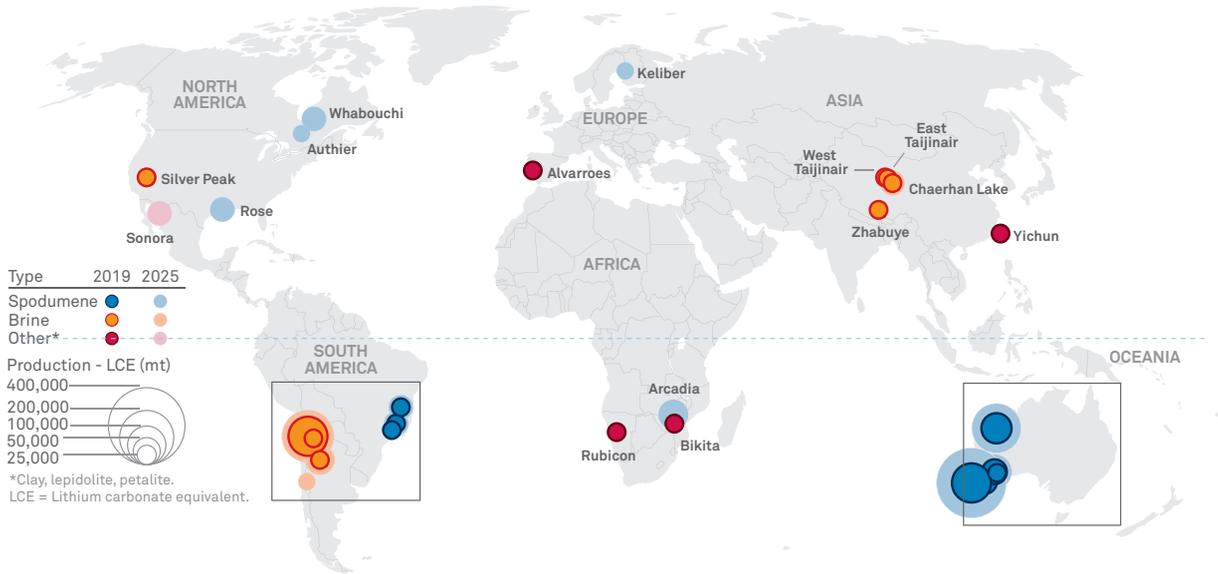
The abundance of spodumene supply and subsequent low price has drawn down input costs for Chinese converters, seeing the Platts lithium carbonate CIF North Asia assessment fall 25% over the same period to sit at \$9,500/mt November 15.

Lithium production



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

Global lithium production growth



“There seems to have been a short-term build-up of lithium raw material during 2019 which has fed through into short term lithium pricing (and lithium company share prices),” Asa Bridle, of lithium developer Savannah Resources told Platts.

Bridle also argued that the present spodumene oversupply was due to delays in downstream conversion capacity coming online in China, “The key is to recognize this as a short-term imbalance in the market and not necessarily an indication of longer term trends.”

Vincent Ledoux Pedailles of Infinity Lithium took a similar view, citing expectations that the present oversupply would last until 2020 before balancing the year after. “Spodumene is exported to China mostly to third-party converters where the conversion into lithium chemicals is inefficient,” he said, adding that miners were looking at integrating conversion capacity to “better control their value chain and improve their margins.”



The supply/demand imbalance has also been exacerbated by slower than projected electric vehicle sales in 2019, due in part to Chinese subsidy cuts in July, but also to a broader downturn in global automotive sales

Bacanora Lithium CEO Peter Secker pointed out that, when talking about an oversupply of lithium, it is important to distinguish between the lower-grade hard rock material coming out of Australia that requires additional processing and carbon footprint, and the chemical grade material used in batteries.

“There’s a lot of low grade concentrate around but the battery grade material is pretty balanced. Generally speaking, Australian production is at the higher end of the cost curve, with South American at the lower end,” Secker said.

This has seen wider argument that Australian hard rock mining could find itself in the role of swing production, with projects coming on and offline as the price dictates. Meanwhile, brine projects with more favorable positions on the cost curve would be able to operate under all but the most extreme low prices.

Supply outlook

Looking ahead, S&P Global Market Intelligence forecasts substantial growth in lithium supply until 2025. New mines and brine lakes, coupled with expanded output from several existing projects should put global lithium production above 1.5 million mt on a lithium carbonate equivalent (LCE) basis.

Australia, presently the largest producing nation, is set to maintain its position, with existing mines (many of which came online in the last three years) steadily ramping up production, bringing over 400,000 mt LCE of new supply by 2025.

South America is set to see supply growth of around 199%, as new brine lakes are beginning production and most existing salars are expected to increase output. With longer lead times, the oncoming brine projects were probably in the same batch of funding as the hard rock mines that have come online in Australia since 2016.

With the Authier, Rose and Whabouchi mines set to come online before 2025, North America’s share of lithium supply is set to increase to over 5%, potentially allaying some fears around North America’s present minor role in the EV battery chain.



South America is set to see supply growth of around 199%, as new brine lakes are beginning production and most existing salars are expected to increase output

companies, battery companies and even car companies investing or partnering with raw material suppliers/miners.”

Pedailles also stressed the need for greater investment into raw materials, “If low prices remain in the short- to medium- term, it will lead to a reduced investment pipeline. This in turn will lead to an even more dramatic undersupply situation down the line and much higher prices.”

Success during present low prices would align to producer size, Bacanora’s Secker said, stressing that large investments were still flowing into the lithium supply chain from established majors. He also argued that companies with partnerships or joint ventures would be more resilient.

“The junior companies who want to develop projects alone will struggle,” Secker said. ■

Europe, however, is expected to add only one new lithium source by 2025, marginally increasing its share of global supply. With potential for 25 battery gigafactories to be operational across the continent by 2025, Europe looks set to remain dependent on non-domestic raw material supply – even as the European Commission has thrown its weight behind developing the sector and ensuring security of raw material supply.

Keeping up with EVs

Despite the present oversupply, and near threefold supply growth expected by 2025, there is a strong argument that further out, as momentum builds, demand could outweigh supply.

“If forecasts for EV penetration are to be believed – along with the billions of dollars car companies have sunk or will sink into EV development and production – then lithium demand is set to increase 10-fold over the next decade.” Bridle said.

He added that, given the reliance of cathode and battery producers on lithium supply, there was strong incentive for supply investment from downstream users. “The lithium sector has provided some good examples of this trend already with lithium chemicals

Go deeper

S&P Global Platts' battery metals coverage spans news, price assessments, podcasts and more

Trg 0.00% 73.10°	Slp 0.05% 69.70°	Sah 0.10% 43.19°	ADCo 0.11% 58.40°	As 0.17% 49.52°	Nem 0.21% 39.80°						
Alg 0.00% 68.70°	Cos 0.04% 48.20°	Ba 0.10% 42.80°	Nio 0.13% 40.00°	EF 0.17% 45.20°	Ose 0.20% 39.60°	SP 0.26% 58.40°	Es 0.37% 36.70°	WTI 0.42% 40.80°	Ma 0.51% 34.10°		
NWSC 0.01% 63.00°	Ag 0.04% 47.88°	Sha 0.09% 42.20°	Aga 0.10% 37.40°	BH 0.17% 39.30°	Eko 0.19% 38.50°	QDFC 0.26% 57.00°	LLS 0.33% 36.67°	BNB 0.40% 37.50°	Hi 0.53% 33.00°		
EFC 0.04% 55.00°	P44 0.05% 44.00°	P35 0.05% 35.00°	Ql 0.13% 36.00°	Az 0.14% 35.01°	Jb 0.25% 37.60°	Dr 0.29% 33.00°	Pl 0.37% 33.20°	Ko 0.37% 31.70°	Me 0.47% 32.90°		
Alb 0.02% 51.70°	Nk 0.04% 42.40°	Se 0.09% 34.50°	Cab 0.12% 32.62°	Er 0.16% 34.80°	BL 0.18% 32.75°	Zaf 0.25% 30.90°	WR 0.31% 30.00°	Gir 0.42% 29.70°	Sch 0.44% 24.90°		
ArSL 0.04% 50.60°	BHo 0.04% 38.60°	Rab 0.07% 33.42°	Daq 0.11% 32.30°	Co 0.14% 30.68°	CS 0.20% 26.30°	For 0.28% 30.30°	Dj 0.34% 27.60°	Paz 0.41% 25.60°	Cl 0.47% 23.60°		
Tap 0.03% 44.60°	VG 0.04% 16.70°	Dob 0.09% 21.40°	Dar 0.12% 24.99°	Chm 0.13% 26.90°	Esc 0.19% 24.10°	Qin 0.28% 16.50°	Boz 0.29% 16.90°	Eb 0.40% 19.80°	Dal 0.51% 23.20°		

The crude oil spectrum

S&P Global Platts has created a periodic table of oil highlighting the vast array of crude qualities that make up the global barrel. Eklavya Gupte and John-Laurent Tronche look at some of the key grades making waves in the market today

CPC 0.54% 46.20°	Mb 0.79% 40.20°	ArEL 1.00% 39.21°	QtL 1.22% 41.30°	IrL 1.46% 33.60°	Lav 1.93% 34.00°	Kir 2.23% 34.30°	Kw 2.52% 31.00°	BasHvy 4.20% 23.55°
Fo 0.54% 37.31°	Hu 0.64% 28.30°	Das 1.11% 39.20°	Ur 1.25% 31.30°	Pos 1.67% 31.50°	Uza 1.84% 33.90°	Db 2.13% 30.40°	ArM 2.54% 30.90°	KI 3.89% 21.30°
SiL 0.57% 35.10°	Gr 0.70% 25.74°	Ol 0.89% 38.70°	Om 1.38% 30.50°	Sue 1.64% 29.90°	ArL 1.96% 33.30°	ALS 2.37% 28.06°	BasL 3.16% 28.80°	WCS 3.59% 20.90°
ESPO 0.55% 34.70°	Vs 0.83% 24.27°	Th 0.90% 32.30°	Cu 1.38% 28.80°	IrHvy 1.77% 29.50°	Ma 1.82% 29.99°	RGh 2.50% 24.00°	ArH 2.75% 27.80°	Sor 3.38% 19.2°
RnHvy 0.61% 22.80°	Captain 0.70% 19.20°	Sh 0.84% 24.20°	Al 1.26% 19.60°	Or 1.63% 23.31°	VnMdm 1.85% 27.00°	My 2.30% 21.80°	Miss 2.95% 27.60°	D16 4.10% 16.00°
Juba 0.56% 17.10°	Kr 0.70% 14.00°	Lo 0.87% 23.30°	Rub 1.33% 12.70°	Ca 1.41% 17.45°	VH1 1.85% 23.50°	Na 1.96% 19.00°	VH2 2.50% 16.00°	Sq 3.50% 9.00°

The global oil market is brimming with a smorgasbord of crudes, from the Canadian tar sands extracted with the help of steam and sand, to the lightest US condensates whose color mirrors a glass of fine white wine.

Each crude stream possesses its own unique characteristics, and when refined yields varying proportions of different refined products. Understanding crude quality has never been more important, following the dramatic rise in US shale output, which has transformed the composition of the global oil market.

To reflect this change, S&P Global Platts created a periodic table of oil cataloguing 120 of the most important grades on international markets. Like the periodic table of elements, the list starts with the lightest crudes and ends with the heaviest. The grades are classified by their specific gravity, or density, and sulfur content.

Light crude oils have an American Petroleum Institute gravity of 34 degrees or more, medium crudes have a gravity between API 25-34 degrees, and heavy grades are API 25 degrees or lower. Oil grades with sulfur content lower than 0.6% are considered sweet, while those with sulfur content above this level are classed as sour.

Here are a selection of grades that have recently come to the fore, in a turbulent year for the petroleum supply chain.

Ba

Bakken

Quality: **Light Sweet**
Country: **US**
Output (b/d): **1,249,000**
Sulfur level (%): **0.10**
Specific gravity (C): **42.80**

Light sweet

Light sweets generally trade at a premium to Platts Dated Brent due to their strong yields of gasoline and distillates. Some

condensates are priced at a slight discount to Platts Dated Brent because of their high naphtha content.

The US crude oil production boom that has taken place over the past decade has drawn attention to West Texas and its flagship grade WTI. However, the Bakken-Three Forks formations of North Dakota and Wyoming, often

lumped together as “Bakken,” also produce a significant amount of light sweet crude that makes its way to refineries in the US Midwest and US Gulf Coast, and occasionally into the global market.

The field produces almost 1.5 million b/d of Bakken, a light sweet crude that typically has an API of between 41-43.7 degrees and a sulfur content of 0.12%. Its importance in both the domestic and international markets has grown significantly since the start-up of the Dakota Access Pipeline (DAPL) and its southern leg, the Energy Transfer Crude Oil Pipeline (ETCOP) in June 2017.

Together, these form a 570,000 b/d system that moves oil from the Williston Basin up near the US border with Canada, all the way down to the Texas Gulf Coast at Beaumont and Nederland. Bakken trades relative to NYMEX WTI from its point of origin down to the pipeline’s terminus. Along the US Gulf Coast, it has averaged a \$4.50/b premium to NYMEX WTI in 2019.

Mb

Murban

Quality: **Light Sour**
Country: **UAE**
Output (b/d): **1,584,000**
Sulfur level (%): **0.79**
Specific gravity (C): **40.20**

Light sour

Light sour crudes boast a high fuel oil and gasoil content but are also high in sulfur. They normally trade at a slight premium to the

Platts Dubai sour benchmark.

Crudes that are both light and high in sulfur are a rarity and Murban, produced on shore from the Abu Dhabi emirate of the UAE, is one of the biggest streams of such oil. Due to its burgeoning production and popularity among Asian refiners, Murban is emerging as a key Middle East crude benchmark.

The crude accounts for more than half of UAE production at around 1.6 million b/d on average, and is one of the major streams in the Middle East with a large spot market. The Abu Dhabi National Oil Company and Intercontinental Exchange are in the process of



launching a futures contract for Abu Dhabi's flagship Murban grade next year.

A surge in arbitrage flows into Asia, as well as rising US crude exports, have raised competition for Middle East producers at a time when Asian refiners are striving to diversify their crude sources. Murban is also a deliverable grade in the Platts benchmark Dubai and Oman crude assessment process. At least 40% of Murban onshore production is freely traded. The crude variety is exported from Jebel Dhanna and Fujairah.

BL**Bonny Light**

Quality: **Medium Sweet**
Country: **Nigeria**
Output (b/d): **225,000**
Sulfur level (%): **0.18**
Specific gravity (C): **32.75**

Medium sweet

Medium sweets are very attractive to both simple and complex refineries due to their high middle distillate yields, and

are generally priced at a premium to Platts Dated Brent.

Bonny Light is one of the most prized crudes in the world due to its high gasoline content. Produced onshore in Nigeria's oil rich Niger Delta, it is very popular with refiners globally, and production has averaged around 250,000 b/d recently.

India, the main driver of oil demand growth, is the largest buyer of this Nigerian grade. However, militants in the Niger Delta have caused disruptions to pipelines, regularly targeting the key infrastructure tied to the crude and export flows. Bonny Light crude loadings have been under force majeure at least three different times in the past 12 months due to pipeline leaks caused by attacks by militants.

Many Nigerian crudes are either light or medium sweet, yielding generous amount of diesel, jet fuel and gasoline, making them more expensive than sour crudes. Crudes like Bonny Light are now competing with US shale, due to the quality similarities, and this has greatly altered the direction of crude flows globally.

ArL**Arab Light**

Quality: **Medium Sour**
Country: **Saudi Arabia**
Output (b/d): **5,502,000**
Sulfur level (%): **1.96**
Specific gravity (C): **33.30**

Medium sour

Medium sour crudes form the staple diet of complex refineries. They generally trade at a discount to Platts Dated Brent but recently prices for some grades have

strengthened, due to the supply tightness of such crudes globally.

Arab Light is the key export grade for Saudi Arabia, the world's largest exporter of crude. This crude is a mainstay of the key Asian refining hubs of China, India, Japan and South Korea, making it very significant for the world oil market.

Despite being a high-sulfur crude, it boasts a medium-gravity API, making it a well-rounded grade for refiners to process. When refined it produces a wide variety of products, especially for those with complex processing units.

Arab Light is mainly produced from the giant Ghawar and Khurais fields, but it also contains volumes from other fields. The Saudi grades most affected by attacks on the country's oil infrastructure in September were Arab Light and Arab Extra Light.

The Abqaiq facility, which was damaged in the attacks, helps process Arab Light and also Arab Extra Light. The Abqaiq plant has the ability to depressurize, desulfurize, and de-gas crude production, making it safe for pipeline transport.

Dob**Doba**

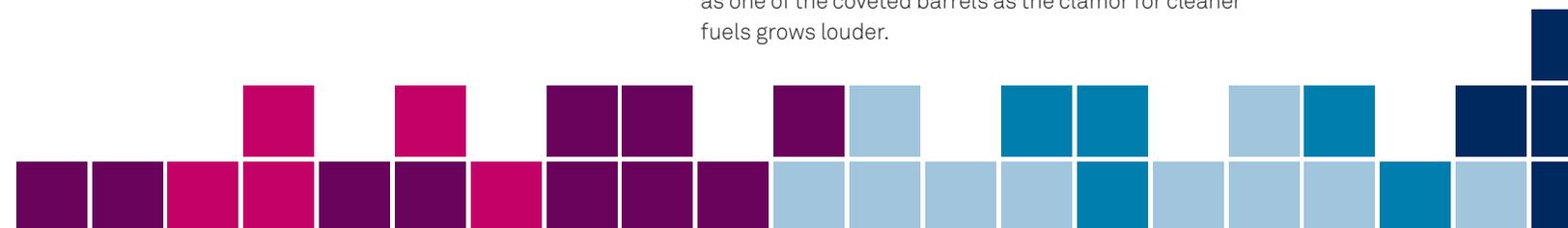
Quality: **Heavy Sweet**
Country: **Chad**
Output (b/d): **150,000**
Sulfur level (%): **0.09**
Specific gravity (C): **21.40**

Heavy sweet

Heavy sweets are traditionally priced at a discount to Platts Dated Brent but their popularity has broadened. They have

become more valuable ahead of the IMO 2020 sulfur cap due to their very low sulfur content.

Named after a city in southern Chad where vast amounts of oil was discovered, this crude has emerged as one of the coveted barrels as the clamor for cleaner fuels grows louder.



Doba's demand used to be limited to complex refiners due to its extremely acidic profile, but its quality has changed over the years due to new fields Badila and Mangara coming on stream.

This change in quality has broadened the customer base for Doba. The crude's appeal has increased sharply ahead of the IMO 2020 sulfur cap due to its fuel oil-rich but low-sulfur content, which makes it an ideal grade for producing marine gasoil.

This crude is finding homes in refineries all over the world and has been particularly popular in the storage hubs of Fujairah, UAE and Rotterdam in the Netherlands, where the crude is processed at topping facilities to make IMO-compliant fuel oil. The price of Doba has risen dramatically as a result.

Crude differentials for this grade reached a record high of Dated Brent plus \$1.65/b in late September, according to Platts data. Around four year ago, this Doba was trading just below Dated Brent minus \$8.00/b.

Doba production has also risen over the year with production averaging around 150,000 b/d, compared to levels of around 80,000 b/d six years ago. Oil from landlocked Chad is pumped via the Kome-Kribi (Doba) pipeline to the coast of Cameroon, where it loads at a terminal around 10 km offshore.

WCS

West Canadian Select

Quality: **Heavy Sour**
Country: **Canada**
Output (b/d): **1,600,000**
Sulfur level (%): **3.59**
Specific gravity (C): **20.90**

Heavy sour

Heavy sour is popular in complex refineries as they can be tough to refine due to their high sulfur content. They are priced at a significant discount to light crude

benchmarks such as Platts Dated Brent or the NYMEX light sweet crude futures contract.

As its name implies, Western Canadian Select is a select blend of heavy sour material produced in – you guessed it – Western Canada. There is no true production of WCS. Like the US grade WTI, WCS is a blended barrel, meaning its supply is based upon and controlled by the inputs available plus pipeline space and economics.

The primary consumers of this heavy sour crude are US Midwest and US Gulf Coast refiners, which have sufficiently complex plants to process it and enjoy the significantly depressed prices at which WCS trades.

Why are WCS values so low? Essentially, the crude is land-locked. There is more crude production in Western Canada than there are avenues to export it, which causes its price to fall to levels where rail cars are used to help clear the glut.

A shortage of heavy sour crude -- brought on by OPEC+ cuts, declining Mexican output and sanctions on Venezuela and Iran -- has increased the global interest for WCS. However, so far, US Midwest and USGC refiners have maintained a consistent appetite for WCS, preventing large-scale exports. ■

Go deeper

Explore the full interactive periodic table of oil, created by S&P Global Platts editors and data visualization specialists. The table brings together 120 grades representing the most diverse and important streams in global oil markets





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Congratulations, Gale Klappa, on being named a 2019 Global Energy Awards Finalist in the Lifetime Achievement category.



The biggest challenges to decarbonization are still ahead

We must find the right balance of technology, policy and individual responsibility to build a future energy system that is clean and affordable, writes S&P Global Platts global director of analytics, Chris Midgley

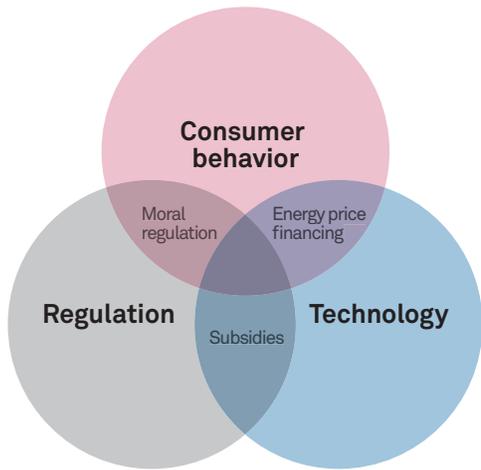


The Extinction Rebellion protests and the passionate pleas of Greta Thunberg for world leaders in politics and industry to take action on what they describe as the unprecedented global climate emergency have brought a greater sense of urgency to the energy transition.

There can be no doubt that the cycle of significant climate events is increasing and that emissions of CO₂ or greenhouse gases (GHGs) are rising at alarming rates. However, in a world where over 1 billion people still lack access to simple electricity and many more

still live in poverty, the dual challenge of providing affordable clean energy and tackling the impacts of climate change remains complex.

Addressing the challenge of climate change will require us to find a balance between regulation and government policy, technology, and consumer behaviour. Government policy can come with unintended consequences and tends to use taxpayers' money inefficiently. The German Renewable Energy Policy or *Energiewende*, for example, has successfully grown renewable energy in the country from less than 4% in 1990 to 40% today, but has also meant high electricity bills. However, CO₂ emissions in Germany have been impacted by marginal dispatchable electricity coming from carbon-intensive lignite (low quality coal).



protesting about the cost of change, such as the gilets jaunes in France, or the protests in Iran, Ecuador and Chile over reductions in fuels subsidies and increases in transport costs. Regrettably, consumers are strongly motivated by their personal welfare, which is determined by their disposable income or relative wealth. Lower energy costs over the last five years have resulted in an increase in energy consumption as the world economy has created wealth and jobs, leading to what I have previously described as consumer hedonism. Taking away this privilege is hard, and with lower energy prices, technology will find it harder to compete with traditional fossil fuels and/or get the financing required.

So has the Energiewende been a failure? Far from it. Without Germany effectively subsidizing the renewables industry, it would have not created the scale of demand that has seen technology and manufacturing processes bring down the cost of renewables to below the cost of thermal (oil, gas or coal) power generation.

Technology often needs a helping hand to gain momentum before it can compete with traditional fossil fuels. But policies cost money. We may have movements like Extinction Rebellion pushing for change, but we have equally passionate ones

However, there is a new pressure emerging that I call “moral regulation” or self-regulation. Corporations are coming under increasing pressure from shareholders to meet environmental, social and governance (ESG) standards, and are being punished for not addressing the impact of their businesses on society. We have started to see this among International Oil Companies (IOCs) as their strategies, and more importantly capital, have moved away from high-intensity carbon fuels towards less carbon intensive gas and renewables, some even shifting towards becoming electricity suppliers. At the same time, National Oil Companies (NOCs) are recognizing the risk of reliance on fossil fuels and potentially having stranded assets, and as





such are looking to diversify their economies. Saudi Arabia's strategy to float part of Saudi Aramco in an IPO in order to raise funds to invest in its Vision 2030 is a case in point.

Technology and regulation need to work together effectively to help provide momentum in the right direction but without distorting market forces. Today, subsidizing electric vehicles effectively benefits the wealthy who can afford them. Subsidizing the scrapping of old polluting vehicles instead would enable the less wealthy to be able to afford cleaner, more efficient, vehicles, which can have a bigger impact on emissions than increasing the number of EVs on the road.

A counter-argument could be, do EVs need subsidies to help give them the momentum to compete and bring down costs? Road transportation makes up 20% of global carbon emissions, so clearly it needs to be addressed, but electrifying transportation simply moves emissions up the supply chain to power generation, which today produces 40% of GHG emissions. The current trend towards the electrification of everything may not be the optimal solution.

Technology will need to provide a range of solutions to tackle the energy transition across the supply chain. Renewables will play a significant role both in liquid fuels and electrons. The biofuels sector must avoid competing with land for food and adversely impacting ecosystems, by shifting its focus to transforming plant waste to biofuels, or converting used vegetable oils or tallow from animal fat, through bio-refining. This process can provide liquid fuels such as naphtha ("bio to plastics"), gasoil and, possibly most opportune, jet fuel, in order to decarbonize aviation which contributes over 1 gigaton of CO₂ per year.

New renewable electricity has leapfrogged new conventional thermal power in terms of levelized cost of generation but needs to solve the problem of intermittency. In the short term, wind and solar challenge the economics of new combined cycle gas turbine (CCGT) plants and have pushed countries like China and Russia to focus on coal for base-load generation. Compared with CCGT, traditional coal plants have less turndown, meaning they have to run at higher base-load when ample renewable energy is available. Clean coal power plant with carbon capture and storage (CCS) or use (CCU) can be efficient and have net

zero emissions but the right incentives are needed to encourage investment in the technology.

Solving the problem of storing intermittent electricity generation continues to be a significant challenge. Diversifying away from battery storage (and electric vehicles) could be resolved by moving towards a hydrogen economy. When burned, hydrogen emits water, but it requires a lot of energy to produce.

Using renewable net-zero carbon energy to produce hydrogen at scale and in a distributed fashion can provide an affordable solution to first partially decarbonize natural gas, by blending in hydrogen. Hydrogen could then also be used in the road transport sector, in particular as a solution for heavy commercial road transport, in fuel cell vehicles, for which cost and infrastructure are the only current constraints.

Rethinking consumption

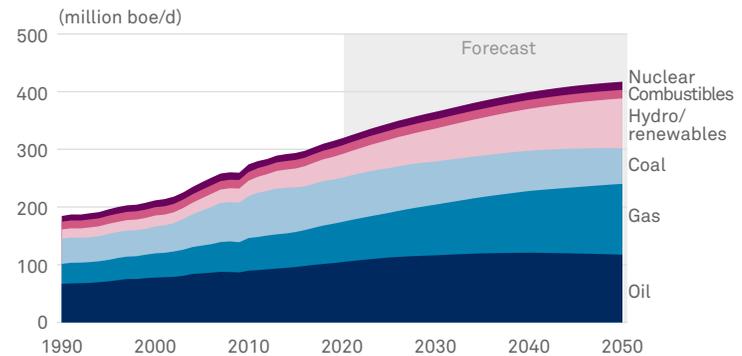
Using less energy is something we can and should all be doing today – adjusting our thermostats, buying fewer disposable goods and using more mass transport. Over time we need to recycle, reuse and, most importantly, reduce what we use. Industry is looking at similar opportunities, such as reusing carbon dioxide in CO₂ to petrochemicals. Or reducing the need for energy intensive commodities such as steel and aluminum (even paper), where plastics can be used to lightweight durable products, or, if used responsibly, with the right policies and processes around recycling and reuse, in consumable product supply chains.

We will continue to need fossil fuels in our energy mix for decades to come, so we need to ensure that the fossil fuels we do consume are of the lowest possible carbon intensity and impact on our planet. With the advent of big data and the Internet of Things (IOT) we can use things like blockchain technology to track and monitor the impact of the carbon we consume. This would enable us to create carbon attributes for the fossil fuels we produce, process and consume.

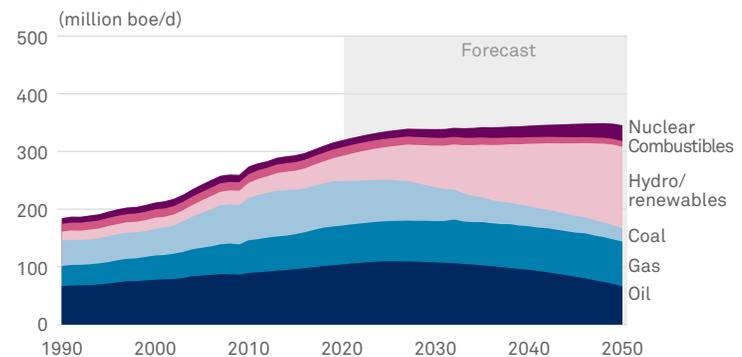
Today, gasoline and diesel have sulfur and other environmental specifications, and we should also have a specification for the energy (or carbon) used to produce gasoline, incentivizing use of the gasoline with the lowest energy intensity and making inefficient

Global energy mix scenerios

Most likely case



Limit warming to 2°C



Source: S&P Global Platts Analytics

production uneconomic. Likewise, the energy used to produce and transport natural resources such as gas and oil – and to liquefy LNG – can be measured. Again, by assigning a cost to the energy used we can create transparent tradable markets to incentivize use of only the least energy intensive hydrocarbons.

There are many uncertainties around the future of traditional fossil fuels but there are also many opportunities to make our supply chains more efficient and less energy intensive, to enable the world to achieve its objective of minimizing global warming to less than 2 degrees Celsius. However, technology alone will not achieve this outcome. We will need well-thought through policies, socially responsible companies and investors, and consumer acceptance to changing behaviours and the cost increase of sustaining our planet for generations to come. ■

Insight Conversation: Alex Schneider, Lundin Petroleum

Lundin Petroleum discovered the 2.7 billion barrel oil field Johan Sverdrup, offshore Norway. CEO Alex Schneider talked to Nick Coleman about its significance for Norway, and the wider challenges facing upstream companies in the North Sea

Johan Sverdrup is the largest field discovered in Norway in several decades. Three weeks from starting up on October 5, it was producing in excess of 200,000 b/d. And by summer 2020 production is set to reach 440,000 b/d.

The new oil stream is a boost for the North Sea industry, and will supplement major grades such as Ekofisk and the UK's Forties, which are sold as far afield as China and South Korea.

As well as boosting supply in the region, Johan Sverdrup could point the way for new projects on environmental good practice. The offshore facilities should produce minimal emissions: under the first phase, all the energy used at the four offshore platforms is supplied via an undersea cable from the national grid, in turn generated largely from hydropower.

With the second phase on stream in 2022, and output rising to 660,000 b/d, the field will be a conduit for power supplies to nearby fields, including Edvard Grieg, Ivar Aasen, and Gina Krog.

Lundin, which discovered Johan Sverdrup in 2010, retains a 20% stake in the asset, while Norwegian state company Equinor is the main shareholder and operator of the field.

What does the startup of the Johan Sverdrup oil field mean for Lundin and Norway's oil and gas industry?

It's tremendous on all counts. Johan Sverdrup is transformational for Lundin Petroleum. If you go a little bit back in history, to 2015, Lundin Petroleum was producing about 20,000 boe/d, we quadrupled our production mainly through a field we discovered [in 2007] called Edvard Grieg, which was an important field because it gave us the key to discover Johan Sverdrup in 2010.

Edvard Grieg [which came on stream in 2015] was instrumental for the growth of the company and of cash flow, but Johan Sverdrup is going to be the field that will allow us in essence to almost double again our production. We are close to 50% under budget. Johan Sverdrup will really provide the next transformational growth of the company. It is a phenomenal field and phenomenal for Norway also. Johan Sverdrup will generate NOK900 billion [\$100 billion] of tax revenue

and it will be a large part of the oil production in the Norwegian Continental Shelf and by far the largest field in both the North Sea UK and Norway together.

Are the days numbered for small, focused exploration companies?

We continue to say that our main strategy is organic growth. We want to continue to grow through the drill bit with our ability to discover new resources. We have other projects in the pipeline and our objective is not to just sit on Johan Sverdrup. We will continue to explore and we certainly believe the Norwegian Continental Shelf has some extraordinary potential so we're there to stay, and to continue to explore.

Did the collapse of the oil price in 2014 force companies like yours to have more production and get their debt levels down?

For Lundin the downturn was an opportunity. We've always been a very efficient organization in terms of cost, so when the downturn came, for us actually it was business as usual. We took the opportunity of lower rig rates, cheaper seismic, to expand our position in the Norwegian Continental Shelf. Just in the last two years we've increased our acreage position in Norway by almost 60% and we're drilling now more exploration wells as a result of that investment than we did before. The downturn is a tough time for oil companies, but it's also an opportunity and certainly for us was an opportunity.

What's the key to exploration success in Norway?

It's a lot of work. You have to have a clear strategy, you have to have obviously an excellent team of people, and you have to have a critical mass. The ingredient for us in the Norwegian Continental Shelf has been an excellent team of people, it's a very flat management structure that has allowed us to be directly in contact with the sub-surface people and it may have been

of help that the CEO comes from a sub-surface background. Exploration can be quite tough and you have ups and downs and you have to persevere and then success comes.

How equipped is Norway really for an expansion into the Arctic, in terms of the societal and political environment?

It's happening – with fields such as Goliat, and Equinor making a large discovery, half a billion barrels, called Johan Castberg... and ourselves with the Alta-Gohta fields. Norway is well equipped. We have to be clear: it's Arctic, but it's ice-free Arctic, its relatively shallow water, a benign environment. The regulation in Norway is probably the most stringent in the world so Norway is very well equipped to explore in such an area. It's a



very prospective area. If you have the right approach and you're very careful – we're all very conscious about the environment and everybody wants to do their best and [comply with Norwegian regulations] – it's a place in my view that is totally viable, and it's something we can explain to the larger public.

Is your message sufficient to persuade environmental critics, given we've seen protesters board a BP rig in the UK North Sea?

If I have a message to environmentalists such as Greenpeace, my belief is there is an energy transition, oil and gas have a role to play in that energy transition, I would say look at what Norway's doing, what they've done successfully in trying to reduce their carbon footprint. If you're an environmentalist you should say, please, do more in Norway, and perhaps less in other countries which have got less regulation and which have got a carbon footprint which is far more damaging. So that would be perhaps a better dialogue between business and environmentalists.

There's a lot of talk about reducing emissions from oil fields resulting from the use of electricity, lighting, energy for driving drilling rigs – with Johan Sverdrup you're going to have power from the Norwegian grid. But is that applicable to every small oil and gas accumulation?

Every oil company now has to look very carefully at how best to produce the barrel. The saving in Johan Sverdrup platform in one year by using onshore electricity mainly from hydropower, it's an equivalent of 410,000 private cars per year. Will that work everywhere? Probably not, but there are other solutions. Equinor are looking at installing wind power around their platforms in Norway. This could be used in Canada and other places. Every country will have to look at solutions based on their natural resources. For Johan Sverdrup it's been a phenomenal achievement and probably one of the lowest carbon footprints in the offshore industry.

Production from other fields has mostly been declining. Is Norway's industry set up in the most optimal way? Does Equinor need to be privatized? Does there need to be structural change?

There has been a structural change if you go back to 2000. At that time the Norwegian Continental Shelf was really under the control of five or six majors and no small independents like Lundin were present. In 2000 they made the first step to change that and allow smaller companies to come into the Norwegian Continental Shelf. That was followed by a fiscal change which was the refund, the 78% refund for any exploration spend...[] That has definitely accelerated exploration.

The environment in Norway to explore for new resources is there. Now are we doing enough? Probably not. We're still suffering from the downturn, there are fewer companies prepared to dedicate enough spending on capex for exploration and the Norwegian continental shelf needs new discoveries.

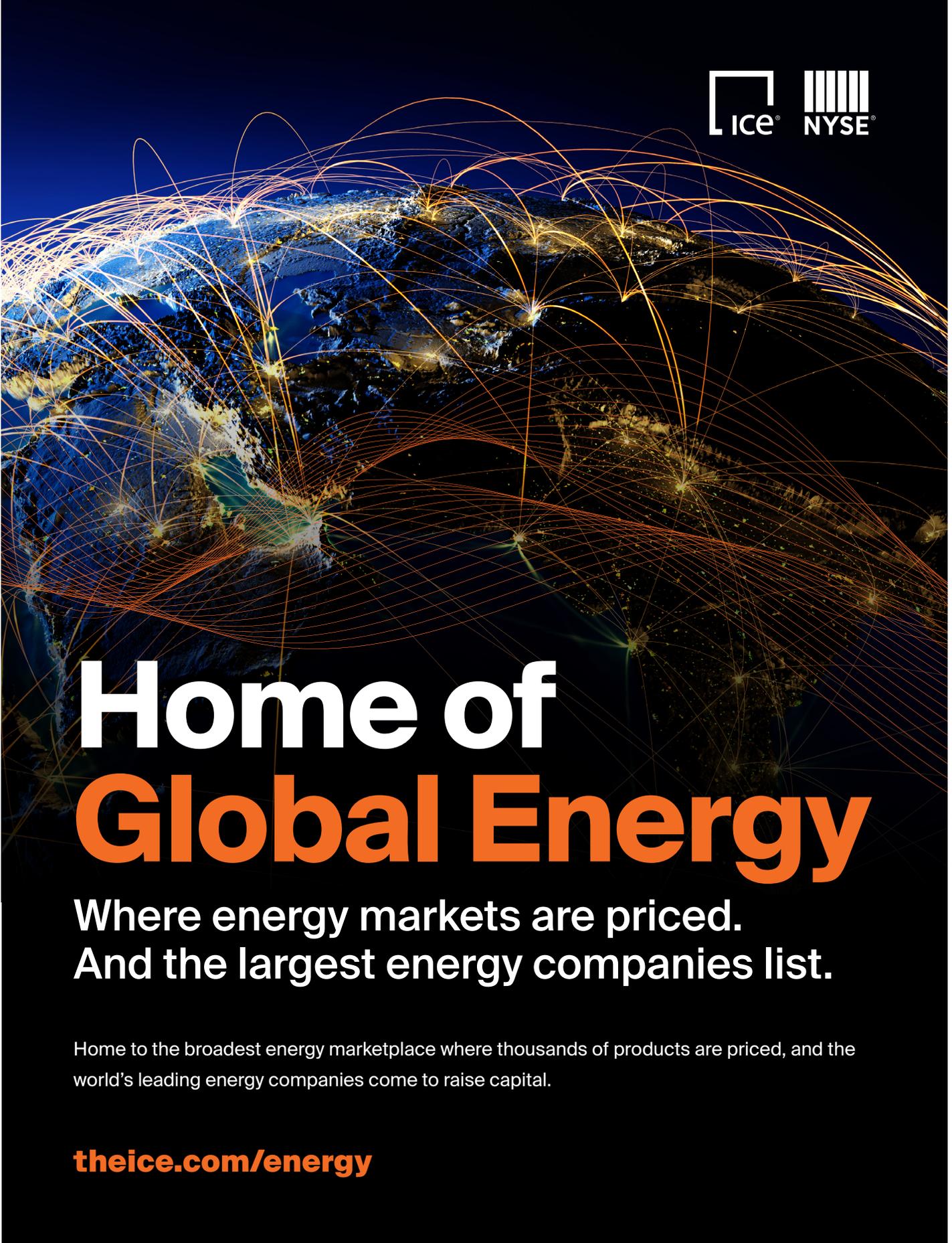
After Johan Sverdrup and maybe Johan Castberg later on, but on a much smaller scale, there are no other fields of large size to be developed, so something needs to happen otherwise beyond Johan Sverdrup there's going to be decline, that's for sure. It's one thing to buy barrels, you're just shifting from one hand to the other, but you also need people that want to explore.

Will the rise of mid-sized players change the equation?

There are more and more players through M&A. The Norwegians always wanted diversification, they always wanted more competitors and they are achieving that.

What are your operating costs per barrel?

We are close to \$4/boe. We're guiding the market that post-Johan Sverdrup for the next eight years we will have operating costs between \$3.4 and 4.4/boe. Johan Sverdrup, the field itself, is less than \$2/boe, which you could say is competitive with the Middle East. ■

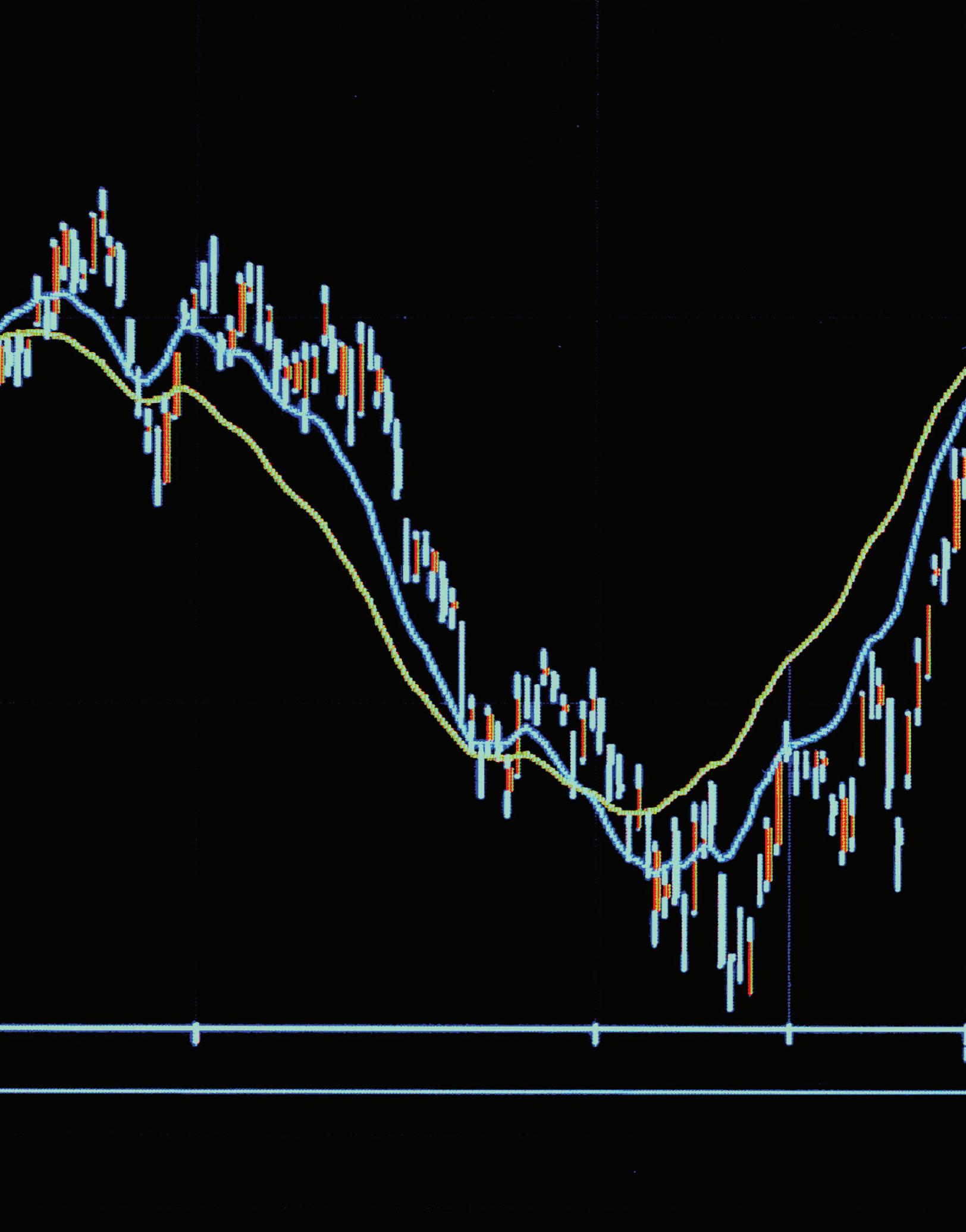
A graphic of the Earth at night, with a dense network of glowing orange and yellow lines connecting various points across the globe, representing a global energy network. The lines are most concentrated over North America and Europe.

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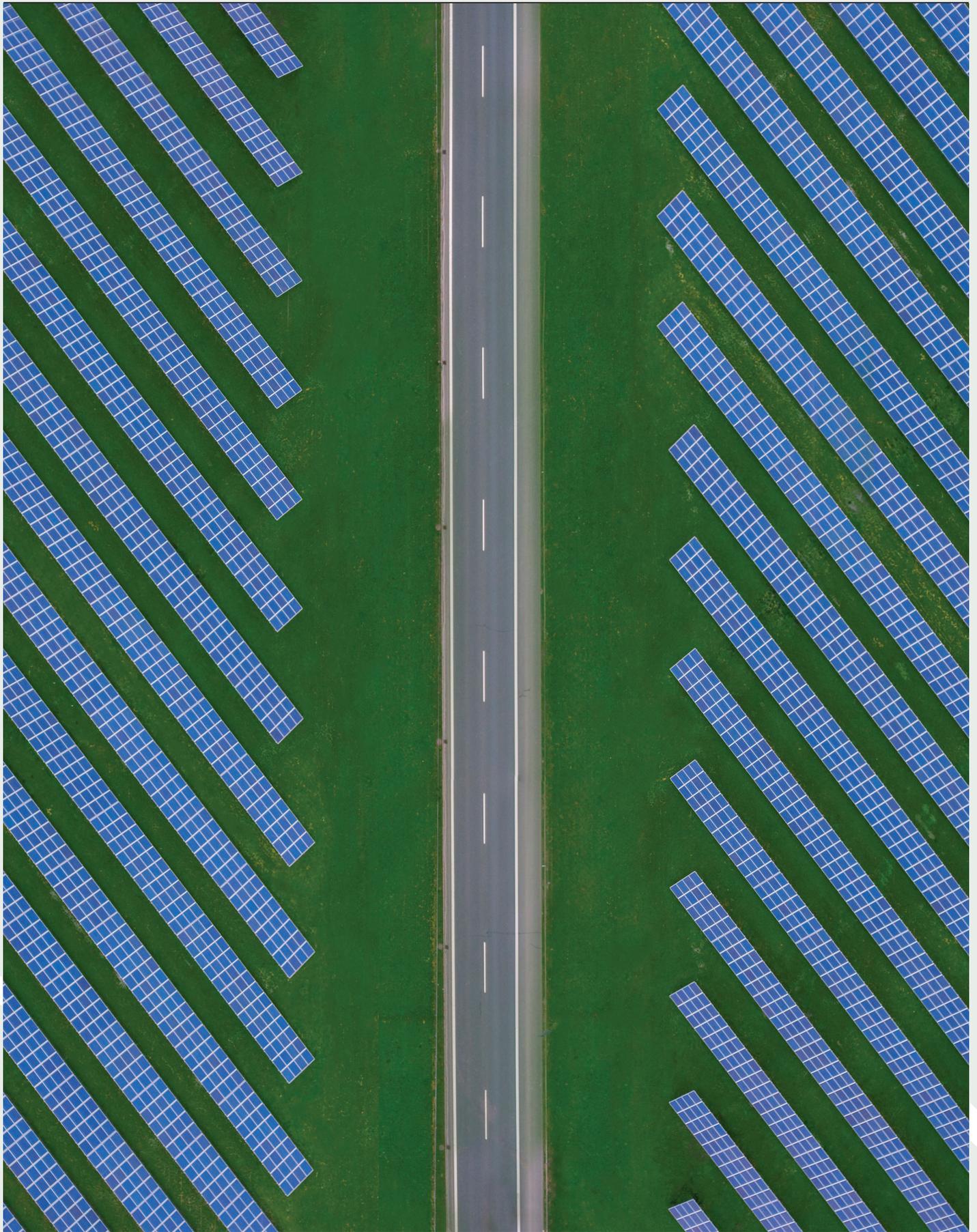
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New wave

The global energy system is constantly changing – and markets are evolving alongside it. From green electricity to LNG to global oil, S&P Global Platts looks at some of the most eye-catching emerging trends



Defining the value of “green” power

An EU system of electronic tags certifying the origin of renewable electricity has been around since 2007. Today, Guarantees of Origin are traded in an increasingly liquid market and across national borders, even helping to finance new projects

Businesses and consumers are becoming more demanding about the origin of their electricity supply, motivated by a growing sense of urgency to act on climate change.

European utilities have noted a strong rise in demand for green electricity – that is, electricity from renewable sources. An important part of the response has been the use of Guarantees of Origin (GOs) – tradable tags that certify the provenance of power supply, down to quite specific details of the generation technology involved and the geographic location.

“Green demand”

Businesses are a key source of demand, driven by environmental, social and corporate governance (ESG) principles, as they seek to show customers and investors they are taking climate change and environmental impacts seriously.

Local councils and government departments are also paying attention to the source of their electricity supply, to meet green targets.

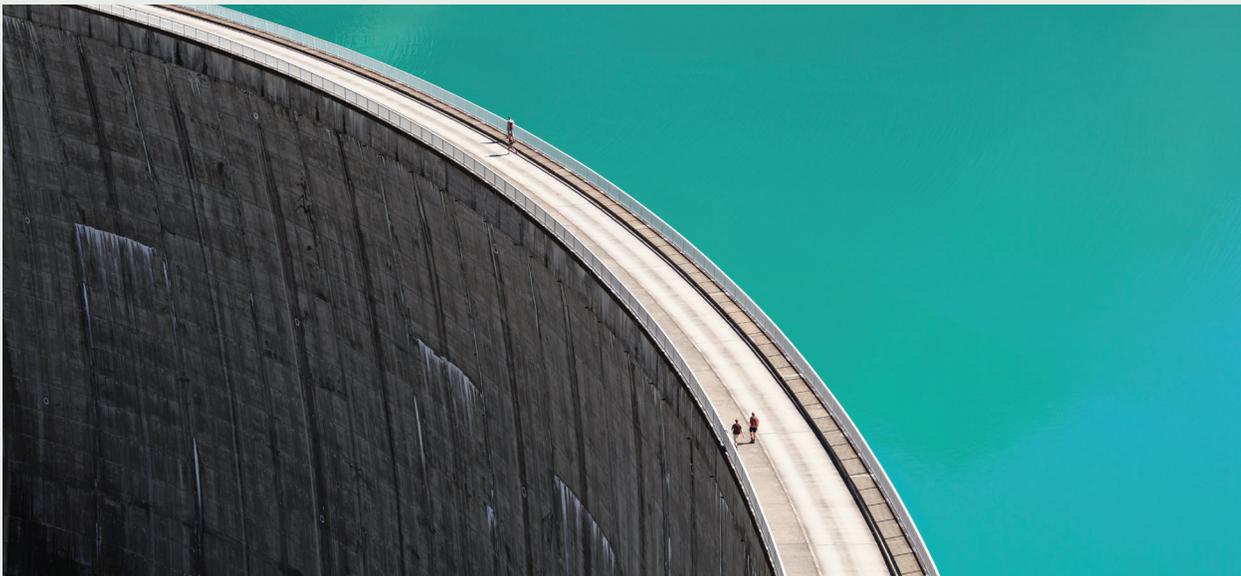
Perhaps even more important has been the trend of consumers opting in or changing their power tariffs to so-called “green tariffs” – enabled by widespread liberalization in Europe’s retail electricity markets. Several new entrants have capitalized on this demand, branding themselves as 100% green power suppliers.

Since 2007 GOs have been used to verify to an electricity customer that a quantity of power – measured from 1 MWh – corresponds to a quantity of power produced from a specified, renewable, energy source. It also includes details such as location, type and capacity of the installation where the energy was produced, so that no double counting occurs in the system.

And to reflect an ever more integrated European power market, legislation has been updated so that producers of renewable generation that receive no subsidies may export their GOs certificates across Europe.

As countries have opted into this mechanism, tracking of their GOs has been enabled via the European Energy Certificate System (EECS).

Trade tends to be bilateral, predominantly via brokers and more recently bundled in with Power Purchase Agreements (PPAs), which has given the market a new



dynamic. PPAs are long-term agreements between power consumers and producers, which fix a price and a quantity for future delivery periods.

In countries such as Spain, bundling of GOs in PPAs has permitted renewable projects to receive finance. This is because the GOs are seen by the financing agent as providing cash flow for the project.

Assigning value

The typical market logic that assigns value according to abundance or scarcity applies to GOs too. GOs underpinned by the most abundant technology – hydroelectricity – have lower prices while those associated with solar, which is relatively scarce, command higher prices.

However, region specifications have also played a role in the demand/supply dynamics. Government bodies have been seen to demand “homegrown” green energy – for example, a Dutch council might opt for GOs from Dutch solar plants rather than Belgian ones, incurring a hefty premium.

But it is the customer that best knows their needs, and they could equally go for the cheapest “non-specific” or “bulk” GO products such as Large Nordic Hydro or unspecified EU Wind, or buy GOs for power plants or technologies in certain locations.

The key origins for GOs have historically been the Scandinavian countries due to their hydroelectricity capacity. Italy and Spain are next, but have fewer exportable GOs due to their subsidies for solar and wind projects. Hydro-rich Portugal is getting set up to implement the GOs system in 2020, sources close to the matter have told S&P Global Platts.

Growing supply

GO supply is still largely inelastic due to the limited share of renewables in the overall European electricity production. However, due to 2020 renewable targets some countries are set to see a ramp up of non-subsidized green generation capacity. Spain, for example, is looking at 8 GW of possible unsupported wind and solar generation.

European countries continue to invest in renewable energy generation capacity and renewable generators are falling out of subsidy systems, becoming eligible for GOs and increasing supply.

The supply/demand gap is set to continue to increase, especially as GOs expire. Expired GOs are certificates that have not been cancelled, i.e. redeemed to cover power consumption for a given period, before the expiration date of the certificate, hence forgoing the value of the certificate. Some utilities have been heard

Local councils and government departments are also paying attention to the source of their electricity supply, to meet green targets

to lose track of purchased GOs, later realizing they had lost millions as the certificates expired.

According to data from the Association of Issuing Bodies, which facilitates the EECs, supply reached 602 TWh in 2018, and is projected to rise to around 650 TWh in 2019. Demand stood at 508 TWh in 2018, projected to reach around 550 TWh in 2019.

For comparison, total EU power production from hydroelectric, solar and wind generation in 2018 was estimated at 853TWh by environmental group Sandbag.

In short, the GOs space is becoming increasingly relevant to the promotion of renewables and wider efforts to mitigate climate change. ■





JKTC: an Asian spot LNG hub emerges

Asian LNG spot trade volumes jumped in 2019, and market participants are increasingly considering Japan, South Korea, China and Taiwan as a hub of interchangeable destinations. By Ciaran Roe

Exports of US LNG, on destination-free terms, have been regarded as the game changer for the market in recent years. But this view neglects the role played by China's rising demand, and the changes taking place among traditional LNG buyers in Northeast Asia, which are driving the rapid establishment of an LNG trading hub.

The global LNG market is becoming more liquid and spot-oriented. The US tackles the supply leg of this increasingly flexible market, but the greater flexibility on the demand leg can be ascribed to surging demand in China, whose LNG buyers in recent years have been under-contracted and consequently more willing to enter into prompter, more short-term trade than longer-established import markets. The combination of these supply and demand legs has enabled portfolio players and traders to play a more active role in the LNG spot market.

The appearance of destination-free cargoes has also created an environment where buyers are pushing sellers to allow for more destination flexibility for LNG cargoes under long-term contracts. Meanwhile the over-contracted nature of some Northeast Asian end-users is encouraging new variety in business models, with some Japanese utilities entering the portfolio player segment.

Spot trading surges

Spot trade volumes have surged as a result. Spot deals collected by S&P Global Platts in Northeast Asia jumped 57% in 2019 year-on-year from January–September to 392. This follows an 82% jump in the whole of 2018 versus 2017 (332 Northeast Asia spot trades were collected by Platts in 2018).

Indeed, while supply – and the number of liquefaction suppliers – in 2019 is only ramping up from the US, market evolution has been storming ahead in the

expanding spot trading hub of Japan, Korea, Taiwan and China, or JKTC. Together, these locations imported 192 million mt of LNG in 2018, or 62% of global demand. This “hub” is not an intersection of physical pipelines or a pipeline network like certain regional natural gas hubs. It is more akin to oil trading hubs where delivery can be made or taken at multiple ports or terminals.

JKTC optionality – the ability for the buyer to divert the cargo to terminals within these locations – is so commonplace that it appears in 66% of fully transparent spot market bids, offers and trades. Meanwhile, Japan, Korea or China (JKC) appears in a further 32% of spot market bids, offers and trades for delivery into Northeast Asia. Single location delivery optionality – the ability to deliver a cargo into only one of Japan, Korea, Taiwan and China – appears in less than 1% of bids, offers and trades.

These percentages come from data reported via the Platts Market On Close (MOC) assessment process – a daily real-time price formation process where companies report named, firm bids, offers and trades. Since June 2018 over 1,600 bids, offers and trades have been reported via the JKM MOC.

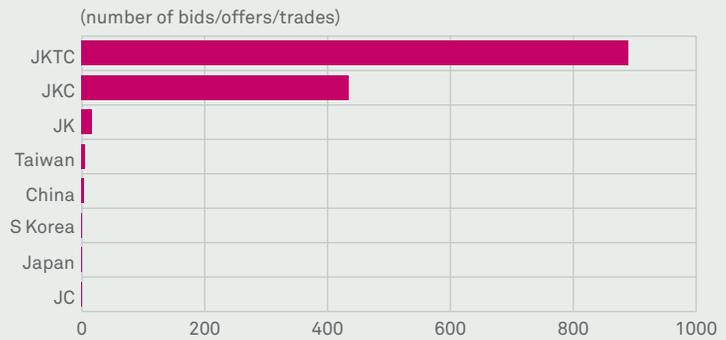
There are two other clear ways to understand the impact certain importing nations are having on spot market dynamics in Northeast Asia – the world’s largest LNG importing region.

One is by analyzing the base discharge port listed in bids. Companies state in their bids the base port where the cargo will discharge, unless the seller is notified of a diversion before an agreed date.

This data shows that Japan’s terminals are used in 43% of bids, while China and Korea are used around 29% and 25% respectively. This is broadly in line with the overall volume of LNG that each of these nations import, at least in volume order – Japan is the largest LNG importer globally, China is second and Korea is third.

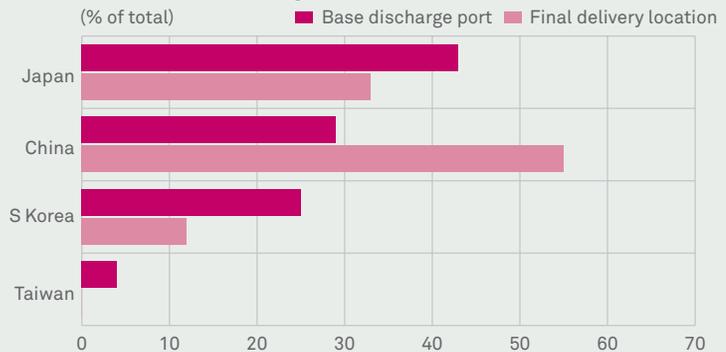
A second perspective comes from looking at the locations where cargoes performing against trades reported in the JKM MOC have been delivered. By this measure, China comes out on top: 48% of the trades reported in the MOC have been delivered to Chinese regasification terminals versus just under 40% to Japan and nearly 15% to Korea.

Delivery location options of MOC activity



Data reflects MOC activity between June 2018–September 2019
Source: S&P Global Platts

Location of MOC activity



Data reflects MOC activity between June 2018–September 2019
Source: S&P Global Platts

More flexibility

This data could imply a fixed, final structure to today’s LNG market. Certainly the under-contracted nature of China’s end-users and the higher logistical flexibility in China is a draw for companies looking to deliver LNG cargoes into Northeast Asia.

But Japan is making swift moves to liberalize its downstream power market, which could encourage more competitiveness among its utilities, thereby bringing more into the trading space and encouraging further logistical flexibility at Japan’s LNG receiving terminals. This process could redefine the priorities of Japan’s LNG importers, so that the predictability of cargo deliveries is turned down to allow for a higher degree of operational flexibility.



The structure of the market is still evolving, and any price benchmark in this space needs to remain flexible. Northeast Asia is, and will likely remain, the focal point for global LNG price formation, having organically formed its own trading hub, JKTC. It allows flexibility to buyers and sellers within the constraints of end-user markets that are gradually undergoing the process of liberalization, and reflects the bulk of total global LNG demand.

Furthermore, an expanding shipping fleet, more flexible commercial contracts and greater trading standardization are key factors that will boost trading flexibility within this JKTC hub.

Platts JKM, which reflects deliveries into JKTC, is being used by industry participants to express the significance of this hub. Companies have begun to use JKM for

contractual settlement as far upstream as the Permian Basin, and as far downstream as domestic gas markets, reflecting the growing impact LNG cargo trade is having on the LNG and natural gas markets globally. ■

Go deeper

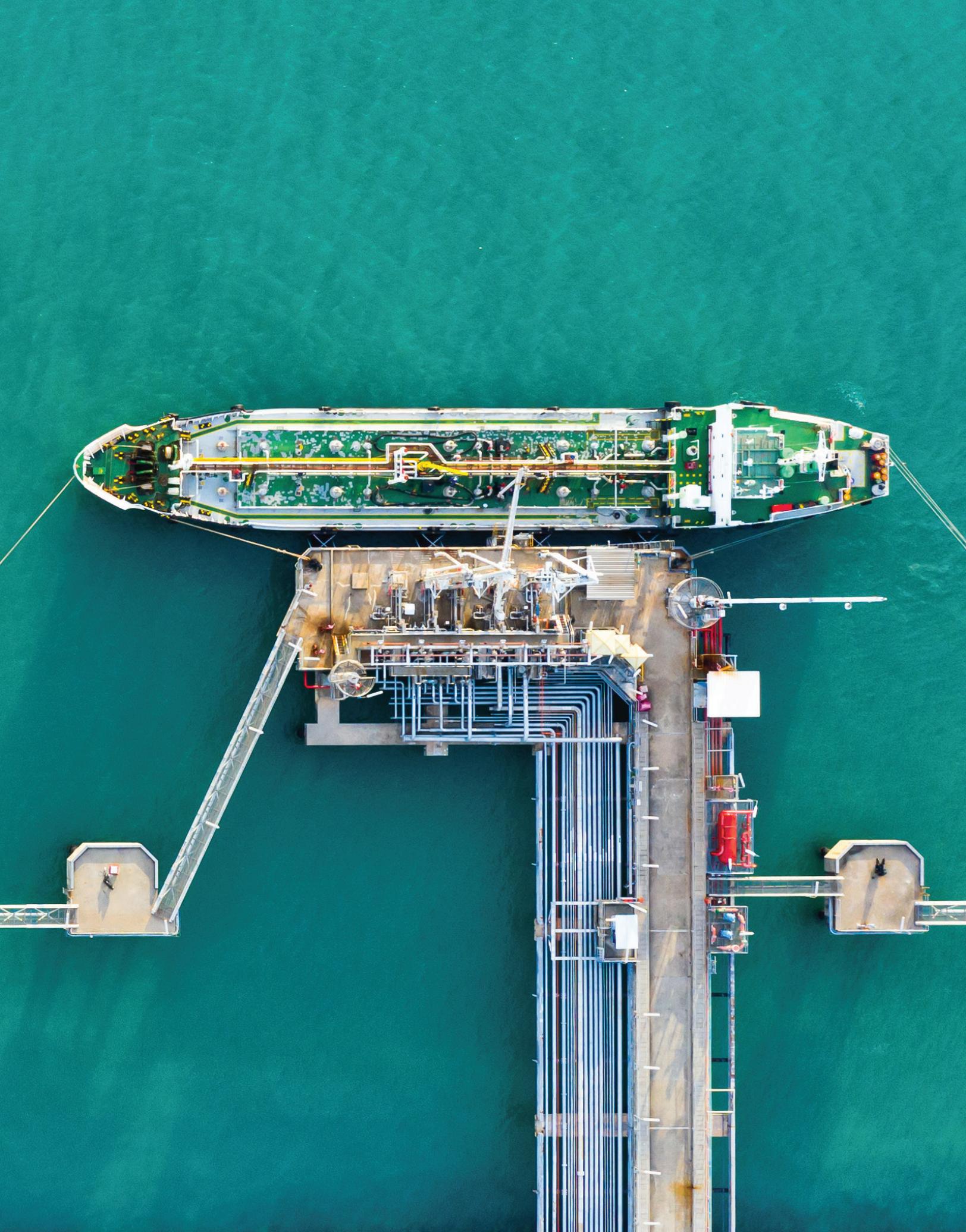
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Trading up

Persian Gulf producers are set to muscle in on global crude flows, upending traditional trading models as they build a new breed of NOC-backed trading houses. By Dan Colover





Crude oil trading, an area once dominated by Western oil majors and opaque independent traders, is poised for a sea change as Middle Eastern oil producers look to capture more value through crude sales.

Trading by NOCs in the Middle East has traditionally been muted, with producers selling their crude on a term basis under contracts linked to an official selling price (OSP).

Typically these term contracts include restrictions on re-sale or final destination of the crude cargoes in order to thwart any secondary market for the world's biggest oil flows.

Oman largely led the region in being one of the first to actively trade its equity crude barrels in the spot market, when it set up Oman Trading International (OTI) in 2006 as a joint venture between Oman Oil Company and Vitol. Since 2016 OTI has been wholly owned by the Government of Oman. Oman's crude barrels have a few characteristics that make it an exception to other Middle Eastern crude barrels.

The Sultanate is not a member of OPEC, and its crude cargoes have no destination restrictions or re-sale prohibitions. These factors allow Omani crude to be freely traded in the spot market. OTI's activity has grown steadily in recent years with the company trading over 120,000 b/d of crude in 2016, a ten-fold increase since it started trading in 2006.

SOMO going solo?

Other Middle Eastern oil producers are now moving away from a strict term contracts model by marketing crude and products directly.

Abu Dhabi's national oil company ADNOC was an early adopter of the new sales model, removing destination restrictions on some of its crude cargoes in exchange for a premium to the OSP. In 2016, Saudi Aramco began spot crude sales of barrels held in storage in Japan to end-users in Asia, marking a new phase in the tussle with regional rivals for dominance over Asia's oil market.

Other NOCs have also explored ways of increasing the value of their crude sales. Iraq's state oil marketer SOMO entered joint ventures with Russia's Litasco and China's Zhenhua for crude sales in 2017 and 2018 respectively. But both those JVs have now ended and Iraq appears keen to take a more direct approach.

SOMO has subsequently reportedly been looking at setting up an office in Singapore and has curtailed the re-sale of its crudes by term lifters. In addition, in recent years it has offered crude cargoes for sale through auctions and tender processes.

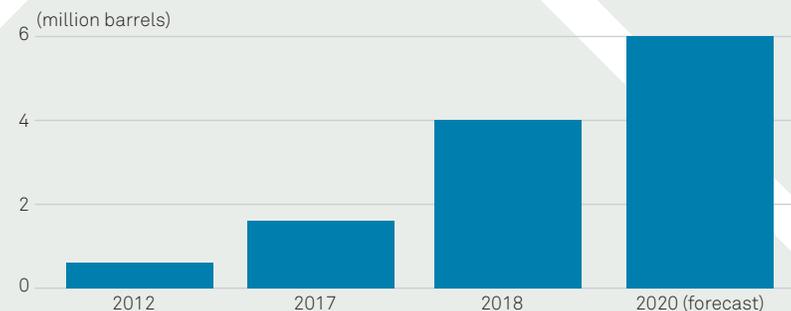
Saudi trading boom

Saudi Arabia's Aramco Trading (ATC), set up in 2010, started life handling oil product sales for the kingdom. In 2017 it expanded its portfolio to include crude trading. Significantly, however, the crude trading does not include any of the five main export grades from Saudi Arabia: Arab Super Light, Arab Extra Light, Arab Light, Arab Medium and Arab Heavy. Other crude and condensates produced in Saudi Arabia, including Khuff condensate and third-party barrels, are traded by the company.

Last year, ATC's total oil trading volumes reached 4 million b/d, up from 1.6 million b/d in 2017, and it expects trading volume to jump a further 50% to reach 6 million b/d by 2020.

With ATC still unable to trade the main Arabian crude export grades, however, the development of its trading strategy is seen as an evolution rather than a revolution.

Aramco's surging traded oil volumes



Source: Aramco Trading



Some market watchers believe it is a matter of time before Kuwait sets up a trading division, most likely initially to trade oil products

ADNOC has also recently set up trading teams to handle crude and product trading. The product trading is a JV with Austria's OMV and Italy's Eni.

In addition, the company is currently reviewing its retroactive OSP formula. A change to this formula could dramatically alter how ADNOC's crudes are traded in the market, whether by an ADNOC trading venture and/or third parties.

With details of any potential switch yet to appear, however, the role of ADNOC's trading team and future strategy around the UAE's crude trading are unclear. ADNOC is developing infrastructure that could allow more liquid trading of its crude should it so wish.

Earlier this year it announced plans for an underground crude storage facility in Fujairah for 42 million barrels of crude. The facility will be ready in 2022 and is set to be the largest single-site underground storage facility in the world. Abu Dhabi has crude oil production

of over 3 million b/d with around 60% of this held as ADNOC equity.

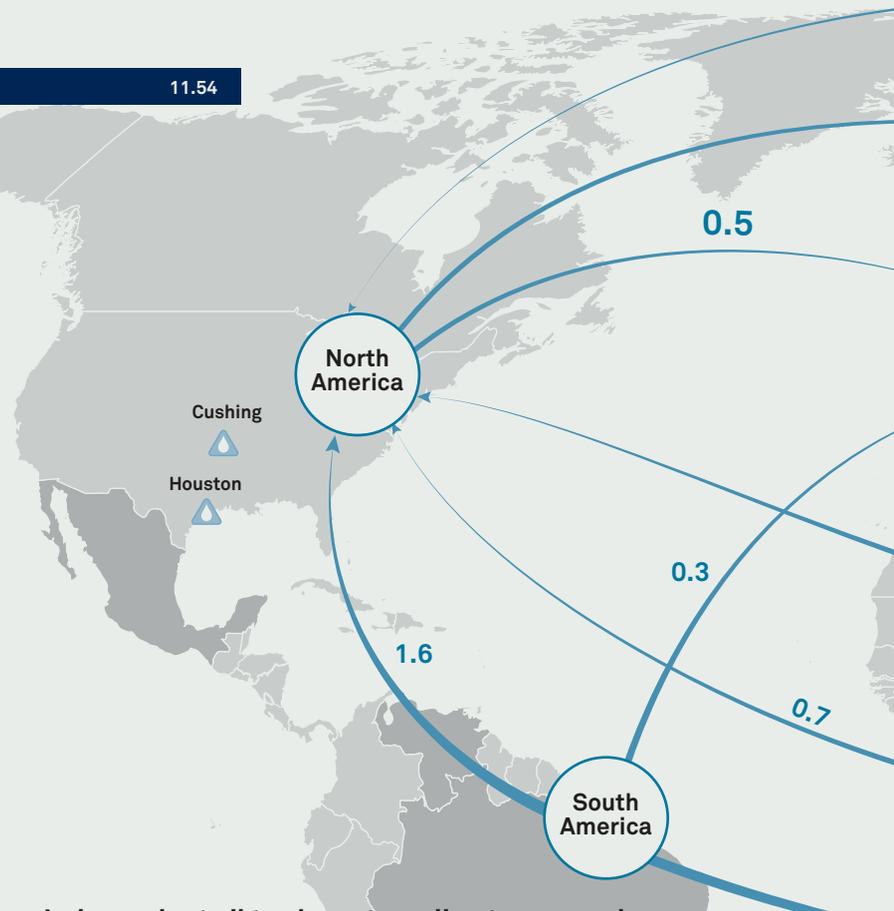
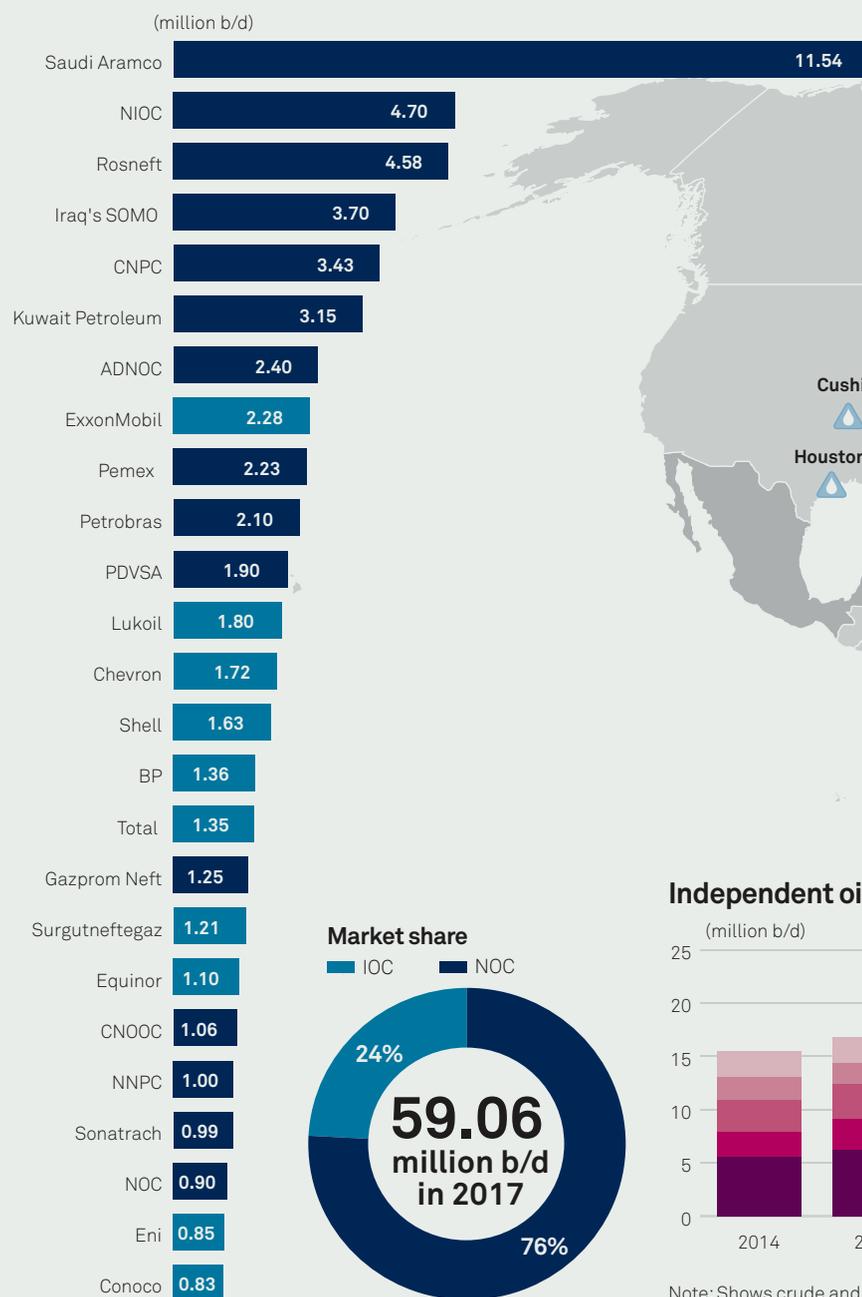
Among the major oil-producing nations in the Gulf, this leaves Kuwait as the last to formally announce any formation of a trading unit.

Some market watchers believe it is a matter of time before Kuwait sets up a trading division, most likely initially to trade oil products. Such a unit could be formed when the joint venture Duqm refinery in Oman comes online in the coming years, according to market sources.

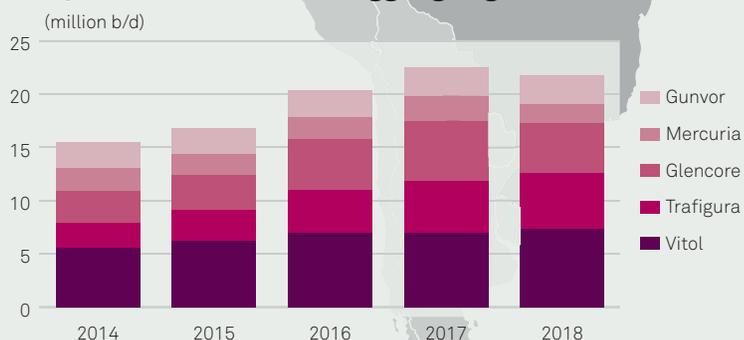
The NOCs in the Middle East have seen the progress that independent trading houses have made in recent decades, acquiring assets and becoming more integrated in a world of thin margins. It's now a case of the NOCs developing their trading capabilities as they take advantage of their size and stability in ever changing markets. ■

NOC titans leverage oil flows in global expansion

World's 25 top oil companies by production (crude and NGLs)



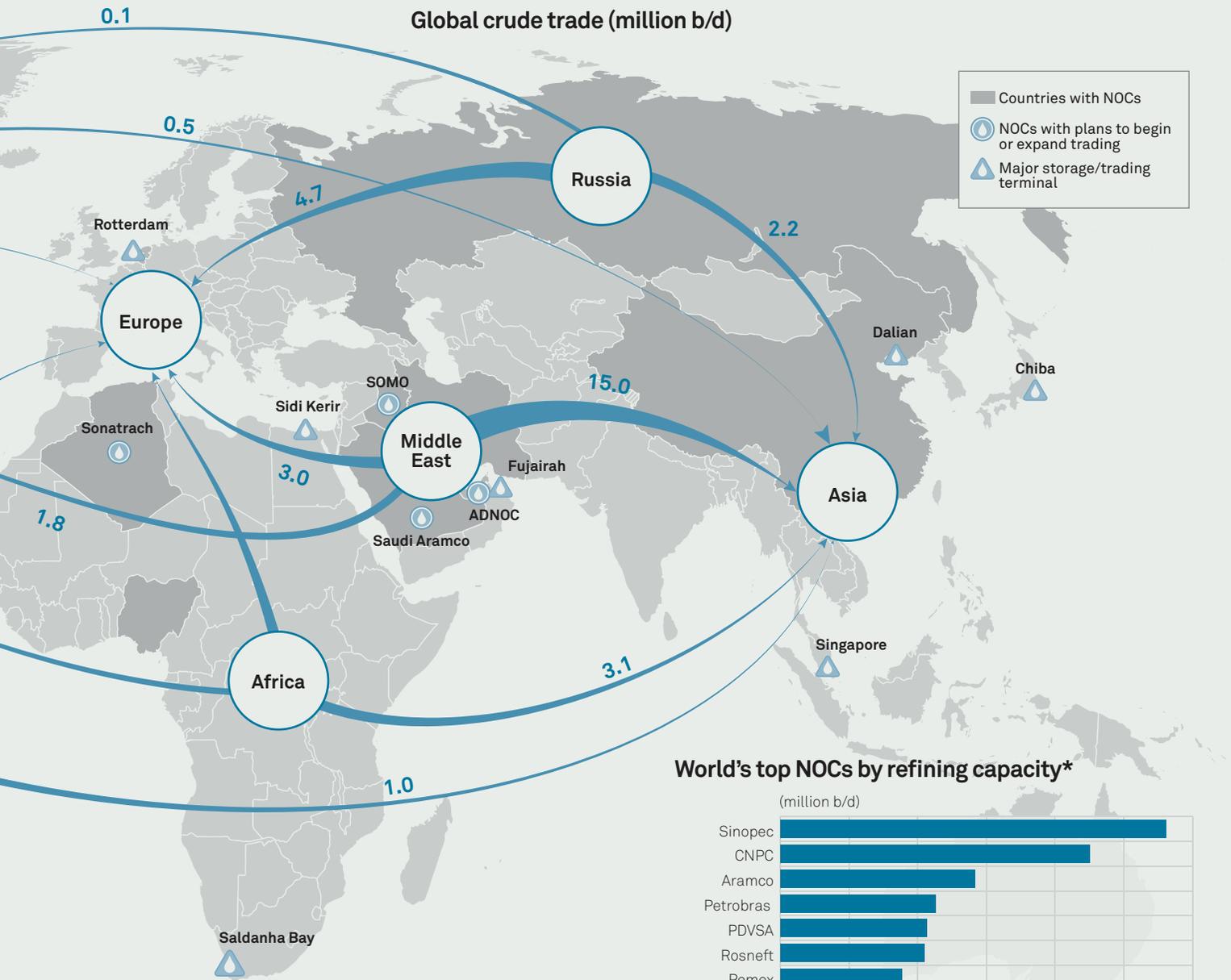
Independent oil traders struggling to grow volumes



Note: Shows crude and oil products

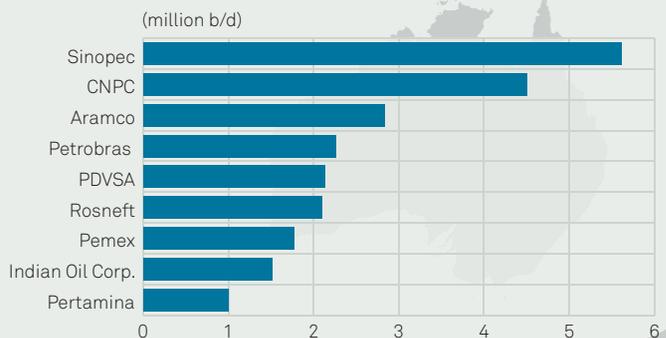
Liquids production and trade flows based on 2017 data.
Source: S&P Global Platts, IEA, company filings

National oil companies rule the roost when it comes to control over the majority of the world's crude production and ownership of large-scale infrastructure, storage and downstream assets. But despite their dominance in global oil flows, NOCs have traditionally left billions of dollars of spot oil sales and trade arbitrage deals each year to independent commodity traders and integrated oil companies. This could be set to change fast. Saudi Aramco, the world's biggest exporter, and the UAE's ADNOC are among a growing number of NOCs keen to develop in-house commodity trading operations to capture more value from their own assets. If successful, the move could mark a major shake-up of control over global oil and commodity trade flows, with independents such as Vitol and Trafigura facing tough new competition.



6 million b/d Aramco target for oil trading volumes in 2020

World's top NOCs by refining capacity*



*2019 estimate



Race to zero

US utilities have stepped up their efforts to provide environmental, social and governance reports with clear emissions reduction goals. And growing pressure to disclose sustainability credentials could help accelerate the shift towards renewables, writes Jeffrey Ryser

The year 2019 may come to be seen as pivotal in the transformation of the US electricity sector.

A drive by dozens of US electricity utility holding companies to provide environmental, social and governance (ESG) reports has brought to the forefront numerous new commitments to zero carbon emission goals, and an accompanying surge in plans to install thousands of megawatts of wind and solar generation over the next few decades.

The preparation and release of ESG reports in the US power sector has jumped significantly this year. The Edison Electric Institute, the US association representing investor-owned electric utilities, had 21 of its members participate in a sustainability report pilot program in late 2017. Now, 35 of its members have posted their own ESG/Sustainability template on their websites.

At the holding company level, EEI has 63 member companies, but when measured by market capitalization, more than 90% of the US investor-owned electric power industry is currently using the ESG/Sustainability Template to report information to investors, according to EEI spokesman Brian Reil.

“As ESG disclosure continues to evolve from a ‘nice-to-have’ to a ‘must-have,’ EEI’s efforts to create a

comprehensive reporting template and methodology that respond to the needs of both members and financial institutions are notable,” said Val Smith, global head of corporate sustainability at Citi, following the launch of EEI’s version 2 reporting template in late August.

EEI and its member companies do not necessarily consider all ESG/sustainability information to be financially material, but intend the information provided to be “supplemental” to material financial information provided to the US Securities and Exchange Commission.

Nevertheless, the increase in this supplemental information has brought with it a material increase in CO₂ emissions reduction goals that foreshadow a major reshuffling in utility business models with dramatic implications for the US power generation mix, and a potentially large reduction over the next few decades in fossil fuel usage for generation.

“The growing interplay between environmental and social forces will have a transformative impact on the credit quality of these sectors, and will likely translate into balance sheet and/or business model realignment for industry players,” Moody’s Investors Service said in one of its recent ESG Focus reports.

Moody’s estimated that utilities and power companies “are on track to achieve a 27% reduction

in CO₂ emissions by 2030.” That percentage also appears likely to rise given the utility actions announced this year.

Moody’s said that legislative and regulatory support “drives the pace of carbon transition.” It said that policymakers are influencing the speed of the transition to a more carbon-friendly generation mix “by facilitating investments in renewable energy and, in one instance, the expansion of nuclear generating capacity.”

“Among US corporate sectors, electric utilities and power companies are best positioned to significantly reduce carbon dioxide emissions by 2030,” largely due to the decline in coal-fired power generation, Moody’s said.

It noted that with coal in decline, environmental opposition to natural gas also “is on the rise.” That opposition already has led to a large turn away from natural gas in long-term utility planning.

“A heightened public focus on reducing carbon emissions could prompt state legislators and regulators to accelerate the pace of the power sector’s transition to renewable energy sources. If we were to assume that declining coal-fired generation is replaced by a mix of 20% natural gas and 80% renewable generation (instead of the 60% natural gas/40% renewable mix assumed in our base case), the result would be a net reduction in CO₂ emissions of 650 million tons, instead of 532 million tons, representing a 35% reduction from 2018 emissions by 2030,” Moody’s said.

ESG impacts credit, loans

S&P Global Ratings has said that, over the past year, more and more businesses have shifted focus to address issues closely linked to the mitigation of and adaption to climate change. The ratings agency says that ESG considerations are finding their way into loan pricing. Sustainability or ESG linked loans have emerged as the latest innovation for bank loans, both investment grade and speculative grade.

The S&P 500 ESG Index was developed to serve as a benchmark for index-linked investment products. The methodology of the S&P 500 ESG Index was

constructed with two objectives, S&P Global has said: to provide a similar risk/return profile to the S&P 500; and to avoid companies that are not managing their businesses in line with ESG principles, while including companies that are.

As of October 31, 2019, the S&P 500 ESG Index had 315 constituents, with 190 constituents of the S&P 500 excluded. These exclusions comprised 26.32% of the S&P 500 index’s market capitalization as of the same date.

Surge in CO₂ commitments

Given the absence of a federal climate change policy, a growing number of utilities have been encouraged by investors over the past two years to set their own carbon targets, noted the pro-renewables group, the Energy and Policy Institute, in a June report.

There has been a recent jump in ESG reporting, and an increase in climate goals in particular, with at least seven utility holding companies declaring they will reach 100% CO₂ emission reductions by 2050.

US electric utility CO₂ emissions reduction goals (%)*

Utility company	2030	2050
AEP (from 2000 levels)	70	80
Alliant (from 2005 levels)	40	80
Ameren Missouri		80
Avangrid		100
Avista		100
Consumers		90
Dominion	55	80
DTE Energy	45	80
Duke (from 2005 levels)	50	100
First Energy		90
Idaho Power		100
MidAmerican Energy	100	
National Grid		80
NextEra Energy (from 2001 levels)	65	
NIPSCO		90
NRG Energy	50	100
Portland General Electric		90
PSEG*		100
Southern California Edison		80
Southern Co.		90
Vistra (from 2010 levels)	50	
WEC (from 2005 levels)		80
Xcel Energy (from 2005 levels)	80	100

*Consumers is 90% by 2040; MidAmerican’s 100% goal is by 2020; NextEra is 65% by 2021; NRG’s goal of 50% is by 2025; Southern said “low to no” carbon emissions by 2050; net-zero carbon goals are represented as 100%. Source: Company reports



One of the seven is Duke Energy, which in September announced an updated climate strategy with a new goal of net-zero carbon emissions from electric generation by mid-century. The company said it was accelerating its near-term goal by cutting its carbon dioxide emissions by half, or more, from 2005 levels by 2030. Xcel Energy, based in Minnesota, said earlier in May that it is on pace to reach its interim goal to cut carbon by 80% by 2030, with its longer-term goal being the delivery of 100% carbon-free electricity by 2050.

Warren Buffet's Iowa-based regulated utility MidAmerican Energy has installed so much wind generation that it has said it might be able to reach 100% reduction by next year. Numerous other electric power companies have slightly lower CO₂ emission reduction goals. Dominion Energy has said it is "committed to reduce carbon emissions from its power stations 55% by 2030 and 80% by 2050, and to cut methane emissions in half by 2030."

On November 5, the CEO of Vistra Energy presented analysts with a 10-year fundamental outlook, reflecting Vistra's announced goal to cut carbon dioxide emissions by more than 50% by 2030 from 2010 levels. The Dallas-based company has already completed or announced plans to retire 14 coal plants and three gas plants, which should cut CO₂ emissions by 42%, CEO Curt Morgan said, adding that "our fundamental analysis would suggest that future retirements of this magnitude will be warranted based on economics alone."

Even in the Midwestern part of the country, ESG sustainability reports have become de rigeur. Alliant Energy, based in Madison, Wisconsin, has said it is targeting a 40% reduction in carbon emissions below 2005 levels by 2030 and an 80% reduction by 2050. The WEC Energy Group, based in Milwaukee, Wisconsin, said in July that its long-term goal is to reduce total carbon dioxide emissions by 80% below 2005 levels by 2050.

A national price on carbon

The Democrat-led House Energy and Commerce Committee adopted a bold target earlier this year to achieve a 100% clean economy by 2050. In an October 31 hearing, the committee chairman, Democrat from New Jersey Frank Pallone said, “In the power sector, there are clear, achievable ways to get to 80% decarbonization, but it’s the last 20% that will, by far, be the biggest challenge.”

Pallone said, “Getting to 100% will require a balanced portfolio of low- and zero-carbon technologies — including solar, wind and nuclear power — as well as energy storage and carbon capture technologies. Without this balanced portfolio, deep decarbonization will happen at a slower pace and at a higher cost to homeowners and businesses.”

However, according to PSEG President and CEO Ralph Izzo, “The shortest path to a net-zero economy requires setting a national price on carbon.”

“This is what will drive the innovation needed to achieve our goals. This is what allows us to end technology-specific subsidies that layer on additional costs,”

Some doubts remain about whether a country the size of the US can or even should go 100% renewable, but it is fairly clear that the sprint away from coal generation will continue

he said. “And this is what will help drive emissions reductions through market mechanisms not just from the power sector but economy-wide.”

In early October, the New York Independent System Operator, or NYISO, proposed embedding the social cost of carbon dioxide emissions into the wholesale price of electricity. NYISO may end up providing the model that will be used by regulated power markets and grid operators.



Pushing the clean agenda

Deloitte, the audit and consulting firm, released a report in early October on a survey it did of 308 executives from eight industries, not including the US power sector. Deloitte said that 45% of the executives from those industries have a target year to increase renewable energy sources in their electricity consumption. Six companies indicated they were aiming at 100% renewable energy.

One non-energy company, Amazon, issued in mid-September what it called a climate pledge committing it to 100% renewables by 2030 and net zero carbon emissions by 2040. Amazon said it will speed up its adoption of renewable energy with the goal of converting 80% of the company's energy sources to renewable energy by 2024.

Coal plummets, renewables soar

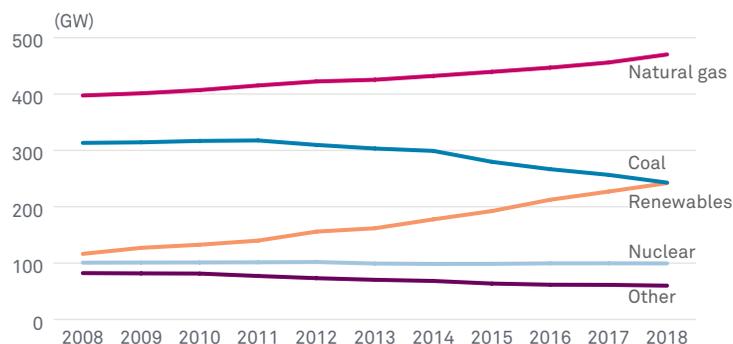
Some doubts remain about whether a country the size of the US can or even should go 100% renewable, but it is fairly clear that the sprint away from coal generation will continue.

There is approximately 1.1 million megawatts of installed generation capacity of all types that are available to the US grid. Between 2010 and the first quarter of 2019, US power companies announced the retirement of more than 546 coal-fired power units, totaling about 102,000 MW of generating capacity, according to the US Energy Information Administration. "Plant owners intend to retire another 17,000 MW by 2025," said the EIA in a July 2019 report.

EIA said coal-fired capacity will average 25% of the US fuel mix in 2019, while natural gas-fired generation will rise from 34% in 2018 to 37% in 2019 and 2020. Since the end of 2007, installed wind capacity across the US has gone from 16,907 MW to 97,963 MW at the end of the second quarter 2019, a nearly six-fold increase.

In 2007 there was 830 MW of solar PV capacity installed in the US. At the end of Q2 2019, the total reached 69,100 MW, according to the Solar Energy Industries Association. During the 12-year period, the combined capacity of US wind and solar has grown from 17,737 MW to 167,063 MW.

Net summer generation capacity by fuel type



Source: Energy Information Administration

A combination of federal production tax credits and guaranteed federal construction loans and cash reimbursements helped spur the growth of wind, while an investment tax credit has aided the development of solar generation.

The question is, how much wind and solar growth can realistically be expected and over what period of time? According to the American Wind Energy Association, there were approximately 20,900 MW of new onshore wind facilities under construction in Q2 2019 alone, with 1,962 power purchase agreements signed, 52% by corporate customers.

One potential new area for zero-emission generation is offshore wind, which East Coast utilities along with European developers have estimated could reach as much as 18,000 MW by 2030. Currently, there is only 30 MW of offshore wind installed in US waters.

Nukes seek subsidies

Nuclear generation emits no carbon, and the 98,000 MW of installed nuclear capacity in the US makes it a prime baseload generation platform to build on if the goal is reducing CO₂. However, the growth of natural gas supply and generation in the US and the rapid rise of renewables have pushed power prices so low that nuclear plants cannot compete and many are being retired.

Several states in the US have chosen to subsidize nuclear generation rather than see it retired. A total of 14 nuclear reactors at 10 plants in five states with

combined capacity of 12,400 MW are now receiving state subsidies in the form of zero emissions credits, or ZECs, to keep them operational.

Exelon Energy owns all or a portion of six nuclear facilities that are now receiving ZECs. The Chicago-based holding company in September closed its most famous, or infamous, nuclear facility, the 819 MW Three Mile Island in Pennsylvania, bringing its total fleet down to just under 18,200 MW.

Exelon has long argued, though, that since 90% of its generation fleet is carbon emissions free it has a seat at the table when it comes to discussing deep carbon emission reductions. Many have argued that net-zero emissions in the US cannot be achieved without impacting reliability unless nuclear remains a large part of the generation mix.

Power of public opinion

Prior to the United Nations launching its Climate Action Summit in September in New York, UN Secretary General Antonio Guterres said in a television interview that he believed “public opinion is waking up” to the threats of climate change.

“What we see in the US, even if it’s probably the country where you have a bigger number of people disbelieving [in climate change], there is already a solid majority believing,” Guterres said. “Central banks are including climate change risks. We see rating agencies including

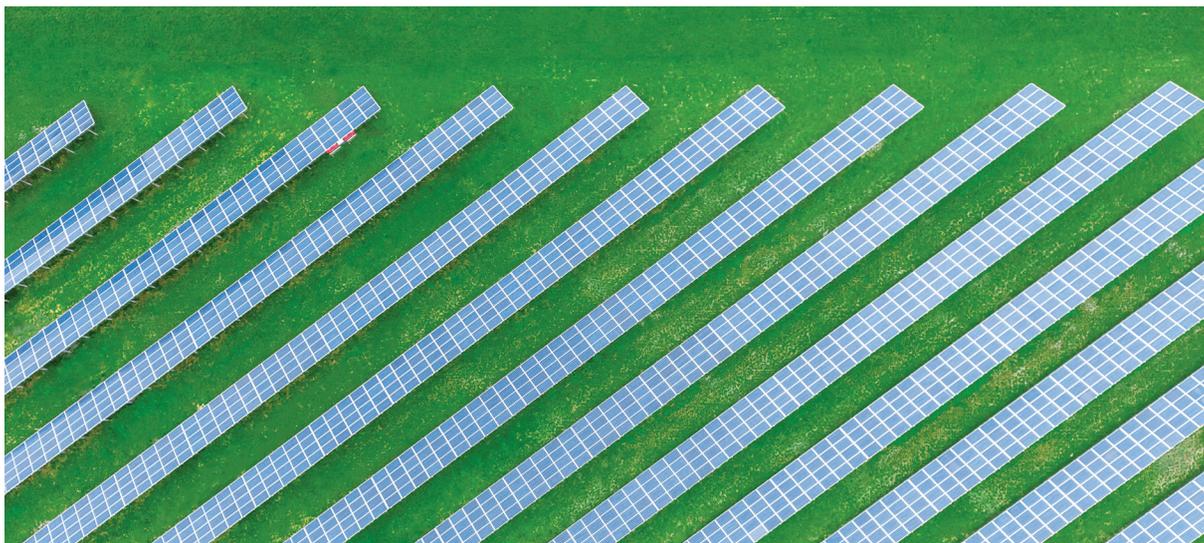
climate change risks. We see more and more big asset managers representing trillions of dollars divesting from fossil fuels.”

Guterres said governments follow public opinion. “I am starting to see governments also understanding that they need to act. We still have emissions growing. We are still not there. Climate change is running faster than what we are. But for the first time I’m seeing more and more countries accepting that they have to be carbon neutral in 2050,” Guterres said.

After the summit, London-based fund manager Octopus Investments Limited released a report forecasting that “it will cost the UK alone more than GBP1 trillion to hit net zero carbon emissions by 2050.” Nonetheless, it noted, the UK is now one of over 75 countries that have committed to the zero carbon emissions target.

The Octopus report, titled “The Great Transition: Opening the renewables floodgate,” argued that over the coming decade, institutional investors plan on divesting \$920 billion from fossil fuels, “while also ploughing \$643 billion into renewable energy.”

The report also said that a survey showed institutional investors “know they can play an important role in tackling climate change, but less than a quarter of respondents have adjusted their portfolios to reflect that.” The report added: “While mounting pressure from external parties is being felt globally, the most common response is to launch ESG products in-house.” ■





AEP's about-face on coal, renewables

Columbus, Ohio-based holding company American Electric Power, long one of the country's largest utilities and coal-fired generators, said in September it wants to cut its carbon dioxide emissions "faster than anticipated" and revised its 60% by 2030 reduction target to 70% from 2000 levels. It also said it was "confident" it could get its emissions down to 80% of its 2000 level by 2050.

AEP emitted 167 million metric tons of CO₂ in the year 2000, making it one of the biggest electric power emitters that year.

In 2007, when emissions from the US power sector reached a peak of 2,425 billion mt, AEP's emissions were still as high as 151 million mt. However, since 2011, when its annual CO₂ emissions totaled 136 million mt, AEP has retired 8,620 MW of its coal-fired capacity, bringing emissions down to 69 million mt in 2018.

AEP has said that through the end of 2019 it expects coal-fired generation to represent 46% of its total capacity, while natural gas-fired generation will represent 27% and nuclear generation 7%. Another 1,450 MW of AEP's coal-fired capacity is expected to be retired in 2020, and a further 1,300 MW by 2028.

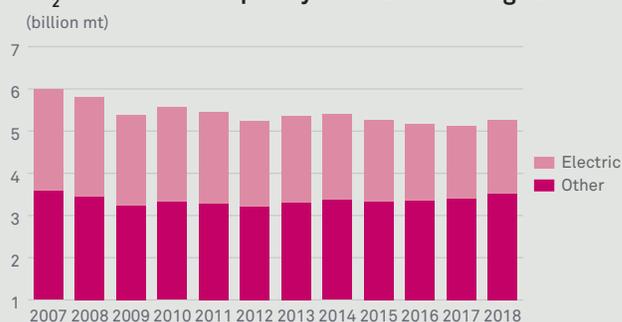
In recent financial presentations, AEP executives told analysts that the company has come a long way since 2005 when coal-fired generation capacity was 70% of its total. In 2019 renewables – hydro, wind, solar and pumped storage – represent 16% of AEP's fuel mix.

It has said in its integrated resource plan that with generation additions and additional retirements through the year 2030, it expects coal-fired capacity

to account for 27% of its fuel mix, natural gas 22% and nuclear 7%, with hydro, wind, solar and pumped storage reaching 40% combined.

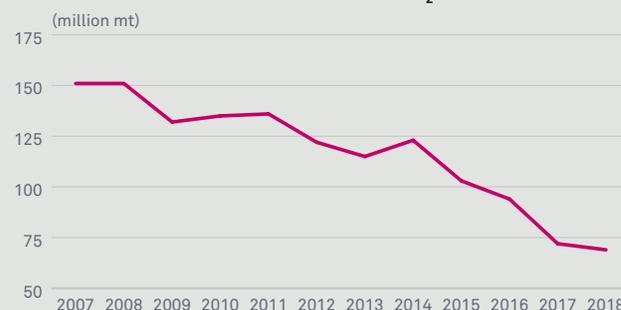
Its target of an 80% CO₂ reduction from its 2000 level by 2050 translates to just 13.3 million mt of CO₂ annually by mid-century. ■

US CO₂ emissions from peak year of 2007 through 2018



Source: Energy Information Administration

American Electric Power's annual CO₂ emissions



Source: AEP EEI ESG/Sustainability Report for Investors



Recycled plastics: consumer demand vs economic reality

As EU demand for recycled plastics grows, manufacturers face high recycled-PET prices, and a larger supply of high-quality plastic waste is needed. By Ben Brooks and Luke Milner

Recognition of plastic waste as a global problem has spurred legislation and industry initiatives in the last two years, and driven growth in demand for recycled plastics.

When it comes to developing recycling as a sustainable business, Europe leads the way, and in particular the EU market for polyethylene terephthalate (PET), best known as the material of choice for plastic drinks bottles. But the evolution of PET and recycled PET (R-PET) markets in 2019 highlighted underlying concerns around profitability and cost, as price trends shifted with changing demand patterns.

Demand for recycled plastics over the longer term is expected to grow in part due to European Union policy initiatives to increase the recyclability and recycled content of packaging. In the short term, the market's true commitment to sustainability will be tested in the face of unfavorable economics.

Recycled PET premium

There has been much talk about a growing disconnect between pricing in the recycled PET flake market and the virgin PET market. Flake prices have traditionally

Bearish virgin makes switching from R-PET attractive



Source: S&P Global Platts

held a wide and fairly steady discount to the virgin market, making the product economically viable and a boon for marketing. However, 2019 saw virgin resin prices sink, at first to parity with flake prices, and then below.

Virgin PET spot prices had not previously fallen as low as spot flake prices since S&P Global Platts first began assessing flake prices in February 2008. In December of that year, virgin spot prices fell to a Eur10/mt premium over flakes, but that is as close as they had come to parity until this year, according to Platts data.

Since February 2008, spot virgin PET has on average been Eur214/mt more expensive than flake and most market participants see a triple-digit discount to the virgin price as necessary to make recycled flake prices competitive, given the additional costs required to process recycled flakes.

This year, though, a combination of high virgin stocks, bearish feedstock prices and relatively weak demand over the summer have seen virgin resin prices fall. Recycled flakes, on the other hand, have proved more resilient in 2019. A tighter supply of good quality recycled material and the need for buyers to secure recycled supply chains has kept recycled PET prices more stable.

On the surface, this looks positive for food-grade R-PET demand growth, but it may also have a less positive impact if these dynamics were to continue in the long term.

Converters have been eyeing the possibility of switching much of their flake buying capacity into cheaper virgin resin, for certain end uses such as sheet and film. For sheet producers, this has begun to take place. For bottle producers, however, this is easier said than done.

“It comes down to whether the consumer is really willing to pay substantially more for a 100% recycled bottle or not,” a recycler said. “There comes a price point at which it is not economically sustainable.”

Although this is a concern, the market is skeptical about the ease with which companies can quickly switch their buying activities away from R-PET to virgin resin. In part, this is down to the difficulty in running different blends of virgin resin and R-PET for individual packaging through existing machinery – which requires some level of packaging redesign.

More importantly, it may prove difficult to reverse big brands’ decisions of increased recycled content, set to last over many decades, just because of poor economics over a relatively short time frame.

Clear future for plastic

Despite these unfavorable economics, the industry remains positive about complying with recycled contents legislation, driving sustainability initiatives and building on current recycling rates.

From the recycling side, Europe appears well placed to meet upcoming legislation. Christian Crepet, Executive



Director of Petcore, an industry body representing the whole PET value chain, says there is currently a 300,000 mt overcapacity of mechanical recycling in Europe. To hit recycled content of around 40-50% in bottles, the infrastructure is there, he believes.

Chemical recycling, whereby post-consumer plastic is depolymerized to its original state, is also progressing well in Europe. Crepet says there are seven chemical recycling startups associated with Petcore and big recycling companies are also seeing good progress in this field. He sees the two recycling forms working well together in the future.

There are challenges that need to be addressed, however. Crepet's top priorities include moving away from colored PET and sticking to clear packaging; moving to single polymer packaging to avoid mixing different polymers; and improving collection rates across Europe.

This final point is being well addressed in Europe. The UK government, for instance, proposed in March 2018 the introduction of a deposit return scheme as a means of increasing collection rates within the UK.

According to the UK government's Commons Select Committee environmental audit, a deposit return scheme in the UK could significantly increase recycling rates from around 57% to between 80%-90%, as in countries with successful deposit return schemes.

In continental Europe, many countries already have successful deposit return schemes and there are plans, particularly in Germany, to increase their scope further by accepting a wider range of plastic packaging.

Crepet's first point is that the future of PET is clear. Colored packaging, he says, will simply not be accepted in years to come because people are now aware of the difficulties in recycling it. Brands and consumers are recognizing the fact that the industry must return to clear packaging in order to boost recyclability. Coca-Cola, for instance, is switching its Sprite branded bottles from light green to clear in order to boost recyclability and make it easier to incorporate 50% R-PET in their manufacture.

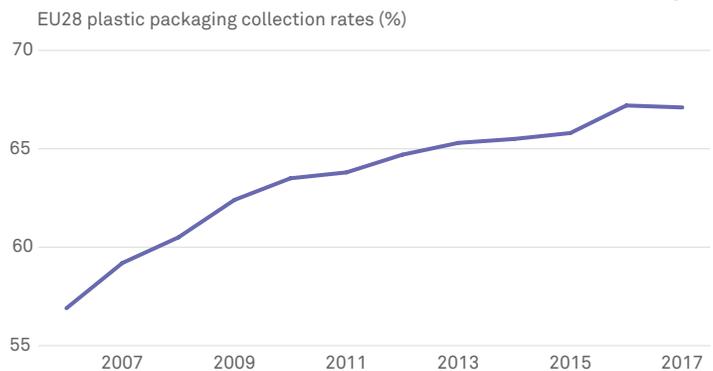
The PET bottle industry is well placed to deliver on targets. The tray industry, however, has further to go. A key issue in this market is the use of mixed polymers in

R-PET food grade pellets immune to virgin drops



Source: S&P Global Platts

Collection rates have improved but still have further to go



Source: Eurostat

packaging, with around 50% of plastic tray packaging using a mix of different polymers that makes them difficult to recycle, according to Crepet.

There is progress being made, however, to move towards single polymer trays and Crepet believes that in a few years around 75% of plastic trays will be a monomer material and that chemical recycling could provide a solution to the remaining 25%. ■

Go deeper
 Read the full S&P Global Platts special report "Plastics recycling: PET and Europe lead the way"



ABOUT US:

Santa Fe Gas (SFG) is one of the first multinational natural gas marketing companies with offices in Houston, Mexico City and Guadalajara, offering an integrated range of energy services in the United States and Mexico.

SFG was created as a subsidiary of Fermaca, one of the most important companies in the Mexican energy sector and the second largest operator of natural gas transportation infrastructure in Mexico.

OUR TEAM:

SFG is formed by a group of experienced professionals with a wide expertise in the market, capable of delivering high quality, competitively priced services to a variety of clients located in the US and Mexico, including power generators, industrials, local distribution and marketing companies.

OUR SERVICES



Gas Purchases & Sales



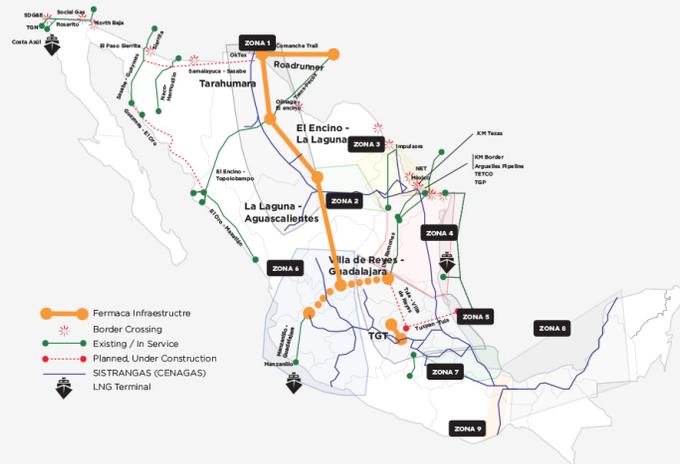
Nominations and Balancing



Other Services

- Hedging mechanisms that allow end users to fix a low natural gas prices.
- Physical swaps with other market participants.
- Asset Management Agreements.
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With 24 years of experience, Fermaca is one of the most important companies in the Mexican energy sector and the second operator of private natural gas transportation infrastructure in the country.

Our focus is on midstream sector, we transport natural gas from the Waha basin in Texas, United States to the area of Western Mexico.

OUR SERVICES

We are a natural gas transport company that offers Interconnection and On Boarding / Due Diligence services with the aim of developing energy infrastructure that meets the needs of natural gas transportation to end users.

SCADA SYSTEM

Fermaca has the most advanced real-time monitoring and control system in Latin America, controllers operate 24 hours a day, 365 days a year, through the SCADA (Supervisory Control and Data Acquisition) System that allows monitoring, control and data acquisition in real time, so it is possible to remotely monitor the entire trajectory of our pipelines.



WAHALAJARA SYSTEM

Fermaca currently has 1,760 kilometers in operation, with transportation capacity of 3,256 MMCFD (billion-cubic feet per day).

By the end of 2019, the Fermaca gas pipeline network will be 2,150 kilometers in total, of which 1,828 kilometers will be in national territory. Together, the entire network will have a transport capacity of 5,331 MMCFD (billion-cubic feet per day).



Asia's pivot to US crude

With Iranian barrels out of bounds and repeated attacks endangering Middle Eastern oil supply chains, Asian buyers have dialed up their efforts to diversify supply this year. Gawoon Philip Vahn reports



Asia has demonstrated a voracious appetite for US crude oil in 2019.

Major energy consumers including India, South Korea and Japan, as well as multiple Southeast Asian buyers, are increasingly shifting their focus to North American barrels to cover growing supply disruption risks in the Middle East.

Asian refiners have been under constant pressure this year to secure adequate crude supply as geopolitical tensions in the Middle East significantly raised the region's energy security concerns.

The US sanctions blocking access to abundant Iranian crude supply, as well as a series of attacks on oil tankers and key output facilities in the Persian Gulf, meant many regional refiners that rely heavily on Middle Eastern sour crude grades were kept on their toes.

South Korea, China, Japan and India were among the eight countries granted a waiver in November 2018 allowing imports of Iranian barrels to continue until May 2, 2019. But with no further extensions beyond that date from the White House, the vast majority of Asian refiners suspended purchases of Iranian crude and condensate.

Shortly afterwards, a series of attacks in June on oil tankers in the Gulf of Oman, including one on a UAE-flagged ship, put the oil market on alert and triggered growing concerns over supply disruptions.

Iran denied involvement in the incidents. However, the country had on a number of occasions threatened to close the narrow Strait of Hormuz if its oil exports were squeezed by US sanctions, which are supported

by its regional rivals Saudi Arabia and the UAE. About 21 million barrels of crude transit the waterway daily – more than one fifth of global oil supply.

Then in September, Saudi Arabia – the biggest supplier of crude to Asia – suffered a temporary loss of 5.7 million b/d of crude production after attacks on its core oil facilities. Following the attacks, which briefly curtailed nearly 60% of the kingdom's output, a number of Asian refiners were notified by Saudi Aramco that some of their September and October term crude oil supplies would be affected.

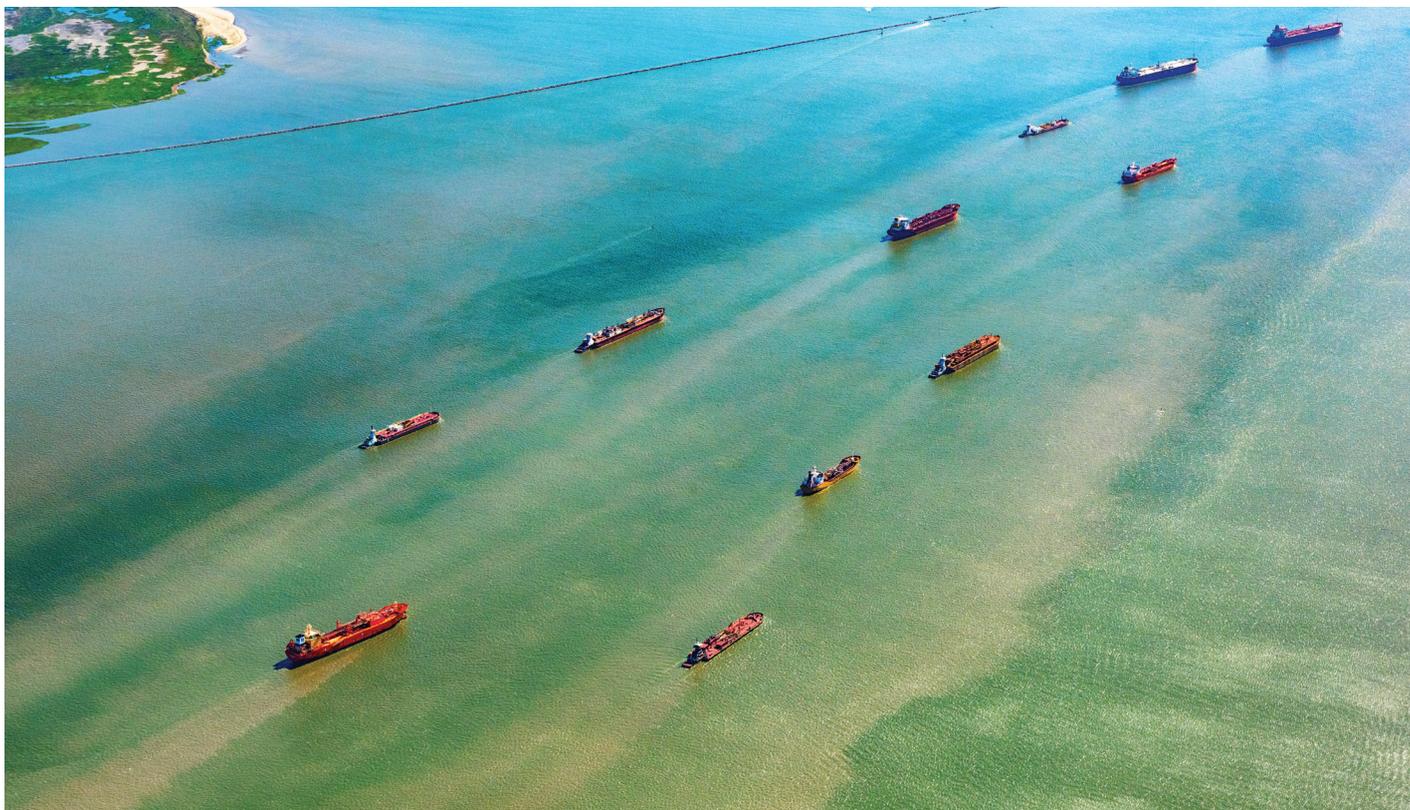
In China, at least three state-run refineries saw shipment of their October term contract barrels from Saudi Arabia pushed back due to the output disruption. Several other term customers were notified by Saudi Aramco that they would have to take Arab Medium or Arab Heavy as substitutes instead of light sour crude.

Reliable supply

The heightened risk of Middle Eastern supply disruptions gave Asian refiners little choice but to seek out more reliable crude supply sources, and they looked to the North American market.

South Korea has emerged as Asia's biggest customer for US crude oil this year, importing 98.67 million barrels of crude and condensate from the North American producer over January-September, up more than threefold from a year earlier, data from Korea National Oil Corporation showed. "This is part of efforts to cope with the impact of the loss of Iranian oil ... the government has been helping local importers diversify crude supply sources," said an official from the country's Ministry of Trade, Industry and Energy.

The heightened risk of Middle Eastern supply disruptions gave Asian refiners little choice but to seek out more reliable crude supply sources, and they looked to the North American market



The country's efforts to diversify crude import sources saw the share of Middle Eastern crude in its monthly procurement basket fall below 70% during the third quarter of 2019, compared with more than 85% on average in 2016, latest data from KNOC showed.

Meanwhile, the US exported around 260,000 b/d of crude oil to India over the first eight months of this year, more than doubling the 138,000 b/d sent in the same period in 2018, according to the US Census Bureau. "The US is helping India by providing a secure energy supply while meeting its environmental goals," Kenneth Juster, the US Ambassador to India, told the India Energy Forum in October.

Taiwan broke into the top three buyers of US crude in Asia this year, receiving 186,590 b/d of crude oil from the US over January–August. That was almost double the 100,593 b/d imported in the same period a year earlier, according to data from the Bureau of Energy, Ministry of Economic Affairs. Taiwan's strong preference for US crude came as little surprise, as the WTI benchmark remained at a discount against its Middle Eastern and European counterparts Dubai and Brent.

Platts data show the spread between the front-month WTI swap and same-month Dubai crude swap averaged minus \$3.59/b so far in the second half and minus

Asia's voracious appetite for US crude oil

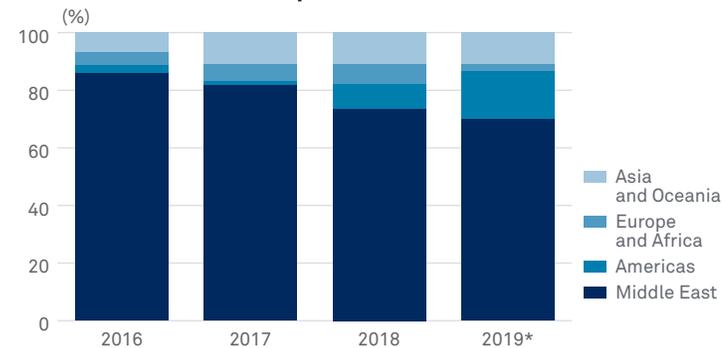


January-August

*Includes Singapore, Thailand, Indonesia, Vietnam and Malaysia

Source: US Energy Information Administration

South Korea's crude import basket



*January-September

Source: Korea National Oil Corp.

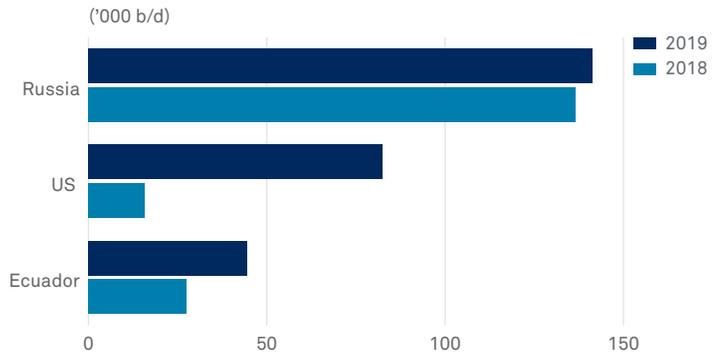
\$5.57/b year to date. The outright price spread between WTI MEH (Magellan East Houston) on a CFR Asia basis and the UAE's flagship light sour Murban crude on Asia delivered basis averaged minus 7 cents/b so far this year, S&P Global Platts data showed.

Sweet and sour

As far as crude quality is concerned, Asia has shown interest in a wide variety of US grades in 2019. Lighter and sweeter US crude grades, including WTI Midland, Bakken, and Eagle Ford crude and condensate, have been among the most popular grades heading to Asia, but some high-sulfur US grades have also regularly attracted customers across Asia since the third quarter.

In South Asia, India's Mangalore Refinery and Petrochemicals Ltd bought 1 million barrels of Thunder Horse crude from the US via spot tender for delivery over October 11-20. Thunder Horse has a gravity of 32.3 API and 0.90% sulfur content. This North American spot crude cargo deal marked the Indian state-run refiner's first ever purchase of the medium sour US grade. "We are open to buying more US [sour] grades

Japan's growing imports of non-Middle Eastern crude



January-July
Source: Ministry of Economy, Trade and Industry

at competitive prices in the near future," a company official told S&P Global Platts.

In addition, Indian Oil Corporation holds a term supply contract to take light sweet US crudes, as well as medium sour Mars Blend grade, for 2019, Asian trade sources with knowledge of the matter told Platts. Mars Blend is a medium crude with gravity of 29.99 API and 1.82% sulfur content. India's flagship state-run refiner has put in place "a robust sourcing plan" to replace Iranian volumes after the US did not renew sanctions



waivers for key customer of Iran's oil, IOC Chairman Sanjiv Singh said in early May.

In Northeast Asia, Japan imported 1 million barrels of medium sour Southern Green Canyon crude from the US late last year and the country received 995,663 barrels of Mars Blend in March, according to data from the country's Ministry of Economy, Trade and Industry. Southern Green Canyon has an average gravity of 28.2 API and typical sulfur content of 2.3%, according to crude assays from BP.

Elsewhere, out of the 98.67 million barrels of US crude South Korea has received so far this year, close to one fifth of the total consists of high-sulfur US grades including Mars Blend, Southern Green Canyon and Poseidon, trading sources at SK Innovation, Hyundai Oilbank and GS Caltex said.

Southeast Asia joins the party

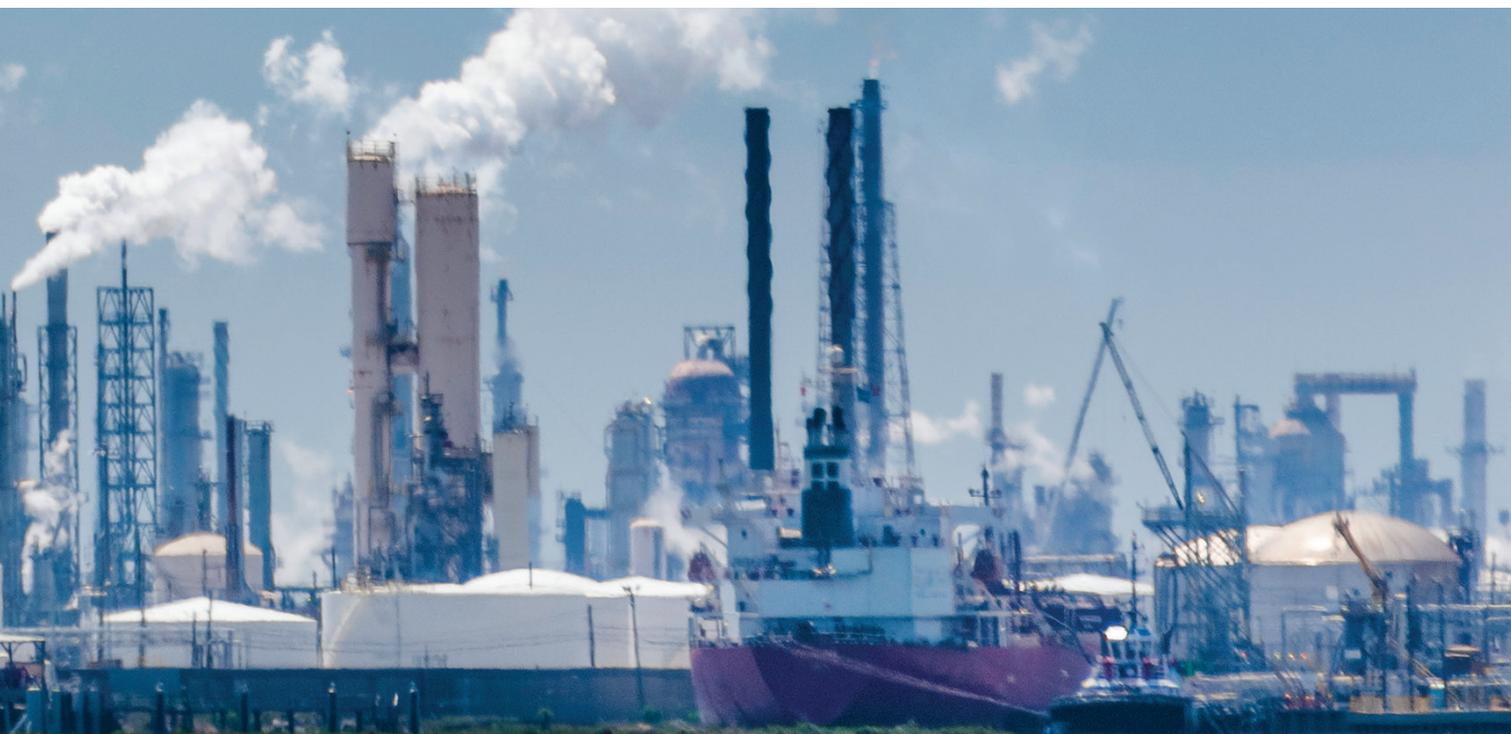
As rival Northeast Asian and Indian importers actively snapped up both sour and sweet US crude cargoes to cover any potential shortfall in Middle Eastern crude supply, Vietnam and Indonesia decided to act quickly to secure their own requirements.

Binh Son Refining and Petrochemical Company (BSR), an affiliate of the state-run Petrovietnam, said it would import 2 million barrels of WTI Midland crude from the US in the fourth quarter. The company, which operates Vietnam's 148,000 b/d Dung Quat refinery, received a cargo carrying 1 million barrels of the light sweet US crude in October, and was due to receive another cargo in December, a company official said. Dung Quat refinery received its first cargo of US crude in the second quarter of 2019.

Indonesia's state-run Pertamina also bought its first cargo of US crude in the second quarter. A company source said the cargo of light sweet WTI Midland crude arrived in Indonesia in early June and that more cargoes could be purchased later in H2.

US-China trade tensions

China's surprise decision in August to include crude oil in its latest round of tariffs on imports from the US did little to restrict the overall US-Asia crude trade flows as various other Asian buyers were keen to pick up US crude cargoes diverted from Chinese buyers.



In retaliation for the US government's 10% tariff on Chinese goods announced on August 15, Beijing announced a week later that it would levy a 5% tariff on US crude imports from September 1, as part of a new round of tariffs on \$75 billion worth of US goods.

However, US crude oil suppliers were able to shrug off the counter-measures from Asia's biggest oil consumer as demand for the US product remained robust in the region. As US crude has increasingly become a staple for many Asian refineries, the higher offtake from refiners in South Korea, Taiwan, India and Thailand has more than made up for the cutback in China's purchases this year.

China was the biggest buyer of US crude oil in Asia in 2018, but US crude sales to the Middle Kingdom have been rather small this year. The Asian country imported 15.45 million barrels of crude oil from the US in H1, down 76.2% from the same period a year earlier, according to data from the General Administration of Customs. "We are unlikely to take much US crude as it attracts a 5% tariff now," said a senior executive at state-run Chinese refiner Sinopec.

China's sharp cutback in light sweet US crude purchases has presented other regional buyers with an opportunity to secure more low-sulfur refinery feedstocks, market participants said. With a resolution to the trade dispute looking to be within reach, there is scope for a significant revival in Chinese imports. In Southeast Asia, traders and refinery sources in Thailand, Singapore and Vietnam told Platts that companies may consider offers from Chinese refiners and traders looking to resell some of the US crude cargoes initially bought for fourth quarter deliveries. "US crude is a very popular item for many Asian refiners, so there are plenty of buyers willing to absorb the volume that China wouldn't take," said a trading desk manager at a Southeast Asian refiner.

Freight cost challenge

US crude suppliers have emerged as the winner in the battle over the vast and growing Asian demand pie this year, but it may not be plain sailing going into 2020.

US crude suppliers have emerged as the winner in the battle over the vast and growing Asian demand pie this year, but it may not be plain sailing going into 2020

A sharp rally seen in international dirty tanker freight rates in the fourth quarter this year could continue to exert a strong influence on crude pricing, potentially making the US-Asia arbitrage uneconomical.

The sharp spike in VLCC freight rates, after the US imposed sanctions on China's COSCO Dalian Tanker Shipping on September 25 over its failure to adhere to the US's Iran sanctions, raised alarm bells among Asian crude importers as the cost of shipping crude oil from regular long-distance supply sources in Africa and the Americas rose sharply.

S&P Global Platts assessed the benchmark Persian Gulf-Far East Asia 270,000 mt VLCC rate at an all-time high of Worldscale 327.50 on October 14. On a dollar per metric ton basis that equates to \$65.53/mt.

Although the sharp rally in global dirty tanker rates came to a halt, with Platts benchmark Persian Gulf-East Asia VLCC marker pulling back around 40% from the record high hit in mid-October, freight rates remained significantly higher than the levels seen for most of 2019.

Higher freight rates will have a direct impact on Asian crude buyers, preventing them from taking advantage of price arbitrage between oil producing regions.

"This will lead Asian buyers to favor more nearby supply from within the region or the Middle East," Platts Analytics said. ■

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Tariffs and tribulations: recasting US metals industries

The Trump administration has tried to bolster the US steel and aluminum sectors through hefty tariffs on imports, with mixed results. Michael Fitzgerald, Nick Ruggiero and Joe Innace analyze the highs and lows of the last two years

“Trade wars are good, and easy to win,” President Donald Trump tweeted in March 2018 after imposing sweeping tariffs on US imports of steel and aluminum.

The application of a little-known trade remedy sent shockwaves across the metal markets and upended well-established supply chains.

More than two years have passed since the Section 232 investigation was carried out by the US Department of Commerce, under provisions in a 1962 trade act, and 21 months since the tariffs were imposed on the grounds of national security.

The 25% tariff on steel imports to the US appears to have had more impact on company balance sheets and investment decisions than the 10% tariff on aluminum imports. Nonetheless, North American metals markets have been rattled.

A steel renaissance?

Steel prices in the US neared 10-year highs during the summer of 2018 on the back of the tariffs. The daily Platts TSI US hot-rolled coil index, a bellwether finished steel price, surged by almost 57% from the fourth quarter of 2017 to a peak of \$920 per short ton in

US hot-rolled coil price



Source: S&P Global Platts

early July 2018. The rise in US steel prices, much more than anticipated, kicked off a celebratory atmosphere for many US steelmakers with US Steel CEO David Burritt declaring a “renaissance” for the industry.

The party in 2018 has been followed by a tariff-induced hangover in 2019. Prices went on a nearly year-long skid from July 2018 to July 2019, with 10-year highs

replaced by three-year lows. The drop pushed steel prices to levels not seen since the collapse of oil prices in 2015-2016.

The decline of steel prices had two main causes. Prices overreacted to the 25% tariffs as uncertainty and the fear of a supply crunch led to a sharp increase in buying activity. The runaway prices only fueled more buying as market participants who waited faced higher domestic prices when they finally placed orders.

The rollout of the tariffs left market players confused about the rules of the game. The application of the tariffs was broader than many expected and between March and June there was an ever changing landscape of which countries were subject to the tariffs. However, as trade policy calmed in the second half of 2018 and the tariffs were established, buyers began reducing long positions as inventory costs started to look inflated. The destocking continued into the first quarter of 2019 with a brief pause before resuming through the summer of 2019.

The second contributing factor to the decline was a pickup in supply from restarted domestic capacity and higher mill run rates. Domestic steelmakers, like US Steel, looked to capitalize on the high steel prices by bringing back previously shuttered capacity. By October 2018, US Steel had restarted two blast furnaces at its Granite City Works in Illinois with a rated raw steelmaking capability of 2.8 million st/year.

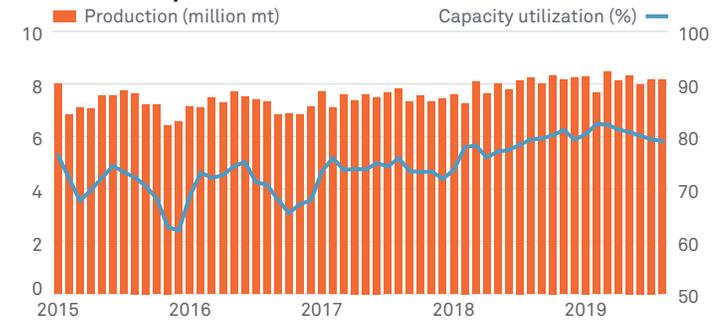
India-based JSW moved further into the US market by acquiring an Ohio-based mill in March. The steelmaker restarted its electric-arc furnace in December 2018.

The restarted capacity was coupled with higher mill utilization rates following the tariffs, leading to the highest annual domestic steel production since 2014 at 95.47 million st.

Despite the price slide in the second half of 2018, the year went down in the record books for domestic steelmakers. Nucor and Steel Dynamics Inc. both cashed in on record annual profits with Nucor netting \$2.4 billion and Steel Dynamics earning \$1.3 billion. Meanwhile, US Steel posted its largest annual profits since the 2008 peak at \$1.1 billion.

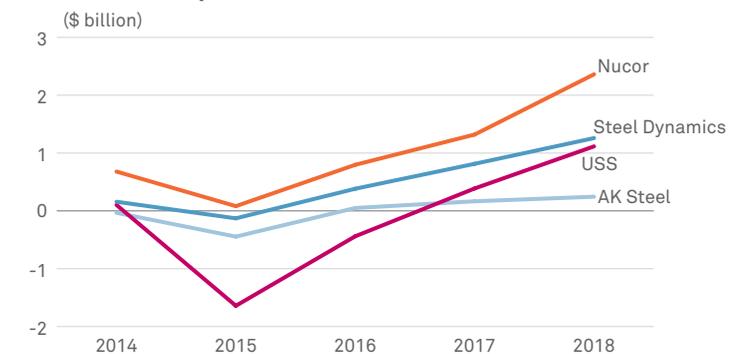
The surge in US steelmaker profits and nearly 10-year price highs may have disappeared but the impact is

US raw steel production



Source: American Iron and Steel Institute, S&P Global Platts

US steelmaker profits



Source: S&P Global Market Intelligence

set to shape the US steel industry for the next decade. Through last year, domestic mills unleashed a flurry of new projects to expand domestic capacity. The wave of new flat-rolled supply will come online over the next three years, and is estimated at 8.2 million st, without including the restarted capacity at US Steel or JSW.

The capacity increases can be viewed through two lenses. In the glass half-full view, the new mills will be a giant leap forward that helps to modernize the US steel industry, allowing it to compete on the global stage more effectively than ever.

However, in the glass half-empty view, the added capacity will result in a glut of domestic supply and depressed prices. As a consequence, higher-cost mills will have to either shut down or consolidate. This thesis has been trademarked "Steelmageddon" by Bank of America. "I think this is the most transparent train wreck I've seen in my career. And it's coming for us," Timna Tanners, an analyst at the bank, said in March



at S&P Global Platts' Steel Market North America conference in Chicago. "The path from here to the next five years could be pretty ugly."

Aluminum import dependence

While raw steelmaking saw a production boost from section 232 tariffs, the impact was nowhere near as great for aluminum.

There is a simple reason. The US-North American aluminum industry is deeply integrated, and Canada's smelters are a major source of aluminum for US companies.

The US produces about 80% of all the finished steel it consumes, but only about 17% of all the primary aluminum it consumes. Even at full capacity, the US could only meet less than half its primary aluminum needs, according to the Aluminum Association.

Steel industry lobbying groups such as the American Iron and Steel Institute and Steel Manufacturers Association have energetically supported the tariffs, citing the wave of new investment and job creation.

Interestingly, their counterpart, the Aluminum Association, never embraced the tariffs.

In February of this year, the Aluminum Association said: "Claims that the Section 232 tariffs on aluminum have driven a significant amount of US investment are not supported by the facts."

The group asked for the tariffs to be removed on "vital" trading partners and for the administration to focus on what it sees as the real problem – China's excess aluminum capacity. In May, the US lifted the 10% Section 232 tariff on aluminum imports from Canada and Mexico.

Shifting trade flows

Tariffs have not proved a magic bullet for the aluminum industry. Instead, the lifting of import tariffs against Canada and Mexico in May has resulted in some significant shifts in trade flows to the US from these countries.

Primary aluminum in the US in the form of ingot, sows, T-bars, billet and slab are manufactured into semi-

finished products such as extruded profiles, coil, sheet and plate, foil, rod and bar, and die castings. US Census Bureau data shows that flows of unwrought aluminum from Australia, which are mainly in the form of P1020 ingots, are up 305% through August year on year. Imports from Canada were down 14.4% during the same period.

North American total demand – shipments by domestic producers plus imports – for H1 2019 totaled 14,258 million lb (6.47 million mt), up 0.7% year on year. Demand for semi-fabricated or mill products totaled 10,413 million lb, up 2.2% year on year. Apparent consumption, demand less exports, for H1 2019 was estimated at 12,753 million lb, up 2.2% year on year, all according to the Aluminum Association.

Australia, Argentina, Canada and Mexico are exempt from Section 232, but US Census data shows 36.6% of imports are still facing tariffs.

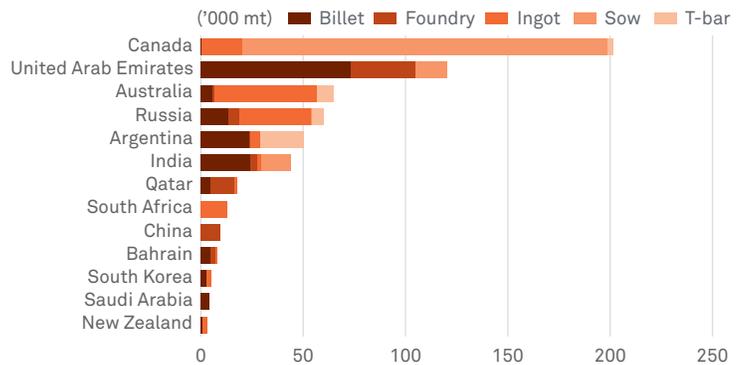
The largest supplier of sows to the US is Canada. Data from Panjiva, part of S&P Global Market Intelligence, which tracks ocean shipments to US ports, showed that of the 178,465 mt of sows only 4,976 mt or 2.8% were 99.85% purity or greater.

Most of the sows imported from Canada into US ports are P1020, 99.7% purity, for which S&P Global Platts holds the benchmark in the US; and P0610, 99.8% purity. Together these account for 95.6% of imports. Canadian exports to the US were up 33.4% year on year in July and 28.1% in August.

The September data showed Australian imports of unwrought aluminum to the US were down 50% month on month, a trend the market was expecting. Canada's exemption from Section 232 means producers that have smelting operations in both Australia and Canada have an incentive to shift their sales. For the US market, this means less Australian ingot and more Canadian sows, which is a change from the majority of 2018 and 2019.

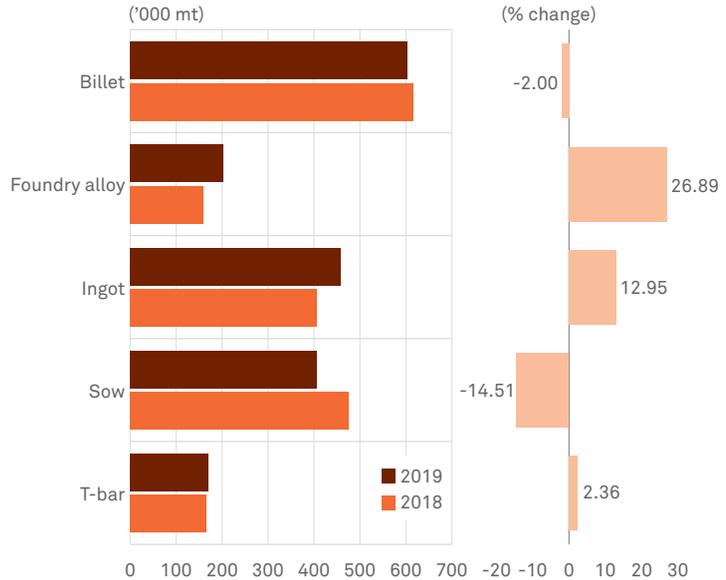
During Q3, duties were levied on 81.7% of imported billet – used in automotive, building and construction, HVAC and engineering – and 97.3% of imported foundry alloys – used for aluminum castings in wheels, chassis components and electrical applications.

US primary aluminum imports by country, Q3 19



Source: Panjiva

US primary aluminum imports to port January–September



Source: Panjiva

The Panjiva data for Q3 showed that 48% of total US primary aluminum imports faced duties, mainly due to the data not including shipments from Canada by rail and road.

Mixed results

Section 232 had two stated goals: to increase domestic steel mill capacity utilization above 80% and reduce imports.

For the steel sector, it is possible to say the tariffs were successful in achieving the stated goals. Domestic steelmaking increased as utilization rates moved higher. In addition, imports year-to-date through September 2019 were down by 13% to 20.64 million mt, their lowest level since 2011. Some of the more traditional steel trading partners, like Turkey, have been squeezed out due to the tariffs. Others have had a narrower offering of products or are limited by quotas.

Still, the most noticeable development in 2019 is the fact that even as imports have been severely restricted and rendered uncompetitive with domestic prices, US mills have been their own worst enemy. Import pricing has historically helped to set a floor for domestic steel prices, and mills have typically competed against imported material but rarely gone below import offers. This has not been the case in 2019. Import offers have been at a considerable premium to domestic prices through most of the year.

While there have been some notable trade flow shifts stemming from the aluminum tariffs, they have not been a major shot in the arm to aluminum smelting in the US. There are just eight remaining viable aluminum smelters in the US. In 2017, the year before the Section

The surge in US steelmaker profits and nearly 10-year price highs may have disappeared but the impact is set to shape the US steel industry for the next decade

232 tariffs, the average rate of aluminum capacity utilization was about 43% in the US. Platts estimates US aluminum smelters' average rate of capacity utilization at around 65% in 2019 – short of the stated 80% goal.

In both aluminum and steel the tariffs have helped raise operating rates among US producers. But even with the tariffs on aluminum and steel, prices have succumbed to global macro headwinds.

As one steel executive said, “the market is going to do what it’s going to do.” Translation: Market fundamentals have a way of trumping trade actions. ■



Aluminum derivatives react

Exchange prices on both sides of the Atlantic have been reflecting the relatively weak global demand and persisting uncertainty around geopolitics and tariff regimes.

Physical aluminum producers, consumers and traders can hedge out their price risk using the London Metal Exchange's physically deliverable contract, which has over 550 approved warehouses in 33 locations across the US, Europe and Asia.

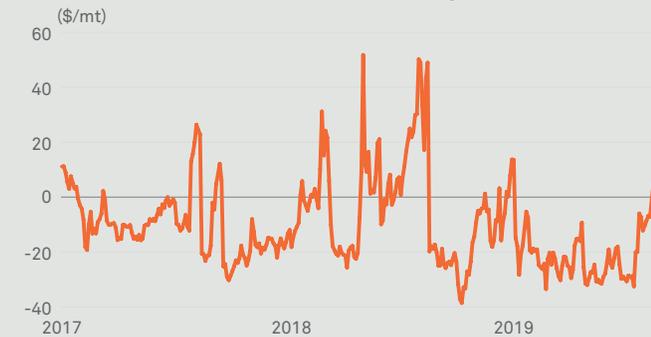
For most of 2019 financial spreads on the LME on a month-to-month basis have been considered large enough to cover the cost of carry and financing. This in turn is supportive for premiums such as those assessed by S&P Global Platts, which reflect regional pricing.

Even with weak spot demand and pressure on flat price, traders and banks can hold positions and cover costs if carries are wide enough – around \$7/month is needed on average. But cash to three-month spreads were under pressure in early November at the tightest levels since January 2019.

At that point the December 2019/January 2020 spread was in backwardation, i.e. the December contract's price was higher than January 2020. In general, if sustained over a prolonged period of time, this would put pressure on premiums, since traders would look to sell physical or deliver on to the LME.

Meanwhile, on the CME, the US aluminum transaction premium has moved into weaker backwardation since

LME aluminum cash to three-month spreads



CME aluminum US Midwest transaction premium forward curve



the Canada/Mexico exemption from section 232. CME Group's Aluminum Midwest US Transaction (symbol AUP), a benchmark settled on a monthly basis against Platts' US Aluminum Transaction premium, had a spot-to-six month spread of around 0.75 cents/lb in mid-October, from 2.85 cents/lb in May 2019 right after the announcement that tariffs on Canada would be lifted, which was a new high for the year.

Calendar year 2020 premiums in the US dropped sharply in Q4 due to recent selling pressure from producers. This came after 2020 demand was revised lower both in the US and globally by major producers and banks, while the possibility of production increases by Chinese smelters in 2020 also looms.

As open interest declined during 2019 so did AUP average daily volumes, which sits at 7,250 mt per day, down from 10,300 during the same period in 2018, due to uncertainties over tariffs and the macroeconomy. A reduction in US imports and drawing on inventories has also contributed, as market participants seek to avoid holding expensive stock, potentially at a loss.

Weak carry spreads and business conditions looked set to spur producer and fund selling into year-end and the drawing down of producer inventories, with a negative impact on the near-term flat price and premiums. ■



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Insight from Washington



By Meghan Gordon

For every barrel of oil produced from the average Permian Basin well, about three barrels of water gets pumped out with it.

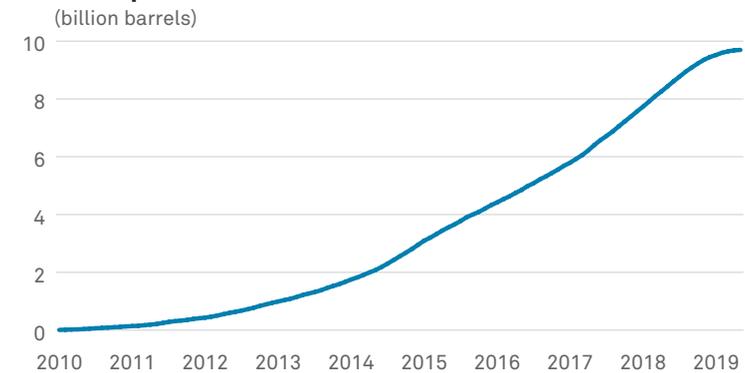
The water-to-oil ratio is lowest in the established Midland Basin, but more exaggerated in the Delaware and other Texas basins.

A midstream water management industry has grown up in Texas alongside the shale oil boom. Most of the water gets injected back underground into disposal wells, although more and more is getting treated and moved to other drilling sites to frack new wells.

Still, more research and infrastructure will be needed to handle the growing volumes of produced water if Permian production growth continues even at the recently scaled-back projected levels.

Permian oil producers want to get a better handle on produced water before it becomes a crisis, said Karr Ingham, a petroleum economist and executive vice president of the Texas Alliance of Energy Producers.

Permian produced water volumes



Source: S&P Global Platts Analytics

The group recently published a study with the Independent Petroleum Association of America containing a series of recommendations for improving the outlook for produced water management.

Produced water could become an existential threat to US oil drillers either from running out of reservoirs to store it, or from tightened regulations as a result of increased earthquake activity or policies by a future US president opposed to fossil fuel development.

Permian drillers have pumped more than 9 billion barrels of water from horizontal wells since 2010, according to S&P Global Platts Analytics.

“The continued problem of how to deal with produced water has been on the radar of most interested in the basin’s future potential,” said Andrew Cooper, quantitative analyst on Platts Analytics’ supply and production team.

Cooper said operators such as Shell, Apache and Oxy/Anadarko have developed acreage in more water-heavy zones than the likes of Pioneer and Chevron.

He added that Apache is trying to reuse produced water during well completions to improve the overall well lifecycle, and Shell wants to haul less water to disposal sites and recycle more of it.

About 50 companies currently provide water management services in the Permian Basin. The Texas Alliance said that makes the industry ripe for consolidation if private-equity investors want to target companies with large continuous acreage and pipeline miles.

Searching for new uses

Oil producers and these water managers would like to find outlets for “beneficial reuse” of the produced water outside of the oil and gas industry, such as irrigation after heavy treatment. The water often contains salts, oil, grease, naturally occurring radioactive materials, bacteria and other solids.

The Environmental Protection Agency has been working with states, mostly New Mexico, to explore ways to recycle produced water other than underground injection, said Katie Bays, co-founder of Sandhill Strategy.

“Economically, treatment costs must come down,” the Texas Alliance study says. “If desalination costs can be lowered, especially for non-food crops, the economics will line up and it will be dam-breaking.”

Disposal will continue to be the preferred strategy for managing produced water and must remain a viable option, the study says.

“However, concerns are developing about the adequacy of injection well capacity as demand ramps up quickly,” the Texas report says. “Some Permian sub-basins are currently constrained due to insufficient injection well capacity. Projected production growth will worsen the situation.”

The study has recommendations on a host of federal regulations that could someday limit options for produced water disposal, treatment or reuse.

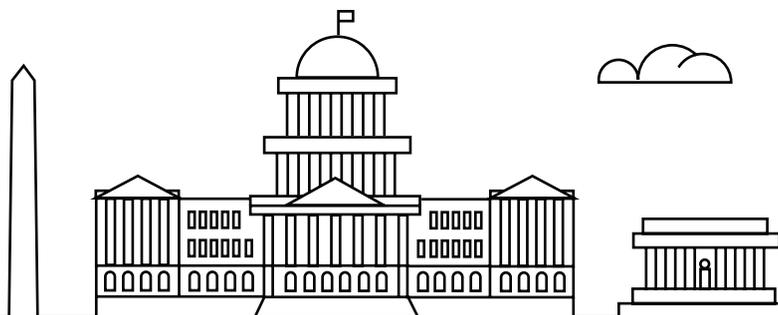
Potential regulatory risk

Looming over the issue is the 2020 presidential election and promises by several Democratic candidates to ban fracking.

While most analysts do not think an outright fracking ban by the White House could survive a court challenge, there is growing concern among US oil producers that a future administration might try to go after produced water disposal to effectively shut down drilling.

Bays said EPA’s efforts around produced water recycling are more bipartisan, as “better water management strategies are generally a public good.”

“What would be kind of awful for industry would be to require that all produced water be treated and recycled, which would be crazy expensive, but I haven’t heard anything about that,” she said. “It would be a big stretch to start requiring companies to recycle, but interesting to think about.” ■



Insight from Brussels



Siobhan Hall

Ending tax breaks for fossil fuels like diesel is a key policy pledge for the incoming EU commissioners, as part of the drive to make the EU carbon neutral by 2050. This is set to be a major test of national governments' commitment to reducing fossil fuel use, as fuel tax changes are very visible to voters.

Any tax changes, if eventually imposed, could have a major impact on demand for diesel, gasoline, biofuels, natural gas and electricity in transport, by changing the relative cost of various fuels.

The European Commission has estimated that excise duty revenues on electricity and energy products collected across the EU total around €225 billion (\$249 billion) per year. The importance of these revenues to national budgets varies from 1.1% to 3.2% of GDP, so individual governments as well as different energy producers and users are likely to have very different interests.

The EU's transport sector is already facing stricter CO₂ emission standards for new cars and trucks from 2025 as part of efforts to encourage alternative fuels such as electricity, biofuels, hydrogen and LNG.

These efforts will continue, as new European Commission president Ursula von der Leyen has said cutting transport emissions will be a key policy focus over the next five years.

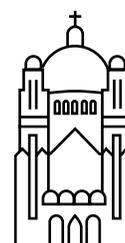
She has asked the incoming EU economy commissioner, Paolo Gentiloni, to lead work on changing EU energy tax rules to support the EU's climate and energy goals, and to end fossil-fuel subsidies.

Diesel's tax advantage

The EU last agreed minimum energy taxation rates back in 2003, when the focus was on creating a competitive internal market, and diesel was favored over petrol as a more efficient transport fuel.

The minimum excise duty for unleaded gasoline became €359 per 1,000 liters, compared with €302 per 1,000 liters for diesel fuel. The diesel rate rose to €330 per 1,000 liters in 2010, but remained lower than unleaded gasoline.

Most national governments apply higher taxes than the minimum rates, and these vary significantly across the EU. The rules allow governments to tax energy products differently based on their sulfur content, energy content, CO₂ emissions, biofuel shares, or commercial use, for example.



This means road freight diesel may have tax breaks that deter “more sustainable transport modes,” according to a European Commission evaluation of the 2003 energy taxation directive in September.

Such favorable rates for diesel in the directive have contributed to “excessive dieselization” of Europe’s road vehicles, the EC said. It argued that these rates work against the EU’s transport policy goals to reduce carbon emissions and air pollution.

Diesel/gasoil road transport demand in Western Europe averaged 5,800 million b/d in 2018, according to Platts Analytics. This is 4% higher than the average 5,574 million b/d in 2003, before the current tax rules applied.

In contrast, unleaded gasoline road transport demand in Western Europe averaged 1,767 million b/d in 2018, down 33% on the 2,649 million b/d average demand in 2003, Platts Analytics data shows.

Unanimity challenge

The EC last tried to update the EU’s energy taxation directive in 2011, when it proposed new minimum EU energy tax rates to start in 2013 based on CO₂ emissions and energy content rather than volumes.

But the proposal failed to achieve the unanimous approval needed from finance ministers in the EU Council to become law, and the EC eventually withdrew it.

Attitudes are now changing, according to Finnish finance minister Mika Lintila, who is leading the finance ministers’ debates during the Finnish EU presidency until the end of 2019. All EU finance ministers agreed in September that energy taxation could help the EU meet its climate and energy goals.

The minimum tax rates set in the 2003 directive “do not reflect any specific logic and are too low, which means they do not encourage energy-efficient technology and emission-free activities,” according to the Finnish EU presidency.

It called for the directive to be revised to differentiate between renewable and non-renewable fuels, and differences in greenhouse gas emissions.

The current directive taxes fuels according to volume, not energy content, which discriminates against renewable fuels in favor of conventional fuels, particularly diesel, the EC said in policy paper in April.

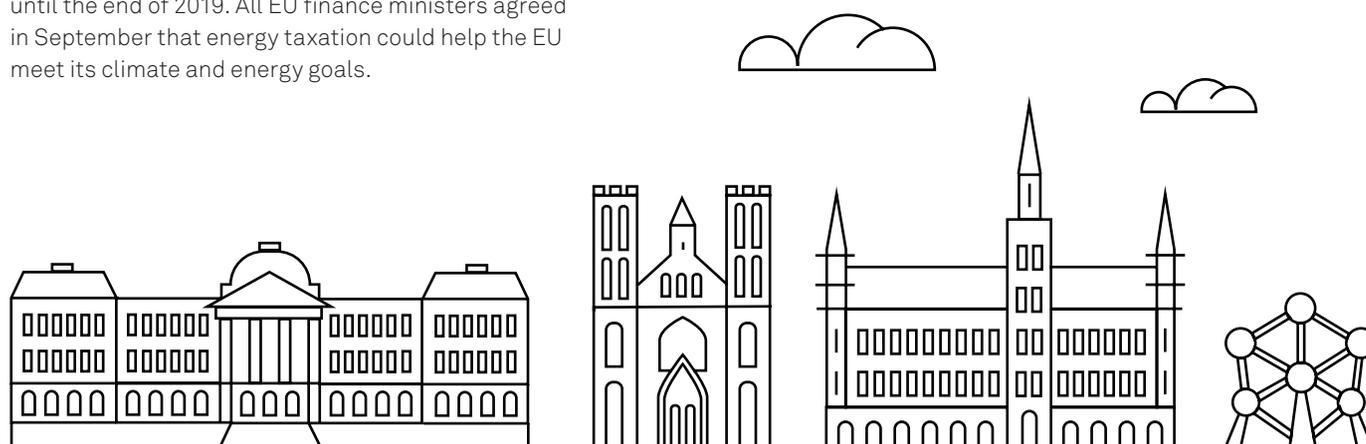
The directive also does not cover new fuels, or energy storage, and exempts international aviation and maritime transport from fuel taxes.

Popular protests

The ministers may have been swayed by the rise in climate protest marches across Europe, such as those inspired by the teenage Swedish activist Greta Thunberg.

Around 15,000 people took to the streets in Brussels in September for example, to protest against governments’ inaction on climate change. This was part of coordinated protests in other major cities across the world.

But the protests can also go the other way, as demonstrated when French president Emmanuel Macron was forced in 2018 by the gilets jaunes – yellow vests – to drop a fuel tax rise. ■



Insight from Shanghai



By Sebastian Lewis

China's EV sales have seen breakneck growth over the past decade, but the path ahead looks bumpier as the government tries to wean the market off expensive subsidies given to buyers that have cost nearly \$37 billion so far.

China has put leadership in the development of what it calls New Energy Vehicles (NEVs) – battery electric vehicles (BEV), plug in hybrid (PHEV) and fuel cell vehicles – and the technologies that fuel them at the heart of its industrial policy. The country is the world's largest market for electric vehicles, with 2.3 million battery electric and plug in hybrid vehicles on the road in 2018, accounting for 45% of the global stock. Government policies mandating procurement of EVs mean that China accounts for 99% of the global market for electric buses.

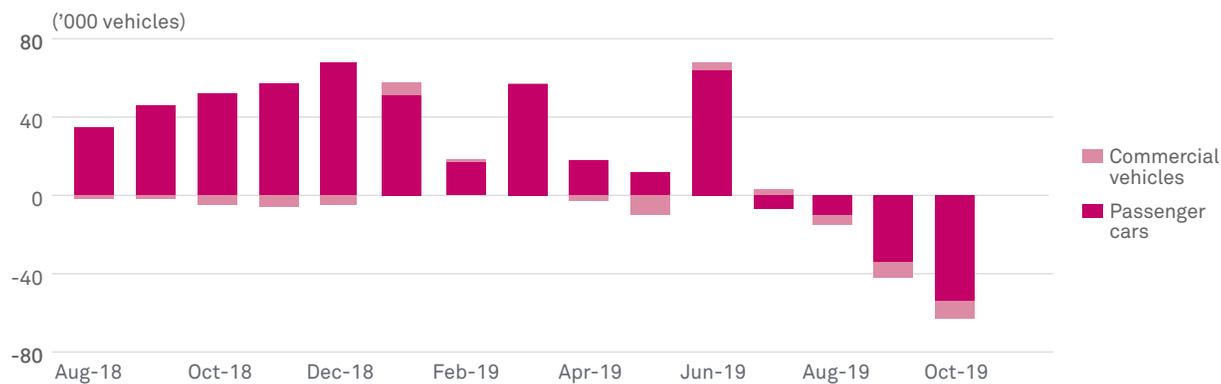
But after growing at high speed over the last decade achieving compound annual growth rate of over 100%, this year electric car sales are faltering. Could it be that China's electric car revolution has finally run out of juice?

Sales of electric vehicles are down more than 20% this year as China takes an axe to the subsidies that

have supported EV sales since 2009 when they were introduced. Fewer than 1,000 passenger BEVs and PHEVs were sold in China in 2009. In 2018 this rose to more than one million vehicles, making China the world's largest market for electric cars by far, well ahead of the global number two, the United States, where sales were only a third of China's.

But this soaring growth cost the government an estimated RMB 245 billion (\$36.6 billion) in direct central and local government subsidies to buyers according to the Center for Strategic and International Studies, a think tank. Add lost revenue from exempting EVs from sales tax, as well as mandated government procurement of vehicles like electric buses and investment in charging infrastructure, and total government largesse was RMB 390 billion (\$58.3 billion) between 2009-2017. That's more than the economy of Slovenia.

Year on year change in electric vehicles sold in China



Source: CEIC, Platts

The subsidy programme inadvertently helped create and sustain a huge number of players. By the end of 2018 more than 200 companies were authorized to make EVs, and a further 200 were awaiting government approval. In 2016 the Ministry of Finance reported that some of these manufacturers had been fraudulently claiming subsidies. Little wonder the government decided enough was enough.

Less carrot, more stick

Starting January 2017, the government tightened the requirements for subsidies, making them more dependent on the energy density of the battery, a measure of how much charge it can hold for its weight. This meant that autos using older battery technologies would not qualify for subsidies.

But the big change came in March this year. Tighter technical requirements around range and battery density mean that many passenger cars are no longer eligible for subsidies. And for those that still are, the subsidies are a lot less generous. The funding for the most efficient BEV offering a range of greater than 400 km has been halved from RMB 50,000 to 25,000. PHEV subsidies have also been slashed by 50% and are now one third of what they were in 2016.

And if that wasn't enough, local governments are no longer allowed to offer subsidies to buyers. Little wonder that EV sales are down 28%, or 124,000 units since June

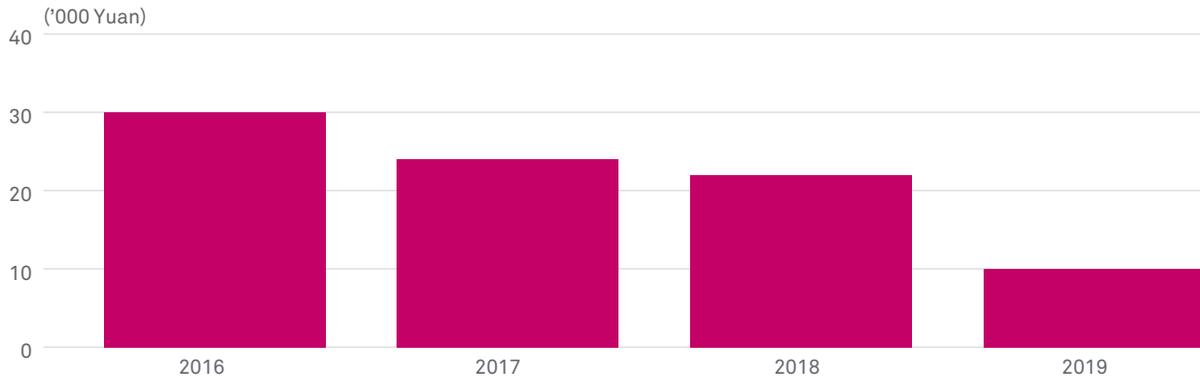
when the policy came fully into effect. In an already weak autos market, paring back purchase subsidies has made buying an EV a lot less attractive.

The subsidy programme will be phased out by the end of 2020 to be replaced by a new policy called the “dual credit policy”. This scheme compels manufacturers of passenger automobiles to produce NEVs and improve the fuel efficiency of the ICE vehicles.

Each NEV produced is awarded NEV credits according to a complex formula which takes into account factors like type of vehicle, maximum speed, energy consumption, weight, and range. These credits are used to offset against a target based on total production of passenger cars. Those manufacturers that do not earn enough credits must purchase them from manufacturers that have surplus credits or face financial penalties.



China subsidies have been slashed for electric vehicles



Source: International Council on Clean Transportation

This year the target number of NEV credits is equal to 10% of total production. The 15 million passenger cars sold in the first nine months of this year must therefore earn 1.5 million credits. Over the same period 800,000 NEVs have been produced suggesting that each car will need to earn on average 1.9 NEV credits.

This year the target should be relatively easy for the industry to meet. But it will rise by 2% in subsequent years so that by 2023 car makers will need to earn NEV credits to meet 18% of their output. The ratcheting up every year of the target means that manufacturers will need to produce more efficient cars with a higher range as well as increase the number of NEVs they produce in order to gain the required number of credits.

The government's hope is that the stick of sanctions if car makers do not meet their NEV credit targets will be more effective than the carrot of subsidies in meeting government ambitions to make China a global leader in NEV production and battery technology.

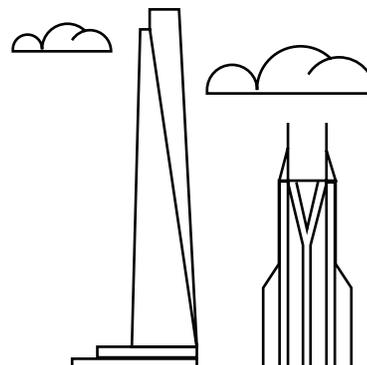
In this new Darwinian landscape, car makers will have to bring down costs to make NEV competitive with ICE vehicles. This will require using the latest battery technologies. Without government subsidies, only the strongest domestic auto companies are likely to survive.

They will be encountering stiff competition. The dual credit policy means foreign carmakers that hitherto had little interest in making NEVs have little choice other than to commit to investing in NEV production. VW and its local partners aim to be able to produce

1.5 million EVs by 2025. That's nearly 50% more than total EV sales in China last year. And others want a slice of the action too. In October Tesla gained approval to start producing cars at its factory in Shanghai; then in November, Mercedes launched its first China-made electric SUV.

It's likely that in the short term the removal of buyer subsidies will see NEV sales continue to contract. But with the dual credit policy forcing so much investment into NEVs, it's unlikely we will have to wait long before advanced battery technologies coupled with economies of scale mean the price of NEVs will fall to be competitive with ICE vehicles without subsidy.

Far from running out of juice, it looks like China's EVs sector has just paused for a quick recharge before getting back on the electric highway. ■



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Inside the shortlist: the Energy Transition Award

The Energy Transition Award was developed to recognize the leadership of power companies in the transition to a low-carbon, sustainable economy. By Drew Fryer 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 today are responsible for around one-quarter of global greenhouse gas (GHG) emissions¹, and it is expected that the sector would need to lead global decarbonization efforts in order to enable climate change to be limited to below 1.5°C of warming, avoiding its worst impacts. To do this, it is expected that renewable electricity would need to rise to 70-85% of supplies by 2050, with coal fired power falling to near zero².

The Energy Transition Award recognizes companies at the forefront. Those that are leading the way in reporting and reducing GHG impacts; those that are publishing robust targets to improve performance, those that are aligning with global energy transition commitments; and those that are demonstrating leadership in innovative ways.

Award criteria

No nominations were accepted for this award. The list of 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 Index³, captured by Trucost's annual research engagement program⁴. Consideration was given not only to how companies are performing today, but also their performance over the past five

1 Intergovernmental Panel on Climate Change (IPCC), 2014: Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

https://www.ipcc.ch/site/assets/uploads/2018/02/ipcc_wg3_ar5_full.pdf (page 9)

2 IPCC, 2018: Summary for Policymakers. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. World Meteorological Organization, Geneva, Switzerland, 32 pp. https://www.ipcc.ch/site/assets/uploads/sites/2/2019/05/SR15_SPM_version_report_LR.pdf (page 15)

3 Data as of June 28 2019: <https://us.spindices.com/indices/equity/sp-global-largemidcap-usd>

4 <https://eu.spindices.com/documents/additional-material/the-trucost-research-process.pdf>

Award criteria

Shortlisted companies:

Power utilities were ranked on a series of 12 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 (TCFD¹), 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, 2012-2017 (%)	GHG	Recent trajectory
GHG intensity of power generation (tCO2e/MWh)	GHG intensity	Point in time
Reduction in GHG intensity of power generation, 2012-2017 (%)	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, 2012-2017 (%)	Green-brown share	Recent trajectory
Growth in renewables power share ex. hydro, 2013-2017 (%)	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 ²	2°C alignment assessment	Forward looking indicator
Alignment of GHG pathway with limiting warming to below 2°C (Sectoral Decarbonization Approach methodology ³)	2°C alignment assessment	Recent trajectory
Potential earnings at risk from carbon pricing	Financial impact	Forward looking indicator

1 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. <https://www.fsb-tcfid.org/>

2 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 the global temperature increase below 2 degrees Celsius. <https://sciencebasedtargets.org/>

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

years, as well as forward-looking indicators of future performance in the energy transition.

Forward-looking indicators include:

- Published goals to address future climate impacts
- Calculations of alignment of their emissions trajectory with Paris Agreement goals to limit warming to 1.5-2°C
- Potential future earnings at risk from carbon pricing.

Each company was ranked across 12 indicators of energy transition, feeding into an overall ranking for each company. This overall ranking determined the 12 shortlisted finalists for the Energy Transition Award.

Summary results

The shortlisted finalists for the Energy Transition Award are:

- Contact Energy
- E.ON
- EDP-Energias de Portugal
- Enel
- ENGIE
- Iberdrola
- Ørsted
- Pinnacle West Capital Corporation
- Sempra Energy
- SSE
- Verbund
- Xcel Energy

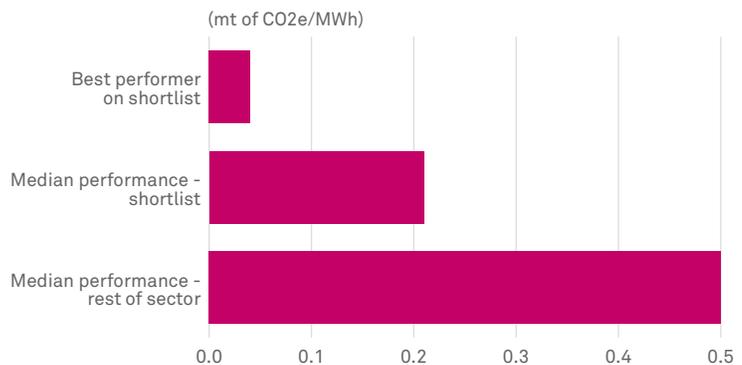
While these companies are finalists for their own unique reasons, they share the following traits:

- Exemplary performance among peers in terms of current GHG impacts
- A trend in reducing their impacts over time
- Published goals to meet the objectives of the Paris Agreement to keep a global temperature rise well below 2°C above pre-industrial levels

- Lower potential earnings impacts from a rising price on carbon

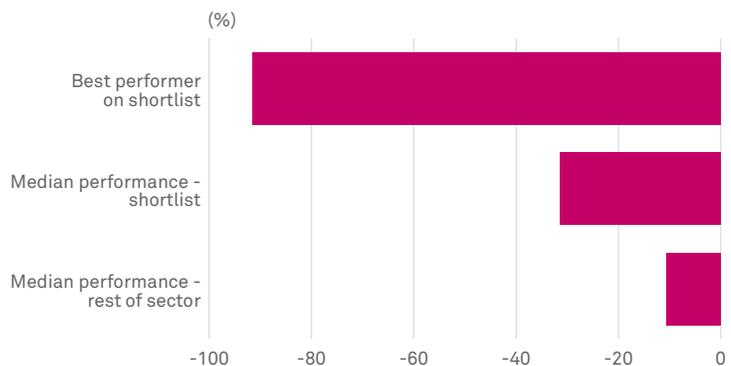
In assessing the industry, what is evident is a wide gulf between the strongest performers, as represented by the 12 shortlisted companies, and their wider industry. This is indicative of different and evolving risk and opportunity profiles as the transition toward a zero carbon power grid continues, and may increasingly be seen as a marker of strong long-term management and governance practices within a rapidly changing industry.

Emissions intensity per unit of power generated



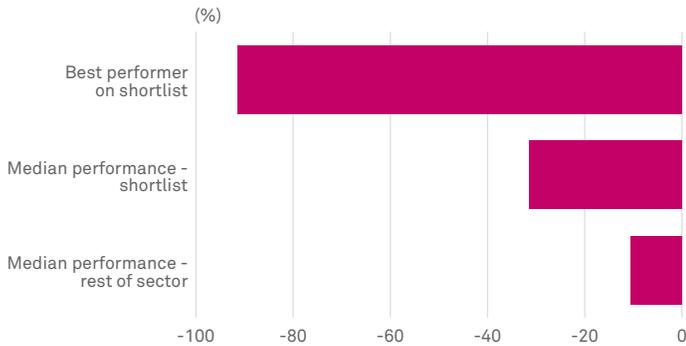
Source: Trucost

Change in GHG emissions in intensity 2013-2017



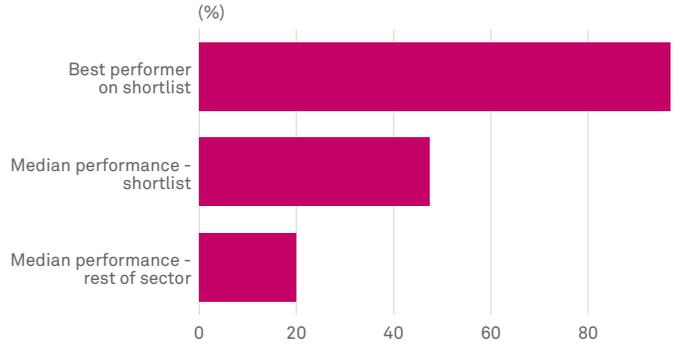
Source: Trucost

Change in GHG emissions in intensity 2013-2017



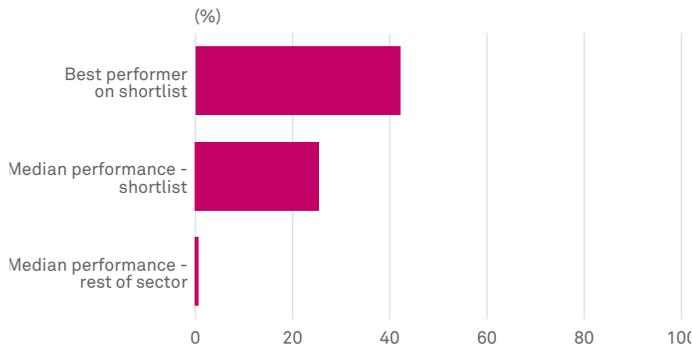
Source: Trucost

Share of zero and near zero power generation



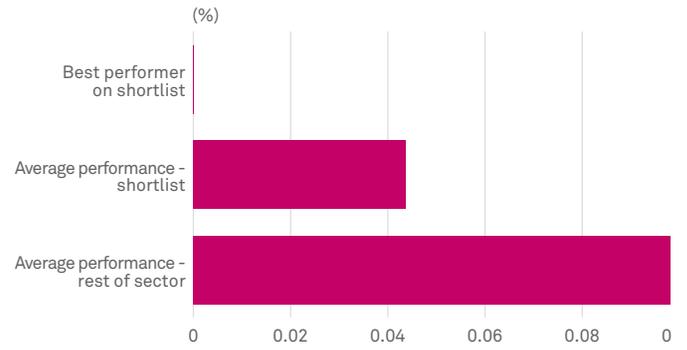
Source: Trucost

Share of renewables excluding hydro



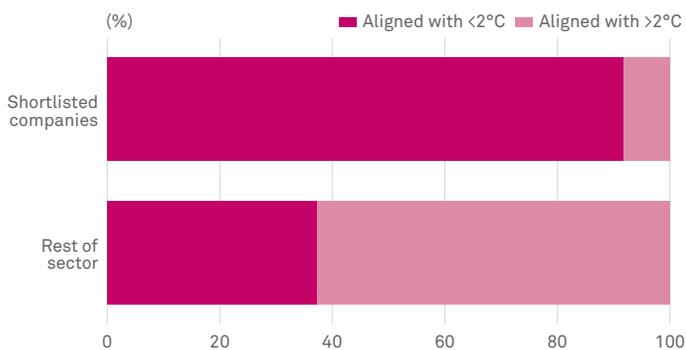
Source: Trucost

Additional EBITA at risk from carbon pricing 2020



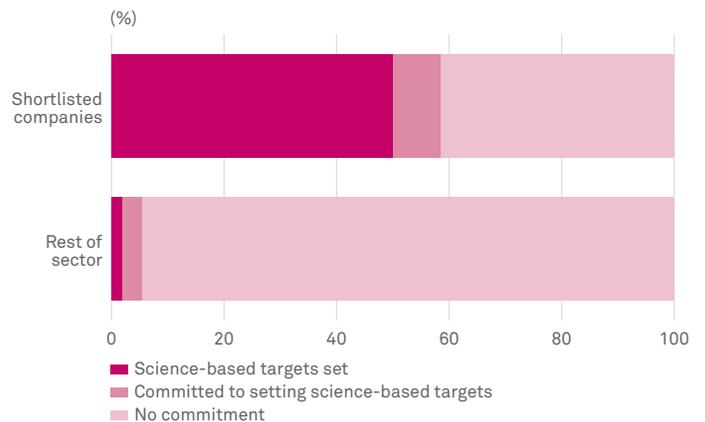
Source: Trucost

Climate scenario alignment



Source: Trucost

Science-based targets



Source: Science-Based Targets Initiative

Highlights from shortlisted finalists

Contact Energy reduced its operational emissions by almost half since 2013, during which its emissions intensity fell by one-third. Contact produces the majority of its energy, over 80%, from zero or near zero emissions sources. The company set a science-based target during 2019.

E.ON has undergone a complex transformation from a conventional fossil fuel power utility, first to a renewables-focused utility and retailer and eventually to a specialized energy networks and retail services-focused utility. In 2016 it separated the fossil fuel power assets that had been central to its operations into a new entity, Uniper, spinning these off and then selling its stake in 2018. Also in 2018, E.ON took a controlling interest in Innogy, as well as undertaking asset swaps with RWE that left RWE focused on power generation and E.ON focused on networks and final energy consumers. Leading up to the latest stage of its transformation, E.ON had reduced its operational GHG emissions and emissions intensity by over 90%.

EDP is a significant developer of renewable energy globally and derives around 40% of its power from renewable sources, up from one-third five years earlier. It has set a science-based target to reduce emissions from electricity production: 55% per unit of power generated by 2030, from 2015 levels.

Enel has committed to a science-based target to reduce emissions 25% per unit of power generated between 2007 and 2020, and to operate on a carbon neutral basis by 2050. Its commitments includes the decommissioning of 13 GW of fossil power plants in its home market of Italy. Over 40% of its power

generated is already from zero and near-zero emitting sources.

ENGIE has reduced its operational emissions by over one-third during the five-year period examined, having divested and shut down a number of its highest emitting generators. It has committed to an 85% reduction in direct emissions by 2050 and elimination of coal-fired power from its portfolio.

Iberdrola has an emissions intensity and green power share that are among the best of any large, geographically and operationally diverse utility. It generates over 50% of its power from zero and near-zero emissions sources, including 25% from non-hydro renewables. The company has shut 15 coal power plants since 2001 with plans to shut its remaining two by 2020. Iberdrola had its targets confirmed as consistent with science-based levels in 2019. It commits to reduce emissions by a further 20% by 2030 and become carbon neutral by 2050.

Ørsted has in recent years sold its upstream oil and gas business and announced a phaseout of coal-fired power generation by 2023, further shifting its focus to 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. 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.

Pinnacle West Capital reduced its operational emissions by 25% and reduced its emissions per unit of power generated by 50% over the five-year period of focus. It has a target to reduce emissions per unit of power generated

by 48% by 2032 from a 2005 base year, and a strategy of continuing to increase solar power generation with battery storage to meet anticipated increases in customer demand.

Sempra Energy exhibits strong rates of improvement within its wider peer set. It sharply increased zero and near-zero power generated from 15% to 47% of its total over the five-year period examined, the majority of that in renewables, while having a generation portfolio with no coal-fired power assets. Its absolute GHG emissions and emissions per unit of power generated fell by over 30%.

SSE has reduced its GHG emissions by two-thirds, and its emissions intensity by more than 40% 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 phaseout of coal-fired power not fitted with carbon capture and storage. The company has also committed to setting a science-based target.

Verbund reduced both its absolute GHG emissions and its emissions intensity, already among the lowest in its industry, by more than half 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.

Xcel Energy reduced its operational emissions by 10 million mt of CO₂ over the period, around 20%, and its emissions intensity fell by 15%. Zero and near-zero power generation rose from 30% to 40% of power generated. It has a target to reduce absolute emissions by 60% between 2005 and 2030.

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2019 S&P Global Platts Global Energy Awards

Committed to customers and future-focused



By Murray Fisher

The S&P Global Platts Global Energy Awards program, now in its 21st year, honors the organizations and individuals dedicated to excellence in the energy industry.

The 2019 program reflects an infusion of new ideas and processes as companies rethink traditional ways of doing business: the evolution of technology and management of customer relationships in divergent environments were frequent topics. Above all, our 2019 energy leaders are incorporating sustainability in today's transformations and tomorrow's strategies.

This year's roster was truly global, with nominations arriving from more than 40 countries. Judging was conducted by an impartial panel of international energy experts with backgrounds in regulation, policymaking, corporate leadership, trading and strategic consulting. S&P Global Platts commends the Global Energy Awards winners for their inspiring performance.

Judging Panel



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



François-Xavier Saint-Macary

Chairman and Co-founder, Ingensis



Clare Spottiswoode

CBE, Former United Kingdom Gas Regulator



Flora Zhao

Former President, Gas Asia, BP IST



ENERGY COMPANY OF THE YEAR

Baker Hughes

United States



The Energy Company of the Year, selected by judges from the list of finalists in all categories, demonstrates all-around excellence in executing a total energy strategy. Fullstream provider Baker Hughes captured the Award of Excellence for LNG, while also presenting compelling nominations in the Corporate Award for Green Initiatives and Emerging Technology of the Year. The company has demonstrated leadership by combining success in the present with a vision for the future.

“Technology is driving our industry forward, and this is a company enabling that evolution,” a judge commented. Baker Hughes, the judges’ unanimous selection for Energy Company of the Year, provides technology and services across the oil and gas supply chain. The company employs technology to help customers improve energy efficiency and practices what it preaches, committing to attain net-zero carbon equivalent emissions in its operations by 2050.

Baker Hughes combines the enthusiastic spirit of a startup with “considerable” resources. It employs more than 9,000 engineers and scientists, spent \$700 million on R&D in 2018, and has 17 global innovation centers. The company also has an exceptionally broad base for global co-operation, with operations in more than 120 countries. Judges feel that as Energy Company of the Year, Baker Hughes “shows supreme confidence in tackling the key obstacles we currently face while propelling the industry into the future.”



CHIEF EXECUTIVE OF THE YEAR

Vicki Hollub
Occidental Petroleum Corporation
United States



Occidental

Occidental Petroleum Corporation's Vicki Hollub lived up to her reputation for "long-term plays" and impressed judges by completing a "massive deal that solidified Occidental's position in the Permian Basin."

During her 35-year career at Occidental, Hollub moved through senior management and technical positions before becoming President & CEO in 2016. She now oversees the company's substantial oil and gas, chemical and midstream operations, and recently faced down fierce competition to complete its acquisition of Anadarko Petroleum in a transaction valued at a total of \$55 billion, the largest deal in the sector since 2016. "She's not afraid to challenge bigger companies, and she doesn't shy away from a fight," praised one judge.

Judges also lauded Hollub's "conviction and decisive action," as she completed Occidental's strategic cash flow breakeven plan six months ahead of schedule and prioritized its plans to combat climate change and carbon emissions. She is also a highly respected industry representative, serving on the board of the American Petroleum Institute and as chair of the US Secretary of Energy Advisory Board.

The panel congratulates Hollub for her tenacity, deep industry knowledge and "unwavering dedication" to transforming and empowering Occidental.



CHIEF TRAILBLAZER OF THE YEAR

Paula Gold-Williams
CPS Energy
United States



New this year, the Chief Trailblazer award honors the CEO of a company with assets valued \$15 billion or less. Judges hailed Paula Gold-Williams of CPS Energy as "an absolute customer and community advocate" who is advancing her nation's largest municipally owned energy utility with a focus on energy diversification, including both fossil fuel resources and renewables.

Gold-Williams' customer-first approach often finds her deep in the heart of San Antonio, TX, the US' seventh largest city. She is a valuable resource for her community, as Immediate Past Chair of the San Antonio Chamber of Commerce and member of an extensive range of boards and committees.

Gold-Williams has more than 30 years' leadership experience in her community, the last 14 at CPS Energy, where she progressed from Controller and Assistant Treasurer to the top job in 2016 – becoming the nation's first African American female energy utility CEO.

"She's omnipresent in her city, and still finds time to excel as CEO," remarked one judge, noting that CPS customers' combined energy bills rank among the lowest of the nation's 20 largest cities. Judges salute this winning CEO as "a true trailblazer, a motivator and a dynamo."



LIFETIME ACHIEVEMENT AWARD

Caren Byrd
Morgan Stanley
United States



Morgan Stanley

2019's Lifetime Achievement honors go to a leader who has "stood the test of time" over nearly five decades, with a career-long focus on electric utilities. Caren Byrd forged a path for herself and the women who followed in demanding roles and global and male-dominated industries. She joined Morgan Stanley as one of the company's first female investment bankers in 1972 and is now a Managing Director in the company's Global Power and Utility Group.

Throughout her career, Byrd has proven to be "a rock, and consistent contributor, both inside and outside her company," noted one judge. Industry organizations value her deep sector knowledge: she has worked with the Electric Power Research Institute, the Institute of Nuclear Power Operations, and the Edison Electric Institute, where she contributed to an ESG financial reporting template.

Judges agreed that Byrd has "dedicated a lifetime" to her industry and "brokered countless critical deals." She is "easily recognizable for her contributions" within Morgan Stanley, paving the way for more women to succeed in energy and financial services.



**RISING STAR AWARD:
 COMPANY**

ReNew Power
India



The "striking trajectory" of this Rising Star wowed judges: ReNew Power, founded in 2011, "started from scratch as a small company" committed to delivering cleaner and smarter energy choices, and is now India's largest renewable power producer. The company has outpaced the growth of the country's renewable energy industry as a whole from its inception through 2018, nearly doubling its operational capacity in each of the past three fiscal years.

ReNew develops, builds, owns and operates utility-scale wind and solar energy projects, as well as distributed solar energy projects. Beginning with a single wind project, it now boasts more than 100 utility-scale operations across India, generating 1% of the country's total electricity and claiming to mitigate 10.5 million tonnes of carbon dioxide each year.

ReNew is funded by a who's who of global energy finance, with a roster of "large and reputable" partners that includes Goldman Sachs, Abu Dhabi Investment Authority, Canada Pension Plan Investment Board, Japan's JERA, and Global Environment Fund. Judges agreed that ReNew "deserves recognition for its early success" the company displays "fantastic potential for continued growth."

RISING STAR AWARD: INDIVIDUAL

Judges elected to recognize two equally qualified winners, each with distinctive strengths, in this very competitive category.



RISING STAR AWARD: INDIVIDUAL

Mai Al-Eisa
Kuwait Petroleum International
 Kuwait



This chemical engineer with an MBA drew praise from judges for “achieving success in a region that’s historically challenging for women in leadership roles.” Kuwait Petroleum International’s Mai Al-Eisa has spent more than 20 years in the Kuwaiti oil sector driving multinational teams on strategic megaprojects such as the purchase of 50% of the Duqm refinery, a joint venture with Oman Oil Company to produce diesel, jet fuel, naphtha and LPG.

“She has earned a lot of trust,” stated one judge, leading to her current position as Manager, Manufacturing Vietnam. In this role, Al-Eisa oversees financial and operational improvements at the Nghi Son refinery, a manufacturing joint venture in Vietnam, as it advances its commercial operation.

Al-Eisa impressed judges with her ability to move “with strategic agility and grace” through the worlds of both engineering and finance, serving as a role model for many future leaders. At the 2018 Abu Dhabi International Petroleum Exhibition & Conference, she spoke about the challenges of women in the oil business. Judges applauded the “resounding success in a sensitive region” of this “remarkable winner.”



RISING STAR AWARD: INDIVIDUAL

Yoven Mooroooven
ENGIE
 France



With his in-depth knowledge of international business development across the energy value chain, this “charismatic” Rising Star is suited to his career at ENGIE, a company judges know as “nimble and unafraid of risks.”

Born in Mauritius, Yoven Mooroooven “established himself at a young age, developing experience and responsibility in multiple industries quickly.” He first joined ENGIE Global Markets in 2003, moving on to Macquarie and Deutsche Bank before returning to ENGIE in 2013. As head of the International Division of ENGIE’s Global Energy Management business unit, he accelerated the company’s business activities worldwide, working across APAC, the Americas and Africa.

Mooroooven now leads the Africa Business Unit of ENGIE, working with the company’s African stakeholders to tackle the country’s challenging environment and ever-growing energy demand through green generation solutions, decentralized energy services and new technology. Judges pointed to “double-digit revenue growth during his first year” and feel he is laying solid groundwork for further development in the region.

Judges found Mooroooven, like his employer, to be “impressively balanced and global” and expect him to enjoy a “long career with few limits.”



FINANCIAL INVESTMENT OF THE YEAR

Capital Dynamics
Switzerland



In a rare repeat win, asset management firm Capital Dynamics' Clean Energy Infrastructure business captured the Financial Investment prize for the second year in a row with another "complex, innovative and sophisticated" deal, this time in the renewables/energy storage space.

Confident that energy storage technology would revolutionize the power market, Capital Dynamics acquired the Townsite Solar Project located in Boulder City, Nevada, featuring an energy storage facility that the company claims to be one of the largest in the world: a 90-MW/360-MWh battery system. Capital Dynamics then secured three long-term power purchase agreements to service two municipalities and a cooperative. The project is expected to be fully constructed by the end of 2021. In a statement, the company called the project "the first hybrid utility-scale solar and energy storage project serving fixed volume power purchase agreements... this type of service represents the future of the renewable energy sector."

Judges salute Capital Dynamics for its skill in "identifying and investing in a key technology" and feel that this "large deal with a renewables focus" provides a template for future deal making in the sector.



CORPORATE DEAL OF THE YEAR

Enel Green Power
Italy



Judges were pleased to see Enel's renewable energies division, Enel Green Power, accomplish a "massive renewables deal" as the company completed project financing for the Villanueva and Don José solar photovoltaic parks, now connected to Mexico's grid. Not only did the deal "bring additional solar to a critically important country," but it also reveals "incredible potential" for growth of renewable energy in the region.

The deal's complex financing, considered a first in Mexico, featured a "structured loan that mitigated risk." Enel Green Power also earned judges' respect through deft navigation of policy issues and the "collaborative effort" it displayed "in closing such a large, scaled deal" – one that involved multiple banks and financial institutions.

Villanueva is now Mexico's largest operating solar park and Enel Green Power's largest renewable plant, offsetting emissions of over 1 million tons of CO₂ while providing energy for over 1.4 million Mexican households. Notably, it is the first energy project to commence operation following Mexico's historic energy reform, and represents a bright future for projects to come.



**AWARD OF EXCELLENCE:
UPSTREAM TRANSFORMATION**

**Abu Dhabi National
Oil Company**
United Arab Emirates



Abu Dhabi National Oil Company (ADNOC) presented judges with a “big and complex,” “globally-minded” project ripe with “cutting-edge technology” that typifies the forward-thinking nature of the Award of Excellence. Its offshore, ultra-sour gas mega-project, the Ghasha concession, is not only one of the world’s largest – it also epitomizes a fresh solution to a common Upstream challenge “this is how a large oil producer should evolve.”

ADNOC’s Ghasha project, with a 40-year term and a reported valuation of \$20 billion, features a digital oil field employing robotics, remote monitoring and control systems, and predictive maintenance to help optimize production and achieve its “ambitious goals.” It also houses development, drilling and production infrastructure on environmentally friendly artificial islands. With expected start-up by 2025, the project already shows “revolutionary vision”.

Judges believe that Ghasha, which has already drawn partners from Austria, Germany and Italy, will help return its home country to gas self-sufficiency while burnishing ADNOC’s image as an “innovative and attractive” company, bound to attract new international partnerships. “Think of the potential,” one judge marveled.



**AWARD OF EXCELLENCE:
MIDSTREAM**

**Enterprise Product
Partners**
United States



With its ample supply of pipelines, storage facilities, processing plants and terminals, midstream giant Enterprise Products Partners is certainly massive. Additionally, judges found the company is proving itself to be an “agile and flexible” leader as it “capitalizes on a growing NGL and LPG business.”

“The shale revolution changed the US gas industry. Enterprise recognized quickly how to adjust and seize the opportunity,” reflected one judge. The firm has grown significantly since its 1998 IPO, increasing its asset base from \$715 million to \$57 billion in 2018 through organic growth opportunities and acquisitions. Judges liked that Enterprise is employing its many strengths to “solve the bottlenecks” in this fast-growing industry. It is expanding its terminal on the Houston Ship Channel, and is in development on a Gulf of Mexico terminal designed specifically to load supertankers, giving it first-mover status among its competitors.

Judges deemed Enterprise’s win to be “timely” given the strength of the current market for NGLs and LPG, and feel the firm has an “impressive overall plan with a bright future ahead.”



AWARD OF EXCELLENCE: DOWNSTREAM

Valero Energy Corporation
United States



In a tight race marked by lengthy discussions, Valero Energy emerged as this year's Downstream winner with a "success story" revealing its "investment in a more sustainable future."

Valero, the world's largest independent refiner, understands the importance of pursuing alternative-energy opportunities. The company has "made a substantial investment in cleaning up its carbon growth," observed a judge. It recently acquired three ethanol plants, vaulting it into position as the second-largest corn ethanol producer in the world. It is also active in renewable diesel, which the company calls its "low-carbon centerpiece". Its joint venture Diamond Green Diesel ranks as the world's second-largest renewable diesel producer.

Judges appreciated Valero's "considerable commitment" to alternative fuels with a total investment of \$1.7 billion in ethanol and \$1.8 billion in renewable diesel. They also registered that the company's investment strategy is part of an overall "path of excellence". The company is recognized as an outstanding employer, with high rates of employee volunteerism and record charitable donations. "They're leading the way as a good corporate citizen, while succeeding in a tremendously competitive environment."



AWARD OF EXCELLENCE: LNG

Baker Hughes
United States



Continued strong US shale production brings LNG back as a competitive category again this year. The triumphant Baker Hughes, named Energy Company of the Year, caught judges' attention due to its "global collaboration and sharing of technology in a difficult environment."

Though Baker Hughes is a diverse company working across the entire oil and gas value chain, judges were particularly impressed by the "proven solutions" it exhibits in the global LNG market, where the company brings a broad approach to improving efficiency in production, liquefaction, regasification, and storage facilities.

In a business where downtime can equal significant lost revenue, the company offers "a huge amount of support to mitigate significant economic challenges." Across its liquefaction train installations, its equipment operates at reliability rates above 98%. Baker Hughes "drives excellence for its partners," including Petronas, Eni and BP, which employ the company's turbomachinery and offshore equipment technology in their floating LNG projects.

Judges commend Baker Hughes for "constantly improving and innovating" in its technology. They find the power of this LNG leader is simply "transformative."



**AWARD OF EXCELLENCE:
POWER**

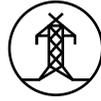
Xcel Energy
United States



Ambitious goals drive this year's "future-oriented and customer-focused" Power winner. Xcel Energy, a major US electricity and natural gas service provider operating across eight states, aims to deliver 100% carbon-free electricity by 2050 and cut carbon emissions 80% by 2030 company-wide. Judges took note of the company's "distinct plan on how to get there." "They're not just talking about investing in renewables," judges commented. "They're investing and then implementing, on an impressive scale."

To achieve its commitment, Xcel Energy is investing in wind and solar; helping customers manage energy usage; maintaining its carbon-free nuclear plants; and retiring or reducing its aging coal plants. Judges recognized Xcel Energy's investment in demand-side management in particular, which they saw as "tackling the ever-challenging problem" of providing a consistent power source to the grid through solutions including the first use of direct wind energy storage technology in the US.

The company is well on its way to being carbon-free: in 2018, it reduced carbon emissions from the electricity that serves its customers by 38% compared to 2005 levels. Judges salute Xcel Energy as a forward-looking organization that is "taking risks and winning big."



GRID EDGE AWARD

GridBeyond
Ireland



GridBeyond exemplifies the Grid Edge goal: improving the link between customers and utilities. The company serves energy, financial and operational stakeholders in industrial and commercial organizations with demand side response, intelligent energy services and flexibility solutions.

GridBeyond employs a "data-driven" approach – its intelligent energy technology platform uses machine learning and data analytics to automatically manage energy through monitoring services and dynamic price and asset optimization. It developed the world's first hybrid battery and demand network, "first-to-market technology" that enables demand-side response to be delivered "when there's both too much and too little generation or demand on the grid."

Judges appreciate that GridBeyond employs "a broad-scope approach" as it assists with renewables' integration into the electricity mix. This "customer-centric" company's solutions are now in use at more than 350 sites across the UK and Ireland in sectors including industrial, manufacturing, metals, plastics, paper, food, transport and logistics.

Judges salute GridBeyond for "solving a specific problem across the grid" and look forward to seeing the company "work on a global scale" through its planned international expansion.



CORPORATE SOCIAL RESPONSIBILITY AWARD: TARGETED PROGRAM

PERU LNG
Peru



Need is urgent in Peru's rural areas, which have high levels of poverty and poor access to public infrastructure and services. However, local government budget execution rates are low. Fortunately, the country is home to a firm with a commitment to operational efficiency. PERU LNG, which operates the first LNG plant in South America, leveraged its business skills in a smart program that "teaches local government to better manage its resources."

PERU LNG's "Capacity Building in Local Governments" project focuses on the Ayacucho region; one of Peru's most impoverished. Though the region has pressing needs, district municipalities needed assistance accessing public funds for project development. Working in cooperation with Universidad del Pacífico, PERU LNG helped municipalities strengthen their management skills and access approximately \$13 million in public funding. The project resulted in installation of water, sewage and basic sanitation units, as well as construction of and improvements to health centers and schools.

In a category that drew broad global representation, judges feel PERU LNG went beyond providing a temporary fix; it empowered the sustainable development of its communities in a "future-oriented program with long-term impact."



CORPORATE SOCIAL RESPONSIBILITY AWARD: DIVERSIFIED PROGRAM

**Oil and Natural Gas
Corporation Limited**
India



In India, companies are required by law to invest in social development. This year's Diversified CSR champion, Oil and Natural Gas Corporation (ONGC), went "above and beyond" the stated requirements, putting its CSR budget to work on a comprehensive array of more than 4,000 projects that bring positive impact to society.

ONGC, India's largest national oil company, focused its "multi-pronged approach" on projects including healthcare and sanitation in remote communities "where the government sometimes doesn't reach." Of note, the company recently opened a 300-bed hospital for the underprivileged in Assam; improved and expanded a hospital for prenatal and postnatal care; brought medical treatment to the elderly through deployment of 31 mobile medical units in nine states; set up the 455-bed National Cancer Institute in Nagpur; and constructed 16,000 household toilets.

ONGC believes its mission is to develop "social wealth" in its communities by "stepping beyond the mandatory provisions." Judges agree that the company is "the clear winner" for its diversified program that leaves deep impacts in the country it serves.



CORPORATE AWARD: GREEN INITIATIVES

Microsoft
United States



A new category to the program, Corporate Award for Green Initiatives recognizes a heavy energy consumer that is committed to energy efficiency. As it has done in technology, Microsoft is “setting an example and creating a road map” with its “vibrantly green” initiatives.

Microsoft has operated as carbon-neutral since 2012 and is one of the largest buyers of green power in the world. As a next step, in 2017 the company pledged to reduce its operational carbon emissions 75% by 2030 against a 2013 baseline; it reached 50% by the end of 2018, a “massive achievement in the judges’ estimation.

The panel particularly appreciated that Microsoft is “taking thoughtful, targeted steps to purchase renewable energy,” completing wind and solar power purchase agreements totaling 1.6 gigawatts. The company is also “showing its commitment in its own backyard” by modernizing its Redmond headquarters and constructing 17 new buildings totaling 2.5 million square feet. When construction is complete, Microsoft intends to power the entire campus with carbon-free fuels.

Judges congratulate Microsoft for “making big strides” and displaying “a refreshingly public, clear and proactive approach to achieving an important goal.”



CONSTRUCTION PROJECT OF THE YEAR

Sterlite Power
India



Power transmission assets developer Sterlite Power believes that “access to reliable power should be a fundamental right.” However, access can prove difficult in India’s mountainous regions. Judges lauded Sterlite Power for “using new approaches to accomplish project goals ahead of schedule in a very difficult environment.”

Sterlite Power’s National Region Strengthening Scheme 29 (NRSS-29) is the largest private sector transmission project awarded in the country to date. It is situated in the socio-economically challenged Kashmir Valley region, which often experiences blackouts during the harsh winters. This demanding operational project required a “complex approach” including the first use of helicopters in Asia to operate in high altitude, deep snow and inaccessible terrain. The project boosted the state’s power transmission capacity by 33%, helping to ensure reliable power access for more than 12 million residents of the region.

Judges commend Sterlite Power as a “solid company with a remarkable track record,” and, noting its 10 power transmission projects now underway in Brazil, look forward to the next chapters of its success story.



ENGINEERING PROJECT OF THE YEAR

Dominion Energy
United States



Dominion Energy, with operations in power generation, power delivery, and gas infrastructure, put its “large-scale” engineering prowess on display with the Greenville County Power Station. Completed in 2018, the station is fully equipped with “state of the art equipment and technology” that befits a company with a “standout reputation” for providing sustainable, reliable, affordable and safe service.

This “marvel of efficiency” offers many superlatives. It is one of the cleanest natural gas-powered stations in the US, features the largest power block of its kind in the world, and operates under an air permit with the strictest CO2 limits in the nation. Judges also marveled at the facility’s “distinctive” air-cooled condenser system, the largest of its kind in the country, which saves more than 8 million gallons of water each day over traditional systems.

Dominion completed the \$1.3 billion Greenville project on time and on budget. Judges believe the project, with its “sustainable practices,” exemplifies the company’s commitment to meeting the energy needs of its customers in an environmentally responsible manner.



COMMERCIAL TECHNOLOGY OF THE YEAR

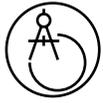
Limejump
United Kingdom



Last year’s Rising Star winner, hailed by previous judges as “a leader in grid utilization” that is “providing balance to many moving parts,” returns with commercialization of its “grid demand response solution that addresses a challenging but important issue.” Energy technology firm Limejump’s “data-driven approach” brings machine learning, algorithmic expertise and advanced trading strategies to the task of delivering renewable resources where demand requires, in sub-second speed. “It’s sophisticated technology that could have huge market impact,” observed a judge.

Limejump employs a Virtual Power Platform (VPP), an aggregation of flexible energy generation and storage assets of different sizes and technology types, with a goal of delivering 100% renewable energy at all times to its customers. Through its VPP, Limejump manages one of the largest portfolios of batteries in the world, covering an estimated 40% of the UK’s active battery capacity.

Judges applaud Limejump for its “consistent performance and growth.” Following its acquisition by Shell New Energies in early 2019, judges feel the company “has solid financing and true potential to take off.”



EMERGING TECHNOLOGY OF THE YEAR

NuScale Power
United States



The Emerging Technology winner is a first-mover with “the potential to dramatically change our industry.” NuScale Power is developing a groundbreaking small modular reactor (SMR) to supply reliable and abundant carbon-free nuclear energy, a solution that shows “exceptional flexibility for applications within the nuclear industry.”

The SMR features what the company calls a “safer, smaller, scalable version of pressurized water reactor technology,” with design that brings together the reactor vessel, steam generator, and high-pressure steel containment into a single, simplified unit. Billed as the first self-protecting reactor, it has the ability to

shut down and self-cool, and is “far along on the path to achieving design certification,” the world’s first and only SMR to undergo such review by the US Nuclear Regulatory Commission.

Once regulatory review is complete, NuScale plans a 12-module SMR plant in Idaho, with additional international agreements in process. Judges expect its modular technology could “radically cut the cost of new nuclear builds” by enabling customers to incrementally increase facility output. “It’s a great idea with incredible potential” for a new generation of nuclear power.

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20th Annual
**Caribbean Energy
Conference**

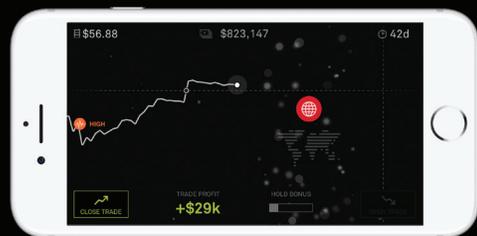
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Staples is The Worklife Fulfillment Company, helping businesses of all sizes be more productive, connected and inspired — however and wherever they work today. With dedicated account teams, category professionals, innovative brands and a curated assortment for business, Staples provides customized solutions to help organizations achieve their goals.



Dr. Sultan Al Jaber

Group CEO
ADNOC

ADNOC

With a production capacity of more than 3.5 million barrels of oil per day and 10.5 billion cubic feet of natural gas per day, Abu Dhabi National Oil Company (ADNOC) is one of the world's leading energy producers and a primary catalyst for the growth and diversification of the economy.

We operate across the entire hydrocarbon value chain, through a network of fully integrated businesses, with interests that range from exploration, production, storage, refining and trading to the development of a wide range of petrochemical products.

Since 1971, our work has enabled our country and our people to realize their remarkable potential; we have helped to create thousands of jobs, driven the growth of a diverse knowledge-based economy, invested in education and research, and developed critical social infrastructure.

Our Smart Growth Strategy

We recognize that, to help meet the growing global demand for energy and maximize the value of every barrel that we produce, we must embed a dynamic, performance-led, commercially-minded corporate culture that applies the latest technology and harnesses our resources effectively.

We have also extended our approach to partnerships, developing mutually-beneficial propositions to attract new strategic partners, and are taking a more proactive approach to the management of our assets and balance sheet.

Harnessing the Power of Technology

We are embracing digitalization to unlock value across our operations. We recognize the value of artificial intelligence, data analytics, Blockchain and machine learning and are applying the power of technology across our entire value chain, from drilling platforms to trading platforms.

We are using predictive analytics to significantly reduce operational costs, and leveraging cutting-edge artificial intelligence platforms and Big Data analytics to unite data,

people and technology, allowing us to make better operational and business decisions with the aim of saving, and generating, billions of dollars.

Protecting Our Environment

We take a proactive approach to environmental protection and are committed to reducing our carbon footprint. We are committed to reducing flaring and the production of greenhouse gases, and continue to research, develop and implement innovative projects and technologies to help reduce harmful emissions.

We are expanding the capture, use and storage of carbon dioxide (CO₂), to further reduce our carbon footprint – which is already one of the smallest in the industry – and liberating natural gas, previously used for oil field injection, for more valuable purposes. By 2030, advanced technology will enable us to capture up to 5.0 million tons of CO₂ annually to be safely locked away underground, a six-fold increase on current levels.

We are also committed to biodiversity protection, and have introduced a series of marine protection and development projects, including mangrove and seagrass plantation, coral reef rehabilitation, and the building of artificial reef and fish habitat structures.



Andrés Gluski

President & Chief Executive Officer
The AES Corporation

AES: Accelerating the Future of Energy

Working together with you, we're improving lives by delivering greener, smarter energy solutions the world needs.

We are AES and we are...

Leading the Renewable Transition

As one of the largest renewables solutions providers and developers, we're working with customers to support the transformation of electric grids around the world. Our shifting portfolio includes innovative solutions such as the green blend and extend offering, which systematically replaces coal with lower cost renewables and accelerates access to low-cost solar and wind for existing customers, while maintaining reliability.

Working in Partnership

We collaborate directly with customers to meet their needs today and co-create solutions that meet their needs into the future. In December 2018, AES made history by bringing the world's largest operational solar-plus-storage system online for the Kaua'i Island Utility Cooperative. Winner of the 2019 U.S. Edison Award, the project delivers nearly 11 percent of the island's power, bringing Hawaii one step closer to its goal of 100 percent renewable energy by 2045. In Chile, we are combining energy storage with our 750 MW Alto Maipo hydropower plant to create a first-of-its-kind virtual reservoir.

Driving Transformation

We're leading the change in our industry. Together with Siemens, we launched Fluence in 2018, the world leader in energy storage. Fluence provides a range of energy storage technology solutions including design, delivery and integration in over 160 countries. We're also diversifying the energy mix by bringing liquefied natural gas (LNG) to Central American and Caribbean countries that have traditionally relied on expensive fuel oil or diesel. These efforts build upon the success we've had in the Dominican Republic since we introduced gas 19 years ago, saving consumers more than half a billion dollars a year and avoiding approximately four million tons of CO₂ emissions annually. AES plans to build a similar project in Vietnam in the coming years, which will bring many of these same benefits to Southeast Asia.

Applying Innovation

We use proven technologies, often from outside our industry, to bring safe, dependable, cost-effective power to our customers. It's what we call applied innovation. Drones are an example of how we apply innovation. We're a leader in the use of drones in the energy sector and are setting new standards for improved safety and efficiency. Through the use of drones across our operations, we have eliminated more than 57,000 hours of hazardous work while generating \$10 million in benefits.

Developing our Talent

Our people are our energy. They share a passion to help meet the world's current and changing energy needs, while contributing to the communities in which we live and work. We aim to develop our people to their fullest potential as we accelerate the future of energy.

Integrating Digital

The future is digital. In November 2019, we entered a 10-year strategic alliance with Google to accelerate the growth and adoption of clean energy by leveraging Google Cloud technology to pioneer innovation in the sector. We will work together to improve the experience for corporate energy customers and to develop and implement solutions that enable broad adoption of clean energy.

Statistics:

Fortune 500 Global Power company listed on NYSE

Named to Dow Jones Sustainability Index for North America
Six Years in a Row

Named one of the World's Most Ethical Companies by Ethisphere
Six Years in a Row

Committed and On Track to Reduce Our Carbon Intensity by 50%
by 2022 and 70% by 2030 (Compared to 2016 levels)

On Pace to Increase Renewable Footprint by 15.7 GW through 2024



Ibrahim Al-Buainain
 President & Chief Executive Officer
 Aramco Trading Company

An Emerging Global Energy Trading Powerhouse

Aramco Trading Company (ATC) is the trading arm of Saudi Aramco; established in Dhahran in 2010. The company started trading activities in 2012, with a mission to balance Saudi Aramco's refined products system. Its trading portfolio consists of refined and special products, in addition to Aromatics, Polymers, Crude oil, and LNG.

Aramco Trading Company is the fastest growing trading house this decade has witnessed. The company managed to successfully expand its trading activities, increase volumes, grow geographical presence, establish new offices, and obtain global recognition in a short time span while sustaining a healthy financial and operational growth. Aramco Trading was recognized as the number one charterer of refined products in the region, the number one blender in the Arabian Gulf and Indian subcontinent, and the number one supplier of Naphtha to Asia.

Aramco Trading expanded its role from merely balancing Saudi Aramco's local system, to the supply and trading integrator of all Saudi Aramco's global Downstream assets. Now, the company has three subsidiaries of its own, Aramco Trading Limited in UK, Aramco Trading Fujairah in UAE, and Aramco Trading Singapore in Singapore.

With currently 4 offices operating worldwide, Aramco trading has wider access to markets and client base, a more talented and diversified workforce, and a more complex and integrated business model. This supports the company's role in integrating and optimizing the global assets, helps the company to expand geographical coverage, and grow its market outreach and position.

Aramco Trading is currently amongst the top trading houses worldwide in terms of product traded volumes, and is yet expected to grow its traded volume further with the expected rise in both the Downstream refining capacity and third party trading activity. These major milestones were achieved in less than 4 years once Ibrahim Al-Buainain, the current CEO, joined the company.

Ibrahim Al-Buainain is the President & CEO of Aramco Trading Company. He is also the president and CEO of Aramco Chemicals Company, a wholly-owned subsidiary of Saudi Aramco serving as the marketing and sales arm of the company's petrochemical products from its subsidiaries in the kingdom of Saudi Arabia and around the globe.

Al-Buainain was appointed as President & CEO of ATC in 2016, and has 30 years of diversified experience in the oil and gas industry. He has previously been the global head of Transaction Development in New Business Development, charged with executing joint ventures, merger and acquisition divestitures, as well as other transactions.

Al-Buainain joined Saudi Aramco in 1989 as an operation engineer at Ras Tanura Refinery. In 1995, he was appointed a lead project engineer for the Shaybah program.

From 1998 to 2004, he worked with the Saudi Aramco Joint Venture Company in South Korea (S-Oil) as the General Manager, responsible for trading and logistic activities of crude oil, refined products, and chemicals.

In 2004, Al-Buainain became a portfolio manager for all Saudi Aramco International Joint Ventures, and in 2007 he was named the Director of the Asia Joint Venture Department.

In 2009, he was assigned as the Director for the Rabigh Phase-II development project — a joint venture between Saudi Aramco and Sumitomo Chemical.

From 2011-2013, Al-Buainain was the Director of the Structuring and Venturing Department — responsible for the development and implementation of sustainable and growth-oriented business models. In parallel to this, he was appointed as CEO of Saudi Aramco Energy Ventures.

In 2014, Al-Buainain became President & CEO of Aramco Asia, which supports Saudi Aramco's corporate strategic objectives in the Asia-Pacific region.

Al-Buainain holds a Bachelor's degree in Mechanical Engineering, an MBA in Global Management, and a Master's degree in Innovation and Global Leadership from Massachusetts Institute of Technology (MIT).



James Torgerson
Chief Executive Officer
AVANGRID

AVANGRID

As one of the cleanest U.S. utilities and a leader in renewable energy, AVANGRID stands at the forefront of the nation's transformational change in how we generate and use energy. Through our utilities and our renewables businesses, we are positioning ourselves as a pioneer in the U.S. offshore wind industry, building the grid of the future, and developing clean and smart solutions for our customers.

Based in Orange, Connecticut, AVANGRID trades on the New York Stock Exchange under the ticker symbol AGR. It is the U.S. affiliate of Iberdrola, S.A., the world's largest clean energy company.

AVANGRID has two primary lines of business: Avangrid Networks and Avangrid Renewables. Avangrid Networks owns eight electric and natural gas utilities, serving 3.25 million customers in New York and New England. Avangrid Renewables owns and operates 7.2 gigawatts of electricity capacity, primarily through wind power, with a presence in 22 states across the United States. AVANGRID employs approximately 6,500 people.

AVANGRID takes the challenges posed by climate change seriously. In 2016 the company pledged to reduce emissions intensity from its power plants 25% by 2020, compared with a 2015 baseline, and for its generation facilities to be 100% carbon neutral by 2035 — making it the first U.S. utility to set a goal for carbon neutrality. In 2018, AVANGRID's CO₂ emissions intensity was 54 grams of CO₂ per kilowatt-hour of electricity produced (119 pounds/megawatt-hour). This is approximately a 15% reduction compared with the 2015 baseline, and eight times lower than the 2018 U.S. utility average.

The Avangrid Networks electricity and natural gas distribution companies are piloting and deploying sustainable, industry-leading technologies to adapt to rapid changes in how energy is generated and consumed. These areas of innovation include microgrids, fuel cells, energy storage and electric mobility.

In order to mitigate the potential impacts of increasingly frequent and severe storms, Avangrid Networks' electric distribution companies are developing major initiatives to improve the efficiency and resiliency of our system, which are expected to be completed in the coming years.



Lorenzo Simonelli
Chairman, President
& Chief Executive Officer
Baker Hughes



Taking Energy Forward

Baker Hughes (NYSE: BKR) is an energy technology company that provides solutions for energy and industrial customers worldwide. Built on a century of experience and with operations in over 120 countries, our innovative technologies and services are taking energy forward—making it safer, cleaner and more efficient for people and the planet.

Baker Hughes operates across four business segments – Oilfield Services, Oilfield Equipment, Turbomachinery and Process Solutions, and Digital Solutions – as the only fullstream technology company in the industry. We have the scope and scale, portfolio and expertise to drive better outcomes and optimize solutions across markets and industries and through cycles.

From the first rotary drill bit to the world’s most extensive portfolio of compressors and gas turbines, and from digital solutions that predict outcomes to modular deepwater technology, for more than a century our inventions have been revolutionizing the industry.

As an energy technology company, we are committed to reducing the carbon intensity of our operations, applying proven low-carbon technology to help our customers meet their environmental goals, and innovating for the future of energy.

Our People, Planet, and Principles framework grounds and guides our responsibility to sustainable operations and enables us to accomplish our business priorities while doing our part to progress shared global goals and commitments.

In 2019, Baker Hughes formally joined the UN Global Compact corporate responsibility initiative and committed to its principles in the areas of human rights, labor, the environment and anti-corruption.

Visit us at bakerhughes.com.

Statistics:

Operate in 120+ countries worldwide with more than 67,000 employees, including 9,000 engineers and scientists

In 2018, earned \$23 billion in total revenue, invested \$700 million in R&D, and launched 100+ new products

Oversee four innovation and technology centers and 13 product development centers globally

Achieved a 34% reduction, since 2012, in scope 1 and 2 emissions across our global operations

Committed to 50% reduction in CO₂ equivalent emissions by 2030 and to achieve net zero CO₂ equivalent emissions by 2050



Innovation at work

Powering More for Less

Established in 2001, Bruce Power is Canada's only private sector nuclear generator, annually producing 30% of Ontario's power at 30% less than the average cost to generate residential power.

Bruce Power is a Canadian-owned partnership of TC Energy, Ontario Municipal Employees Retirement Systems (OMERS), the Power Workers' Union and The Society of United Professionals. A majority of our employees are also owners of the business.

Ontario is counting on Bruce Power to provide a reliable and carbon-free source of affordable energy through 2064. To do so, Bruce Power has signed a long-term agreement with the province to refurbish six of its eight units, investing \$13 billion private dollars into these publicly-owned assets. Bruce Power's Life-Extension Program will create and sustain 22,000 jobs annually, while injecting \$4 billion into Ontario's economy each year.

Bruce Power employs more than 4,000 people and, over the past 18 years, has been one of the largest investors in Ontario's electricity infrastructure, providing billions in private dollars to the Bruce Power site, which continues to be owned by the province. The site is leased under a long-term arrangement where all of the assets remain publicly-owned while Bruce Power funds all infrastructure upgrades, makes annual rent payments, and pays for the cost of waste management and the eventual decommissioning of the facilities.

Bruce Power has also partnered with the local communities to ensure economic benefits from our Life-Extension Program are leveraged across the region. To date, nearly 60 nuclear suppliers are having a local impact creating local jobs and career opportunities.

Another way Bruce Power positively impacts millions of people is through the world's health-care system. Bruce Power produces Cobalt-60, which helps sterilize 40% of the world's single-use medical devices and equipment, such as sutures,

Mike Rencheck
President & Chief Executive Officer
Bruce Power



gloves and syringes. Bruce Power also produces medical-grade Cobalt-60, which treats brain tumours and other cancers. For many brain cancers, Cobalt-60 is one of the most precise and advanced forms of radiation treatment available. Bruce Power has also announced plans to be a world producer and exporter of an isotope to treat prostate cancer, while exploring a range of other isotope opportunities.

Bruce Power and our employees are extremely active in our communities across Bruce, Grey and Huron counties. Every year, we invest about \$2 million into our communities through the Sponsorship and Community Investment Program, our Indigenous initiatives, an Environment and Sustainability Fund, and more than \$100,000 in annual elementary, secondary and post-secondary educational scholarships.

Bruce Power has a bright future as we embark on our Life-Extension Program and continue to deliver affordable, clean, reliable energy and medical isotopes for generations to come.

Statistics:

Bruce Power generates 30% of Ontario's electricity at less than 30% of the average cost to generate residential power

Provides 6,400 megawatts of low-cost, reliable and carbon-free energy

Employs 4,200 full-time employees

Creates and sustains 22,000 jobs across the province each year

\$1.2 billion annual investment in Ontario labour income

Bruce Power produces Cobalt-60, which helps sterilize 40% of the world's single-use medical devices and equipment

70% of the energy the province of Ontario needed to shut down coal plants was provided by Bruce Power



Jack A. Fusco
President & Chief Executive Officer
Cheniere Energy, Inc

About Cheniere Energy, Inc.

Cheniere Energy, Inc. is an international energy company headquartered in Houston, Texas, and is the leading producer of liquefied natural gas in the United States. We provide clean, secure, and affordable energy to the world, while responsibly delivering a reliable, competitive, and integrated source of LNG, in a safe and rewarding work environment.

In February 2016, Cheniere became the first company to ship LNG from a commercial facility in the contiguous United States. Since startup, more than 850 cumulative cargoes of LNG originating from Cheniere have been delivered to 32 countries and regions worldwide. And today, Cheniere is a top-5 global provider of LNG.

LNG is natural gas in liquid form. It is produced through a refrigeration process that drops the temperature of natural gas down to -260 degrees Fahrenheit, at which point it converts to liquid, and its volume shrinks by 600 times, enabling global transport in LNG carriers. LNG is non-toxic and non-flammable. When burned, natural gas emits less carbon than coal and oil, with significantly less traditional air pollutants.

In support of our global reach, Cheniere has additional offices in London, Singapore, Washington, Beijing, and Tokyo.

Our facilities

Cheniere is operating, constructing, and developing two LNG facilities on the U.S. Gulf Coast. Cheniere's Sabine Pass liquefaction facility (SPL) is located in Cameron Parish, Louisiana, and currently has five fully-operational liquefaction units, or "trains" as they are known in the LNG industry. A sixth train at SPL has all necessary permits, reached FID in June 2019, and is nearly 40% complete. When all six trains are completed, the aggregate nominal production capacity of SPL is expected to be approximately 27 million tonnes per annum (mtpa) of LNG.

Cheniere's Corpus Christi liquefaction facility (CCL) in South Texas is the first greenfield LNG export facility in the U.S. lower 48, and began operations in 2018. Train 1 and 2 are operating

and Train 3 is expected to be fully operational in 2021. When all three trains are completed, the aggregate nominal production capacity of the CCL Project is expected to be approximately 13.5 mtpa of LNG.

Our business model

Cheniere is a full-service LNG provider. We purchase natural gas from the robust, transparent, and liquid U.S. natural gas market in multiple states and Canada, process the natural gas into LNG, and offer our customers the option to load the LNG onto their vessels at our terminals, or we will deliver the LNG to regasification facilities around the world.

Approximately 80 percent of Cheniere's expected aggregate LNG production capacity, either completed or under construction, is contracted through long-term agreements with investment-grade customers. The remaining volumes of LNG we can produce are available for our integrated marketing unit to sell into the market. That gives Cheniere the unique combination of long-term, contracted stable cash flows, with marketing opportunities driven by shorter-term natural gas supply and demand fundamentals in markets worldwide.

Natural gas is transported to Cheniere's LNG facilities on 3rd party pipelines on which we own firm transportation capacity, as well as on pipelines Cheniere has constructed, owns, and operates.

Our commitment to safety and the environment

At Cheniere, each employee has the responsibility to preserve and protect the environment, conduct operations in a safe manner, and recognize the potential impacts of our operations on our communities and customers. These responsibilities help us achieve our overall environmental and safety goals, and our long-term, holistic, and successful corporate sustainability program.

Cheniere's LNG terminals and pipelines are designed to meet or exceed U.S. federal codes and standards and we use the best technology available to manage safety and environmental challenges at all locations.



Paula Gold-Williams
President & CEO
CPS Energy



CPS Energy

CPS Energy has been in the business of powering Greater San Antonio and the dreams of our customers for more than 159 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 municipally owned electric and natural gas company.

Through our vertically-integrated business model, we provide secure, safe, reliable, resilient and environmentally-responsible electric services to more than 1 million customers. Further, combined (electric and gas) bills are affordable, with residential bills ranking lowest when compared to the 20 largest U.S. cities.

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.

CPS Energy is an innovative and strategic utility company driving clean energy and energy efficiency through multiple paths, including our New Energy Economy (NEE) and the Save for Tomorrow Energy Plan (STEP). Through our NEE partners, a solar manufacturing hub was created in our community and has attracted companies committed to clean energy and energy efficiency. CPS Energy's strategic alliance with its NEE partners is currently reaping \$1.2 billion annually in economic impact, has installed 400 MW of solar, and has brought millions in educational investment within the San Antonio area.

Meanwhile, along with our community, CPS Energy will meet the goals of our STEP, which called for saving 771 MW – the equivalent of a large power plant – by 2020. Energy efficiency technology provided by NEE partners along with rebates, incentives and a robust weatherization program have all helped us achieve the STEP targets early and under budget.

Ranked as one of the best-managed and most economical utilities in the nation, CPS Energy is positioned to handle present needs as well as the vibrant future growth expected in the San Antonio area.

Sound financial management enables the utility to enjoy AA+, Aa1, and AA ratings from Fitch Ratings, Moody's Investors Service, Inc., and Standard and Poor's Rating Services, respectively.

Statistics:

Year Founded: 1860

Assets: \$11 billion

Payment Towards City's General Fund (since 1942): \$7.6 billion

Credit Rating: AA+ Credit Rating

Employees: More than 3,000

Customers: More than 1 million

Service Territory: Approximately 1,515 square miles to include 8 counties & 31 suburban cities

2019 Rankings:

- No. 1 – Largest Municipally Owned Electric & Gas Utility in the U.S.
- No. 1 – Largest Solar Power Producer in Texas
- No. 2 – Wind Power Producer in Texas
- No. 7 – Solar Power Producer in the U.S.



ENGIE

ENGIE is global energy player operating on five continents. We aim to become, along with our 160,000 employees, the world leader in the zero-carbon transition “as a service” for our clients, relying on our key activities: renewable energy, gas and services.

ENGIE is active at each link of the energy value chain.

Our expertise breadth enables us to be a one-stop shop with solutions meeting customers’ increasingly sophisticated needs.

Operating at the heart of ENGIE, our global energy management solutions experts develop our midstream business worldwide, specializing in risk management and trading, with an expertise built over 20 years optimizing the Group’s asset portfolio.

With a 1,350 staff developing this business in 16 offices worldwide and 5 trading platforms (Houston, Singapore, Paris, Brussels, Rome,) we cover the full energy mix, serving clients across the value chain, from upstream producers to downstream prosumers. Our global reach and strong local presence enable us to offer diverse profiles customized services and help them make the most of rapid changes in mature or emerging markets. Our offer includes energy supply & global commodities; energy transition services; risk management & market access; asset management.

We are growing into a reference global green midstreamer, linking clients wanting to lower their carbon footprint and source green energy to renewable asset owners. We provide green corporate PPAs; global & local flexibility services; power optimization for renewable producers; local smart grids solutions. Strongly focused on digitalization, we develop e-services such as digital client platforms, web apps and blockchain-based solutions.

ENGIE is committed to building an ever-closer relationship with its customers and territories.

This reflects in our Group’s organization including several business units in Europe and around the world.

With a long-standing presence in the US and Canada and 6,000+ employees in the region, we help customers decarbonize, decentralize, and digitalize their operations, with comprehensive services including clean power generation; energy storage; and retail energy supply comprising renewable, demand response, and on-bill financing options. As part of ENGIE North America and as the US n°1 distributed energy storage company, ENGIE Storage serves energy producers, distributors, and consumers, including utilities, network operators, and energy consumers in business and government.

ENGIE ambitions to provide energy access for all around the world and has developed a strong presence in emerging countries. Our activities in Africa well illustrate this commitment.

3,000 employees are dedicated to developing throughout the continent centralized and decentralized power generation solutions and energy services, improving energy efficiency. Our Group provides Africa with innovative and integrated responses to unprecedented challenges in terms of energy needs.

Our Africa portfolio now includes 3,000 MW of electricity generation facilities, in operation and in construction in Morocco, Egypt, Senegal and South Africa; service activities in Morocco, Tunisia, Algeria, South Africa, Mozambique, Côte d’Ivoire, Burkina Faso, Mali, Senegal, Ghana and Niger; decentralized power generation, mini-grids development and Solar-Home-Systems (SHS) in 9 countries, serving over more than 4 million Africans.

Statistics:

€61Bn revenues

104.3 GW installed power production capacity

24.8 GW of installed renewable capacity

1st IPP worldwide

1st globally in micro-grids

1st European gas infrastructure operator

1st globally in cold distribution networks



Golden Pass LNG terminal in Sabine Pass, Texas, where export facilities are under construction.



Golden Pass LNG

Golden Pass LNG, owned by affiliates of Qatar Petroleum (70%) and Exxon Mobil Corporation (30%), two leading energy companies with an unrivaled record of producing, shipping and marketing natural gas globally, is adding liquefaction and export capabilities to its existing liquefied natural gas terminal in Sabine Pass, Texas.

Golden Pass LNG's existing terminal includes five 155,000 m³ LNG storage tanks – each large enough to hold the volume of 62 Olympic-size swimming pools, two marine berths that can accommodate the largest LNG carriers in the world and a 69-mile pipeline with nine interconnects to interstate and intrastate pipelines.

Construction on the new project began in the second quarter of 2019. The three train, around 16 million ton per year, liquefaction plant is expected to start up in 2024. Additionally, once operational, Golden Pass will be one of the largest purchasers of natural gas in the country.

The project is an approximately \$10 billion investment that will generate billions of dollars of economic growth and millions of dollars in annual taxes to local, state and federal governments. The project will also generate tens of thousands of jobs across the life of the facility, including approximately 19,000 construction jobs over five years with peak employment reaching around 7,000 jobs. During operations, the project will create more than 200 new, permanent jobs.

Golden Pass LNG's vision is to be the premier LNG exporter in North America by integrating our core values of people, integrity, safety, community and environment in everything we do, and ensuring the lowest cost of supply across our value chain.

With the future in mind, Golden Pass is demonstrating innovation in facility design and construction. It will: (1) be a best in class U.S. Gulf Coast LNG terminal, (2) utilize an efficient design, and (3) demonstrate superior reliability.

Best in Class US Gulf Coast Terminal

- Three LNG Process Trains (APCI C3/MR technology)
- Stringent oxide elimination technology on main equipment
- Repurposing existing terminal and pipeline facilities to minimize incremental socio and environmental impacts

Efficient Design

- One of the most fuel-efficient designs
- Waste heat recovery (steam generation) units on gas turbines driving 100 MW Steam Turbine Generators (one per train) for zero emission power generation

Superior Reliability

- Self-generated electrical power, not grid dependent
- Proven GE Frame 7 gas turbine drivers
- Enhanced storm protection levee to deter flooding
- Highly experienced shareholder and employed operational / maintenance staff

Golden Pass is also utilizing a unique approach to maximize use of local businesses and the local workforce. The company's Opportunity Roadmap program is designed to help Southeast Texas residents and businesses take advantage of unprecedented industrial growth in the region. Together with our community, we will achieve our mission to bring clean energy from Texas to power the world.

Visit GoldenPassLNG.com for more.

Statistics:

\$10 billion investment

One of the largest buyers of natural gas in the United States at 2.6 bcf/day

Best in class LNG terminal with superior reliability

19,000 construction jobs, 7,000 at peak

200+ new, permanent jobs

Five 155,000 m³ LNG storage tanks

Two marine berths to accommodate the largest LNG carriers in the world

Startup expected in 2024



Bruce Grewcock
Chairman & CEO
Kiewit



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. .

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 2018, Kiewit had revenues of \$9 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

2018 Revenue	\$9 billion
Workforce	20,000 employees
Equipment fleet	15,000 units with a replacement value of \$2.5 billion
2019 ENR rankings	<ul style="list-style-type: none"> – No. 1 Fossil Fuel – No. 2 Power – No. 5 Overall Top Contractor – No. 5 Design-Build Firm



North Atlantic Refining Limited Partnership

Located in Come By Chance, Newfoundland and Labrador, Canada, North Atlantic Refining Limited Partnership (NARL) is an independent refinery committed to building a long-term sustainable business. The refinery is adjacent to one of the largest hydrocarbon basins in the world and can process 135,000 barrels per day.

NARL has seen many changes since it was founded in 1973, but none as significant as its 2014 purchase by Silverpeak, a merchant bank based in New York City. The company made NARL the cornerstone asset of its integrated energy platform which also includes oil exploration and production, fuel distribution, and renewable power. There was a time NARL was considered a non-viable business, but with a fighting spirit; the support of its employees, union, and provincial government; and targeted investment in growth and improvement, NARL is now set to become the fourth largest refinery in Canada by 2021.

In 2016, NARL changed its business model to become a merchant refinery, requiring significant reorganization of the company's workforce and development of existing functions. To support these changes, NARL invested in the development of IT software and new work processes, which ultimately resulted in a more efficient enterprise. The company continues to take an innovative approach to operating a refinery led by a dynamic, diverse, and capable workforce.

Being a safe and reliable operator is in the core belief system of its leaders, supervisors, and front-line employees. This is evidenced by the company's safety record—exceeding 2.5 million person hours worked without a Lost Time Accident. NARL's corporate values also include diversity and inclusion to offer new points of view, innovation to foster creativity and challenge conventional wisdom, as well as transparency.

NARL is Newfoundland and Labrador's second-largest private employer with 600 hardworking employees, many of whom are second, and even third-generation members of the NARL family. Under the leadership of Silverpeak, NARL has developed

Kaushik Amin
Partner, Silverpeak and Board Chair,
North Atlantic Refining
Limited Partnership



programs to offer significant professional development and career opportunities for the local workforce. In particular, since Silverpeak's acquisition in 2014, opportunities for women in technical and leadership fields have grown tremendously.

The refinery now contributes more than \$300 million to Newfoundland and Labrador's economy and accounts for 5% of the province's GDP annually. In addition to oil refining, the refinery's affiliates own the Orangestore brand of convenience stores, an agricultural chemical sulfur business, a marine business with three Canadian-flagged vessels, and distributes propane and home heating oil to more than 50,000 customers.

NARL has transformed from a niche refinery to a market-responsive, operationally excellent, and environmentally sensitive refinery. With a number of innovative projects on the horizon to further increase productivity and reduce its environmental footprint, excellence will remain at the core of NARL's strategy as it moves closer toward its vision for long-term sustainable refinery.

Statistics:

Improved performance with daily refining capacity now surpassing 135,000 barrels of oil

Exceeding 2.5 million person hours worked without a Lost Time Accident

Since 2008, achieved a voluntary 43% reduction in absolute air emissions with an intensity-based reduction surpassing 55%

Contributes more than \$300 million to the local economy and accounts for 5% of Newfoundland's GDP

Second largest private employer in Newfoundland and Labrador with 600 hardworking employees



ROYAL PRIMA PETROLEUM

Royal Prima Petroleum, LLC Dynamically Infusing Technological Advancement

Royal Prima Petroleum, LLC, is a Houston, Texas based company working persistently to fulfill the ever-increasing demand for petroleum fuel products both in the U.S. and internationally. At RPP, we expect and demand the highest level of performance from ourselves, our providers, suppliers and our transportation contractors. Placing a great emphasis on conducting our business with honest and integrity, we treat our community, clients, employees, and business partners with fairness and sincerity, while relentlessly pursuing excellence in our services.

Our company's multifaceted mission allows us to easily adapt to the fluid conditions of the energy market. Firstly, in the petroleum sector, RPP has the dual focus of economically increasing crude oil exploration and extraction, as well as reducing the carbon footprint of energy production through improving clean fuel technology. Consequently, we are able to increase profitability for the company's shareholders and clients, while also bringing long-term benefits to our surrounding community. Geographically, RPP and its associates focus on business growth in various regions of North America, as we aim to generate higher returns through maximizing recovery and minimizing costs through continuous technological improvements.

In addition to providing petroleum products and services, RPP continues to advance innovations in co-generational technology, so that we can aid the industry-wide effort to sensibly expand production to meet growing energy demands, while simultaneously taking extra measures to safeguard the environment, such as fully and thoroughly securing project sites.

Bryan Martinez,
CEO, Director
Royal Prima Petroleum



Tracey Martinez,
COO, Director
Royal Prima Petroleum



Furthermore, RPP has a particular emphasis on generating opportunities for veteran-owned and operated companies. We are committed to helping our fellow brothers and sisters who served in the armed forces to achieve their aspirations, and allocate to veterans-owned businesses many rewarding contracts for fuel or services coming from both the government and private sectors, often times with well-established end users such as the U.S. Postal Service and the U.S. Navy.

In short, Royal Prima Petroleum keenly understands the importance of providing our community and clients with the best products and services within the energy industry. To that end, by utilizing our unique knowledge, experience, and resources, we are able to continuously bring forth cutting-edge advancements and innovations to our field. The dedicated team of professionals at RPP never cease our tireless endeavor to find and implement the most suitable applications for our innovative technologies, which allows us to creatively and efficiently maneuver through the ever-changing landscape of the energy market, to the betterment of our clients, business partners across the industry and the World.



Jeffrey W. Martin

Chairman and Chief Executive Officer
Sempra Energy

Sempra Energy: Investing in North America's Energy Infrastructure

At Sempra Energy, we are always looking for new and better ways to serve our customers. It drives our employees' sense of purpose every day. We believe that improving the lives of those we serve also helps make our company even more valuable for all our stakeholders.

We're currently charting a new purpose-driven path to advance our strategic mission – to be North America's premier energy infrastructure company. Our employees are working to deliver energy with purpose to 40 million consumers worldwide, advancing communities through the power of people, ideas and innovation.

We are focused on the most attractive markets in North America, including three of the top 15 economies in the world: California, Texas, Mexico. We have a narrow focus within the value chain of electric and natural gas infrastructure, and are well-positioned to serve important emerging markets, including North America's liquefied natural gas (LNG) export market with a goal of delivering 45 Mtpa to the largest world markets.

At Sempra, we are driven by the role we can play in enabling the energy transition ahead. Using abundant, clean and low-cost natural resources, Sempra is helping reduce the U.S. trade deficit, create jobs, meet global energy demand and improve the energy security of the nation's allies.

This strategic focus is paying off for shareholders. Sempra delivered approximately 832% in total shareholder return from 1998 to 2018 — well above the industry average. Financial performance ends with the numbers, but starts with exceptional management bench strength, including differentiated capabilities to accelerate innovation, manage risk and seize opportunities.

Led by Chairman and Chief Executive Officer Jeffrey W. Martin, Sempra's 20,000 employees are united by our values to do the right thing, champion people and shape the future. We know

that improving the lives of those we serve also helps make our company even more valuable to all our stakeholders and we are proud to be consistently recognized for our leadership in diversity and inclusion and social responsibility.

Sempra is the only North American utility holding company named to the Dow Jones Sustainability World Index. We concluded years ago that low-carbon energy delivery was the best business model and have spent the last decade driving down impacts, improving environmental, social and governance disclosure, and meeting customers' needs for cleaner forms of energy.

Sempra's family of companies include:

IEnova

IEnova develops, builds, and operates energy infrastructure in Mexico, and is one of the largest private energy companies in the country with operations in 17 of Mexico's 32 states.

Oncor Electric Delivery Company LLC

Oncor, based in Dallas, operates the largest distribution and transmission system in the state, providing safe and reliable service to approximately 10 million Texans.

San Diego Gas & Electric

SDG&E is an electric and natural gas utility that provides clean, safe and reliable energy to approximately 3.7 million consumers in San Diego and southern Orange Counties.

Sempra LNG

Sempra LNG develops, builds and invests in liquefied natural gas facilities in North America. The company is currently pursuing development of five strategically located LNG export projects in Texas, Louisiana and Mexico, with a goal of delivering 45 Mtpa to the largest world markets.

Southern California Gas Company

SoCalGas is the largest natural gas distribution utility in the U.S., providing safe, reliable, and increasingly renewable natural gas service to approximately 21.9 million consumers.



Bjørn Einar Brath
Chief Executive Officer
Siemens Offshore Solutions



Siemens Gas and Power

Siemens Gas and Power (GP) is a global pacesetter in energy, helping customers meet the evolving demands of today's industries and societies. GP comprises broad competencies across the entire energy value chain and offers a uniquely comprehensive portfolio for utilities, independent power producers, transmission system operators, the oil and gas industry and other energy intensive industries. Products, solutions, systems and services address the extraction, processing and the transport of oil and gas as well as power and heat generation in central and distributed thermal power plants, power transmission and grid stability, as well as energy transition technologies including storage. With global headquarters in Houston and more than 64,000 employees in more than 80 countries, Siemens Gas and Power has a presence across the globe and is a leading innovator for the energy systems of today and tomorrow, as it has been for more than 150 years.

Making a difference for the future of energy

The world is evolving rapidly, with global population expected to rise nearly 30 percent by 2050. So are the challenges. Today, more than one billion people lack access to power, and atmospheric CO₂ is at its highest level in 3 million years. The solutions must evolve as well, if we are to meet society's growing demand for clean energy. Combining engineering and digital expertise with an extensive technology portfolio, Siemens Gas and Power is leading the charge. We are securing energy supply, making energy greener and making digital happen.

Securing energy supply

Global energy demand is growing. Both renewables and fossil fuels are integral to the energy mix of the future. Our Siemens-Gamesa joint venture is the largest wind energy company in the world. In addition, we are driving utilization of natural gas—a clean, abundant, and economical 'bridge fuel'—through extensive gas-to-power capabilities. Our portfolio includes integrated engineering solutions for pipelines, LNG and power generation plants. Concurrently, we are pushing the technological envelop to harness offshore resources sustainably and cost-effectively.

Making energy greener

In addition to reducing emissions through gas utilization, we develop technologies to make oil and gas activities greener—from unconventional plays to offshore platforms. In addition, we are actively developing next-generation hydrogen power solutions to contribute further to emissions reduction.

And making digital happen

Advances in sensor technology and data analytics have paved the way for industrial asset optimization across all verticals, including oil and gas. We use machine data to predict and preempt the failure of critical equipment, thereby enhancing safety and efficiency. Similarly, artificial intelligence enables asset performance management at the fleet level. Other areas of opportunity include additive manufacturing and virtual reality. Additive manufacturing makes it possible to 'print' spare parts and components on demand, and so-called 'digital twins' enable design, testing and training in virtual, risk-free environments. We are active in all these digital domains.



Sterlite Power – Leading Global Developer in Power Transmission

Sterlite Power is a global developer and solution provider of power transmission infrastructure. We are driven by our core purpose of “Empowering humanity by addressing the toughest challenges of energy delivery”. We believe that access to electricity transforms societies and delivers long-lasting social impact. Therefore, access to Reliable Power should be a Fundamental Right. Our core purpose has shaped our journey right from inception, and today we have growing operations across India and Brazil. Our Global Infrastructure business has a portfolio of 24 assets with capex of \$5.6 Bn spanning 13,315 circuit kms and 23,885 MVA. Our Solutions business helps power utilities address their network congestion challenges by upgrading and uprating existing infrastructure. With an industry-leading portfolio of power conductors, EHV cables and OPGW, we also export to 60+ countries. In our Convergence business, we build efficient optical ground wire network to deliver high-speed data over existing power transmission lines. The company has set new benchmarks in the industry by using cutting-edge technologies and innovative financing. Sterlite Power is the sponsor of IndiGrid, India’s first power sector Infrastructure Investment Trust (“InvIT”), which has recently attracted investment from KKR and GIC.

The renewable revolution, electrification of transport, and a global demand for long-term yield assets, are together creating an unprecedented opportunity globally for the transmission sector. We are excited to be leading this space with our unique capability of addressing the toughest challenges around Time-Space-Capital.

Pratik Agarwal

Group Chief Executive Officer
Sterlite Power



Innovation and sustainability are the cornerstones of our business. We leverage the best of technologies like helicrane, drone-stringing, robotics, LIDAR, data analytics and digital platforms across the lifecycle of our transmission projects. Project management is our core competence. Testimony to this is Sterlite Power winning the IMPA Global Project Excellence ‘Gold Award’ in the mega sized projects category in 2019. We take pride in delivering our projects ahead of schedule with the highest standards of Quality & Safety. As a responsible corporate citizen, conservation and caring for the environment is our second nature.

Statistics:

Leading global developer in Power Transmission

Portfolio across India & Brazil: 24 transmission projects, US\$ 5.6 Bn, 13315 circuit kms

Largest manufacturer of power conductors in India, export to 60+ countries

Purpose driven organization with more than 1100 employees globally

Sponsor of India’s first Infrastructure Investment Trust (IndiGrid)

Innovative technologies: Helicranes, Drone Stringing, Live line reconductoring, LIDAR

Awards & Recognition: IPMA Gold award winner in 2019 in mega projects category, S&P Global Platts Global Energy Awards 2019 Finalist, ROSPA Gold award for Safety, EEF Global Sustainability award



Mohammad N. Al-Naghash
 President & Chief Executive Officer
 Yasref

Yanbu Aramco Sinopec Refining Company (YASREF)

The Yanbu Aramco Sinopec Refining Company (YASREF) is a joint venture between Saudi Aramco (62.5 percent ownership) and Sinopec (37.5 percent). The Company operates a world class full-conversion refinery constructed on the Red Sea that processes more than 400,000 bpd of crude oil into gasoline, high quality diesel, and liquefied petroleum gases (LPG) as well as byproducts including sulfur and petroleum coke for export. The refining complex was designed to process predominantly Arabian heavy crude oil.

The Refinery is a product of the Kingdom of Saudi Arabia's strategy to address global energy demand while attracting foreign investment to expand the country's economy. Due to its diet of large quantities of heavy crude, not only does the facility ease tight refining capacities but it also addresses the mismatch between the available crude supplies and current refinery configurations that complicate the industry worldwide.

Within a few years of breaking ground on the project, YASREF generated thousands of direct and indirect jobs for the community (with 40,000 workers on site at peak construction). Also, the joint venture enrolled approximately 700 Saudi employees in the apprentice program in order to ready them to assume full jobs in operations, maintenance, industrial relations and engineering activities. The Project was committed to support the Kingdom and Region's economy by localizing engineering expertise and promoting the Saudization concept in the industry. Now in production as a fully-operating facility, YASREF has continued that commitment. As a fully operating refinery, YASREF has generated 1,200 direct employment opportunities in the Kingdom and some 5,000 additional indirect jobs through industrial development.

The construction of YASREF's 400,000 bpd heavy oil refining facility on a 5.2 square kilometer plot represented numerous environmental and logistical challenges given its location on the environmentally sensitive Red Sea and next to the historic fishing and commercial shipping city of Yanbu. In order to be sensitive to the potential impacts of their operations, YASREF took care during the engineering and design phase to mitigate or avoid any impacts on the ecosystem by selecting the pipeline corridors that connected the site to the marine

terminal away from any coral reefs and mangrove conservation areas. This was done despite the extra cost of engineering and constructing of these pipelines corridors. From the beginning, YASREF was committed to protect the environment and has been in full compliance with local and international environmental guidelines and legislation.

The Project FEED started in mid-2006 with the initial scoping project completed in mid-2008. The Project was engineered, procured and constructed under 18 different EPC lump sum type contracts, which were awarded between August and October 2010. The construction started in February 2011. The final phase of construction was completed in September 2014. The Project was completed on time and substantially under budget.

The original budget for the project was \$12.9 billion USD but actuals are just over \$7 billion USD (final #'s need to include the new administration building due for completion in December, 2015).

Refinery products include:

287,000	barrel per day (bpd) of Diesel
105,000	barrel per day (bpd) of Gasoline
16,000	barrel per day (bpd) of Butane
5,000	barrel per day (bpd) of Propane
400	ton per day (TPD) of Benzene
1,200	ton per day (TPD) of Pelletized Sulfur
6,200	ton per day (TDP) of Petroleum Coke

US Crude Exports

Bellwether or blip?

The industry uses S&P Global Platts US crude export price assessments for greater transparency, certainty and confidence in a new phase of market development.



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Make sense of crude exports with our data and insights, along with market access via Platts eWindow.

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**A natural
gas supplier
who goes the
EXTRA MILE
after mile
after mile
after mile...**

From miles of infrastructure to the people who never stop working to help your business succeed, we go beyond expectations at every turn. We design world-class comprehensive strategies, customized natural gas plans, competitive pricing options and more that are trusted by over 100,000 customers in over 30 states. It's our products and our people behind them that make us one of America's most trusted energy partners and a winner of the 2018 Mastio Quality Award.



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