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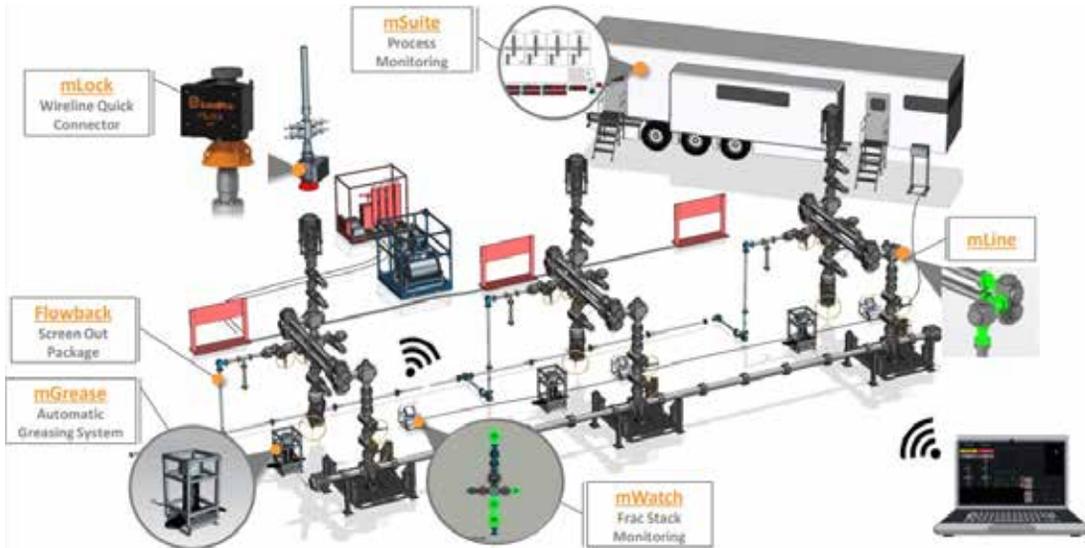


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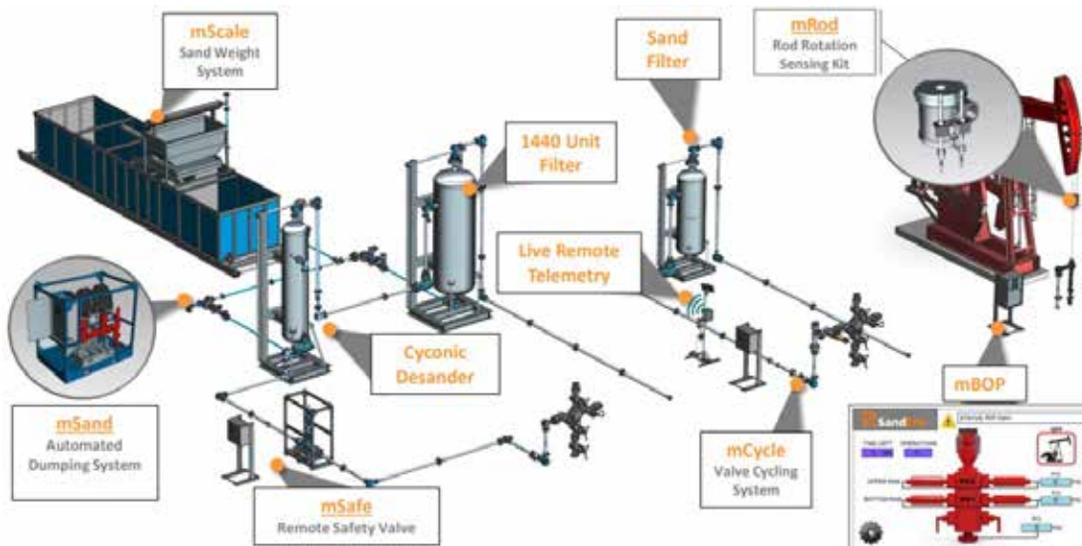


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Message from the editor
SHAYNA WIWIERSKI



Well lots has happened since the last issue of the *Bakken Oil Report* magazine.

As reported on page 16 by the Heartland Institute, oil production in the Bakken has bounced back from low production levels seen in May and June of 2020. The number of producing wells was 36 percent higher in December 2021 then the record low in May 2020.

Another huge news story, the war in Ukraine, has everyone looking at the rise of gas prices. On page 13, API talks about two common claims about American oil and natural gas production amid Putin's war in Ukraine. Author Kevin O'Scannlain

talks about some key facts about federal leasing in America and the claim by White House Press Secretary Jen Psaki about unused federal leases on American oil and gas land.

Those two stories are just a preview of what we have in store for you in this issue. I hope you enjoy reading this edition of the *Bakken Oil Report* and if you want to keep up to date between issues of the magazine, visit us online at bakkenoilreport.com.

As always, strike oil!

Shayna Wiwierski
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We need pipeline capacity to get natural gas to market, strengthening both our economic and national security

In February, the North Bakken Pipeline Expansion went into service, providing an additional 250 million cubic feet per day of natural gas takeaway capacity for operators in the region. This is exactly the kind of investment we need to make the best use of our country's abundant energy resources to reduce flaring and strengthen our economic and national security. Unfortunately, President Biden and his administration continue to advance hostile environmental policies that treat our oil and natural gas reserves as a liability, undermining domestic production, driving up inflation and making us more reliant on OPEC and our adversaries, like Iran, Venezuela and Russia. That's the wrong approach for our nation, and we continue to push back on this harmful agenda, including at the Federal Energy Regulatory Commission (FERC).

Starting in October 2020, FERC began stalling its consideration of new pipelines and other critical energy projects, like the North Bakken Expansion Pipeline. These delays were holding up the construction of, and discouraging investment in, facilities that are needed to ensure our nation remains energy independent, which we achieved under President Trump. That's why I led a bipartisan group of 25 senators in pressing the members of FERC to act on the North Bakken Expansion Pipeline, along with 13 other natural gas projects that were pending consideration by the commission. Our efforts resulted in the approval of this important pipeline project in North Dakota, but our work is far from finished.

FERC recently approved two policy statements on partisan lines that impose new standards on the approval of natural gas infrastructure,

including pipelines. The policy changes go beyond the authority granted to FERC by Congress and stand to impact not only future projects, but also those that have already completed the required environment impact statements (EIS). This would impose tremendous uncertainty in an already burdensome regulatory process and constrain our natural gas supply at a time when families and businesses are already impacted by skyrocketing energy prices at home, in addition to exacerbating global energy security challenges due to Russia's unprovoked, full-scale invasion of Ukraine.

Instead, we should expand the development of America's vast natural gas supplies and build the pipelines and facilities needed to get it to market. Doing so would both bring down inflation here at home and empower us to export U.S. liquefied natural gas to our European allies, reducing their reliance on Russian natural gas. That's good for both our economy and national security, and it's the case I made to the members of FERC during a recent Senate Energy and Natural Resources Committee hearing. As a result, FERC has since paused the implementation of these two policy statements and will take public comment on the proposals.

These harmful policies are just some of the most recent examples of the Biden administration's continued war on oil, natural gas and coal. The president needs to reverse course and take the handcuffs off our energy producers, enabling them to produce the affordable and reliable energy that every home and business relies on. That's exactly what we're working to accomplish every single day. ▀

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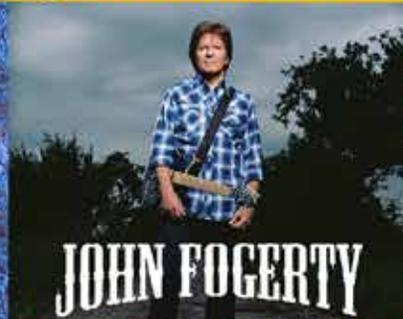
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The ESG movement will destroy the U.S. economy: It's time to speak up

The United States economy, its industries, corporations, commercial businesses and private citizens, derive 80 percent of their energy needs from fossil fuels. Petroleum, in the form of gasoline, diesel or jet fuel, delivers 90 percent of America's transportation needs. Oil is also used in the manufacture of some 6,000 consumer products, everything from asphalt and tires, to fertilizer, pharmaceuticals and plastics. Nearly two-thirds of the country's electricity is generated using coal or natural gas.

Oil, natural gas and coal are fossil fuels, and given the facts stated above, any sensible person would have to conclude they are absolutely essential

to the function of modern society.

Yet as crazy as it sounds, there is an effort among major financial firms to discourage investment in the fossil fuel industry. It's called the ESG movement – Environmental, Social and Corporate Governance – and it's driven by the notion that we're in the midst of a "climate crisis," and if humanity doesn't stop emitting carbon dioxide and other greenhouse gases, fire and brimstone will soon rain from sky. That last part's an exaggeration, but seriously, why would we want to undermine the very fabric of our society based upon the mistaken belief that carbon dioxide emissions are causing bad weather?

China, India and other nations certainly aren't buying it. Recent reports suggest China will increase its coal production this year, exceeding the record 4.07 billion tons it mined in 2021. That figures out to about 12 million tons a day, while U.S. production has fallen to about 12 million tons per week. The fact is, Beijing will not even consider reducing its coal production. Last year, China added 38.4 gigawatts of new coal-fired power stations, roughly three times the new capacity built in the rest of the world.

As unpleasant as the thought is to environmental extremists, coal also remains vitally important to maintaining electric reliability in the United States.

As unpleasant as the thought is to environmental extremists, coal also remains vitally important to maintaining electric reliability in the United States.

But despite this reality, President Biden and company have renewed Obama's regulatory War on Coal, and Wall Street banks are obliging by launching a financial war that is starving the coal industry of investment capital.

Both Biden and the United Nations support allowing banks and investment firms to collude to "transform" our energy infrastructure, effectively assigning a higher priority to social goals than maintaining a healthy economy. Allowing banks to reshape economies and lifestyles so that they are in line with the preferences of the Biden administration's climate fanatics is a very dangerous game.

Public opinion polls have begun to reflect the discontent with higher energy prices resulting from anti-fossil fuel policies.

Biden's approval rating dropped below 40 percent, causing him to resort to tactics like releasing oil from the nation's strategic reserves in an attempt to lower prices and boost his poll numbers. But meanwhile, every executive branch agency remains under orders to force a reduction in production and use of fossil fuels in every way it can devise.

It's time for citizens to speak out and demand that common sense be restored. The rush to eliminate fossil fuel use would drive society back to the misery of pre-industrial times. The development

of the fossil fuels industry has not only vastly improved our way of life, it is increasing our longevity, extending the average lifespan to 80 years or more. Without fossil fuels, we can easily see by observing the world's poorest countries, how miserable life would become.

We can all agree we want clean energy, but forcing such a rapid transformation without viable, affordable alternatives is just plain foolish. Instead of anti-fossil fuels, it's time for the people to demand anti-ESG bills from their legislatures and put a stop to the financial collusion that will lead to shortages, even more inflation, and loss of personal freedom. ▶

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Biden's release from the Strategic Petroleum Reserve will fall short of its rhetoric

By Paige Lambermont

The Strategic Petroleum Reserve (SPR) is not and never has been intended as a political tool for price manipulation. President Biden's decision to utilize the reserve as such is short sighted. The administration has said that the intention is to release up to 180 million barrels from the reserve over the next six months and then replenish the reserve once petroleum prices lower in the future. The main problems with this are the small scale of impact that the action is likely to have, as well as the improper usage of the reserve that this action constitutes.

In November, the administration promised a release of 50 million barrels (18 million from the reserve and 32 million in the form of swaps). This extra capacity not only failed to meaningfully lower prices, but the rise in prices actually continued virtually unabated in the months leading up to the start of the war in Ukraine.

This release will be significantly larger, but nonetheless, it is unlikely to have anywhere near the administration's desired level of impact on prices. The U.S. consumes nearly 20 million barrels of oil per day, and this release would constitute a maximum of only one million barrels per day.

This is a drop in the bucket compared to the change that an increase in production would produce, but this administration's policies have disincentivized production at every turn. From canceling the Keystone XL Pipeline, which would have moved Canadian crude to refineries on the Gulf Coast, to pausing permitting on federal lands, the curtailment of offshore lease sales, and to the array of other anti-energy policies that this administration has pursued at every turn.

None of this would be an issue if the U.S. has back-slid on energy independence since the previous administration, amid

a regulatory environment that has been highly unfavorable to new oil and gas development. It should come as no surprise that what is proving to be insufficient investment in oil and gas development is now translating to higher prices during a supply crunch.

Even as the administration looks to make this release, the most recent budget proposal is still rife with anti-development policy propositions, including an expensing framework that would make it much more difficult for oil and gas companies to write off the depreciation of their assets, like equipment, over time. Policies like this will only serve to further drive down investment (and future production).

The Strategic Petroleum Reserve is there for oil supply emergencies. It does not exist for a president to try to shore up flailing poll numbers during a price spike, and using it in this way undermines the justifications that are so often made for keeping it around that it exists as a last resort back-up for times of real emergency.

Paige Lambermont is a policy associate at the Institute for Energy Research. In her role, she writes about the impacts of government policy on energy markets. She has a Bachelor's degree in Political Science from American University and is from Butler, Pennsylvania. ▀

The Strategic Petroleum Reserve is there for oil supply emergencies. It does not exist for a president to try to shore up flailing poll numbers during a price spike, and using it in this way undermines the justifications that are so often made for keeping it around – that it exists as a last resort back-up for times of real emergency.



Correcting two misguided energy myths

By Kevin O'Scannlain

Let's address two common claims about American oil and natural gas production amid Putin's unprovoked war in Ukraine.

The first, by members of the Biden administration, including White House Press Secretary Jen Psaki, is that American oil and natural gas producers are sitting on "unused" federal leases and thus do not need access to more. The second, by some industry critics, is that ramping up U.S. production will not help Ukraine today.

Psaki has made the claim about "unused" federal leases before. It has become a line the White House uses when pressed to explain why it is not doing more to support American oil and natural gas production – with soaring demand putting upward pressure on prices and with much of Europe at the mercy of its top energy provider, Russia.

Some key facts about federal leasing in America:

- The law already requires companies to either produce oil and/or natural gas on leases or return the leases to the government generally in the first 10 years.
- When a company acquires a lease, it makes a significant financial investment at the beginning of the lease in the form of a non-refundable bonus bid and pays additional rent until and unless it begins producing.
- For federal onshore leasing, the law prevents any one company from locking

up unproductive excessive federal acreage.

- Developing a lease takes years and substantial effort to determine whether the underlying geology holds commercial quantities of oil and/or natural gas. The lengthy process to develop a federal lease is often extended by administrative and legal challenges.

The argument about "unused" leases is a red herring, a smokescreen for energy policies that have hindered the world's leading producer of natural gas and oil. In fact, American oil and gas producers are willing to do their part to support U.S. energy leadership, including providing energy that can help allies abroad.

Ultimately, federal policies affect the energy investment climate. Specifically, they impact the ability of producers to take the financial risks involved in spending billions of dollars to find and develop oil and natural gas. Mischaracterizing the way federal leases work does not help foster new investment in critical energy projects.

Now, for the second claim, about the usefulness of American energy to Ukraine. Technically, there's some truth there because, indeed, implementing policies to help increase American oil and natural gas production will not help Ukraine today, but this type of thinking is short-sighted for the long haul.

Unfortunately, the administration has

discouraged American energy for more than a year now. It immediately halted new federal leasing – key to future energy investment and production. It canceled energy infrastructure, blocked development in parts of Alaska, entertained new taxes to punish the U.S. energy industry and chilled investment by signaling that oil and natural gas wouldn't be part of America's future energy mix. Meanwhile, the administration called on OPEC+, the oil cartel, to increase production more rapidly in the face of rising energy costs, bypassing American producers.

The current situation is a reminder that U.S. energy abundance requires foresight and planning, investment and policy support. This is the path to allowing American energy to support ourselves and our allies.

Now is the time for the administration to fully support American oil and natural gas. President Biden strongly encouraged made-in-the-USA production during his State of the Union address – but omitted homegrown oil and gas. American-made oil and natural gas are the leading energy sources running the U.S. economy and, when exported, provide significant support for economies around the world. With Russian artillery pounding Ukraine, the importance of American energy leadership could hardly be clearer.

Kevin O'Scannlain is vice president of upstream policy at the American Petroleum Institute in Washington, DC. ▀

SRC leads with hot water plus flue gas injection

December 2021 brought news that SRC would receive funding from Innovation Saskatchewan's Saskatchewan Advantage Innovation Fund (SAIF) for its Hot Water Plus Flue Gas Injection Project.

SRC's Enhanced Oil Recovery (EOR) and In-Situ Processes team are working on the project, which is designed to validate hot water injection plus flue gas for EOR purposes in Saskatchewan's Viking formation.

THE VIKING

According to Petro Nakutnyy, SRC's director of operations, EOR and in-situ processes, the Viking doesn't have many places left for drilling, but there is oil left that could be usable for the oil industry. The use of Hot Water plus Flue Gas Injection project has been developed to address the issue and has not been field tested in the Viking before.

"Oil recovery from Viking wells often does not exceed 15 percent of the original oil in place under primary production and waterflooding, leaving a lot of oil behind. SRC has been looking into various ideas of expanding the life of the wells in the Viking formation and improving the ultimate oil recovery," says Nakutnyy.

"We have observed a positive effect from injecting hot water into the Viking core while exploring new ideas to improve oil recovery. This project will investigate the use of the hot water plus flue gas injection process in the laboratory and will lay the ground for a potential pilot project in the field."

SRC has been working on projects in the Viking formation for more than 10 years and has developed significant expertise about the region and the technology that can help improve oil recovery for industry working in the area.

INDUSTRY PARTNERS

The industry consortium led by SRC has examined many ways to improve production in the Viking formation, including chemical, gas and warm/hot water flooding. Previous results suggest that hot water injection can increase oil recovery from the Viking formation.

Joining SRC on the project is General Energy Recovery Inc. (GERI), who has worked with SRC on testing Direct Contact Steam Generation (DCSG) technology for Enhanced Oil Recovery (EOR) applications in heavy oil fields over several years.

GERI has developed a portable hot water/and flue gas DCSG-based process. This technology will be adapted for the Viking formation to generate hot water instead of steam. This project will test this process under laboratory conditions to test the expectations that increased water temperature along with flue gas co-injection can positively impact oil recovery in the Viking, especially where steam may not be a practical option for operators due to the formation's high sensitivity to fresh water.

"GERI is excited to be working once again with SRC and also with leading Viking operators on new opportunities to enhance Viking oil production in a cost-effective and sustainable way," said Brian



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Kay, chief technology officer, General Energy Recovery Inc.

“We believe that SRC’s work will demonstrate the relevance of DCSG technology in extending Viking well life and in so doing providing crucial benefits to Saskatchewan in terms of future provincial royalties and jobs. We thank the Saskatchewan Advantage Innovation Fund, SRC, and the operators involved for their vital support.”

THE PROJECT

Nakutny notes that the Viking formation is sensitive to fresh water, and the project will focus on the optimal temperature of

water for increasing oil recovery in the region.

The work will take place in 2022, with laboratory work completing in the late spring. After analysis and calculations, if the results are positive, the Hot Water plus Flue Gas injection project will potentially head into field trials in the Viking formation.

This project will help extend the life of oil wells in the Viking formation in a way that benefits both industry and the environment. Nakutny says the project will help industry avoid additional drilling while also increasing recovery in an efficient, sustainable manner.

FUNDING

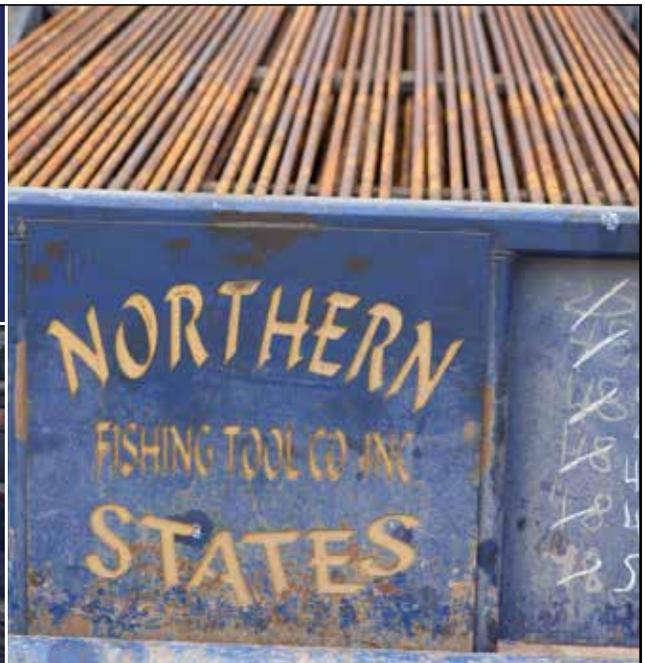
The industry partners – GERI, Baytex Energy and Whitecap Resources – funded 70 percent of the project.

The Innovation Saskatchewan funding – a total of \$23,700 – covers about 30 percent of the total project cost. The funding will help fund the research to validate the concept, collect the data required to prepare for field trials and to help determine its technical and economic feasibility.

Learn more about the Direct Steam Generation project and SRC’s Enhanced Oil Recovery (EOR) and In-Situ Processes services at src.sk.ca. ▶

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Bakken news good for the short term, potential long-term troubles are looming

By H. Sterling Burnett

The news concerning oil and gas production in the Bakken Shale basin is good for now, but may not be over the mid- and long-term, depending upon politics.

The good news is that higher prices for oil has resulted in rising demand. Therefore, oil production in the Bakken, while still not matching its pre-pandemic peak of 2019, has bounced back from low production levels in May and June of 2020. The number of producing wells was 36 percent higher in December 2021 than the low recorded in May 2020, and the amount of oil produced daily has increased by more than 32 percent since May of 2020.

More good news comes from the fact that gas flaring associated with oil production declined dramatically in recent months, from 10 percent of associated gas produced to just six percent in the last quarter of 2021. This decline occurred even as oil production ramped up.

Higher gas prices have resulted in a growing number of small independent operators following the major producers and adopting best practices to use, capture, store, and transport natural gas that has become more valuable. Indeed, gas production has increased in the Bakken to approximately three Bcf/d, just under the all-time high set in November

2019. More good news is found in the fact that gas production in the Bakken is likely to continue to increase, and flaring decrease, as WBI Energy Transmission's North Bakken Expansion natural gas pipeline expansion comes online in the region in the coming months.

Now for the bad news: If the Biden administration and the Democrats in Congress have their way, oil and gas production in the Bakken will become a hollow shell of its heyday by 2030.

During his campaign for the presidency, President Biden said climate change was, "the number-one issue facing humanity. And it's the number-one issue for me."

Among the steps Biden has taken to fight climate change: he cancelled the Keystone XL pipeline partnership with Canada on his first day in office, and Biden imposed a moratorium on new oil and gas leases on federal lands and on the U.S. outer-continental shelf.

As a result, the Biden administration is using a “whole of government approach” to fighting climate change, committing through the president’s control of various regulatory agencies, and the government’s purchasing power, to achieve a 50 to 52 percent reduction from 2005 levels in economy-wide net greenhouse gas emissions by 2030, and to reach net-zero emissions for the nation as a whole by 2050.

Realistically, to meet those targets, oil and gas will have to go.

Among the steps Biden has taken to fight climate change: he cancelled the Keystone XL pipeline partnership with Canada on his first day in office, and Biden imposed a moratorium on new oil and gas leases on federal lands and on the U.S. outer-continental shelf. Since then, Biden has canceled oil and gas leases in the Arctic National Wildlife Refuge; proposed methane emission restrictions that would make it harder and more expensive to develop, store, and transport oil and natural gas in the United States; proposed

increasing the fees and royalty rate oil and gas producers must pay the federal government; and recently announced plans to foreclose drilling on more than half of the National Petroleum Reserve-Alaska.

In addition, Biden is pushing to further restrict new production on federal lands, to enact stricter regulations on production on state and private lands, to restrict natural gas use for appliances and electric power production, and to electrify the entire federal vehicle fleet, and force automakers to do the same by 2035. Any of these policies by themselves harm the fossil fuel industry, combined, they spell doom in the Bakken and beyond.

H. Sterling Burnett, Ph.D.
(hburnett@heartland.org) is a senior fellow at The Heartland Institute, a non-partisan, non-profit research center headquartered in Arlington Heights, Illinois. ▀

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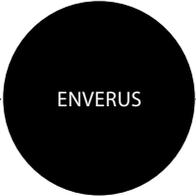
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Bakken 2022: Returning activity and growth vs. inflationary pressures



Akash Sharma.

By Akash Sharma and Madhav Goyal



Madhav Goyal.

As the world cautiously recovers from the worst pandemic in the last 100 years, so does the narrative across the oil and gas industry. Nowhere is this truer than the Bakken, a hallmark of the original shale boom in the United States. Activity

is returning to the Bakken with a 12.5 percent YoY increase in well starts from 2020 to 2021, and 34 active rigs in March 2022, up 240 percent since its lowest point in June 2020.

We have also seen signs of recovery

in frac crew activity, but not nearly as dramatically as in rig activity trends. As operators seek to ramp up activity and bring up Bakken production numbers, supply chain constraints leading to price inflation have created some headwind for

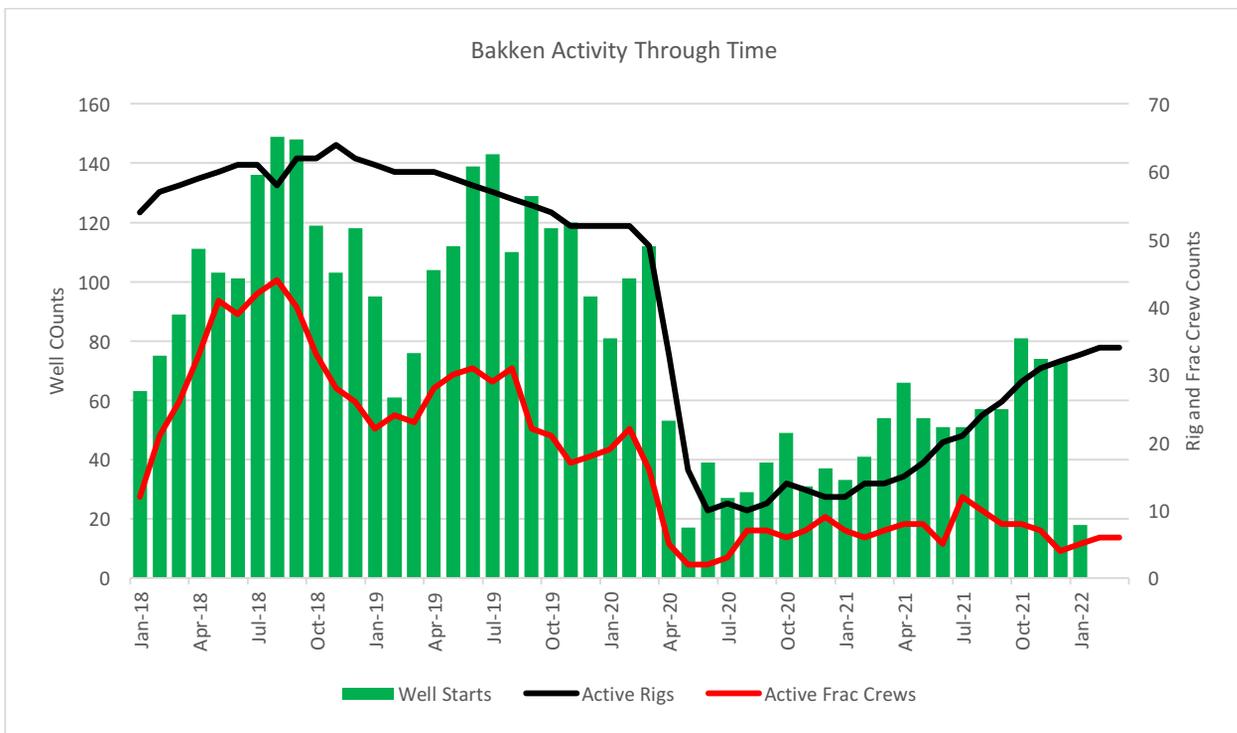


Figure 1: Well counts by production start dates in the Williston Basin

maintaining cost-efficient operations.

A key area where price increases have been directly impacted is steel-based categories. With increased difficulty sourcing steel and the resurgence in activity-driven demand, steel-related products have become significantly more expensive in the Bakken. Steel impacts all aspects of the field development lifecycle, from oil country tubular goods (OCTG) to surface facilities, and increased pricing would require CAPEX revisions by Bakken operators. Figure 2 shows how steel-impacted products have outpaced other products and services in price increases in the Bakken.

Within the steel-impacted categories, OCTG stands out as a major concern for operators as it accounts for 15 to 20 percent of well costs. The price of steel – and in turn pipe – is only expected to increase over time, especially given current Russian sanctions. This could directly impact the financial efficacy of operations in the region and could also have a suppressive impact on the activity projections.

Looking at Figure 3, we see not only a consistent MoM price increase in the commodity, but also a widening gap between the upper and lower end of the market. This seems to suggest that not only are prices increasing across the board, but the gap between contracted pricing and spot market pricing is also widening, while the upper end of the market gets further and further away from the index.

Several other indicators, such as diesel or labor, also have widespread impact on oil and gas operational commodity pricing in the region. But steel appears to be the dominant theme. Operators who can effectively manage their operations and associated costs will come out as winners on the other end of this increasingly volatile period.

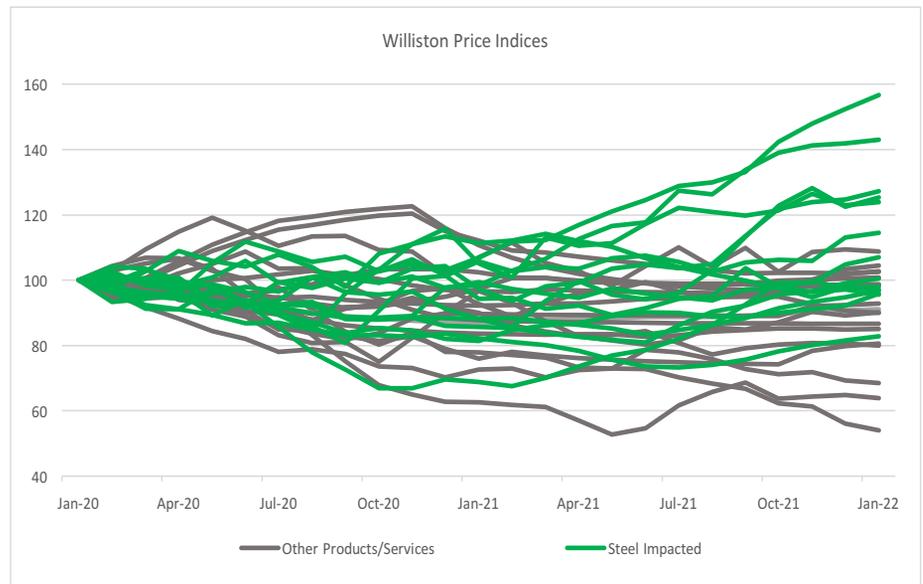


Figure 2: Market price indices for all major categories in the Bakken, split by impact of steel (green)

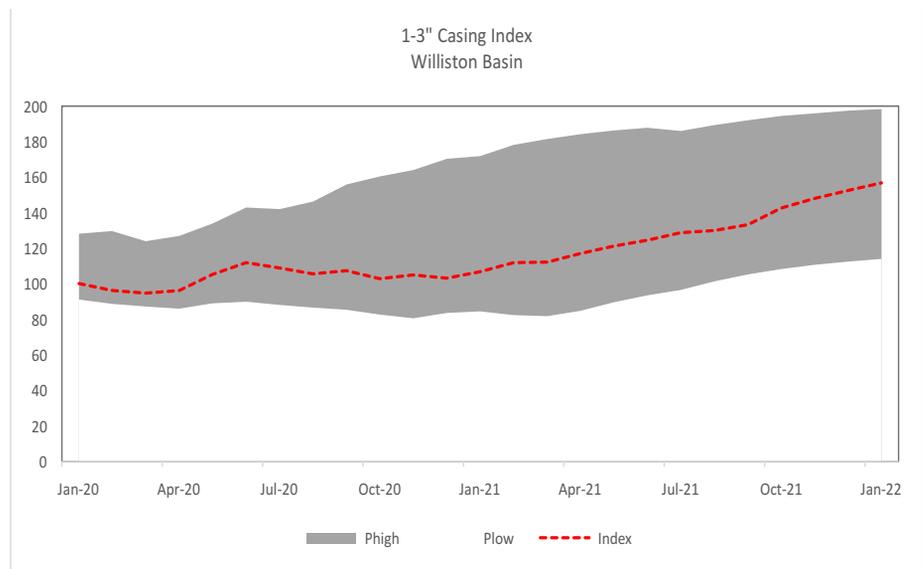


Figure 3: Casing indices in the Williston Basin

Akash Sharma is a director of products at Enverus and manages new product development and advisory services on leveraging proprietary cost data in conjunction with market data to deliver value to operators and service providers alike. He earned a Master of Science in Petroleum Engineering from the University of Houston and is working towards a Master of Science in Analytics from Georgia Tech.

Madhav Goyal is an analyst at Enverus, working on the OpenInsights Market Indices and Advisory Services teams where he analyzes market and proprietary data for product development and consulting engagements. He holds a Master in Business Analytics from ESADE Business School, Barcelona. ▀

Outdoor Heritage Fund delivers opportunities in Western North Dakota



The OHF, overseen by the North Dakota Industrial Commission, plays a key role in providing opportunities for landowners and agencies in supporting innovative approaches to land management.

Since 2018, the Bakken Development and Working Lands Program (BDWLP) and BDWLP II has continued to be a vital Outdoor Heritage Fund (OHF) program in western North Dakota. Funding provided through OHF has allowed private landowners and public entities to improve soil health, restore grasslands and wildlife habitat, and enhance farming and ranching on public and private lands. The OHF, overseen by the North Dakota Industrial Commission, plays a key role in providing opportunities for landowners and agencies in supporting innovative approaches to land management.

The BDWLP was developed to create and enhance working agricultural lands and wildlife habitat near energy sites, as well as throughout the broader landscape; create urban nature/interpretive sites, and coordinate and facilitate energy site



The BDWLP was developed to create and enhance working agricultural lands and wildlife habitat near energy sites.

reclamation. The Forest Service and five western grazing associations are also able to improve public lands through vegetation management, restoring native plant communities and installing range infrastructure.

Due to the drought and high demand for water and fence developments in western North Dakota, the OHF approved the Grazing Resiliency in the Bakken (GRB) program to provide further cost-share opportunities for private landowners. GRB is an extension of funding for infrastructure developments that had been obligated in BDWLP I and II. Soil Conservation Districts (SCD's) are experts in designing projects with landowners and have assisted hundreds of landowners, constituting thousands of acres of rangeland improvements.



The BDWLP was developed to create and enhance working agricultural lands and wildlife habitat near energy sites, as well as throughout the broader landscape; create urban nature/interpretive sites, and coordinate and facilitate energy site reclamation.

Through local SCDs and the North Dakota Natural Resources Trust, the programs (BDWLP I, BDWLP II, GRB) have completed 572,616 feet of fence (both cross and boundary), 243,566.4 feet of water pipeline, 200 water tanks, 64 water wells, 4,639.24 acres of cover crops, 1,605.21 acres of tame grass and 2,197 acres of native grass. Not including the acres of grass seedings, the infrastructure established (fences, water developments) has improved grassland health and management on 100,130 acres in western North Dakota. The water developments provide resources to pastures that were previously unable to be grazed due to lack of water and have allowed for longer rest periods for surrounding pastures from grazing. This allows time for grasslands to recover and re-establish following grazing disturbances and increases the health of the grasslands for grassland birds and other wildlife.

Throughout drought and lingering COVID effects, the OHF has continued to provide opportunities not only through the above-mentioned programs, but several other programs that benefit the state. Because of the overwhelming popularity of the BDWLP and GRB programs, the Natural Resources Trust submitted a fourth grant request for funding to OHF in March of 2022. We hope to have additional funding available for landowners in the summer of 2022 to continue rangeland developments.

If you have questions on the Bakken Development and Working Lands Program, please contact your local NRCS/SCD office, or call Jesse or Eric at the North Dakota Natural Resources Trust at 701-223-8501. ▀

Exploring new horizons for North Dakota's energy future



Steven Smith.



Bethany Kurz.



John Harju.

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at the University of North Dakota Energy &
Environmental Research Center*

One of the oft overlooked states contributing to the global energy balance is quietly proceeding, business as usual, with an approach to clean energy production and resource development that could serve as a model for the rest of the country. North Dakota has been blessed with rich fertile topsoil, sprawling expanses of prairie grasslands, and a subsurface geologic environment full of opportunities for energy development. North Dakota has a celebrated past as an agricultural powerhouse, a net exporter of electricity through coal utilization, and a top oil-producing state in the nation. The foundations of North Dakota's resource development and its state leadership's vision provide a stable base for clean, sustainable use of its resources while advancing commercial opportunities as the energy future evolves.

At present, North Dakota is leveraging its prolific agricultural, coal, and oil resources to develop new commercial

market opportunities in the areas of carbon storage, petrochemical development and hydrogen production. Each of these technologies relies on the use of subsurface geologic formations for either permanent or temporary storage of injected products. North Dakota's geology provides the necessary pore space and sealing formations for carbon storage, and salt formations are available for the potential development of engineered salt caverns commonly used for temporary natural gas liquid (NGL) and hydrogen storage. While engineered salt caverns have been used commercially for gas and liquid storage for over a century, this practice has yet to be deployed in North Dakota.

In partnership with the state of North Dakota, the Energy & Environmental Research Center (EERC) at the University of North Dakota is conducting research to determine the viability of developing engineered caverns in North Dakota's subsurface geologic salt formations. The

current work is building from a scoping study performed by the EERC in 2020 that identified the potential for North Dakota salt formations to be used for NGL storage. Results of the 2020 study concluded that salt formations in western North Dakota have adequate depth, sealing formations, and proximity to surficial infrastructure needs to warrant additional research.

At present, the EERC's follow-up study is focused on the drilling of a stratigraphic test well targeting three salt formations greater than 6,000 feet beneath the surface. The intent of the well is to collect whole core from the salt formations and their associated upper and lower sealing formations. Laboratory testing of the core will provide data detailing the salt composition, geomechanical properties, and the sealing potential of the overlying rock. Once the core characterization is complete, the EERC's team will analyze the data and perform modeling and simulation to determine

Engineering design will be completed to understand surface infrastructure needs and develop operational guidelines for a variety of commercial scenarios encapsulating an “all-of-the-above” solution for NGL and hydrogen storage.

the maximum cavern dimensions that can be achieved; evaluate the long-term cavern roof stability for injection, storage, and retrieval scenarios; and determine cavern operational design parameters informed by current and forward-looking commercial applications.

The information gained through core evaluation will guide the assessment

of the commercial market opportunity that may be created in North Dakota. Engineering design will be completed to understand surface infrastructure needs and develop operational guidelines for a variety of commercial scenarios encapsulating an “all-of-the-above” solution for NGL and hydrogen storage. Site-specific locations with adequate accumulations of salt, proximity to gas-

processing plants, pipeline transmission, and water resources will be identified and evaluated for commercial development potential.

As populations grow, medical advances extend human life spans, and technological advances open new doors for industrial solutions, one thing is clear: clean, sustainable energy will be a critical component driving the future. The study, initiated by North Dakota’s leadership and being conducted by the EERC, will help to optimize energy development and expand the energy portfolio of North Dakota and is scheduled for completion by the middle of 2023. ▸



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PTRC expands its expertise on CO₂ storage to shallower reservoirs



The Aquistore research site is the largest field research lab in the world related to CO₂ storage. Here, the CO₂ pipeline from Boundary Dam feeds into the injection well, behind and to the left.

For the past 22 years, the Petroleum Technology Research Centre (PTRC) has had a growing reputation for expertise in monitoring and validating the deep subsurface storage of CO₂ – both in depleted oil reservoirs and in deep saline formations.

The substantial body of research and data available from the PTRC stretches across

its 15 years of research at the Weyburn CO₂-EOR project, and most recently at the Aquistore CO₂ storage project. This latter research and injection site, which is taking CO₂ from SaskPower's Boundary Dam CCS facility near Estevan and storing it 3.2 kilometers underground in a brine and sandstone formation, has so far permanently stored more than 400,000 tonnes of CO₂ underground. That's the

same as taking 100,000 cars off the road for one year.

"What we've learned at Weyburn and Aquistore has allowed the companies involved to provide assurance to both the public and to provincial and federal regulators that the CO₂ has been permanently and safely stored underground," says Ran Narayanasamy, CEO of the PTRC. "From project conception, through geological characterization, risk assessment and measurement monitoring and verification (MMV), the PTRC has proven itself to be Canada's expert organization on bringing CCUS projects to reality."

With the recent announcements by the Government of Canada supporting tax credits for geological storage and CO₂ emissions reductions from the oil and gas sectors, PTRC's expertise is increasingly sought after.

Both of PTRC's storage projects, situated in southeastern Saskatchewan, are about very deep geological storage of carbon dioxide (between 1.5 to 3.2 kilometers underground). Saskatchewan and Alberta are very fortunate to have

With the recent announcements by the Government of Canada supporting tax credits for geological storage and CO₂ emissions reductions from the oil and gas sectors, PTRC's expertise is increasingly sought after.

several geological strata that are capable of storage – many of them with good porosity and permeability that makes storing of significant volumes of captured CO₂ possible.

With that being said, injected CO₂, in order to take up as little space in the reservoir as possible, usually needs to be compressed to a liquid-like status (called super-critical). This compressed CO₂ acts like a liquid and becomes miscible with the water, brine or oil in the formations.

“When injecting CO₂ into shallower formations – let’s say around 1,000 metres or even shallower – the challenge is that pressures in the reservoir may not be high enough to keep the injected carbon dioxide in this supercritical

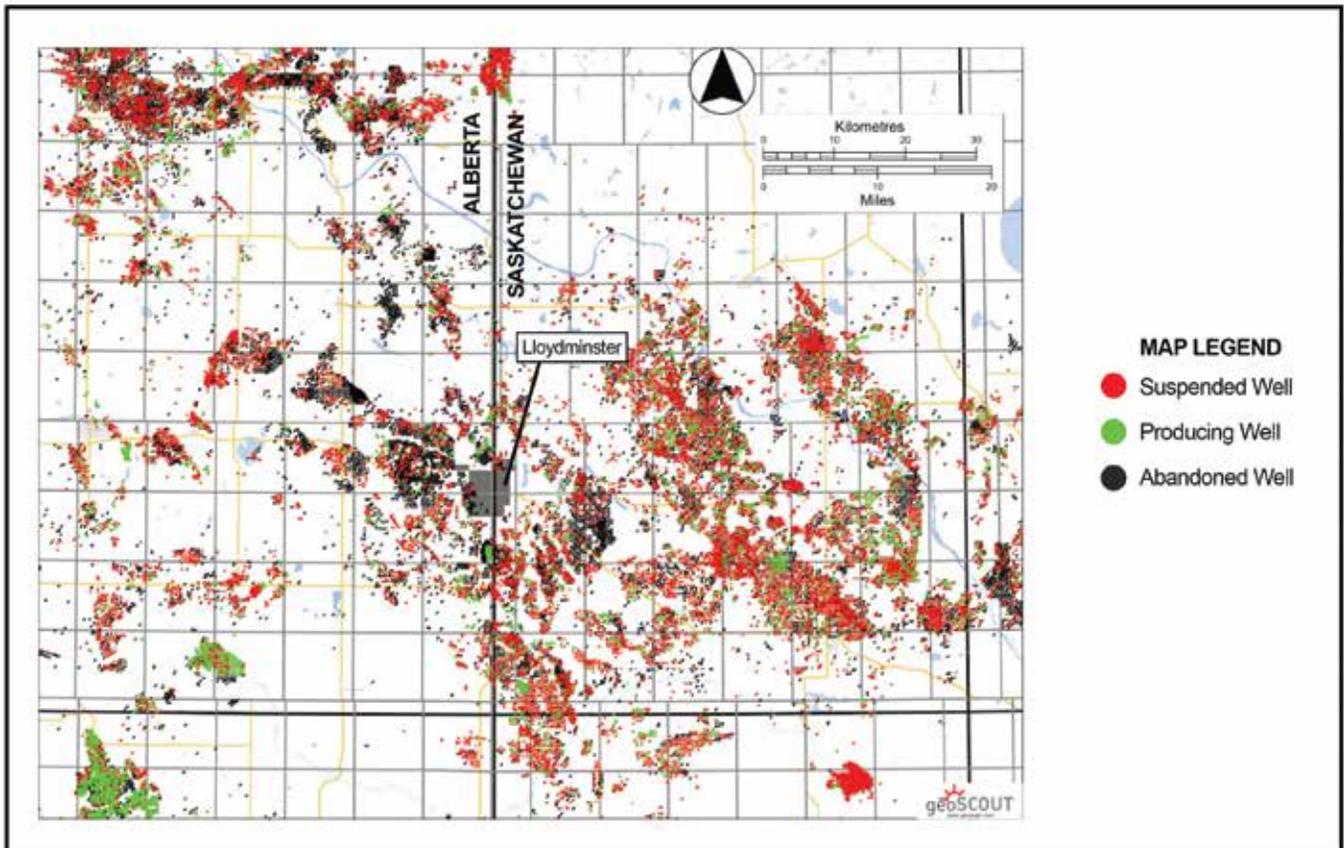
state,” says Erik Nickel, the director of operations at the PTRC. “This is a concern for those companies hoping to capture and dispose of their CO₂ in areas where the geology only allows for shallower forms of storage. Our research is now addressing this challenge head on.”

Areas of Saskatchewan and Alberta, such as the heavy oil region around Lloydminster, which has significant emissions reduction challenges for both production and refining of oil and gas, could benefit from research into shallow storage in reservoirs above 1,000 meters. There are thousands of suspended oil wells in the region that could act as storage locations, using existing infrastructure that would otherwise go

unused. Likewise, the storage and use of CO₂ in some of the strata of the Bakken and Viking Formations in Southern Saskatchewan carry emissions mitigation potential.

“Aquistore remains one of the best field laboratories in the world for studying deep geological storage of CO₂,” notes Nickel. “We are sharing our findings with industrial and research clients from around the world. But we recognize not all jurisdictions have the ability for deep geologic storage. We are now working in unison with groups like Carbon Management Canada and through our heavy oil research network [HORNET] to find a way to make shallower storage feasible and safe.”

PTRC has published a white paper on CO₂ use and storage in the heavy oil regions of Canada. It can be viewed on our website at www.ptrc.ca/pub/docs/OfficialWhitePaper%20Final.pdf. ▾



Well distribution in the heavy oil regions of Saskatchewan and Alberta. Black dots are closed wells; red is suspended. It is thought some of these suspended wells could be used for CO₂ storage. Image composed using GeoScout.



Bismarck-Mandan: Home to your business

The Bismarck-Mandan community boasts a very competitive tax structure with some of the lowest income and property taxes in the country.

The title says it all, Bismarck-Mandan: Home to your business. Bismarck-Mandan does have a compelling argument as to why that could be true.

Let's start with one of the top concerns for businesses looking to expand into a new region or community: workforce. Let's face it, every growing community across the country struggles with workforce, but Bismarck-Mandan is working on solutions.

Beginning with the education system in Bismarck-Mandan, we see that Bismarck boasts the largest public school district in North Dakota and fall 2021 saw increased enrollment for the

17th year in a row. Mandan, not to be outdone, has seen an increase in enrollment for 12 straight years. Bismarck Public Schools also benefits from their Career Academy – a joint career and technical education center that is shared by Bismarck Public Schools and Bismarck State College.

Bismarck State College (BSC) has recently become the region's only polytechnic institution, giving students a chance to earn Bachelor of Applied Science degrees in areas like Cybersecurity and Advanced Manufacturing. BSC is certainly not the only higher education institution in Bismarck-Mandan making strides; the University of Mary recently opened a brand-new College of Engineering. This continued investment in education lends itself well for companies who are looking to fill their workforce pipeline.

The Bismarck-Mandan community boasts a very competitive tax structure with some of the lowest income and property taxes in the country. Additionally, there are many local and state incentive programs that can assist businesses interested in Bismarck-Mandan; among these is a scholarship/loan repayment program, for students in high-demand or skilled workforce. Recently, North Dakota also implemented an Automation Tax Credit, which reduces a company's tax liability if they begin to include automation into their processes. Furthermore, Bismarck-Mandan is home to the Bank of North Dakota (BND), the only state-owned bank in the United States. BND offers a variety of unique financing programs, including an interest buydown program to aid offsetting costs of emerging or expanding companies.



Bismarck-Mandan is a community that values business and is dedicated to supporting industry.



Bismarck-Mandan has seen a 20 percent increase in population in the last decade, and with that comes the need for exceptional quality of life amenities. Bismarck-Mandan boasts over 100 miles of walking trails, multiple recreational activities on the Missouri River, as well as nearby campgrounds, hunting and fishing opportunities.

Bismarck-Mandan is located at the intersection of Interstate-94 and U.S. Highway 83, providing access to markets across the Midwest and beyond. The Bismarck Airport has daily service on Delta to Minneapolis/St. Paul, on United to Denver, and on American Airlines to Dallas/Fort Worth, near daily service on Allegiant to Las Vegas, Phoenix/Mesa, and Orlando/Sanford, and seasonal service to Denver on Frontier Airlines and to Phoenix-Sky Harbor on American Airlines. The Bismarck-Mandan area is serviced by two Class-1 railroads (BNSF and Canadian Pacific), and has ample and inexpensive resources like water, natural gas and power.

Bismarck-Mandan is clearly a community that values business and is dedicated to supporting industry. As the community continues to grow, there is specific interest in bringing in energy companies and those businesses that play the support role for the energy industry. If your business wants to make Bismarck-Mandan its home, Bismarck-Mandan is waiting for you.

To learn more, contact the Bismarck Mandan Chamber EDC! ▶

Bismarck-Mandan has seen a 20 percent increase in population in the last decade, and with that comes the need for exceptional quality of life amenities.

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The View Steakhouse is a 7,000-square-foot upscale restaurant located on the third floor.

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The Spirit Lake Casino & Resort features a 39,530-square-foot gaming floor with over 560 slot machines that are 100 percent ticket in-ticket out. The gaming floor includes two Blackjack tables, Let it Ride, Ultimate Texas Hold Em' and a Craps table.

The most recent addition of amenities to Spirit Lake Casino & Resort is alcohol and off sale. Recently we have converted our entertainment auditorium to the Auditorium Sports Bar featuring everything you need for a great night of fun. Watch your favorite sports teams on one of the 15- to 65-inch TV screens, play a game of pool, darts or cornhole. The Spirit Lake Liquor Store, located near the Auditorium Sports Bar, is open Monday through Saturday from 11 a.m. to 11 p.m., and on Sunday from 12 p.m. to 11 p.m.

Spirit Lake Casino & Resort is your premiere entertainment destination. The Spirit Lake Auditorium Sports Bar offers live music monthly, and once a month the auditorium is converted back to our 950-stadium seating for our big monthly concerts from fall to spring. During the summer we take our premiere entertainment outdoors for bigger capacity and even bigger names at the Outdoor Entertainment Arena.

The View Steakhouse is a 7,000-square-foot upscale restaurant located on the third floor. The View offers a 180-degree lake view, self-tinting glass, perfect lighting and steam LED fireplace, creating an amazing ambiance to dine in. The View is open on Tuesday through Saturday from 3 p.m. to 9 p.m. and offers happy hour specials and weekday specials. Enjoy other dining options for your dining experience, including a snack bar located on the gaming floor, which also offers a select variety of alcohol beverages. The grill is open daily from 10 a.m. to 11 p.m. and 11 p.m. to 1:30 a.m. for beverages. The Dakotah Buffet is open Thursday through Monday from 3 p.m. to 9 p.m. and offers an all-you-can-eat salad bar, daily special entrees, side dishes and desserts.



Above: Spirit Lake Casino & Resort is your premiere entertainment destination.

Left: Spirit Lake has everything you need for a successful day on the lake, including bait, tackle, fishing licenses (state and tribal), fishing equipment, snacks and gas.



Spirit Lake Grocery is open seven days a week from 8 a.m. to 11 p.m. Spirit Lake Grocery offers great weekly specials, a butcher for custom meat orders, custom birthday cake orders and curbside or delivery service. The Spirit Lake Marina offers the best lake access in the area. They are open seven days a week from 6 a.m. to 2 a.m. Spirit Lake has everything you need for a successful day on the lake, including bait, tackle, fishing licenses (state and tribal), fishing equipment, snacks and gas. Rentals are available for boats, pontoons, cabins or RV sites.

The Spirit Lake Hotel features include 122 rooms and suites. Styles include standard, poolside, and whirlpool family suites. Many rooms offer a scenic view of Devils Lake. There is also a four-story atrium pool with waterslide, wading pool, hot tub and steam room. Spirit Lake also offers the best banquet and meeting room space in the area with different-sized rooms to suit your needs. Our Showroom has space for up to 500, the Cedar & Walking Eagle Ballrooms for groups up to 200 and the Tipi Room or pool area for birthday parties of up to 35.

For more information, visit our website at www.spiritlakecasino.com, or call us at (701) 766-4747. ▀

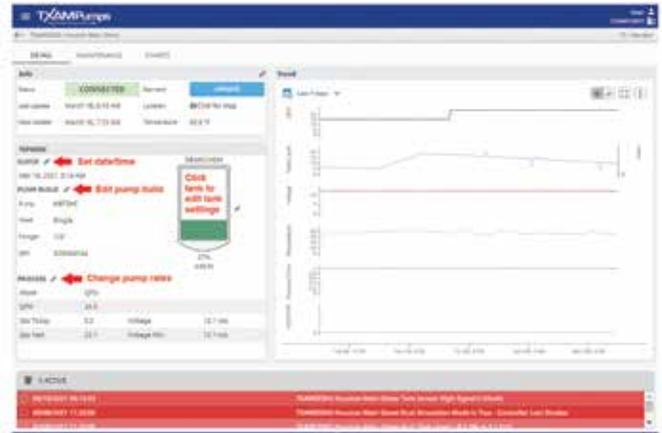
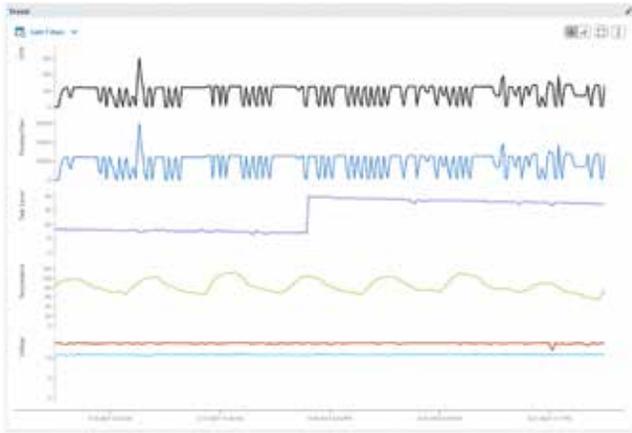


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TXAM Pumps, established in 1986, is based in Houston, TX. Privately owned and operated, truly every location visited is like an extended family to include our distributors. TXAM team members all pitch in to provide great quality and reliable solutions to best fit the scenario to meet the chemical provider and end user needs.

For the past few years, the talk in the oil and gas industry has been IOT (Internet of Things), including devices and controllers which can provide real-time information, termed automation. TXAM Pumps' in-house engineers have advanced the flagship HBT pump models to accommodate customers with a Universal Pump Controller (UPC) that is SCADA ready, as well as provide MODBUS cellular options. Attaching temperature probes to our chemical injection systems are also of added value, especially in West Texas and southeast New Mexico, where ambient temperatures change as much as the wind blows.

Another great TXAM development has been the multipoint injection skid. The unique design setup saves in equipment costs, limited space, ESG efficiency, and injects chemicals at up to 16 separate chemical injection ports at different rates. They are also outfitted with the Universal Pump Controller.

A top-tier automation pump controller would be the TSP 600N. TSP 600N utilizes MODbus RS 485/TCP for controlling and monitoring through a local network, or TXAM proprietary CLOUD network.

TSP 600N features ProFlo, H2S Mode, Dynamic temperature mode, Tank Level Sensor, Stroke Counting, and Cloud integration.

Visit TXAM Pumps' website at TXAMPumps.com and click the Resources tab for data sheets to download, as well as to find out about other benefits for selecting TXAM Pumps and controllers. ▶

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