



AIDEA sale of Pentex to IGU closes; major step in IEP plans

The Alaska Industrial Development and Export Authority has announced the completion of its sale of Pentex Natural Gas Co. to the Interior Gas Utility. As reported in the June 17 issue of Petroleum News, on June 12 the IGU board approved completion of the sale, which then closed on June 14. The IGU board had previously approved the sale completion, subject to a letter of agreement with AIDEA making some changes to the terms of the sale. The AIDEA board then approved the sale completion on May 31 but had made its approval contingent on modifications to the letter of agreement. During its June 12 board meeting IGU agreed to the modifications.

The sale results in the consolidation of Fairbanks Natural Gas and IGU to form a single gas utility serving the Fairbanks area. FNG is a subsidiary of Pentex, which also owns the Titan liquefied natural gas plant near Point Mackenzie and a trucking operation for shipping LNG to Fairbanks.

Interior Energy Project

The sale comes as part of the Interior Energy Project, an
see PENTEX SALE page 10

EPA, Corps, publish MOU on new policies for Alaska wetlands

The Environmental Protection Agency and the U.S. Army have issued a memorandum of understanding setting specific policies for wetlands mitigation requirements in Alaska. The guidelines relate to so-called section 404 permitting by the U.S. Army Corps of Engineers. This type of permitting, required if a proposed project will involve the discharge of material into the waters of the United States, commonly impacts oil and gas projects in Alaska.

Under the permitting rules, impacts on wetlands must be avoided to the extent that is practicable. If, however, significant impacts are unavoidable, a developer may be able to obtain a permit for a project by undertaking or paying for compensatory mitigation, restoring equivalent wetlands to compensate for any wetland degradation caused by the project.

Alaska is unique

The new guidelines recognize some unique characteristics
see WETLANDS POLICIES page 10

Frack bumps Nikolaevsk production; four-fold increase only temporary

After years of steadily declining Nikolaevsk unit production, Hilcorp reported a significant increase in production last year as the result of a fracture stimulation effort.

The company credited its fracture stimulation of the Red No. 1 well in March 2017 with increasing natural gas production to 600,000 cubic feet per day in 2017, up from 154,000 cubic feet per day in 2016, according to a plan of development submitted in May 2018.

The benefits of the workover operation were short lived. Red No. 1 produced 232,000 cubic feet per day before the operation and 2.3 million cubic feet per day immediately following it. But production had fallen to 850,000 cubic feet per day by June 2017 and then to "pre-stimulation levels," climbing to 540,000 cubic feet per day by March 2018.

Prior to conducting the operation, Hilcorp had estimated that the fracture stimulation would add between 1 million to 3 million cubic feet per day from the Tyonek formation.

Hilcorp generally produces at the Nikolaevsk unit intermittently during winter months and during periods of low market
see NIKOLAEVSK OUTPUT page 10

EXPLORATION & PRODUCTION

Looking at it again

Nanushuk/Torok discoveries push a rethink of North Slope oil potential

By ALAN BAILEY

Petroleum News

New major oil discoveries in the Nanushuk and Torok formations on Alaska's North Slope are causing some significant rethinking of the oil potential of the region, as companies move towards development of these exciting finds and people assess further exploration opportunities.

Petroleum geologist Paul Decker from Alaska's Division of Oil and Gas recently talked to Petroleum News about the nature and significance of the new finds. Decker sees the new Nanushuk/Torok oil play as opening the possibility of further significant oil discoveries to the west of

Unlike shallow oil to the east, found in sands above the legacy North Slope oil fields, the Nanushuk/Torok oil has not been degraded by microbes to form viscous or heavy oil.

the central North Slope. The play may also prove valuable as a geologic paradigm for oil prospects in the newly opened 1002 area of the Arctic National Wildlife Refuge, Decker thinks.

The three recent finds consist of the Pikka/Horseshoe trend in the Nanushuk in the

see RETHINKING DISCOVERIES page 11

EXPLORATION & PRODUCTION

A place at the table

Senior BP executive says Alaska in unique position for global energy transition

By ALAN BAILEY

Petroleum News

The state of Alaska is uniquely positioned to lead and benefit from the transition in global energy, as the world addresses the challenge of reducing energy related emissions, Susan Dio, chairman and president of BP America Inc., told the annual meeting of the Resource Development Council on June 20. While innovation is a key to meeting that challenge, through finding more efficient ways of producing energy, for example, Alaska has consistently pioneered technical innovation, Dio said.

"Your capacity for innovation has been enormously valuable in recent years, and I predict that



SUSAN DIO

it will be even more valuable in the years to come," she said.

She commented on the manner in which BP in Alaska has been a global leader in enhanced oil recovery and how the company has been able to hold production from the Prudhoe Bay field constant for three years as a result of improved efficiency.

Dio also commented on BP's interest in the Alaska liquefied natural gas project, saying that BP is playing its part in making that project succeed. The use of natural gas as a fuel, particularly for power generation, will be critical to addressing the long-term challenge of carbon dioxide emissions, she said.

see DIO SPEECH page 8

PIPELINES & DOWNSTREAM

Looking beyond US

Canadian governments, industry, turn attention to more pipelines amid trade spat

By GARY PARK

For Petroleum News

A U.S.-Canada trade fight being spearheaded by unparalleled hostility between President Donald Trump and Prime Minister Justin Trudeau has prompted talk of new pipelines in Canada to unlock Alberta's oil sands by opening routes to new crude oil markets beyond North America.

Spurring that debate is a new forecast by the Canadian Association of Petroleum Producers that Canadian crude output should grow by 33 percent from 2017 levels to 5.6 million barrels per day in 2035.

Eager to take advantage of global oil prices and



RACHEL NOTLEY

lower Canada's dependence on the U.S. for its exports, Alberta Premier Rachel Notley appealed to all Canadians to support the Trans Mountain pipeline expansion and "diversify our markets," indirectly pointing to the 1.1 million bpd Energy East project that was shelved last year by TransCanada.

Speaking to a business audience in Calgary, she suggested the Trans Mountain project could be a vital bulwark against Trump's imposition of tariffs on steel and aluminum from Canada, Mexico and the European Union, to which Canada retaliated with a bundle of dollar-for-dollar counter-tariffs on a

see TRADE SPAT page 7

ENVIRONMENT & SAFETY

Stat review finds 2017 emissions increase

Up after 3 years on GDP growth, increased coal use; power sector, producing 1/3 of global emissions, 38% coal-based after 20 years

By KRISTEN NELSON
Petroleum News

In introducing the BP Statistical Review of World Energy 2018, BP Group Chief Executive Bob Dudley said in a June 13 statement: “2017 was a year where structural forces in the energy market continued to push forward the transition to a lower carbon economy, but where cyclical factors have reversed or slowed some of the gains from prior years. These factors, combined with a rising demand for energy, has resulted in a material increase in carbon emissions following three years of little or no growth.”

In remarks in London Dudley urged focus on the long-term picture rather than the short-term changes. He said the increase in emissions in 2017 was not the direction they wanted to see, noting that some of the recent “exceptional performance” in reduced emissions has been boosted by cyclical developments.

He noted that Spencer Dale, the BP group chief economist, had drawn attention to that likelihood last year.

Emissions increase

Along with growth in energy demand, carbon emissions are up, Dale said June 13 in London when introducing BP’s 2017 Statistical Review (see story in June 17 issue), and in the introduction included in the Statistical Review.

He said the increase in carbon emissions is estimated at 1.6 percent in 2017, following three consecutive years of little or no growth, with factors driving the increase in emissions including global GDP growth which was above trend levels, much of which was driven by industrial activity.

The turnaround in coal consumption was also a factor, he said, with the coal market experiencing a mini revival in 2017. Global coal consumption was up 1 percent, led by India, with 4.8 percent growth, with demand both inside and outside the power sector. In China, which had seen three successive years of decline in coal usage, con-



BOB DUDLEY

sumption was up 0.5 percent. Dale said this was despite coal-to-gas switching in China for both industrial and residential use.

Dale said that some of the recent performance gains in emissions were boosted by cyclical developments, so some reversal was likely. He said the good news is that structural factors influencing long-term emissions continue to progress, such as the growth in the use of natural gas (see June 17 story).

Coal in China

He said coal, which had been in free-fall for several years, “experienced a mini-revival last year,” with coal production up 3.2 percent, driven by increases in China of 3.6 percent and in the U.S. of 6.9 percent, with U.S. production increases mainly going for export.

Dale attributed the 2017 increase in coal production in China to government measures to reduce excess capacity in that country’s coal sector, driven by a need to manage the price of coal: too high and it eliminates pres-

see **STAT REVIEW** page 3

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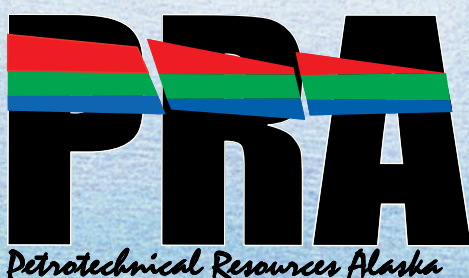
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• EXPLORATION & PRODUCTION

State approves new POD for Prudhoe Bay

Operator BP summarizes work accomplished under 2017 plan, lays out what owners plan for 2018 for initial operating areas of unit

By KRISTEN NELSON
Petroleum News

The Alaska Division of Oil and Gas has approved BP Exploration (Alaska)'s 2018 plan of development for the initial participating areas, the oil rim and gas cap, at the Prudhoe Bay field. In a June 13 letter of approval, division Director Chantal Walsh said the POD, dated March 29, was declared complete by the division April 1. BP had provided a technical presentation March 22, prior to submitting the POD, she said.

2017 report

Reporting on 2017 activities, BP, the Prudhoe Bay operator, said crude and condensate rates averaged 186,800 barrels per day, which combined with production from satellite fields and a portion of Point McIntyre, fully utilized processing capacity at Prudhoe. The field delivered 68.19 million barrels to the trans-Alaska oil pipeline in the year ending Dec. 31, the company said.

Gas production totaled 2,549 billion cubic feet, with 2,289 billion cubic feet of dry gas reinjected, 89.8 percent of the produced gas stream, with gas production continuing to be governed by facility handling constraints. Other major uses of gas were as fuel, 5.7 percent of produced gas, and in miscible injectant production, 3.3 percent.

Natural gas liquids production averaged 42,000 bpd, with 1.53 million barrels delivered to the trans-Alaska oil pipeline.

Produced water averaged 930,000 bpd, for a field-wide average water cut of

83 percent, with 804,000 bpd of produced water injected in waterflood and water-alternating-gas operations, and 94,000 bpd of produced water exported for injection into satellite fields.

Miscible gas injection continued, with MI delivered to MI-capable drill sites based on MI efficiency — barrels of oil per unit of MI.

MI injection was expanded in 2017 to two new MI patterns at Point McIntyre.

2017 saw 386 rate-adding wellwork jobs completed and some 1,000 wellwork jobs overall, including integrity, surface repairs, capacity sustainment, rate enhancement, well diagnostics, surveillance and rig workovers.

A focus area in 2017, BP said, was “recovery of liquids from the Sag River gas cap via wellwork on uncompetitive Ivishak producers.”

“Sag River gas contains condensate that has not been swept out through update lean gas reinjection and can be recovered as liquids at surface.”

Sag River recovery is being done by plugging off uncompetitive Ivishak producers and adding perforations upscale in the Sag River gas cap. Work done in 2017 at 29 wells produced 7,000 bpd of new production, with the entire program currently producing some 12,000 bpd.

Two rigs were working at Prudhoe in 2017, with 27 wells drilled, primarily by sidetracking underperforming wells using both conventional rotary and coil tubing rigs.

“As Prudhoe Bay has matured, drilling targets continue to become smaller and more complex with increasing drilling and reservoir risk,” BP said.

2017 facility, reservoir optimization

During the 2017 Gathering Center 1 facility maintenance turnaround corroded carbon steel piping in wet gas service was replaced with stainless steel pipeline, mist eliminators and inlet devices were upgraded, along with heat exchanger bundles.

In-line inspections were performed on some 83 miles of lines: three produced oil pipelines, eight three-phase cross-country pipelines, 10 produced water injection pipelines, one seawater injection pipeline and one gas lift transit pipeline.

Stock tank vapor and intermediate pressure turbine-driven gas compressors were replaced at all three flow stations with electric motor driven compressors. BP said this project was fully sanctioned in 2012, the compressor replacement at Flow Station 1 was completed in 2014; the compressor installation at FS-3 was completed and startup was in December 2016; FS-2 compressor installation began in January 2017 with startup in February 2018.

41st year

The IPA is in its 41st year, 30 years beyond plateau production at the field, and “the PBU owners’ key priority is on efficient production of the existing wells and plant,” BP said. The field, with 1,423 wells, is well developed and large-scale drilling programs — more than 50 new wells in a year — “have largely been replaced by operations efficiency increases, hundreds of wellwork jobs each year to maintain and enhance existing wellstock

... and reservoir management techniques as the key drivers.”

BP said emphasis on increasing production efficiency “resulted in only minor decline in the IPA’s 2017 production rate when normalized for the GC-1 TAR.”

Reservoir management

In the gravity drainage area, emphasis will be on operation, maintenance and repair of existing wells, and on sidetracks, as well as oil vaporization by lean gas injection.

BP said that drilling and well work in the gravity drainage area is “increasingly challenged by continued gas cap expansion resulting in thinner oil columns, and water encroachment from gas cap water injection.”

In the east waterflood/enhanced oil recovery area, focus is on optimizing water and MI injection, identifying potential new penetrations, pattern reconfiguration and wellwork.

In this area, seven wells are planned at Flow Station 2 for 2018 with additional wells planned for the future.

In the west waterflood EOR area, focus is on optimizing production and enhancing recovering by replacing voidage and maintaining reservoir pressure. One rig workover is planned for 2018 to allow a currently inoperable injector, X-11A, to restart injection.

Updip Zone 4 project targets remaining oil where the gas cap has expanded into

see PRUDHOE POD page 9

continued from page 2

STAT REVIEW

sure for inefficient mines to close or merge and raises energy costs; too low and the price could threaten the coal industry, which provides some 60 percent of China’s energy.

In early 2017 Chinese authorities introduced a target band for steam coal prices, Dale said, indicating ranges where authorities would increase their attention and then ranges where authorities would intervene on domestic coal prices. Because of high prices, Chinese authorities moved to increase coal production to lower prices and the increase in Chinese coal production over the last year was the direct result, he said.

Impact of power sector

Dale cited the impact of the power sector, absorbing more than 40 percent of primary energy in 2017, and said this

Statistical Review is the first to include comprehensive data on the fuel mix within the power sector. Global power generation was up by 2.8 percent in 2017 which is close to its 10-year average, he said.

While wind energy increased 17 percent and solar 35 percent, renewables accounted for only 8 percent of total generation.

Dale said that what struck him was that coal’s share in power generation is the same as it was in 1998 — 38 percent. In spite of the growth of renewables and strong policy efforts to shift away from coal to cleaner carbon fuels, there has been almost no improvement in the power sector fuel mix in 20 years, he said, noting this was worrying because power generation is the most important source of carbon emissions, accounting for over a third in 2017. ●

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● ENVIRONMENT & SAFETY

Research: Diet shift for belugas in inlet

By DAN JOLING
Associated Press

Beluga whales in Alaska's Cook Inlet may have changed their diet over five decades from saltwater prey to fish and crustaceans influenced by freshwater, according to a study by University of Alaska Fairbanks researchers.

An analysis of isotopes in beluga bone and teeth showed belugas formerly fed on prey that had little contact with freshwater. More recent generations of belugas fed in areas where rivers pour freshwater into ocean habitats.

New information on Cook Inlet belugas is important because the species is endangered and its numbers have not increased despite hunting restrictions and other protections. Mark Nelson, a wildlife biologist for the Alaska Department of Fish and Game and the lead author of the study, called it a little piece of that puzzle.

"If there's something we can do to help them recover, we might start to know what that might be," he said in a phone interview from Fairbanks.

A population of 1,300 belugas in Cook Inlet dwindled steadily through the 1980s and early 1990s. Alaska Natives harvested nearly half the remaining 650 whales between 1994 and 1998. Subsistence hunting ended in 1999 but the population remains at only about 340 animals.

Cheekbones, teeth analyzed

Belugas feed on fish, crab, shrimp, squid and clams. Nelson as part of graduate work joined other researchers to analyze samples of cheekbones and teeth of beluga whales that died between 1964 and 2007.

They first looked carbon and nitrogen isotopes taken from bone, which is replenished by a whale's diet throughout its life.

The analysis indicated that feeding had changed between generations. That could have signaled a prey change from ocean-bottom creatures to fish, Nelson said. It could have meant belugas were leaving Cook Inlet to feed. Researchers said both were unlikely and turned their attention to beluga teeth.

Like tree rings, teeth have annual

growth layers. Measuring isotopes in the growth layers reveals how feeding habits by an individual changed over its life, Nelson said.

A key question, Nelson said, was when change occurred in feeding habits and whether the change could be linked to documented events, such as a change in herring abundance or even the 1964 Great Alaska Earthquake. Researchers found no evidence of a sudden change in diet.

"It was a pretty steady change over the whole course of time, the whole course of that almost 50 years of data," Nelson said.

Prey from fresh water

Researchers then analyzed strontium isotopes in teeth. They established that belugas might be eating the same food but that their prey was coming from areas of Cook Inlet influenced by fresh water. That meshed with data from aerial surveys indicating recent generations of belugas were spending time in upper Cook Inlet near big rivers such as the Kenai and the Susitna.

"From that, we were able to say that not only are they spending more time in the freshwater environments, they're actually getting most of their food from that freshwater environment," Nelson said.

Verena Gill, a marine mammal specialist with the National Oceanic and Atmospheric Administration, said the findings are significant because they cover five decades.

"We know that it is a real change rather than an anomalous year or two," she said.

The study tells NOAA administrators that the Cook Inlet belugas' shift to more freshwater-influenced habitat began long before the documented population decline, Gill said.

"However, whether this is due to a change in prey availability or foraging location of whales has yet to be determined," Gill said.

NOAA announced in September it was granting \$1.3 million to Alaska for additional beluga research.

Researchers will analyze more teeth and pin down strontium signatures of water samples to determine what areas of Cook Inlet are important to belugas, Nelson said. Isotope research will be coupled with acoustic recorder research, which can determine where belugas are spending time and where they are feeding. Much is known about summer feeding habits but not much about winter habits.

"Understanding that better could be a real key here," Nelson said. ●

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ENVIRONMENT & SAFETY

July rig air quality workgroup meeting

A workgroup formed to develop recommendations for air quality permitting and procedures for temporary oil and gas drilling rig operations at existing Alaska facilities will hold its next meeting on July 12, the Alaska Department of Environmental Conservation has announced. This Oil and Gas Drill Rig Workgroup is organized by DEC and the Alaska Department of Natural Resources. The workgroup includes representatives from DEC, DNR, the Alaska Oil and Gas Association, Cook Inlet Regional Citizens Advisory Council, the Alaska Support Industry Alliance and the North Slope Borough.

In October 2017 a technical subgroup within the workgroup published a report on air quality modeling for portable oil and gas operations on the North Slope. The workgroup itself last met in February 2016. That meeting involved a presentation on options for ensuring that portable operations meet required air quality standards.

—ALAN BAILEY

CORRECTION

Exploration well is the Starfish

The article titled "Starfish success" in the June 17 issue of Petroleum News makes some reference to the exploration well drilled by Glacier Oil and Gas Corp. in the Badami unit this winter as the Swordfish well. The correct name of the well is the Starfish well. Petroleum News apologizes for any confusion.

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● FINANCE & ECONOMY

Idaho questions production ‘discrepancies’

By **KEITH RIDLER**
Associated Press

Idaho officials want a Texas oil company to explain what a state agency calls “discrepancies” involving oil and gas production records for wells in Idaho following an evaluation of records dating back to 2014.

The Idaho Oil and Gas Conservation Commission on June 13 directed the Idaho Department of Lands to ask Houston-based Alta Mesa to account for apparent discrepancies between what was produced and what was sold at specific wells.

The records examined by the Idaho Department of Lands involve nine wells operated by Alta Mesa.

“There’s a big discrepancy between production volumes and what was reported sold,” Mick Thomas, administrator for the Idaho Department of Lands’ oil and gas division, told the commissioners.

State officials say they also want to know about 28,000 barrels of liquids potentially worth millions of dollars that Alta Mesa said involved testing early in the production process that weren’t reported. At the time, Idaho didn’t require reporting for testing.

“I would like an explanation of those first couple years,” said Commission Chairman Kevin Dickey.

Alta Mesa didn’t immediately respond to phone messages from The Associated Press.

Oversight issues

The evaluation of the records follow efforts by lawmakers in 2017 to improve oversight of the industry as expected wind-falls of oil and gas money to state coffers and landowners have failed to happen despite several years of production. Severance taxes on reported production have never matched Idaho’s cost to regulate the industry.

The new laws in 2017 revamped the commission overseeing Idaho’s natural gas and oil industry and beefed up the Idaho Department of Lands. Lawmakers also required more detailed reporting requirements for oil companies.

Under those new laws, the commission in February requested that Alta Mesa provide production volumes on all oil and gas wells in the state. State officials on May 9 examined those production records and produced spreadsheets state officials say contain discrepancies. The spreadsheets were given to the five-member commission.

It’s not clear when Alta Mesa might respond to the commission’s request for an explanation.

Also royalty issues

On a related front, the Idaho Land Board, which includes Gov. C.L. “Butch” Otter, last year directed the Idaho Department of Lands to conduct an audit on three Alta Mesa wells the state has a financial interest in, and that could provide insights into royalty payments and severance taxes. That audit is still being conducted.

In other action, a watchdog group and

southwest Idaho landowners last year filed a federal lawsuit against Idaho officials contending a state-approved process forcing them to sell their natural gas and oil violates the U.S. Constitution. That case remains active.

Idaho has a long history of oil and gas exploration starting in the early 1900s, but it was Alta Mesa using new technologies that made Idaho an oil and gas producing state. The company has spent more than \$160 million finding reserves to tap and building infrastructure but has also at times expressed frustration as Idaho officials have tried to find the best regulatory plan. ●

ENVIRONMENT & SAFETY

Waves cause Antarctic shelf disintegration

A group of researchers have determined that storm-driven ocean swells have caused catastrophic disintegration of Antarctic ice shelves in recent decades, according to a recent paper published in Nature. Apparently reduced sea ice coverage since the late 1980s has exposed ice shelves to the swells, causing the shelves to flex and break. This, in turn is leading to runaway collapse of large areas of ice shelf through a process that, while related to climate change, is not directly a result of rising temperatures. As some areas of ice shelf collapse, more areas of ice shelf become exposed to wave action.

According to a report by the Australian Antarctic Division, Dr. Luke Bennetts, a co-author of the research paper, has commented that the ice shelves perform a critical role in slowing the movement of land-based glaciers into the ocean. And, unlike the loss of sea ice, the loss of land ice will cause sea levels to rise.

“Ice shelves fringe about three quarters of the Antarctic coast and they play a crucially important role in moderating sea level rise by buttressing and slowing the movement of glacial ice from the interior of the continent to the ocean,” Bennetts said.

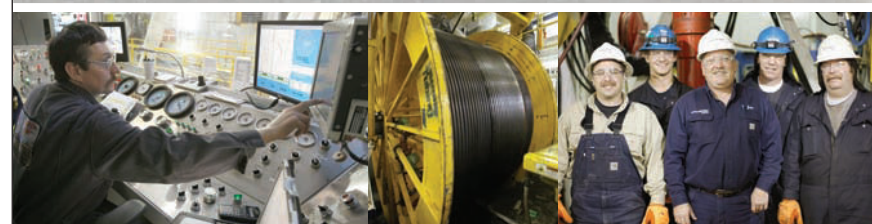
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● FINANCE & ECONOMY

Trump declares oil too high, blames OPEC

By **DAVID KOENIG**

Associated Press Business Writer

President Donald Trump blames OPEC for oil prices that he says are too high, and no doubt many Americans feel the same way.

But it's more complicated than that.

Crude has more than doubled since bottoming out below \$30 a barrel in early 2016, causing U.S. motorists to face the highest gasoline prices since late 2014.

On June 13, the national average for a gallon of regular stood at \$2.91, up 25 percent from a year ago, according to the AAA auto club.

"Oil prices are too high, OPEC is at it again. Not good!" Trump tweeted that morning.

OPEC is the Organization of the

Petroleum Exporting Countries. Members of the cartel, led by Saudi Arabia, and other big producers including Russia have played a role in reversing the plunge in crude prices that started in 2014. They have shown discipline in limiting production since the start of last year, helping push up the benchmark price of international crude.

Prices, however, were already rising on growing demand and expectations that a sharp pullback in new investment by oil companies would reduce the oil supply.

"Over time it would have happened anyway because of the cutbacks in (drilling) investment, but definitely OPEC's cut in production helped speed the reduction of the oil glut," said Phil Flynn, an oil analyst for The Price Futures Group.

Some estimates put the post-crash

reduction in investment by major oil companies such as ExxonMobil, Chevron and BP at more than \$1 trillion. Flynn compared that to eliminating the fourth-largest oil producer in the world.

Meanwhile, output from Venezuela — a major oil exporter to the U.S. — has plunged as the country goes through a political and economic crisis. Most analysts expect production there to go even lower.

While Venezuela is a member of OPEC, "the disaster in Venezuela, which has created a hole in the market, is not the fault of OPEC," said Daniel Yergin, the vice chairman of research firm IHS Markit and author of several books on the energy industry.

Then there is Iran, OPEC's third-biggest producer. The country boosted production after the U.S. lifted sanctions related to Iran's nuclear program in 2016, but analysts expect output to fall when the Trump administration's decision to withdraw from the deal takes full effect later this year.

U.S. companies have filled some of the gap created by Venezuela, OPEC and non-OPEC producers including Russia. Using drilling advances such as fracking, operators in Texas and North Dakota have pushed U.S. production higher.

U.S. oil production has more than doubled in the past decade, including a 19 percent increase since OPEC's limits took effect in January 2017, according to the U.S. Energy Information Administration.

Oil prices have eased slightly in recent weeks. Saudi Arabia has already started pumping more crude. The kingdom report-

ed that it increased production in May to about 10 million barrels a day.

Trump's tweet — similar to one he wrote in April, blaming OPEC for "artificially Very High" oil prices — came a week before a much-anticipated OPEC meeting in Vienna and may have been designed to influence the discussion.

"The president's tweets are really telling the other oil-producing countries to step up your production to make up for the coming sharp declines that are expected in Iranian oil exports," Yergin said.

OPEC is under scrutiny in Congress, too. The House Judiciary Committee approved a bill June 13 to subject OPEC to U.S. antitrust law by removing state immunity shields. The committee chairman, Rep. Bob Goodlatte, R-Virginia, said shielding a cartel like OPEC "makes a mockery of U.S. antitrust law, threatens the American economy and has the potential to harm our national security." The measure now goes to the full House.

Jason Bordoff, a Columbia University professor and former energy adviser to President Barack Obama, said politicians always fret when gasoline prices rise before a big election.

Democrats are trying to blame Trump for higher gasoline prices, sensing the issue will resonate with voters in the November midterm elections that will determine control of the House and Senate.

Charles Schumer, the leader of Senate Democrats, recently linked \$3-plus gasoline to Trump's decision to revive sanctions on Iran. Schumer spoke as he stood in front of the price sign — regular for \$3.09 — at an Exxon station on Capitol Hill. ●

PIPELINES & DOWNSTREAM

Permian line would move 1 million bpd

Oil giant Exxon Mobil Corp. and Plains All American Pipeline have agreed to build a pipeline to transport crude from the Permian basin to the Texas Gulf Coast.

The June 12 announcement by Irving-based Exxon Mobil and Plains All American, with headquarters in Houston, did not include financial details.

Both companies have signed a letter of intent to transport crude oil and condensate from sites in West Texas. The pipeline would originate in both Wink and Midland, with delivery points in Webster, Baytown and Beaumont.

The companies say the goal would be to ship more than 1 million barrels per day. Officials plan to use existing pipeline corridors to help limit potential community and environmental disruptions.

Further details weren't immediately released.

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● EXPLORATION & PRODUCTION

More wells at Kuparuk, facilities at Milne

By KRISTEN NELSON
Petroleum News

The Alaska Division of Oil and Gas has approved requests from ConocoPhillips Alaska for new wells at the Kuparuk River unit and requests from Hilcorp Alaska for production facilities additions at the Milne Point unit.

In a June 19 decision the division approved a plan by Kuparuk operator ConocoPhillips to drill three new wells and install three conductors, three temporary mouse holes and three cellar boxes at Drill Site 2M in the Kuparuk River unit. The division said the purpose of the project is to increase oil production at Kuparuk.

The decision is an amendment to the Kuparuk River unit plan of operations.

The conductors will be installed in a 42-inch diameter hole to a depth of some 100 feet and if water is encountered a 20-inch diameter heavy-wall pipe will be driven in. Mouseholes will be installed some 45 inches away from the center of the conductor using 16-inch diameter

casings. The cellar boxes will be approximately 6 feet in diameter and 5 feet deep. Wells will be drilled following installation of the conductors, mouse holes and cellar boxes. Wellhouses and related appurtenances will be installed upon completion of the wells, the division said.

All work will be performed on pad and the division said the project is expected to begin immediately upon receipt of the required permits and be completed by Dec. 31, 2019.

Milne Point

Hilcorp Alaska applied to the division to place portable modular polymer injection facilities on L Pad and J Pad in the Milne Point unit. Hilcorp, operator at Milne, won approvals for the placements June 1 and 13.

Activities at both pads include leveling the existing gravel pad, placement of 6-inch rig mats, stacking and securing portable modular units — four at each pad, placement of water letdown modules, installation of self-standing exterior landings for access to second level modules, adding new sections of insulated 3-inch pip-

ping to tie-in to water letdown skid, installation of new 2-inch insulated piping to tie-in to wells and installation of electrical and instrumentation in the portable modular units.

The facilities will be adjacent to existing transformer skids on the pads.

On June 15 Hilcorp received approval to place three heated 20-foot Connex storage units on A Pad at Milne. The Connexes are necessary to provide heated storage for chemicals, materials and tools sensitive to extreme temperatures, the division said.

Work includes leveling the existing gravel pad; installing support timbers and liners under the storage units; installing electrical for required heated storage of chemicals, materials and tools; and installation of interior lights.

The Connexes will be placed adjacent to existing facilities on the pad. ●

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TRADE SPAT

variety of imports from the U.S.

G7 summit

That led to a series of scathing and bitter exchanges at the G7 summit in Quebec, with Trump accusing Trudeau of being a “weak” leader, culminating with Trump trade adviser Peter Navarro suggesting there is a “special place in hell” for leaders like Trudeau.

In the process, Trump has warned he is prepared to widen the trade war to curb auto imports from Canada, currently estimated at C\$62 billion a year, ignoring the fact that the U.S. currently enjoys an overall trade surplus with Canada.

Notley said these events have made the U.S. status as a “monopoly buyer” of Canadian energy “harder and harder to stomach.”

“If the last days and weeks tell us anything, it’s that we, as Canadians, need to take control of our economy density. That means being strategic with our resources, our wealth and our energy security,” she said.

“We simply must diversify our markets and build our independence accordingly. It has never been more important for Canada to get a Canadian pipeline built to a Canadian coast.”

Trudeau on markets

Trudeau echoed Notley’s views, saying that a pipeline to open new markets is “something we can all agree is probably a good idea,” while Trudeau’s Natural Resources Minister Jim Carr said the strained relationship with the Trump White House underscores the importance of having “more than one customer for our main natural resource.”

Alberta Economic Development and Trade Minister Deron Bilous said the trade hostility with Trump puts more pressure on Trudeau to “engage with China on free-trade talks because there is such significant potential in that market. (Because of the dispute) Canadians in general are ... acutely aware that we need to do more to expand our markets.”

He said Canada “can’t be pushed around (by Trump’s threats). It’s unfortunate a trade war starts to escalate like this ... our hope is that cooler heads will prevail.”

CAPP report

The sense of urgency is captured in the

CAPP report that emphasizes the need for Canada to become more competitive and build more pipelines if it wants to get that additional oil to market.

“We don’t build freeways for traffic jams, we build them to have efficient flow of traffic,” CAPP President Tim McMillan told reporters. “We should be looking at (ways) to reach the most profitable markets in the most efficient way possible and build the infrastructure to meet that need.”

Of the projected output of 5.6 million bpd, 4.2 million bpd is estimated to come from the oil sands (up 1.5 million bpd from today), while conventional output in Western Canada is forecast to remain static at 1.33 million bpd, leaving offshore Newfoundland to contribute 220,000 bpd.

The greatest prospect for growth is identified as the Montney and Duvernay formations in northern Alberta and British Columbia, which are expected to add 500,000 bpd of pentanes and condensates by 2026.

Negative impact

CAPP warned that the struggle to get major pipelines built, Canada’s regulatory policies and uncertainty related to provincial and federal climate change policies, as well as a series of cancelled projects,

have had a negative impact on investor confidence.

McMillan said Canada needs the Trans Mountain expansion, Enbridge’s Line 3 into the U.S. and TransCanada’s Keystone XL to the Texas Gulf Coast if it wants to succeed as a global supplier.

“The U.S. has growing supplies (to the point) where they are self-sufficient in gas already and is looking to become self-sufficient in oil in the next decade,” he said. “Today, Canada has only one customer for crude oil (beyond its domestic market) and growing markets around the world want Canadian product, so there’s just a natural incentive for us to be build-

ing to new markets.”

But the loss of foreign investors is the biggest concern, with David McKay, chief executive officer of the Royal Bank of Canada, fretting that investment is flowing out Canada’s energy and clean-technology sectors “in real time,” while tax and regulatory changes are making the U.S. more competitive.

Peter Tertzakian, chief energy economist at Calgary-based ARC Financial, wrote in the Financial Post that Canada’s oil and gas industry, rated as the world’s fifth largest, “ranks high on many per-

see TRADE SPAT page 12

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DIO SPEECH

A dual challenge

The challenge that the world as a whole faces involves reducing greenhouse gas emissions while simultaneously meeting the rising global demand for energy, Dio said. The rise in energy demand mainly originates from rising prosperity. BP projects an energy demand increase of 35 percent by 2040, with that entire increase coming from the developing world, in particular China and India.

This will require a transition to a lower carbon economy through the use of renewables and through making every form of energy cleaner.

"The state of Alaska is uniquely positioned to lead and benefit from this transition," Dio suggested.

For, although renewable energy is set to continue as the fastest growing sector of the energy industry, fossil fuels will continue to exist as a critical component of the energy mix. Even in BP's most aggressive low-carbon scenario for the future, a scenario that meets the targets set in the Paris climate change accord, fossil fuels will account for more than 50 percent of total energy in 2040, with oil and gas accounting for more than 40 percent of the total.

The BP strategy

To meet the energy challenge, BP has adopted a strategy of reducing emissions from the company's operations, improving the company's products and creating new low-carbon businesses, Dio said.

As an example of emission reductions, Dio cited the use of a mathematical model for optimizing production from 180

For example, the improvement in operational efficiency in the Prudhoe Bay field from 80 percent to more than 85 percent over the past three years represents an annual oil production gain equivalent to a new oil field in Prudhoe Bay.

Lower 48 wells, resulting in a 75 percent reduction in venting emissions events, a 20 percent production increase and a 20 percent cost reduction. BP's shipping business has recently built 26 new oil tankers that are 20 percent more fuel efficient than the previous generation of tankers. And the company is building six new LNG tankers that are about 25 percent more efficient than their predecessors.

In terms of improved products, BP is now the largest supplier to the U.S. transportation sector of biogas generated from organic waste, as an alternative to liquid fossil fuels. The company is also the largest marketer of traditional natural gas in North America. And BP Castrol now offers a range of carbon-neutral engine oils, including an oil made from sugar cane derived stock.

New BP low-carbon businesses include 14 U.S. wind farms. A BP joint venture with DuPont converts corn sugar into bio-isobutanol, which can be blended with gasoline in higher concentrations than ethanol. BP has partnered with Lightsources, the largest European solar development company, and is planning the largest solar energy facility in the state of Kansas. The company is also investing in a wide range of smaller companies that

support low carbon technologies, Dio said.

Worldwide, BP plans to spend at least \$500 million per year on low carbon initiatives, she said.

Alaska's opportunity

Bearing in mind the world's continuing dependence on fossil fuels, Alaska has a "huge opportunity" to contribute to the energy transition through improved efficiency in oil and gas production, reductions in the carbon intensity of the oil industry and supporting the expanded use of natural gas, Dio said.

For example, the improvement in operational efficiency in the Prudhoe Bay field from 80 percent to more than 85 percent over the past three years represents an annual oil production gain equivalent to a new oil field in Prudhoe Bay. BP plans to conduct a new 3-D seismic survey in 2019 across the entire Prudhoe Bay field. Data from this survey will support new drilling and well work, to help further extend the life of the field, Dio said.

With increasingly competitive global energy markets, it is very important to continue to pursue improved business efficiency. But sound and predictable tax and regulatory policies that support long-term investment and the use of advanced technologies are particularly important, Dio said, commending the state Legislature for rejecting recent proposals for tax increases.

A role in gas revolution

From the perspective of natural gas development, BP thinks that, with massive gas resources at Prudhoe Bay, Alaska can and should play a major role in the global gas revolution, Dio said.

"I believe no single fuel is more important to the global energy transition than natural gas," she said.

Dio said that BP is going to help make the AKLNG project happen — in May the company announced a gas sales precedent agreement with the Alaska Gasline Development Corp.

"Geographically, Alaska benefits from its relatively close proximity to East Asia, which imports more LNG than any other region on Earth," Dio said.

However, with global LNG supplies set to more than double by 2040, and with more than 40 percent of that growth coming in the next five years, the LNG market is becoming increasingly competitive. To

In terms of improved products, BP is now the largest supplier to the U.S. transportation sector of biogas generated from organic waste, as an alternative to liquid fossil fuels. The company is also the largest marketer of traditional natural gas in North America.

keep Alaska competitive, the state must continue to maintain a stable tax and regulatory environment, Dio said.

Dio told reporters that BP's commitment to the AKLNG project reflects the fact that BP sees natural gas production as a key pillar of the company's strategy for addressing the energy transition. She also commented that Alaska's proven ability to be innovative in the use of new technologies can help with the project viability.

The opening of ANWR

During her speech Dio also commented on the opening of the 1002 area of the Arctic National Wildlife Refuge for oil and gas activities, saying that this represented a big policy victory at the national level. BP supports access to federal lands for responsible exploration and development, while also supporting the Department of the Interior's development of an environmental impact statement for oil and gas leasing in the refuge.

"The industry has proven ways to safely develop sensitive areas while minimizing environmental impacts," Dio said.

Dio later told reporters that BP has openly supported the opening of the ANWR coastal plain, but that any interest in participating in ANWR exploration would depend on the outcome of Interior's work in evaluating the environmental impacts of oil and gas leasing in the refuge.

At this point, Alaska has achieved real momentum, having come through a very difficult period with renewed strength and commitment for future development, Dio told the RDC meeting. Despite the changes in the global energy situation, the work that the oil industry does and the investments that it makes will remain essential to human prosperity for decades to come, she said. ●

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PRUDHOE POD

Zone 4 to improve recovery of isolated oil lenses.

BP said recovery of liquids from the Sag River gas cap from uncompetitive Ivishak producers will continue, with some 10 wellwork jobs expected, but no wells targeting Sag River expected in 2018.

At the Eileen west end/northwest Eileen areas, the objective is to optimize production under constraints of gas lift supply and the total gas oil ratio of the EWE large diameter flow line. While additional drilling opportunities are being evaluated in this area, they are challenged by the current economic environment and complex geology and gas and gas influx.

Production, well forecasts

Production decreased from 197,900 bpd in 2016 to 186,800 bpd in 2017, due to natural decline and the GC-1 facility turnaround, partially offset by increased operations efficiency and high wellwork activity.

The average annual IPA crude and condensate production rate is expected to be between 150,000 and 187,000 bpd in 2018, with total NGL production between 30,000 and 46,000 bpd, BP said.

BP said it expects to do some 400 wellwork rate-adding jobs, and some 700 non-rate adding jobs, "as well as an active, fieldwide reservoir surveillance program driving these activities."

Rotary penetrations will remain about the same as in 2017, about five, with coil penetrations reduced from 22 in 2017 to some nine in 2018. Rig workovers are expected to increase from one to one to three in 2018.

2018 projects planned

A controls reliability and renewal project is aimed to reduce a backlog of aging control systems, "install control systems with a broader base for support, and improve life-cycle cost, while minimizing the impact on production during implementation," BP said, with activities planned at FS-3 this year, with FS-1 and GC-2 to follow in 2018-19.

At the seawater treatment plan, BP said the long-term plan is to maximize field recovery. Seawater is used in various areas of the IPA for pressure support and in other areas is injected to support production through waterflood and EOR operations.

Upgrades and maintenance are underway to improve the dew point of dehydrated gas from flow stations and gathering centers, BP said, improving the reliability of the central gas facility.

"Invention and application of new technology has underpinned the IPA's outstanding production record and will continue in the future," BP said, with pilot testing of the Operator Workbench in this plan period, a mobile device allowing field workers to collect and input data without returning to a computer station.

A field-wide 3-D seismic survey is being evaluated, using the same technology used in the North Prudhoe survey in 2014.

And installation is planned for more wireless monitoring of pressure and temperature at wells.

Major gas sales

BP said it has provided a draft confidentiality agreement to the Alaska Gasline Development Corp. to allow disclosure of information to AGDC for the Alaska LNG project, but said that as of the date of filing its POD it had not

received requests for information from AGDC, the Federal Energy Regulatory Commission, any other agency, any other unit operator or any third party regarding the AKLNG project.

BP said that during 2018-19 the Prudhoe owners anticipate appropriate planning and activities to position for a major gas sale "consistent with AGDC progress on the AKLNG project and based on prior work done by the PBU operator to prepare for a MGS. Depending upon AKLNG project milestones and activity, the timing and scope of MGS-related activity may need to be adjusted, and if plans do not occur as scheduled during the 2018-19 time period, then the PBU operator would not anticipate including similar information on MGS activities in the 2019 POD submission."

BP listed long-range MGS activities that would be needed to support sales gas delivery, byproduct injection, shared infrastructure and field facility maintenance and said the Prudhoe owners "will continue to maximize the opportunity for improved recovery by way of injection of indigenous lean gas and MI into Prudhoe Bay reservoirs."

Indigenous gas is a proven method to support production and improve ultimate recovery with indigenous gas injection contributing approximately 40 percent of PBU production, BP said, and reinjection of processed gas will continue. The Prudhoe owners will also be preparing for potential commercial discussions with the Point Thomson unit owners for potential delivery of gas from that field for injection into the Prudhoe reservoir and will evaluate a range of potential impacts on the Prudhoe reservoirs and on the operation of the unit. ●

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Petroleum NEWS

Oil Patch Bits



Volant appoints GM for new Houston area facility

Volant said it is pleased to announce that Aaron Sinnott has agreed to join its Houston-based business Volant Oil Tools US as its general manager.

Sinnott previously worked for Weatherford with 25 years of experience in tubular running services and well integrity, ranging from field operations to global oversight. His deep understanding of well construction and well integrity in combination with his drive to build teams and envision solutions to market needs will directly benefit Volant's U.S. customers and, by association, its global customer base.

Volant has been providing products and services into the U.S. since the early

2000s and is now increasing its operations and customer support capabilities by opening a location in the community of Katy, Texas. The facility will be 20,040 square feet, with 16,425 square feet dedicated to shop and warehouse activities. Operating in Katy will provide closer access to spare parts and consumables, an added training location for operation and maintenance of Volant tools, tool rental services, convenient tool maintenance and refurbishment, torque ring installation and centralizer crimping and swaging services.

Volant's facility is expected to open in late summer and Sinnott is on board to build its Houston team preparing to deliver excellence to current and new customers. For more information visit: www.volantproducts.ca.



AARON SINNOTT

Companies involved in Alaska's oil and gas industry

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PENTEX SALE

AIDEA project intended to expand the supply of natural gas for Fairbanks consumers to address the cost of energy in the city and to alleviate air quality problems that primarily result from the use of wood burning stoves in the winter.

“It has taken time and much hard work by a group of very dedicated people to bring us to this milestone day, when we can now proudly say that AIDEA has fulfilled its assignment to advance the Interior Energy Project for the benefit of Interior Alaska residents,” said AIDEA board chairman Dana Pruhs. “The sale of Pentex to IGU represents the culmination of nearly a year and a half of in depth due diligence and negotiations, and now a unified, locally controlled gas utility for the Interior is a reality.”

\$54 million purchase

AIDEA purchased Pentex in 2015 for \$54 million with the aim of eventual Fairbanks utility consolidation. To buy Pentex, IGU is paying AIDEA that original purchase price plus an agreed rate of return that reflects the fact that AIDEA paid for the purchase using money from its revolving fund. IGU’s payment for Pentex comes from Sustainable Energy Transmission and Supply, or SETS, loans, authorized for use by the IEP. The loan terms include zero percent interest and no payments required for the first 15 years, followed by interest and principal payments over the next 35 years, with an interest rate of 0.25 percent. If demand for gas in

the Interior falls short of expectations, the repayment of principal can be deferred for a further five years. The state Legislature has also authorized the issue of up to \$150 million in bonds.

LNG storage

Also under the IEP, the construction of a new LNG storage facility is in progress in Fairbanks. In 2015, through the use of IEP SETS funding, FNG and IGU expanded the gas distribution network in Fairbanks in anticipation of an increased gas supply. By warehousing summer produced LNG for use in the winter, the new storage facility will enable the consolidated gas utility to start making use of the expanded network. The eventual objective, however, is to further develop the customer base in Fairbanks by using IEP loans to further expand the distribution network and increase the LNG production capacity. Increased LNG production could come from expansion of the Titan plant, although an alternative involving the construction of a new plant is also a possibility.

“We made it to the one-yard line last year, and now we have finally brought it into the end zone,” said AIDEA board member and Fairbanks resident Gary Wilken in response to the sale of Pentex. “I am profoundly honored to have been part of this years-long effort that is now poised to bring such tremendous benefit not only to this generation, but for generations to come.”

—ALAN BAILEY

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NIKOLAEVSK OUTPUT

demand, which might explain the bump in early 2018.

In its new plan of development, running through July 2019, Hilcorp did not propose any drilling or workover projects at the Nikolaevsk unit. The state has yet to approve the plan.

Previous attempts

After partnering with the Enstar affiliate Alaska Pipeline Co. on a 10-mile pipeline connecting the field to the nearby Anchor Point Pipeline, Hilcorp brought the Nikolaevsk unit online in December 2012 from the Red No. 1 well at 5 million cubic feet per day.

Nikolaevsk production had fallen to 2.5 million cubic feet per day by the start of 2013 and to 796,000 cubic feet per day by the end of the year. The company suspended production from April to October 2013 in response to seasonal demand restrictions.

Even with a compressor installed in

early 2014, production fell from 1.1 million cubic feet per day in early 2014 to 300,000 cubic feet per day in late 2014. The company suspended production from November 2014 through February 2015 due to seasonal demand.

Union Oil Company of California announced a discovery at the Nikolaevsk unit in 2004 but never developed the field because of its distance from the regional transmission grid.

The company proposed plans in 2009 to drill at two Nikolaevsk prospects — the existing Red prospect and a nearby Blue prospect. The company ultimately relinquished the Blue prospect and blamed market conditions on its inability to farm-out the Red prospect.

A plan in early 2011 to study a potential pipeline to the North Fork unit soon became moot when Unocal Oil Company of California sold its Cook Inlet portfolio to Hilcorp.

—ERIC LIDJI

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WETLANDS POLICIES

of Alaska that differentiate the state from other parts of the United States and that can make it difficult to use the same mitigation approach as is used elsewhere. In particular, Alaska has vast areas of untouched wilderness, with limited opportunities for mitigation sites, particularly in a single watershed. Much of the land is under public rather than private ownership and management. And areas of permafrost pose particular challenges when it comes to the feasibility of mitigation techniques.

The new guidelines offer several approaches to dealing with Alaska’s unique circumstances, including a recognition that a larger watershed scale may be required than in the Lower 48 for locating mitigation sites, a recognition that wetlands impacts may be unavoidable in regions with high proportions of wetland, and a recognition that compensatory mitigation may not be feasible in some regions because of the limited availability of suitable mitigation sites. The guidelines also suggest that “out-of-kind” mitigation may sometimes be appropriate: for example, enhancing streams impacted by mining as an alternative to restoring wetlands. In Alaska there may be mitigation opportunities on public land. And a less rigorous permit review is appropriate for small projects with minor environmental impacts, the

new MOU says.

Expressions of support

“Our revised guidance offers a consistent and practical approach to wetlands protection and aquatic resource restoration in Alaska,” said EPA Administrator Scott Pruitt when announcing the new guidance. “We look forward to working with the State of Alaska and our federal partners to implement the guidance, which will produce better environmental and economic results across the state.”

“Alaska is different than the Lower 48 — from our still developing infrastructure, to the rugged challenges of building in our wild Arctic environment, we face unique circumstances requiring flexibility in implementing wetlands mitigation,” said Sen. Dan Sullivan, R-Alaska. “When the Lower 48 states were being developed, they didn’t need to deal with today’s onerous regulatory restrictions. I am encouraged to see EPA and the Army Corps, recognizing these issues.”

“We are encouraged that the EPA and Army Corps recognize Alaska’s unique context with respect to wetlands, mitigation, and development under the Clean Water Act, and we look forward to working together with them to protect these values using the flexibility provided by this new MOU,” said Alaska Gov. Bill Walker.

—ALAN BAILEY

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Nanushuk — A Slice from the Heart of the Watermelon

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South Nanushuk Prospect. 35,423 acres. East to west – 18 linear miles covering multiple Nanushuk clinothems. The prospect covers 3 linear miles north to south. Immediately north of 1 billion-plus barrels-of-oil-in place Umiat Oil Field – a Nanushuk oil reservoir. The geological thesis for the South Nanushuk Prospect is that the Umiat oil is a tell-tale indicator of significantly larger Nanushuk oil deposits deeper and to the north of Umiat Mountain. Armstrong’s discoveries located north of the South Nanushuk Prospect (i.e., Pikka and Horseshoe) have reified our Nanushuk prospect thesis. The South Nanushuk Prospect is south of the 1.2 billion barrel (proved contingent reserves) Pikka Unit and 20+ miles south of Armstrong’s Horseshoe wildcat well. USGS geophysical data confirm continuity of the Nanushuk and Torok formations through the South Nanushuk Prospect leases (BLM; NPR-A). Each of the Nanushuk clinothems arcing through the South Nanushuk Prospect begin south of the Umiat Oil Field and extend north through the Pikka Unit.

For access to the data room: www.nanushuk.com.

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RETHINKING DISCOVERIES

Colville River delta region, the Willow discovery in the Nanushuk of the north-eastern National Petroleum Reserve-Alaska and a major oil pool in the Torok under Smith Bay,

Oil Search in partnership with Repsol and Armstrong Energy is pursuing a development in Nanushuk sands in the Pikka unit — Armstrong also drilled the successful Horseshoe Nos. 1 and 1A wells in equivalent sands some 20 miles to the south of Pikka. During the last winter ConocoPhillips encountered oil in the Putu Nos. 2 and 2A wells, and in the Stony Hill No.1 well, all in that Pikka/Horseshoe trend. And ConocoPhillips is planning the development of its Willow discovery. Caelus Energy made its huge Smith Bay discovery in 2015 but thus far has not been able to further delineate the find or conduct any flow tests for the oil pool.

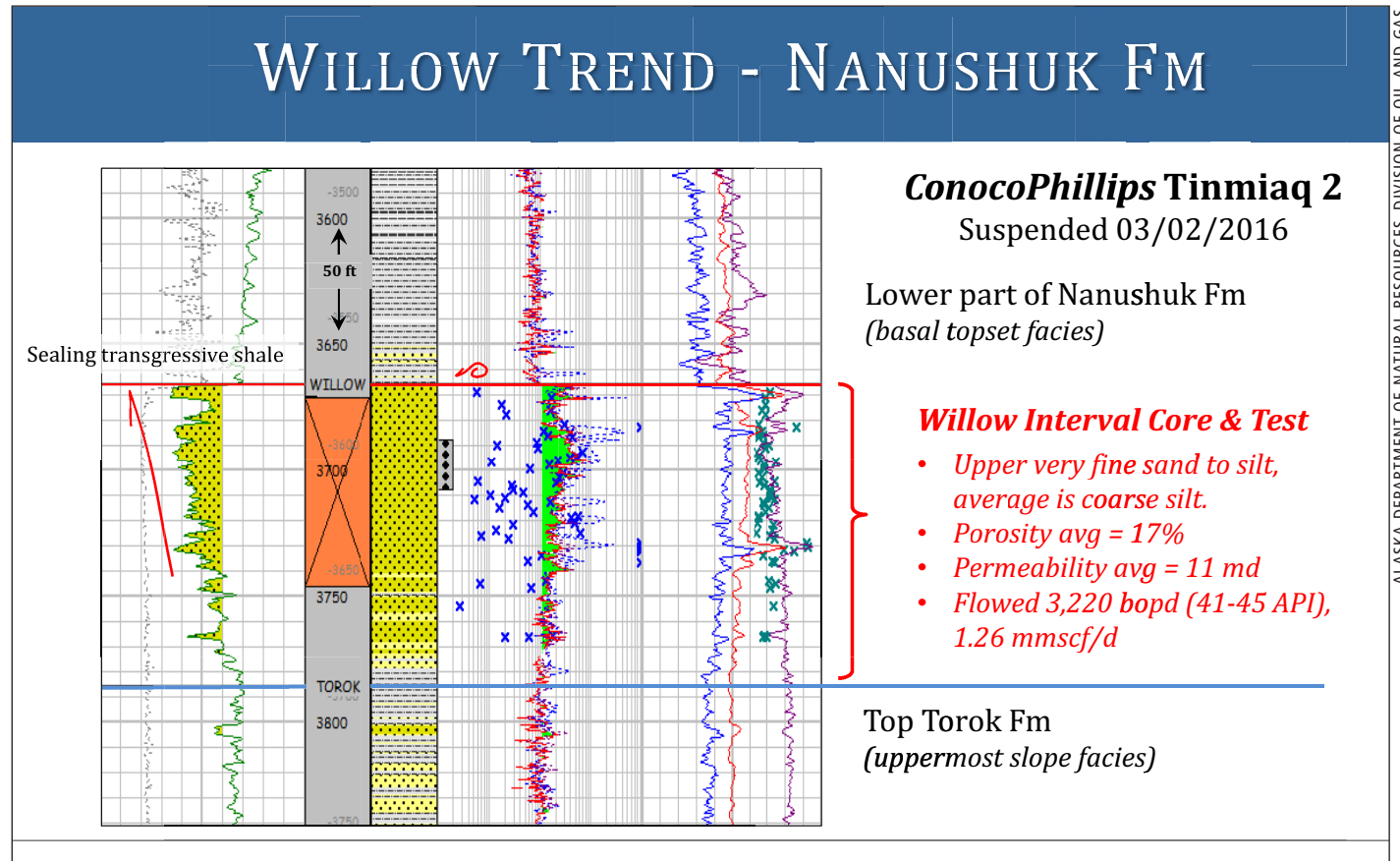
Brookian oil plays

The Nanushuk and Torok form part of what geologists refer to as the Brookian sequence, the youngest and shallowest of the petroleum bearing rock sequences in Arctic Alaska. The sediments that formed the rocks were deposited down the margin of an ancient marine basin that filled from west to east, with the basin margin itself migrating in that same direction, as the basin filled. The more sandy sediments deposited in shallow water at the top of the margin later formed the Nanushuk formation, while the muddier and more layered sediments on the sloping side and on the floor of the basin formed the Torok formation.

Oil in the Nanushuk and Torok is found in what are called stratigraphic traps, hydrocarbon traps created through the disposition and sequence with which the sediments forming the rocks were laid down. The key to understanding the particular success of the Nanushuk play is the effect of cycles of sea level change and corresponding changes in sediment deposition, as the ancient basin margin migrated east, Decker explained. During periods of relatively low sea level, rivers dumped large quantities of sand out across to the basin shelf edge; it also appears that the sands were commonly reworked along the shelf edge to form elongated sand bodies, in some cases several miles long, such as is now observed in the Pikka/Horseshoe trend, Decker said.

Distinctive oil traps

Then, as sea level rose, submerging the sands, the tops of the sand bodies were



Recently released data for ConocoPhillips Tinmiaq 2 well, used to delineate the company's major Willow oil prospect in the Nanushuk formation in the National Petroleum Reserve-Alaska, indicates good reservoir quality and a flow rate of more than 3,000 barrels of oil per day of light oil.

scoured off and impervious muddy sediments were deposited on top, to form what would later become hydrocarbon seals. In cross-section, the package of sediments took on a sigmoidal shape, pointed at top and bottom, with the sand at the top pinching out between mud above and below, and with the pointed end of the sand body directed towards the west, towards the source of the sediment pouring into the basin. Oil later accumulated in upper parts of the sand bodies.

Oil in the Torok formation is found trapped in interlayered shales and sands referred to as turbidites. And, given the more muddy nature of these sediments, deposited relatively far into the ancient basin, reservoir quality in the Torok tends not to be as good as in the Nanushuk. In addition to the Smith Bay discovery, oil has been found in the Torok in the Nuna and Moraine pools that straddle the Ooguruk and Kuparuk River units and in the Cassin discovery made in 2013 by ConocoPhillips to the north of the Willow discovery.

The sands with their potential hydrocarbon contents, particularly in the Nanushuk, tend to show up in seismic cross sections as seismic amplitude anomalies, thin bands along which the recorded seismic signals are particularly strong. And an examination of a northwest to southeast cross-section of the northern part of NPR-A reveals a multiplicity of these anomalies, with their distinctive shapes, curving down towards the east, marking the migrating eastward

margin of the ancient basin.

Given that much of the North Slope, apart from the area of industrial development, is underexplored, the multiplicity of amplitude anomalies with their distinctive shapes raises an intriguing question over just how many oil pools remain undiscovered in the region, Decker commented.

Publicly available data

And an examination of what is now known publicly about the new discoveries can also prove illuminating.

Maps of the structure and thickness of

the sands in the Pikka/Horseshoe trend confirm that the sands would have been deposited just beyond the edge of the ancient marine shelf. Interestingly, a plot of oil pressure data from the various wells drilled in the trend demonstrates that fluid pressures have been communicating all through the trend across geologic time, Decker said. In other words, there appears to be significant reservoir continuity along the entire trend.

However, in detail, the rock quality does vary, so that there will likely be

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RETHINKING DISCOVERIES

internal barriers to oil migration, with the hydraulic fracturing of horizontal wells being needed to encourage oil production, Decker added.

A plot of the water pressure gradient at Horseshoe juxtaposed on the oil pressure gradient for the trend suggests an oil/water contact at a depth of about 4,500 feet. That would imply the existence of an oil column more than 600 feet thick, Decker said.

The Willow discovery involves a large sand body that appears to have similar continuity to Pikka/Horseshoe across a considerable distance. Phillips Petroleum, later to become ConocoPhillips, originally made the discovery in 2002 from the drilling of the Hunter A well, a discovery that prompted the company to obtain

some leases over the prospect in the 2002 NPR-A lease sale, Decker said. However, the company had other development interests at the time and did not return to the discovery until after Armstrong and Repsol had found and tested their Pikka discovery between 2013 and 2015. In 2016 ConocoPhillips confirmed the Willow trend through the drilling of the Tinmiaq No. 2 and Tinmiaq No. 6 wells, about 10 miles from the Hunter well.

Data from the two Tinmiaq wells, which have recently become public, appear to indicate lateral continuity across to the Hunter well in the sands that form the Willow reservoir. The data also indicate the presence of a younger and shallower sand body, referred to as the Falcon sand, that was not found in the Hunter well. It is not yet known whether the Falcon sand contains oil, Decker said.

Data from the Tinmiaq No. 2 well show

that the reservoir interval contains fine grained sand and silt but that the reservoir quality is good, Decker said.

Light oil

And the oil in the Nanushuk/Torok discoveries is relatively light, a factor that should help when it comes to oil production. The API density of the oil may relate to the oil source rock. The Pikka/Horseshoe oil is thought to have originated from a source in the Shublik formation and has an API of around 40. The Willow oil has an API of around 30 — recent U.S. Geological Survey research suggests that this oil may have come from a source rock known as the HRZ, or possibly from a Jurassic source, Decker said.

Unlike shallow oil to the east, found in sands above the legacy North Slope oil fields, the Nanushuk/Torok oil has not

been degraded by microbes to form viscous or heavy oil. Decker speculates that, being at a deeper level within the geologic section, the Nanushuk and Torok may have been protected by impervious shales from water infiltration that might have promoted the degradation.

Because the maximum depth of burial of the main North Slope oil source rocks tends to increase towards the south, geologists tend to view the southern region towards the Brooks Range foothills as gas prone rather than oil prone. However, given the potential for lateral migration of fluids within the rocks, it is difficult to say how far south oil may be found in the Nanushuk/Torok play, Decker suggested. And, paradoxically, there is oil in the Nanushuk in the Umiat oil field, in the presumed gas province more than 40 miles south of Horseshoe.

ANWR implications

With the west to east migration of the basin margin that formed the Nanushuk and Torok strata ending at around the location of the current Colville River, these rocks are not found to the east of this region. However, a similar geologic process took place to the east, with much younger rocks forming as the ancient marine basin continued to fill. That raises some interesting questions regarding oil prospects in the 1002 area of ANWR.

The prospects in the younger Brookian sediments, deposited on the ancient shelf margin in the 1002 area, make a major contribution to the overall estimates of recoverable oil in the area. But the Nanushuk-style reservoir model, with reservoir sands pinching out towards the direction of origin of the sediments, has not really been evaluated, Decker said. Could this type of prospect add to the area's oil potential?

Overall, with the new Nanushuk play proving a key to the opening of much more oil resource on the North Slope, a robust regional geologic framework is needed, to put everything into perspective and develop an effective exploration model, Decker said. The underexplored North Slope is still yielding exploration surprises, with the emergence of more assessed oil resources and the existence of many undrilled leads, he said. ●

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He said Berlin-based Transparency International gives Canada top marks for low corruption, placing Canada behind only Norway among 28 oil-production countries that meet 90 percent of the world's demand, while facing extreme pressure to "divest from, entrap and shut down production," at the same time those consumers give a "thumbs up to suppliers that bear the least accountability or respect for the planet." ●

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