

## TECHNOLOGY

# US sanctions stimulate innovation

**Nic Newman takes a look at recent innovative developments in Russia's oil and gas sector.**

Russia's upstream oil and gas industry has historically depended on western know-how, technology and equipment. Western field service companies such as Halliburton, Weatherford, Schlumberger and Baker Hughes typically provided advanced drilling and hydraulic fracturing technology alongside sophisticated IT services. Indeed, according to *Reuters* in August 2018, the Russian drilling and oil servicing market was worth about \$20bn/y, of which western oil and gas service companies had a healthy 20% market share.

A valuable natural endowment of oil and gas resources allowed Russia to become the world's third largest oil producer after the US and Saudi Arabia, and the second largest natural gas producer after the US. Indeed, Russia made claim to the title of the world's largest gas exporter after Norway and the second biggest oil exporter in 2018, according to the US Energy Information Administration (EIA). Such is Russia's importance, it joined forces with OPEC to limit production to maintain prices (as OPEC+) until a recent dispute and so called 'oil price war' which was subsequently rectified by US President Trump's discussions with Saudi Arabia (see ppXX).

However, it has been several years since US sanctions, in

response to Russia's invasion of Crimea, prohibited US energy companies from transferring their technology and the rouble's devaluation after the collapse in the oil price made imported technology prohibitively expensive. The US imposed sanctions banning American and other foreign companies from collaborating with major Russian energy companies such as, Gazprom Neft, Lukoil, Surgutneftegas and Rosneft, on their strategically important deepwater, Arctic and shale projects. Likewise, access to capital from western banks was also restricted. This slowed development and increased costs of some of Russia's domestic projects. As recently as 2018, the country relied on foreign technology for 50% of its hard-to-extract projects and as much as 80% for LNG and offshore developments.

But sanctions also had the positive effect of stimulating domestic innovation.

In response to US sanctions, most western energy and service companies withdrew from Russia's new projects. ExxonMobil pulled out of joint Arctic projects with Rosneft and Shell withdrew from a joint venture with Meretoyakhaneftgaz and Gazprom Neft in the Yamal Nenets Autonomous District. Nevertheless, a joint venture between Shell, Salym Petroleum Development (SPD), a Gazprom Neft-Shell joint venture) to expand activities in developing the Salym group of fields was concluded in April 2020. US sanctions also opened the way for Chinese, Japanese and South Korean companies to increase their share of the lucrative Russian market.

Elsewhere, foreign companies have valued their business with the US over and above dealing with Russian energy companies. For example, at the behest of President Trump, completion of the Nordstream 2 gas pipeline was interrupted and the Swiss pipe-laying contractor Allseas stopped pipe-laying in December 2019. Instead, Gazprom has been forced to

deploy the *Akademik Cherskiy* pipe-laying vessel, normally stationed in Nakhodka on Russia's Pacific coast, to complete the final section, which will delay completion to 2021.

Sanctions on western multinational collaborations on technology, capital and expertise have also slowed Russia's development of new resources, including shale in the Bazhenov formation, challenging prospects in the Russian Arctic and the Shapsha group of oil fields in western and eastern Siberia, which were destined to replace declining production of ageing fields in Western Siberia. Western expertise is considered to be critical for development of these projects, which are needed to maintain Russian oil and gas exports to both the west, most notably Europe, and the East, most notably China, suggests James Henderson in a recent OIES (Oxford Institute for Energy Studies) *Insight* report.

## Import substitution

Loss of access to leading western oil and gas technology has had the positive effect of encouraging import substitution and innovation in a sector whose revenues could contribute nearly half of the Russian government budget.

Led by the government, companies have begun funding in-house research and been collaborating with universities. Gazprom has already registered 2,555 patents, of which 441 were being used in the field, according to the company's 2014–2018 Factbook.

## LNG innovation

Russian gas exports in 2019 were valued at some \$50bn, of which LNG production accounted for 15%. Such is the importance of LNG production, that domestic producers have stepped up innovation in this area. For example, PAO Severstal, a vertically integrated steel and mining company, has developed a low-carbon cryogenic steel which is resistant to cold and retains plasticity and strength, even at

Novy Port in Yamal Nenets Autonomous District – in response to US sanctions, a number of western majors have withdrawn from Russian projects in the region

Photo: Gazprom Neft



low temperatures. This advanced material was used in Gazprom's LNG plant at the Baltic Sea port of Portovaya.

In a complementary initiative, an industrial size cryogenic LNG pump developed by JSC LGM has been used on Russian projects, including Sakhalin-2, Yamal-LNG, Arctic LNG-2, Baltic LNG and Far Eastern LNG plants. Likewise, JSC Teplokhimmontazh, a producer of concrete structures based on a sliding formwork, is constructing the LNG storage reservoir within the Novatek's terminal in the Baltic Port of Vysotsk near Finland's border.

Gazprom Neft's oil division has developed a proprietary GeoMate GPS tracking app, for the collation and analysis of geological information across all its producing and planned oil and gas fields on a single integrated platform. The software and engineering behind the new system were developed by the Gazpromneft Joint Scientific and Research Centre.

#### Fracking, rig design, EOR and small wells

Meanwhile, Rosneft, in partnership with the University of Tyumen, has developed thermochemical gas fracturing to replace traditional hydraulic fracturing, for shale plays in the Maysky area of Russia's Pacific region. Russia's news agency RIA Novosti claims the new fracking technique could increase oil production by between 1.7–6 times the initial output level. Professor Konstantin Fedorov, Director of the Institute of Physics and Technology claims well output improvement can last 300 to 1,000 days – an impressive claim, considering that shale wells in the US are estimated to decline after the first full month of production, according to the EIA.

Ever since the 1940s, Russia has produced land rigs able to cope with harsh weather and difficult geological conditions. Uralmash has introduced the 3900EK-BM – a new cluster rig which drills down to a depth of 2,900 metres.

Lukoil's Kravtsovskoye D-6 oil field in the Russian sector of the Baltic Sea is largely a Russian affair, albeit with a HRI Houston drilling rig. Rein-Shelf engineering designers based in the Kimry Tver region designed the jacket, while the NIPishelf Institute of Sebastopol designed the pipeline. Russians constructed the platform under the control of Germanischer Lloyd, the Russian marine shipping register and Rostekhnadzor (the Federal Service for Ecological, Technological and Nuclear Supervision.)

Western Siberia accounts for more than half of Russia's crude



output. Arresting the rate of decline and increasing oil recovery rates are crucial to extending the life of old oil fields. Lukoil has been particularly successful in reducing the average annual decline to just 2%/y with its in-house physical, chemical, hydrodynamic and thermal reservoir treatment techniques.

The company is now drilling small-diameter wells, which save on average 30–50% of standard well construction costs and are claimed to enable more oil reserves to be brought onstream with reduced well-pad costs. This technology is considered to have significant potential and Lukoil plans to increase small diameter well production in coming years.

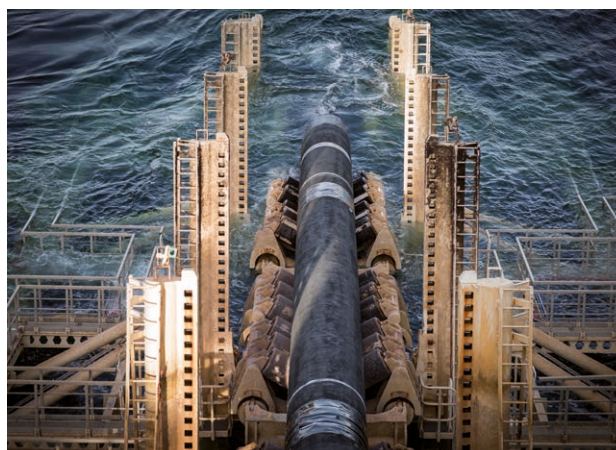
In sum, Russian energy companies have sought to improve efficiency of existing operations and develop new resources with innovations in exploration, field development and enhanced oil recovery (EOR). Commenting on these developments, Artem Frolov, Vice-President at Moody's in Moscow, told *Nastassia Astrasheuskaya* of the *Financial Times*: 'Although domestic oil producers are pursuing import substitution strategies through in-house research

Salym production facilities

Photo: Gazprom Neft

Swiss contractor Allseas stopped its Pioneering Spirit pipe-laying in December 2019 at the behest of US President Donald Trump, leaving Gazprom to deploy the Akademik Cherskiy to complete the final section of the Nordstream 2 pipeline

Photo: Nordstream 2/Axel Schmidt



and development centres, the development of commercially workable technologies and fully localised production of the required equipment will probably take years.'

#### Limited transition towards decarbonisation

Russia's reliance upon its rich heritage of fossil fuels continues apace with new field developments, rising production and increasing exports. Although there has been an increase in investment and production of natural gas and LNG for domestic consumption, power generation and transportation needs, there has been limited transition towards decarbonisation in terms of renewables investment.

Gazprom has established LNG fuelling stations for both trucks and buses. As of 31 December 2018, there were 293 operational compressed natural gas (CNG) filling stations for cars, owned by the Gazprom Group, of which 235 were operated by Gazprom Gazomotornoye Topливо and 58 by subsidiaries of Gazprom. In addition, Gazprom is supplying LNG fuel for 22 locomotives operating the 7,152 km Sverdlovsk Railway division network. The railway network provides all weather access to the gas fields in the north of Siberia. Simultaneously, Russia is exporting increasing volumes of 'cleaner' gas.

In addition, companies like Novatek, Gazprom and Rosneft are taking steps to minimise the environmental impact of their activities. However, they appear to show little or no active interest in investing in renewable power generation, according to the *Moscow Times*. Rather, renewable power investments have been led by foreign companies, including China's Amur Sirius, Italy's multinational energy company Enel, Finnish firm Fortum and German engineering giant Siemens.

Generally, Russian oil and gas firms and their subsidiaries are showing little interest in making the transition towards low carbon. Rather, they prefer to maximise use of their rich oil and gas endowments despite the Paris Accord on climate change and emission reduction. Despite the traditional low price of these commodities, there are signs that increasing public concerns regarding climate emergency may encourage a move towards renewables and decarbonisation, given recent extraordinary high temperatures (both winter and summer) in Russia and increasing international pressure on the climate change front. ●