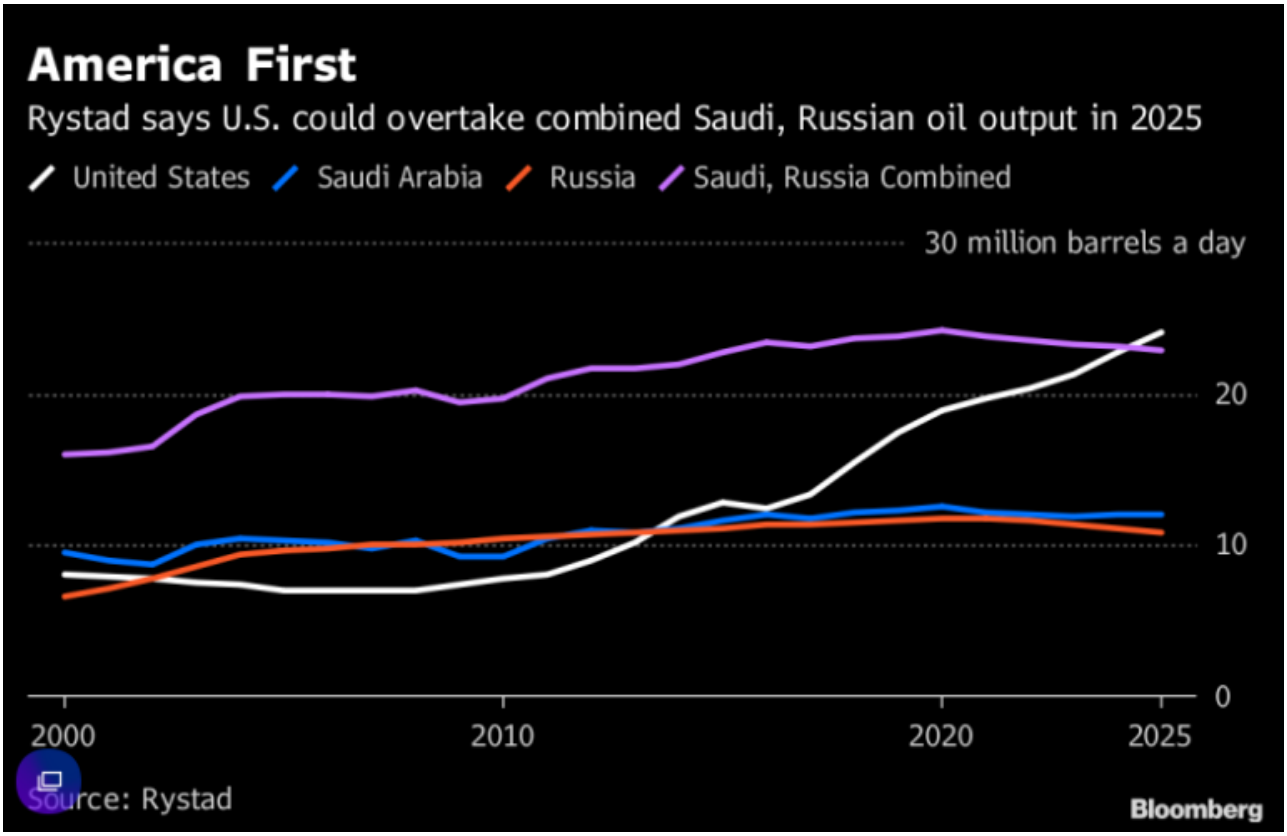
U.S. Shale Can Add a Saudi Arabia and Pay Investors, Rystad Says



(Bloomberg) — U.S. shale-oil companies are on track to add production equivalent to Saudi Arabia's output by 2030, without needing the external financing the industry's boom has relied on so far, according Rystad Energy AS.

"They are going to be very profitable, they are going to be able to return surprisingly good cash amounts to investors and still grow one Saudi Arabia," said Per Magnus Nysveen, senior partner at the Oslo-based consultant.

Although the shale revolution has helped American oil production more than double since the start of the decade, its dependence on debt and equity to grow production volumes while offering limited returns to investors has raised doubts about its sustainability.

That trend seems to be reaching a tipping point, with drillers entering a new era of discipline in which they've cut capital spending and launched share buybacks.

The frugality will continue during the shale industry's coming expansion, which will see it add about 1 million barrels a day of production a year through to the end of the next decade, effectively creating a new Saudi Arabia, according to Rystad.

"The financing party is over," he said. But drillers "have enough cash from the producing wells to finance quite a lot of capex, so they don't need this financing any more."

Companies have been cash-flow neutral this year, and will be "very positive" in 2020, Nysveen said in an interview in London. Drillers learned to squeeze costs during the market downturn in the middle of this decade, slashing the oil-price needed to produce a barrel by half to about $40, Rystad estimates.

Despite the flood of American crude, oil markets are unlikely to become oversupplied as demand is healthy and output is declining at ageing fields around the world, said Nysveen. In fact, markets will become "dangerously tight" as the growth in shale output levels off toward the end of the next decade, Nysveen predicts.

To contact the reporter on this story: Grant Smith in London at gsmith52@bloomberg.net

To contact the editors responsible for this story: James Herron at jherron9@bloomberg.net, Helen Robertson, Rakteem Katakey

Qatargas supplies commissioning LNG cargo to India’s Ennore terminal

Doha: Qatargas has supplied a commissioning Liquefied Natural Gas (LNG) cargo for India’s newest LNG receiving terminal, Ennore, near the southern Indian city of Chennai.

The commissioning LNG cargo was delivered onboard the vessel ‘Golar Snow’ on 25th February 2019 by the Swiss commodity trader, Gunvor, to the state-owned Indian Oil Corporation Limited (IOCL), which owns and operates the five million tonnes per annum (MTPA) terminal. Qatargas sold the cargo Free On Board (FOB) basis to Gunvor.

Ennore will be India’s fifth operational LNG terminal and the first LNG terminal on the East Coast of India. Once fully commissioned, Ennore will provide regasified LNG to anchor customers, including Chennai Petroleum Corporation Limited, Madras Fertilizers Limited, and Manali Petrochemicals.

Qatar has established a strong partnership with India since July 1999 when Qatargas started supplying LNG to Petronet. Since then it has delivered over 1,500 cargoes under its various long term sales and purchase agreements as well as supplying significant volumes into the short term/ spot market.

India is a key market for Qatargas given its geographical proximity and growth potential. In addition to the Ennore Terminal, terminals located at Mundra and Jaigarh are also due to be commissioned in the near future as well as a host of other gas related infrastructure projects. These additional terminals will increase India's capacity to import LNG from 30 MTPA to 44 MTPA – a 46 per cent increase as India continues to make strides in achieving its ambitious target of 15 per cent gas in the energy mix.

Access to Venezuela's oil fields fuels Putin's support for Maduro

Russian President Vladimir Putin and Chinese President Xi Jinping have each championed a model of authoritarian capitalism (call it “development with a dictator’s face”). But what neither leader seems to have anticipated is that the Russian and Chinese commercial sectors are becoming political forces in their own right, increasingly bringing pressure to bear on policymaking.

Over the past two decades, Russian and Chinese multinational corporations – many of them awash in cash – have become powerful foreign-policy tools for their respective regimes. But they were once seen as modernising forces that would help open up business and society alike. With energy giants like Gazprom and Rosneft promising to bring commercial values to backward Russia and the newly independent former Soviet states, Anatoly Chubais, a key architect of Russia’s privatisation programme, touted them as the vanguard of a new “liberal empire.” (Insofar as these firms also bound the former Soviet republics closer to Russia, so much the better.)

Likewise, in China during the presidencies of Jiang Zemin (1993-2003) and Hu Jintao (2003-2013), the rise of banks like the Industrial and Commercial Bank of China and the Agricultural Bank of China, and of energy and heavy-industry firms like Sinopec, Sinochem, and the China Railway

Construction Corporation, were seen as harbingers of modernisation. Yet today, no one could mistake these firms for the equivalent of an ExxonMobil or a Microsoft. With top executives often parachuting directly into the boardroom from high political office, Chinese mega-corporations have long represented a merger of business and the state.

Moreover, as Gazprom, Rosneft, and the Chinese technology giants ZTE and Huawei have grown more essential to their respective governments, business and state interests have become even harder to disentangle. In the interest of their "national champions," both the Russian and Chinese governments now seem to be pursuing policies they might not have chosen otherwise.

This dynamic is clearly on display in Venezuela. Through its affiliation with Venezuela's state oil monopoly, Petróleos de Venezuela (PDVSA), Rosneft has funnelled upward of $17bn in loans to the Chavist regime over the past decade. Meanwhile, Rosneft gained 3mn tonnes of oil in 2017 from its operations in Venezuela; more generally Russia has invested in many Venezuelan industries, from banking to bus assembly. At the same time, Venezuela has been one of the largest buyers of Russian weapons among Latin American countries.

Owing to these debts and other economic ties, Putin has little choice but to back the Venezuelan strongman Nicolás Maduro's crumbling regime, even as public support in Russia for the Kremlin's foreign interventions declines. Rosneft's interests in Venezuela are simply too deep for it to withdraw, especially now that Western sanctions have crippled the firm's ability to secure financing in international markets.

Russia's support for Maduro does not rise to the same level as its commitments in Syria, where its relationship with the Assad family goes back decades. Rather, its continued engagement in Venezuela reflects a cold, hard business calculation. According to Reuters, private security contractors with close ties to the Kremlin have been sent to defend Maduro. At the same time, there have been unverified (but plausible) reports of Russian planes departing Venezuela

with shipments of gold, as payment for the country's debts. Putin knows that if National Assembly President Juan Guaidó takes power, those who stood with Maduro will likely be ousted, and Russia's privileged access to Venezuela's oil fields revoked.

In monetary terms, Maduro's fall could mean even larger losses for China, which has investments in Venezuela estimated to be worth around $60bn – at least three times more than Russia's. Like Russia, China got into bed with the Venezuelan regime in the 2000s, when the country was flourishing under former President Hugo Chávez. While China secured a sorely needed source of oil for its fast-growing economy, Chávez was able to reduce Venezuela's reliance on the US as one of its leading export markets. In the meantime, Chinese tech giants have aided the Maduro regime in its domestic surveillance efforts, and (like Russia) China has sold Venezuela expensive weapons.

Still, should Maduro fall, China may be less exposed than Russia. The Chinese have been careful to cultivate contacts among various elements of Venezuelan society, including the opposition. And while China still supports Maduro officially, it has not followed Russia in accusing the US of an attempted coup.

This suggests that China wants to avoid the kind of radical steps that Russia is taking. The Kremlin is now actively competing with the US to influence the course of events in Venezuela, and has described the US attempt to deliver humanitarian aid across the Colombia-Venezuela border as a ruse to smuggle in weapons for the opposition.

China's moderate behaviour no doubt owes something to its ongoing trade negotiations with the US. Before extending his deadline for imposing higher tariffs on Chinese imports, US President Donald Trump indicated that Huawei and ZTE might be included in a final Sino-American trade deal. That would certainly please Xi, whose paramount interest is to protect both firms' economic might.

With the ability to bar US companies from selling crucial inputs to Chinese firms, the Trump administration could

inflict serious harm on both ZTE and Huawei. Huawei already stands accused of conspiring to violate US sanctions on Iran, leading to the arrest of its chief financial officer, Meng Wanzhou, in Canada this past December. And ZTE has pled guilty to similar charges, paying penalties of $1.4bn in 2017.
At the end of the day, Venezuela can't hold a candle to the strategic importance of these two firms. And for the Kremlin, the calculus is the same: the prerogatives of business define the national interest. But, perhaps to Putin's chagrin, in Venezuela that calculus has produced the opposite outcome. – Project Syndicate

* Nina L Khrushcheva is Professor of International Affairs at The New School. Her latest book (with Jeffrey Tayler) is In Putin's Footsteps: Searching for the Soul of an Empire Across Russia's Eleven Time Zones.

Renewables super grid proposed to solve Europe's energy dilemma

A pan-European electricity system powered by decentralised renewable energy supply and connected across a high-volume super grid has been described as the least-cost option to provide an optimal pathway to achieving the goals of the Paris Agreement while at the same time solving key obstacles towards developing a functional European Energy Union.

Researchers from Lappeenranta University of Technology (LUT) in Finland have for several years now been developing 100 per cent renewable energy super grid models for global regions, and in 2016 even developed a first-of-its-kind planetary renewable energy model.

Further, in November 2017, on the sidelines of the United Nations Climate Change Conference COP23 in Bonn, Germany, LUT researchers showcased how a 100% global renewable energy grid is not only a viable option but the most cost-effective option.

Focusing their attention on the European Union, LUT researchers recently published an article in the

journal *Renewable Energy* entitled *Flexible electricity generation, grid exchange and storage for the transition to a 100% renewable energy system in Europe*which reveals the results of two scenarios: the first depicts a scenario made up of 20 European regions acting as independent energy "islands"; the second scenario depicts those same 20 regions connected through a pan-European super grid.

This second option, labelled as a "SuperSmart" energy system – as it acts as a compromise between two European Energy Union approaches that have been floated in recent years; a decentralised renewable energy Smart Grid approach, and a centralised and regulated Super Grid – would utilise decentralised renewable energy generation across the European Union combined with a super grid to facilitate pan-European energy trade.

"The results clearly show that the least cost solution is based on domestic and decentralised supply with cross-border trade, as this reduces the total electricity system cost from 69 €/MWh in 2015 to 51 €/MWh in 2050," said Christian Breyer of the LUT Solar Economy group who coordinated the research.

"A substantial economic benefit through cross-border trade is worth 26 b€ per year, by trading only 12% of total end user electricity demand in Europe."

"A SuperSmart approach respects the unique contributions that different regions of Europe can make while adhering to a clearly defined target of net-zero greenhouse gas emissions by 2050" added Michael Child, LUT researcher and lead author of the research.

The study modelled the two scenarios out to 2050 and considered the current capacities and ages of power plants, as well as project increases in future demands. Further, the LUT study weighs important elements of the European power sector which are not always taken into account by other modelling

studies.

Specifically, the study looked at prosumers – those who both produce and consume energy – and the impact they have on the amount of energy that flows through a centralised grid and found that up to 6% less peak interconnection capacity would be necessary when considering prosumers, which naturally leads to lower costs.

Germany Set to Draw More Russian Gas, Regardless of What Trump Says

Germany is preparing one of its biggest sustained increases in natural gas consumption in almost two decades, regardless of U.S. admonitions that it shouldn't draw so much of its energy from Russia.

Gas will be one of the main beneficiaries from Chancellor Angela Merkel's effort to close coal and nuclear plants, which generate half of the nation's electricity. While the government is seeking to spur renewables, industry executives, energy forecasters and investors say that more gas will be needed to balance the grid when power flows ebb from wind and

solar farms.

That outlook helps explain why Merkel is allowing construction of the Nord Stream 2 pipeline from Russia and encouraging new facilities to import liquefied natural gas. In the years ahead, Germany may need much more gas to make up for closing power stations if it falters in its 500 billion-euro ($568 billion) effort to shift toward cleaner fuels.

“Natural gas demand has to go up at least in the short term to make up for the loss of coal,” said Trevor Sikorski, head of natural gas, coal and carbon at Energy Aspects Ltd., an industry consultant in London. “That is probably why Germany’s government is keen for Nord Stream 2.”

Range of Views on Germany's Gas Demand

Forecaster	Increase	Change	View
Energy Aspects	Maximum 4 BCM by 2022	4%, in comparison to 90.2 billion cubic meters consumed in Germany in 2017, according to BP's report	Sees intense competition from other energy sources like solar and wind
Oxford Inst. For Energy Studies	5-10 BCM by 2022	Maximum 11%,in comparison to 90.2 billion cubic meters consumed in Germany in 2017, according to BP's report	Gas has opportunity to grab market share as coal and nuclear plants shut
Bloomberg Intelligence	5 BCM by 2022	5.5%,in comparison to 90.2 billion cubic meters consumed in Germany in 2017, according to BP's report	Renewables likely to capture the majority of the energy gap
German LNG Terminal	100 BCM a year	111%, in comparison to 90.2 billion cubic meters consumed in Germany in 2017, according to BP's report	Coal and nuclear leaving the grid, plus declining gas production in Germany and Netherlands, will create a shortfall that gas can fill
Zukunf Erdgas (industry group)	50-81 TWh a year by 2022	From 5% to 7%, in comparison to Zukunft Erdgas estimates on the current consumption	Expects coal exit will double the use of gas for electricity generation
BloombergNEF	From 63 TWh in 2030 to 91 TWh in 2040	44%, considering that gas will maintain relative stable level of generation through the 2020s	Sees surge in gas use to balance variable power flows from renewables
Wood Mackenzie	119 TWh by 2022	56%, in comparison o the 76 TWh supplied in 2018	Expresses outlook in terms of gas supply, which will rise with new pipelines and LNG

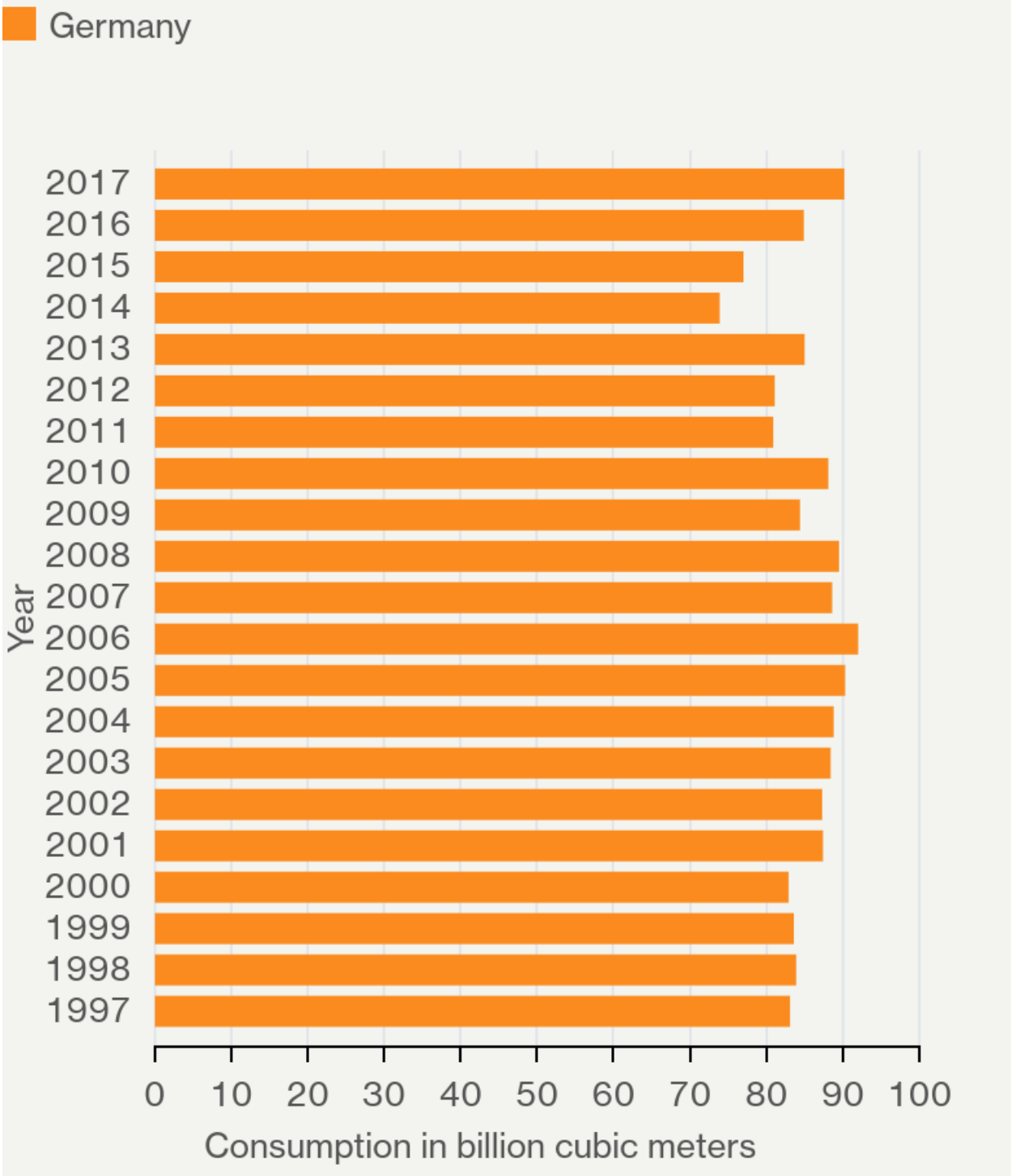
There’s a number of issues clouding the outlook for how much new gas Germany will need and when. Those include a lack of clarity on which coal plants will close and when, what restraints the government imposes on the spiraling cost renewables and whether Germany can rely on neighboring nations to make up for temporary shortages on the grid.

A further complication is the assessment forecasters are making, including differences in their forecasting horizons. Even so, almost all of them are looking for gas demand in Germany to grow — some like Energy Aspects see a few percentage points of expansion and others like the import plant promoter German LNG Terminal anticipate demand doubling.

“It is very much moving to the gas-plus-renewables power future that we advocate as opposed to the coal plus renewables situation,” Steve Hill, executive vice president at Shell Energy, said at an event hosted by the unit of Royal Dutch Shell Plc in London on Feb. 25.

Stable Consumption

Germany's natural gas demand eased with economic slump early in the decade then shot up in the past three years as nuclear reactors closed



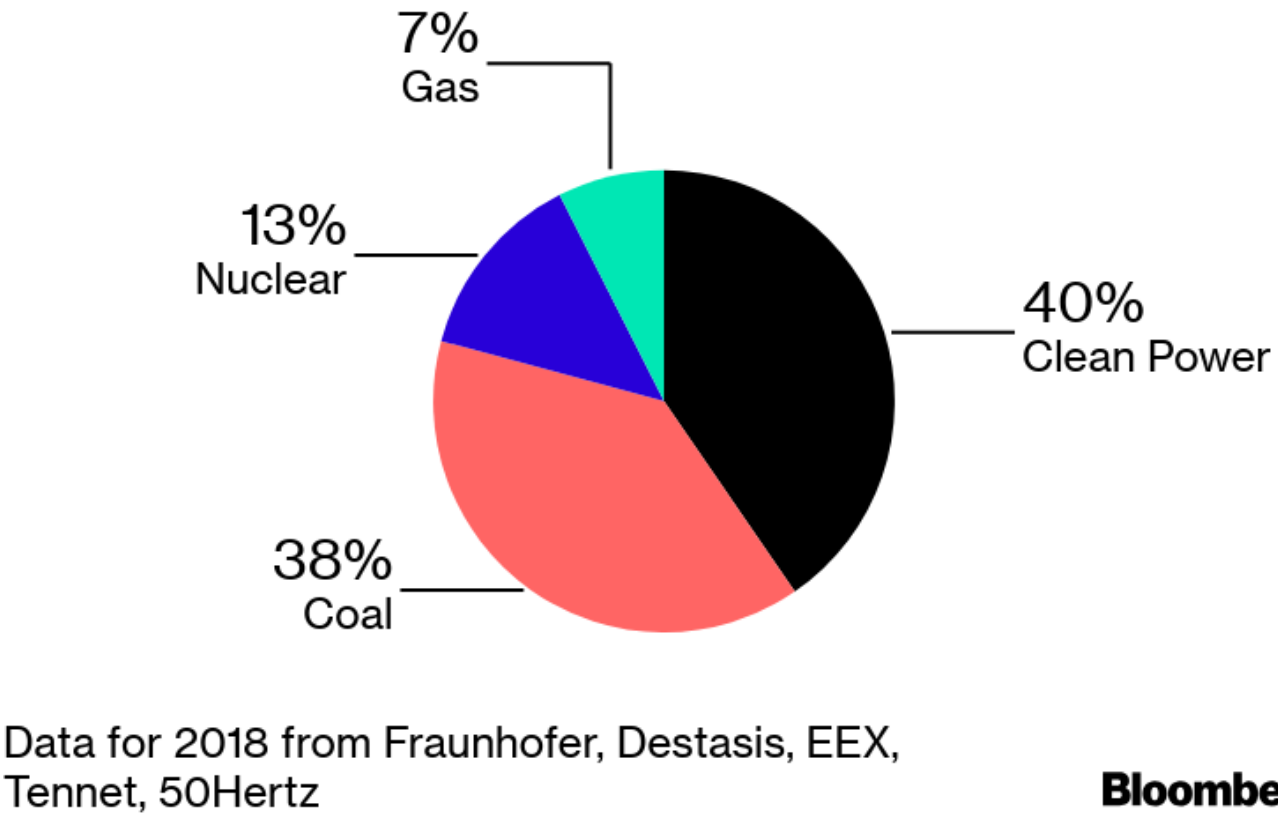
BP Statistical Review of World Energy 2018

Bloomberg

Those forecasts mark a departure from the past two decades, when the solar industry took off and left demand for gas broadly steady. Gas use surged 22 percent in the past three years as atomic sites closed in the wake of the 2011 meltdown at the Fukushima plant in Japan. That largely returned flows to the levels prevailing since 2000, making up for a dip earlier in the decade when the economy slowed.

Now, Germany is starting to think about additional sources of electricity as it winds down its coal plants to meet its climate commitments under the Paris agreement at the same time as it is shuttering the atomic units. While renewables have been gaining rapidly in recent years and will continue to do so, the grid needs a source of supply that can make up for when wind and solar don’t work.

Natural gas is the most obvious choice. It burns cleaner than coal and can feed plants that start and stop when grid dispatchers ask.



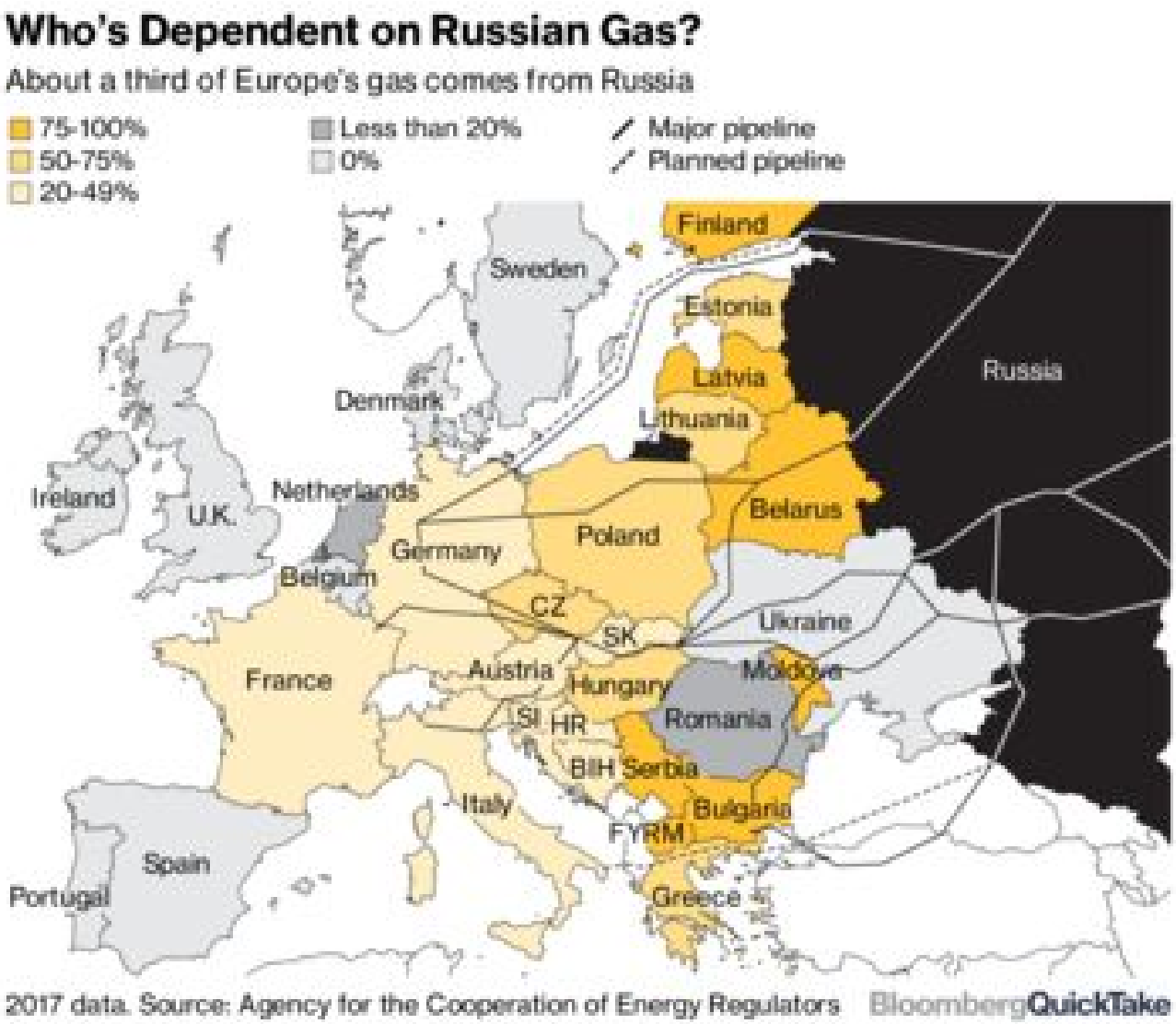
“There is certainly more room for natural gas,” said Jean-Baptiste Dubreuil, senior natural gas analyst at the International Energy Agency in Paris. “Coal is baseload, and the question now is to what extend that baseload can be replaced by renewables. Where it is not possible, it will be for gas to step in.”

Drawing more gas risks angering the U.S., which wants Germany along with the rest of Europe to develop alternatives to Russian flows. Russia currently feeds a significant share of Germany’s gas needs and is building the Nord Stream 2 pipeline underneath the Baltic Sea to add to the ways it can bring in supply.

The 1,220 kilometer (758-mile) Nord Stream 2 undersea link to Germany initiated by Russia in 2015 is due to be complete in 2019.

The state pipeline champion Gazprom PJSC has been pumping at near record rates into Europe and will bring on that new route as early as the end of this year. Gazprom isn’t the only company gearing up to supply more.

Three German towns — Brunsbuettel, Stade and Wilhelmshaven — are lobbying hard to win federal support to build Germany’s first LNG terminal. That would allow countries from Qatar to Algeria and even the U.S. to send ships with the super-chilled fuel to Germany. And tapping LNG to balance the grid raises separate concerns about security.



2017 data. Source: Agency for the Cooperation of Energy Regulators

“The more Europe bets on LNG, the more dangerous its reliance on imports can get,” said Manfred Leitner, executive board member overseeing downstream at the Austrian oil company OMV AG, which is helping finance the Nord Stream 2 link. “LNG is simply the flexibilization of gas in terms of destination, which means more competition among geographical regions. It is more expensive and less reliable than pipeline natural gas.”

A number of risks could slow or even halt the gas expansion — starting with unseasonably warm weather across the northern hemisphere that depressed demand for heating in Asia and Europe this winter. To refine their forecasts, analysts are watching:

- Whether more homes shift toward gas and away from electricity for heating
- How quickly electric cars spread, which will have a big impact on power demand
- Goals that Germany sets for use of renewables, currently envisioning 65 percent of electricity supply by 2030
- Competition for gas coming from renewables as the cost of wind and solar falls
- Which coal plants close first, since the most polluting units using lignite also are in economically depressed areas where the government needs voter support
- Whether Germany moves to limit gas use either because of pollution or climate concerns

---

IEA Holds Workshop on the Role of Nuclear Power in a Clean Energy System

With the aim of identifying the key issues and exploring the future of nuclear power, the International Energy Agency held a workshop on 25 February on the role of nuclear power in a clean energy system.

The event brought together representatives from IEA member countries, industry leaders and experts to examine the role of nuclear energy in mature power markets and the implications of an uncertain future for nuclear energy for energy security, the economy and the environment.

“Nuclear energy plays a major role in both energy security and sustainability in today’s energy mix,” said Dr Fatih Birol, the IEA’s Executive Director, in his opening remarks. “However without appropriate policy attention, its contribution will shrink, creating challenges for meeting our energy policy goals in the future.”

The workshop featured Jean Bernard Lévy, the Chairman and Chief Executive Officer of Électricité de France, Michal Kurtyka, Poland’s Deputy Minister of Environment and President

of COP24, and John Parsons from the Sloan School of Management at MIT.

Other speakers included Minister of State Peter Kaderják from Hungary, Deputy Commissioner Shin Hosaka from Japan, Deputy Minister Rene Nédela from the Czech Republic and Assistant Secretary Ted Garrish from the United States Department of Energy.

The workshop focused on four themes: the outlook for nuclear power in advanced economies; the economic position of nuclear power in mature power markets; the role of nuclear power in power systems requiring more flexible resources; and the investment challenges for new nuclear power, including Small Modular Reactors.

With limited investment in new plants, the contribution of nuclear to the power mix in mature markets is set to decline significantly under current policy frameworks. In the IEA's New Policies Scenario, nuclear power production grows as two countries, China and India, are responsible for over 90 percent of net growth to 2040. By contrast, outside of Japan, nuclear power generation in developed economies is set to decline by 20 percent by 2040. This decrease will be far greater if expected investments in plant life extension or new facilities do not take place.

The IEA is preparing a special report, "Nuclear Power in a Clean Energy System" which will examine these issues and develop policy recommendations. The report will be launched at the 10th Clean Energy Ministerial meeting, held in Vancouver, in May.

Source: **International Energy Agency**
Date: **Feb 27, 2019**

Investing in gas: the effect of carbon taxes, gas prices, and the growth of renewables

Highlights

- A cumulative cash flow analysis is presented for a natural gas power plant.
- Wind and solar expansion can strongly improve the profitability of natural gas power plants because their value decline leads directly to a value increase for load-following plants.
- CO_2 price increases pose an important risk for natural gas power plants, but this risk could be cancelled out by the value gain from increased wind and solar market share.
- The other important risk is natural gas price

volatility, but this is a risk that the industry has decades of experience with.

Introduction

Past articles in this series offered some qualitative discussions on the risks involved in several mainstream energy options. Following the previous articles on onshore wind, utility-scale solar PV and nuclear, this article will present a quantitative analysis of these risks for natural gas. The final article, on coal, will follow soon. The analysis will be presented for a typical developed world scenario. Developing world technology cost levels are very different and will be covered in a future article.

All the most influential assumptions will be clearly explained and their impact on the results will be quantified in a sensitivity analysis. This will give the reader the opportunity to clearly see the quantified impact of the risk under the assumptions they think are the most appropriate.

Methodology

Results will be presented in the form of a discounted cash flow analysis for only 1 kW gas power over a two year construction period followed by a 40 year operating period. The investment is made linearly over the two year construction period, followed by the annual receipt of revenues from electricity sales and payment of fuel and operating and maintenance (O&M) costs.

Capital costs are taken as $1250/kW. This was found to be a good global average when adjusting for purchasing power parity. O&M costs are taken as 2.5% of the capital cost per year and these costs are assumed to increase linearly by 1% per year. Fuel costs were taken as $6/GJ (costs per GJ are almost equivalent to costs per MMBtu) and plant efficiency was

taken to be 60%. These assumptions were derived from cost data presented in a 2015 IEA report on electricity costs.

After the initial $1250 capital investment, the annual cash flows from electricity sales at an average wholesale price of $60/MWh and a capacity factor of 45% are shown below. In addition, it was assumed that this load-following gas plant earns 105% of the average wholesale price when no wind and solar are on the grid because it will tend to produce more electricity during times when the price is high.

Load-following plants also earn some revenues from capacity and ancillary services. According to the latest IEA world energy outlook, this represents about 5% of plant revenues in the EU and 20% in the US. We will take the low value in this analysis and assume 5% of added revenues from these grid stability services on top of energy sales.

Costs from load-following operation (startup costs and reduced efficiency) are small. For a 45% capacity factor, the impact of frequent plant restarts or frequent part-load operation amounts to only about $1/MWh in levelized cost in coal plants (costs for more flexible gas plants should be slightly lower). This small added cost should be cancelled out by the conservative assumption that all O&M costs are fixed ($/kW/year) whereas, in reality, some O&M costs will decrease with lower plant utilization rates.

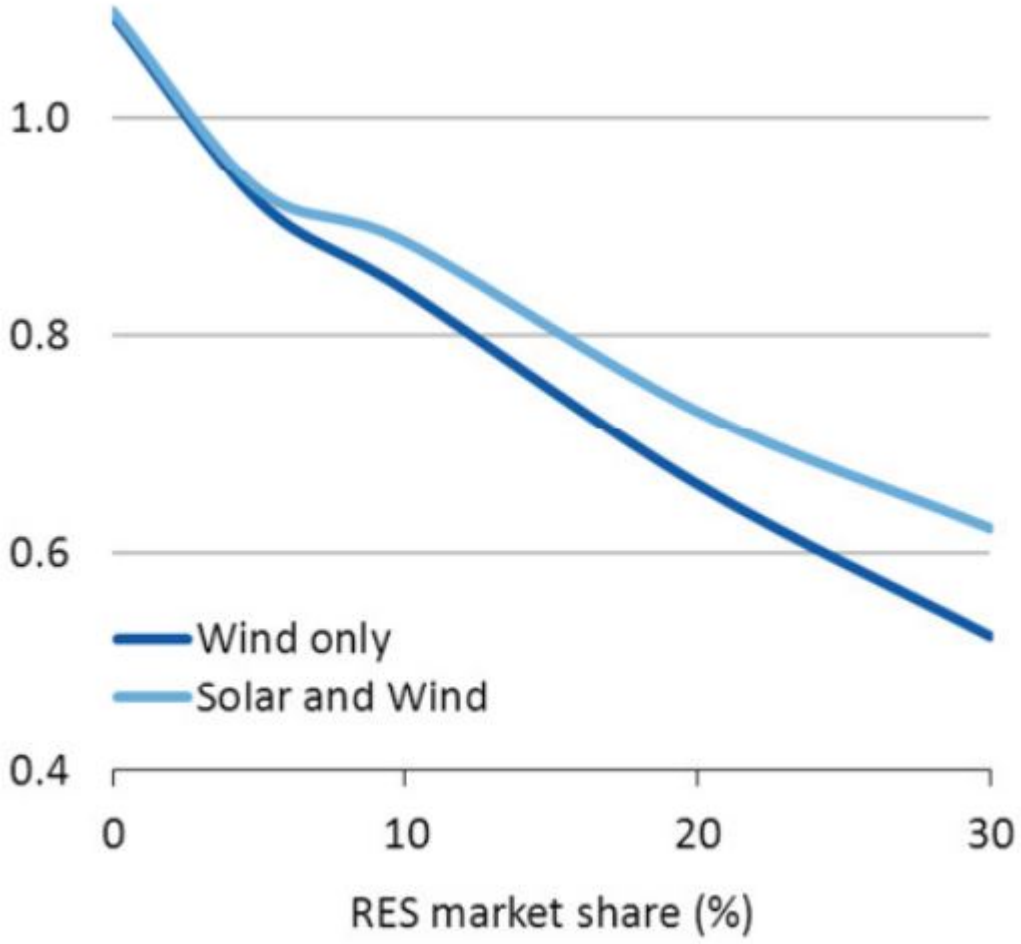
Using this information, a cumulative cash flow curve can be constructed (below). As shown, the initial $1250 investment is recovered in year 12 when no discounting is applied (discount rate of 0%). When a discount rate of 7.4% is applied, the net return on investment is zero. In other words, this analysis would return a levelized cost of electricity of $60/MWh if the discount rate is set to 7.4%. This is close to the 8% discount rate often assumed to be a good return in developed economies.

Next, the effects of a CO_2 price and expanding variable renewable energy (VRE) market share over the plant lifetime are explored. The CO_2 price is assumed to increase linearly at a specified rate over the lifetime of the plant. CO_2 intensity of the plant is set to 0.5 ton/MWh, which includes upstream emissions (e.g. fugitive methane emissions).

Regarding VRE expansion, it is assumed that the capacity factor of the load-following plant (assumed to be 45%) is not affected by the VRE market share. VRE expansion will instead displace baseload generators (or force baseload generators to turn into load-following generators by reducing their capacity factors).

However, VRE expansion will strongly increase the average value of load-following plants. While VRE sells most of its electricity during times of low electricity prices (leading to lower average value), exactly the opposite happens to load-following plants. These plants produce most of their electricity during times of high residual demand and high prices (leading to higher average value). Greater electricity price variability from higher VRE market shares is therefore great for load-following plants.

In practice, value is increasingly transferred from VRE generators to load-following generators as the VRE market share increases. To capture this dynamic, it is assumed that average value increases by 1% for every 1% increase in VRE market share. This is a little more than half the rate at which combined wind and solar market value declines with increasing market share (below). It is assumed that VRE market share starts at 7% (current global average) and expands to a maximum market share of 60%.



Combined wind and solar expansion leads to smaller value declines than wind expansion only (source).

The annual cash flow for a CO_2 price increase of $2/ton per year and a VRE expansion rate of 2% per year is shown below. The revenues of the plant increase gradually due to the increase in average value caused by the high price volatility stemming from increasing VRE market share. On the other hand, CO_2 costs become as large as fuel costs at the end of the plant lifetime as CO_2 prices climb to $80/ton.

The cumulative cash flow analysis shows only minor differences due to these two competing effects, although the overall economic performance improves slightly.

Effect of the discount rate

The effect of discount rate on the average electricity price required is shown below where several different risks related to gas power plant investment are explored. Note that the average electricity price required is used here instead of the levelized cost of electricity to account for the value increase of gas power with increasing VRE market share. This measure can be interpreted as the average market price over an entire year that will yield a zero return on investment with a specified discount rate. The actual electricity price received by the gas power plants will be higher.

Firstly, it is clear that the effect of discount rate is much smaller than for the wind, solar and nuclear power plants discussed earlier. Natural gas power plants are relatively simple and cheap to construct, with fuel costs usually being the primary expense.

Increasing VRE market share has a substantial positive effect on the economics of a load-following natural gas plant. In essence, the load-following plant gains the value lost by the wind and solar plants, simply because it is dispatchable.

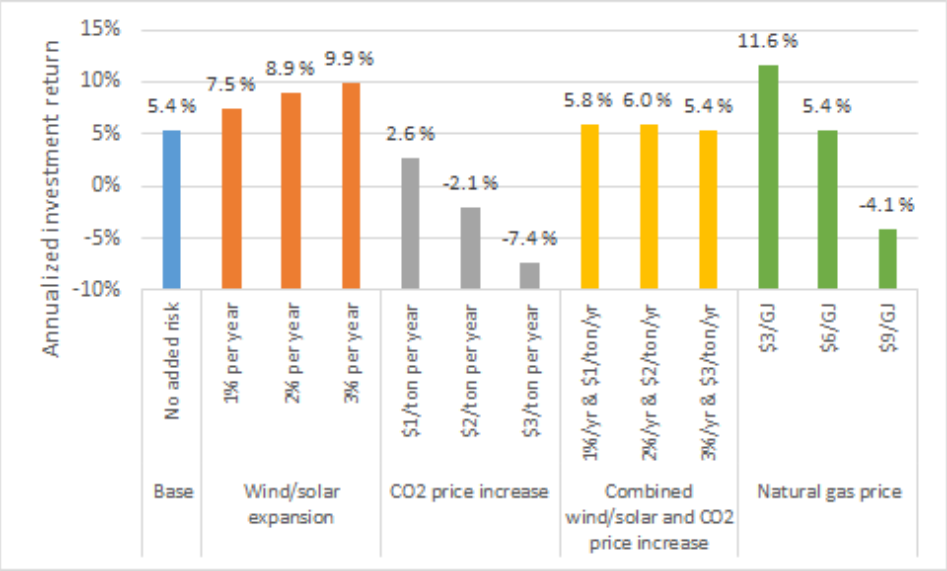
As may be expected for any fossil fuel plant, CO_2 price hikes pose a major risk. Interestingly, however, this risk becomes significantly smaller with increasing discount rate because high CO_2 prices are only expected later in the plant lifetime. When the discount rate is high, these high costs in the distant future are strongly discounted, minimizing the negative effect.

Since fuel cost is the major cost component of a typical natural gas power plant, a sustained increase in natural gas pricing also poses a major risk.

Quantifying the risk

Next, the three risks discussed in the previous section will be quantified in a sensitivity analysis. This quantification is done by determining the discount rate giving zero return on investment when the average electricity price is set to $60/MWh. The annualized return on investment is then quantified as the discount rate minus 2% to account for margin erosion from technological improvements of new plants that come online during the plant lifetime as well as financial/legislative costs (paying the bankers and lawyers involved in setting up financing for the plant).

As shown below, the investment return is a reasonable 5.4% under the base case assumptions (blue bar). The orange bars show that VRE expansion has a clear positive effect due to the value increase caused by high rates of VRE expansion.



As shown by the grey bars, an increase in CO_2 price causes large reductions in investment returns. The plant becomes unprofitable after 26 and 17 years respectively when the CO_2price increases at rates of $2/ton and $3/ton respectively. Investment returns go negative when the CO_2 price increase exceeds $1.7/ton per year.

It is unlikely that VRE expansion or CO_2 price increase happens in complete isolation. When these two effects happen at the same time, they tend to cancel each other out almost exactly for the natural gas power plant (as can be seen on the yellow bars above). This is an important element that reduces the risk involved in load-following fossil fuel power plant investments.

Finally, the large impact of natural gas pricing is shown by the green bars. When natural gas prices fall to the level facilitated by the US shale revolution, excellent annualized returns in excess of 10% can be expected. On the flip-side, returns become negative when the natural gas price exceeds $8.2/GJ.

Conclusions

This article has quantified the impact of natural gas power plant risks on expected investment returns. Increasing CO_2 prices present a very important risk for any new fossil fuel power plant. Gradually increasing CO_2 prices eventually render the plant unprofitable, requiring it to shut down early (or be retrofitted with CO_2 capture technology).

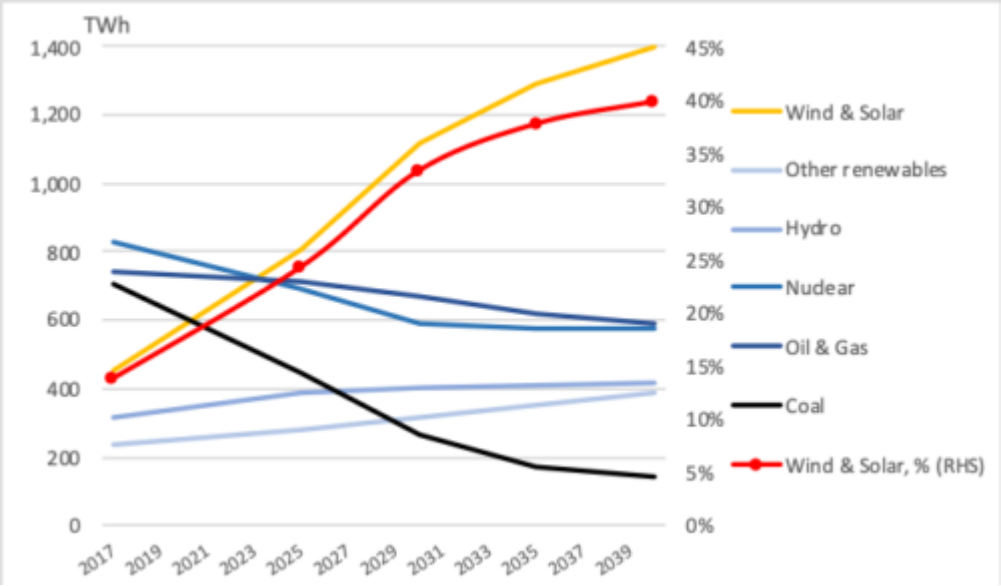
Wind and solar expansion presents a major benefit to a load-following gas power plant. These plants perform well in an electricity market with wide price swings because most output can be concentrated during the times with the highest prices. Since wind and solar expansion is highly likely in an environment with increasing CO_2 prices, this dynamic substantially reduces the CO_2 taxation risk.

Natural gas pricing was shown to have a very large effect on power plant profitability. This is a risk that investors and power plant operators have decades of experience with.

Given that the two new effects of CO_2 prices and VRE expansion

tend to cancel each other out, the business case for natural gas power plant investment is not expected to change much. Given that wind and solar technology-forcing has seen significantly more practical deployment than technology-neutral CO_2 pricing, the business case for natural gas power plants may well improve even further over coming decades.

IEEFA Update: When will renewables dominate EU power markets?



LONDON – Market analysts are projecting relentless renewable energy growth in the European Union over the next two decades, but to become a reality, this trend will need to be backed by clear, stable policy, private financing and grid integration solutions. This is especially true for the larger economies, such as Britain, France and Germany, if they are to follow the lead of early movers such as Denmark.

There is no doubt that renewables are the future of power

generation in Europe, and worldwide, backed by unstoppable trends including cost reduction, decarbonisation, digitalisation, and the electrification of heat and transport, but the speed of this transition is still up for grabs.

In their set-piece analyses last year, both Bloomberg New Energy Finance (BNEF) and the International Energy Agency (IEA) projected rapid growth in wind and solar power.

The IEA projection appeared in its World Energy Outlook (WEO), an annual overview of global energy sector trends that features its baseline *New Policies Scenario*. The IEA has also developed a *Sustainable Development Scenario* based on the conditions needed to limit average global warming to "well below 2°C," in line with the Paris Agreement on climate change.

Both IEA scenarios project rapid growth in wind and solar power in the EU, becoming the main source of power generation around 2023 and reaching a 40-44% market share by 2040 (see Figures 1 and 2).

BNEF bases its annual *New Energy Outlook* on trends in global technology. It foresees an even bigger and faster transition to wind and solar power, to become Europe's leading source of generation around 2021, reaching a 66% market share by 2040 (see Figure 3).

In the past, such projections have often failed to match actual growth in renewables, and solar power in particular. The IEA has a track record of getting it wrong: its latest World Energy Outlook had to revise upwards wind and solar growth projections across the board from the year before. In its 2018 WEO, for example, it upgraded global projected wind and solar under its baseline scenario to 21% market share in 2040, from 19% in its previous estimate, and 32% in Europe, up from 27%.

These repeated projection errors were due to rapid cost

reductions in solar power, especially, which caught by surprise both policymakers and market analysts. However, as policymakers begin to withdraw financial support, not least in Europe, a fairer question now is whether such stellar growth will continue, or could analyst projections be overly optimistic?

Key questions include:

- **How will future growth in wind and solar be financed?** Many European countries previously assured premium cash flows to renewable energy projects through feed-in tariffs and green certificate schemes. Such measures have recently started to attract pension funds, interested in long-term, stable revenues that match their liabilities. New financing schemes will need to offer similar revenue stability to continue to attract low-cost capital, but such schemes are still a work in progress. One emerging alternative is the purchase of renewable electricity by corporations under long-term contracts. At present, however, this is very limited in Europe, compared with the historical market as supported by feed-in tariffs. Another alternative is a zero-subsidy contract, with government backing, which assures stable revenues, but without a premium to power markets. While the latter may offer the stable cash flows private investors need, there will be learning curve first to convince pension funds and others that the "good old days" of subsidies are not coming back.
- **How will variable sources of electricity such as wind and solar be integrated into the grid?** Already, several European countries have achieved a wind and solar market share above what BNEF and the IEA are projecting for the continent as a whole by 2040, at 50% or more of electricity supply. But these countries, such as Denmark, created favourable grid conditions over a decade or more, and may have been lucky enough to find

themselves with certain natural advantages. Denmark, for example, is fortunate to be able to trade electricity with very large neighbours (Germany to the south, Nordic countries to the north), buffering the variability of its wind power.

Achieving renewables growth across the continent will require a methodical approach to boost flexibility, and so buffer the variability of wind and solar power. They must develop markets that support investment in demand-response and electricity storage and internal and cross-border transmission. Charts of trends in energy mix may be visually exciting but they do not capture these vital behind-the-scenes prerequisites, even though they arguably will be as important as quantities of generated electrons going forward.

Three Things Keeping Gazprom Managers Awake at Night

Undervalued shares, the risk of sanctions and increasing competition with liquefied natural gas are all causing sleepless nights for Gazprom PJSC’s managers.

At an investor meeting in Singapore on Thursday, when asked about what keeps Gazprom managers awake at night, board member Oleg Aksyutin said it was the need to “take into account all the aspects” for the future of its gas exports to Europe and Asia.

It’s “in particular the black swans, and trying to understand the extent to which we can whiten these swans and expect them to appear, is something that continuously keeps us alert,” Aksyutin said.

The remarks indicate the company’s board sees the need to firm up its competitive position against alternatives such as LNG and new pipeline routes reaching into Europe from the south and the Caspian Sea region.

Russia’s biggest gas producer aims to strengthen its position in Europe, where it increased its market share to almost 37 percent last year, according to Gazprom. The company also aims to become the top gas supplier to China where it plans to start deliveries by the end of this year.

While Gazprom’s projects to expand export routes in Europe, such as the TurkStream pipeline across the Black Sea and the Nord Stream 2 link across the Baltic Sea, have faced criticism both within and outside the European Union, the company sees them as one of the reasons its shares should be valued higher.

Germany Preparing to Draw More Russian Gas, Disregarding Trump

Once Russia’s biggest company by market capitalization, Gazprom is now surpassed by domestic oil companies Rosneft PJSC and Lukoil PJSC. The nation’s state-run gas producer has been losing investor appeal in recent years as spending plans have eclipsed the promise of higher dividend payouts.

Gazprom management has signaled it sees the possibility of paying half of its profit out as dividends after its current investment cycle ends in 2020, according to Chief

Financial Officer Andrey Kruglov. The final decision will be made by shareholders, Kruglov said.

“Raising its market cap is one of the fundamental objectives that the management of the company is pursuing,” Kruglov said at the same event. The company budgeted for record high dividends of 10.43 rubles (16 cents) per share for 2018, or 27 percent of net income under International Financial Reporting Standards.

Besides the valuation of the company, which depends “on the effort contributed by every office and every employee,” said Elena Burmistrova, director general of the company’s export unit, sanctions and “certain pressure” from U.S. LNG deliveries to Europe are also “worrisome” for Gazprom.

Earlier this week in Hong Kong, Gazprom’s top executives dismissed the impact of LNG on the company’s position in the European gas market and said U.S. sanctions had little impact on its operations.

Russia’s proposed TurkStream 2 pipeline sparks Bulgaria, EU energy worries

Russia is pushing for a new gas pipeline running through Bulgaria that could supply Western Europe with energy.

But does the TurkStream 2 proposal threaten to strengthen the Kremlin's influence over the European Union?

Bulgaria is considering joining Russia's TurkStream 2 pipeline proposal and, according to the country's Ministry of Energy, is ready to invest €1.4 billion ($1.6 billion) in the project.

Russian Prime Minister Dmitry Medvedev is set to travel to the country next week, where he is expected to discuss the pipeline. However, its completion is dependent on approval from the necessary authorities, including the European

Commission. Experts have already expressed doubts over whether the pipeline will be profitable (in fact, only the third market test was successful), implying that the government in Sofia is working to further Russian interests.

The original 910 kilometer-long (565 mile) TurkStream gas pipeline runs under the Black Sea, linking Russia and Turkey. This project is due to be completed by the end of this year, along with the Power of Siberia pipeline, which links Russia to China, and the Nord Stream 2 pipeline from Russia to Germany. Turkey is Russian energy giant Gazprom's second biggest client after Germany.

arket. Gazprom has two options for reaching Western Europe: either through Greece and Italy or through Bulgaria, Serbia, Hungary and the Baumgarten hub in Austria. Earlier in February, Gazprom CEO Alexei Miller met Serbian President Aleksandar Vucic to discuss the pipeline project. However, the chairman of Greece's main opposition party, New Democracy, said on Thursday ahead of a two-day visit to Moscow that his country was considering whether to allow the new pipeline through Greek territory.

The original TurkStream pipeline runs under the Black Sea, connecting Russia and Turkey

Russian gas an EU dependence

The European Union currently imports most of the natural gas it uses. According to Eurostat data, for the first semester of 2018, 40.6 percent of this imported gas came from Russia, followed by Norway and Algeria. Until recently, most of the Russian gas supplied to the EU ran through pipelines crossing Ukraine. After the revolution that forced pro-Russian President Viktor Yanukovych from office, and the subsequent annexation of Crimea by Russia in 2014, relations between Moscow and Kyiv deteriorated. The Nord Stream and TurkStream pipelines allow Russia to supply natural gas to

Western Europe without running through Ukrainian territory, thus denying Kyiv transit fees and billions of euros in profit.

Sixty-seven percent of Russia's tax revenues come from energy exports, particularly gas, which is a powerful political instrument for the Kremlin. Companies such as Gazprom, as well as virtually all Russian resource oligarchs, operate under the Kremlin's benevolent eye. And, in numerous cases, the elites in countries such as Bulgaria, Serbia and Turkey are tempted by Russian overtures. Furthermore, the supporters of the Nord Stream pipeline in Germany and within the Hungarian government, including Prime Minister Viktor Orban, have been accused of enabling Russia's geopolitical power games.

Bulgaria is highly dependent on the import of Russian energy: more than two-thirds of the gas it consumes domestically comes from Russia. On the eve of Bulgaria's accession to the EU in 2007, Vladimir Chizhov, Russia's ambassador in Brussels, playfully called the country "our Trojan horse in the EU, in the good sense."

In 2014, the Bulgarian government abandoned TurkStream's predecessor, the South Stream gas pipeline, due to pressure from Brussels, which said the project wasn't compliant with EU legislation. In an effort to avoid potential sanctions, Gazprom has now chosen a Russian company – oil and gas pipe maker TMK, which arguably has "no connections" to Gazprom – to construct the pipeline, according to the Russian news outlet RBC.ru.

The Nord Stream 2 pipeline, which bypasses Ukraine on the way to Germany, has been a source of controversy

The Russian lobby in Bulgaria

The pro-Russia lobby is a powerful force within Bulgarian politics. Volen Siderov, the leader of the populist right-wing party Ataka, is a great admirer of Russian President Vladimir

Putin, for instance. What’s more, Valentin Zlatev, a key figure in the energy sector and the CEO of Lukoil Bulgaria, which belongs to Russian multinational corporation Lukoil, has been described as the kingmaker of Bulgarian politics.

According to Transparency International, Bulgaria continues to have the highest level of corruption within the public sector among EU member states. While relations between power brokers in Sofia and Moscow are often based on pragmatism, the majority of the country’s population still harbors a special sympathy for Russia.

However, two particularly thorny issues between Bulgaria and Russia threaten to complicate progress on the TurkStream 2 project. The deputy chair of Bulgaria’s ruling party, GERB, has warned that the upcoming European Parliament elections could be vulnerable to Russian interference. Furthermore, the poisoning of the Bulgarian arms dealer Emilian Gebrev in 2015 has been linked to the case of Sergei Skripal and his daughter in the United Kingdom last year. There are allegations that both Skripal and Gebrev were targets of Russian intelligence operatives.