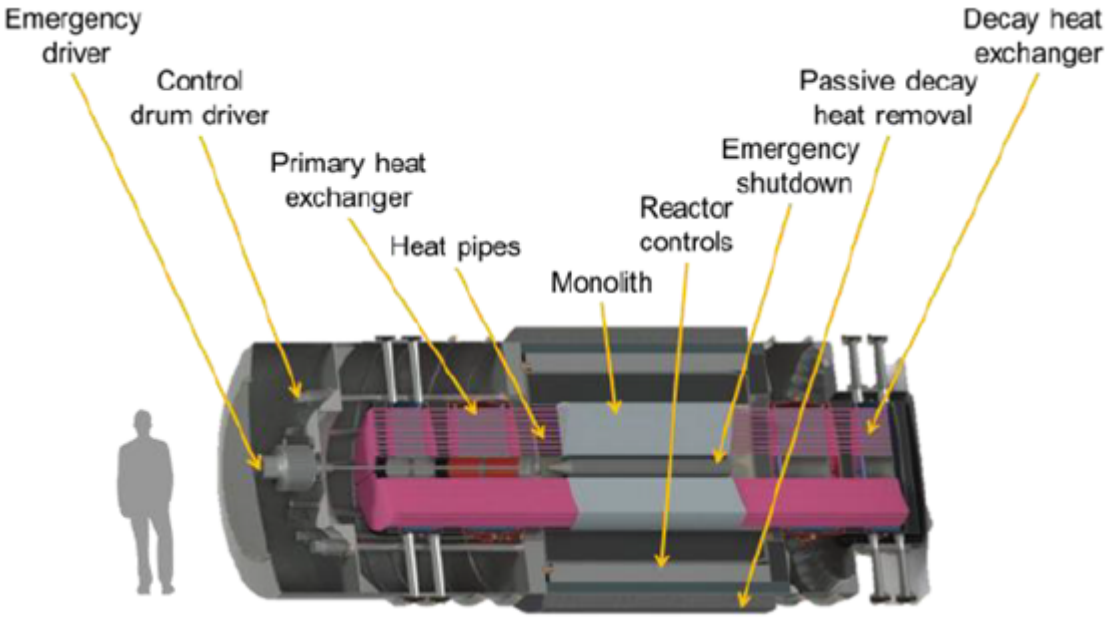
Next generation nuclear: 25MW, smaller, safer, can be sited anywhere



Dan Yurman *looks at plans for* ***Small and Micro Nuclear Reactors****. A* ***UK*** *report on Micros that generate* ***30MW*** *says it's an opportunity for the country to own the IP and export units that are* ***simple in design****,* ***factory constructed*** *and capable of being* ***sited in remote locations****. Given the rough ride nuclear can get, the report warns that* ***progress will depend on political, regulatory and financial support****. Meanwhile, in the* ***US, Westinghouse*** *will have a* ***25MWe*** *unit ready to test by 2022. And while the world waits for such Micros,* ***China*** *will begin construction at the end of this year of a* ***125MW Small Modular Reactor****, expected to be* ***operational in 2025****.*

Westinghouse launches new SMR effort

After several earlier false starts, including a complete withdrawal in 2014 from efforts to enter the SMR market, **Westinghouse buoyed with a $12.9 million grant from the U.S.Department of Energy**, is making another go of it. The

firm said **it will spend $28.9 million to demonstrate the readiness of the technology of its 25-MWe eVinci micro-reactor by 2022**.

The government money, which is covering about half of the costs, will cover costs used toward design, analysis, licensing to manufacture, siting, and testing work.

The monolith will serve as the second fission product barrier (the fuel pellet is the first barrier) as well as the thermal medium between the fuel channels and heat pipes. The heat pipes will extract heat from the core using a technology based on thermal conductivity and fluid phase transition.

Key technical attributes

On its website Westinghouse said the reactor's small size and innovative design set it apart. (Technical Profile – PDF file) Here's a short list of key technical details.

- Transportable as a reliable energy generator
- Fully factory built, fueled and assembled
- Output of 25 MWe electrical
- Up to 600ºC process heat for petro chemical and other industrial uses
- 5- to 10-year life with walkaway inherent safety
- Target less than 30 days for onsite installation
- Autonomous load management capability
- Proliferation resistance through encapsulation of fuel
- Minimal moving parts

Challenges ahead for a new design

Westinghouse told Power Magazine that it faces several key challenges. First among them is **getting enough HALEU fuel**. The Department of Energy is supporting multiple efforts to address that issue including a contract to produce it by **Centrus Corp** by 2020 and deployment of a HALEU-based TRISO-X fuel

fabrication pilot line at the **Oak Ridge National Laboratory**.

Other issues which are faced by all SMR developers include **the question of how many deals are needed to be inked in their order books to get investors to provide the funds**for factory production facilities.

Because the design is unique, Power Magazine noted that Westinghouse will have to go through the long and expensive safety evaluation process at the **NRC**. The firm told Power Magazine it faces "first of a kind" challenges in licensing, instrumentation, remote reactor monitoring, and logistics.

"These challenges require careful risk management and planning, but they are not considered showstoppers and their management is part of the Westinghouse eVinci reactor development program."

Small modular reactors have big potential market in UK, says government-funded report

(NucNet): **Micro nuclear reactors (MNRs)** are a feasible option for the UK and have a potential market in the hundreds by 2030, a new government-funded report has concluded.

The report, produced by **Nuvia**, **WSP** and **Atomic Acquisitions**, concludes that there is great potential for development of MNRs between 2030 and 2035.

It says MNRs, **typically under 30 MW**, could bring significant economic benefits to the UK but must be "decisively supported" because they will only proceed with clear support and facilitation of political, regulatory and financial factors.

The study, Market and Technical Assessment of Micro Nuclear Reactors, says;

"Due to their size and unique characteristics, there are

several potential market opportunities for MNRs. **A potential global accessible market of up to 2,850 megawatts has been estimated by around 2030**," the report says.

"A potential MNR industry could enable the UK to grow indigenous civil nuclear reactor manufacturers gaining intellectual capital at low entry cost. At present this core part of the civil nuclear supply chain is not provided in the UK."

In its conclusions the report says key advantages of micro reactors include **simplicity of design, including safety systems**; potential **ease of construction through factory construction**; **lower overnight cost** of each unit resulting in ease of financing; and the possibility of **placing reactors in remote locations**.

December construction start for Chinese 125 MWe SMR

(WNN) China's **Ministry of Environment** is proceeding to build an **ACP100 small modular reactor (SMR)** at Changjiang, **Hainan**, with construction to begin by the end of this year.

According to Chinese publication Nuclear World, **construction is expected to take 65 months with the 125 MWe unit expected to start up by May 2025**.

According to data about the ACP100 in the **IAEA "SMR Book,"**the ACP100 is **a multipurpose power reactor designed for electricity production, heating, steam production or seawater desalination** and is **suitable for remote areas that have limited energy options or industrial infrastructure**."

The design, which has 57 fuel assemblies and integral steam generators, (see table right) incorporates passive safety features and will be installed underground.

A two-unit ACP100 plant will be located on the northwest side of the existing Changjiang nuclear power plant, according to the 22 March announcement. The site is already home to two operating **CNP600 PWRs**, with **two Hualong One units also planned for construction at that site**.

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Dan Yurman is the author of Neutron Bytes and writes on nuclear matters.

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Renewables could account for 86% of global power generation in 2050

According to the International Renewable Energy Agency (IRENA), renewable energy sources (RES) could account for 86% of power generation in 2050. IRENA's reference scenario foresees electricity to become the central energy carrier, reaching a 50% share of final energy consumption by 2050 (from the current 20%). Renewable power development should benefit from the fall in the Levelized Costs Of Electricity (LCOE), which should halve between 2010 (US$80/MWh) and 2050 (US$40/MWh) for wind power and divide 9-fold for solar, from US$347/MWh in 2010 to US$38/MWh in 2050. Solar PV deployments could accelerate from the current 109 GW/year to 360 GW/year in 2050, while wind capacity additions could surge from around 54 GW/year to 240 GW/year.

Conversely, fossil fuel consumption would decline: oil demand would be reduced to 22 mb/d (from current 95 mb/d), gas demand would reach 2,250 bcm/year (from around 3,750 bcm/year in 2018) and coal demand would collapse from around 5,360 Mtce/year in 2018 to 713 Mtce/year in 2050. The investment required to decarbonise the global energy system is estimated at US$15,000bn by 2050 (-40% than previous estimates due to decreasing renewable power generation costs).

The higher renewable power generation could cut CO_2 emissions by 27% in 2030 (compared to the current level), by 48% in 2040 and by 71% in 2050, leading to a fall in CO_2 emissions per capita, from 4.3 tCO_2/cap in 2010 to 1.1 tCO_2/cap in 2050.

https://www.enerdata.net/publications/daily-energy-news/renewables-could-account-86-global-power-generation-2050.html

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China plans to boost domestic coal production by 100 Mt in 2019

China expects to increase its coal production by 100 Mt in 2019 from the 3.5 Gt produced in 2018. Despite China’s

commitment to cut excess produciton capacity, production will be boosted by the 194 Mt/year of new coal mining capacity approved in 2018 and by the 29.5 Mt/year new coal mining capacity to be added in 2019. Consequently, coal imports could decrease by 10 Mt to 12 Mt in 2019.

China is by far the world's largest coal producer, with a production that increased by 3% in 2018 (+100 Mt). Coal production increased rapidly over 2000-2011 (almost 9%/year) before peaking in 2013 at 3.8 Gt and reducing until 2016. The trend shifted in 2017, when production grew again (+100 Mt or +3%). The northern and north-western regions are the main production areas.

https://www.enerdata.net/publications/daily-energy-news/china-plans-boost-domestic-coal-production-100-mt-2019.html

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China's installed capacity expected to reach 2,000 GW in 2019

According to the China Electricity Council (CEC), China's installed capacity should reach around 2,000 GW at the end of 2019, representing a total increase of more than 100 GW compared to 2018 (1,900 GW). Most of the capacity increase – around 62 GW – will come from non-fossil fuel capacities. Coal consumption for power generation is expected to increase by 80 Mt in 2019.

China is the world leader in annual newly installed capacities for wind and solar. The wind power capacity increased by more than 20 GW in 2018 (+13%) and reached 184 GW. Overall, Chinese wind power capacity has increased nearly sixfold since 2010. Solar power capacity have soared over the past years, from less than 900 MW in 2010 to more than 130 GW in 2017 (+53 GW over 2016) and to nearly 175 GW in 2018 (+44 GW in 2018).

https://www.enerdata.net/publications/daily-energy-news/chinas-installed-capacity-expected-reach-2000-gw-2019.html

Israel Builds World's Largest Solar Power Tower

The Ashalim solar and thermal electric power plant in Israel's Negev Desert is up and running. The state-of-the-art facility is equipped with more than 50,000 computer-controlled heliostats or mirrors, which can track the sun in two dimensions and reflect the sunlight onto a boiler placed on top of a tower measuring 240 m-high (787.4 ft). That's higher than some of the tallest sky scrapers in the world and by far the tallest solar tower ever built.

How does it work? All those tens of thousands of mirrors are hooked up to a computer operated tracking system so that they all move precisely with the orbit of the earth around the sun throughout the day and direct the heat from the sunlight to a spot on the boiler on top of the tower to within 0.0015499969 of an inch. The super hot water in the boiler produces superheated steam, which is then conveyed through pipes down below with enough pressure to spin a steam turbine-generator at astronomical speeds needed to produce electricity. The solar run generator can put out 300 megawatts of clean

electricity every day, or enough to power about 150,000 homes.

Another feature of the Ashalim project is the use of solar thermal technology that can store energy for use at night in order to provide consistent and reliable output of electricity. This is one of the largest renewable energy projects in the world. The facility covers an area of over 3 sq. km (2 sq. miles).

Israel’s climate is ideal for solar power, particularly in the Negev which enjoys more than 300 sunny days a year. Israel has been home to many solar technology breakthroughs, but the government has been slow in getting away from using fossil fuels for power. But that is definitely starting to change with a goal getting 10 percent of its energy needs from renewable sources by 2020 with the new solar project. Once the project is proven fully successful, Israel plans to move ahead rapidly towards renewable energy sources.

Together with the recent discovery of huge deposits of natural gas along Israel’s Mediterranean Coast, the Ashalim plant will contribute to Israel’s security by reducing dependence on fossil fuel imports. It will also keep us safe by keeping 110,000 tons of CO2 emissions per year out of the air we breath.

Lebanon Announces New Blocks for Offshore Energy Work in Waters Also Claimed by Israel

Lebanon announced on Friday five offshore blocks to be included in its coming bidding round for energy exploration and production licenses, including four along disputed maritime borders.

Offshore energy development has been a central ambition for successive governments in cash-strapped Lebanon, but political paralysis has caused years of delays.

Blocks 8 and 10 both include waters also claimed by Israel, while blocks 1 and 2 include waters claimed by Syria. One of the two blocks for which licenses were awarded last year, block 9, is also on the disputed maritime border with Israel.

Energy Minister Nada Boustani announced details in a televised news conference of the upcoming licensing round, which she said on Thursday had been approved by the cabinet and would have a bid deadline in early 2020.

A consortium of France's Total, Italy's Eni and Russia's Novatek won the first licensing round last year for blocks 4 and 9 and plans to drill its first exploration wells by the end of this year. It has said it will avoid disputed waters.

"We expect greater participation in the second round of licensing," Boustani said, adding that representatives from

Russia’s Lukoil, Spain’s Repsol and Britain’s BP had visited Lebanon in the last few weeks.

“For sure Total and Eni are still interested,” she added.

Lebanon is on the Levant Basin in the eastern Mediterranean where a number of big sub-sea gas fields have been discovered since 2009 in waters off Cyprus, Israel and Egypt.

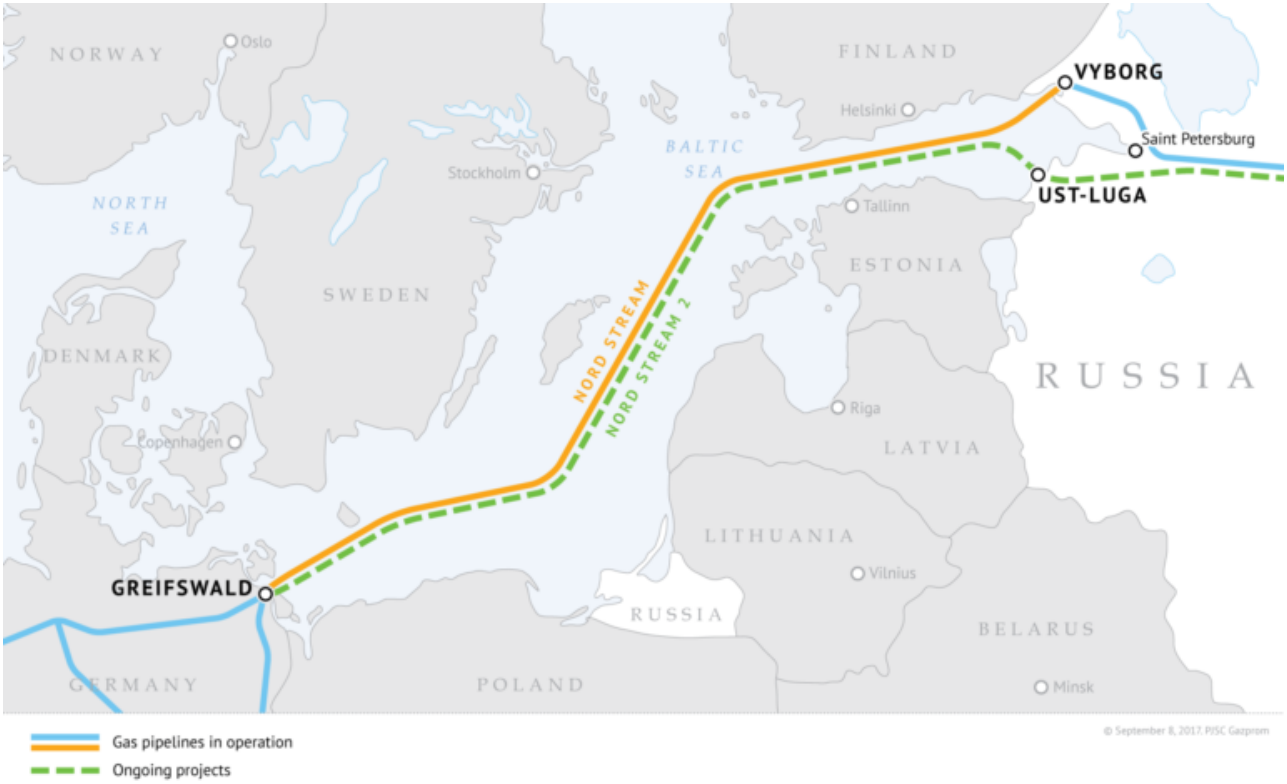
Beirut tried to launch its first offshore exploration in 2013, but domestic political problems delayed it until 2017.

For this round, it has merged the pre-qualification process for license bidders into the bidding process.

Pro-transparency group, the Lebanese Oil and Gas Initiative, urged the government to reconsider the decision, saying it might make the process more opaque.

> *Lebanon Announces New Blocks for Offshore Energy Work in Waters Also Claimed by Israel*

Nord Stream 2 to Be Implemented Even With Amendments to EU Gas Directive – Novak



MOSCOW (UrduPoint News / Sputnik – 05th April, 2019) The Nord Stream 2 gas pipeline project will be implemented even with the introduction of amendments to the EU Gas Directive, Russian Energy Minister Alexander Novak told reporters Friday.On Thursday, the European Parliament approved amendments to the EU Gas Directive, which relate to the rules of operation of offshore sections of gas pipelines in the European Union. Now the amendments should be finally approved by the Council of the European Union."Based on the draft [amendments to the Gas Directive] that were considered and adopted by the European Parliament yesterday, we can say the project will be implemented. And, of course, it will be implemented under this legislation, within the framework of what may be adopted.That is, these Gas Directive requirements will be implemented," Novak said when asked if changes to the EU Gas Directive would affect the implementation of the Nord Stream 2 project.The Nord Stream 2 project is a joint venture of Gazprom and five European companies: France's ENGIE, Austria's OMV, British-Dutch Royal Dutch Shell, and Germany's Uniper and Wintershall. The 745-mile-long pipeline is set to run from Russia to Germany to deliver Russian gas to European consumers.The pipeline project

has been welcomed by some countries in Europe and opposed by others who raise concerns over the alleged danger of Europe's dependence on Russia and subsequent diminished transit role of Ukraine. Moscow has repeatedly reiterated that the pipeline is a purely commercial project.https://www.urdupoint.com/en/amp/world/nord-stream-2-to-be-implemented-even-with-ame-586932.html?__twitter_impression=true

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Fourth Report on the State of the Energy Union

The fourth report shows the progress made on the energy union since the start of the Juncker Commission. Building on results achieved so far, the report sets out legal rules, as well as political commitments and targets for a cleaner and

greener world. It takes into account evolving global environmental, economic and competitiveness challenges.

The energy union aims to give consumers secure, sustainable, competitive and affordable energy. It does so by overhauling European energy and climate systems and policies, putting the EU at the forefront in addressing global renewable energy and climate change.

Fourth Report on the State of the Energy Union COM (2019) 175

Implementation of the Strategic Action Plan on Batteries – COM (2019) 176

https://ec.europa.eu/commission/publications/4th-state-energy-union_en

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Does Germany need LNG?

Proposals to build a German LNG import terminal have gathered momentum, but does the country need its own supply of LNG?

As Europe’s largest gas market, Germany seems an obvious candidate to take advantage of the growing global appetite for LNG. However, the country remains an outlier, lacking direct access to the LNG market.

Momentum around proposals to develop a German LNG import terminal has gathered pace in the last year. But similar proposals have come and gone in Germany over the years. Has enough now changed for the country to join the world’s growing club of LNG importers?

German gas supply on the political agenda:

The German government has given its political backing to an LNG terminal. Pressure from the US government on Germany to cease reliance on the Russian-led Nord Stream 2 gas pipeline has put the issue of an import terminal in the spotlight. While US influence cannot be ruled out, it is not a key catalyst. A more fundamental issue is one that has little to do with Russia or the US: the critical shifts in Germany’s gas supply mix.

German gas supply mix:

Less stability in the gas supply mix means that Germany's gas market has been underpinned by four main sources: domestic gas production (accounting for just 7% of demand), alongside direct access to major piped supplies from Russia, Norway and the Netherlands, and access to LNG through neighbouring LNG import terminals nearby.

Timelines:

2030 – Planned closure of Groningen gas field which is 1/5th of the current share of Dutch supply to German gas market

2038 – Commitment to phase out coal from the German market

'Gronin-gone' – a shifting supply mix:

While Germany's major gas supply sources have been remarkably consistent and reliable over the past 20 years, all that is set to change. By 2030, only two sources will be left– Russia and Norway.

Since 2000, one-fifth of German gas supply has come from the Netherlands, with the majority sourced from Europe's largest gas field, Groningen. However, this field has been mandated to shut-in by 2030. Possibly earlier.

Germany's gas supply-demand balance will open up from 2022/ 23, which coincides with the planned start-up date for a German LNG import terminal. LNG is also set to play an increasingly important role in Europe, with European imports expected to double by 2025. Our analysis shows that more import capacity will be required to support this demand.

Coal is on its way out:

Despite unprecedented investment in renewable energy, Germany has made slow progress towards reducing emissions. However, a recently published road map now recommends a full coal phase-

out by 2038, with an option to advance this cut-off to 2035.

The phasing out of coal will be positive for gas demand. Germany's recently announced road map for phasing out coal has sharpened the focus on security and diversity of gas supply further. The country's power supply mix currently comprises coal, nuclear, gas and renewables. Within the next 20 years, it will comprise only gas and renewables.

The benefits of German investment into LNG are clear:

The reasons why Germany does not yet have its own access to LNG is straightforward: pipeline suppliers have proven reliable and competitive. But all that is changing: Groningen's upcoming closure puts a question mark over future security of supply, while the growth and diversification of LNG supplies creates interest in the market. For example, the delivered cost of US LNG (on a full life-cycle basis) is competitive into the forecast German hub price.

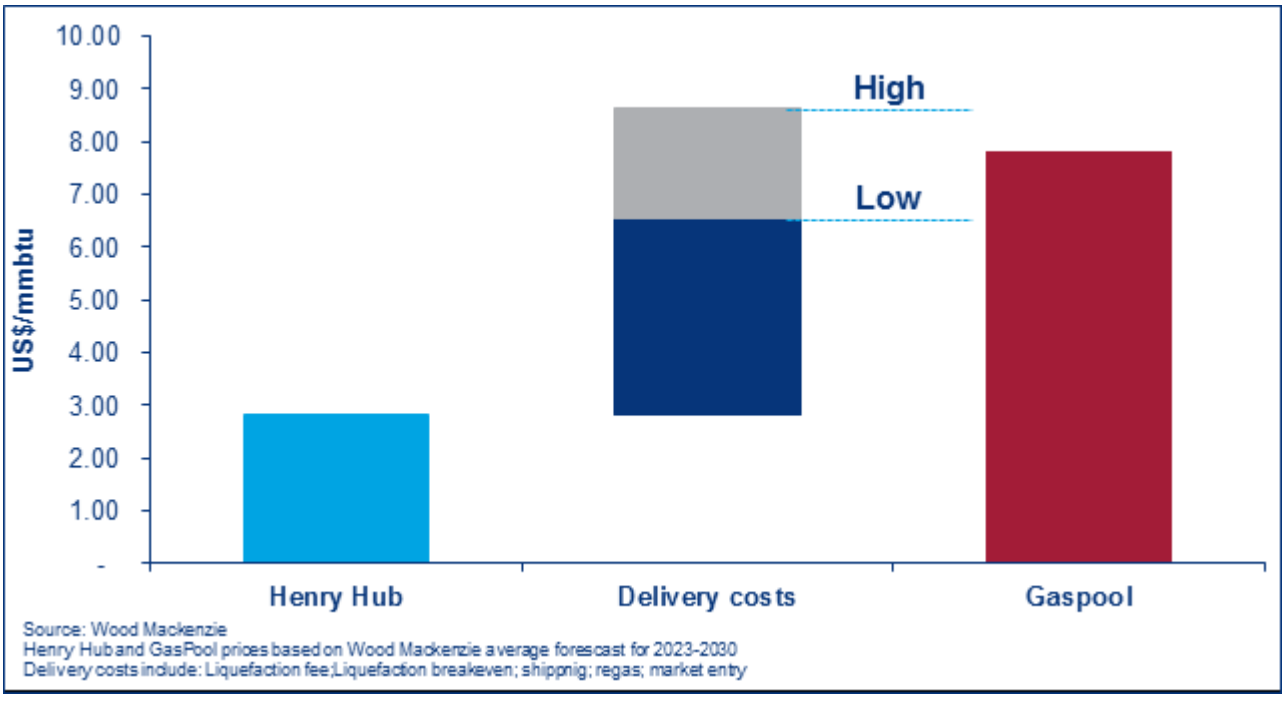

Chart showing US LNG cost into German hub price

The momentum behind a German LNG import terminal shows no signs of abating. And it is clear Germany would benefit from

having direct access to the world’s growing LNG market. We expect a final investment decision (FID) on at least one of the three proposed import terminal projects by the end of 2019.

US crude oil production increased by 17% in 2018 thanks to tight oil

According to the United States Energy Information Administration (EIA), US crude oil production grew by 17% in 2018 to a yearly average of 10.96 mb/d, reaching a new record. Domestic production even reached 11.96 mb/d in December 2018, the highest monthly level of crude oil production. US crude oil production has increased significantly over the past 10

years, driven mainly by the development of tight rock formations. Companies operating in these areas have increased the use of horizontal drilling and hydraulic fracturing techniques. Tight oil production accounted for around 60% of total crude oil production in the United States in 2018.

The EIA predicts that this growth in crude oil production will continue over the 2019-2020 period and will reach 12.3 mb/d in 2019 and 13 mb/d in 2020. Most of the production will come from Texas, which made up 40% of the national total (about 4.4 mb/d) in 2018 and has been holding the top position in nearly every year since 1970 except for 1988 and from 1999 through 2011, when offshore production from the Gulf of Mexico (GoM) area was higher. Texas's production rose by another 0.95 mb/d in 2018, mostly due to the significant growth within the Permian region, which made up nearly 60% of the total US increase. The EIA expects three major tight oil plays in the Permian Basin, namely Spraberry, Bone Spring, and Wolfcamp, to account for half of cumulative tight oil production until 2050 (it should reach 12 mb/d in 2050), followed by the Bakken plays (19%) and Eagle Ford plays (17%).