



page ANS June production 477,364 bpd,  
2 down 10% from 531,827 bpd in May

## IHS dubs North Slope a 'super basin,' oil output to grow 40% in 8 years; ConocoPhillips wins \$2B

ALBEIT A BIT LATE, IHS MARKIT HAS TAKEN A HARD LOOK at the resurgence of oil exploration and development on Alaska's North Slope and on Aug. 21 released the results of research that calls the North Slope a late-emerging-phase 'super basin,' rather than a mature basin.

"The Alaska North Slope ... is poised to re-emerge as a major source of U.S. energy production, with crude oil output potentially increasing as much as 40 percent during the next eight years," IHS said in a press release announcing its analysis. The firm classified

see INSIDER page 6



## State's fall lease sale date set; blocks include work commitment

The Alaska Department of Natural Resources, Division of Oil and Gas, will open bids at its fall lease sales Nov. 15 at 9 a.m. at the Dena'ina Center in Anchorage.

The sales include the state's annual Beaufort Sea, North Slope and North Slope Foothills areawide sales, and three sales of blocks of leases: Gwydyr Bay block; Harrison Bay block; and Storms block.

Minimum bids are: \$25 per acre for the Beaufort Sea, North Slope and block sales; and \$10 per acre for the Foothills sale.

Royalty rates are 16.67 percent for the Beaufort Sea sale, state-ASRC tracts and the north sub-region of the North Slope

see FALL LEASE SALE page 8

## Trans Mountain cleared for takeoff; Vancouver protest camp dismantled

Canada's National Energy Board has given the green light for Trans Mountain to start construction on sections of its pipeline expansion between Alberta and British Columbia at the same time police demolished a protest camp at the line's terminal site in Vancouver.

The federal regulator said Trans Mountain had met all applicable pre-construction conditions to start work on the link from Edmonton, Alberta, to Kamloops in central British Columbia, noting it had ratified 96 percent of the route on that segment.

The NEB said the company could start clearing a right of way, subject to other government permits and regulations, adding that 72 percent of the entire detailed route has now been approved, leaving two hearings for the final section to take place in October.

see TRANS MOUNTAIN page 9

## Fairbanks businesses support AGDC

The Alaska Gasline Development Corp. said Aug. 17 that several Fairbanks-based businesses have joined the Alaska Gasline Coalition, a group of organizations which support AGDC's efforts to advance the Alaska LNG project.

The new Fairbanks members are: Airport Equipment Rentals, Brice Inc., Doyon Ltd., Fairbanks Building & Construction Trades Council, Fairbanks Central Labor Council, Fairbanks Economic Development Corp., Fairbanks Laborers Local 942, Frontier Supply Co., Ghemm Inc., Plumbers & Pipefitters Local 375 and Yukon Equipment.

"A primary purpose of the pipeline is to provide Alaskans with a reliable source of gas and a clean, affordable energy alternative," said AGDC President Keith Meyer. "Access to North Slope natural gas will transform Interior Alaska com-

see AGDC SUPPORT page 9

### EXPLORATION & PRODUCTION

# More details emerge

BLM publishes more detail on ConocoPhillips' planned Willow development

By ALAN BAILEY  
Petroleum News

In conjunction with the scoping process for an environmental impact statement for ConocoPhillips' proposed Willow oil field development in the northeastern National Petroleum Reserve-Alaska, the federal Bureau of Land Management has published more details from ConocoPhillips' plan for the field.

In May the company filed what it referred to as a master plan for the development, in anticipation of BLM having to produce an environmental impact statement for the project. The master plan published was somewhat of an outline in nature. The document that BLM has now published puts a

The layout would be designed to minimize redundant parallel pipelines.

bit more flesh on that plan.

However, ConocoPhillips has not yet made a final investment decision for the project, with that decision presumably requiring more detailed engineering and technical analysis, to pin down the project economics.

Meanwhile BLM is seeking public comments on the scope of the EIS.

### Processing facility and drill sites

In general terms, the development, in the Bear see WILLOW DETAILS page 10

### EXPLORATION & PRODUCTION

# GMC a huge resource

Geologic Materials Center provides access to rocks for exploration, research

By ALAN BAILEY  
Petroleum News

For an explorer seeking oil, gas or minerals in Alaska's resource rich lands, the general absence of roads and the seasonal nature of surface access can prove formidable hurdles.

In part to address this problem, the state's Geologic Materials Center in Anchorage maintains a vast collection of rock samples that enable rocks to be examined and investigated at negligible cost. And recently the facility has also been providing access to modern seismic data, made publicly available under the state exploration tax credit rules. Access to samples and data can prove particularly valuable for newcomers to the state,

Given the huge cost of, for example, drilling a well in Alaska, the scale of the center's collection represents a massive investment.

enabling preliminary investigations of exploration concepts.

### Easy access

Ease of access to geologic materials that are otherwise difficult or impossible to reach also makes the center invaluable as an educational resource — the center has mineral and rock sam-

see GMC RESOURCE page 11

### PIPELINES & DOWNSTREAM

# One down, two up

Court places another obstacle in way of Keystone XL, some now see it as doomed

By GARY PARK  
For Petroleum News

The seemingly unending struggle to open new markets for Canadian oil has seen TransCanada's Keystone XL rocked by what some believe is another crippling delay, while Enbridge's Line 3 and Kinder Morgan's Trans Mountain projects have edged closer to construction starts.

A United States federal court judge added to the years of delay for Keystone XL by ordering the State Department to undertake an environmental assessment of TransCanada's proposed route revisions through Nebraska.

Judge Brian Morris said the new evaluation was necessary following the Nebraska Public Utilities

Canadian industry leaders say the upshot is obvious: Action is needed to diversify the customer base otherwise hopes that Canadian crude production can continue on a growth curve from 4.2 million bpd to 5.6 million bpd in 2035 will be dashed.

Commission's approval of the US\$8 billion, 1,140-mile pipeline along an alternative route in the state, rather than the company's desired route, which he said had not been properly studied.

TransCanada was poised to start preliminary work on Keystone XL, which had been scheduled to carry 830,000 barrels per day from Alberta to

see PIPELINE UPDATE page 8

• EXPLORATION & PRODUCTION

# ANS June production averages 477,364 bpd

North Slope output down 10% from 531,827 bpd in May; Cook Inlet June production averaged 14,914 bpd, down 5% from 15,620 in May

By KRISTEN NELSON  
Petroleum News

Alaska North Slope crude oil production, including natural gas liquids, averaged 477,364 barrels per day in June, down 10.2 percent, 45,956 bpd, from a May average of 531,827 bpd, and down 2.9 percent from a June 2017 average of 491,527 bpd, a drop of 14,163 bpd.

Volumes are based on Alaska Oil and Gas Conservation Commission data, posted by field and pool on a month-delay basis.

ANS production totals include 41,578 bpd of NGLs — from Prudhoe Bay, Endicott and Northstar — and 106 bpd from Greater Mooses Tooth in the National Petroleum Reserve-Alaska. A small volume from GMT also appeared in May production. The field is under construction and operator ConocoPhillips Alaska told Petroleum News that GMT is not in production and the volumes are due to flowback from a well during the cleanup process to remove drilling mud.

As for the North Slope drop in production from May

to June, Alyeska Pipeline Service Co. said Aug. 22 that there were five planned maintenance shutdowns between April 27 and July 6: 12-hour shutdowns April 27, May 25, June 15 and July 6; and an 18-hour shutdown June 23.

Both BP and ConocoPhillips told Petroleum News earlier in the summer that they planned maintenance. The three June shutdowns would have impacted production in that month.

## Endicott, Badami show increases

Only two North Slope fields had June-over-May increases in production, the Hilcorp Alaska-operated Endicott field and Badami, operated by Glacier Oil and Gas subsidiary Savant Alaska.

Endicott averaged 6,505 bpd of crude oil and 743 bpd of NGLs in June, a total of 7,248 bpd, up 8.9 percent, 593 bpd, from a May total of 6,655 bpd and down 1.2 percent from a June 2017 total of 7,332 bpd.

Badami averaged 2,180 bpd in June, up 64 percent, 851 bpd, from a May total of 1,329 bpd, and up 151.4

percent from a June 2017 total of 867 bpd. Glacier put its Starfish exploration well, the B1-07, on line in mid-May and Glacier CEO Carl Giesler told Petroleum News in June that the well tested at rates of more than 2,500 bpd.

## Largest per-barrel change at Prudhoe

The BP Exploration (Alaska)-operated Prudhoe Bay field, the North Slope's largest, averaged 198,568 bpd of crude in June and 39,874 bpd of NGLs, a total of 238,442 bpd, down 14.9 percent from a May combined average of 280,058 bpd and down 9.6 percent from a June 2017 total of 263,579 bpd.

The ConocoPhillips Alaska-operated Kuparuk River field averaged 108,325 bpd in June, down 1.8 percent, 1,756 bpd, from a May average of 110,081 bpd, and up 3.4 percent from a June 2018 average of 104,748 bpd.

The ConocoPhillips-operated Colville River field averaged 62,638 bpd in June, down 4.6 percent, 3,003 bpd, from a May average of 65,641 bpd, but up 11.1 per-

see JUNE PRODUCTION page 7

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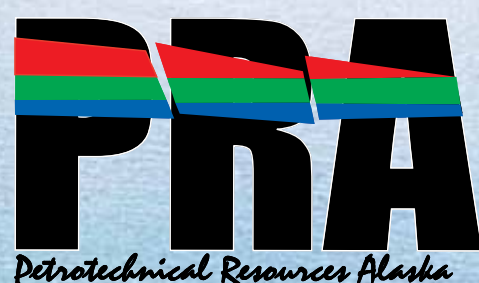
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• ALTERNATIVE ENERGY

# Alaska geothermal: tantalizing possibilities

*The state has many volcanoes, hot springs, but harnessing these remote features as viable energy sources has proven challenging*

By **ALAN BAILEY**  
Petroleum News

The Alaska Department of Natural Resources' recent announcement that it is seeking nominations of land for geothermal use has again brought attention to what appears to be an underused state resource. With its myriad of volcanos and hot springs, why does the state not make much use of geothermal energy?

As amply demonstrated by Iceland's geothermal heating and power generation systems, natural heat can be an excellent energy source for human use. In the Alaska Interior, a geothermal energy system at Chena Hot Springs, used for greenhouse heating and electricity generation, has for a number of years demonstrated that a system of this type can operate effectively in the state. But hot springs in Alaska only appear at specific, isolated locations, not necessarily close to any habitation. And a crucial challenge in Alaska is finding a geothermal location where the nearby energy demand is sufficient to justify the significant up-front cost of geothermal development. As tends to be the case with most renewable energy sources, the cost of the energy consists mainly of the cost of amortizing the substantial system development cost over some extended period of time.

## Unalaska and Akutan

For a number of years two remote communities in the Aleutians, Unalaska and Akutan, have been interested in harnessing power from nearby volcanos.

The city of Unalaska has wanted to develop known geothermal resources on the flanks or near the base of the Manushin Volcano, just 14 miles from town. Although Unalaska is a small, remote community, it is the site of a substantial fish processing plant, which, if it were to use the geothermal power, would improve the project economics. Geothermal energy would replace the use of diesel generators. However, to date the Unalaska project has not moved to a development stage.

Akutan also hosts a seafood production facility and is close to an active vol-

**In 2008 Ormat Technologies, a Lower 48 geothermal company, paid \$3.5 million for 15 state leases on the flanks of Mount Spurr.**

cano. The city has drilled some test geothermal wells but has yet to establish a viable geothermal project.

## 2007 lease sale

The state's invitation to nominate land obviously only applies to state land, and not to federal, Native or privately owned territory. Previously, in 2007, the DNR invited bids for geothermal leases adjacent to two active volcanoes on the west side of Cook Inlet: on the flanks of Mount Spurr, and on Augustine Island. In both cases the presence of active volcanoes would point to the presence of geothermal energy in the subsurface. But the viability of the geothermal resource for power generation or other uses depends on the precise nature of that resource, and on the viability of a development at a relatively remote location.

## Mount Spurr

Of the two, Mount Spurr appears the more attractive proposition, given that the leasable land lies 80 miles west of the Municipality of Anchorage and just 40 miles from the closest point on the Railbelt electricity transmission grid. A geophysical survey conducted in the 1980s pointed to the possible existence of a layer of warm or hot brine 2,000 feet below a plateau at the entrance to the pass on the south flank of the mountain. There were also geochemical indications of geothermal water in the area.

In 2008 Ormat Technologies, a Lower 48 geothermal company, paid \$3.5 million for 15 state leases on the flanks of Mount Spurr. In 2009 the company began an evaluation of its leases by conducting various forms of aerial survey, coupled with gravity and electromagnetic measurements. The company followed up in 2010 with the drilling of two core holes to

see ALASKA GEOTHERMAL page 7

## PIPELINES & DOWNSTREAM

### Researchers find refuelable battery concept

Research chemists in the University of Glasgow, Scotland, have discovered a new battery technology that enables the fluid inside the battery to be replaced when the battery runs down, rather than having the battery recharged. This presents intriguing possible applications in electric cars: Instead of having to plug a car into a recharging station for some significant period of time, the battery fluid would be replaced at a filling station in an operation somewhat similar to the refueling of a gasoline or diesel vehicle.

According to a university news release, the technology uses nano-molecules that can store electrical power or hydrogen. The fluid could be used to release electricity or hydrogen gas. In addition to possible applications for electric cars, the technology could potentially be employed in energy storage systems in conjunction with fluctuating renewable energy sources, the researchers think.

Presumably, to be used in practice, especially at a commercial scale, the practicalities and commercial viability of the technology would need to be proved. At this point the technology is at a pure research stage.

—ALAN BAILEY

## ENVIRONMENT & SAFETY

### Alyeska investigating oil at buried valve

Alyeska Pipeline Service Co. engineering and field personnel are assessing crude oil found Aug. 19 in an excavated area at the vertical bypass riser of Remote Gate Valve 35A, a buried mainline valve at pipeline milepost 194, between Atigun Pass and Pump Station 5, the company told Petroleum News in an Aug. 22 email.

Crews were inspecting the vertical bypass riser when the oil was discovered; approximately 10 gallons of crude oil was recovered with equipment on hand.

Plans are being developed to safely excavate the valve and the determine the cause of crude oil in the excavated area, Alyeska said.

Additional oil spill response equipment is on hand to support the operation.

The company also said it is not known whether the crude oil is related to a historic spill.

Remote Gate Valve 35A is buried 8 feet belowground, Alyeska said. On Aug. 22 engineers and response personnel were nearing completion of a plan to further excavate to the top of the mainline pipe.

The company said crews will have access to the entire valve and top of pipe once it is exposed.

—PETROLEUM NEWS



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## EXPLORATION & PRODUCTION

### Drilling outside Oklahoma's core fields

Oil production continues to expand throughout Oklahoma, including in areas outside the state's two core fields.

The STACK and SCOOP fields are dominated by larger, independent oil companies that include Continental Resources Inc., Devon Energy Corp. and Newfield Exploration, the Oklahoman reported.

But smaller, private companies reported strong results in other parts of the state, such as the Merge between STACK and SCOOP, the Anadarko Basin in western Oklahoma, and the Arkoma Stack in southeast Oklahoma.

"Oklahoma is unique in how many stack interval plays are available," said Rome Nichols, production manager for LeNorman Operating. "There are 14 different commercial targets in the Anadarko Basin."

The state's oil fields have the benefit of being near several pipelines, storage facilities, processing plants and refineries, according to operators. But Oklahoma's production is still affected by changing patterns in the oil market.

Oklahoma's production normally goes north to Midwest markets, which are now served primarily by production in Ohio and Pennsylvania. Because of that shift, Oklahoma's production prices have been discounted as local producers face a higher cost to transport oil and natural gas.

Pipeline projects planned and under construction in Oklahoma hope to open up more capacity to move south and export terminals and chemicals plants along the Gulf Coast.

"Right now, the way the U.S. methane market is situated, the vast majority of producers are paying higher differentials than they're historically used to just get gas to market," said Scott Goodwin, vice president of operations at FourPoint Energy. "We've seen it just in the last month ease up very significantly. I think it will continue to ease up."

—ASSOCIATED PRESS

## INTERNATIONAL

# Iran oil minister: Total pulls out of Iran

By **NASSER KARIMI**  
Associated Press

Iran's oil minister said Aug. 20 that France's oil giant Total SA has officially pulled out of Iran after cancelling its \$5 billion, 20-year agreement to develop the country's massive South Pars offshore natural gas field over renewed U.S. sanctions.

The parliament's website ICANA.ir quoted Oil Minister Bijan Zanganeh as saying that since Total first announced its decision a while ago, Iran has been in the process of "looking for an alternative" to Total. He didn't elaborate.

There was no immediate comment from Total.

Earlier in August, Iran said China's state-owned petroleum corporation took a majority 80 percent share of the project. CNPC originally had some 30 percent of shares in the project.

The renewed U.S. sanctions took effect in August, after America's pullout from the nuclear deal in May. The reinstatement of the sanctions exacerbated a financial crisis in Iran, which has sent its currency, the rial, tumbling.

### Decision in May

Total announced in May its decision to cancel the multibillion-dollar project in Iran because of U.S. sanctions. The group said at the time it couldn't "afford to be exposed to any secondary sanction," including the loss of financing by American banks.

The 2017, \$5 billion contract for new development at the massive South Pars

offshore natural gas field was the first major gas deal signed with Iran following the 2015 nuclear deal.

Total said in May that its actual spending to date with respect to this contract was less than 40 million euros.

Total had pulled out of Iran already once before, in 2008, as Western sanctions over its nuclear program began to ramp up. The 2015 landmark nuclear deal — which curbed the Iranian nuclear enrichment program in return for the lifting of international sanctions — marked a rush for Western businesses to access Iran's largely untapped market of 80 million people. Most prominently, airplane manufacturers rushed in to replace the country's dangerously dilapidated civilian fleet.

### Largest natural gas field

South Pars is the world's largest natural gas field and is shared by Iran and Qatar, where it's called North Dome. Qatar produces more than 590 million cubic meters per day from the shared field and plans to increase production by 10 percent by 2022.

Iran's total gas production stands at 750 million cubic meters per day, of which 550 million is consumed domestically.

Iran exports gas to neighboring Turkey and Iraq, and pipelines to Pakistan and Oman are in the works. Iran also imports some 12 million cubic meters per day from neighboring Turkmenistan. ●

—Associated Press writer Sylvie Corbet in Paris contributed to this report.

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# Congratulations

## Congratulations ConocoPhillips!

Hats off to Conoco as it continues to move forward on its plans for a standalone Willow processing facility west of the central North Slope.

The project will include the construction, operation and maintenance of a central processing facility; the construction of up to five well pads, with up to 50 wells on each pad; roads, an airstrip, pipelines and construction of a temporary Beaufort island to facilitate the delivery of project modules.

As BLM starts EIS scoping for Willow, Acting State Director Karen Mouritsen says “analyzing the proposed Willow prospect in a single MDP/EIS will result in a quicker and more efficient process for the approval of applications for permits to drill.”

ConocoPhillips recently upped its estimated recoverable oil from Willow to 400-750 million barrels, with peak production rates near 100,000 barrels per day.

Investment looks to be \$2-3 billion over four to five years, with first oil flowing by 2024 to 2025. An additional \$2-3 billion would then be spent on cumulative drilling over multiple years to sustain production.

The Willow discovery involves reservoir sands in the Nanushuk formation, in a near identical geologic setting to the huge Pikka/Horseshoe field that Oil Search and partners Armstrong and Repsol plan to develop on the other side of the Colville River.



Joe Marushack, President  
ConocoPhillips Alaska

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- Alaska Energy Services, LLC
- Alaska Dreams
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- Alaska Frontier Constructors (AFC)
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- Alaska West Express
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- North Slope Telecom
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## INSIDER

the North Slope as “an arrested, late-emerging-phase ‘super basin,’ rather than a mature basin.”

Kareemah Mohamed, associate director, plays and basins research at IHS and lead author of the firm’s analysis, was quoted as saying, “Previously thought of as a mature basin, recent large discoveries made in the shallow Nanushuk and Torok formations indicate this basin has a lot of room left to grow beyond the Endicott and Ivishak formations, which are the reservoirs from which the giant Prudhoe Bay and Endicott fields produce. This is why we refer to this basin as being in the late-emerging-phase, because it still has such significant resources to offer.”

IHS said the estimated ultimate recovery for the North Slope is 54.8 billion barrels of oil equivalent, which includes the 38 billion boe in remaining resources combined with the 16.8 billion barrels of oil produced to date from the Slope.

According to IHS analysis, “despite the geologic potential of the ANS, potential investment risks include needed service-sector expansion to support expected production growth, uncertainty over whether the state of Alaska will maintain its tax-incentive program, infrastructure access for new entrants, and the potential application of unconventional technology in a complex operating environment,” Mohamed said.

Although IHS’ analysis comes after the initial Nanushuk discoveries were first announced by Armstrong and Repsol in 2016, which triggered the revival of exploration and development on the North Slope, its analysis is accurate — or as one North Slope player said, “IHS Markit gets it.”

For example, Mohamed said that aside from the new discoveries, the basin warrants attention from prospective operators because the Slope now has fewer barriers to entry for operators, making it more competitive. He also referred to “advances in new drilling technologies that help reduce operating costs, efficiencies from economies of scale, state-level incentive programs for accelerated permitting, and infrastructure investment make this largely onshore conventional basin worth considering anew.”

Not all reports from Outside Alaska researchers pick up on all of these factors.

“We anticipate increased bidding activity and farm-ins as established operators expand their presence, and new entrants seek to gain early mover advantage by leveraging low acreage prices to enter newly opened areas,” IHS said.

New production in the short term will largely come from ConocoPhillips, ExxonMobil and Oil Search, IHS said, also noting operators such as Eni chasing onshore reservoir trends into the shelf area in the Beaufort Sea. This is likely a reference to Eni’s wildcat well at Nikaitchuq North.

“This activity is a leading indicator of an approaching wave of near-field exploration” on the North Slope, Mohamed said.

Oil Search is the operator of much of Repsol and Armstrong’s acreage in the initial discovery area, which is west of the central North Slope in what is referred to by Alaskans as the billion-dollar fairway.

Mohamed’s comparison with Alaska’s competitors: “For onshore light-oil opportunities in a stable country with a positive investment outlook, the ANS provides a viable alternative to the competitive Lower-48 unconventional basins, where acreage prices are an order of magnitude greater, and have transportation and raw material constraints, even if they are temporary.”

In its press release, IHS said it “defines super basins as basins that have multiple reservoirs and source rocks, diverse play types across numerous geologic horizons, infrastructure with access to markets, and established service sector and supply chains. Additionally, to achieve ‘super basin’ status with IHS, basins must hold at least 5 billion boe in conventional remaining reserves and have already produced at least 5 billion boe.

To speak with Kareemah Mohamed, contact Melissa Manning at [melissa.manning@ihsmarkit.com](mailto:melissa.manning@ihsmarkit.com)

For more information on the IHS Markit Plays and Basins: Alaska North Slope Basin; Resurgence in an Arrested, Late-emerging Super Basin analysis, contact [clare.fletcher@ihsmarkit.com](mailto:clare.fletcher@ihsmarkit.com)

*Note: Referring to Armstrong and Repsol’s huge North Slope discovery, Mark Myers told Petroleum News on Feb. 14, 2016, “the proven contingent oil*

*reserve number makes the discovery the largest since the Alpine field, the probable contingent reserve number the largest since the Kuparuk field, and the possible contingent number makes the discovery the largest since Prudhoe.”*

*Myers, who at the time was commissioner of the Alaska Department of Natural Resources, called the Armstrong-operated Pikka unit find “amazing” and was “very excited” to see the development moving forward.*

*The Nanushuk pool, initially referred to as the Ugruk discovery, had a 650-foot-plus oil column, good porosity and 150-foot thick net pay, he said.*

—KAY CASHMAN

## Conoco to get \$2 billion in Venezuela settlement

**HOUSTON, TEXAS-BASED CONOCOPHILLIPS SAID AUG. 20** it has a settlement agreement with

Petróleos de Venezuela S.A., or PDVSA, the Venezuelan state-owned oil company, to recover approximately \$2 billion, the full amount awarded to Conoco by an arbitral tribunal constituted under the rules of the International Chamber of Commerce, or ICC, plus interest through the payment period.

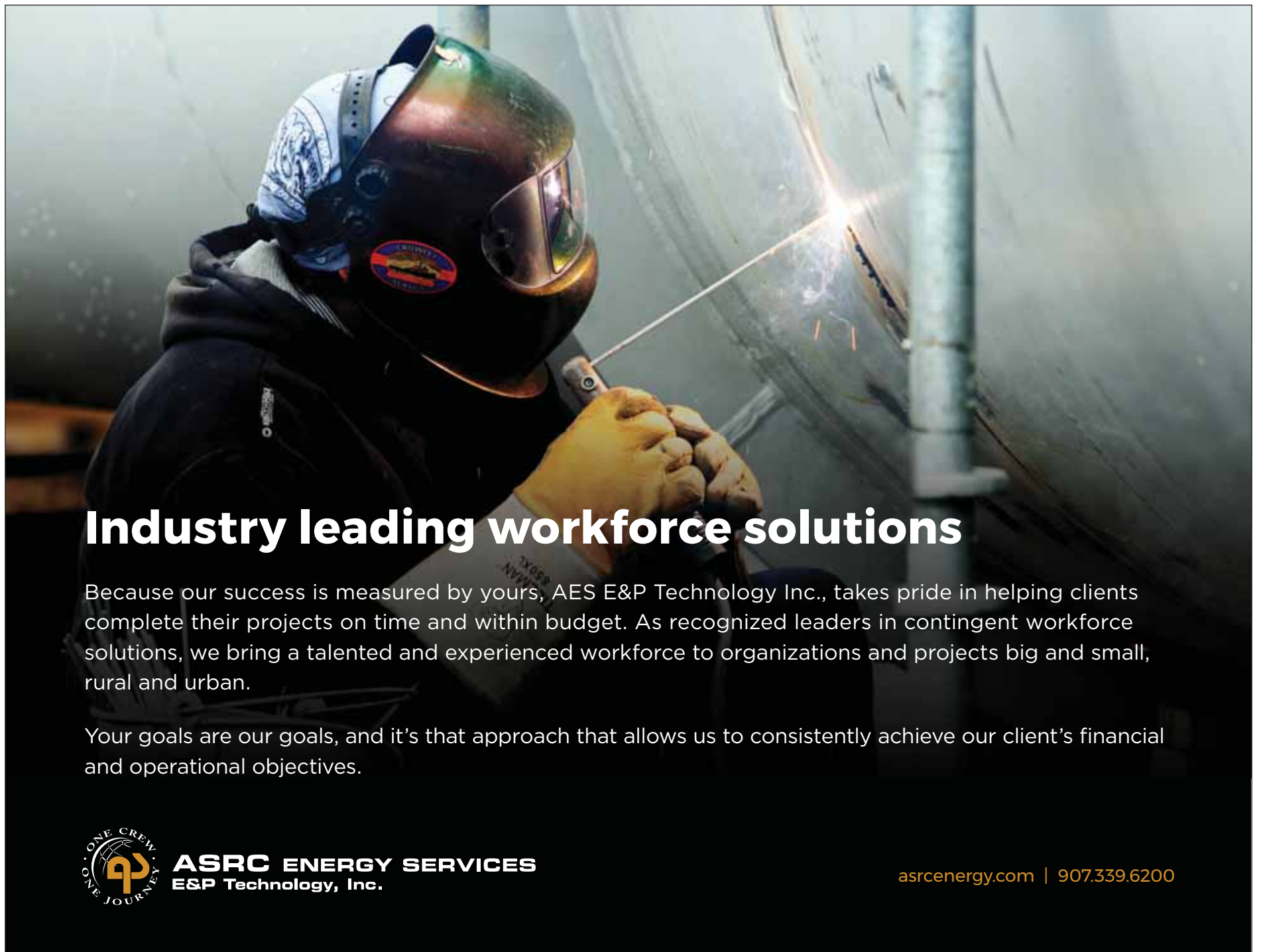
PDVSA agreed to recognize the ICC judgment and make initial payments totaling approximately \$500 million within a period of 90 days from the time of signing. The balance of the settlement is to be paid quarterly over a period of 4.5 years.

The award relates to the unlawful expropriation of Conoco investments in the Hamaca and Petrozuata heavy crude oil projects in Venezuela in 2007 and other pre-expropriation fiscal measures. The ICC arbitration award is final and binding upon the parties.

Conoco has a separate and independent legal action pending against the government of Venezuela before a tribunal under the auspices of the World Bank’s International Centre for Settlement of Investment Disputes, or ICSID.

The ICSID tribunal has already ruled that Venezuela’s expropriation of Conoco’s investments violated international law. Proceedings are underway to determine the amount of compensation owed to the oil

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## ALASKA GEOTHERMAL

depths of 1,000 feet. Then, in 2011, the company brought in a drilling rig to drill to a depth of 4,000 feet.

### Disappointing results

Unfortunately, the deeper well proved disappointing, encountering no hot water and subsurface temperatures no higher than 140 degrees F. The Ormat project leader for the drilling effort later told the Alaska Senate Resources Committee that the well had unexpectedly encountered a type of rock called a conglomerate, a rock type that does not hold heat particularly effectively. There may also have been some mixing of warm geothermal fluid with cold glacial water from the surface, the project leader said.

Although Ormat formulated plans for further drilling and field work, perhaps drilling closer to the volcano's crater, those activities never happened. In February 2015 the company announced that it was writing off the \$7.3 million it had invested in its Mount Spurr venture.

The disappointing outcome of Ormat's efforts clearly illustrate the risks associated with geothermal exploration. However, there is obviously volcanic heat associated with Mount Spurr: It would appear premature to write off the mountain's potential as a source of usable energy, not too distant from a major population center and its associated electricity grid.

### Augustine

Augustine, while obviously another potential source of volcanic heat, would be more challenging to develop, given its relatively remote location. The nearest power plants on the Railbelt grid are at Beluga 150 miles to the northwest and Nikiski 112 miles to the northeast. Having not received any bids, based on the 2007 lease sale, in 2013 the state offered 26 geothermal tracts in the Augustine area in conjunction with a Cook Inlet oil and gas lease sale. The state received a bid on one of the tracts but nothing resulted in the way of geothermal development. ●

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continued from page 2

## JUNE PRODUCTION

cent from a June 2017 average of 56,361 bpd.

The Hilcorp-operated Milne Point field averaged 20,259 bpd in June, down 3.1 percent, 641 bpd, from a May average of 20,900 bpd, but up 3.3 percent from a June 2017 average of 19,615 bpd.

The Eni-operated Nikaitchuq field averaged 19,170 bpd in June, down 1.4 percent, 271 bpd, from a May average of 19,441 bpd, and down 0.5 percent from a June 2017 average of 19,270 bpd.

The Caelus Alaska-operated Oooguruk field averaged 10,758 bpd in June, down 4.2 percent, 477 bpd, from a May average of 11,235, and down 9.5 percent from a June 2017 average of 11,881 bpd.

The Hilcorp-operated Northstar field averaged 6,035 bpd of crude in June and 961 bpd of NGLs, a total of 6,996 bpd, down 34.6 percent, 3,705 bpd, from a May total of 10,701 bpd, and down 7.9 percent from a June 2017 total of 7,593 bpd.

The ExxonMobil Production-operated Point Thomson field averaged 1,242 bpd in June, down 78.3 percent, 4,492 bpd, from a May average of 5,734 bpd, and up 343.6 percent from a June 2017 average of 280 bpd.

### Cook Inlet down 4.5 percent

Cook Inlet crude oil production averaged 14,914 bpd in June, down 4.5 per-

cent, 706 bpd, from a May average of 15,620 bpd and up 12.4 percent from a June 2017 average of 13,267 bpd.

Hilcorp's Beaver Creek field averaged 67 bpd in June, down 22.1 percent from a May average of 86 bpd.

Granite Point, also operated by Hilcorp, averaged 2,848 bpd in June, down 0.2 percent from a May average of 2,853 bpd.

Hansen, the Cosmopolitan project, operated by BlueCrest, averaged 801 bpd in June, down 4.8 percent from 841 bpd in May.

McArthur River, operated by Hilcorp, averaged 4,973 bpd in June, down 3.7 percent from a May average of 5,166 bpd.

Middle Ground Shoal, also operated by Hilcorp, averaged 963 bpd in June, down 30.8 percent from a May average of 1,392 bpd.

Redoubt Shoal, operated by Glacier's Cook Inlet Energy, averaged 1,260 bpd, up 8.2 percent from a May average of 1,165 bpd.

Hilcorp's Swanson River averaged 1,450 bpd in June, down 2.4 percent from a May average of 1,486 bpd.

Trading Bay, also operated by Hilcorp, averaged 1,565 bpd in June, down 9.6 percent from a May average of 1,731 bpd.

West McArthur River, operated by Glacier's Cook Inlet Energy, averaged 987 bpd in June, up 9.7 percent from a May average of 900 bpd. ●

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## PIPELINE UPDATE

U.S. Gulf Coast refineries by the end of 2018, but instead faces a new round of uncertainty.

The result for Western Canadian producers is expected to be prolonged price discounts, with the recent spread between Western Canadian Select crude from the oil sands settling in the range of US\$25 to US\$30 a barrel this year, compared with sub-US\$20 historic averages.

### Diversifying customer base

Canadian industry leaders say the upshot is obvious: Action is needed to diversify the customer base otherwise hopes that Canadian crude production can continue on a growth curve from 4.2 million bpd to 5.6 million bpd in 2035 will be dashed.

Chris Bloomer, chief executive officer of the Canadian Energy Pipeline Association, told the Financial Post that “we need the pipeline, we need it yesterday and we need more market access across the board.”

“We’re not getting a fair price for our crude in the U.S. because of a lack of (pipeline) capacity. That’s just fundamentally an issue.”

Tim McMillan, chief executive officer of the Canadian

Association of Petroleum Producers, said the new obstacle for Keystone XL should prompt a call for action “for Canada to get its own house in order” and find a way to access new markets.

He said Canada should be taking advantage of its vast coastlines that open the way for shipments to Asia and Europe, instead of forcing the cancellation of projects such as TransCanada’s Energy East and Enbridge’s Northern Gateway that offered combined exports of 1.6 million bpd.

Bloomer noted that the shortage of pipelines is compounding the risks of using rail which reached an all-time high in May of almost 200,000 bpd, up 70,000 bpd from a year earlier.

Former TransCanada executive Dennis McConaghy said the Keystone XL court ruling was based largely on a “technicality” that would not satisfy opponents on either side of the issue, with environmentalists, indigenous communities and others now insisting that Keystone XL would never be built.

The plaintiffs in the U.S. lawsuit were the Indigenous Environmental Network and Northern Plains Resource Council who argued that the State Department breached several acts in issuing a presidential permit for the pipeline without a required environmental assessment of the changed route, although Morris rejected their demand to revoke the permit issued by President Donald Trump in 2017.

## Verdicts

Still pending is a Nebraska Supreme Court verdict, expected later this year, on an appeal by Omaha-based Domina Law, claiming that the Nebraska utilities commission did not have the authority to consider alternate routes.

TransCanada said it needed time to examine the decision by Judge Morris before commenting, but Sierra Club senior attorney Doug Hayes said the verdict was a “victory for clean water, climate and communities that would be threatened by the pipeline.”

“This proposed project has been stalled for nearly a decade because it would be all risk and no reward and, despite the Trump administration’s efforts, they cannot force this dirty tar sands pipeline on the American people,” he said.

The remaining hopes for relief rest with Line 3 to double existing capacity from the oil sands to U.S. Midwest refineries to 760,000 bpd and the Trans Mountain plan to triple volumes to 890,000 bpd, targeting Asian buyers.

Federal Natural Resources Minister Amarjeet Sohi and Enbridge Vice President Leo Golden announced on Aug. 16 that construction has started on Line 3, while the National Energy Board said the same day that it was granting permission for work to commence on Trans Mountain. ●

Contact Gary Park through publisher@petroleumnews.com

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## FALL LEASE SALE

areawide and the three block sales; and 12.5 percent for the south sub-region of the North Slope areawide and Foothills. The primary lease term is 10 years for the Foothills tracts and 8 years for all other tracts, with a possibility of a one-time extension under certain conditions.

### Work commitments

For the block sales, the state will only accept bids on entire blocks.

The state described the blocks as contiguous, state-owned lands which have geological and seismic data available to the public. The division said it “has not identified and analyzed prospects,” but it

is including drilling requirements, with specified targets, in each of the blocks.

The Gwydyr Bay block is 23,012 acres of state-owned uplands and state-owned tide and submerged lands in nine leases in the North Slope and Beaufort Sea areawide sales, north of Prudhoe Bay and east of Milne Point. Based on the acreage and the \$25 per acre minimum bid, the minimum bid for the Gwydyr Bay block would be \$575,300.

The work commitment for the Gwydyr Bay block is a well to the base of the Kuparuk A.

Specifics are: “Before the fifth anniversary of the effective date of the lease, the lessee shall complete, suspend, or plug and abandon one well that has penetrated to the base of the Kuparuk A interval as observed as the Miluveach top

correlative stratigraphic surface seen in the Sak Riv 1A well ... at 12,348 feet measured depth. The penetration may not be within a 1,500 feet radius of the bottom hole location of any existing well.”

The work commitment includes submittal of well data including “at a minimum a mudlog, gamma ray log, resistivity log, and porosity log, before the fifth anniversary of the effective date of the lease, to substantiate adherence to the work commitment terms.”

The Harrison Bay block, at 66,275.28 acres, is the largest of the blocks. It consists of 21 leases in the Beaufort Sea areawide sale area. Based on acreage and the \$25 per acre minimum bid, a minimum bid for the Harrison Bay block would be \$1,656,882. The block is northwest of the Colville River unit and southeast of Smith Bay along the National Petroleum Reserve-Alaska.

Required drilling for the Harrison Bay block is to the base of the Kuparuk C, with a well to be drilled before the sixth anniversary of the lease. The specific are that the well be completed, suspended or plugged and abandoned “to the base of the Kuparuk C interval as observed at the LCU correlative stratigraphic surface seen in the S. Harrison Bay #1 well ... at 7,289 feet measured depth.” Well data

(the same as listed for the Gwydyr Bay well) would need to be submitted before the sixth anniversary of the effective date of the lease to substantiate adherence to the work commitment.

The Storms block is south of Prudhoe Bay, adjacent to the Guitar unit, and includes 30,592 acres of state-owned uplands in 12 leases in the North Slope areawide sale area. At the minimum bid of \$25 per acre, the minimum bid for the Storms block would be \$764,800.

A well is required to the base of the Kuparuk C before the fifth anniversary of the effective date of the lease. Specifics are that the lessee shall “complete, suspend, or plug and abandon one well that has penetrated to the base of the Kuparuk C interval as observed as the LCU correlative stratigraphic surface seen in the Hemi Springs State 1 well ... at 7,256 feet measured depth.” Well data, the same as listed for the Gwydyr Bay block well, is required to be submitted before the fifth anniversary of the effective date of the lease to substantiate that the work commitment has been completed.

Language is the same for all of the blocks: the lease will automatically terminate if the lessee fails to meet the work commitment.

### Extension possible

Rental is \$10 per acre for years one through eight, except in the Foothills where rental begins at \$1 per acre in year one, increasing by 50 cent increments to \$3 per acre in years five through 10.

see FALL LEASE SALE page 9

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## INSIDER

company.

The \$2 billion represents about a quarter of the international reserves held at Venezuela’s central bank. PDVSA is behind on \$6.1 billion in bond payments to creditors, Bloomberg reported Aug. 20.

A judge in Delaware recently granted Canada mining company Crystallex the right to seize shares of U.S.-based refiner Citgo Petroleum Corp., which is majority-owned by PDVSA, a state-owned company of Venezuela.

—KAY CASHMAN

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## TRANS MOUNTAIN

With construction on the C\$9.3 billion expansion now scheduled to start soon, he Royal Canadian Mounted Police snuffed out a potential flashpoint by enforcing a court injunction to dismantle a protest camp that was established over five months in defiance of local safety and health bylaws.

### Camp occupants removed

The RCMP removed 11 occupants from the site, and arrested five who refused to leave, though they were later released.

George Manuel, a spokesman for the Shuswap First Nations, said the evictions will not stop the protest, arguing that the British Columbia Supreme Court does not have jurisdiction over land claimed by indigenous people.

Will George, of the Tsleil-Waututh First Nation, said the protest camp may have been removed, but "this movement will continue to grow."

The RCMP said the public will eventually be able to re-enter the camp and resume "peaceful, lawful and safe" protests.

Nearby residents said the eviction was long overdue, with one claiming the community had been "severely impacted by the protesters," while the local municipality has "aided, abetted and accommodated the protesters over the rest of the neighborhood who are taxpaying citizens."

He said the residents had been forced to tolerate constant drum-beating and

chanting at night, illegal fires in a tinder-dry area and threatening confrontations with camp leaders.

### Claim to land an issue

In issuing an injunction, B.C. Supreme Court Justice Geoffrey Gomery said the position the protesters had advanced through the news media was not a valid case for an aboriginal title claim to the land.

He also said the goals of the camp occupants had evolved from simply objection to the Trans Mountain expansion to blocking a public right of way and making members of the public feel unwelcome and culminating in a threat to "kill" a fire official.

Trans Mountain officials and the Canadian government, which is about to acquire ownership of the pipeline system from Kinder Morgan, declined to comment on the enforcement of the injunction.

An organization representing 97,000 Metis (people of mixed aboriginal and European settlers) in Alberta voted in favor of endorsing the pipeline expansion from 300,000 barrels per day to 890,000 bpd.

President Audrey Poitras said solid economic investment in projects such as pipelines will "provide a better future for our children and grandchildren."

The Metis Nation of Alberta is one of several indigenous communities that have expressed interest in taking an equity stake in Trans Mountain.

—GARY PARK

Contact Gary Park through publisher@petroleumnews.com

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## AGDC SUPPORT

municates. The newest members of the Alaska Gasline Coalition will assist AGDC to communicate Alaska LNG project progress and help ensure that Alaskans across the Interior are prepared for the opportunities that come with it."

"Alaska LNG will positively impact the shareholders of Doyon by delivering clean natural gas to Interior communities, providing jobs and economic opportunities, and raising revenue to the state for essential services," said Aaron Schutt, Doyon Ltd. president and CEO.

"Alaska LNG means jobs for the

Interior," said Scott Eickholt, secretary treasurer of Fairbanks Laborers. "Our communities are relying on this project to bring affordable energy, cleaner fuel and an economic boom to the state only seen one time prior. It is our generation's legacy much like the Trans-Alaska Pipeline System project of the 1970s was our fathers' and grandfathers' legacy."

AGDC said it provides the coalition with regular updates on Alaska LNG, highlights opportunities for Alaskans to get involved and uses the coalition to demonstrate support of Alaskans for the project and in-state capabilities to potential investors, the global LNG industry and stakeholders.

—PETROLEUM NEWS

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## FALL LEASE SALE

For all other acreage, after eight years the DNR commissioner may grant an extension, with the combined term not to exceed 10 years, based on funds expended to explore and develop the lease, types of work completed and any other relevant information. The lease extension may be conditioned on a performance bond or a work commitment or both.

If a one-time lease extension is granted, the rental for the last three years of the lease will increase to \$250 an acre, although the commissioner may impose a lower rent if it is determined the lessee has exercised reasonable diligence in exploring and developing during the initial term.

—KRISTEN NELSON

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## WILLOW DETAILS

Tooth unit, will entail the construction of a central processing facility, five initial drill sites, and an infrastructure pad for support facilities including personnel accommodation, ConocoPhillips' plan says. The new BLM publication indicates that the central processing facility will be co-located with the Bear Tooth No. 3 drill site. Gravel roads will provide access to the field facilities from the Greater Mooses Tooth unit to the east and to the drill sites from the central processing facility.

Road layouts may involve bridge crossings of the Judy Creek, the Fish Creek and the Kalikpik River. The layouts are designed to minimize road lengths, to

**ConocoPhillips first announced its Willow discovery in January 2017, following the drilling of the Tinmiaq No. 2 and Tinmiaq No. 6 wells, although it appears that the company actually found the Willow oil pool in 2002 through the drilling of the Hunter A well.**

the extent possible to place roads on higher and drier ground, and to minimize wildlife disturbance, the publication says.

A 5,400-foot airstrip would be constructed near the infrastructure pad, for access by fixed-wing aircraft.

### Sealift of modules

The development plan envisages the

delivery of modules for facility construction by sealift via a 12-acre gravel module transport island in Harrison Bay, in the nearshore waters of the Beaufort Sea, and via an onshore ice road to the project site. The gravel island would be constructed during the 2021-22 winter season using an adjacent ice pad.

Modules would be barged to the transport island in the summer of 2023 and staged on the island until the winter construction season, when the modules would be moved by ice road to the project site. However, modules for drill sites BT4 and BT5 would be delivered by a second sealift in the summer of 2028, for installation during the following winter.

At the end of the island's design life all gravel slope armoring and other man-made items would be removed, so that the island would be reshaped naturally by wave and ice action, the publications says.

### Pipeline system

Once the field is in operation, infield pipelines will carry produced fluids from the drill sites to the central processing facility. An export pipeline will then transport sales-quality crude oil from the central facility to a tie-in point on the existing Alpine pipeline at the Colville River Delta 4 North pad. The development would also require the construction of a seawater pipeline, a diesel pipeline, and a freshwater pipeline. Pipelines would run parallel to roads; valves would be installed on each side of pipeline creek and river crossings.

The layout would be designed to minimize redundant parallel pipelines. For example infield lines from four of the drill sites would be connected in series, through a single connector to the processing facility, with just the fifth site needing its own pipeline system.

The seawater pipeline would carry seawater, presumably for water injection, from the Kuparuk River unit to Willow. Similarly a diesel pipeline would carry refined hydrocarbon products from Kuparuk. These two pipelines would be installed under the Colville River using horizontal directional drilling. The lines would be bundled together inside an outer pipeline casing, for the protection of the permafrost from heat and to contain fluids in the event of a pipeline leak.

Produced water separated in the central processing facility would be re-injected into the subsurface for reservoir pressure maintenance and for waterflood for improved oil production. Produced natural gas would be used as fuel in field facilities and would be injected back into the reservoir rocks for reservoir pressure maintenance and improved oil recovery.

**In July ConocoPhillips upped its estimate for recoverable resources in Willow from 300 million to 400-750 million barrels of oil equivalent.**

Gas may also be used for gas lift, to improve well productivity.

### 50-well drill sites

Each drill site is being sized to accommodate at least 50 wells with a 20-foot wellhead spacing. Wells could be either production wells, or injectors for injecting water or gas into the subsurface. The infrastructure pad, the operational base for the field, would be located about a mile from the central processing facility, away from any potential blast hazard associated with the processing system. In addition to a personnel camp, the infrastructure pad would house a variety of facilities, including a warehouse, communications infrastructure, a helipad and an emergency response center. Two water source access pads would provide access to freshwater intakes from two adjacent lakes.

### Announced in 2017

ConocoPhillips first announced its Willow discovery in January 2017, following the drilling of the Tinmiaq No. 2 and Tinmiaq No. 6 wells, although it appears that the company actually found the Willow oil pool in 2002 through the drilling of the Hunter A well. In the past winter the company further appraised the find through the drilling of the Tinmiaq Nos. 7, 8 and 9 wells. The field reservoir is in the Nanushuk formation, at a depth of a little over 4,000 feet in a similar geologic setting to the major oil field in the Pikka/Horseshoe trend that Oil Search and its partners are developing on the east side of the Colville River.

In July ConocoPhillips upped its estimate for recoverable resources in Willow from 300 million to 400-750 million barrels of oil equivalent. The company had previously indicated that production from standalone facilities could peak at as much as 100,000 barrels per day. The company has indicated that development of Willow will likely cost \$2 billion to \$3 billion over four to five years after a final investment decision is made, with first oil flowing from the field by 2024 to 2025. A further \$2 billion to \$3 billion would then be spent on cumulative drilling over multiple years to sustain production. ●

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## Arctic Ambitions VII Conference and Trade Show by WTC Anchorage

American and overseas business executives and government officials will be gathering in Anchorage next month to participate in Alaska's premier Arctic event focused on commerce, trade and investment in the region. Under the theme "Tradition, Technology, and Transformation", the seventh annual **Arctic Ambitions Conference and Trade Show** takes place on September 11th and 12th at the Sheraton Anchorage Hotel.

WTC Anchorage launched the Arctic Ambitions Conference in 2011 in response to growing interest by Alaskan companies, and companies from around the world, in opportunities now, and in the future, for commercial development in the Arctic. These days, there is a plethora of Arctic related events, but often these events are focused on non-business related topics. To help address this void, WTC commenced the Arctic Ambitions conference to focus squarely on "the business of the Arctic."

This year's event will feature two special panels: *Asia in the Arctic* and *Alaskan Native Corporations in the Arctic*.

At Arctic Ambitions VII, WTC Anchorage will outline its concept for positioning Alaska as an Arctic center for international business. Alaska is America's Arctic state and is ideally situated for a wide variety of commercial activities involving the Arctic, including air and marine transportation, warehousing and logistics, business and financial services for the region and other associated activities to support trade commerce and investment. For foreign companies who are seeking to establish a presence in the American Arctic, Alaska would be a natural choice and we need to prepare ourselves to serve in that capacity.

Arctic Ambitions VII Conference builds upon the success of the previous six editions of the event. The prior conferences brought together presenters from Canada, Finland, Norway, Russia, Korea, Alaska and other countries and regions. Government officials and business executives discussed their roles and developments unfolding in the region. This year's agenda includes a full day of presentations, three keynote addresses, two special panels, and an evening networking reception. The following day will feature panel discussions and the closing luncheon.

For further details the conference, and to register to attend, visit WTC Anchorage's website: [www.wtcanc.org](http://www.wtcanc.org)

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## GMC RESOURCE

ples that can be made available for educational purposes, geologist and GMC curator Kurt Johnson, told Petroleum News. He and geologist Jean Riordan, aided by two interns, currently operate the center.

For example, the center has rock cores from wells drilled through the Nanushuk formation in the northeastern National Petroleum Reserve-Alaska, a part of the North Slope rock sequence that has become of particular interest for oil exploration in recent years. Students can examine reservoir-quality Nanushuk sands, and the impermeable layers within the sequence that can trap oil. Similarly, it is possible to hold and examine conglomeratic sands from the Ivishak, the main reservoir in the Prudhoe Bay field.

Johnson sees scope for further expanding a partnership that the center enjoys with the University of Alaska Anchorage. Researchers from UAA already use the center's rock collection. Johnson thinks that UAA could bring equipment to the center and make use of the center's expertise — the center has a workshop for cutting and preparing rock samples.

### Voluntary donations

Much of the material in the center is voluntarily donated, although some well cores come via the Alaska Oil and Gas Conservation Commission in connection with well data becoming publicly available. Oil company Shell, for example, has donated a huge quantity of well cores and surface rock samples, some dating back to the early days of that company's involvement in the state. Cores have come from old Middle Ground Shoal and West Foreland wells in Cook Inlet, and from exploration wells drilled in the Chukchi Sea between 1989 and 1991. The center is currently collating a huge collection of rock samples donated by Amoco.

Both the Shell and Amoco collections include surface rock samples from areas in the Arctic National Wildlife Refuge that are no longer accessible, Johnson said.

Other well core samples have come from even more remote locations, in the Gulf of Alaska and in some of the offshore basins in the Bering Sea, where exploration was conducted a number of years ago.

There are also rock cores from coalbed methane drilling in the Matanuska-Susitna Borough, and engineering rock cores obtained during investigations into the possibility of building a hydroelectric dam at Watana on the Susitna River. The center has a set of cores obtained from seismic shot holes dating from the days when dynamite was used in seismic surveying in the NPR-A. These cores can, for example, provide insights into where gravel may be mined for the construction of roads and pads in the region, without the need to conduct new tundra travel or surface coring, Johnson commented.

The U.S. Geological Survey has also donated a collection of some 150,000 rock samples, collected while conducting geologic research in Alaska.

### World class collections

The center houses a world-class collection of microscope slides of plant spores and pollen, used in particular for determining the age of sediments. The center also holds the world's largest collection of fossil Alaska foraminifera, tiny organisms used for aging rocks and for other purposes. Alaska geologist Robert Blodgett told Petroleum News that, for example, foraminifera in the collection



Geologists Jean Riordan and Kurt Johnson operate the state of Alaska's Geologic Materials Center in Anchorage. They are standing next to a part of the center's huge collection of boxed well cores from across the state and its offshore waters.

demonstrate that during the Cretaceous period there was a major temperature contrast between Arctic Alaska and what is now the more southerly part of the state.

Larger fossils to be found in the center's collection can be spectacular: beautifully preserved ancient sea stars, and many types of shell fish, for example.

One of the more curious set of samples in the center's collection consists of rock samples obtained in the Aleutian Islands before and after nuclear bomb testing in the region — the idea was to determine what impact, if any, the explosions had on the rocks, Johnson said.

The center also holds a collection of aerial photographs of Alaska through the 1950s to 1980s. These photographs can prove invaluable in, for example, assessing coastline and vegetation changes in the state, Johnson said.

Altogether the center houses about 700,000 geologic samples in 170,000 boxes, Johnson said. And those numbers grow, as more material makes its way into

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Intern Alex Busk examines a well core from the Nanushuk formation in the Wolf Creek No. 3 well in the NPR-A.

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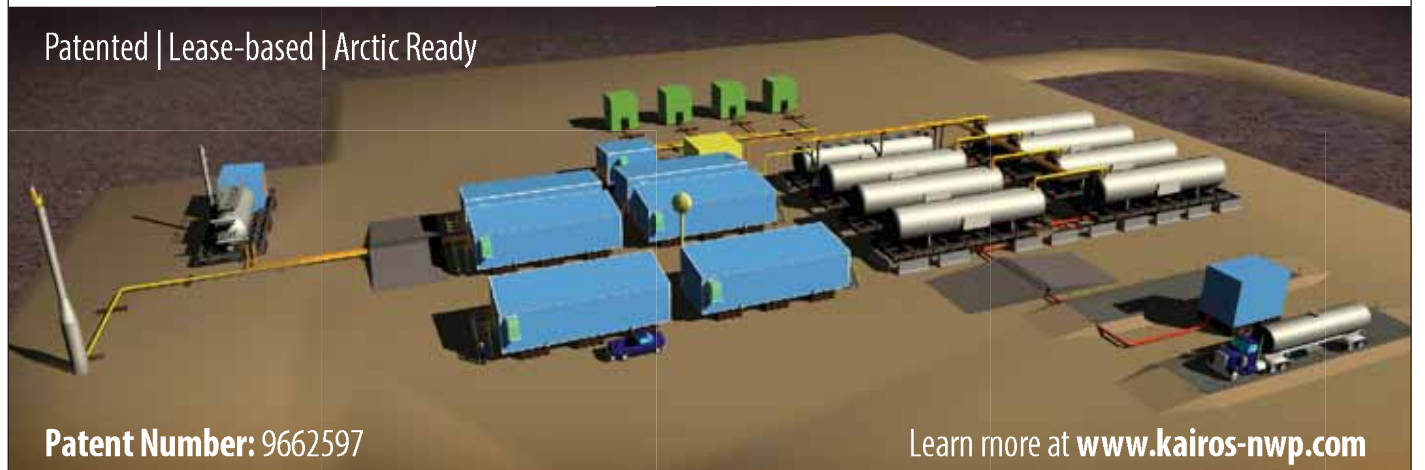


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Intern Walter Zimmerman at a workstation in the Geologic Materials Center. The contents of sample boxes donated to the center have to be examined, identified and catalogued.



## Insights into North Slope oil sources

The North Slope of Alaska has a reputation for being particularly rich in oil source rocks, the rocks that have generated the oil in the region's prolific oil fields. And among the valuable resources in the state's Geologic Materials Center in Anchorage are samples of various North Slope oil types and of the rocks that sourced the oil. It is possible to use the samples to, for example, characterize different oil types, to figure out where the oil associated with oil discoveries has likely come from. That, in turn, can provide insights into the nature of a particular discovery, and into the potential for making further, similar oil finds.

Geologist Art Banet showed Petroleum News some of the oil samples in the center's collection and explained some of the nuances of oil categorization and identification. There are perhaps 10 different types of oil across the North Slope, Banet said.

The oil found in the Prudhoe Bay oil field, for example, is relatively dark and heavy, a factor that led explorers to seek similar oil elsewhere on the North Slope. Thus, while people were looking for reservoir rocks stained with that particular oil type, they may have overlooked lighter and relatively colorless oil that is also prolific in the region, Banet suggested. This possible "bypass oil" is now being discovered in the northeastern National Petroleum Reserve-Alaska, he said.

The center's collection includes oil samples from various natural oil seeps in Arctic Alaska. The biggest seeps in the region are at Cape Simpson. However, the second and third largest seeps are two locations on the coast of the Arctic National Wildlife Refuge. Then come seeps at Umiat and a location known as Fish Creek.

At one time the state was able to use oil samples at the center to demonstrate to federal officials that the oil from Simpson came from a natural seep, and not from oil drilling, Banet said.

Rock specimens in the center may also provide insights to the origin of oil in the Triassic Shublik, one of the most prolific oil source rocks under the North Slope. The center's collection includes tasmanites, a kind of algae-rich oil shale, from strata in the Brooks Range equivalent in age to the Shublik. Could this algal material have generated the Shublik oil?

Ken Bird, a geologist who is an expert on Alaska and North Slope geology, has told Petroleum News that there was initial skepticism over the tasmanite origin hypothesis, given a lack of reports of tasmanite being found in well penetrations of the Shublik. However, it is likely that when the Shublik was heated to oil generating temperatures or above, the tasmanite algae were destroyed, Bird said. And, in general, tasmanite algae have been found in surface and subsurface rocks across the North Slope region, he said.

The conclusion is that tasmanite algae have likely contributed to some undetermined extent to North Slope petroleum generation, Bird said.

—ALAN BAILEY

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## GMC RESOURCE

the center. Given the huge cost of, for example, drilling a well in Alaska, the scale of the center's collection represents a massive investment.

### On-line catalogue

Although all of the boxes have been indexed and catalogued, the examining, identifying and cataloguing of all of the boxes' contents is an on-going work in progress, especially as new material con-

tinuously arrives at the center. Catalogue information goes into the center's computer database. Members of the public can access the database through the center's website, to search for available samples and microscope slides. People can either conduct text searches, or they can use an interactive map system, to search for the availability of samples from a particular area. Data can be downloaded from the site. The website also provides information about publicly available seismic data that the center holds.

The center itself operates almost like an oversize box store, with sample boxes barcoded and handheld barcode readers used for stock taking and locating samples.

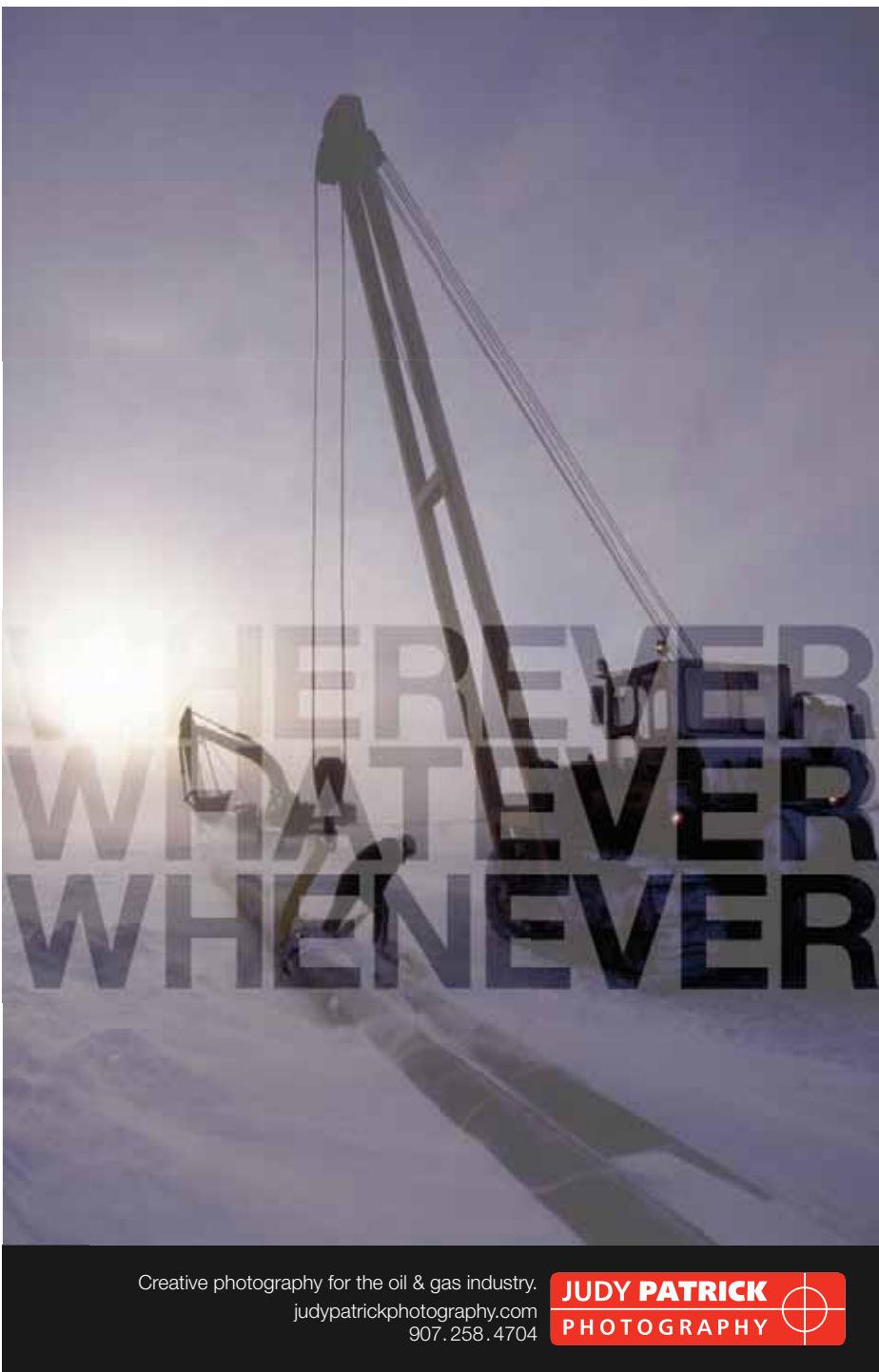
And the center has its own computer server system, with data storage arrays that amount to around two petabytes, and with an arrangement for data mirroring in Fairbanks for data protection.

In the age of online data access, the center is evaluating its future role and types of service that it can provide. For example, the center may try to use a spectral reflectance technique that reveals the components of a rock without any damage to the rock samples. The results could perhaps be made available online, for viewing anywhere in the world, Johnson commented.

With resource development being such an important aspect of the Alaska economy, the state places great value in the services that the GMC can provide. However, the geologists that frequent the center tend to think that this treasure chest of rocks and data could see more use. It is possible to make tremendous discoveries here, Blodgett said.

"It's amazing. The unrealized potential of this place," he said. ●

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