

Paris Energy Club – Spring Meeting
Thursday 18 April 2019

Summary of Discussion

The 2019 spring meeting of the Paris Energy Club discussed recent energy market development and prospects, tackled regional issues, and the ongoing digitalisation in the energy sector and associated challenges.

1. Energy market development and prospects

Oil markets

In the very short term, oil demand exhibits a solid and strong growth. The IEA expects oil demand to grow by 1.4 million barrels per day in 2019, but uncertainty surrounding the macroeconomic picture and concerns about the outcome of US-China trade talks are among the factors to monitor. On the supply side, the level of compliance with the OPEC+ Agreement is very good so far, which may lead to a tighter market towards the second and third quarters of the year.

According to the IEA medium-term report, global oil markets are going through a very significant change, with the US leading the expansion in global oil supply. US liquid production is expected to grow by 4 million barrels per day over the period to 2024, turning the United States into a major exporter with US gross export nearly doubling from today's level to roughly 9 million barrels per day by 2024. Such additional oil flow gives buyers of crude, especially in Asia, a wider choice of suppliers.

Liquid production growth will also be sourced from countries such as Brazil, Iraq, Norway, the United Arab Emirates, and the new producer, Guyana. Canada's oil output is expected to grow modestly over the period, as long as production expansion is constrained by the lack of transportation capacity (pipelines). Russia is expected to maintain the current high level of production.

All in all, non-OPEC production is expected to increase by more than 6 million barrels per day through to 2024. OPEC's production capacity will fall by 0.4 million barrels per day by 2024, with Iran and Venezuela posting the deepest production losses (unless the situations of those two countries change), while Iraq will be the largest source of growth from the OPEC countries.

The US shale industry can respond to price signals more swiftly than other resources. Therefore, the US shale oil output could be much higher in the coming years if the price goes up higher than the assumption used by the IEA (around \$60 per barrel); at \$80 per barrel, the US output could

be as much as 2.4 million barrels per day higher by 2024 than the level assumed in the IEA's Oil Medium-Term Report.

Over the same period, demand growth remains solid totalling an increase of about 7.1 million barrels per day. Petrochemicals take up the largest share (global petrochemical demand will be about 30% of the total growth) while transport fuel demand growth slows.

Given their weight in future additional oil demand, China, India and the Middle East were examined more closely. China's growth slows due to the rebalancing of the Chinese economy, the implementation of stronger environmental policies, promotion of EVs and natural-gas-based vehicles and fuel efficiency standards. India's demand would remain robust, so at the end of the forecast period in 2024, India's annual growth absolute level should be nearly the same as that of China at around 160 thousand barrels per day. In the Middle East, oil consumption growth will increase due to the ongoing implementation of IMO regulations that will displace fuel oil as bunker fuel leading to greater use of fuel oil in the power generation sector.

IMO 2020 raises a major challenge for the refining industry, but the transition will be eased by lower demand growth for land-based uses of diesel. The IEA expects the demand for high-sulphur fuel oil to fall from the current 3.5 million barrels per day to 1.4 million barrels per day.

Increasing availability of US shale will have a transformative effect on the refining sector, with the IMO regulations bringing two challenges: 1) refineries will have to use the cracking and cooking units to make the lighter products from the heavier crude; and 2) they will have to desulphurise oil products to a greater extent. The average global product barrel is allowed to contain only 0.34% sulphur, and this percentage will decrease further with the new IMO regulations to 0.24%. The average crude barrel is about 1.2% sulphur, therefore refiners may have to use natural gas to produce hydrogen for the desulphurisation, at higher costs.

Gas markets

Gas prices in Europe halved during last winter, due to a conjunction of demand and supply developments. On the demand side, warm weather in February led to weaker than expected demand. On the supply front, three new projects came online all at the same time leading to higher gas supplies in December (Ichthys LNG in Australia, Yamal in Russia, and Bovanenkovo from Gazprom). The launch of these projects was of course expected but it occurred at different dates than originally planned. The combined capacity of the 3 projects is 40 bcm, some 1% of total gas supply.

The question is what is going to happen in the coming months? Player behaviour is set to mitigate the risk associated with two unexpected and difficult-to-forecast issues. One is the possible delay in launching North Stream 2, which is supposed to be operational by 1 January 2020, due to delays in Denmark granting permission to lay the pipeline in its territorial waters. The other issue is the transit via Ukraine. With a newly elected President, the country may find it difficult to ink a new transit contract before the end of the year.

Despite these issues, European gas security should not be affected thanks to the larger than average quantities of gas in storage. Record levels of LNG and pipe gas are coming into Europe,

with storage – already well above the five years average following a warm winter – being filled at an extremely fast pace. LNG ships on the water (growing by 10% per annum thanks to shale gas development) also provide an additional safety net to the market. Such LNG can be called upon once to supplement the quantities drawn from gas storages in order to meet gas demand. The market may register a price spike but Europe gas security would not be under threat.

Russian gas production was high in 2018, giving Gazprom a very good position in the European market and a comfortable one in terms of growing gas reserves. The launch of Kharasaveyskoye on the Yamal Peninsula will add 32 bcm of output by the year 2023, and offset the decline in the West Siberian fields. The Yamal second phase of Novatek is on the way, and it is all signed, adding, in the long term, new export capacity to Gazprom's. Therefore, Russia looks very promising as an international player in both the pipeline and the LNG markets. Once completed, North Stream 2 will add to Ukrainian transit to convey new flows of Russian gas to meet the large demand in Europe.

With the Power Siberia project almost completed, Russia is also looking east. In Gazprom's strategy, there is a very big interest in becoming the key player in the Chinese market targeting more than 25% of the domestic gas market in China within the next 15 to 20 years.

2. Regional developments

Energy sector investment in the MENA region

According to APICORP's five-year investment outlook¹, there is a major transition of investments in the MENA region towards natural gas, downstream and the petrochemical sector, as well as renewables. APICORP is projecting a total of USD1 trillion of investment over the next five years, between now and 2023. That is a 5% increase compared to last year's outlook, contrasting with the 11% decrease in GCC investments over the same five-year period, due to the sharp fall in planned projects, and the second year of consecutive reduction in committed projects.

Out of that USD1 trillion, USD304 billion is invested in the oil sector (upstream, midstream and refining), with around half of these projects already committed. The petrochemical sector, which has been historically important for APICORP, is on the ascendant with total investments of USD123 billion, with an amount of USD33 billion in projects which are already committed. The sector is also witnessing a technology breakthrough with schemes such as the first crude-oil-to-chemicals projects expected by 2025, with USD20 billion dedicated to one single project.

MENA is a growth region for the gas sector and total investments in this sector are around USD186 billion, under half of which is committed.

The power sector will account for 36% of total investments, responding to electricity demand growth in the region. The lion's share of total power investments (34% out of that 36%) are actually in renewables and heavily concentrated in North Africa.

¹ APICORP's outlook focuses on the MENA region and looking at all the different parts of the value chain, oil, gas and electricity. The outlook assumes a band of USD60 to USD70 per barrel for Brent over the five coming years.

Latin America

Latin America's hydrocarbon output exhibits a flat to declining pattern. Brazil's output is growing, while production is shrinking in Mexico and Venezuela, and the rest of the Latin American countries are on standby. Guyana is supposed to start production next year, with a quick ramp up to about 750 000 barrels a day.

Interestingly, Latin America represents 8% of global hydrocarbon production, but at the same time it represents 14% of global 1P reserves, mostly in Venezuela. There is therefore a mismatch between the output and the reserve base.

There is also a mismatch between product demand and product supply in Latin America. Total imports of Latin America are almost equivalent to the exports out of the US Gulf Coast. With the demand for petroleum products peaking in the United States, particularly PADD III, Latin America matters to US Gulf Coast refiners more than ever.

Brazil

In Brazil, both businessmen and policy makers discounted the complexities of developing pre-salt reservoirs, leading to misguided regulatory designs, like Petrobras operating 100% of fields. The local content requirement led to corruption and cost inflation. The recent change was designed to not only attract foreign capital but also divest from a lot of investments in downstream and midstream, and concentrate a lot of the CAPEX on the upstream.

The Brazilian conventional (or non-pre-salt) production registered a pretty steep decline between 2010 and 2014, and the expectation is for pre-salt production to grow very significantly and to keep growing so that overall production could continue to grow. The associated investment requirements are just as significant as they were in the past. However, there is more flexibility for international operators, and the local content rules have been relaxed, so there is a better environment for achieving such objective.

Brazil was mostly a hydropower country before developing gas as an alternative additional source for power. While Brazilian imports of gas from Bolivia were backed by political understanding between the two governments under Lula's regime, the situation may change in the future after the election of Bolsonaro.

Venezuela

The question now is what is going to be the likely path that Venezuela is going to follow? Following the sharp decline in production registered since 2009, the country will have to restore its production capabilities. Wells, the midstream infrastructure and refineries are all in total disrepair and need to be fixed. A massive capital investment is going to be needed not only in the oil industry but across the entire country which has accumulated a massive foreign debt, raising many questions: if there is a change of regime, will the new regime acknowledge the debt, what will be the strategy of the main foreign creditors, including China and Russia, and how should acknowledgement of the debt be managed, and which social, political and business models will prevail going forward?

Mexico

The business-friendly energy reform implemented by the previous government was never fully applied, in particular in the midstream and downstream. For example, the current administration did not liberate domestic prices which remain controlled through the tax regime.

The attempt by the government to reform Pemex and favour private sector participation led to very significant shortfalls in maintenance and capital expenditure which resulted in the situation that Pemex is in today. In the view of one participant, a country like Mexico can find it difficult to do without an oil company, but the oil company cannot continue as a state monopoly and needs to become more competitive. Such balance has yet to be found. Fitch has recently rated Pemex a triple B-, which is the last one before junk. If Pemex goes junk, there is a risk that it could drag the sovereign down.

Legislative or regulatory changes the new administration would like to pursue are difficult to understand. Ongoing investments, particularly in exploration-production, are expected to continue, but no new bid rounds are planned. The bid rounds for new power capacity, particularly for renewables have also been stopped.

Mexican President Andres Manuel Lopez Obrador, who took office on December 1st, 2019, has pledged to boost Pemex's budget and raise output to between 2.4-2.6 million bpd by the end of his six-year term in 2024. With Mexico's crude production standing at 1.6-1.7 million barrels a day, and with an output decline of about 100 000 barrels a day, Mexico's production may reach one million barrels a day at the end of the current administration. That means that the country needs to develop 1.4 million barrels a day of capacity between today and 2024. The probability of that happening is pretty low according to one of the discussants.

Mexico also has issues with its refining sector. The country plans to build a new refinery with a capacity of 350,000 barrels a day for a cost of \$8 billion while the refinery utilisation rate in Mexico is below 40%. In the view of one participant, Mexico should rather import products at very attractive prices and direct scarce financial resources towards investment in E&P.

The power sector is also facing significant challenges. Over the past couple of years, reserve capacity has fallen under 6%, a danger zone, and many experts are expecting managed or unmanaged blackouts. Mexico is examining restructuring the power sector, with a rethink towards a return to the old state monopoly model.

Korean Peninsula

North Korean nuclear missile development which started the 70s, has accelerated under Kim Jong-un. North Korea now has a missile capable of going 3,700 km high, with an imputed range of nearly 10,000 km, meaning that it can easily reach the main cities of the United States.

There was a serious dispute and exchange of very fierce words between Donald Trump and the North Korean authorities in the summer of 2017, but there has been a rush for dialogue since January 1, 2018. In total, there were four summits between the Chinese leader and Kim Jong-un, two summits between Trump and Kim Jong-un, and three involving the North and South Korean

leaders. While President Moon's contribution to favour dialogue between all parties should not be underestimated, China clearly holds the key in all this process, as it has the most important ties with North Korea. China has had a friendship treaty with North Korea since 1961, shares a long border of 1,400 km with its neighbour, an economic channel to more than 90% of North Korean trade, and, most importantly, energy sources.

While Japan and South Korea share the same concern about the North Korean missile program, historical issues and territorial disputes prevent the 2 countries' bilateral relations from being closer. North Korea and US negotiations refer to denuclearisation of the Korean Peninsula and not only North Korea, which means that South Korean nuclear weapons may have to be scrapped if this promise is to be fulfilled.

While there is a long way to go to reach the prospect of a full denuclearisation process, such denuclearisation would provide enormous potential for energy trade through natural gas and power networks. Natural gas pipelines could be expanded through North Korea, and even to Japan. The peninsula could also benefit from the expanding energy trade between Russia and China, and the large high-voltage electricity network throughout Asia.

3. Digitalisation of the energy sector

Digitalisation in the oil sector

Digital transformation is not about technology, it is about how people use the technology and adapt to it. Digital transformation is pulled by users' need to access the same tools at all times, a practice known as ATAWAD (Anytime, Anywhere, Any Device).

Today, billions of people are able to interact on platforms every second. Platforms are similar to markets and once launched and widely used, a platform becomes a natural monopoly that is very difficult to displace.

Digital transformation is about creating value out of data, and improving work practices, safety and operational performance, reducing cost, improving the employee or the customer journey, and developing new services.

Large industries such as the oil industry are not at the leading edge of digitalisation, but industrial companies are doing fairly well in the digital journey because they have understood the value they could get from this digital transformation.

Because digital transformation starts with people, collaboration and sharing are important steps towards work practice improvement. For example, the features of Microsoft Office 365 which impacts management and relationships within teams, with partners (shared documents online, etc.). Going digital is a significant transformation, where training and acculturation are key as humans tend to resist change. Having all stakeholders on board including the top management is crucial to make the digital transformation happen.

International oil companies dealt with big data before big data existed. Large companies have thousands of geoscientists and geophysicists, and run some of the most powerful super-computers in the public domain. For oil companies, one of our challenges is to upskill existing engineers so that they are able to master artificial intelligence very quickly, and to manage and create value out of data. Putting in place good data-management is actually the most difficult part and a fundamental part in any artificial intelligence process. In such a process, the quality of the data is crucial.

Industry has also to think out of the box and partner whenever relevant with the most advanced companies in the world in artificial intelligence such as Google, Amazon, Facebook, who also have a massive amount of data.

The other requirement during digital transformation is to present users with the benefits they will enjoy from such transformation, and improve interaction/relations with customers.

Digitalisation in the electricity sector

Digitalisation in the electricity sector is developing at a fast pace, and helps to adapt to new ways of generating and distributing electricity.

Unidirectional networks (from generators to consumers) tend to be passive, with distributors lacking vision on our low-voltage network, which can represent a significant share of the total network². The evolution towards multidirectional networks and the rollout of smart meters has made the networks more active, and provides information about the low-voltage segment of the electricity chain.

Smart meters help not only to measure the electricity but also collect other measurements such as the voltage, thus helping distributors to pinpoint the problems on the low-voltage network, and indicate places where the network needs to be reinforced (i.e. not changing all the powerlines but implementing such changes when necessary). These new practices make heavy maintenance redundant and lead to significant cost reduction.

With increasing digitalisation comes the issue of systems integrity and cyber-security. Consequences of such attacks could be very damaging, as illustrated in the book “Blackout” by Marc Elsberg (edited in 2012).

Deployment of new uses of electricity also requires further spread of digitalisation. The example of electric vehicles and the associated infrastructure provides a good illustration of this aspect.

Another challenge for the electricity sector is to address the gap between the digital lifecycle (2 to 3 years) and investment in infrastructures (40 years at least, and up to 80 to 100 years for a dam). The electricity sector is used to long-term investments, but has to accept systems that are changing in a very short timeframe.

² Enedis' low-voltage network is about 50% of the whole network, involving 700,000 km of powerlines.

The availability of a large set of data being collected through digital networks is opening up new areas for electricity supply management. Thanks to smart meters, it is today possible to profile consumers (consumption curve, location, etc.) and respond in real time to their needs in the most optimal way. Producing dynamic profiles of consumers can help anticipate the demand curve and reduce uncertainty by more than 50%.

Digital transformation can also enrich behaviour analysis through informed use of available data. For example, HSE performance can be significantly enhanced using data on past accidents (number of workers injured, number of hours of work before the accident, date of the last safety training of the workers, etc.). Analysis of such data can help identify the circumstances that favour the occurrence of accidents, allowing digital systems to set alerts when operational behaviour is coming close to similar circumstances./.