



A Fine Balance: Energy Outlook for 2020

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Energy Industry Report

The Abdullah Bin Hamad Al-Attiyah International Foundation for
Energy & Sustainable Development





INTRODUCTION

A FINE BALANCE: ENERGY OUTLOOK FOR 2020

2020 will be a year of fine balance for energy. Geopolitics and the economy will influence the demand for energy and its price, while potentially also affecting supply.

The world economy is showing some modest signs of improvement, though trade wars and Brexit remain worries.



Energy Industry Report

This research paper is part of a 12-month series published by the Al-Attiyah Foundation every year. Each in-depth research paper focuses on a prevalent energy topic that is of interest to the Foundation's members and partners. The 12 technical papers are distributed in hard copy to members, partners and universities, as well as made available online to all Foundation members.



EXECUTIVE SUMMARY

- The US-China, US-Iran and West-Russia confrontations are key areas of potential dispute, though likely not outright conflict. Local protests have spread widely in 2019 and can disrupt economies and energy production and transit sites.
- Mostly incremental advances in energy technology are expected, with fossil fuels and renewables both improving in cost and environmental impact.
- Deployment of wind, solar, batteries and electric vehicles will continue at a rapid rate, as they become increasingly less dependent on subsidies. Progress in solar PV and offshore wind is particularly impressive.
- Oil and gas markets will remain well-supplied, and prices under pressure, although they may begin tightening later in 2020.
- 2020 may be the year that global coal demand peaks.
- Government and corporate policy is increasingly favouring renewable energy and moving away from the financing, insuring and use of all fossil fuels, including gas as well as coal.



IMPLICATIONS FOR LEADING OIL AND GAS PRODUCERS

- Market conditions are likely to be somewhat better than expected a few months ago, but oil and especially gas still face a tough 2020, with well-supplied markets and downward price pressure. But it could be a favourable time to begin investing for improved conditions around 2021-24, with a slowing of shale growth and few new LNG FIDs reaching market at this time.
- Consolidation is likely in the US shale sector and in private equity-backed European firms, and could present an opportunity for well-funded oil companies to acquire assets.
- Long-term market strategies have to be set with the backdrop of a likely continuing US-China confrontation; more tariffs and other trade restrictions; continuing widespread use of sanctions on various countries and companies; political unrest and volatility; and a threatening situation in the Gulf.
- Major oil- and gas-producing countries have to move quickly to safeguard their market, by continuing to clean up their production, and mapping a clear path to climate-compatible use of hydrocarbons, including with carbon capture, use and storage (CCUS) and direct air capture (DAC).
- Growing bans on single-use plastics are a moderate threat to petrochemical demand growth.

A YEAR OF FINE BALANCE FOR ENERGY

The grand picture of world energy in 2020 will be shaped by the balance within two forces: geopolitics, and the economy. Technology will continue to open up the space of energy possibilities, but government and corporate policy will influence which roads are chosen.

The period from late 2019 through 2020 will be punctuated by several key dates. Of course, unexpected events will also intervene and shape the agenda at key meetings such as those of the WTO and OPEC.

TABLE 1 KEY POLITICAL, ECONOMIC AND ENERGY DATES IN LATE 2019 AND 2020

5th December 2019: Pricing of Aramco shares	Will determine the company's valuation on the Tadawul, and the success of the reform and fundraising objectives of the IPO
5th December 2019: OPEC meeting	Decision on extension / deepening of production cuts
12th December 2019: UK general election	Will decide government that implements (or halts or delays) Brexit
31st December 2019: Expiry of Gazprom gas transit contracts through Ukraine	If no renewal, could lead to a shut-off of Russian gas supplies to EU
1st January 2020: IMO 2020	Sulphur content of marine fuels limited to maximum 0.5%, raising cost of alternatives
31st January 2020: Latest date for Brexit (if no halt/extension)	Depending on outcome of UK election; will affect energy relations with EU, and potentially damage UK and EU economies
February 2020: Iranian parliamentary elections	Will show political direction in Iran, and effect on reformist vote of the failure of the JCPOA and struggling economy
2nd March 2020: Guyana general elections	Significant for policy direction in this new oil producer
June 2020: WTO Ministerial conference, Kazakhstan	Review world trade issues, dealing with dispute resolution and the US-China trade war
July 2020: OPEC meeting	Review of OPEC targets and compliance
Summer 2020: planned launch of Tesla Model Y	Company's first SUV crossover, and a test for broadening electric cars' appeal
3rd November 2020: US presidential election	Crucial for US policy on energy, climate, Iran sanctions, Venezuela & other issues
9-19th November 2020: COP26 UN climate meeting, Glasgow, Scotland	Review progress and step up ambitions on the Paris Accord
December 2020: OPEC meeting	Review of OPEC targets and compliance

GEOPOLITICS: HIGH-LEVEL CONFRONTATION, LOW-LEVEL VOLATILITY

Geopolitics in 2020 will influence energy on a grand scale and on a local one.

On the big scale, the three major ongoing confrontations are between the US and China; between the US and its Middle Eastern partners, and Iran and its allies; and between Russia and the West.

The US-China dispute has been framed by the Trump administration as primarily about trade (discussed below). But disagreements between the two did not begin, and will not end, with Trump. For the first time in 30 years, the US faces a near-peer competitor, and one of growing strength, unlike the later Soviet Union.

The two do not face off directly in many arenas, but Venezuela is one exception, where China (and Russia) have strongly backed the Maduro administration. While it is unlikely that Sino-American disputes escalate beyond the economic arena in 2020, China might take advantage of the Trump administration's increasingly erratic approach, for instance in the South China Sea. It might also be pushed to take a harder line by the Hong Kong protests, or its slowing economy.

As yet, the Belt and Road Initiative (BRI) has not triggered serious crises, and the US does not have a plan to push back against its influence, though the EU and Japan have committed sizeable funds to a competing initiative.

The US-Iran confrontation will continue in 2020, complicated by other issues such as the Russian and Turkish interventions in Syria, and the ongoing war in Yemen.

The Iranian economy has relatively stabilised following the shock of 2018's strict sanctions. However, public discontent is at a high level. In the absence of negotiations, Iran will take increasingly aggressive steps to reduce compliance with the JCPOA, and to strike against neighbouring countries' energy and economic interests. Saudi Arabia and the UAE, though, have initiated some contacts with Tehran to cool the situation.

A Trump administration facing impeachment and the upcoming election is unlikely to be able to concentrate on the Iranian issue, but it might welcome further French-led mediation in the hope of a diplomatic 'win'. This would bring some Iranian oil back on the market and depress prices.

Sanctions also have unpredictable effects, for instance driving up tanker rates sharply in 2019. Such unintended consequences are likely if the US targets other Iranian exports such as petrochemicals, or indeed imposes further measures against Russia or China.

The Russia-West dispute is at a quieter level, and more multi-faceted. It is also complicated by the Trump administration's conflicts of interest. It is most significant currently in the continuing tug of war over Ukraine, and hence over that country's gas transit. The Russian involvement in Syria, and its support for Iran, are also significant, but problems could flare up in unexpected places, for instance in the case of regime change in a Central Asian or Caucasus country.

On the smaller scale, local protest and discontent has become particularly widespread. Outbreaks remain all but impossible to predict, but 2019 saw major protests in Iraq, Lebanon, Iran, Algeria, Sudan, Egypt, Ecuador, Bolivia, Chile, France (the "gilets-jaunes"), Moscow, Zimbabwe and Hong Kong, some of which will continue into 2020. The protests in Iran and France were triggered by fuel price rises.

The chaotic but low-level civil war in Libya will continue, given the inability of General Haftar to take Tripoli, though oil production has been surprisingly robust. Gas drilling in the disputed waters around Cyprus is another potential flashpoint for confrontation between Turkey, the EU and US.

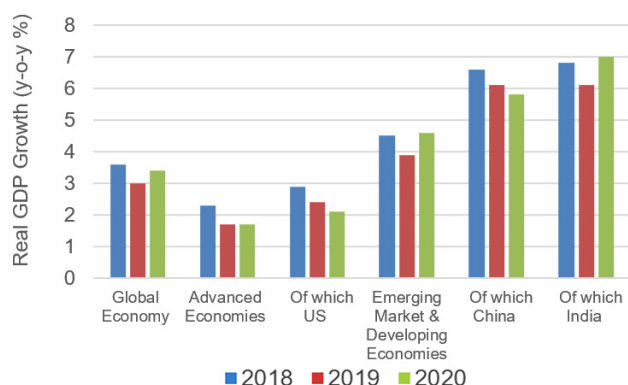
In 2020, there could be outbreaks in the US related to the elections, in the UK over the impact of Brexit, or in Europe for environmental causes. Some of these demonstrations could halt oil and gas production or transport, as in fact happened in Ecuador and (to a limited extent) Iraq. They could spiral into more serious crises, with MENA, Central Asia and parts of Latin America important hydrocarbon-producing regions that are vulnerable.

The protests in France, Zimbabwe and Iran were triggered by fuel price rises, which could be an increasing theme with subsidy reform and attempts to impose climate-related taxes. The protests in Algeria and Bolivia have hampered badly-needed foreign investment in those countries' energy sectors (lithium mining, in the case of Bolivia).

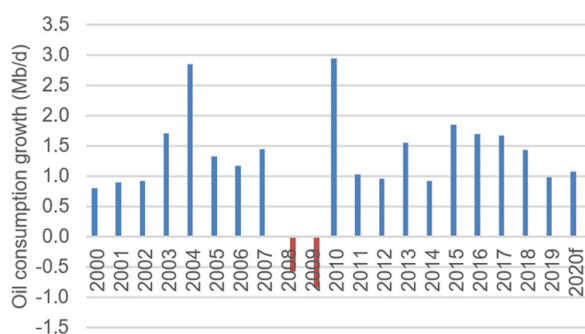
A general atmosphere of protest is also negative for the economy of the affected countries. In cases such as Lebanon and Iraq, it reflects aspirations for desperately-needed reform, but even a reform-minded new government is likely to face years of economic struggle. Hong Kong has now entered a recession and will likely stay financially fragile next year, with potential impact on the city's financial markets.

ECONOMY: A SLOW PICK-UP

The world economy suffered in 2019 from the US-China trade war, but prospects in 2020 look somewhat brighter (FIGURE 1). The US and China, though, are forecast to see a further slowdown. The IMF estimates world trade volumes of goods and services to accelerate from 1.1% growth in 2019 to 3.2% in 2020, but still lower than 2018's growth of 3.6%ⁱⁱ.

FIGURE 1 ECONOMIC GROWTH RATE OF KEY REGIONSⁱⁱⁱ

So far, the slowdown in the global economy, including advanced economies and China, has not reached recession, and OPEC reduced its oil demand forecast only by 40 kb/d for 2020 in its October 2019 monthly oil report. Also, oil demand is still projected to exceed 100 Mb/d, averaging 100.88 Mb/d on an annual level in 2020 compared to 99.8 Mb/d in 2019 (FIGURE 2). Growth of 1.1 Mb/d in 2020 would be slightly higher than 2019, but otherwise the lowest since 2014 (0.9 Mb/d growth).

FIGURE 2 GLOBAL OIL CONSUMPTION GROWTH FROM 2000 TO 2020^{iv}

TECHNOLOGY: STEADY PROGRESS, NO BREAKTHROUGHS

Technology continues to enlarge the sphere of the possible, both in fossil fuels and non-fossils.

Fossil Fuels

Key areas in fossil fuels relate to shale, liquefied natural gas (LNG)^v, carbon capture, and digitalisation.

In shale, attention has focussed on enhanced oil recovery using natural gas or carbon dioxide injection, usually in a 'huff and puff' mode (inject and then produce from the same well). In the Middle East, coating the local sand, usually unsuitable as a frack proppant, can allow it to be used, reducing costs. Better monitoring and simultaneous fracking may reduce the incidence of 'frac hits', where fracks intersect, reducing productivity.

Floating LNG liquefaction is now becoming more mature, with the start-up of Shell's Prelude project in Australia. This can potentially reduce development costs, give access to smaller and remote fields, and avoid onshore location problems. Electric drive lowers the carbon footprint of liquefaction facilities.

Carbon capture, utilisation and storage (CCUS) is an increasingly important technology for maintaining the fossil fuel industry's climate viability. Interesting technologies that could see progress in 2020 include NET Power's CO₂ turbine, Climeworks' direct air capture (DAC) machine^{vi}, and DAC by Occidental with technology from Carbon Engineering^{vii}. Gassnova, a Norwegian state organisation, is developing a carbon capture cluster taking CO₂ from the Mongstad refinery, a combined heat and power plant, a cement plant and an Oslo waste-to-energy facility^{viii}. QP is progressing on CCUS for its new LNG expansion. 2020 will be a crucial year for further progress on real commercial-scale projects.

Digitalisation, automation, artificial intelligence, 'big data', drones and additive manufacturing ('3D printing') form a group of related but somewhat distinct technologies with transformational potential in both fossil fuels and new energies. In fossil fuels, there are already numerous applications for streamlining maintenance and supply chains, finding new hydrocarbons, maximising recovery, reducing offshore and remote personnel requirements, improving energy efficiency and reducing methane leakage. In 2020,

there may be further progress in integrating these technologies into significantly different business models and ways of working.

Solar and Wind

New solar photovoltaic (PV), concentrated solar power (CSP) and wind auction prices are expected to fall further in 2020, as seen in 2, advancing the competitiveness of clean energy with coal.

TABLE 2 GLOBAL WEIGHTED-AVERAGE COST OF SOLAR AND WIND ELECTRICITY (USD/KWH)^x

Technology	2010	2018	2020 (expected)	Change from 2010 to 2020
Solar PV	0.371	0.085	0.048	-87.1%
CSP	0.341	0.185	0.073	-78.6%
Offshore wind	0.159	0.127	0.108	-32.1%
Onshore wind	0.085	0.056	0.045	-47.1%

These costs can be compared with a coal, gas or nuclear plant with all-in generating costs typically in the range of 5-10 US\$/kWh^x. Based on prices registered in auctions and power purchase agreements (PPAs), 40% of renewable energy deployment in 2020 will outcompete existing coal projects^x.

The US solar investment tax credit (ITC) will start phasing out and from 2022 onward, the residential portion of the ITC will be eliminated entirely, and a 10% tax credit will remain for commercial and industrial sectors only. This will incentivise solar projects for all sectors to hurry completion before 2022. Industry players are, however, lobbying for an extension of the 30% tax credit, though this is unlikely given the previous extension and the growing solar competitiveness without subsidies. The gradual subsidy phaseout will mostly impact homeowners in California, owing to the state law passed in December 2018 that requires every new residential construction

of up to three stories to include a solar PV system starting from 1st January 2020.

The production tax credit (PTC) in the US, which mostly applies to wind technology, will be phased out completely in 2021 compared to a 12% tax credit in 2020. Consequently, the US wind market will peak in 2020 with 14.6 gigawatts (GW) of capacity, but the rush will create project delays, slow grid interconnectivity and logistical bottlenecks^{xii}.

The declining costs of renewable energy, emergent regulation from various US state governments, and strong commercial sector discipline, however, will ensure solar and wind technologies will remain competitive even as federal subsidies fade.

Improvements in solar and wind are largely a matter of continuing economies of scale and incremental improvements in manufacturing and deployment. The progress of floating wind turbines gives access to higher wind speeds and deeper waters.

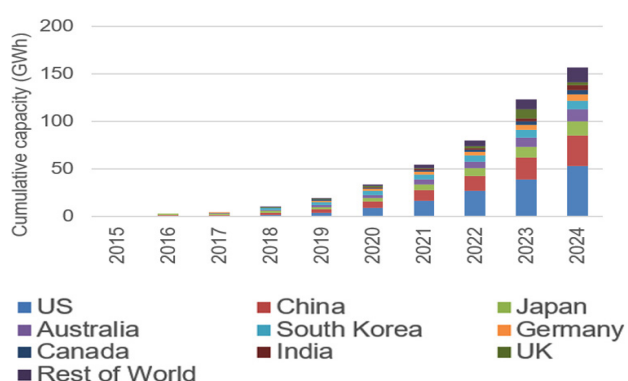
In solar PV, the falling cost of panels results in more of the cost falling on the 'balance of system'. Greater module efficiency, including the use of bifacial panels which collect reflected light from the ground, is a continuing area of improvement. Perovskites, which offer higher theoretical efficiencies, can be used in tandem with conventional cells, although there are still concerns over cost and degradation rates. Floating solar can be deployed on lakes, reservoirs and irrigation canals to make use of scarce land as well as lowering evaporation.

Energy Storage and Batteries

Shows exponential growth in the adoption of energy storage globally as a result of technological innovations, lower prices, and improved safety. Global capacity of energy storage systems is predicted to reach around 34 GWh in 2020 compared to actual capacity of 11 GWh in 2017, a 209% growth according to Wood Mackenzie. The

economics of pairing wind with storage applications, however, is not yet profitable and will likely remain so in 2020, except for regions with large electricity tariff spreads between peak and off-peak hours.

FIGURE 3 GLOBAL CUMULATIVE ENERGY STORAGE DEPLOYMENT ^{xiii}



Prices of lithium-ion batteries shrank by 84% from 2010 to 2018, and further declines are anticipated y-o-y by 9% in 2019 and 17% in 2020 to around \$150/kWh^{xiv}. These sharp decline rates will, however, decelerate as supply side risks increase. On average, prices have fallen 18% annually from 2011 to 2020 compared to a forecast 8% yearly decline from 2021 to 2030. One of the major supply risk concerns is the ethical sourcing of battery materials due to the risk for miners and environment. Some improvements have been made, but investors are seeking 'green' battery alternatives such as nickel and potassium-oxygen and lithium-oxygen batteries, thermal storage, lithium-sulphur batteries, or fuel cells. There will also be increased emphasis on lithium-ion battery recycling and research on biodegradable batteries.

The declining renewable energy prices, however, will pose a risk for commercial financing institutions, whose projects financed half a decade ago are at double the offtake prices seen now. This may tempt some governments to retrospective tariff cuts. Clear regulation, strong guarantees by a credit worthy offtaker, and support by international organisations like the World Bank for low to middle income countries, will be key.

Electric Vehicles

2020^{xv} will be another important year to see whether electric vehicles can continue entering the mainstream, and increasing sales even as overall car purchases fall.

EV sales are forecast to grow by 33% in the US in 2020, reaching 3% of sales (from 2.3% in 2019), fast growth but still short of mass market. European manufacturers will need to hit about 7% of sales in 2020/21 to meet emissions standards, but look set to reach 10%^{xvi}. However, Chinese sales, which have represented more than half the global market, are set to slow, as subsidies were cut in 2019 and are due to be eliminated entirely after 2020, and vehicle sales in general have dropped.

Tesla launches its Model Y, an SUV crossover, in summer 2020, but it and Chinese competitors BYD and BAIC, face growing competition from traditional carmakers who are launching numerous models, notably Volkswagen. These vehicles will drive demand for not only lithium, cobalt and nickel in batteries, but also aluminium (for bodywork and batteries) and copper (for charging stations).

FIGURE 4 TOYOTA'S MINI ELECTRIC CITY CAR ^{xvii}



Transmission and Distribution

China has become a leader in long-distance ultra-high voltage DC cables for transmitting electricity from remote wind, solar and hydro plants. Such lines will become important for balancing grids on a continental scale, for instance from the US mid-west or from Iceland to the UK.

Smart meters are becoming increasingly important for pushing energy efficiency, giving real-time price signals and helping manage demand with the greater share of non-dispatchable renewables. In the UK, 53 million electricity and gas smart meters are planned to be installed by 2020, one for every home and small business .

GOVERNMENT POLICIES

The impact of government policy on energy in 2020 will be mostly in the field of climate. If the Democratic candidate wins the US presidential election, they would not enter office until 2021, but they would likely seek to rejoin the Paris Agreement and reverse many of the Trump administration's anti-environmental policies. The exact policies, though, would vary between a climate hawk such as Bernie Sanders, a pro-market centrist such as Joe Biden or Pete Buttigieg, a more leftist candidate such as Elizabeth Warren (who has promised to "ban fracking" but would lack the power to do so, and has more focus on her social goals), or a centrist billionaire, Michael Bloomberg, who has led a campaign against coal. A second Trump term, though, would be very negative for US climate policy, but might well push other climate activist countries to work together.

Policy in the EU, China and India should be watched closely. The EU is considering 'border carbon adjustments' to allow it to tighten emissions standards without disadvantaging its businesses^{xx}. This could be complicated and problematic for trade. The bloc will introduce new fuel efficiency standards for passenger cars and light commercial vehicles on 1st January^{xxi}. This will likely accelerate the uptake of electric vehicles.

EU states face a scramble to hit their 2020 renewable energy targets, with a goal of 20% across the bloc as a whole. 14 of the 28 nations have hit their target or are close, while the Netherlands and France are well short^{xxii}.

The European Investment Bank has decided it will not lend to any fossil fuel projects in future, stopping at the end of 2021^{xxiii}. This has faced criticism from Total, but is likely a harbinger of further lending curbs to gas as well as coal.

China is set to meet its 2020 target for cutting sulphur dioxide nitrogen oxides and particulate pollution from power plants by 60%^{xxiv}. Carbon dioxide emissions from coal are set to fall by 75.6 million tonnes in 2020, but oil and gas emissions will rise by more than 200 million tonnes, giving an overall increase of 1.2%^{xxv}. The government has suggested it could achieve an overall peak in emissions as soon as 2022, but Premier Li Keqiang has suggested a turn back to coal to stimulate the economy and serve energy security goals.

CORPORATE CSR

Large corporations are committing to three sets of goals to meet customer and society demand: using 100% renewable energy, cutting single-use plastics, and ending funding or investment in fossil fuel projects.

211 RE100 companies have made commitments to go 100% renewable, citing largely variable timeframes for implementation ranging from 2020 to 2050^{xxvi}, though a large portion of the 2020 targets could be delayed. In August 2018, for example, Facebook pledged to operate 100% of its data centres on renewable energy by 2020. While its 102.5 MW solar farm is expected to come online at the end of the year, two other farms with a combined 168 MW capacity will be commissioned in 2021.

Other major corporations committed to solar and wind energy are Google, Amazon, AT&T, Walmart, Apple and Microsoft. Corporations looking to buy clean power are increasingly using wind energy (which is more efficient now due to its integration with AI and improvements in product designs enabling resilience against harsh conditions).

The plans vary from offsetting total consumption in a year, to the more challenging task of meeting real-time electricity demand. So far, these are mostly consumer-facing technology and retail firms, not energy-intensive industries.

The campaign against single-use plastics has stepped up, with a complete ban in the Pacific island nation of Vanuatu. UK retail giants have signed up to ban eight plastic items by the end of 2020^{xxvii}. These can be replaced with biodegradable plastics, reusable items, or biomaterials. This has potential to hit petrochemical demand over the longer term, but also opens some opportunities for new environmentally-friendly polymers.

As with government institutions, so private financial players, including banks, investment funds and insurers, are increasingly moving away from fossil fuels. For instance, US insurer Chubb is to stop investing in or selling policies to coal firms and will be completely phased out by 2022^{xxviii}. Some more significant announcements can be expected during 2020. The impact is likely to be greater for debt financing than for equity, though required returns for equity investors are rising, particular for coal.

COMPANY STRATEGIES

Appetite for capital-intensive, "riskier" projects in upstream oil shall remain lacklustre in 2020. Majors are divesting mature assets and assets in politically insecure countries (primarily in Asia, Middle East and Europe) to focus on key fields that provide quick short-term cashflows such as the US Permian basin and Gulf of Mexico.

The objective of Exploration and Production (E&P) firms is to keep shareholders interested amid low oil and gas prices and rising concerns of environmentalists regarding the carbon footprint of fossil fuel producers. The six majors are planning a total sale of \$35 billion of oil and gas upstream assets, largely by 2021, and led by ExxonMobil

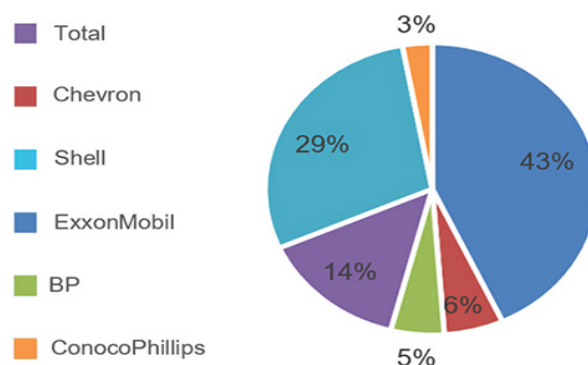
(FIGURE 5), but some assets could be valued at lower than planned if oil prices remain subdued.

BP's sale of its Alaska assets to Hilcorp for \$5.6 billion, a nimble company known for buying mature fields and streamlining operations, after 60 years of operation in the state, was a major upstream deal signifying the shift of new investment trends to US tight oil. This deal also came after the British major's acquisition of BHP's large US shale portfolio last year.

A major phase of consolidation in US shale has been expected for some time, but has not quite materialised, despite Comstock's acquisition of Covey Park to build a leading Haynesville gas producer, and Occidental's buy of Anadarko in August 2019 to build scale in the Permian. 2020 could be a more active year if investor patience runs out and if oil prices dip. 'Mergers of equals' for mid-size firms could be an option to reduce overheads. Some Gulf national oil companies and sovereign wealth funds, which already have holdings in US LNG, such as QP, Saudi Aramco and Mubadala, could also look to go upstream.

Amongst the private equity-backed E&Ps in the North Sea, Siccar Point, invested in by Blackstone and Blue Water Energy, is going through a sale, and could be consolidated by another PE-funded firm, such as Chrysaor, backed by EIG. Neptune Energy, owned by Carlyle and CVC, has talked of an IPO in 2020, though the probability of this has receded.

FIGURE 5 SHARE OF TOTAL ASSET SALES BY MAJOR ^{xxiv}



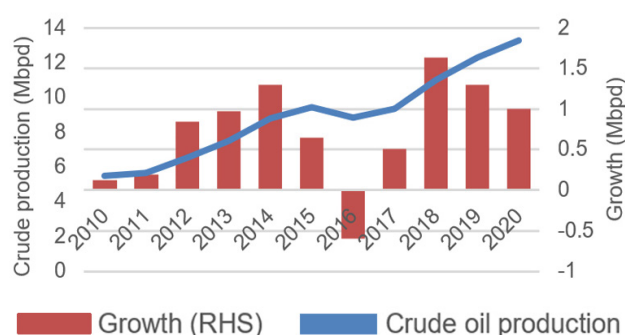
Oil service companies are also planning large sales in 2020. GE wants to sell down its stake in the Baker Hughes business and raise \$3 billion to pay off debts. The large conglomerate will, nevertheless, continue to seek new opportunities for growth through M&A, but will focus on midstream and downstream activities, as opposed to upstream.

The European oil and gas supermajors in particular can be expected to continue their evolution with a number of relatively small deals in renewable energy, batteries, electricity and new energy technologies, while the US firms (such as Chevron and Occidental) should press ahead in carbon capture. They are probably not ready yet for a really large-scale and transformative deal outside the petroleum sector.

OIL MARKETS TO REMAIN ADEQUATELY SUPPLIED IN 2020

Markets are forecast to remain relatively well-supplied throughout the year with ongoing projects in the Americas and the Middle East contributing to the bulk of output. Among major non-OPEC producers, US shale shall lead, but at a diminished rate, as producers continue to trim spending plans to avoid debt distress and meet shareholder returns during a period of softer oil prices. However, production will continue to reach record rates and investors are closely watching how shale operators upgrade capital efficiency, which through optimal completion designs can be enhanced by about 20–25% in key shale basins^{xxx}.

FIGURE 6 US CRUDE OIL PRODUCTION AND GROWTH^{xxxi}



This resilient shale oil growth from the US will likely prompt OPEC+ producers to extend the cuts to June 2020. The deal will be reassessed in the second half the year, but even though agencies forecast a tight market during the second half, OPEC would want to maintain the cuts to support prices, and avoid any rush to increase production. If compliance is abruptly ended to maintain market share, prices could drop to as low as \$50 per barrel, whereas if OPEC maintains cuts till the end of 2020, Brent oil prices could stabilise at around \$60-70 per barrel. The opportunity cost of higher prices is faster growth in non-OPEC production, particularly US shale oil and offshore basins that are breaking even below \$75 per barrel, but OPEC producers will want to maintain a disciplined approach.

In the unlikely scenario of a long-term major supply disruption due to geopolitical events, while demand remains modestly robust, and OPEC's spare capacity is insufficient to offset losses (OPEC spare capacity stood at 2.23 Mbpd in September 2019, not including the Saudi-Kuwait Neutral Zone^{xxxii}), prices could escalate to \$80-90 per bbl. In this regard, Saudi Arabia and Kuwait will rush to restart operations on the Wafra (220 kb/d) and Khafji (280-300 kb/d) fields in the Neutral Zone.

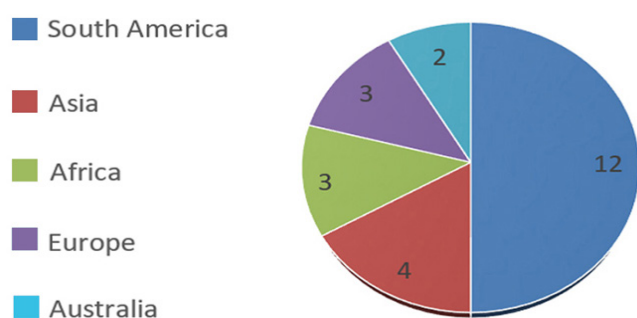
Output from Russia is expected to remain largely stable at 11.5 Mbpd in 2020 (assuming that Russia keeps output adjusted to its OPEC+ quota), but production declines in Western Siberia, which accounts for >50% of all Russian production, shall continue. Russia's commitment to the OPEC+ agreement remains dubious, with key producers expressing displeasure at taking the "price war" too far. Among other FSU, Kazakhstan's output is likely to stagnate as the Kashagan field reaches plateau, and awaits the installation of further upgrades.

New producer Guyana is set to begin in December 2019 with the arrival of a 120 kbbl/day FPSO^{xxxiii}. Other non-OPEC we see contributing to 2020 supply include Brazil (from the new Búzios (ex-Franco), Lara and Lula fields), Norway (from Martin Linge

and Phase-1 of Johan Sverdrup), and the UK (from Liberator oilfield and from Hurricane's fractured basement fields West of Shetland). A recently-announced deepwater discovery in Ghana by an African independent, Springfield^{xxxiv}, and development of other fields, could help the country's production to double to 420 kbbbl/day by 2023^{xxxv}.

Consequently, the global market for floating production, storage and offloading vessels (FPSOs) is headed for a major renaissance with as many as 24 FPSO awards expected by 2020, driven to a great degree by Brazil.

FIGURE 7 PROJECTS WITH FPSOS TO BE AWARDED IN 2019-2020 (ALREADY AWARDED PROJECTS NOT SHOWN)^{xxxvi}



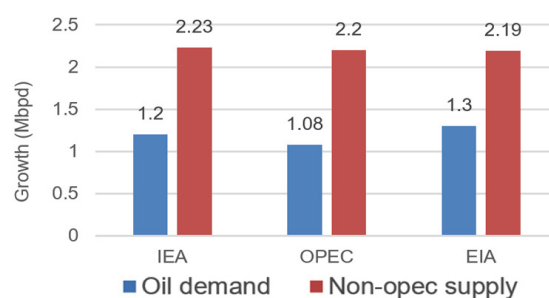
Oilfield spending among Middle Eastern producers is expected to rise by 7%, year-on-year in 2020 from 2019^{xxxvii}, with key producers seeking to expand asset bases and consolidate capital. Appetite for frontier exploration is rising, with Iraq signing an MoU with Russia's Sroytransgaz for oil and gas exploration in its western province of Anbar, and ADNOC signing strategic frameworks with Gazprom Neft for collaborations on domestic E&P activity and awarded a 5% stake to Lukoil for its important sour gas Ghasha development.

Iraq plans large capacity increases in 2020, such as in the CNPC operated Missan oilfields, to boost production to 5 Mbpd. Similarly to Russia, Iraq's compliance to the OPEC+ cuts will remain dubious in 2020. ADNOC is seeking to increase production capacity to 4 Mbpd in 2020, but this is likely to be pushed back due to the OPEC cuts and project delays.

Any capacity increases in Saudi Arabia from its current offshore field expansions is to offset natural declines in maturing fields. In the case of Kuwait, output capacity was planned to reach 4 Mbpd by 2020, but is unlikely to rise above 3.1 Mbpd due to political and bureaucratic obstacles.

Non-OPEC supply is expected to grow strongly and at a higher pace than demand in 2020, as indicated by leading agencies (FIGURE 8). The average non-OPEC supply growth by the three agencies is 2.2 Mbpd compared to an average 1.2 Mbpd of oil demand.

FIGURE 8 OIL DEMAND AND NON-OPEC SUPPLY GROWTH FORECAST^{xxxviii}



South Asia will be the key driver for oil demand in 2020. China's demand will grow, albeit more slowly, by 0.31 Mb/d versus 0.35 Mb/d in 2019^{xxxix}. China will lead in refining and petrochemical integration, with crude distillation capacity increasing by ~1.8 million tonnes per annum (Mtpa) from major planned integrated refining complexes^{xl}. A slower economic outlook, higher efficiency due to integration, and a governmental clampdown on independent (teapot) refineries will stagnate growth in demand, but it still remains a key market.

OECD Asia Pacific and OECD Europe are the two regions with declining oil demand in 2020 (a trend also seen in 2019) partly due to climate change activism, and partly due to global macroeconomic concerns such as trade disputes, and Brexit in Europe.

Refining activity is projected to ramp up in 2020 with the introduction of the MARPOL IMO 2020 sulphur regulations. The regulation will transform demand for crude in major Asian bunkering hubs, with major refiners seeking lighter sour grades for gasoline and straight run naphtha to maximise middle distillate output. Cheap feedstock supply shall continue to support demand, but higher freight premiums as a result of the regulations could change traditional trade flows.

Asian refiners are mostly prepared for the new fuel regulation, but a few oil-exporting Middle Eastern countries lag far behind, predominately Iraq and Kuwait. Iraq's surplus of heavy fuel oil (HFO) will increase in 2020 as it produces more gas for power, lowering domestic demand for HFO, but it will find difficulty in exporting the product, and it does not have necessary storage capacity. Its options are limited to blending with crude oil, which will unfavourably lower quality, or export the HFO at depressed prices^{xli}. In Kuwait, the start-up of the clean fuels project (CFP) by 2020 (repeatedly delayed), is configured to produce 1% sulphur heavy fuel output instead of the required 0.5% by regulation. Consequently, the state refinery company decided to reconfigure operations to produce more Euro 5 specification gasoline and less heavy fuel oil.

In the oil trading domain, the largest upcoming development is ADNOC's introduction of the new Murban futures crude exchange (the ICE Futures Abu Dhabi), planned to be launched in 2020 as a joint venture with major IOCs and trading firms. It wants to establish Murban as a key Asian light sour crude market, alongside West Texas Intermediate (WTI), Brent, Dubai-Oman and China's new INE delivered crude contract. ADNOC also plans to drop destination restrictions on its oil, allowing it to trade freely on the open market, and move to forward rather than retroactive pricing. It is finalising the acquisition of a 10% stake in Vitol's storage business VTTI to gain access to their worldwide storage facilities in the Netherlands, the US, Asia and Africa and is expanding its storage facilities in Fujairah, India and Jordan.

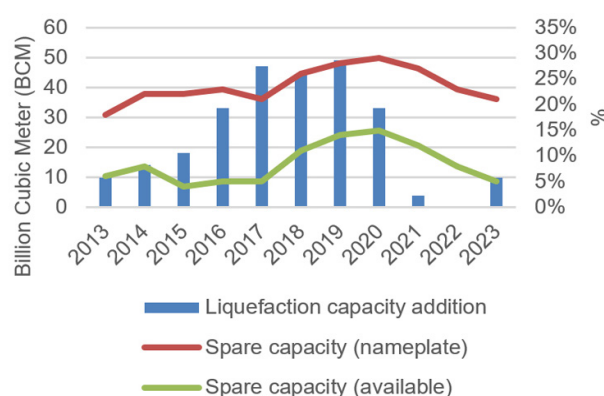
Despite the escalating geopolitical tensions outlined above, any short-term disruptions in oil supply will likely experience, as seen in 2019, a surge in oil prices for one or two days, later reverting to recent trading prices. This is largely due to healthy levels of OECD commercial oil stocks, which are still expected to rise in the first half of 2020. In September 2019, inventory levels were 21.5 million barrels above the five-year average and covered 60.7 days of forward demand^{xlii}. Moreover, available spare capacity within OPEC members, the expectation that US shale would grow at elevated prices (likely at \$65/bbl or above for WTI), and the ability of Canadian oil sands to deliver more barrels from current projects by easing the production limits, will moderate any price spikes.

GAS

Gas Supply

2020 is set to be another strong year of supply growth. Massive LNG new capacity will increase competition, with 33 BCM added (compared to 49 BCM in 2019). Available spare capacity is set to peak in 2020 (FIGURE 9). After this, liquefaction capacity additions will slow until a possible pick-up from 2024 onwards (for FIDs taken in 2019 or 2020). Overall, this suggests LNG prices will remain weak in 2020^{xliii}, unless the world economy is unexpectedly strong or there is another surge in Chinese coal-to-gas switching. This will tend to drag down pipeline gas prices in Europe, particularly given high levels of storage.

FIGURE 9 LNG LIQUEFACTION CAPACITY AND UTILISATION^{xliiv}



U.S. LNG exports, particularly to Asia, are powering increased demand. They are expected to rise from a record 30 BCM in 2018 to 69 BCM in 2020, according to EIA projections. Large players such as ExxonMobil and Cheniere Energy have been prepared to build export terminals without new long-term contracts, while smaller developers have found it difficult to secure financing. Tellurian, backed by Total, has been trying to line up investors for the Driftwood export terminal in Louisiana, with 27 Mtpa capacity. It has a vertically-integrated model, with investors offered a stake in production, pipelines and liquefaction, but FID has slipped to early 2020 from the originally planned first half of 2019. A smaller-scale project, Texas LNG, already delayed its FID from 2019 to 2020, and CEO Vivek Chandra said that decision may slip further^{xlv}.

Qatar has shortlisted international oil firms for a stake in the North Field expansion (NFE) project but says it may choose to do it alone unless majors offer it significant value. The results of the bids will be announced in 2020. In September, QP and Shell signed an agreement to establish an equally-owned joint venture (JV) company to procure LNG, set up LNG bunkering infrastructure at various strategic locations, and facilitate the sale of LNG as a marine fuel to end customers globally. Other liquefaction projects that could take FID in 2020 include Goldboro, Canada's first east coast project, and Energía Costa Azul on Mexico's west coast.

Gas Trade

New players are entering the market as customers for LNG, while additional pipeline projects are also being developed. These include Israel-Egypt, Israel-Jordan, the 'Power of Siberia' from Russia to China, Gazprom's Nord Stream II pipeline from Russia under the Baltic Sea direct to Germany, and its Turkish Stream pipeline under the Black Sea to Turkey.

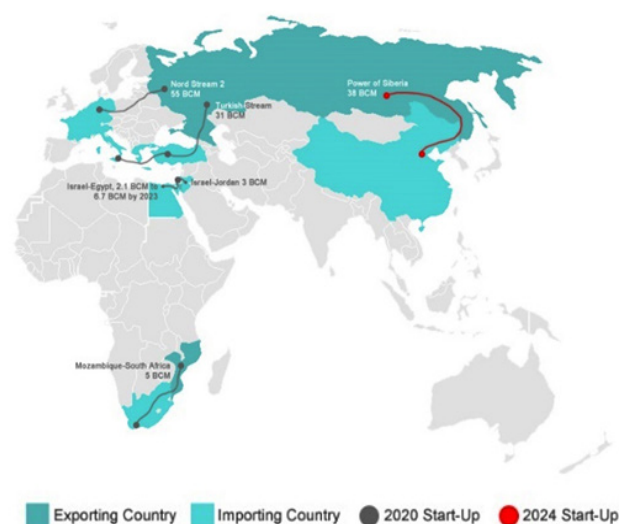
These last two projects are intended to eliminate most of Gazprom's reliance on Ukraine for transit. However, negotiations of a new transit

contract through Ukraine continue, as the previous arrangement expires on 31st December 2019. With Nord Stream II and Turkish Stream not yet ready, this could interrupt gas supplies to Europe and Turkey if EU mediation is unsuccessful. The planned shutdown of the Netherlands' giant Groningen field by 2022 will reduce indigenous European production^{xlvi}.

Poland's PGNiG officially notified Gazprom that it will not renew its natural gas agreement in 2022 and will instead diversify its gas sources with LNG supply from the US and Qatar as well as imports from Norway through the 10 billion cubic meters (BCM) Baltic pipeline to be completed by October 2022. We could see long-term LNG deals signed between PGNiG and the large gas suppliers in 2020 to account for the remaining 7 BCM of demand in Poland. In this regard, the European Commission has approved funding worth \$144 million to expand Poland's LNG Terminal in the northwest from 5 to 7.5 BCM, but this angered green activists who oppose continuing EU support for fossil fuel projects^{xlvii}.

The Power of Siberia is due to start before the end of 2019, and could put further pressure on LNG prices.

FIGURE 10 NEW GAS PIPELINE ADDITIONS IN 2020



LNG imports by Bahrain will probably start in 2020, as a seasonal (summer peak) market. Sharjah could take FID on its planned LNG terminal. Other new LNG importers in the 2019-2020 period include

Kaliningrad (Russia), Gibraltar, Panama and Philippines. Other countries such as Lebanon, Germany, Myanmar and Vietnam could move projects forward in 2020^{li}, though Morocco's planned import terminal appears delayed until 2028. Saudi Arabia remains an intriguing possibility as an importer^{lii}. New import terminals are increasingly incorporating facilities for truck loading and marine bunkering. IMO 2020 will boost the demand for LNG as a clean marine fuel, but newbuild LNG vessels will advance only slowly and it will take time for shipping to develop into a significant market for LNG.

Gas Demand

World demand has reacted surprisingly low LNG prices. The EIA sees overall gas demand growing by a very modest 0.7% in 2020, with nearly all non-OECD growth in China (albeit slowing due to weaker economic growth^{liiii}), offset by a fall in Russia due to growing efficiency and a slow economy. Indian demand also remains limited by domestic supply, pipeline constraints and the cost-competitiveness of coal without pollution controls. Coal-to-gas switching in Europe is limited by infrastructure constraints, while record gas use in 2019 by US power generators may have peaked, with 316 BCM of use in 2019 falling to 306 BCM as renewables pick up market share. Nevertheless, industrial and residential use will mean the US is the largest contributor to OECD demand growth, with a little expansion in Europe and South Korea. After 2020, European demand is likely to decline slowly, as further coal-to-gas switching fails to compensate for growing renewables share and improving efficiency. China has led in using road tankers to transport LNG to bypass pipeline constraints, which could work in India and parts of Africa.

COAL

Supply Will Increase in Geographies With Large Resources, But Dwindle in Others

Coal mining and consumption shall dwindle in European producing markets such as Germany, Spain, and the UK, due to rising taxes on carbon emissions under the EU's proposed Net-Zero Carbon Emissions policy, a rapidly declining share in the overall generation mix, conversion to gas-fired units, and an inability to compete with the economics of gas, nuclear, and renewables. US coal production is expected to fall 13% in 2020, having dropped 8% in 2019, and further bankruptcies in the coal mining sector are likely following Murray Energy's filing this year.

However in countries with a large domestic resource base, such as China, India, South Africa, Indonesia and Australia, coal will remain integral to the generation mix, with resultant air pollution being tackled with scrubbers and shifting heating and small-scale industries to gas. Coal also remains an important employment sector in emerging economies (Africa, Southeast Asia) that are particularly volatile to unrest over lack of job opportunities. China approved 141 million tonnes per year of new coal mines in the first half of 2019 alone, a sharp rise on 2018.

In Africa, Mozambique is expected to show a sharp increase in coal production in the near-term as mining costs in South Africa rise considerably, giving Mozambique a competitive edge^{liv}.

Major Producers Will Remain Major Demand Centres for Coal

Overall global coal demand is forecast to peak by 2020 under major agencies' reference case outlooks (BP, McKinsey, Shell).

China, the world's largest coal producer and consumer, has pledged to reduce reliance on the

fuel to below 58% of its generation mix by 2020, but will remain a key market for the fuel, though its 3.8 billion tonnes of current use are below its self-imposed 4.1 billion tonne cap for 2020, and use next year is expected to fall slightly^{lvi}.

China's fleet of coal-fired power plants will increase by 290 MW within the next 10 years to reach the government's coal capacity cap of 1.3 TW by 2030. 130 GW is currently under construction, supported also by record-level crude steel output, and the expansion of coal-chemical and petrochemical industries.

In the long-term, China is planning to adopt low-cost CCS under the National Development Reform Commission's (NDRC) CO₂ emissions' reduction policy, with a reported 11 projects already under planning. 80% of its power plants are now fitted with pollution abatement measures, though these do not always run. Even if coal demand in power and heating declines, coal-to-chemicals and steelmaking will continue to support demand.

In countries with a lesser focus on CO₂ abatement, such as India, usage of coal is unlikely to be paired with advanced technologies (such as carbon capture and sequestration (CCS), low-sulphur coal) and scrubbers to reduce air pollutants in the near-term. For instance, the Khurja Super Thermal Power Plant in northern India, a planned supercritical coal-fired power plant, will add 1.32 GW of coal capacity to India's generation mix. It is not clear whether the plant is required to be compatible with CCS technologies and mitigate emissions.

Continuing bans on petroleum coke in certain areas will raise India's demand in 2020, who has the world's fifth largest reserves of coal, but continues to import 235 million tonnes per annum to meet supply shortfalls. Cement and sponge iron industries will continue to be major drivers of demand alongside India's electrification drive for all rural areas.

Smaller producers like Pakistan will also experience a rise in domestic coal demand. Pakistan's imports shall double to over 20 million tonnes per annum in 2020, now that the 1.32 GW coal-fired China Power Hub Generation Company (CPHGC) power plant is online, as well as additional planned plants around the country's Thar coalfield reach completion.

In Africa, Kenya, Botswana, Mozambique, and South Africa are expected to keep coal demand robust with new coal-fired power plants under planning.

Countries with high costs of gas development and/or LNG imports will also develop clean coal capabilities for security of supply. These include countries with no resource base of their own, such as the UAE and Egypt, or those with a pre-existing base, such as Turkey, who are trying to limit government spending on expensive gas imports. Jordan is seeking a mix of oil shale and coal-fired generation to diversify its generation capabilities, with the country's first oil shale-fired power plant coming online next year. Low-cost fuel-based generation will account for 5-15% of the overall generation mix by 2025 as a more stable source of power in a country where renewables and gas make up the remainder.

ELECTRICITY TRADE BETWEEN EMERGING ECONOMIES WILL GROW IN 2020

2020 shall see the emergence of power trade agreements in several emerging economies. Regional electricity trade should gradually become integrated with rising renewables capacity, especially in the Middle East, and to a lesser extent in North Africa.

In the Middle East, Iraq plans to begin importing 500 MW of electricity from Kuwait, via an extension of the Gulf Cooperation Council Interconnection Authority (GCCIA) link, into its southern province of Basrah by Q3 2020, with potential to import up to 2 GW in peak demand season. Jordan has agreed

to supply an additional 300 MW from its large renewables capacity, with technical studies currently underway to have the countries' grids linked by late 2020. Saudi Arabia signed a memorandum of understanding (MoU) last year to export power to Iraq from a yet to be constructed 3 GW solar PV plant at a fraction of the price Iraq pays currently for Iranian power (\$84/MWh, compared to Saudi Arabia's proposed \$21/MWh), but there has been no further progress.

Oman meanwhile is exploring opportunities for "regular trading" of power from its GCC neighbours beyond the current 400 MW capacity it has from its 220 kV GCCIA link via Abu Dhabi. The Oman Power and Water Procurement Company (OPWP) is aiming to decrease reliance on burning valuable fuel gas for power, and seeking imports from its more renewables'-established neighbours is increasingly being seen as a way to divert government spending from power generation fuels to planned renewable programmes.

Elsewhere, Egypt has planned a feasibility study into the submarine section of a proposed grid link with Saudi Arabia, signing an MoU with the kingdom for twin 3 GW capacity cables earlier in June. The country has pre-existing links with Jordan and Syria, and could, in principle, re-export Saudi power to its more power-deprived neighbours.

Israel, Cyprus and Greece have signed for a 2 GW HVDC connector^{lvii}, which could use Israel's new gas resources and developing renewables sector.

NUCLEAR POWER WILL TREAD WATER, DESPITE NEW REACTORS

Growth in nuclear power capacity could eventually present an alternative to the less-reliable renewables-based electricity trading. Saudi Arabia has plans to enrich uranium and will tender two nuclear power reactors in 2020, with US, Russian, Chinese, South Korean, and French firms showing interest in development, though they are likely only

to be built by the late 2020s. On the other hand, electricity exports have been a key mandate of the UAE's Barakah Nuclear Power Plant (currently at 93% completion), with the original 2009 deal with KEPCO underlining the prospect of exports to regional neighbours by 2021^{lviii}.

Overall, 2020 could see the start of about 15 GW of nuclear power in China, Belarus, the UAE, Finland (the long-delayed Olkiluoto 3) and others^{lix}. But closures in the US, Japan and parts of Europe will reduce growth in the nuclear fleet.

Nuclear power will continue to need cost reductions to hold its ground against renewables and gas power. NuScale's 60 MW small modular reactor (SMR), to be installed at the Idaho National Laboratory, is one possible way forward.

CONCLUSIONS

2020 will continue to focus on some of the themes of 2019, including an evolving geopolitical confrontation; trade wars; rather anaemic economic growth; well-supplied oil and gas markets; incremental technological progress and deployment in both fossil fuels and new energies; and the move to divest from carbon fuels of all kinds.

It also presents opportunities for oil and gas companies and countries. They can move more boldly on FIDs for new projects, particularly in LNG, although this takes confidence given continuing weak prices. They can acquire struggling competitors, particularly in shale. They can accelerate the retooling of their business models, by incorporating more digitalisation, automation and artificial intelligence. And they can take more ambitious steps in new energies, learning the landscape as preparation for a possible transformational move.

APPENDIX

- i. <https://www.reuters.com/article/asia-oil-freight/rpt-asian-oil-buyers-grapple-with-rising-costs-as-global-freight-rates-jump-idUSL5N26Z07Y>
- ii. IMF October 2019 report
- iii. IMF October 2019 report <https://www.imf.org/en/Publications/WEO/Issues/2019/10/01/world-economic-outlook-october-2019>
- iv. BP Statistical Review of World Energy 2019 to 2018; 2019 and 2020 figures from OPEC's October Oil Report
- v. Al Attiyah bin Hamad International Foundation Research Series Issue 38 (October 2019)
- vi. <https://www.digitaltrends.com/cool-tech/climeworks-carbon-capture-technology/>
- vii. <https://qz.com/1713529/carbon-engineering-and-occidental-will-capture-1-million-tonnes-of-carbon-dioxide/>
- viii. <http://www.rite.or.jp/news/events/pdf/5-Kari-Lise-CCSWS20180123.pdf>
- ix. https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2019/May/IRENA_Renewable-Power-Generations-Costs-in-2018.pdf
- x. Al-Attiyah Foundation Research Series, issue 33, May 2019
- xi. https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2019/May/IRENA_Renewable-Power-Generations-Costs-in-2018.pdf
- xii. <https://www.woodmac.com/press-releases/us-wind-to-peak-in-2020-with-14.6-gw-as-production-tax-credit-expires/>
- xiii. Forecast from 2019 <https://www.woodmac.com/news/editorial/global-energy-storage-market-takes-off/>
- xiv. <https://about.bnef.com/blog/behind-scenes-take-lithium-ion-battery-prices/>
- xv. <https://evadoption.com/ev-sales/ev-sales-forecasts/>
- xvi. <https://thedriven.io/2019/07/24/electric-vehicle-sales-to-surge-across-europe-with-2020-seen-as-new-tipping-point/>
- xvii. <https://www.fircroft.com/blogs/toyota-unveil-futuristic-micro-city-ev-and-an-emotionally-engaging-ai-92911816227>
- xviii. <https://www.power-technology.com/features/chinas-mega-transmission-lines/>
- xix. <https://www.ofgem.gov.uk/gas/retail-market/metering/transition-smart-meters>
- xx. <https://www.ft.com/content/154368c8-ef55-11e9-ad1e-4367d8281195>
- xxi. <https://www.globalelr.com/2019/04/eu-announces-strict-emissions-standards-for-cars-and-commercial-vans/>
- xxii. <https://www.weforum.org/agenda/2019/02/these-11-eu-states-already-meet-their-2020-renewable-energy-targets/>
- xxiii. <https://www.reuters.com/article/total-gas-eib/update-1-energy-group-total-criticises-eibs-decision-not-to-finance-gas-idUSL8N281396>
- xiv. <http://global.chinadaily.com.cn/a/201910/10/WS5d9e310aa310cf3e3556f87c.html>
- xxv. <https://www.reuters.com/article/us-china-coal-carbon/china-co2-emissions-from-energy-sector-still-on-rise-researchers-idUSKBN1XO0QL>
- xxvi. <http://there100.org/companies>
- xxvii. <https://biomarketinsights.com/retail-heavyweights-vow-to-ban-eight-plastic-items-by-end-of-2020/>
- xxviii. <https://www.theguardian.com/business/2019/jul/01/chubb-no-longer-invest-insurance-coal-firms>
- xxix. Qamar Energy; [https://www.rystadenergy.com/newsevents/news/press-releases/majors-global-selling-spreed-could-fetch-\\$27-billion/](https://www.rystadenergy.com/newsevents/news/press-releases/majors-global-selling-spreed-could-fetch-$27-billion/)
- xxx. <https://www2.deloitte.com/content/dam/Deloitte/us/Documents/energy-resources/us-2020-outlook-ogc.pdf>
- xxxi. EIA Short-Term Energy Outlook
- xxxii. IEA September and October 2019 oil market reports
- xxxiii. <https://www.spglobal.com/platts/en/market-insights/latest-news/oil/103019-hess-moves-up-guyana-production-start-sees-first-oil-in-december>
- xxxiv. <https://www.ft.com/content/59ef856e-088d-11ea-b2d6-9bf4d1957a67>
- xxxv. <https://www.theafricareport.com/16814/ghana-oil-production-to-double-to-over-400000bpd-in-next-four-years/>
- xxxvi. Rystad <https://www.rystadenergy.com/newsevents/news/press-releases/FPSO-market-is-booming-with-Brazil-fueling-demand/>
- xxxvii. <https://www.rystadenergy.com/newsevents/news/newsletters/EandP/eandp-newsletter-march-2019/>
- xxxviii. October 2019 oil reports for IEA, EIA and OPEC
- xxxix. OPEC Monthly Oil Market Report, November 2019, https://www.opec.org/opec_web/en/publications/338.htm
- xl. JLC International
- xli. IEA Iraq Outlook 2019
- xlii. <https://www.iea.org/oilmarketreport/>
- xliii. <https://www.hellenicshippingnews.com/global-gas-market-to-be-oversupplied-to-at-least-mid-2020-rbc/>
- xliv. IEA Gas 2018 report <https://www.iea.org/gas2018/>
- xlvi. <https://www.reuters.com/article/us-global-lng-exports/big-u-s-liquefied-natgas-players-move-fast-the-small-race-to-keep-up-idUSKBN1WW0DF>
- xlvi. <https://www.rystadenergy.com/newsevents/news/press-releases/europes-gas-demand-set-to-grow-as-Dutch-giant-folds/>
- xlvi. <https://www.reuters.com/article/norway-poland-gas/norway-poland-gas-link-on-track-for-2022-field-acquisitions-coming-polish-minister-idUSL5N22K6B0>
- xlvi. <https://www.euractiv.com/section/energy/news/greens-furious-as-eu-pours-e130m-into-polish-lng-terminal/>
- xlix. <https://www.reuters.com/article/us-russia-gas-china/gazprom-finishes-filling-china-bound-power-of-siberia-gas-pipeline-idUSKBN1X8165>
- I. Qamar Energy; Wood Mackenzie <https://www.mckinsey.com/solutions/energy-insights/global-gas-lng-outlook-to-2035/-/media/3C7FB7DF5E4A47E393AF0CDB080FAD08.ashx>
- li. <https://www.oxfordenergy.org/wpcms/wp-content/uploads/2019/09/Floating-LNG-Update-Liquesfaction-and-Import-Terminals-NG149.pdf>
- lii. Shabaneh, R. and Schenckery, M. (September 2019) 'Assessing Energy Policy Instruments: LNG Imports Into Saudi Arabia' King Abdullah Petroleum Studies and Research Center
- liii. <https://www.cnbc.com/2019/06/07/the-global-boom-in-natural-gas-demand-is-about-to-slow-iea-says.html>
- liv. <https://www.cnbc.com/2019/08/06/reuters-america-china-coal-mine-approvals-surge-despite-climate-pledges.html>
- lv. <https://www.miningafrika.net/natural-resources-africa/coal-mining-in-africa/>
- lvi. <https://www.reuters.com/article/us-china-energy-coal/china-expects-to-hit-2020-coal-cap-targets-demand-overshadows-study-idUSKCN1SZ17M>
- lvii. <https://euroasia-interconnector.com/permitforconstruction/>
- lviii. <https://www.reuters.com/article/us-emirates-nuclear-analysis-idUSTRE5BS2DF20091229>
- lix. <https://www.world-nuclear.org/information-library/current-and-future-generation/plans-for-new-reactors-worldwide.aspx>



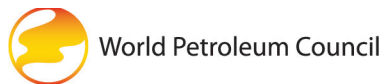


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