PRODUCTION

Boomtime for unconventionals

If North America's oil and gas sector is any indication, the rumours about the death of the hydrocarbon age have been greatly exaggerated, reports *Gordon Cope*, highlighting plenty of action on the unconventionals front.

While renewable and alternative forms of energy have made tremendous strides over the last several years, they have been greatly outpaced by the growth of oil and gas production in North America. The US Energy Information Administration (EIA) noted in April 2019 that output from the US stood at 12.1mn b/d of crude and 79bn cf/d of dry gas. In terms of total energy output, it now surpasses Russia and Saudi Arabia for first place in energy production.

Canada's oil sands hold an estimated 165bn barrels of recoverable bitumen. Unconventional resources in the Montney shale of northern British Columbia and north-west Alberta hold an estimated 13bn barrels of recoverable crude and natural gas liquids (NGLs) and 282tn cf of gas. In 2018, Canada produced an average of 4.5mn b/d and 16bn cf/d, ranking it the world's sixth largest oil producer and fifth largest gas producer.

Permian prowess

In the US, the Permian Basin in west Texas and east New Mexico is responsible for a large portion of the increase. By early 2019, production of light crude in the basin had ballooned to over 4.1mn b/d and almost 10bn cf/d of gas. IHS Markit predicts that Permian production will reach 5.4mn b/d crude, 1.7mn b/d NGLs and 15bn cf/d of gas by 2023.

Midstream companies are scrambling to build new crude and gas pipelines. Plains All American is building the Cactus II 670,000 b/d system. Meanwhile, EPIC, based in San Antonio, was given the green light by the US Army Corps of Engineers to build two new pipelines from the Permian Basin that are capable of carrying up to 590,000 b/d of liquids a distance of 650 miles to the port of Corpus Christi.

Gas transportation shortages in the Permian area are so severe that spot prices at the Waha regional hub in West Texas reached a record low of minus $4.28/mn Btu in April 2019 as producers paid to have the gas taken away. Kinder Morgan is working to alleviate the bottlenecks by building the Permian Highway Pipeline (2bn cf/d capacity) and the Gulf Coast Express Pipeline (1.92bn cf/d capacity).

Appalachian shale

Operators continue to tap the immense unconventional gas reserves in the Marcellus and Utica shale formations located beneath the north-east Appalachian states. In its 2019 *Annual Energy Outlook* (*AEO2019*), the EIA forecasts a growth from 2018 levels of 24bn cf/d of dry gas in the region to 50bn cf/d by 2050.

Over the last decade, takeaway pipeline capacity to New England, the mid-Atlantic and southern states has grown from 5bn cf/d to 23bn cf/d, fuelling both growing domestic demand and LNG export facilities. In late 2018, the US Federal Energy Regulatory Commission (FERC) approved further expansion of Enbridge's Nexus natural gas pipeline system. The $2.6bn system, which runs from Ohio to Michigan, is designed to collect output from the Marcellus and Utica shales in Pennsylvania, West Virginia and Ohio. When finally completed, the 410 km system will move up to 1.5bn cf/d of gas to markets in the US Midwest and to Ontario.

Alaskan renaissance

Production in North America's most northern oil and gas basin is undergoing a renaissance; since dropping from a high of 2mn b/d to 500,000 b/d, new discoveries are reversing Alaska's decline (see also pp14/16). ConocoPhillips' Greater Mooses Tooth (GMT 1) field in the National Petroleum Reserve (NPR) is now online, and is expected to produce 30,000 b/d. The nearby GMT 2 field is expected to produce 40,000 b/d. The company estimates it could be producing up to 300,000 b/d from a host of untapped discoveries within the decade. Hilcorp Alaska's Liberty field, Repsol's Pikka discovery and Eni's Nikaitchuq oil field in the Beaufort Sea have the potential to add another 250,000 b/d.

This may be the tip of the iceberg. The NPR overlies the Barrow Arch, a structural formation in which most North Slope reserves are located. The

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Photo: Encana

US Geological Survey (USGS) estimates that it may hold 8.7bn barrels of crude and 21tn cf of gas. The Obama administration set aside almost half of the 22.1mn acre reserve to protect endangered wildlife, but the Trump administration has announced plans to reverse much of the decision. The state of Alaska seeks a balance between conservation and the continued rejuvenation of their oil and gas sector.

Western Canada unconventionals

The Montney formation in north-east British Columbia (BC) and north-west Alberta has been the major unconventional play in Canada. Production now stands at 7bn cf/d, with 150,000 b/d of associated light oil, condensate and NGLs.

In order to move gas to eastern markets, NOVA is proposing C$2.31bn ($1.72bn) in expansions over the next two years. The projects include 344 km of pipeline in eight looped sections and three new compressors. When complete, the expansions will add 1bn cf/d of capacity.

Pembina Pipeline Corporation is concentrating on servicing the condensate and natural gas liquids produced in the Montney. Its Phase IV expansion added 180,000 b/d of capacity from Fox Creek, BC, to the Alberta border. The 260,000 b/d Phase V will debottleneck fields north of Fox Creek. Phase VI will add a 16 inch and a 20 inch diameter pipeline near Gordondale, in north-west Alberta. By the end of 2019, the company expects to be able to handle up to 885,000 b/d of condensates and NGLs.

The availability of petrochemical feedstock is spurring investment in the downstream sector. Inter Pipeline is in the latter construction phase of its Heartland petrochemical complex, located near Edmonton. The C$3.5bn ($2.63bn) project is designed to produce 520,000 t/y of polypropylene from regional supplies of propane.

A new, C$2bn ($1.5bn) methanol plant has been slated for Grande Prairie, Alberta, by Nauticol Energy. The plant will be built using modular construction. When it is commissioned, it will convert natural gas into 3mn t/y of methanol, the majority of which will be marketed in Asia for use in fuels, petrochemicals and solvents.

Thanks to the resurgence of LNG demand in Asia, major projects in Canada are now once again on the front burner. LNG Canada, led by Shell, plans to build a four-train plant with a capacity of up to 26mn t/y in the port of Kitimat, BC.

East coast Canada

Offshore the east coast of Canada, production from new fields is expected to offset declines in old fields. The government of Newfoundland and Labrador expects production to increase by over 12% in 2019/2020 to 94.2mn boe (252,000 b/d), as producers ramp up output at Hebron. The 700mn barrel field produced an average of 60,000 b/d in 2018; the goal is to reach 150,000 b/d nameplate capacity.

Discoveries and exploration programmes in the Flemish Pass, Orphan and Carson basins also bode well for the future. A recent resource assessment indicates that explored regions in offshore waters hold an estimated 49bn barrels of crude and 194tn cf of gas. The Bay du Nord oil project is expected to be sanctioned in 2020, with first oil in 2025. The provincial government expects production to rise to 650,000 boe/d by 2030.

Exports climb

Consumption in North America is relatively stagnant, so much of the new crude and natural gas is being exported. The EIA reported that oil exports average 2mn b/d in 2018, and is expected to climb much higher in 2019. A host of new export facilities capable of handling VLCCs (very large crude carriers) have been proposed for Gulf ports.

The EIA's *AEO2019* Reference case notes that US LNG export capacity currently stands at 5bn cf/d. Cheniere now has four, 700mn cf/d trains operating in Sabine Pass, Louisiana, and has been shipping LNG to various consumers in Europe and Asia. The commissioning of the fifth train will give the Sabine Pass terminal 3.5bn cf/d capacity. Houston-based Tellurian continues to advance its $15.2bn Driftwood LNG plant in Calcasieu Parish, Louisiana. According to the EIA, the US is expected to reach almost 9bn cf/d LNG capacity by the end of 2019, and 10.3bn cf/d by the end of 2020.

Development challenges

In early 2018, the Trump Administration announced plans to allow development on the offshore continental shelf (OCS) regions in the Atlantic and Pacific coasts. Congress, under the Democrats, is considering several bills to stall the plans. States bordering Atlantic waters, including South Carolina and Florida, have passed legislation banning offshore activities. Democrat-controlled state legislatures are also imposing new oil and gas restrictions. In April 2019, Colorado lawmakers passed a bill overhauling state regulations, placing a much greater emphasis on public health and safety.

Canadian oil sands production also faces challenges. Oil sands production from open pit mines and steam assisted gravity drainage (SAGD) has grown to 2.8mn b/d in 2018, and is expected to reach as much as 4.2mn b/d by 2035. Holdups in pipeline takeaway capacity are causing headaches, however. The delay of TransCanada's proposed Keystone XL pipeline, a 1,900 km line designed to move up to 830,000 b/d from Alberta to Nebraska, and the delay of the Trans Mountain expansion (a project to triple the capacity of a 300,000 b/d line running from Alberta to tidewater in BC), has resulted in cancelled oil sands projects, international disinvestments and huge price discounts.

Enbridge's project to replace its aging Line 3 oil pipeline running from Hardisty, Alberta, to Superior, Wisconsin, has hit another hurdle. In June 2019, the Minnesota Court of Appeal ruled that the Minnesota Public Utilities Commission did not address how a spill would affect the Lake Superior watershed in the final environmental impact statement, creating more delays for the project, which is designed to return the line to full capacity of 760.000 b/d this year.

Looking forward

Positive developments beckon. In Alberta, voters elected Premier Jason Kenney, a pro-oil and gas politician who promises to reconcile forces in the federal government that have chastened the Canadian hydrocarbons sector.

While all producing jurisdictions are in thrall to the price of oil, long-term demand growth in China and India promotes sufficient stability to maintain unconventional production. Producers are also moving to reduce costs and increase recovery. A combination of the two is sufficient to ensure that North America's oil and gas sector remains vibrant for the foreseeable future. ●