

S. HRG. 117-469

PATHWAYS TO LOWER ENERGY PRICES IN THE UNITED STATES

HEARING BEFORE THE SUBCOMMITTEE ON ENERGY OF THE COMMITTEE ON ENERGY AND NATURAL RESOURCES UNITED STATES SENATE ONE HUNDRED SEVENTEENTH CONGRESS SECOND SESSION

JULY 13, 2022



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CONTENTS

OPENING STATEMENTS

	Page
Hirono, Hon. Mazie K., Subcommittee Chair and a U.S. Senator from Hawaii	1
Hoeven, Hon. John, Subcommittee Ranking Member and a U.S. Senator from North Dakota	2

WITNESSES

Fedorchak, Julie, Chair, North Dakota Public Service Commission	5
Bissell, David, President and Chief Executive Officer, Kauai Island Utility Cooperative	55
Larsen, John, Partner, Rhodium Group	61
Ness, Ron, President, North Dakota Petroleum Council	67

ALPHABETICAL LISTING AND APPENDIX MATERIAL SUBMITTED

American Exploration and Production Council:	
Letter for the Record with attached document entitled “Unleashing American Energy Production, AXPC Policy Recommendations”	102
Bissell, David:	
Opening Statement	55
Written Testimony	57
Responses to Questions for the Record	100
Fedorchak, Julie:	
Opening Statement	5
Written Testimony	7
Hickenlooper, Hon. John W.:	
Chart entitled “Below-Market Returns on Oil and Gas Have Slowed Investment (since 2013)”	83
Chart entitled “Monthly U.S. Field Production of Crude Oil”	85
Map entitled “Bakken Shale Well Distribution and Peak Productivity”	85
Hirono, Hon. Mazie K.:	
Opening Statement	1
Hoeven, Hon. John:	
Opening Statement	2
Larsen, John:	
Opening Statement	61
Written Testimony	63
Responses to Questions for the Record	101
National Farmers Union:	
Statement for the Record	105
Ness, Ron:	
Opening Statement	67
Written Testimony	69

PATHWAYS TO LOWER ENERGY PRICES IN THE UNITED STATES

WEDNESDAY, JULY 13, 2022

U.S. SENATE,
SUBCOMMITTEE ON ENERGY,
COMMITTEE ON ENERGY AND NATURAL RESOURCES,
Washington, DC.

The Subcommittee met, pursuant to notice, at 2:47 p.m. in Room SD-366, Dirksen Senate Office Building, Hon. Mazie K. Hirono, Chair of the Subcommittee, presiding.

OPENING STATEMENT OF HON. MAZIE K. HIRONO, U.S. SENATOR FROM HAWAII

Senator HIRONO. The Energy Subcommittee will come to order, and I would like to join with Senator Hoeven, our Ranking Member, in welcoming our panel of witnesses and of course, my special shout-out aloha to Mr. Bissell, who came the farthest, I would say, to join us this afternoon.

Today's hearing will examine pathways to lower energy prices in the United States. As we meet this afternoon, people across the United States and around the world are dealing with high energy prices. Many families are struggling to afford the groceries they need while paying the cost of driving to day care, to work, and everywhere else. Small businesses are trying to figure out if they can afford to expand given the rising cost of making deliveries and paying power bills. Rising oil and natural gas prices are driving inflation in the rest of the economy. Fortunately, average prices at the pump have fallen 39 cents per gallon nationwide in the last month, but prices remain far too high in Hawaii and elsewhere.

In the past year, the American people have faced the disruptions from the pandemic recovery and the consequences of Putin's horrific war against Ukraine. In April, all 100 Senators voted to end imports of Russian energy, even though it meant higher oil and gas prices. The President continues to engage with our allies and partners on how to move away from Russian oil and natural gas and stabilize global supplies. The United States is the largest producer of oil and gas in the world, and it was a net exporter of petroleum in 2020 and 2021. Our reliance on fossil fuels, even when we produce it here, means we will be stuck paying the prices set in the global market, subject to OPEC and affiliate producers like Russia. We are still going to be using fossil fuels in cars, power plants, and industrial plants, but there are cheaper and cleaner alternatives now and in our future. So frankly, this hearing is not

about either/or fossil fuels reliance or alternatives. It is really about how can we altogether lower energy costs to our people.

So we already know from the International Energy Agency that renewable energy sources like wind and solar are the cheapest sources of power available, and electric vehicles are already cheaper over their lifetime than comparable gasoline models, with more affordable hybrid and electric vehicle options on the way. The question for Congress is, how do we help states and individuals achieve the benefits of these cheaper and cleaner alternatives? Hawaii has charted an ambitious course. Because of Hawaii's unique geography, it is the most petroleum-dependent state in the country. Hawaii is not a producer of oil or natural gas. We have to import everything. So you can imagine what the costs were. Record oil prices in 2008 solidified Hawaii's commitment to stop being held hostage by global oil markets and move toward renewable power.

The state established the Hawaii Clean Energy Initiative, with the help of the U.S. Department of Energy, eventually setting a goal of 100 percent renewable power by 2045. Hawaii now is at 40 percent renewable power statewide. But Hawaii's continued reliance on oil for the majority of its power is why electricity rates jumped 34 percent in April from a year earlier, and electricity costs are almost triple the U.S. average. Each island in Hawaii has its own electric grid, unconnected to the other islands. We are going to hear today from Mr. Bissell about how the electric cooperative on the island of Kauai reached 70 percent renewable power and avoided the worst impacts of the global oil shock. Hawaii is leading our nation's transition to clean energy and creating a blueprint that others can follow.

Different states and regions all have different energy mixes, but Congress can and should provide individuals and businesses with long-term incentives to speed up the transition to cheaper, cleaner sources of power, higher energy efficiency, and more affordable transportation options. Congress should also support clean energy manufacturing and supply chains right here in the United States. As we deal with high oil and gas prices now, we need to keep our eye on how we can accelerate the transition to more affordable options while making our country much more energy self-reliant in the long term, like Hawaii is doing.

I am looking forward to hearing from our panel this afternoon about the path forward for affordable, reliable, and increasingly clean sources of energy across the nation. And with that, I turn to Ranking Member Hoeven for his opening statement.

**OPENING STATEMENT OF HON. JOHN HOEVEN,
U.S. SENATOR FROM NORTH DAKOTA**

Senator HOEVEN. Thanks, Chair Hirono, I appreciate it. Thanks for holding today's Energy Subcommittee hearing, and I appreciate our witnesses for being here today as well. Thank you for coming.

Today we are examining pathways to lower energy prices here in the United States. Over the last year, Americans have experienced skyrocketing inflation and energy costs. Inflation is currently 9.1 percent. You saw this morning, it came out at 9.1 percent since a year ago in June, largely driven up, or certainly in substantial part by energy prices, which have increased 41.6 percent over the last

12 months. One year ago, a gallon of gas cost \$3.14. Last month, it hit over \$5 a gallon—a nearly 60 percent increase. Also, electricity prices—13.7 percent increase. Natural gas and fuel oil prices have ballooned by 38 percent and 98 percent respectively over the last year. So, you know, these are not just numbers on a page. I mean, this hits every American. It hits when they pull up to the gas pump, when they go to the grocery store, every product they buy, every service they buy, because every product or service has an energy component in it.

My home State of North Dakota—I am pleased we have two individuals here from North Dakota—we are an energy powerhouse. We produce energy from almost every source you can think of. We do not have nuclear, or as one of my favorite Presidents used to say—“nuclar.” But we have, you know, fossil fuels, traditional fuel sources which we produce significantly, but also renewables as well. We really are an energy powerhouse for this country. And our witnesses here today both have been a very big part of making that happen.

And it is not just the higher prices, right? So in May, the North American Electric Reliability Corporation (NERC) warned that some parts of North America are at elevated risk of energy shortfalls due to generation retirement, loss of baseload, and so that parts of the country could be facing brownouts or even blackouts this summer. And obviously, that is not just an inconvenience, that can be a real risk to people’s lives and well-being. And again, Americans are paying higher gas prices due to President Biden’s Green New Deal policies that are preventing production of energy here at home, and we have seen that. For example, in taking the federal lands, you know, the moratorium—implementing the moratorium on leasing on federal lands, both onshore and off. The Administration came out and did agree to allow 20 percent of the federal lands onshore to be leased, but raised the royalty rate so it increases the cost of the energy, and that is still only 20 percent. But it is not just—we have had witnesses in here from the Administration who have said, well, no, we are allowing some leases, but also there are all these leases that energy companies have that they are not producing. The problem there is that the energy companies either cannot get the drilling permits to produce those leases or they are tied up in litigation in court.

And so, this moratorium on leasing on federal lands both onshore and offshore really is an impediment to producing more energy here at home. And we know, because we, you know, in our state we produce so much energy. After Texas, and I know New Mexico has kind of crept in there, but you know, we produce more oil than any state in the Union. And at one time, we were as high as 1.5 million barrels a day. Now we are down closer to a million. We will hear from Mr. Ness on that and from Ms. Fedorchak on not only the coal-fired electric, but electricity production across the board, and again, North Dakota being a very big exporter. So these policies really matter in terms of not only bringing down the cost of energy across the board, but inflation, because the energy component is in every single product and service. So we need to look for solutions, and the biggest one is to empower our energy producers

here at home, and we can do that. We can do that with the right kind of energy policy.

Again, I want to thank Chairman Hirono for working today with me to hold this hearing, and I do look forward to hearing from our witnesses. And at this point, I would turn to the Chairman and say, how would you like to handle the introductions? Should I introduce our first witness? Do you have further comment first?

Senator HIRONO. I just have very short introductions for each of our witnesses, but if you would like to add to the witnesses from your state, that would be fine.

Senator HOEVEN. I have to embellish just a little bit.

Senator HIRONO. Of course.

[Laughter.]

Senator HIRONO. Okay, so let me turn to our panel of four witnesses. I thank each of you for being with us today, and we ask you to keep your statements to five minutes and your full statements will be entered into the record of this hearing.

First, we have Commissioner Julie Fedorchak, who serves as Chair of the North Dakota Public Service Commission.

Next, we have David Bissell, who is the President and Chief Executive Officer of the Kauai Island Utility Cooperative. Aloha to Mr. Bissell.

We are also joined by Mr. John Larsen, a partner at the Rhodium Group, an independent research firm where he leads energy system and climate policy research.

Finally, we have Ron Ness, the President of the North Dakota Petroleum Council.

So before we start with Ms. Fedorchak, if you would like to add—

Senator HOEVEN. Thank you, Chairman. Yes, I would.

Julie Fedorchak currently serves as Chair of the North Dakota Public Service Commission. She has been on the Commission since 2012. Before that, she was a very valued member of my staff, my state director, and did a phenomenal job. And so, we had to hire six or eight people to replace her.

Senator HIRONO. That happens with women a lot.

Senator HOEVEN. I know. She did a fabulous job. We miss her a lot.

She is the Second Vice President on the Board of Directors for the National Association of Regulatory Utility Commissioners, past President of the organization of MISO States, and that is going to—at some point you can explain to me what, exactly, how MISO works. I am looking forward to that because it does seem like rocket science. And she has been involved in energy in North Dakota for a long time and does a great job.

And also, should I make some comments on Ron or wait until it is his turn?

Senator HIRONO. No, go ahead.

Senator HOEVEN. I am also really pleased to have Ron Ness here today. He has served as President of the North Dakota Petroleum Council since 1999—getting long in the tooth, I guess—but has done a fabulous job. He represents 700 companies in the oil and gas industry, and he came on board in 1999. In the year 2000, North Dakota produced less than 100,000 barrels a day. So one

year after he came on board, our state was producing less than 100,000 barrels a day and that number was going down. And he, through his work, along with others, took us up to 1.5 million barrels a day just about two years ago. We are at about a million now. Again, it goes back to some of these energy policies that are so important. So he is an expert on this issue. Obviously, that is hugely important for the country.

So thanks to both of you for being here. And thank you, Madam Chairman.

Senator HIRONO. Glad to have all of you.

So Ms. Fedorchak, please go ahead.

**OPENING STATEMENT OF HON. JULIE FEDORCHAK, CHAIR,
NORTH DAKOTA PUBLIC SERVICE COMMISSION**

Ms. FEDORCHAK. Thank you. Good afternoon, Senator Hirono, Senator Hoeven, and Committee members. I am really honored to be here to talk about this really important subject today.

Energy is the foundation of our economy and our national security. And as Senator Hoeven said, these energy costs are baked into every product we buy, and they really punish people with low or fixed incomes the most. Customers constantly remind me of this, as does the AARP. They regularly intervene in our rate cases with one message—we cannot afford higher energy costs. North Dakota is an electricity exporting state, and our rates are among the lowest in the nation. Yet, even in my state, costs for energy are rising. Our natural gas bills have increased 30 percent since 2016 and transmission costs for electric customers have increased 388 percent since 2003, and promise to continue rising. These cost increases come while 35 percent of the energy consumed by North Dakotans last year was from renewable sources. Quite honestly, our customers are starting to grow leery of the promises of low-cost renewable energy. Our utilities have aggressively pursued green energy, assuring customers it will save them money, and yet their bills are rising.

So my first plea to you today is this—be honest with American citizens. Transitioning our grid to 100 percent renewable energy may be achievable and desirable, but it is not going to lower costs for many, especially in the next 25 years. I am Chair of the North Dakota Commission and soon to be President of NARUC, so I am intimately familiar with the challenges facing the electric and gas industries today. As important as affordability is, reliability trumps it, and the growing reliability challenges we see nationwide are a reality check on how the electric system works. Prior to 2016, MISO did not have any grid events that required them to use emergency procedures. Since 2016, MISO has had 41 Max Gen events triggering emergency procedures. These challenges are real and growing because integrating renewables is complicated. The physics of the electric grid are stubborn and do not bend to anyone's goals or deadlines. Rapid retirements of thermal units, and a transmission system congested with 17 gigawatts of new renewables since 2011, have contributed to a concerning trend in MISO. Total installed generating capacity is increasing, but the accredited capacity, that which you can count on to meet demand, is decreas-

ing. I have included several charts that clearly and simply illustrate this in my testimony and I urge you to evaluate them.

The current trend is not sustainable, and warning signs are numerous. When demand exceeds supply, people lose power. This is inconvenient, yes, but it is also a life-or-death matter. Remember, 210 people perished in the Texas Storm Uri power outages. So my second plea is that you listen to the grid operators. Ignoring their warnings will have serious consequences for our country.

And this brings me to my final point, and that is timing. Let us consider what we are trying to accomplish. We are reinventing and rebuilding virtually the entire energy system that sustains all aspects of life in the United States. Considering the magnitude of this challenge and the warning signs we are seeing, the solution I suggest is quite simple. Most of this can be solved with one thing—patience—and that is my final plea to you. Clair Mohler, the Head of Operations for MISO, states it this way—Mind the Gap. Mind the gap between the megawatts being retired and being added. The most obvious way to bridge that gap is to extend the life of existing, already operating, and paid-for resources, yet new EPA regulations stand to exacerbate this crisis by forcing even more coal retirements early. I urge you to require the EPA to coordinate with utilities and grid operators on any new regulations that could hasten our growing capacity crisis. Another big gap exists between the reliability attributes of wind and solar megawatts versus thermal megawatts. Give researchers time to fix this gap and to perfect carbon capture and storage for coal and natural gas worldwide. We need to mind the enormous gap in critical minerals needed to support wind, solar, and battery production and the disturbing gap in environmental standards and worker, pay in countries producing them.

The bottom line is this: permitting processes, supply chains, and construction timelines must be acknowledged in establishing our nation's energy policy, otherwise, we have what my friend and former FERC Commissioner Tony Clark calls regulation by wishful thinking, where lofty goals translate into policies that endanger the lives and livelihoods of our citizens. Americans are counting on us to figure this out. We must forge a thoughtful, prudent path through this energy transition that keeps the power on at all times, at prices people can afford.

Thank you.

[The prepared statement of Ms. Fedorchak follows:]

Julie Fedorchak
Chair
North Dakota Public Service Commission

US Senate Committee on Energy and Natural Resources
July 13, 2022
Pathways to Lowering Energy Prices

Thank you for the opportunity to testify today. A special thanks to Sen. John Hoeven for inviting me to be part of this esteemed panel. I am honored to address you on this vital topic that is top of the mind for every American.

I will highlight three areas in my testimony— affordability, reliability challenges, and timing of this transition. Additional detail and references are included in attachments.

Affordability

Regardless of whether you are Republican, Democrat or Independent, I sense we can all agree on one thing: reliable and affordable energy is a necessity for our nation. Energy is the foundation for our economy, impacting every business from the smallest bakeries and body shops to the largest corporations. Energy costs are embedded in every single product we buy. These costs compound throughout the economy and punish vulnerable communities and people with low or fixed incomes the most. The AARP represents perhaps the largest group of individuals on fixed incomes in our nation: senior citizens. They regularly intervene in our rate cases at the North Dakota commission and their core message is always the same – higher energy bills are painful for our members.

Yet even in North Dakota, an electricity exporting state where rates are among the lowest in the nation, costs for energy are rising, in some cases substantially.

Natural gas customers in North Dakota have seen an increase of approximately 30 percent since 2016, a sure indication of the dual use of gas for home heating and electrical generation and the lack of planning and coordination needed to sustain both of those important priorities.

Our electric rates are also rising. Transmission costs in North Dakota have increased 388 percent since 2003. The impacts from these increases weigh heavily on rural areas and older residences that depend on electrical heat during winters that annually drop into the negative teens and at times drop to a temperature that even shuts down our extensive wind generation.

It is noteworthy that 35 percent of the energy consumed by North Dakotans last year came from renewable sources, one of the higher penetrations in the nation. Perhaps this explains why customers are growing leery of the promises of low-cost renewable energy. Our utilities have aggressively pursued green energy, assuring customers that it will save them money, and yet their bills are rising.

So, my first plea to you is this: we need to be honest with American citizens. Transitioning our grid to 100 percent renewable energy may be achievable and, for many, desirable, but it is not going to lower costs for anyone, especially in the next 25 years.

Reliability

As chair of the North Dakota commission, immediate past-president and current Resource Adequacy liaison for the Organization of MISO (Midcontinent Independent System Operator) states, and soon to be president of NARUC, I am intimately familiar with the challenges and opportunities facing the electric and gas industries during this massive technology transformation.

As important as affordability is, reliability trumps it. The reliability challenges in California, Storm Uri in the south and the numerous Max Gen events MISO is experiencing are a good reality check on how the electric system works.

These challenges are real and growing because the physics of the electric grid are stubborn and do not bend to our goals or deadlines.

Take for example that prior to 2016, MISO didn't have any grid events that required them to activate the use of its emergency procedures. Since 2016, MISO has had 41 MaxGen events requiring the use of emergency procedures.

According to their own reliability report, this is a key indicator of MISO's changing risk profile. "While the emergency protocols are a legitimate way for MISO to access additional resources, relying on such protocols much more frequently and in non-traditional times are evidence of MISO's changing risk profile," the MISO Reliability Imperative document states. (Attachment 3)

Rapid retirements of thermal units and a transmission system congested with 17 GW of new renewable generation since 2011 have converged into a concerning trend in MISO. It is illustrated the chart in Attachment 1 page 4.

Total installed generating capacity in MISO, illustrated by the blue bars, is increasing, but the *accredited* capacity is declining. Accredited capacity is generation that can be counted on to meet demand.

Please examine this chart (and others in Attachments 1 and 2) carefully. These are not sustainable trends.

My second plea today is this: listen to the grid operators. They are the independent third party. Their goal is maintaining a stable, reliable grid throughout this energy transition. Ignoring their advice will have serious consequences.

Timing

And this brings me to my final point: timing.

Let us consider for a moment what we are trying to accomplish. We are seeking to:

- Close existing facilities prematurely and require customers to pay for them regardless of their operation,
- Permit and build renewable generating resources to replace many times over the capacity of the retired assets and the current electric system,
- Permit and build billions of dollars in new transmission lines to connect these new resources to the grid,
- Figure out how to incorporate and operate the electric grid reliably with high penetrations of renewable resources, which function very differently than the traditional resources around which the grid was built and has been operating for a hundred years,
- Convert the entire transportation fleet to electric power and develop the charging stations and additional clean power supplies needed to keep them running,
- Convert 58 million home heating systems from gas to electricity and develop additional clean power supplies to keep them warm,
- Convert all industrial power systems from gas to electricity and generate the additional clean power sources to keep them running,
- And all the while, promising to save consumers money.

In short, we are reinventing and rebuilding the entire energy system that sustains the lives, work, travel and communication of every single person and business in the United States.

Considering the magnitude of this challenge, and the warning signs we are already seeing from our current approach, the solution I am going to suggest is quite simple. Most of this can be solved with one thing: patience. That's my final plea to you.

Clair Mohler, the head of operations for MISO, states it this way: Mind the Gap.

Where are these gaps?

There is a big gap in the megawatts being retired and megawatts being added.

Thirty-five percent (about 20 gigawatts) of MISO's coal fleet will retire within the next 5 years. Many more if you count those that could be impacted by new EPA regulations. Yet new generation in the MISO queue includes just 3.8 gigawatts of natural gas units to potentially replace this firm capacity. See Attachment 1, page 3.

The obvious way to bridge that gap is to extend the life of existing, already paid for resources that are operating and connected to the grid today. I urge you to require the EPA to coordinate with utilities and grid operators in the writing of any new regulations that could exacerbate the capacity crisis facing our electric industry.

Another big gap exists between the reliability attributes of wind and solar megawatts versus thermal megawatts. Technology needs to fix that gap and researchers need time to do that. Research and technology can also fix the emission problems of coal and natural gas through commercial scale carbon capture and storage so these fuels can be retained in a diverse, low-carbon mix for the future.

A massive gap exists between the availability of critical minerals today and the amount needed to support wind, solar and battery production. The International Energy Agency estimates that critical mineral production will need to increase by 400 percent by 2040 to hit Paris Accord Goals and 600 percent to be net-zero by 2050.

A disturbing gap exists between the environmental standards, the pay, and working conditions in countries where mining of critical minerals is occurring. That should be an important consideration in the environmental justice considerations of all policy makers.

Quite simply, there is a huge gap between the President's 2035 clean energy deadline and the permitting processes, supply chains, and construction timelines necessary to build the new generation and transmission infrastructure needed to meet that goal. This includes a massive gap between generation capacity to meet current demand (which is tenuous) and the capacity needed to electrify our transportation fleet, home heating, and industrial processes.

Energy policy is a wedge issue. Activists, interest groups, and politicians love to use it to brand people, divide us into opposing camps, and prohibit compromise. We cannot let that continue. These are issues that must bring us together. Americans are counting on us to figure this out.

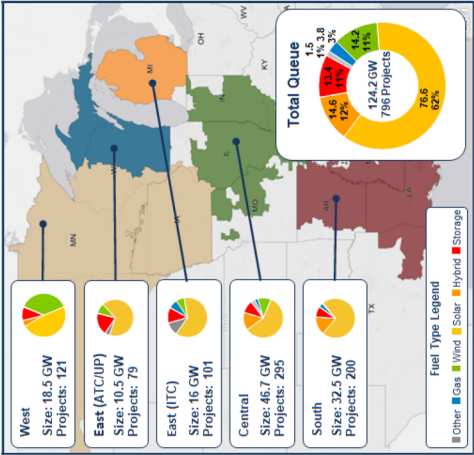
We must forge a thoughtful, prudent path through this energy transition that keeps the power on, at all times, at prices people can afford.

Thank you.

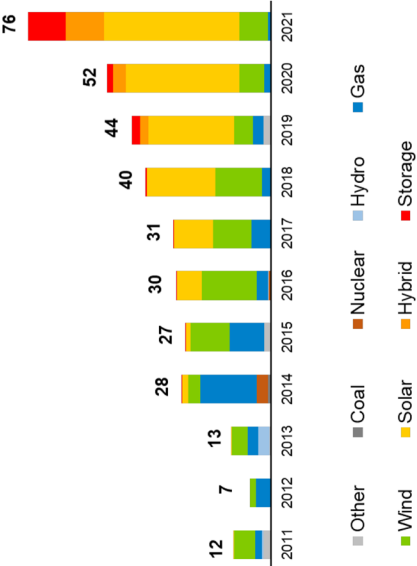


The interconnection queue reveals few resources with the controllable attributes with most being battery-based resources of limited (4-hour) duration

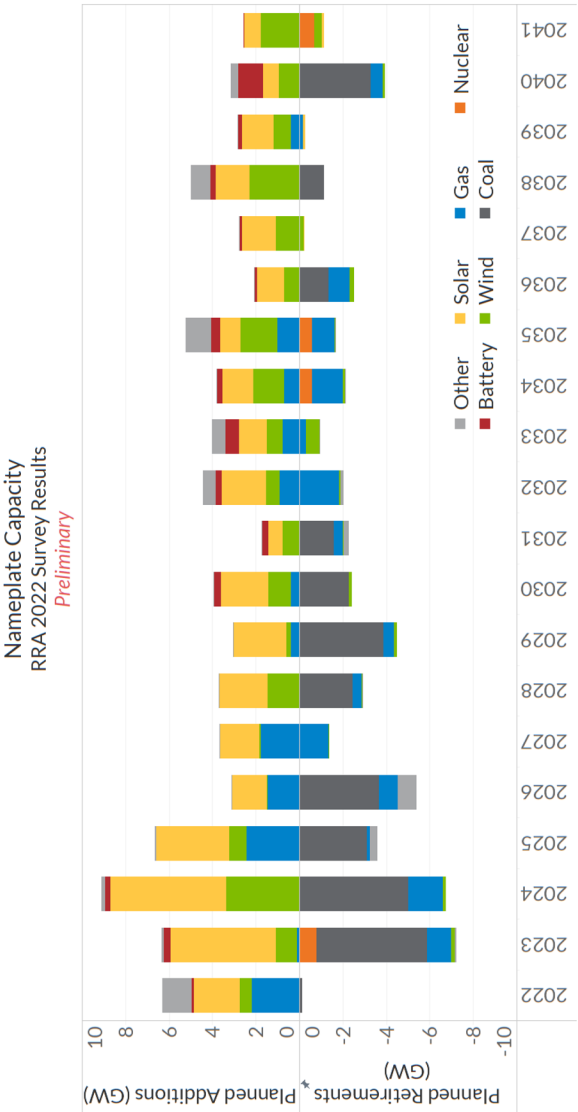
MISO Active Queue by Study Area



MISO Queue Historical Trend by Requested Generation (GW)

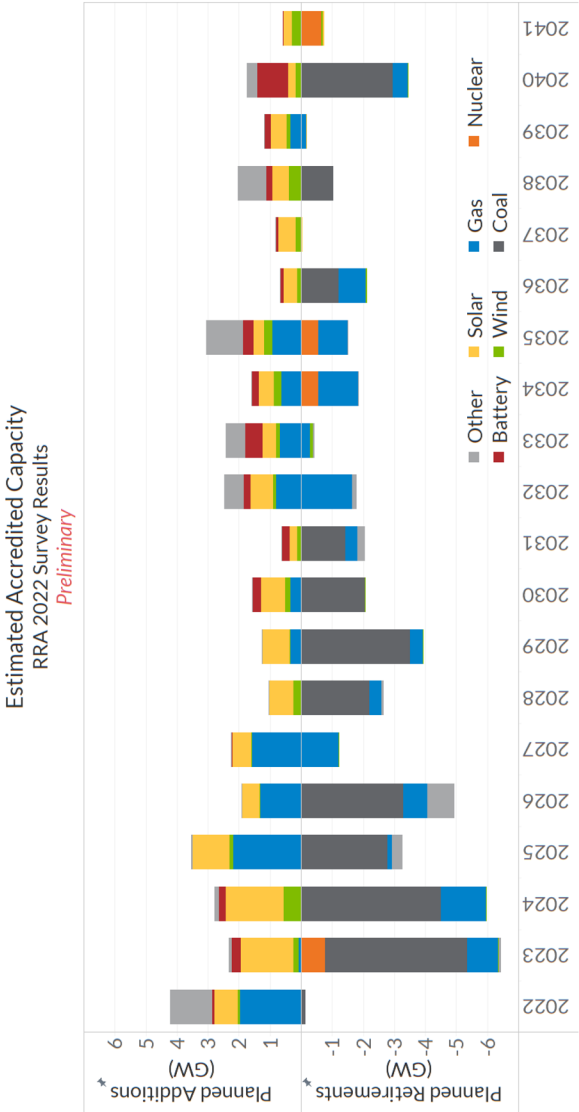


The preliminary 2022 Regional Resource Assessment shows addition of largely renewable resources, coupled with retirement of controllable resources...



The assessment includes information provided by members representing 75% of MISO's load

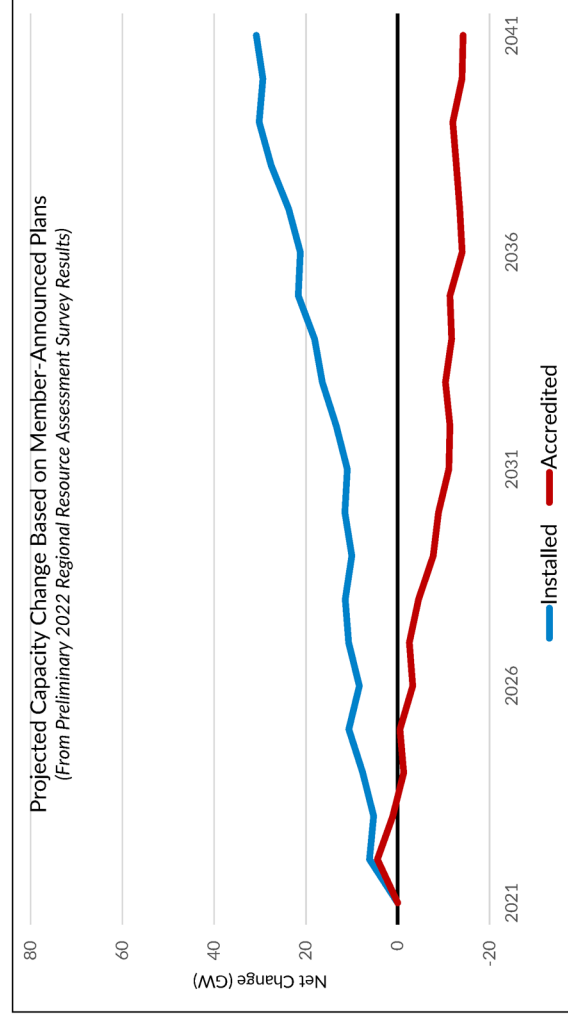
Looking at accredited capacity, planned additions are not on pace to make up for planned retirements



Estimated accredited capacity: 16.6% for wind; 35% for solar, 87.5% for battery, 90% for coal, 90% for gas, and 95% for nuclear



...accredited capacity is declining due to the rapid pace of retirements of controllable resources



*Future projections calculated as change from Future 1 2022 load assumption
Estimated accredited capacity: 16.6% for wind, 35% for solar, 87.5% for battery, 90% for coal, 90% for gas, and 95% for nuclear

4



DRIVERS & RISKS

Influx of renewables & resulting volatility

Generation retirements

Increased probability of outages due to extreme temperatures & fuel supply issues

Changing load shapes & volatility

Persistent operational issues & capacity shortfalls in recent years

PLANNING RESERVE MARGIN

LOLE is the expected number of days per year an area does not have enough capacity to meet load

Planning Reserve Margin is designed to determine the amount of capacity necessary to reliably serve the forecasted peak demand in a planning horizon to a desired reliability target

- Based on a probabilistic Loss of Load Expectation (LOLE) study typically performed to determine the amount of capacity needed to meet a desired reliability target
 - SPP currently maintains a 1 day in 10 years industry practice threshold as a reliability target (equivalent to 0.1 days/year)

STUDY YEAR 5 LIMITATIONS

Electrification generally increases energy usage and flattens peaking load patterns, which could result in a higher PRM

- While the PRM shows a reduction in 2026 (Year 5), SPP staff believes year 5 load forecasts may change due to potential increases of unconventional load and energy patterns
 - Uncertainty of load variability due to the unknown impacts of electrification and unconventional load
 - Unknown impacts from the projected growth in Demand Response
- Year 5 study includes very few resource changes (additions, retirements)
 - From 2023 to 2026, study changes include
 - Decrease of total available capacity by 669MWs
 - Incremental retirements of 878MWs
 - Increase in demand of 1,537MW
 - Study does not include resource planning assumptions beyond LRE submitted resources
 - Due to the study timeline the PRM impacts caused by resource changes may be lagging

RELIABILITY METRIC CONSIDERATIONS

For example, a shortfall of 1 percent of load for 10 hours is measured the same way as a shortfall of 10 percent of load for 10 hours. These disparate events are not differentiated by conventional resource adequacy metrics even as they represent dramatically different situations in terms of options for meeting demand in today's power system

- The 1 Day in 10 Year LOLE Metric was developed in the 1960s
 - Based on risks acceptable to the load at that time (1960s)
 - Load characteristics in the 1960s are quite different from today
 - Based on a thermal resource fleet with 100% capacity factor
 - LOLE is an opaque metric when used in isolation
 - It does not characterize the magnitude, duration, or frequency of specific outage events
- New metrics should address the increase in energy limited resources and quantify the specific characteristics of outage events, including frequency, duration, and magnitude
- Moving forward, measurements beyond the 1-in-10 metric should be considered (i.e. EUE)
 - Further evaluate the need for energy adequacy in Resource Adequacy and what additional metrics are needed



Living Document

This is a "living" report that is updated periodically as conditions evolve, and as MISO, stakeholders, and states continue to assess and respond to the Reliability Imperative.



Contents

A Message from John Bear, CEO	1
Executive Summary	2
Informing and Responding to the Reliability Imperative.....	6
Current Reliability Challenges Will Become More Significant, and New Ones Will Emerge.....	9
MISO Roadmap	15
Market Redefinition	18
Long Range Transmission Planning	21
Operations of the Future.....	25
Market System Enhancements.....	27
The Opportunity: Capturing the Value.....	29
Working Together to Address the Reliability Imperative.....	30
A Message from Clair Moeller, President.....	32
Acronyms Used in this Report	33



A Message from John Bear, CEO

A lot has happened in the MISO Region since we published the first version of this report in late 2020. MISO has made significant progress in responding to the Reliability Imperative — the shared responsibility that MISO, our members, and the states have to address the complex and urgent challenges to electric system reliability in our region.

Despite progress we have made, we still have much to do. Our region's fleet of generating resources continues to evolve in ways that are creating new system needs that we must address, driven by factors such as utility and state policies to reduce carbon emissions.

Another driver of the Reliability Imperative that came into sharp focus in 2021 is the increasing frequency and severity of extreme weather events, which is posing additional challenges.

In the first version of this report, we introduced the four major efforts MISO is undertaking to respond to the Reliability Imperative: Market Redefinition, Long Range Transmission Planning, Operations of the Future, and Market System Enhancements. In this updated version, we discuss what we've learned throughout 2021, our accomplishments to date, and our focus areas going forward.

One clear takeaway from 2021 is that the Reliability Imperative is critical. The work we are doing is not optional — to maintain system reliability, we must respond to the unprecedented change we all face and to avoid the severe health, safety, and economic impacts of prolonged outages. This work cannot be put off for months or years — much of it has long lead times, so we need to act now. And our stakeholders are counting on us — regulatory agencies, utilities, and other entities are looking to MISO to identify problems and find solutions. We appreciate all of the collaboration from stakeholders and are counting on continued support and dialogue as we confront these challenges and opportunities together.

Thank you,

A handwritten signature in black ink, appearing to read "JBear".





Executive Summary

INTRODUCTION

MISO is making significant progress addressing the Reliability Imperative — the shared responsibility that MISO, our members, and the states have to address the urgent and complex challenges to electric system reliability in the MISO Region.

MISO first outlined its response to the Reliability Imperative in the initial version of this report published in December 2020. This updated version highlights the progress we have made since then, new learnings and insights we have developed, additional challenges we see emerging, and our focus areas going forward.

A year after we first published the Reliability Imperative report, we can confirm the urgency of the work and our focus on the four workstreams: (1) Market Redefinition, (2) Long Range Transmission Planning, (3) Operations of the Future, and (4) Market System Enhancements.

FLEET CHANGE CONTINUES TO POSE CHALLENGES

As we discussed in the initial report, many of the challenges we face stem from the changes that are transforming the region's fleet of generating resources. To briefly recap, these challenges include:

- Declining reserve margins and fewer always-on “baseload” resources, due to retirements of thermal units.
- Aging coal resources that remain in service can be more prone to outages, rendering them potentially unavailable when they are needed most.
- Wind and solar resources are not always available to provide energy during times of need. Additionally, renewables must sometimes be curtailed due to transmission constraints.
- The growing fleet of natural gas resources may not be able to procure all the fuel they need at key times, often seasonally based, because of limitations in contractual gas services, lack of dual fuel capabilities, and reliance on a pipeline system that is shared with heating and manufacturing uses.
- The region's penetration of distribution-level and behind-the-meter resources is increasing, yet MISO does not have functional control or visibility into how these resources may affect the larger grid system.

The aggregate impact of these and other challenges has altered the region's historical summer-centric risk profile, making it more prone to grid emergencies in winter and shoulder-seasons that rarely posed risks in the past.



ADDITIONAL DRIVERS AND CHALLENGES ARE EMERGING

While fleet change challenges continue to drive MISO's response to the Reliability Imperative, several additional drivers have become evident since we published the first version of this report. They include:

More frequent and severe extreme weather events: While extreme weather has always been commonplace in the MISO Region, there is evidence that severe weather events that impact electric reliability have been increasing since the early 2010s. For example, in January 2021 the [Electric Power Research Institute found](#) that hurricanes are increasing in intensity and duration, extreme heat events are increasing in frequency and intensity, and cold events are increasing in frequency.

- Recent examples of these kinds of impacts in the MISO Region include Hurricanes Laura, Delta and Zeta in 2020, Winter Storm Uri in February 2021, and Hurricane Ida in August 2021. These events reinforced the need for MISO's work under various parts of the Reliability Imperative. For example, [Winter Storm Uri](#) illustrated the need to better weatherize generation resources, continued gas/electric coordination improvements, and to improve real-time control room decisions, all of which align with efforts MISO is pursuing under the **Operations of the Future** workstream.
- Recent extreme weather events also underscored the need for the **Long Range Transmission Planning** workstream. For example, even though the MISO Region had an adequate supply of generation during Winter Storm Uri, MISO's ability to move even more energy to specific areas was hindered by increased unplanned generation outages and derates, transmission constraints and overloaded lines, and the contractual transfer limit between the MISO South subregion and the rest of the footprint. Uri also illustrated the importance of transfer capability in moving power; robust regional and interregional transmission capacity resulted in limited impacts in MISO's North and Central Regions.
- The recognition of more frequent and severe weather events also aligns with the major efforts executed in the **Market Redefinition** workstream in 2021, wherein MISO led efforts to shift from the summer-focused Resource Adequacy construct to a new 4-season construct, which better reflects the risks in non-summer seasons. MISO [submitted the proposal](#) to the Federal Energy Regulatory Commission in late 2021, along with an accompanying proposal to align the accreditation of thermal resources to their availability in high-risk hours. MISO plans further work to continue in 2022.

Electrification of adjacent industries: While year-over-year demand for electricity in the MISO Region has been flat for many years, it is expected to increase going forward due to the electrification trends in other sectors of the economy. Electric vehicles are growing in popularity, and the residential and commercial building sectors are increasingly using electricity for heating and cooling purposes – with the desire to source this new electric load from renewables.



- In MISO's Electrification Insights April 2021 [report](#), MISO found that electrification could transform the region's grid from a summer-peaking to a winter-peaking system, and that uncontrolled vehicle charging and daily heating and cooling load could result in two daily power peaks in nearly all months of the year.
- The four focus areas of the Reliability Imperative seek to ensure that markets, transmission, operations, and systems — all of which will be directly impacted by electrification — are ready for the coming transition.

HELPING UTILITIES AND STATES MEET THEIR GOALS

The first version of this report outlined the multiple trends that are driving the transformation of the region's resource fleet, such as consumer preferences for clean energy, changing economics, and technological advancements.

While all those trends continue to drive fleet change, perhaps the most notable and important driver is that utilities and states are increasingly adopting policies and goals that reflect and embrace consumers' preferences for clean energy. As of late 2021, for example, 17 of the region's utilities (representing approximately 80% of the region's total load) had committed to reducing their carbon emissions by at least 80% by 2040 or sooner. The federal government has also set ambitious goals to decarbonize the electric sector by 2035, the economy by 2050, and specific goals related to vehicle and building electrification.

Although MISO as an Independent System Operator does not set policy, MISO has an important role in enabling member and state policy goals. MISO uses its markets, planning processes, and operational functions to help its members achieve their policies and goals — and the Reliability Imperative provides a framework to do that.

For example, the **Long Range Transmission Planning** workstream is identifying investments in transmission solutions that will help MISO's members and states meet their ambitious carbon-reduction goals — as many promising locations to build new renewables are not currently served by transmission or otherwise experience constraints. And the **Market Redefinition** workstream will craft necessary revisions to the current market construct and develop the market products that are needed to incentivize and fairly compensate emerging technologies such as battery storage. To account for the uncertainty in policy outcomes and timing, MISO is utilizing the [Futures process](#) to model several different policy trajectories and identify least regrets actions.



STAKEHOLDER INPUT IS CRUCIAL

Much of the work cited in this report is already underway. Many of the ideas and proposals in this report reflect a great deal of technical input from stakeholders. For example:

- MISO proposals to revise the Resource Adequacy construct and to improve how resources are accredited are discussed in the [Resource Adequacy Subcommittee](#).
- Similarly, MISO initiatives for scarcity pricing and the Market System Enhancement effort reflect input at the [Market Subcommittee](#).
- Long Range Transmission Planning is taking place in the [Planning Advisory Committee](#), and cost allocation discussions in the [Regional Expansion Criteria and Benefits Working Group](#).

As we emphasized in the first version of this report, the Reliability Imperative is not intended to replace existing initiatives with which stakeholders are already familiar. Instead, it pulls together a number of strategic initiatives under a single framework for the purpose of ensuring more alignment, reinforcing the sense of urgency, and highlighting the connections among the workstreams.

We designed this to be a "living" report that that we will continue to update as needed as conditions change, and as we learn more about how to best respond to the challenges the region faces from ongoing fleet change, extreme weather events, and other risk factors.

MISO appreciates all of the helpful feedback we have received on the Reliability Imperative, and we look forward to continuing the dialogue with our stakeholders going forward. Urgent attention and action is necessary.





Informing and Responding to the Reliability Imperative

MISO's response to the Reliability Imperative has been informed by years of conversations with our stakeholders. MISO has also undertaken numerous studies to assess the region's changing risk profile and to explore how reliability is being affected by other drivers such as electrification and extreme weather events. This work includes:

MISO FORWARD: This report series, launched in 2019, identifies and assesses key trends that are reshaping the electricity sector. The inaugural FORWARD report focused on the need to enhance resource Availability, Flexibility and Visibility. The 2020 report looked at how different types of members will require different things in their interactions with MISO and the 2021 FORWARD report examined adjacent industries that are expected to exert new demands on the grid going forward. Subsequent iterations will continue to share insights informed by customer and industry interviews.



Renewable Integration Impact Assessment (RIIA): This technical study assesses the impacts of integrating increasingly higher levels of renewables into the MISO system. RIIA indicates that planning and operating the grid will become more difficult when more than 30% of the footprint-wide load is served by wind and solar. However, RIIA also indicates that renewable penetrations of 50% or higher could be reliably achieved if MISO, our members, and the states coordinate closely on the advanced actions that would be needed.



The February (2021) Arctic Event: This report discusses lessons learned from the extreme winter weather event, also referred to as Winter Storm Uri, that affected the MISO Region and other parts of the country in February 2021. MISO and its members took emergency actions during that event in order to prevent more widespread grid failures, which underscores the urgency of MISO's Reliability Imperative efforts. The February 2021 event is just one example of how extreme weather is becoming more frequent and severe in the region, and we are seeing that the impacts of these events can be further exacerbated by the changes that are transforming the region's resource mix. For these reasons, preparing for extreme weather events is a significant part of MISO's response to the Reliability Imperative.





Resource Availability and Need (RAN): This initiative was launched in 2017 to address multiple reliability issues that have emerged due to the region's changing resource mix, declining reserve margins, and other factors. RAN's focus areas included improving processes for resource outages and resource accreditation, as well as transitioning from MISO's summer-focused Resource Adequacy construct to a new seasonal construct that better reflects the region's risk profile. This work is discussed in five RAN whitepapers, and the proposed solutions were filed with the Federal Energy Regulatory Commission (FERC) in 2018, 2019, and 2021. Following the late 2021 FERC filing, RAN was folded into the Market Redefinition workstream of the Reliability Imperative.



MISO Futures: A product of continued collaboration between MISO and its stakeholders, the three MISO Futures provide a set of bookends to explore a wide range of future outlooks. Updated in late 2021, these forward-looking planning scenarios are being used throughout the organization to prioritize and pace the Reliability Imperative work.



Regional Resource Assessment (RRA): The RRA is a new recurring study based on the plans and goals MISO's members have publicly announced for their generation resources. The RRA aggregates these plans and goals — many of which seek to reduce carbon emissions — and uses them to develop an indicative view of how the region's resource mix might evolve going forward in order to meet utilities' stated objectives. The view the RRA produces is designed to help MISO, our members, and state regulatory agencies to better plan and operate the system in a reliable, cost-effective manner.



Markets of the Future: This report illustrates how and when MISO's existing market structures will need to evolve in order to accommodate the profound changes that are occurring in the energy sector. The report presents a timeline of reliability needs that aims to answer the question: "What will be needed and by when?" The needs are presented in four broad categories: (1) Uncertainty and Variability; (2) Resource Models and Capabilities; (3) Location; and (4) Coordination. The report also outlines a transparent path forward for market solutions that anticipate and meet the changing needs.





Electrification Insights: This report explores the challenges and opportunities the grid could face from the growth of electric vehicles and the increasing electrification of other sectors of the economy, such as residential and commercial buildings. Among other things, the report indicates that electrification could transform the grid in the MISO Region from a summer-peaking to a winter-peaking system, and that uncontrolled vehicle charging and daily heating and cooling load could result in two daily power peaks in nearly all months of the year. These and other implications of electrification are addressed through the efforts that MISO is mounting under the Reliability Imperative.



From this groundwork, we know there are many challenges ahead. But we also believe we can respond to the Reliability Imperative in a manner that enables our members to achieve their plans and goals — such as increasing their use of renewables or reducing their carbon emissions. We are determined to do the hard work required to ensure all of our members and their end-consumers benefit from MISO membership.





Current Reliability Challenges Will Become More Significant, and New Ones Will Emerge

Many utilities and states in the MISO Region have announced ambitious plans and goals to reduce some or all of their carbon emissions by some future date. There is also discussion at the national level about how to decarbonize the electric sector and the economy as a whole. So naturally, there's much discussion about what the "end state" of the region's electrical system would look like if these plans and goals are realized.

While MISO also cares about the eventual end state, we are currently focused on — and concerned about — the **transition** that is required to achieve a lower-carbon or zero-carbon end state, because this transition may cause reliability challenges as we learn how to accommodate new resource types and as a large portion of today's generation fleet retires.

Chief among these risks is the region's declining levels of generation capacity and reserves. Today, MISO operates with less excess capacity than in the past because MISO's large footprint has facilitated the sharing of reserve capacity, a direct benefit to customer rates. Nevertheless, many thermal resources have recently retired from service due to economic, regulatory, and environmental pressures, and the aging thermal assets that remain in service may be more prone to unplanned outages and face supply chain issues. While MISO believes it is certainly possible to reliably operate the system with substantially lower levels of thermal resources, we need to ensure that the resources that replace them provide the commensurate capabilities needed to ensure reliable operations. Historically MISO has depended on some of the capabilities that are bundled in thermal generation — such as dispatchable flexibility and inertia — but which are not inherently part of wind or solar generation. Our markets can and will adapt to require, incent, and/or procure those capabilities, but developing those new market mechanisms will take time and stakeholder collaboration, as discussed more in the Market Redefinition section.

The transition to a lower/no-carbon end state also poses risks in the realm of fuel assurance. As the electric generation and fuel industries anticipate the changing fleet composition, there has been contraction in the coal industry. An expansion of renewable and energy storage resources is needed and underway, but during the transition to that new fleet, MISO has concerns about the fuel assurance related to conventional generators providing flexibility and reliability to the system.

- Coal resources have historically been considered very fuel-assure because large stockpiles of fuel can be stored on-site. However, as this report was being developed in late 2021, there were indications that coal supplies were tightening due to a confluence of factors, including contraction of the mining and transportation sectors and supply chain issues related to the COVID-19 pandemic. Additionally, natural gas prices increased significantly going into the winter of 2021-22, which in some instances made coal resources more



economic to dispatch than gas. These factors have combined to increase the risk that a coal plant will be dispatched but will be unable to perform due to fuel availability.¹ Beyond these factors, coal resources have occasionally experienced fuel-assurance issues in the past due to extreme winter weather freezing onsite coal inventories and/or impacting coal-handling equipment.

- Natural gas resources are also subject to fuel-assurance risks because they typically rely on pipelines to deliver gas to them when they need it. However, because the gas pipeline system was largely built for home-heating and manufacturing purposes, situations sometimes arise when gas power plants cannot procure all the fuel they need due to contractual issues related to delivery priorities. In the MISO Region, this has historically occurred during extreme winter weather events that drive up home-heating needs for gas. Typically, many gas generating resources do not have "firm" fuel-delivery contracts, opting instead for less costly "interruptible" pipeline service or a blend thereof.²
- Additionally, natural gas power plants, gas pipelines, and coal generators can be forced out of service by icing and other effects of severe winter weather — as occurred in the MISO Region and elsewhere during the February 2021 Arctic event.

MISO has implemented a variety of tools and processes to develop situational awareness around and mitigate fuel assurance-related reliability issues, such as engaging in direct communications with generation and pipeline operators, and using real-time mapping tools and other means to increase situational awareness of potential problems.

Fuel availability is also a challenge for wind resources, as the graphic below illustrates. The energy output of wind resources can fluctuate significantly on a day-to-day and even an hour-by-hour basis, which complicates MISO's efforts to maintain system reliability. Additionally, when wind output is high, congestion on the transmission system may require MISO to curtail, or turn off, wind resources that could otherwise provide energy. The chart below illustrates how wind output in the region varied significantly in the fall of 2020. The orange areas show instances when high wind output had to be curtailed.

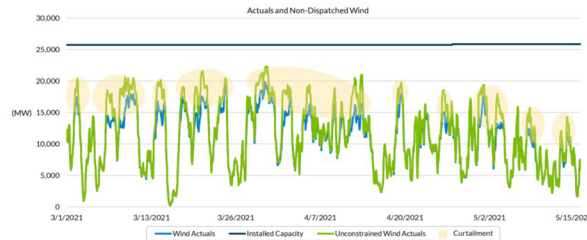
Another trend associated with the changing resource mix is that the region has become reliant on a category of resources that MISO can only access in emergencies. These assets, known as Load Modifying Resources (LMRs), comprise a significant portion of the resources that MISO members currently use to satisfy their Resource Adequacy Requirements.

¹ About 11 GW of coal capacity (approximately 20% of the region's total coal capacity) reported being at high risk of experiencing coal supply issues in the 2021-2022 winter season, according to survey responses. See [MISO Reliability Subcommittee, December 2021](#).

² Less than 25% of the gas generation that responded to MISO's [2021-2022 Generator Winterization Survey](#) indicated it had firm transport contracts in place for all of their supplies during the 2021-2022 winter season. See MISO Reliability Subcommittee, October 2021.



Recent examples of MISO wind generation variability and curtailment



The use of LMRs increased markedly in 2016, when the region's reserve margins began declining due to a combination of factors, including environmental regulation and economic considerations, among other things. Since then, LMRs (including Demand Resources and Behind the Meter Generation) have consistently comprised a little more than 8% of the total resources that have cleared MISO's annual Planning Resource Auction.

Under the MISO Tariff, MISO can only access LMRs to curtail or offset load by progressing through the steps of its emergency operating procedures and formally declaring a grid emergency. The Tariff also limits MISO's use of LMRs in other ways, such as capping how many times a year MISO can call them and requiring MISO to provide certain amounts of lead time before LMRs are expected to perform. Historically, some LMRs were afforded up to 12 hours of lead time before they were expected to perform, but under a MISO initiative that was approved by FERC in August 2020, the lead time for LMRs will be reduced to six hours or less, with 50% accreditation for LMRs with notice time greater than 6 hours in the Planning Year 2022/23 and disqualification beginning with MISO's 2023/24 Planning Year.

Emergency-only use of LMRs is a long-established planning practice in the utility industry. However, as the region's resource fleet continues to evolve and reserve margins continue to tighten, MISO is increasingly dependent on the successful deployment of LMRs to ensure capacity sufficiency. More frequent use of LMRs can result in a host of sub-optimal outcomes. For example, MISO may not be able to access LMRs in time to mitigate rapidly evolving system conditions. Even when LMRs attempt to respond in time, the performance of LMRs may fall short of what they were accredited for.

The long lead times of some LMRs can also require MISO operators to make difficult decisions. If operators do not make a required emergency declaration ahead of time, they risk not having the LMRs needed to meet obligations. If they do make a declaration and dispatch LMRs, they may create uplift and reduce the efficiency of market outcomes in pursuit of reliability. Lastly, given the

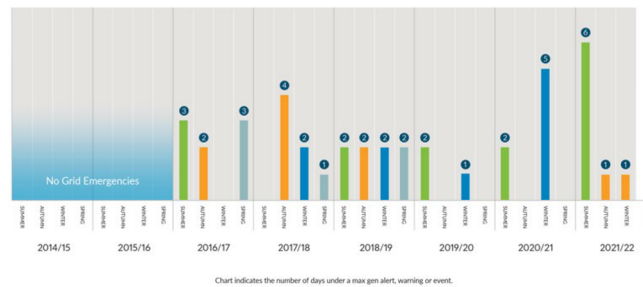


limited number of annual LMR calls per the MISO Tariff, a decision to call an LMR that is ultimately unneeded reduces the availability of that resource in future periods.

MISO has already made several improvements related to LMRs in recent years, such as enhancing LMR participation in MISO's markets, implementing testing requirements to ensure that LMRs can actually curtail firm load, and improving how LMRs are accredited. MISO has also recently implemented improvements to emergency pricing which is in effect when LMRs are deployed. MISO intends to pursue additional improvements going forward as part of the Reliability Imperative's Market Redefinition workstream.

In sum, trends such as thermal retirements and lower excess reserve margins, increasing reliance on LMRs, and the region's increasing reliance on gas and renewable resources have altered the region's risk profile — meaning the region now faces risks in seasons of the year and hours of the day that did not pose challenges in the past. A key indicator of this is the 41 MaxGen emergencies that MISO has had to declare since the summer of 2016. While the emergency protocols are a legitimate way for MISO to access additional resources, relying on such protocols much more frequently and in non-traditional times are evidence of MISO's changing risk profile.

MaxGen Alerts, Warnings, and Events

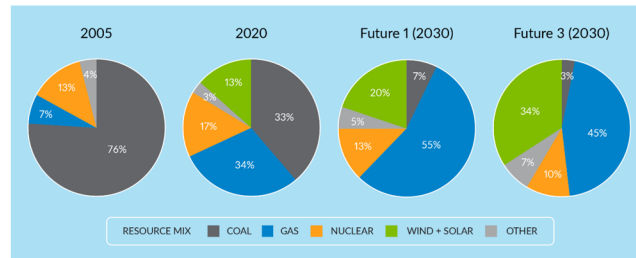




MISO expects reliability risks to increase going forward as the region's resource mix continues to evolve. The figure below shows two scenarios of what the region's resource mix could potentially look like in 2030. These scenarios are based on MISO's forward-looking Futures, which use a range of economic, policy, and technological assumptions to create plausible "bookend" views of what the region's resource mix could look like in 20 years. MISO uses the Futures to inform the development of transmission plans, including those under the Reliability Imperative's Long Range Transmission Planning workstream.

Future 1 is the more "conservative" of these two Futures, as it assumes that state and utility decarbonization/renewable energy goals that are not legislated or otherwise binding are achieved at only 85% of their aspirational targets. Nevertheless, the direction and the magnitude of the continuing fuel-mix changes that are forecast in Future 1 would likely exacerbate the reliability challenges described above. Future 3 pictured above is even more aggressive in terms of forecasted thermal retirements and incorporating additional renewables, so this path would also foster additional reliability challenges. For a detailed look at the reliability challenges that could manifest as additional renewables are incorporated the system, see MISO's [Renewable Integration Impact Assessment](#).

MISO Generation Mix (% of total annual energy by fuel type)



EMERGING RELIABILITY NEEDS

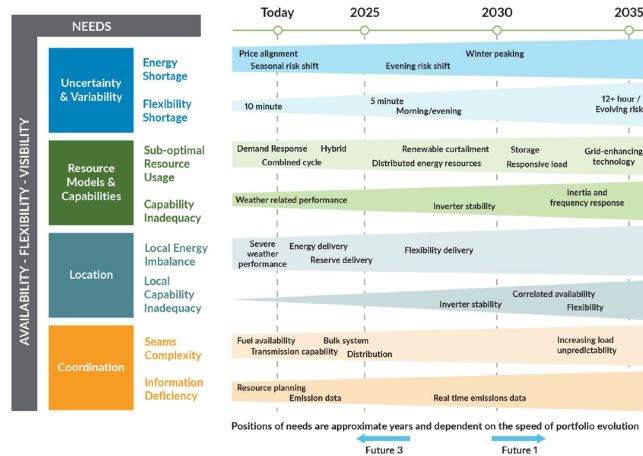
MISO has distilled the system's emerging and shifting reliability needs into four categories: **Uncertainty and Variability** considers new and growing risks, spotlighting energy and flexibility shortages; **Resource Models and Capabilities** considers the optimal use of resources and their inherent capabilities; **Location** examines regional differences and transmission limitations; and **Coordination** explores complexity along the seams (bulk power system and transmission-distribution) and information needs to enhance collaboration and shared visibility.



"We see very little risk of over-building the transmission system; the real risk is in a scenario where we have underbuilt the system. Similarly, across markets and operations, our job is to be prepared."

Clair Moeller, MISO President

Having gathered insights from MISO's modeling, Futures analyses, operational experience, and customer conversations, MISO's 2021 [Markets of the Future report](#) put forward a comprehensive view and sequencing of emerging and shifting needs. The growing risks illustrated in the figure below serve as a guidepost for the Reliability Imperative work, informing priority and pace. Efficient risk mitigation requires a coordinated response from markets, operations, and technology workstreams.



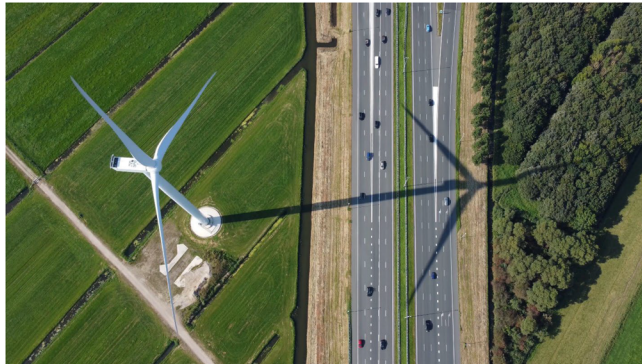
This figure shows future needs by category and estimated timing of emergence or significant shift in need for the region. Detailed descriptions of each need can be found in the [Markets of the Future report](#). Expanding colors are illustrative of relative size of aggregated category risk over time. Future arrows indicate potential shift in timing depending on the pace of change.



MISO Roadmap

Increasing risks and challenges require MISO to act with more urgency. In response, MISO in early 2022 evolved what had been called the Integrated Roadmap into the MISO Roadmap. As illustrated on the following page, the MISO Roadmap lays out MISO's strategic priorities and MISO's view on the path forward to address the urgent challenges we face. It resides on MISO's public website, providing a user-friendly and transparent way for stakeholders to learn about and stay apprised of MISO's strategic priorities. The items on the roadmap will be collaboratively undertaken in the Stakeholder Process, and MISO's attention and resources across those forums will be primarily allocated to those efforts. Where available, the MISO Roadmap links directly to additional detailed materials on MISO's priorities, including the venue, process, and timing for stakeholders to engage in these topics through the formal Stakeholder Process.

[The MISO Roadmap](#) focuses on what MISO considers to be most urgently needed to ensure that we reliably meet members' plans and goals. Currently, the MISO Roadmap is dominated by priorities related to the Reliability Imperative, and the MISO Roadmap will be a living document that is updated as new priorities and challenges emerge and as we get more clarity on the implementation plans of the initiatives.





--- MISO Roadmap ---



The MISO Roadmap is a living document that will be revised as necessary to reflect MISO's strategic priorities and timelines. In addition, for your convenience the document will include links to additional information contained in the MISO Dashboard (previously known as the Issue Tracking Tool). The work to update the Dashboard and links is currently underway, and the functionality will be evolving through the late-February timeframe. We appreciate your patience and understanding as we work to ensure the continued ability to track key work efforts.



CONNECTIONS BETWEEN PRIORITIES AND WORKSTREAMS

MISO's strategic priorities, such as those embodied in the Reliability Imperative's workstreams, are connected and build upon each other. Success in one area depends on progress in another, so efforts must be coordinated and sequenced. For example, achieving reliable and economically efficient grid operations requires both new tools and processes being developed under the Operations of the Future workstream, and market enhancements being developed under the Market Redefinition workstream. Similarly, the ability to interconnect renewable resources may be constrained by the existing transmission system, and is therefore dependent on some of the changes being contemplated in the Long Range Transmission Planning workstream.

By documenting our future vision in this report, and outlining next steps across the four main workstreams, MISO is conducting an important dialogue about how to prioritize different work efforts. As we continue to update this "living" document, we believe the Reliability Imperative will note dependencies and impacts of any future schedule changes. MISO plans to continue the dialogue by updating stakeholder committees regularly on the Reliability Imperative.





Market Redefinition

The transformation of the generation mix increases the complexity of ensuring sufficient resources during the highest risk periods across the year. MISO is addressing this changing risk profile across markets, planning, and future-looking studies. As the generation mix changes, it is important for MISO to provide signals about what will be needed to ensure reliability, and to give the right price incentives when the system is in need. MISO's analysis in the [Markets of the Future report](#) shows that the foundational market constructs in place today will continue to be effective in the future, but only with significant market and operational enhancements and optimizations.

Resource Assessments: In the investment and planning timeframe, MISO is looking to provide information to members about the impact of their individual plans in aggregate. Today, planning is focused on the summer peak hour for the coming year or two. The Resource Adequacy survey that MISO conducts in partnership with the Organization of MISO States (OMS) looks several years ahead, but confidence is lower in the later years. Additionally, the OMS-MISO Survey only focuses on capacity, but increasingly the system will need a forecast of flexibility and other attributes. MISO is developing the ability to provide forward resource assessments and long-term Resource Adequacy reports to better inform future investment and retirement decisions.

- In 2021, MISO published the first iteration of the *Regional Resource Assessment (RRA)* by aggregating publicly announced utility plans and goals to develop an indicative view of regional fleet evolution and model what new reliability needs and gaps may arise.
- Next up: Customer engagement, surveying, and workshops planned for this year aim to improve the accuracy and broaden the application of the next iteration of the RRA. MISO will continue to look for ways to streamline processes for collecting and sharing data for purposes of the RRA and other assessments. Additionally, MISO will explore ways to assess and incorporate severe weather risk into its assessments.

Resource Adequacy Construct: In the planning horizon, MISO is looking to better reflect the changing risk profile and send correct market signals for forward-looking investments. MISO's existing Resource Adequacy Construct was designed for a conventional fleet of resources, where reliability risk was concentrated during the typical summer peak periods. Since the early 2000s, the fleet has moved to more renewable resources that are variable and more uncertain. As the generation mix further diversifies, the "accreditation" process of evaluating each generator's contribution to the system is a key reliability and planning mechanism.

- In late 2021, MISO filed [proposed Resource Adequacy reforms](#) with FERC, which are currently pending review. MISO's proposal includes three primary objectives: (1) to change from the current annual summer-based construct to four distinct seasons, (2) to align thermal resource accreditation with availability in the highest risk periods, and (3) to



require at least 50% of capacity to be secured for each Load Serving Entity prior to the Planning Resource Auction.

- Next up: Accreditation for non-thermal resources will be a focus in the coming year, including wind, solar, battery storage, hybrid generators, and Load Modifying Resources.

Energy Market Pricing and Products: MISO will continue to evaluate the changing risk profile to assess the effectiveness of energy market pricing and products and will explore potential new products and approaches.

- MISO successfully launched the Short-Term Reserve (STR) product in December 2021. This new ancillary service, which is included in both the Day-Ahead and the Real-Time Market, co-optimizes all Energy and Operating Reserves products. The STR product provides reserved and rampable 30-minute capacity, and adds needed flexibility to help manage uncertainty on the system.
- MISO's proposed reforms to emergency pricing and initial reforms to scarcity pricing were accepted by FERC and implemented in 2021. The reforms better align prices during emergencies and tight operating conditions with underlying system risk and provide more effective price signals to help incent resource availability.
- Additionally, MISO increased the Up Ramp Capability requirement by 500 MW to address the trend of increasing operating reserve scarcity by adjusting the 'uncertainty component' that is included in the requirement's formula.
- Next up: Continued evaluation of scarcity pricing reforms, including possible reforms to reserve demand curves, the Value of Lost Load, and the Locational Marginal Pricing price cap. Continued evaluation of dynamic reserve requirements to help manage increasing uncertainty.

Resource Participation Models and Capabilities: Enhancements to MISO's suite of resource participation models are needed to realize the full advantages of increasingly complex resource capabilities. Work to enhance existing products and design new market products is an ongoing Market Redefinition priority.

- In 2021, MISO made enhancements to the Multi-Day Operating Margin forecast that included more granular wind and solar forecast information, emergency capacity forecasts, and sub-regional breakouts (North, Central, South), improving situational awareness for market participants and operators.



- Next up: MISO is working toward a June 2022 implementation date for the new Electric Storage Resource participation model that recognizes the unique characteristics of this resource type. Additionally, MISO will submit its compliance filing to FERC regarding Distributed Energy Resources (DERs) by April 2022. Further, discussion of enabling Storage As Transmission-Only Assets (SATOAs) to provide market services will continue in the Market Subcommittee.

"Meeting the objectives of market redefinition will require a longer-term strategy, improved transparency, and sustained engagement from the MISO stakeholder community."

Richard Doying, MISO EVP Market & Grid Strategy





Long Range Transmission Planning

The ongoing trend of conventional power plants retiring from service as intermittent renewables continue to grow is posing significant challenges to the reliability of the transmission system in the MISO Region. MISO's Long Range Transmission Planning (LRTP) initiative is designed to address these challenges, in concert with other elements of the Reliability Imperative framework.

One focus of LRTP is to improve the transfer capability of the region's transmission system – meaning the system's ability to effectively and efficiently move energy from where it is generated to where it is needed. The need for improved transfer capability is underscored by two major trends that are playing out across the region. The first is that the best sites to build new renewable generation may be located far from existing transmission infrastructure and load centers. The second is that extreme weather events are becoming more frequent and severe in the MISO Region. For example, the [Arctic Weather Event](#) that impacted the MISO Region and other parts of the country in February 2021 showed the crucial need for a robust, "backbone" regional transmission system to move power from where it is generated to where it is needed.

Fortunately, MISO can leverage its large geographic footprint and diversity of resources to ease some of these challenges. One of the keys will be transmission infrastructure that supports these new resources and enhances transfer capability in the region. LRTP is designed to assess the region's future transmission needs in concert with utility and state plans for future generation resources.

Another focus of LRTP relates to maintaining grid stability. The U.S. transmission system is designed to operate at a frequency of 60 hertz. Historically, conventional power plants have played a key role in keeping the grid stable at that level because they have heavy rotating components that are synchronized to spin at the same frequency as the grid. This rotational kinetic energy, or inertia, helps stabilize the grid when a system failure, or contingency, occurs. The new wind, solar, and battery resources that are increasingly being built in the region, however, do not inherently provide rotational inertia in the traditional sense. It is possible for these new resource types to provide the same capabilities, but ensuring that they do will require changes to transmission specifications and compensation mechanisms. More details on how MISO is addressing this and other challenges are available in MISO's [Renewable Integration Impact Assessment \(RIIA\) study](#).



It is important to keep in mind that LRTP does not replace other transmission-planning efforts that have long existed at MISO, such as the annual studies already contained in the MISO Transmission Expansion Plan, or MTEP. LRTP coordinates closely with those efforts, and it is also part of the transparent and cooperative MISO Stakeholder Process. This LRTP effort is most analogous to MISO's previous work on the [Multi-Value Project \(MVP\)](#) portfolio, as both are policy-driven. MISO's Board of Directors approved the 17 projects that comprised the MVP portfolio in 2011.

Futures / Policy Consensus: MISO's LRTP work is driven by changing policy and evolving resource fleet trends discussed earlier in this report. LRTP is grounded in the three robust future scenarios updated over the past year. MISO's LRTP efforts will prioritize meeting the reliability challenges embedded in Future 1, while ensuring that outcomes do not foreclose Futures 2 and 3. Future 1 tries to reflect current MISO member plans across the footprint and various policy objectives of the states. Futures 2 and 3 reflect increasing levels of electrification (e.g., more electric vehicles) and renewables.

LRTP is a comprehensive "transmission roadmap" that will identify and drive investments in transmission projects addressing all needs of the region as the resource fleet continues to evolve. In addition to identifying solutions needed to reliably operate a system with significantly more renewable resources, we are also considering other current challenges. This includes the opportunity to enhance renewable integration in the upper Midwest, as the MVPs have become fully subscribed; addressing import/export limitations in Michigan and other areas; increasing the transfer capability across North and Central MISO and between the Central and South Regions; and other policy and reliability-driven issues.

We expect projects to be approved in tranches, with the first and second tranches focused on the North and Central portions of the footprint, while the third tranche is focused on the South subregion, and the fourth on the North/South subregion interface. The roadmap will be updated as needed to align with evolving resource fleets and business plans, state energy/environmental policies and other dynamic factors that affect the region's transmission needs. As solutions are identified through LRTP, they will be moved into the ongoing MTEP process for final approval by MISO management and Board of Directors. MISO anticipates delivering the first round of suggested LRTP solutions to the Board of Directors in June 2022.

Future 1	Future 2	Future 3
Additions 121 GW	Additions 170 GW	Additions 306 GW
Retirements 77 GW	Retirements 80 GW	Retirements 112 GW
Net Peak Load 136 GW – July	Net Peak Load 148 GW – July	Net Peak Load 164 GW – Jan
CO₂ Emissions 163%* 199 MMT CO ₂	CO₂ Emissions 166%* 189 MMT CO ₂	CO₂ Emissions 161%* 102 MMT CO ₂



Business Case Development: MISO is developing robust business cases for LRTP projects by analyzing multiple benefits relative to the costs and building on the methodologies developed for the 2011 MVP portfolio. The business cases will reflect the need for transmission to ensure reliability of the system, in addition to any economic benefits, given the policy and fleet transition objectives of MISO members and states. This includes helping stakeholders consider both generation and transmission costs and benefits on a holistic basis, including the value of flexibility that transmission provides. Additionally, MISO is looking at how to quantify the resiliency benefits associated with the LRTP portfolio of projects.

Cost Allocation: A key aspect of LRTP will be to ensure that the costs of new transmission projects are allocated fairly. Within the MISO Stakeholder Process, the primary forum for this important work is the [Regional Expansion Criteria and Benefits Working Group \(RECBWG\)](#), which was established to discuss existing or proposed criteria and cost allocation policies for regional and interregional cost-shared transmission projects. OMS has a [working group](#) that focuses specifically on transmission cost allocation issues and has also been engaged in the RECBWG. MISO is committed to continuing to work with its stakeholders on cost-allocation issues in both of these forums.

MISO has put forward a proposal to utilize the MVP methodology in a bifurcated manner that recognizes subregional differences of MISO South and MISO North and Central regions to ensure a roughly commensurate "beneficiaries pay" cost allocation where costs are roughly commensurate with benefits. The MISO proposal also includes commitments for future studies of benefits associated later tranches and to maintain and preserve future options.

"If you love renewables, you'd better love transmission."

John Bear, MISO Chief Executive Officer

Other Planning Efforts: In addition to the significant work specifically associated with the LRTP study and the normal annual MTEP processes, MISO is also engaged in other transmission planning-related efforts. In parallel to the LRTP we have partnered with the Southwest Power Pool (SPP) on a joint targeted study to identify transmission enhancements required to enable the interconnection of low-cost resources along the seam, where the transmission system is currently at its capacity. A cost allocation framework to equitably allocate the cost of the portfolio of projects to both Regional Transmission Organizations is currently under development.



This joint study is an example of the work we have done, and will continue to undertake, to enhance our planning with all of our seams partners. Process improvement work is also internally focused. We are exploring the potential to better integrate the different aspects of our value-based transmission planning process. One example of the results of this work would be the ability to assess the potential market efficiency benefits of Generator Interconnection Projects to factor into the business case.





Operations of the Future

MISO Operations will also be challenged by the different types of resources connecting to the grid including at the residential level, and the increased frequency and severity of extreme weather events that we have experienced in recent years. In addition to implementing lessons-learned from past events, like the 2021 Arctic Event and hurricanes, forward-looking work is underway to ensure that MISO has the people skills, processes, and technology to anticipate and respond to operational opportunities and challenges. This work, termed Operations of the Future, is focused on five large buckets of work: (1) situational awareness, (2) operations preparedness, (3) critical communications, (4) operations planning, and (5) business continuity.

Situational awareness can be improved to turn data into actions. The shift to more weather-dependent, intermittent renewables and distributed resources means that system peaks and operating risks are becoming less predictable and more difficult to manage in day-to-day operations. Today, MISO Operations relies heavily on the expertise of its operators. While operators have access to significant amounts of data (e.g., weather, load), they must manually synthesize data into useable information. This has worked well historically, but as the system changes the solution must envision a future with more complex information and less experienced operators. In the future, MISO Operations needs an integrated toolset for operators that leverages artificial intelligence and machine learning, combined with enhanced data such as Ambient Adjusted Ratings, to provide improved information on system status and capabilities. Techniques to improve how we see and navigate will give operators important information automatically.

Operations preparedness is critical to manage rapidly shifting or challenging operating conditions. Tomorrow's control room will be very different from today's. In the future, system operators will face more rapidly changing system conditions, increased volumes of data, and enhanced technologies and tools. To ensure that control room personnel are ready to manage reliability effectively and efficiently in this new and continually evolving operations environment, MISO is developing improved operations simulations tools and enhancing operator training.





Critical communications will become even more important with the enhanced capabilities and complex operating environment of the future. New control room technologies and capabilities, improved real-time data capabilities, and more complex operating conditions driven by new load and generation patterns will require MISO and its members to communicate even more quickly and efficiently going forward. Enhancements to communications protocols, such as system declarations, are important steps to ensure that MISO and member controls room have the information they need when the need it.

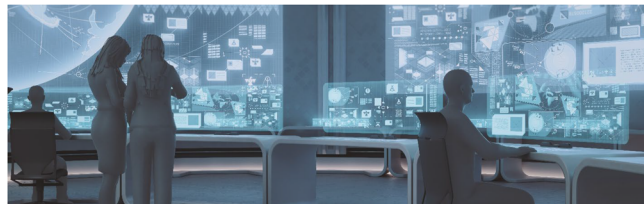
“In the past, predicting load and generation were relatively straight-forward. In the future, the operating environment will be much more variable, and we need the people, processes, and technology to deal with that variability.”

Jennifer Curran, MISO VP System Planning and Chief Compliance Officer

Operations planning enables MISO to remain a step ahead of the shifting energy landscape.

System operators need insights into the future and processes that enable the continued reliable and efficient operation of the bulk electric system. In the future, it will be more important than ever to leverage information in new ways, including aligning operations and planning models and improving outage coordination analysis processing capabilities.

Business continuity capabilities need to evolve to align with the changing technologies, resource portfolio, and threat landscape. Improved tools and updated processes are vital to ensuring that MISO can reliably operate the grid, mitigate risks, and, if necessary, recover quickly in the event of disruptions to toolsets or control centers.





Market System Enhancements

MISO's ability to respond to the Reliability Imperative is enabled through continued market system enhancements and modeling refinements. Current systems and technology are not capable of meeting many of the new, reliability-driven market improvements and fully leveraging new resources such as Storage and Distributed Energy Resources. The Market System Enhancement (MSE) Program was initiated in 2017 to transform our current market platform into a more flexible and secure system that will better accommodate the region's evolving portfolio and technology changes while helping to ensure security and reliability for the electricity grid of the future.

The program remains focused on building and launching new systems with improved performance, security, and architectural modularity, which enhances our ability to deliver new market products more quickly and efficiently. In 2021, the program implemented several external-facing products. These products included Model Manager Phase 1, which transforms how we model the electrical system; the Market User Interface, which updated our interface for stakeholders to participate in the market; and a Short-Term Reserve market product, which is an additional Ancillary Services Market product that improves the procurement and market signals for flexible energy resources for meeting customer demand.

"MISO's Market System Enhancement Program is transforming our technology, processes, and people skills to enable faster adoption of new technologies into the market and better accommodate the region's rapidly changing resource mix to ensure reliable and efficient operations for our customers."

Todd Ramey, MISO VP and Chief Digital Officer





Building on the MSE Program's progress, flexible design, data analytics, and model management will help MISO to meet the Reliability Imperative. In contrast to the current technology, the future market platform will integrate technology and systems to better utilize data. Modern architecture means systems that provide flexibility for the evolving needs of the business. These enhancements will support and facilitate the ongoing transformation across the various workstreams of the Reliability Imperative, including Market Redefinition and Operations of the Future.





The Opportunity: Capturing the Value

As described in this paper, MISO sees the challenges of the changing resource fleet. We are facing a Reliability Imperative to prepare for the future, and MISO is hard at work on a number of key planning, operational and systems efforts.

The fleet change represents not just challenges, but also enormous opportunities for MISO to enable members, states, regulators, and consumers to meet their objectives reliably and affordably.

By listening and taking a system-wide view, MISO can help ensure that all stakeholders have the information they need to make informed decisions about their resources.

By helping forward planning, MISO will help members to develop generation and transmission portfolios that maintain system reliability without over-investing. As member portfolios materialize, MISO markets and operations will optimize the delivery of energy across the footprint. In addition, MISO will continue coordinating with our neighboring seams partners.

MISO has delivered substantial value to its members since its creation, as demonstrated by the annual Value Proposition calculation. Going forward, additional sources of value will emerge through the sharing of attributes across the region's diverse resource fleets. MISO is developing calculations for these new sources of value in an evolved, future-looking Value Proposition. Given changes to fleet, grid, markets, and operations, it is more important than ever that the MISO Region work together so that each member continues to realize the substantial benefits of our regional structure.

"MISO has the opportunity to help its States and Members reach their own policy goals in the most cost-effective way while also ensuring the reliable delivery of electricity to end-use customers."

Wayne Schug, MISO VP Strategy & Business Development



Working Together to Address the Reliability Imperative

This is a report written from MISO's perspective. However, the Reliability Imperative is not MISO's alone. The resource mix in the MISO Region has evolved significantly and will shift further as many members evolve their fleets to meet decarbonization goals. The Reliability Imperative work is required to ensure the grid can continue to be operated reliably as those increasingly diverse member plans are implemented.

The work of the Reliability Imperative is focused on changes to MISO markets, operations, technical systems, and the grid to address the reliability risks resulting from the increasing pace of renewable integration and the increased frequency and severity of extreme weather events. And as an independent, FERC-approved system operator, MISO is responsible for the reliability of the Bulk Electric System and has the obligation to act. This work isn't performed in isolation, however. MISO engages with a broad range of stakeholders to share ideas and discuss potential solutions, including receiving input from industry trade groups, consultants, and other entities with insights into the challenges that are facing our region.

The Reliability Imperative work also involves robust, collaborative dialogue across the many forums within the Stakeholder Process. The collaboration that takes place in these forums has provided valuable policy and technical-related feedback, and MISO is committed to continuing that engagement. The MISO Roadmap, launched in January 2022, captures the strategic work needed across MISO's functions and processes to ensure preparedness for the future. The MISO Roadmap is currently organized according to the Reliability Imperative areas of focus. It will be updated as necessary, and we welcome continued stakeholder input on the process and the items MISO should prioritize.





MISO also recognizes that some action will fall outside of MISO's scope and role. For example, MISO's [report on the February 2021 Arctic Event](#) pointed out the need for improved weatherization of resources, which impacts MISO, but the responsive actions fall outside of our direct responsibility. In line with those findings, [FERC and the North American Electric Reliability Corporation \(NERC\) recently released their own findings](#) on that event and have proposed multiple changes to the way that resources prepare for and communicate about their weatherization. As a directly impacted party, MISO has and will continue to engage the industry in these weatherization practices and appreciates FERC's and NERC's recent actions.

An additional method of engagement that is extremely critical to MISO's near-term and longer-term planning is through the information gathering tools that MISO administers. This includes participation in MISO's annual [Generator Winterization Survey](#), as well as an ad-hoc survey related to the emerging risk related to coal supply. It also includes our work to aggregate member plans in the Regional Resource Assessment. Working together across all of these potential points of collaboration will best position the region to successfully and efficiently respond to the Reliability Imperative.





A Message from Clair Moeller, President

We need to get to the future before the future gets to us.

We need to move quickly to adapt our markets, planning processes, and operational protocols so grid reliability is not impaired by the changes that are fundamentally transforming our electrical system.

We've made some great progress since the initial version of this report in late 2020. For example, we've proposed revisions to our Resource Adequacy Construct that we think will mitigate some of the challenges we're increasingly experiencing due to factors such as fleet change and extreme weather events. We're seeking to revise certain processes in order to better incentivize resources with needed capabilities and attributes to be available when they are most needed. And through our Long Range Transmission Planning efforts, we're identifying transmission solutions that will enable members and states to achieve their policy objectives — many of which seek to increase renewables and/or reduce carbon emissions.



None of this work is easy. In fact, it's often stressful for our stakeholders, as well as for MISO. But it's necessary work. Factors such as changing customer preferences, shifting economics, technological advancements, and increased severity and frequency of extreme weather events are creating a host of new and urgent challenges that we must address to maintain system reliability. These challenges are not anyone's "fault" — but they are everyone's problem. That's why responding to the Reliability Imperative is a responsibility that's shared by MISO, our members, and the states.

We know that not everyone will support every view, recommendation, and initiative that MISO lays out in the Reliability Imperative — and that's OK. MISO welcomes stakeholder feedback on the proposals described in these pages, and if stakeholders have different ideas altogether, we want to hear them. Will we agree on everything? No. But that should not — and must not — stop us from working together to meet the obligations of the Reliability Imperative.

The time to act is now and we must continue to bring our "A" game — the industry is changing, and MISO members are poised to drive exciting, necessary changes over the coming years. Given the regional Reliability Imperative, the MISO community must act quickly and deliberately to ensure that the planning, markets, operations, and systems keep pace with our members' plans.

Let's get to work,



Acronyms Used in this Report

DER: Distributed Energy Resource
FERC: Federal Energy Regulatory Commission
LMR: Load Modifying Resource
LRTP: Long Range Transmission Planning
MISO: Midcontinent Independent System Operator
MSE: Market System Enhancement
MTEP: MISO Transmission Expansion Plan
MVP: Multi-Value Project
NERC: North American Electric Reliability Corporation
OMS: Organization of MISO States
RAN: Resource Availability and Need
RECBWG: Regional Expansion Criteria and Benefits Working Group
RIIA: Renewable Integration Impact Assessment
RRA: Regional Resource Assessment
SATO: Storage As Transmission-Only Asset
SPP: Southwest Power Pool
STR: Short-Term Reserve

Senator HIRONO. Thank you very much, Ms. Fedorchak.

Before I call on Mr. Bissell, I want to say that I was Lieutenant Governor of the State of Hawaii when the Kauai Co-Op first began, and pretty much nobody gave the co-op a chance to succeed. It is a real success story that the users on Kauai are able to have reliable alternative energy sources. So it is, as I said, a real success story.

So please, Mr. Bissell, go ahead.

OPENING STATEMENT OF DAVID BISSELL, PRESIDENT AND CHIEF EXECUTIVE OFFICER, KAUAI ISLAND UTILITY COOPERATIVE

Mr. BISSELL. Thank you and Aloha, Chair Hirono.

Senator HIRONO. Aloha.

Mr. BISSELL. Ranking Member Hoeven and members of the Energy Subcommittee, my name is David Bissell, and I am President and CEO of Kauai Island Utility Cooperative. KIUC, as we are known as, is located on Kauai and it is the smallest and least populated island of Hawaii's four major islands. We provide electricity to 70,000 residents, 20,000 visitors, and 5,000 businesses on a fully isolated grid. Hawaii has established a rigorous Renewable Portfolio Standard, known as an RPS, and according to the RPS, by 2045, 100 percent of a utility's electric sales must be based on eligible renewable energy technologies. Kauai's utility was investor-owned until 2002, when a group of local businessmen formed KIUC as a cooperative and acquired the utility. At that time, Kauai's electric rates were, by far, the highest in the state—more than 70 percent higher than the rates on Oahu, and were likely the highest electric rates in the nation. This was a function of having a grid more than 90 percent reliant on imported oil. KIUC's first elected Board of Directors immediately committed to transitioning as quickly as possible from oil to renewables. Back in the early 2000s, this was driven primarily by economics, although the environmental benefits were equally compelling.

In 2008, the KIUC Board set a goal of reaching 50 percent renewable by 2023. At that time, viable renewable energy options were hydro, biomass, and waste energy. Solar was considered too expensive to pursue at the time. However, within six years, solar technology became much more affordable, with declining equipment pricing and the federal investment tax credit. By 2016, a biomass plant and several utility-scale solar projects had been commissioned, bringing us to 40 percent renewable. Since then, strategic partnerships with both Tesla and AES have resulted in the addition of three large-scale solar-plus-storage projects, the first of their kind anywhere in the world when they were commissioned. We reached our goal of 50 percent renewable four years early in 2019 and achieved 70 percent renewable this year. It is notable that KIUC has led the State of Hawaii in both renewables and reliability for the past three years.

The environmental benefits of our transition to 70 percent renewable are easy to measure, and significantly reduce greenhouse gas emissions. The transition has also greatly benefited our members financially. Since early 2021, when oil prices started spiking, rates for KIUC members have increased roughly 10 percent. This is pri-

marily due to our bringing on renewables via competitive pricing, and it has compared us favorably to the other islands whose rates have gone up by 35 to 50 percent in that same time period. And we are very proud to say for the past three months, we have reached a major milestone: for the first time in our history, KIUC posted the lowest electric rates in the State of Hawaii.

I would like to emphasize how important federal incentives have been to our success. The investment tax credit has indirectly benefited our members through lower rates and purchase power agreements. With inflation and supply chain issues impacting renewable project costs throughout the country, we strongly encourage an extension of the credits at the original 30 percent and adding a direct-pay with a delay in further phaseout until at least 2030. Alternatively, extending the completion of the construction timeline required from the end of 2025 to 2030 could at least allow existing projects to receive the credits that were in place when the projects were started.

As a not-for-profit cooperative, we also support the direct-pay option for not-for-profits to be able to receive the same level of tax incentive as for-profit, investor-owned utilities and developers. Currently, we have to use varied, complex project structures or have for-profit entities build and own our renewable projects to receive these essential tax credits and benefits. A direct-pay option for not-for-profit cooperatives would likely lower costs for our members from the same level of federal tax incentives.

Cost of capital is another key cost item for a utility. We are able to borrow from RUS, but one problem from borrowing from RUS is it is prohibitively expensive to refinance with the RUS when interest rates decline. We support the Flexible Financing Rate for Rural America Act of 2021, which would allow us to take advantage of rates when they go down. Thank you to Senators Hirono, Hoeven, and other Senators serving on the Committee for co-sponsoring this measure.

We believe KIUC has demonstrated that high-penetration renewables can be cost-effectively integrated into an electric grid without associated reliability issues. We have been fortunate to have many great partners on our renewable energy journey. We appreciate the federal incentives we received and hope we can continue to receive your support as we move toward 100 percent renewable Kauai. Thank you again to Senator Hirono for making it possible for us to testify today. Thank you for your attention. I will be happy to answer questions afterwards.

[The prepared statement of Mr. Bissell follows:]

**Testimony of David J. Bissell
President and Chief Executive Officer
Kaua'i Island Utility Cooperative
Before the Senate Committee on Energy & Natural Resources
Subcommittee on Energy
July 13, 2022**

Aloha Chair Hirono, Ranking Member Hoeven and members of the Energy Subcommittee.

My name is David Bissell. I'm the President and CEO of Kaua'i Island Utility Cooperative. KIUC is located on Kaua'i, the smallest and least populated of Hawai'i's four main islands. We provide electricity to 70,000 residents, 20,000 visitors, and 5,000 businesses on a fully isolated grid.

Hawai'i has established a rigorous Renewable Portfolio Standard (RPS). According to the RPS, by 2045, 100 percent of a utility's electricity sales must be based on eligible renewable energy technologies.

Kaua'i's utility was investor-owned until 2002, when a group of local businessmen formed KIUC as a cooperative and acquired the utility. At that time, Kaua'i's electric rates were by far the highest in the state, more than 70 percent higher than rates on O'ahu, and were likely the highest electricity rates in the nation. This was a function of having a grid more than 90 percent reliant on imported oil.

KIUC's first elected Board of Directors immediately committed to transitioning as quickly as possible from oil to renewables. Back in the early 2000's this was driven primarily by economics, although the environmental benefits were equally compelling.

In 2008, the KIUC Board set a goal of reaching 50 percent renewable by 2023. At the time, viable renewable energy options were hydro, biomass and waste to energy. Solar was considered too expensive to pursue at the time. However, within six years solar technology became much more affordable with declining equipment pricing and the federal investment tax credit. By 2016, a biomass plant and several utility-scale solar projects had been commissioned, bringing us to 40 percent renewable.

Since then, strategic partnerships with both Tesla and AES have resulted in the addition of three large-scale solar-plus-storage projects, the first of their kind anywhere in the world when they were commissioned. We reached our goal of 50 percent renewable four years early in 2019, and achieved 70 percent renewable last year.

Figure 1 below illustrates the growth in various types of renewables since 2010.

It is notable that KIUC has led the State of Hawai'i in both renewables and reliability for the past three years.

The environmental benefits of our transition to 70 percent renewable are easy to measure in significantly reduced greenhouse gas emissions. The transition has also greatly benefited our members financially. Since early 2021 when oil prices started spiking, rates for KIUC members have increased roughly 10 percent. That's compared to increases of between 35 and 45 percent for all of the other

Hawaiian Islands. This is primarily due to bringing on renewables via competitively-priced, long-term power purchase agreements to replace oil, with its associated price volatility.

Figure 2 shows monthly year-over-year increases in residential electrical rates for the six Hawaiian Islands serviced by KIUC (Kaua'i) and Hawaiian Electric Industries (O'ahu, Maui, Lāna'i Moloka'i, and Hawai'i), from July 2021 to July 2022.

For the past three months, we've reached a major milestone: for the first time in its history, KIUC posted the lowest electric rates in the State of Hawai'i. A trend of rate stabilization correlating to an increase in renewables on KIUC's system is depicted in **Figure 3**.

I'd like to emphasize how important federal incentives have been to our success. The investment tax credit has indirectly benefited our members through lower rates and purchase power agreements. With inflation and supply chain issues impacting renewable project cost throughout the country we strongly encourage an extension of the credits at the original 30 percent and adding direct pay, with a delay in further phase out until at least 2030. Alternatively, extending the completion of the construction timeline requirement from the end of 2025 to 2030 could at least allow existing projects to receive the credits that were in place when the projects were started.

As a not-for-profit cooperative we also support the direct pay option for not-for-profits to be able to receive the same level of tax incentive as for-profit investor owned utilities and developers. Currently, we have to use very complex project structures, or have for-profit entities build and own our renewable projects to receive essential tax credits. A direct pay option for not-for-profit cooperatives could likely lower costs for our members from the same levels of federal tax incentives.

Cost of capital is another key cost item for a utility. Cooperatives are eligible to borrow from Rural Utility Services (RUS). One problem with RUS borrowing is that it is prohibitively expensive to refinance with RUS when interest rates decline. We support the Flexible Financing for Rural America Act of 2021, which would allow cooperatives to refinance our loans when rates are lower. I would like to express my appreciation that Senators Hirono, Hoeven and other Senators serving on the Energy and Natural Resources Committee have cosponsored this measure.

We believe KIUC has demonstrated that high penetration renewables can be cost effectively integrated into an electric grid without associated reliability issues. We have been fortunate to have many great partners on our renewable energy journey. We appreciate the federal incentives we have received to date and hope that we can continue to receive your support as we move towards a 100% renewable Kaua'i.

I'd like to thank Senator Hirono for making it possible to testify today. Thank you for your attention, and I'll be happy to answer any questions you may have.

Figure 1:

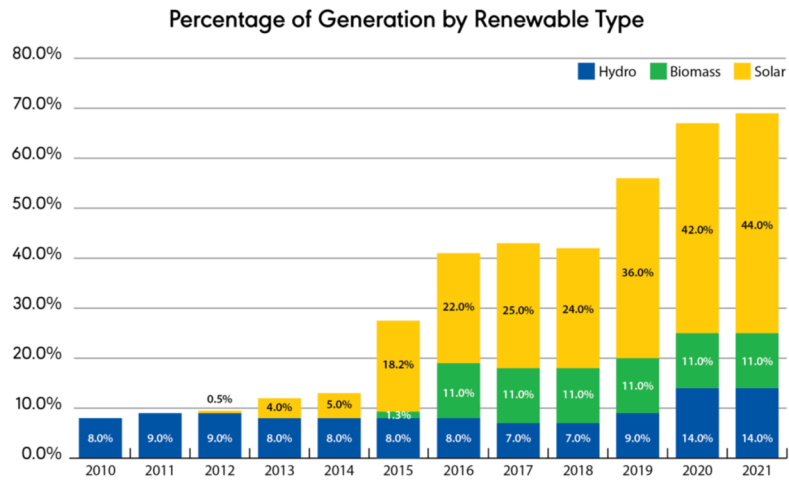


Figure 2:

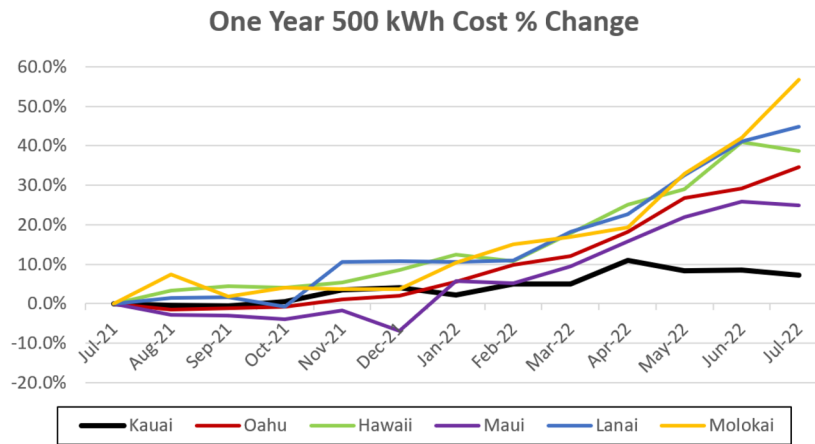
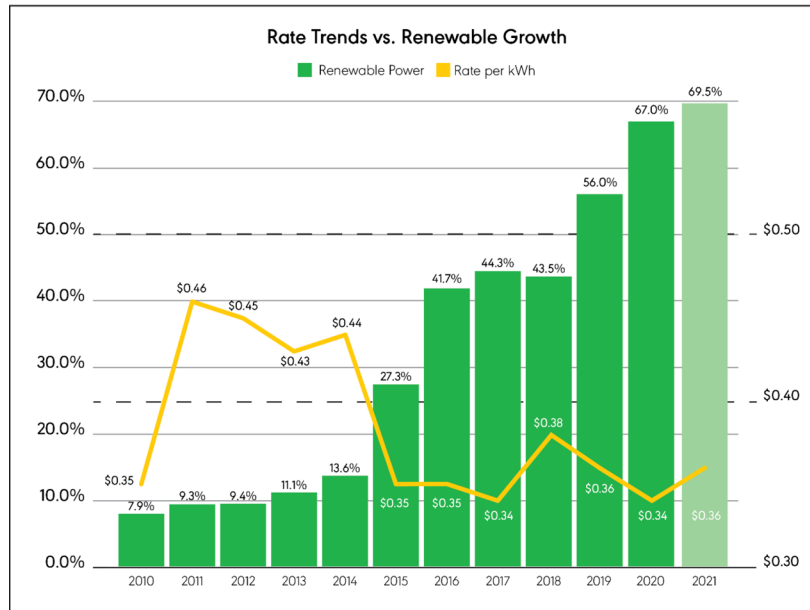


Figure 3:



Senator HIRONO. Thank you very much, Mr. Bissell.
Mr. Larsen.

**OPENING STATEMENT OF JOHN LARSEN,
PARTNER, RHODIUM GROUP**

Mr. LARSEN. Thank you, Chair Hirono, Ranking Member Hoeven, and members of the Subcommittee for inviting me to speak today. My name is John Larsen. I am a partner at Rhodium Group, an independent research firm whose research informs decision-makers in the public, private, and philanthropic sectors. I lead Rhodium Group's U.S. energy systems research, where we focus on analyzing clean energy policy, emerging clean technologies, and market trends. I am also a non-resident senior associate in the Energy Security and Climate Change program at the Center for Strategic and International Studies.

I appreciate the opportunity to speak with you today about options for lowering energy costs for consumers. Along with historically high inflation for most goods and services, household energy costs have risen substantially this year. Rhodium Group estimates national average household costs for both home energy and transportation, together, will be approximately \$5,100 this year, on average, per household. That is a 23 percent increase compared to 2020 during the height of the pandemic, and it has been primarily caused by the rapid rise in fossil fuel prices over the past 6 to 12 months. That is especially the case for petroleum products such as gasoline, diesel fuel, and heating oil, which have seen monthly average year-on-year increases of 34, 48, and 60 percent, respectively, over the past 12 months.

While total household energy costs are currently elevated, they are roughly in line with average costs over the last 40 years. Why are households encountering historically average energy costs in the face of rapidly increasing fuel prices? It is actually a testament to American policy and market developments that have steadily reduced the exposure of households to energy price shocks, and made such shocks incrementally more manageable over time. These developments include the increasing efficiency of American vehicles, buildings, appliances and devices, electric power market competition, the shale boom, and relatively recently, the shift toward cheap renewable energy sources such as wind and solar that have no fuel costs, unlike fossil fuels. Looking back over the past 40 years, the proportion of household energy cost to disposable income, often referred to as energy burden, steadily has declined from eight percent in 1982 to three percent in 2020. With recent price elevations, households, on average, are back to spending four percent of their disposable income on energy costs. Things would currently be much worse for consumers if homes, appliances, and vehicles had seen no energy efficiency improvements over the past 40 years and in turn, were even more exposed to volatile energy prices.

Looking forward, new, forthcoming estimates from Rhodium Group, as part of our annual projections of U.S. energy and emissions trends, show that household energy costs will slowly decline back to near-2020 levels, but it will take at least seven years to do so. The trend reflects renewable energy deployment, increasing efficiency of energy consumption, increases in conventional energy pro-

duction, and diversification away from the most volatile fossil fuels, such as a gasoline, towards alternative-fueled vehicles. While this is good news, it is not necessarily a cause for celebration. High energy cost on households adds to the massive financial burden and challenges that Americans are already facing due to inflation. The 50 million low-income households in the U.S. face energy burdens that are, on average, three times higher than that of non low-income households, and these same households are also more vulnerable to price spikes.

Congress can do more now to accelerate energy cost reductions for American households above and beyond what current policy and markets will deliver, and they can do so while also contributing to tackling the challenge of climate change. The Clean Energy Tax Credit package and other clean energy investments outlined in Senate legislative text in December can serve as a strong foundation for cutting energy costs further and faster than market trends alone. Federal incentives and investments can cut energy waste from buildings, diversify energy demand from light duty vehicles, and will have a meaningfully positive impact on household finances. Clean electric tax credits can expand the amount of electricity that comes from fuel-free, zero-price-volatility resources like wind and solar. Carbon capture tax credits, and clean manufacturing investment programs can improve the environmental performance of energy producers in factories. Tax credits for clean fuels and clean hydrogen can diversify America's fuel mix beyond petroleum and build on the Infrastructure Investment and Jobs Act's historic investments in scaling up these new technologies.

Previous Rhodium analysis found that legislation like that under consideration in the Senate, coupled with new policy actions taken by executive agencies and states, can cut household energy costs by 12 to 14 percent, on average, in 2030, relative to a forecast where no new action happens, and all this while putting U.S. climate targets within reach. Importantly, most of these savings come from lower gasoline expenditures—a fuel with some of the highest price volatility and vulnerability to global supply disruptions. These benefits do not come at the expense of the oil and gas industry, as we found that petroleum production would be roughly unchanged compared to current policy in 2030, and natural gas would increase from today's levels, enhancing America's energy security. Families in the U.S are feeling the heat from elevated energy costs. Congress has concrete legislative options before it that can make a real difference in cutting these costs and reducing exposure to future price shocks.

Thank you again for the opportunity to testify today. I look forward to your questions about our research and our findings.

[The prepared statement of Mr. Larsen follows:]



July 13, 2022

Statement of John Larsen
Partner, Rhodium Group

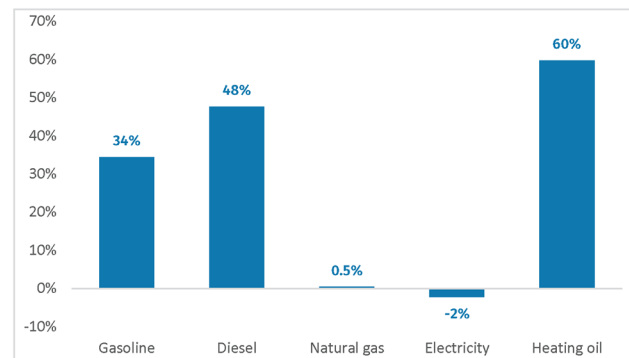
Presented to: Senate Energy and Natural Resources Committee Subcommittee on Energy hearing on
“Pathways to Lower Energy Prices”

Thank you Chair Hirono, Ranking Member Hoeven, and members of the Subcommittee for inviting me to speak today. My name is John Larsen, and I am a partner at Rhodium Group, an independent research firm whose research informs decision-makers in the public, private, and philanthropic sectors. I lead Rhodium Group's US energy systems research, where we focus on analyzing clean energy policy, emerging clean technologies and market trends. I am also a non-resident senior associate in the energy security and climate change program at the Center for Strategic and International Studies.

I appreciate the opportunity to speak with you today about options for lowering energy costs for consumers. Along with historically high inflation for most goods and services, household energy costs have risen substantially this year. Rhodium Group estimates that national average household costs for home energy and transportation will be approximately \$5,100 this year. That's a 23% increase compared to 2020 during the height of the pandemic, and it's been primarily caused by the rapid rise in fossil fuel prices over the past 6 to 12 months. This is especially the case for petroleum products such as gasoline, diesel fuel and heating oil, which have increased by 34%, 48%, and 60%, respectively on a national average basis over the past 12 months (Figure 1).

Figure 1. Change in Household Energy Prices for Select Fuels

Year-on-year percent change from 2021 to 2022

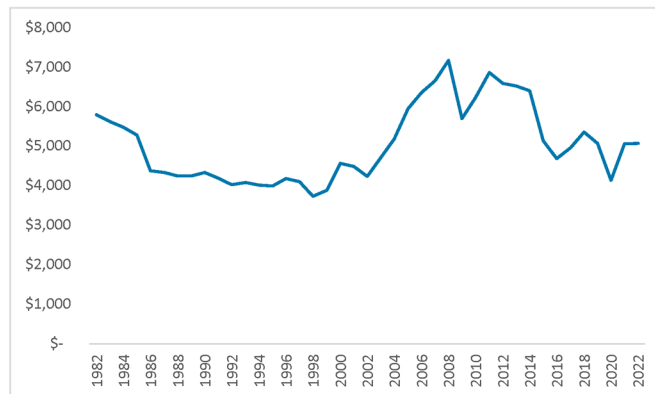


Source: Energy Information Administration and Rhodium Group analysis. Note: Values reflect the change in estimates for June 2022 prices relative to actual June 2021 prices for households.

While total household energy costs are currently elevated, they are actually roughly in line with average costs over the last 40 years (Figure 2). Why are households encountering historically average energy costs in the face of rapid increases in fuel prices? It's a testament to American policy and market developments that have steadily reduced the exposure of households to energy price shocks and made such shocks incrementally more manageable. These developments include the increasing efficiency of American vehicles, buildings, appliances, and devices, electric power market competition, the shale boom, and a relatively recent shift towards cheap renewable energy sources that have no fuel cost, unlike fossil fuels. Looking back over the past 40 years, the proportion of household energy costs to total disposable income, often referred to as energy burden steadily declined from 8% in 1982, to 3% in 2020. With recent price elevations, households on average are back to spending 4% of their disposable income on energy costs (Figure 3). Things would currently be much worse for consumers if homes, appliances, and vehicles had seen no energy efficiency improvements over the last 40 years and in turn were even more exposed to volatile energy prices.

Figure 2. National Average Annual Household Energy Costs, 1982-2022

2021 dollars

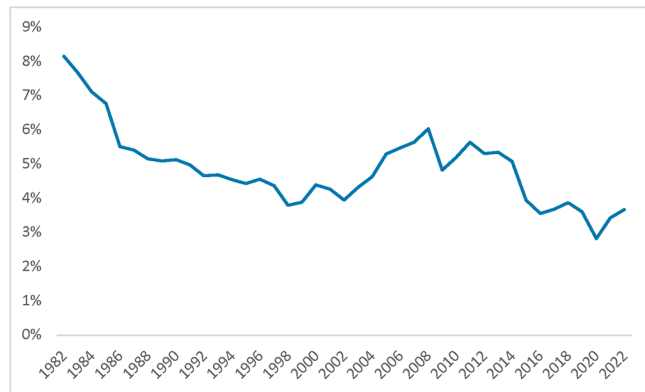


Source: Rhodium Group analysis of Census, Bureau of Economic Analysis and Energy Information Administration data. Note: Costs include expenditures for residential home energy consumption and road transportation. 2022 values are estimates.

Looking forward, new forthcoming estimates from Rhodium Group as part of our annual projections of US energy and emissions trends show that household energy costs will slowly decline back to near 2020 levels, but it will take at least seven years to do so. The trend reflects renewable energy deployment, increasingly efficient energy consumption, increases in conventional energy production, and diversification away from the most volatile fossil fuels such as gasoline towards electric vehicles. While this is good news, it is not necessarily a cause for celebration. Higher energy costs on households add to the massive financial challenges that Americans are currently facing due to inflation. The 50 million low-income households in the US face energy burdens that are three times higher than that of non-low-income households.¹ These same households are also more vulnerable to price spikes.

¹ (Department of Energy Office of Energy Efficiency and Renewable Energy, Low-income Community Energy Solutions. <https://www.energy.gov/eere/slsc/low-income-community-energy-solutions>)

Figure 3. Household Energy Costs as a Share of Disposable Income (Energy Burden), 1982-2022
Percent share



Source: Rhodium Group analysis of Census, Bureau of Economic Analysis and Energy Information Administration data. Note: Costs include expenditures for residential home energy consumption and road transportation. 2022 values are estimates.

Congress can do more now to accelerate energy cost reductions for American households above and beyond what current policy and markets will deliver. And they can do so while also contributing to tackling the challenge of climate change. The clean energy tax credit package and other clean energy investments outlined in Senate [legislative text](#) in December² can serve as a strong foundation for cutting energy costs further and faster than market trends alone. Federal incentives and investments can cut energy waste from buildings, diversify energy demand from light-duty vehicles, and will have a meaningfully positive impact on household finances. Clean electricity tax credits can expand the amount of electricity that comes from fuel-free, zero-price volatility resources like wind and solar.³ Carbon capture tax credits can improve the environmental performance of energy producers and manufacturers.⁴ Tax credits for clean fuels and clean hydrogen can diversify America's fuel mix beyond petroleum and build on the Infrastructure Investment and Jobs Act's historic investments in scaling up these new technologies. Previous Rhodium analysis found that legislation like that under consideration in the Senate, coupled with new policy actions taken by executive agencies and states, can cut household energy costs by 12-14% on average in 2030 relative to current policy while also putting US climate targets within reach.⁵ Importantly, most of these savings come from lower gasoline expenditures—a fuel with some of the highest price volatility and vulnerability to global supply disruptions. These benefits do not come at the expense of the oil and gas industry. We found that petroleum

² (Senate Democrats, Senate Committee CBO Scores for Build Back Better, 2022.

<https://www.democrats.senate.gov/senate-committee-cbo-scores-for-build-back-better>)

³ (Larsen, King, Kolus, Dasari and Herndon, Pathways to Build Back Better: Maximizing Clean Energy Tax Credits, 2021. <https://rhg.com/research/build-back-better-clean-energy-tax-credits/>)

⁴ (Larsen, King, Hiltbrand and Herndon, Capturing the Moment: Carbon Capture in the American Jobs Plan, 2021. <https://rhg.com/research/carbon-capture-american-jobs-plan/>)

⁵ (Larsen, et al. Pathways to Paris: A Policy Assessment of the 2030 US Climate Target, 2021. <https://rhg.com/research/us-climate-policy-2030/>.)

production would be roughly unchanged compared to current policy in 2030 and natural gas would increase from today's levels, enhancing America's energy security.

Families in the US are feeling the heat from elevated energy costs. Congress has concrete legislative options before it that can make a real difference in cutting these costs and reducing exposure to future price shocks. Thank you again for the opportunity to testify today. I look forward to your questions about our research and findings.

Senator HIRONO. Thank you, Mr. Larsen.
Mr. Ness.

**OPENING STATEMENT OF RON NESS,
PRESIDENT, NORTH DAKOTA PETROLEUM COUNCIL**

Mr. NESS. Chair Hirono, Ranking Member Hoeven, and members of the Subcommittee, thank you for inviting me to testify today. As President of the North Dakota Petroleum Council, I am proud of the contribution our operators have made to our domestic energy industry, and I look forward to discussing how our full potential can be unleashed.

As global demand for energy has returned post-COVID, worldwide oil production has failed to keep pace, leading to a substantial rise in energy costs, and severely impacting Americans as they fill their tanks. We, as an industry, want to work collaboratively with Congress and the Administration to address this current energy crisis. Together, we can focus on serious solutions that will increase American production and lower our energy prices. Increasing American oil and natural gas production will help reduce prices, but it does not occur with a flip of the switch. Industry faces numerous hurdles to increasing production, including access to new leases, permits, and easements on federal lands, burdensome regulations, difficulty in building infrastructure, finding workers, and access to new capital investment. In the past 15 months, we have seen an onslaught of new proposed regulations that will make it difficult and costly to grow production.

But one of the biggest obstacles our industry faces is attracting capital investment to maintain, stimulate, and expand exploration and production. In the Bakken, we need \$20 million per day of investment to substantially grow production. Investor hesitancy is being driven by the rhetoric that it is time for our country to leave fossil fuels behind. The power of the bully pulpit is real and the words of our leaders matter. If government leaders say they are doing everything in their power to end an industry, a strong market signal is sent that that industry might not be a sound investment. This could all change tomorrow if the President and Congress change their message to the American people, bankers, investors, and workers that we need American oil and natural gas and that our industry has their support. They could instruct federal agencies to do everything within the law to encourage and facilitate production. Energy security is national security, and we must not lose sight of that. Russia has weaponized their position as one of the top oil and gas producers in the world, as they supply our enemies and hold our allies hostage. We must maximize our production, not only to supply our domestic needs, but also assist our allies.

The perfection of horizontal drilling and hydraulic fracturing paved the way for the oil shale boom in the United States. The next step can be to support innovation and technology to reduce emissions from all energy sources. North Dakota Governor Doug Burgum and our legislature have been encouraging innovation, not regulation, as a pathway to cleaner energy, and we work in partnership with the state to achieve this goal. The State of North Dakota has also set up the Clean Sustainable Energy Authority to re-

invest oil production tax revenues to achieve these goals. Our technology is constantly improving. Our horizontal wellbores are getting longer—now three miles instead of two—and our surface footprint and wellsite emissions continue to decrease. If we want to ramp-up production, looking at ways to streamline regulations and permitting is an important place to start.

As Senator Hoeven mentioned, we were at about 1.5 million barrels a day in 2020. Today, we are a little over 1.1 million barrels a day. So that is 400,000 barrels a day of the gap alone that our country is missing. The American Petroleum Institute recently published a ten-point policy plan to restore U.S. energy leadership and fuel economic recovery. We urge lawmakers to seriously consider these policies they can act on now. To grow energy production and reduce energy supply disruptions, we need more pipeline and refining capacity across the country. It has become extremely difficult, costly, and time consuming to build pipelines, and almost impossible to build new refineries. This must change. We need our regulatory certainty to build the infrastructure necessary to transport and refine our products.

If we want affordable and reliable energy, it is up to America to produce it. The good news is, we know we have significant resources left to extract, specifically in the Bakken in North Dakota, as well as the other unconventional shale plays across the country. With the right policies in place, our domestic oil and gas producers can increase production and contribute to lowering energy prices. We need energy champions. We need our leaders to stand up and say they are willing to partner with our industry to support our efforts in a clear path for us to do what we do best—produce American oil and natural gas. This is not a time to wind down or move away from our industry, it is a time to invest in it and build it up as an America-First solution. We stand ready to work with our Senators to move forward in solving these issues I outlined in lowering energy prices for everyone.

I invite you to North Dakota to see firsthand how energy production can work in harmony with our shared environmental goals. Thank you, Chairman Hirono. I would be happy to answer any questions.

[The prepared statement of Mr. Ness follows:]

**Testimony of Ron Ness
President
North Dakota Petroleum Council**

**Before the Senate Committee on Energy and Natural Resources'
Subcommittee on Energy**

“Pathways to Lower Energy Prices”

July 13, 2022

Introduction

Chair Hirono, Ranking Member Hoeven, and members of the Subcommittee, thank you for inviting me to testify today on pathways to lower energy prices. As President of the North Dakota Petroleum Council (NDPC), I am proud of the many contributions our North Dakota oil and natural gas producers have made to our domestic energy industry and look forward to discussing how our full potential can be unleashed.

Established in 1952, the NDPC is a trade association that represents more than 600 companies involved in all aspects of the oil and natural gas industry, including oil and natural gas production, refining, pipeline, transportation, mineral leasing, consulting, legal work, and oil field service activities in North Dakota, South Dakota, and the Rocky Mountain Region.

Energy Prices

All Americans, including North Dakotans, are feeling the impacts of rising energy prices. With an inflation rate at its highest level since the 1980s, grocery prices up more than ten percent, and gas prices at record highs, we must work together to provide the solutions needed for consumers across the country.

Increasing American oil and natural gas production will help reduce prices, but it does not occur with the flip of a switch. Industry faces numerous hurdles to increasing production, including access to new leases, permits, and easements on federal lands, burdensome regulations, difficulty in building infrastructure, rig availability, workforce availability, increased input costs, supply chain uncertainty, and access to new capital investment.

If we are going to find solutions, we must recognize where the problems exist. The White House will tell you this is a result of Russia's war on Ukraine. While this has enhanced the price increases, the increase in gas prices is a direct result of increased demand coupled with production restraints caused by anti-oil and gas policies put into place by the Biden Administration.

In January 2021, this Administration announced plans to transition away from fossil fuels and is working to implement policies within every possible federal agency to move in that direction. Executive Orders have been issued, proposed regulations have been published, and previous regulations have been rescinded, creating a highly uncertain and unpredictable regulatory environment. This makes it both costly and difficult for the highly regulated energy sector to plan and grow energy production.

We, as an industry, want to work collaboratively with Congress and the Administration to address this current energy crisis. Together, we can focus on serious solutions that will increase American production and enhance our energy and national security.

Mixed Messages

One of the most significant obstacles the oil and natural gas industry faces in its efforts to meet growing energy demand is difficulty attracting the capital investments necessary to maintain, stimulate, and expand exploration and production. In the Bakken, we need \$20 million per day of investment to substantially grow production.

Investor hesitancy is being driven by the rhetoric that it is time for our country to leave fossil fuels completely behind. The power of the bully pulpit is real, and the words of our leaders matter. If government leaders say they are doing everything in their power to put an end to an industry, a strong market signal is sent that the industry might not be a sound investment.

Amidst their messaging and regulatory efforts to hamstring our industry, the President and his Cabinet are calling on us to increase production. This contradictory messaging is confusing and creates added uncertainty in the market.

This could all change tomorrow if the President and Congress changed their message to the American people, bankers, investors, and workers that we need American oil and natural gas and that our industry has their support. They could

instruct federal agencies to do everything within the law to encourage and facilitate more production.

Our industry has been accused of taking advantage of high prices to enrich shareholders by investing in dividends and stock share buy-backs rather than investing in additional exploration and development.

Besides the operational challenges of labor and supply availability and costs, our industry's investment decisions are being driven by the market and what matters to their investors. This Administration and many in Congress are telling the market that fossil fuels are not here to stay, that they are not a stable long-term investment. So even at a time of record profits, we are not seeing companies reinvest in growing production because the market is signaling that is not a sound investment.

We all know that fossil fuels will be around for decades to come. But we need positive reinforcement from the leaders in our country to assure all Americans that they are committed to our energy security. Energy security is national security, and we must not lose sight of that.

Foreign vs. Domestic

We appreciate the President's acknowledgement that we are in a crisis and need more oil supply to bring down energy prices. However, as he travels to foreign countries searching for more oil resources from countries with demonstrated human rights abuses and poor environmental standards, he is ignoring the vast oil and natural gas resources we have here in the United States.

We do not need to look to other countries to produce more oil. We have the resources and the capabilities to produce everything we need here at home. A stable domestic supply of oil and natural gas directly contributes to a strong national and economic security position, and we are proud of the role we play in ensuring our security.

Russia has weaponized its position as one of the top oil and natural gas producers in the world as it supplies our enemies and holds our allies hostage. We must maximize our production, not only to supply our domestic needs but also to assist our allies.

Iran produces 2.5 million barrels of oil per day, almost all of which goes to China. As China enriches Iran, Iran enriches uranium, and we enrich China, a country that

owns 85% of the world's rare earth metals needed for the so-called "energy transition" away from fossil fuels. California imports 56% of its oil, mostly from Ecuador, Saudi Arabia, and Iraq. Ecuador has among the worst environmental greenhouse gas standards in the world with a flaring intensity 3.2 times that of the United States according to the World Bank.

These nations do not hold themselves to the same environmental standards as the United States. If our leaders are concerned about lowering greenhouse gas emissions throughout the world as soon as possible, we should produce more oil and natural gas domestically where we have stricter environmental standards and much lower emissions than the countries from which the President is seeking oil. These actions directly increase, not decrease, overall greenhouse gas emissions.

These facts lead to one question: Is this transition away from fossil fuels really about what is best for the planet, or is it simply about shutting down an entire industry because it has fallen out of favor with the ruling class? Elimination of fossil fuels may poll well in certain parts of the country, but only because the true impacts of life without energy have never been realized.

In March 2022, North Dakota's oil production was 1,122,640 barrels per day. This is about 400,000 barrels of oil per day lower than the state's peak production in November 2019. United States officials have discussed the possibility of importing more oil from Venezuela to help meet demand. The entire country of Venezuela only produced 668,000 barrels of oil per day in January 2022. By just ramping up North Dakota production to our previously high levels, we could go a long way towards filling the need without relying on Venezuela. The same logic would apply to relying on Iran, Libya, Saudi Arabia, or any other unstable country for that supply. Not to mention the additional supply we would see if other oil-producing states were able to ramp back up to late 2019 levels.

Benefits to North Dakota and the Country

Nearly fifteen years ago, the combination and perfection of horizontal drilling and hydraulic fracturing paved the way for the oil shale boom in the United States. At a time when Americans were concerned that the nation was running out of domestic oil supplies, this new technology allowed us to tap into vast reserves of oil and natural gas right here at home.

The growth of oil production in the Bakken not only helped drive overall domestic production, but it also created a plethora of new opportunities for the citizens of

North Dakota. Rather than losing population to other states because of limited job opportunities, young people began to move to or remain in North Dakota to attend school and pursue high-paying careers. We are now building new schools to accommodate that growth instead of closing them due to outmigration.

Currently, one in five workers in North Dakota are employed either directly or indirectly by the oil and natural gas industry. Tax revenues from the industry make up 53% of total state revenues. This is not an industry our state can live without, nor can the nation thrive without our energy.

North Dakota Governor Doug Burgum and the state Legislature have been encouraging innovation, not regulation, as a pathway to cleaner energy, and we work in partnership with the state to achieve this goal. The state of North Dakota has also established the Clean Sustainable Energy Authority to reinvest oil production tax revenues to achieve these goals. Our technology is constantly improving. Our horizontal wellbores are getting longer (now three miles instead of two) and our surface footprint and wellsite emissions continue to decrease.

There are over a hundred thousand private mineral royalty owners and several thousand surface owners in the Bakken. Those private individuals, combined with the regulatory oversight provided by the North Dakota Industrial Commission (NDIC), create an atmosphere that favors environmental innovation versus forceful overregulation.

Besides state regulators and interested royalty owners, our industry employs tens of thousands of people who live where they work and have a vested interest in environmental stewardship. We scrutinize ourselves. Oil producers were working on setting and achieving Environmental, Social, and Governance (ESG) goals before anyone else. Foreign oil producers cannot claim the same environmental success that we do.

North Dakota is also leading the way towards carbon capture and sequestration technology. We recently began storing carbon dioxide in an aging oil field, which will result in more oil production while also reducing carbon dioxide emissions and essentially creating carbon-negative barrels of oil.

There is a proposed pipeline underway that will gather carbon dioxide produced by ethanol plants across the Midwest for permanent storage in central North Dakota. This carbon dioxide would be stored in purpose-drilled wells in an ideal geological

formation using the technology, tools, know-how, and personnel of our industry, which shows how we are leading the way in innovative solutions.

Regulatory Certainty

If we are serious about ramping up production, we need to look at the layers of regulations that operators must work through to start producing. Leasing, permitting, drilling, completing, and producing wells, and then transporting oil and natural gas to market can sometimes take years. A lot of this time can be spent working through the permitting process, which requires compliance with all federal regulations. If we want to ramp up production, looking at ways to streamline regulations and permitting is an important place to start.

The American Petroleum Institute recently published a [Ten-Point Policy Plan to Restore U.S. Energy Leadership and Fuel Economic Recovery](#) (see attached). We urge lawmakers to seriously consider these policies they can act on now.

We also appreciate the efforts of Senator Hoeven to address some of these regulatory hurdles by introducing S. 4227, which would streamline the oil and natural gas permitting process. This bill would require at least 50 percent federal mineral interest in a drilling spacing unit before federal Bureau of Land Management (BLM) permits would be required to drill.

This legislation would be especially helpful in North Dakota where we have a split-estate, essentially a checkerboard of federal and private mineral ownership under private surface ownership. A minimal presence of federal minerals triggers the full BLM permitting requirements, which can be very burdensome and even discourage or stop production of private minerals in the process.

Another issue we face with this split-estate is there are unleased federal minerals mingled with leased federal and private minerals. These unleased federal minerals are preventing private minerals from being produced, creating inefficiencies and lost revenues. Our operators stand ready to work with the Department of Interior and the BLM to identify unleased parcels in areas that are already being developed so we can maximize production and efficiency and return valuable royalty revenue to the federal taxpayer.

These types of small changes would go a long way in helping to grow energy production and reduce energy supply disruptions.

This split-estate also presents challenges that the BLM has both caused and could help overcome. Although the BLM recently conducted the first onshore lease sales of this administration – only after being ordered to do so by a federal district court – it intentionally reduced the amount of acreage being offered for lease by approximately 80% from the amount that had already been nominated and undergone environmental review¹.

Further, in North Dakota, that reduction eliminated some of the parcels from potential leasing on the most prospective acreage that could have incentivized further development of the valuable Bakken Shale resources. The parcels remaining in the auction were primarily only those that had either already been developed and through the recent resolution of a title dispute were now available to lease or parcel – also of which the Department of Interior either knew or should have known were not prospective for development. In the sale package for the Montana-Dakotas field office, this resulted in a full 55.4 percent of the acreage on-offer not receiving a single bid, even with commodity prices at their current high.

This intentional sabotage of the congressionally mandated lease sale process is damaging to the United States government through the loss of potential revenue and to the State of North Dakota on a magnified basis due both to the direct loss of revenue and the forestalled development opportunities on the split-estate. Every citizen of the country also experiences the damage through the dizzying prices resulting for them at the fuel pump, the grocery store, and every time they pay their bills because of the increased supply that the Biden administration has intentionally blocked.

Long-Term Commitment

As our industry continues to invest in production, it is critical that our product reaches the market. Our industry will need pipeline and refining capacity to keep pace with our country's projected future growth. It has become very difficult to build pipelines in our country and almost impossible to build new refineries. This must change. If we are serious about ending this crisis, we need investment and regulatory certainty to build the infrastructure necessary to transport and refine our products.

¹ <https://www.doi.gov/pressreleases/interior-department-announces-significantly-reformed-onshore-oil-and-gas-lease-sales>

Conclusion

If we want affordable and reliable energy, it is up to America to produce it. The good news is that we know we have significant resources, specifically in the Bakken in North Dakota as well as other unconventional shale plays across the country. With the right policies in place, our domestic oil and natural gas producers can increase production and contribute to lowering energy prices.

We need energy champions. We need our leaders to stand up and say they are willing to partner with the hardworking men and women of the oil and natural gas industry, to support our efforts, and clear a path for us to do what we do best – produce American oil and natural gas. This is not a time to wind down or move away from our industry. It is a time to invest in it and build it up as an America First solution.

We stand ready to work with our Senators to move forward in solving the issues I have outlined and lower energy prices for everyone. I invite you to North Dakota to see firsthand how energy production can work in harmony with our shared environmental goals.

10 IN 2022

TEN POLICIES TO UNLEASH AMERICAN ENERGY & FUEL RECOVERY



American
Petroleum
Institute

America's core promise – the freedom to be, to create, to aspire – drives the opportunity for all Americans to have better lives and reach new heights. **American energy empowers American opportunity.** Given today's global unrest and economic uncertainty, this has never been more true.

Americans have been here before, with fuel shortages in the 1970s serving as a vivid reminder. **Today, energy demand is outstripping supply.** Inflation is the highest it has been in 40 years. Fuel prices have soared. Putin's brutal aggression in Ukraine has united the West against his regime and the energy he once sold to Europe. It is all connected – and alarming. But a solution is beneath our feet.

Our nation is blessed with abundant natural gas and oil that is the envy of other countries. It is a foundation of our economy, **supporting more than 11 million U.S. jobs**, and makes our American way of life possible. It has revived Main Street storefronts, restored U.S. manufacturing, driven job creation and bolstered our nation's ability to compete. It has made America safer in a turbulent world.

Given global circumstances, it is time for an energy awakening – for the natural gas and oil supply chain and the government at all levels to open a new era of working together **to ensure that essential energy resources are unlocked; to encourage investment opportunities and accelerate infrastructure development; and to strengthen global energy security, affordability and reliability.**

Bottom line: Washington policymakers must confront the global mismatch between demand and supply that has driven higher fuel prices by supporting greater U.S. production. To address the growing crisis we face, Congress and the President must support energy investment, create new access and keep regulation from unnecessarily restricting energy growth. **The world is calling out for energy leadership. America can and should step up fast.**

10-POINT PLAN TO RESTORE U.S. ENERGY LEADERSHIP

- 1** Lift Development Restrictions on Federal Lands and Waters
- 2** Designate Critical Energy Infrastructure Projects
- 3** Fix the NEPA Permitting Process
- 4** Accelerate LNG Exports and Approve Pending LNG Applications
- 5** Unlock Investment and Access to Capital
- 6** Dismantle Supply Chain Bottlenecks
- 7** Advance Lower Carbon Energy Tax Provisions
- 8** Protect Competition in the Use of Refining Technologies
- 9** End Permitting Obstruction on Natural Gas Projects
- 10** Advance the Energy Workforce of the Future

API's 10-point plan to restore U.S. energy leadership and help fulfill our great nation's core promise.

1

Lift Development Restrictions on Federal Lands and Waters

The Department of the Interior (DOI) should swiftly issue a 5-year program for the Outer Continental Shelf and hold mandated quarterly onshore lease sales with equitable terms. DOI should reinstate canceled sales and valid leases on federal lands and waters.

2

Designate Critical Energy Infrastructure Projects

Congress should authorize critical energy infrastructure projects to support the production, processing and delivery of energy. These projects would be of such concern to the national interest that they would be entitled to undergo a streamlined review and permitting process not to exceed one year.

3

Fix the NEPA Permitting Process

The Biden administration should revise the National Environmental Policy Act (NEPA) process by establishing agency uniformity in reviews, limiting reviews to two years, and reducing bureaucratic burdens placed on project proponents in terms of size and scope of application submissions.

4

Accelerate LNG Exports and Approve Pending LNG Applications

Congress should amend the Natural Gas Act to streamline the Department of Energy (DOE) to a single approval process for all U.S. liquefied natural gas (LNG) projects. DOE should approve pending LNG applications to enable the U.S. to deliver reliable energy to our allies abroad.

5

Unlock Investment and Access to Capital

The Securities and Exchange Commission should reconsider its overly burdensome and ineffective climate disclosure proposal and the Biden administration should ensure open capital markets where access is based upon individual company merit free from artificial constraints based on government-preferred investment allocations.

6

Dismantle Supply Chain Bottlenecks

President Biden should rescind steel tariffs that remain on imports from U.S. allies as steel is a critical component of energy production, transportation, and refining. The Biden administration should accelerate efforts to relieve port congestion so that equipment necessary for energy development can be delivered and installed.

7

Advance Lower Carbon Energy Tax Provisions

Congress should expand and extend Section 45Q tax credits for carbon capture, utilization, and storage development and create a new tax credit for hydrogen produced from all sources.

8

Protect Competition in the Use of Refining Technologies

The Biden administration should ensure that future federal agency rulemakings continue to allow U.S. refineries to use the existing critical process technologies to produce the fuels needed for global energy markets.

9

End Permitting Obstruction on Natural Gas Projects

The Federal Energy Regulatory Commission should cease efforts to overstep its permitting authority under the Natural Gas Act and should adhere to traditional considerations of public needs as well as focus on direct impacts arising from the construction and operation of natural gas projects.

10

Advance the Energy Workforce of the Future

Congress and the Biden administration should support the training and education of a diverse workforce through increased funding of work-based learning and advancement of STEM programs to nurture the skills necessary to construct and operate oil, natural gas and other energy infrastructure.

Senator HIRONO. Thank you very much. I am going to start the five minutes of questioning.

So the purpose of this hearing is really to focus on affordable and reliable energy, and in that, I do have a question for Mr. Bissell of KIUC. Solar energy costs have fallen by over 80 percent in the last decade. In 2020, the International Energy Agency described solar energy as, and I quote them, “the cheapest electricity in history.” That description does not even cover the public health benefits from reducing air pollution or reducing the costly impacts of climate change. At the same time, investing in the clean energy transition does have upfront costs. So what would you say to members who are worried that their energy bills could go up as we invest in new clean sources of energy, probably in the short term? And the second thing, the second question I have for you, how did KIUC deal with the reliability of reliance on intermittent power?

Mr. BISSELL. Thank you, Senator. The cost of solar, particularly large-scale solar, throughout the country now is at or below any other cost of producing electricity. It has reached parity. Prices at large scale seemed to be going steadily downward until the recent inflation pushing all the costs up, but we have seen on Kauai, from the time we started, prices are about a third of what they were initially, and we have been able to really help stabilize our electric bills because of it. We have about 45 percent of our island’s energy coming from solar, and we have also been able to do it reliably. We use a combination of, interestingly, our legacy fossil fuel units to support our grid, but also, more importantly, batteries. We have invested extensively in battery storage. We have been at the forefront of it. And the batteries have actually substantially increased the reliability of our grid. If we had one of our conventional units trip offline now, instead of potentially losing the entire island, oftentimes it happens and our members do not even know that it occurred because the batteries respond instantaneously.

So it is a mix of taking advantage of the low cost of solar, but also a proper amount of batteries to provide firm and stable renewable energy.

Senator HIRONO. And I think, KIUC, you have also gone into the community to encourage them to use energy-efficient refrigerators, et cetera and to enable them to understand how much energy they are actually using by—I think you passed out ways that they could measure their at-home energy use. So it is a combination of initiatives that KIUC has really pushed that has led to where you are now.

For Mr. Larsen, a study by the National Renewable Energy Laboratory found that drivers can save as much as \$14,500 on fuel costs over 15 years by driving an electric vehicle instead of a gasoline-fueled vehicle. But EVs, currently, tend to have a higher sticker price than gasoline models. Manufacturers like GM tell us that more affordable EV options are on their way. Do tax credits work to support the purchase of electric vehicles, and how can they help an average household?

Mr. LARSEN. Thank you for the question.

EV prices have, like a lot of other products, have been actually, you know, going up for the most part due to inflation recently, but the cost savings from that National Renewable Energy Lab study

are certainly, probably, amplified by also the recent gasoline price increases, so you are avoiding more cost. And I think what we should be expecting with electric vehicles is something very akin to what we have seen with solar technology, where, as production ramps up, innovation continues apace. Costs should come down, not just operating costs, but for sticker prices of these vehicles throughout the decade. Tax credits have been an important tool already in starting that electric vehicle transition.

Tax credits, going forward, can incentivize deployment of an array of technologies for diversifying the light duty fleet, so electricity, fuel cells, other things could be very important to making those vehicles more accessible to lower income households and for the types of households that actually do the most driving. And so, I think that is one tool that could be quite important along with other investments around charging infrastructure and all the other associated technology you are going to need to really support a ramp-up in deployment.

Senator HIRONO. Before I turn to Senator Hoeven, I want to note that General Motors, Ford, Toyota, and Stellantis, which is the owner of Chrysler, are planning to invest \$20 billion to manufacture electric vehicles and batteries in the United States.

Senator Hoeven.

Senator HOEVEN. Madam Chair, I am going to defer to Senator Cassidy, from the great State of Louisiana, because he has to be somewhere at 3:30, if that is all right?

Senator HIRONO. Please.

Senator CASSIDY. Thank you, Senator Hoeven. Thank you, Madam Chair.

Mr. Ness, it was recently widely publicized that oil being released from the Strategic Petroleum Reserve was going overseas. And so I inquired with industry, and they tell me they are at 95 percent capacity. So when the Administration decided to release more oil, for whatever reason, they did not think about the need to process that oil into gasoline. Now, we inquired further and we found that due to a variety of reasons—demand destruction, policy, regulatory pressures associated with a desire to move away from petroleum-derived fuels—that is not the driver, that is the Administration's policy—there has been a closure or repurposing of seven petroleum refineries since the start of 2020. There has been two additional refineries with total capacity of 400,000 barrels per day announced that they will close or repurpose by the end of 2023. Now, is it at all possible to lower the price, beyond demand destruction, is there any reasonable way to lower the price at the pump if we have lower and lower refinery capacity as we go forward, no matter what our oil supply is?

Mr. NESS. Chair Hirono, Senator Cassidy, I think those numbers are astounding, and I urge this Committee to look into some of the demand destruction on the refining side and certainly releasing barrels from—

Senator CASSIDY. Well, let me ask you, specifically, what about the regulatory process? You mentioned regulatory. If the regulators are making it hard to keep it open, and therefore, they are closing because the cost of compliance is so expensive. Any thoughts on that?

Mr. NESS. There are serious concerns throughout industry when you look at the RIN credits on the conversion of these fuels now at biofuel facilities, which are taking, basically, oil and gas refining supply off the market, and a conversion of those because of the value of these credits. And a lot of that—

Senator CASSIDY. So just for people who may not be familiar with this. There are tax credits encouraging the manufacture of biodiesel that make it more profitable to make biodiesel—kind of a niche product, but that takes refining capacity off to produce gasoline, which Americans are paying so much for. And some of this is ethanol, which means that corn, which could be used to lower the price in the grocery store or to feed people in Ethiopia, is being used to make biofuel as a, you know, we all know the reasons why we do it, but nonetheless, we are diverting foodstock, when there is inflation in the grocery market, to make biofuel. And RINs is how you encourage people, the refineries to use it, but the RINs have become more expensive.

Mr. NESS. The RIN costs are punishing to American small refiners, in particular, punishing the larger refiners as well.

Senator CASSIDY. But under the previous Administration, the small refiners were not required to buy RINs, as I recall. I am told that this Administration is requiring the small refiners to buy these RINs, which increases their cost to production, which is putting them out of business. Is that a correct assessment?

Mr. NESS. You are correct. They are transitioning those refineries to biofuel refineries, which we have one in our own state, about 20,000 barrels a day, a diesel refinery using Bakken oil—now it is a good project for North Dakota overall—but the overall assessment of demand daily and production and supply of oil and gasoline should be looked at in this discussion.

Senator CASSIDY. So the person who is watching this from home on C-SPAN or may see or watch it on YouTube or whatever, when the Administration says they are doing everything possible to lower the price of gasoline, they have actually got a set of policies which are putting refineries out of business, which makes it absolutely impossible to lower the price at the pump, no matter how much oil we release from the Strategic Petroleum Reserve or beg the leader of Saudi Arabia to release.

Mr. NESS. Senator, I would say we need to look at American oil and gas production opportunities and support that production. That will hopefully also drive the price of crude oil lower, which is the feedstock for all of these facilities.

Senator CASSIDY. I get that, but on the other hand, if we don't have refinery capacity, we could produce all the oil in the world, and we are not going to get there. Correct?

Mr. NESS. You are correct. Our consumption is not going down. It is going to go up.

Senator CASSIDY. I have been calling for an operation warp-speed, in which instead of just looking at one part of the supply in isolation without considering, my gosh, we have to be able to refine it, that we look at everything as a continuum, work out the regulatory policies in a coherent fashion, so when the President gets up and says he is doing everything possible, we can actually take him at his word, except then reading about how refinery capacity is

being destroyed because of regulations and being frustrated because we are paying so much at the pump.

Madam Chair, I yield. Thank you.

Senator HIRONO. Thank you.

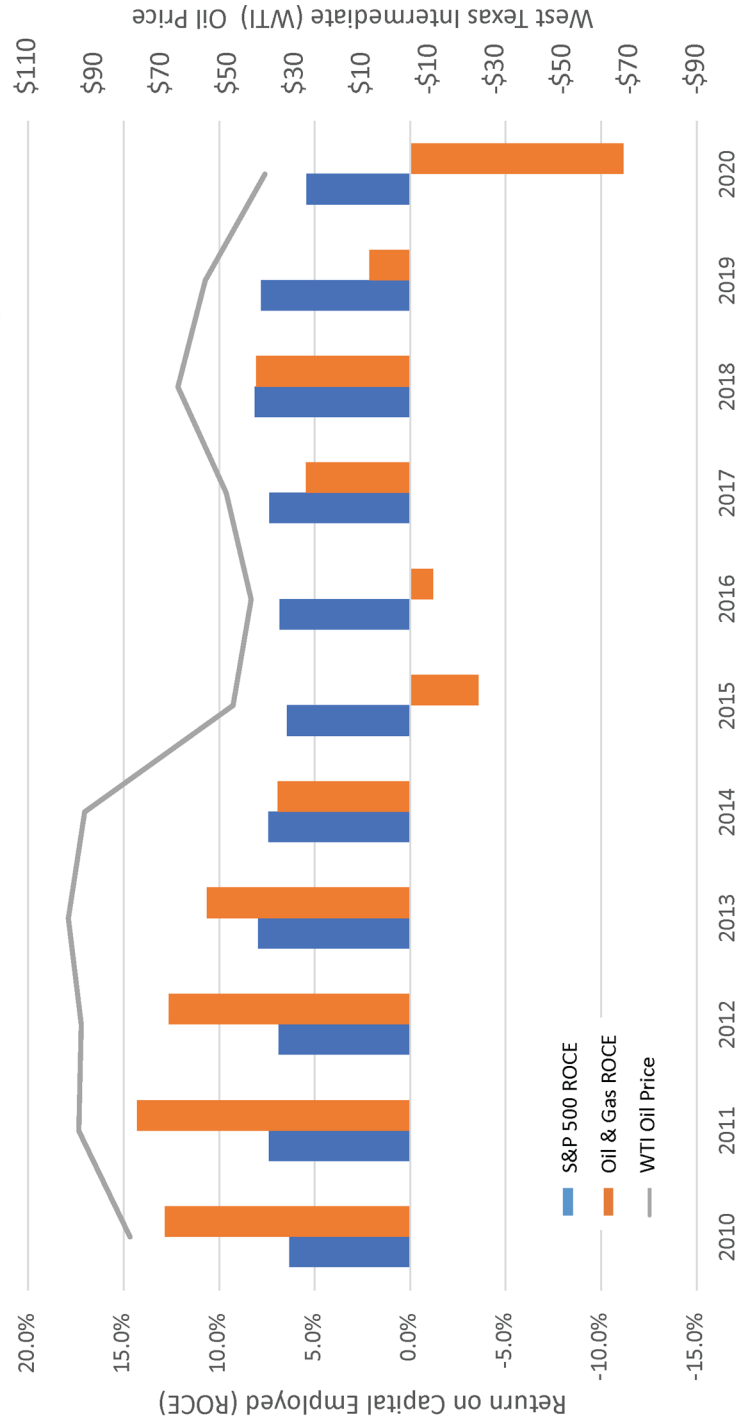
Senator Hickenlooper.

Senator HICKENLOOPER. Thank you, Madam Chair. Thank all of you for your service and your time here, your testimony.

Let me start with Mr. Larsen. Our economy has experienced a number of big supply shocks, and I think that they, in some ways—and this is somewhat similar to what we were just discussing—they amass the preexisting fundamentals also driving today's high prices. The plot here, courtesy of the Payne Institute at the Colorado School of Mines—I realize there are several schools of mines that are envisioned—shows three quantities. In orange, it is the return on capital for the oil sector, and blue, the same quantity for the S&P, and gray is the price of oil. Since 2013, when prices fell below \$70 a barrel, oil has been a difficult investment, at best. At times, outright losing money and certainly consistently underperforming the market. In short, the geology itself seems to be, well, be part of the problem in terms of simultaneously having both cheap oil and expanding the oil sector.

[The chart referred to follows:]

Below-Market Returns on Oil & Gas Have Slowed Investment (since 2013)



Sources: Factset, Energy Information Administration (EIA)
Courtesy of the Payne Institute for Public Policy at the Colorado School of Mines

Senator HICKENLOOPER. So Mr. Larsen, I was going ask if you could comment on the implications of the past ten years for oil and gas production in this country. What lessons do you think we should learn from that, and would investing in clean energy help us avoid the sharpness of these situations in the future?

Mr. LARSEN. Thanks for the question, Senator. It is an important question.

I mean, I think, for any major economy, diversity of fuel supply is important, and in particular, when you have concentration on one particular fuel source for a major part of your energy systems, say, for transportation, having diversity is a good thing to have both for long-term affordability, but also to avoid or at least shield exposure to volatility. Clean energy investments are one way to do that, and I do think that, you know, the reason elevated prices would probably show a different bar in 2021 or 2022 here, but you know, as the trend shows, things go up and down a lot in the oil and gas sector, and I think you would see a different view looking at other types of fueled energy supplies.

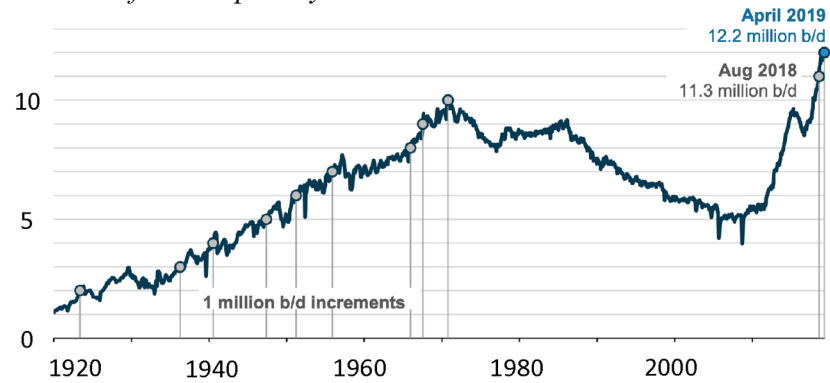
Senator HICKENLOOPER. All right. Thank you.

Mr. Ness, we talked a little bit before this, before this hearing started, a little bit about the issues around oil production and declining oil production and some of the trends that create an appearance but are not always true, as you were describing to me. And as a recovering geologist myself, I thought we had a map they showed me yesterday on these shale plays, like the Bakken in North Dakota. And as someone who was there when they began using directional drilling and combining that with increasingly sophisticated and focused forms of fracking that heightened returns, I think it is interesting to look at. Here, if you look at the map, the way it lays out, red wells are highly productive, the blue and black ones, much less so. And many of those wells, in terms of offsets, are closer than 500 feet even though we know they interfere with each other at 2,000-foot spacings.

[The map referred to follows:]

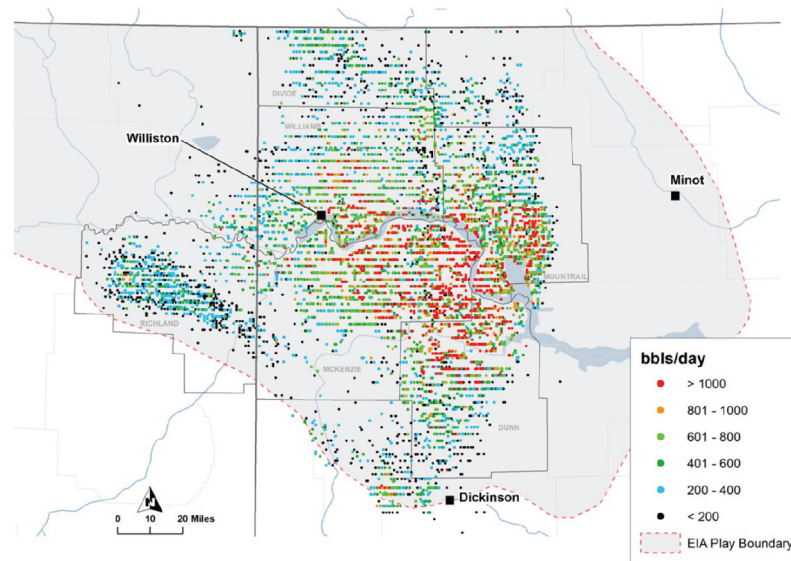
Monthly U.S. field production of crude oil

Millions of barrels per day



Source: EIA, Petroleum Supply Monthly

Bakken Shale Well Distribution and Peak Productivity



Source: *Shale Reality Check 2021*, J. David Hughes, 2021. Data from Enverus, April, 2021, EIA shapefile March 2016. Copyright Van Hoesen and Hughes, 2021.

Senator HICKENLOOPER. I thought it would be interesting to hear you explain again to all of us why you are optimistic about increased and consistent, and indeed expanding Bakken production.

Mr. NESS. Thank you, Senator Hickenlooper and you certainly know, as a former Governor of Colorado, many of our producers were located in those great mines, those great geologists, those great engineers were located in Denver and your surrounding area there. We drilled about 17,000 wells in the Bakken over the past 15 years. Our production, as Senator Hoeven had mentioned, grew from about 90,000 barrels a day to, we were on our way to about 1.8 million barrels a day and we got stuck at about 1.15, 51, 55, and then COVID hit and then we have seen a downturn in price and it was economically devastating to our industry.

But really, the prize of the Bakken and the prize of the shale plays across this country is here. What I am here to encourage the Senate to look at, out of every 100 barrels of oil in the Bakken, with the best technology in the world, we leave 85 of those behind. As a geologist, you know, that those great oil resources of the top ten oil fields in the world, the resource is there. The technology will come, the encouragement, the policies have to be there and you are going to go back in. You are not going to leave that much oil in the ground. We see that in New Mexico. We see that in Texas. We see that in Wyoming now, certainly in your State of Colorado, Oklahoma. That is just on the oil shale side.

So the opportunity is there. The resource is there. It now takes the technology credits, like utilization of carbon dioxide to make sure that credit synchs up with the storage credit. We are going to produce more out of the Bakken, but we have to recharge that either with gas and/or carbon dioxide. We need to continue to keep that pressure up in that tremendous reservoir that has billions and billions of barrels in it, but we need the right price to go get it and the right investment climate to encourage. Your chart is telling in terms of why investors get shy and they back off. Along with that, with the ESG policies, the bank policies, and then really, the sentiment against investing in oil has been harmful, frankly, to the Bakken.

Senator HICKENLOOPER. Got it. Thank you.

And I have additional questions for Mr. Bissell. I think the work that you guys have done in Hawaii is remarkable, but I will have to submit those in writing, and same for you, Ms. Fedorchak.

Senator HEINRICH [presiding]. Actually, I am going to recognize Senator King.

Senator KING. Go ahead.

Senator HEINRICH. You sure? I will recognize myself for a moment then.

[Laughter.]

Senator HEINRICH. Mr. Larsen, could you just, in a relative way, not in any sort of fine-grained way, walk us through what energy sources have experienced the highest levels of volatility in the current market and what have been the most stable.

Mr. LARSEN. Happy to. Petroleum products, in particular, have seen the highest price volatility—gasoline, diesel, heating oil, and I mean, that should not surprise anybody because you see it when you drive by the gas station. In the meantime, delivered electricity

is relatively stable, and I should say, this is national average numbers I am talking about here. You asked me to stay high-level, and electricity is relatively stable, though, in some states we are seeing elevation due to natural gas prices, and delivered natural gas prices, at least to residential consumers, have not seen the same kind of magnitude of spikes as we have seen for petroleum.

Senator HEINRICH. They have seen increases, but it is—

Mr. LARSEN. Yes, but not a spike.

Senator HEINRICH. I noticed it most particularly in comparing a few different things, and one is the cost of, you know, running my truck for a month, if it is driven regularly, could be 400 bucks. My electric vehicle in the same month, which is much smaller, but probably \$63. And according to the app that tracks the equivalent that I would have spent at the gas pump if my car had not been powered by electrons, would be like \$257 a month. So you really see a much more dramatic impact on people's pocketbooks in those places where petroleum is squarely at the center of their energy budget.

Walk us through, a little bit through, just on the electric side now, Mr. Larsen, the relative, the different sources of electricity on the grid and what is cheapest today and what is most expensive. And I don't care if you want to do it on wholesale or retail or levelized, the relative costs are all the same. So just walk us through most expensive to cheapest.

Mr. LARSEN. Thanks. Maybe I will talk about, you know, levelized cost today of any of these, you know, generation options, and to Mr. Bissell's earlier point, solar is certainly the cheapest. Wind is not far behind. From there, at least with elevated gas prices, I would say, you are probably neck and neck between existing nuclear plants and a large natural gas combined cycle plant, and then coal, depending on the region and the fuel source, you know, where you are getting that coal, it could be a little different, but you know, coal and gas are probably in the same ballpark, let's put it that way.

Senator HEINRICH. So that is a big change, right?

Mr. LARSEN. Yes.

Senator HEINRICH. Coal being the most expensive and solar being the cheapest. That would not have been true ten years ago by any stretch of the imagination, right?

Mr. LARSEN. No, I mean when—I have been at this for nearly 20 years now, and everybody said coal was the price to beat.

Senator HEINRICH. Right.

Mr. LARSEN. But with renewables, and then it was gas is the price to beat and now, solar is the price to beat.

Senator HEINRICH. Yes.

Mr. LARSEN. That is where we are at.

Senator HEINRICH. What is a new project coming online in price, in cents per kilowatt-hour, like what are we talking about on the grid today?

Mr. LARSEN. I mean—

Senator HEINRICH. Less than two cents, I believe, or wholesale.

Mr. LARSEN. Wholesale, yes, that sounds about right. I mean, Mr. Bissell would know better than I. He is the practitioner. But yes, I think, I mean, that seems like the right neighborhood.

Senator HEINRICH. Gasoline prices are driving a 40-year record high. We are all feeling that. Certainly, my constituents are feeling it at the pump. But for the last decade we were told that if we just drilled more, we would get lower prices. New Mexico certainly stepped up. The country is producing a lot more oil and gas than we ever have as a nation. New Mexico produces six times the crude that we used to. But that never showed up in the price at the pump. I never saw a direct impact, positive impact for the consumers in my state.

So explain to us why domestic production numbers are so disconnected from the price at the pump because there is this mythology that if we just increase production, all of this inflationary pressure is going to go away.

Mr. LARSEN. Petroleum product prices, like gasoline, are largely driven by global oil prices, which is, you know, independent of any one production action anywhere in the world, and are a function of global supply and demand, right? Now, that is why you have not seen this translate. You know, as oil prices have gone up, we have seen gasoline prices go up, exactly as one would expect. I do think a near-term increase in production here, if it was, you know, could have sufficient influence on global markets in the near-term to put downward pressure on those oil prices, at the same time, you know, that is a near-term measure compared to additional investments that would diversify, you know, fuel supply over time and, you know, shield the United States from the next shock.

Senator HEINRICH. Got you. Thank you very much.

Senator Hyde-Smith, you are next.

Senator HYDE-SMITH. Thank you. Like many of my colleagues have stated, the United States is experiencing record level energy prices that are hurting every American family, and we are going to have to have some real solutions and we are going to have to get some relief pretty quickly as we well know, and everything on the table considered, in my opinion.

Mr. NESS, as we have seen in this year and last year, the United States' fossil fuel industry has been under attack by adversarial energy policies, executive orders, and federal regulations intended to cripple these industries. How do these actions contribute to the instability and unpredictability of the energy market as a whole?

Mr. NESS. Senator Hyde-Smith, U.S. oil production today is a little less than two million barrels a day less than what it was in 2020, 2019. So we do need to increase our oil and gas production. That will have a direct impact. As the world's largest producer on the world supply of oil and decrease, ultimately increase, gasoline prices at the pump, as the previous speaker mentioned. What we have seen on the oil and gas industry, coming off of a very rough period through COVID, we have just seen an onslaught beginning with cancellation of the Keystone XL Pipeline, then the cancellation of federally mandated leasing requirements on federal lands. Everything has been slow-walked, and we see now the creep of climate requirements into permits, leases, all of the provisions that operators need to do to get those permits out and put together a development plan that they can then bring to Wall Street to attract the type of capital they need to drill and expand and grow oil production in our country.

So we see this throughout our office and in North Dakota on a regular basis. We are commenting against federal rules and doing whatever we can, but again, back to those financial markets—it could start today with a message to the financial sector to investors, to workers, to everybody that we need American energy, of all sources. We certainly lead that effort in North Dakota. We think it is possible. Our energy sectors can work together quite well in our state, grow the production of all, Senators. Certainly, Senator Hoeven has been a huge champion of that. So we can do this, but we need to get away from the transition, away from, to a transition to cleaner energy of all sources and we think the Bakken is the cleanest barrel in the world and certainly American barrels are much cleaner than the barrels that we are seeking from other countries to send our way. So we hope it starts here and produce more American energy of all types because we are going to need it.

Senator HYDE-SMITH. I totally agree, and it could not start soon enough.

How would energy prices, as well as prices at the pump, be affected if the Department of the Interior were to swiftly finalize the five-year plan, the leasing program, for the Outer Continental Shelf and conduct quarterly onshore oil and gas lease sales with, of course, equitable terms?

Mr. NESS. Ranking Member Hyde-Smith, some of those plans, of course, are long range plans, but the message to the market in the world is immediate. And when you begin to do that, as I mentioned in my comments, the bully pulpit has power, and that message to investors and to the investment community and to the markets is strong that America is going to stand up, produce more American oil and natural gas. The Russian equation must be factored into this. It is a geopolitical issue at this point, not just the pain that all of our constituents and your constituents are feeling when they pull up to the pump.

Senator HYDE-SMITH. Yes, you are exactly right to hurt Putin's ability to weaponize Russian energy against us and our allies.

Okay, one other thing while I have about a minute left, and to you again, Mr. Ness. I want to look at the necessity of natural gas pipeline infrastructure. Americans are obviously seeing and feeling the effects of the cancellation of the Keystone Pipeline. Will you expand on the importance of the natural gas pipeline infrastructure and while also looking at a streamlined permitting process, and should Congress authorize critical energy infrastructure projects to support the production, processing, and the delivery of energy?

Mr. NESS. Senator Hyde-Smith, infrastructure is key to not only energy development, but to lowering energy prices, because of the movement from the production areas to the consuming areas to the refining areas and certainly the Marcellus Shale is not in my backyard, but I know that the ability of that shale play is incredible to produce more natural gas. We cannot only supply our own citizens, but we can supply our friends and allies, and we have certainly seen that in the Bakken, as we have, we are now moving 700,000 barrels a day from the Bakken to our largest refining center in Louisiana Gulf Coast every single day, responsibly, reliably, quietly, environmentally soundly, through the Dakota Access Pipeline. It

is an incredible asset to our nation to be able to supply our own refineries in America with homemade American Bakken oil versus Libyan oil, Venezuelan oil, OPEC oil.

Senator HYDE-SMITH. Yes, it just makes sense. Thank you guys, for coming and being willing to testify today. And I certainly appreciate it and my time is out.

Senator HIRONO [presiding]. Thank you, Senator Hyde-Smith.

Senator KING.

Senator KING. Thank you, Madam Chair.

Mr. Ness, do you think some of the record profits from the oil companies might have been invested in production instead of stock buybacks and dividends? The top three oil companies made \$35 billion in profits in the last three months. You are talking about a lack of capital. That sounds like a big pile of capital to me.

Mr. NESS. Senator King, as I mentioned in my remarks, our investors and our owners of companies who are investors in banks and others had an extremely rough period through COVID and the economic devastation of our industry, and I think the hesitancy and the rhetoric that is coming out of the agencies, the Administration, makes it hesitant for those investors to want to put money back in at big numbers in order to—

Senator KING. I am not talking about investors. I am talking about your companies. I am talking about your companies that have cash in the bank—\$35 billion in the last three months. That is money that is available for investment. You are not making that investment. You are turning it back to your stockholders.

Mr. NESS. Senator King, I think all industries should be looked at in terms of their profits and records, but certainly our companies are trying to economically recover, make plans for the future, and that is why these permits, these plans, are incredibly important as we want to invest.

Senator KING. Do stock buybacks help?

Mr. NESS. Stock buybacks, I think, are the investors in these companies make determinations on how they should best suit their investors and certainly that is a decision that each board makes—

Senator KING. The decision made is to give the money to the stockholders, not to put it into increased production. That is a decision. That is a policy decision that the companies made. I am not talking about you, personally, but the industry, generally, made a decision over the last 12 months to invest record profits in stock buybacks and extraordinary dividends rather than the typical pattern, which is when the prices go up and there is an increase of demand, which there was as we came out of the COVID pandemic, to make investments in production to meet demand. That did not happen because of deliberate decisions about where to put that money.

Mr. NESS. Senator King, I think with the right policies and right investment climate, you are going to see the American shale producers—

Senator KING. Is your industry really that afraid of Joe Biden? I mean, seriously, you are talking like rhetoric and comments is going to drive your entire industry. I have never known of that before. We have been trying to get off of fossil fuel for some time. All

of a sudden, you are saying that the cancellation of the Keystone Pipeline, which wouldn't have come online for years and years, is somehow sending shockwaves through the industry. Are you seriously—

Mr. NESS. Those messages do send shockwaves through the industry, and more specifically, through the financiers and the banks and Wall Street, and that is what supplies. And in the Bakken, as I mentioned, we need \$20 million a day of investment capital to grow and expand the Bakken. And certainly, to that—

Senator KING. Well, divide \$20 million a day into \$35 billion and—

Mr. NESS. On a magnitude applied in New Mexico, in Texas, and other places. So the policies of banks and of financial pressures, the inclusion of climate into permits into the investment policies, they are having a significant impact. And certainly, we are very proud of the reductions that we are seeing in emissions—

Senator KING. I think what is having a significant impact is the desire to give money back to your stockholders.

Mr. Bissell, I am fascinated by your project because you responded directly to our friend from North Dakota, you have a stable grid with, what is it? 70 percent renewables? Based upon storage. Storage is the key, is it not, Mr. Bissell?

Mr. BISSELL. Yes, storage is essential to stabilizing a grid, and on Kauai, it is really fascinating because we are a stand-alone grid. So we are kind of a test case for what the industry can do, that you can produce affordable, stable, and reliable energy from the sun and from other renewable sources without a significant impact on reliability—if anything, a positive reliability in our case.

Senator KING. But generally, more nationally and internationally, to me, storage is the real secret to the transition away from fossil fuels because as we have already learned, solar and wind are the cheapest forms of energy today. The problem is intermittency and the stability of the grid. If we can deal with the storage issue, either through batteries or more traditional technologies, like pumped storage, and there is a lot of other research going on, that is what is going to get us there, it seems to me. And you are a good test case for that.

Mr. BISSELL. Yes, I am glad you mentioned pumped storage technology. We are actively developing a pumped storage project on Kauai because, really, that is the next frontier. You go from relatively short-term storage of four to five hours, but to get to 100 percent or way out there on the renewable side, you have to have longer-term storage, and you can go back to some old technology. Pumped storage is old, but it works.

Senator KING. I think one of the important points that needs to be made about this transition is that the cost of solar and wind and pumped storage and battery storage is capital. There is no fuel cost. So once you have that system in place, you are buffered, you are free from the vagaries of the fossil fuel market because your capital cost is fixed the day you install the entity and so, that is a way of getting away from these swings that we have seen that are so damaging to consumers.

Well, I appreciate it, and thank you for coming all the way from Hawaii to share that with us.

Mr. BISSELL. You are welcome. Thank you.

Senator HIRONO. Thank you, Senator King.

Senator Hoeven.

Senator HOEVEN. Thank you, Madam Chairman.

Mr. Bissell, didn't you say that still 40 percent of your energy is from oil?

Mr. BISSELL. Thirty percent, currently, yes.

Senator HOEVEN. So you still are 30 percent dependent on oil.

Mr. Ness, so those policies that you were talking about with Senator King, formerly Governor King. He and I worked together as Governors too, and he's been out to North Dakota. So, he is, you know, he is good at advocating his point, but he is also open minded when you work with him on things, and that is much appreciated.

So those policies though, again, even in Kauai, they are 30 percent still dependent on oil, all the way out there in beautiful Hawaii. We were at 13 million barrels a day. Now, we are down to about 11 and a half million barrels a day. In North Dakota, we were at 1.5 million barrels a day. Now, we are 1.1 million. That is 400,000 of that 1.5 million we are down right now. And it is those policies that are preventing us from sustaining and growing energy production in—first question—in places like North Dakota, isn't that correct?

Second, don't those policies hit your smaller companies even harder than the bigger companies?

Mr. NESS. Senator Hoeven, and your point is well taken, and certainly in the Bakken, you know, we have a large mix of oil and gas producers. Many of them are small, regional, independent oil and gas producers who completely rely on investment capital. They do not have the reserves. They do not have the type of production that warrants the revenue generation. They need to go out to the street. They need to find that money and they need to, you know, find a positive reaction in their response to their solicitations, essentially, to grow production, grow Bakken production. And what they are seeing from the banks, what they are seeing from investors, is hesitancy.

I directly attribute that back to something that is fixable. There is a fix to this. And we need the all-of-the-above energy policy, grow all production of all resources.

Senator HOEVEN. And that is really what you are saying is, it is about all-of-the-above to truly make us energy secure, energy independent, and that that baseload is a vital part of it as well, right?

Mr. NESS. One hundred percent. We completely rely on reliable, affordable electricity in our state for, not only to run our oil and gas operations, but certainly, as a state, we have a, you know, we are growing all types of production, but we are going to need it in this country. We need to grow production.

Senator HOEVEN. And you work hard on the environmental stewardship. As a matter of fact, you would say your industry is really a leader, globally, in terms of environmental stewardship, wouldn't you?

Mr. NESS. The advancements that we have made in just the last three to five years are simply amazing on the emission reductions, our gas capture technologies. I was sharing with Senator

Hickenlooper earlier, a Denver company has come up with an incredible—we are powering the cloud now. Making Bitcoin off of some of the remote well locations. Incredible strides on the advancement—three-mile laterals, versus two-mile laterals, and yes, so the reductions in emissions that we have seen, making that Bakken barrel, I think, the cleanest barrel in the world.

Senator HOEVEN. And when we talk about production on federal lands, you do need access to those leases because even if, you know, even if companies have some leases, if they are held up because they cannot get drilling permits or they are held up in litigation, they cannot produce those leases, correct? So they need to be able to bid for more of those leases. And in fact, when those leases have been offered, haven't the companies gone out and aggressively bid for more of those leases?

Mr. NESS. Senator Hoeven, yes. We saw the lease hold this last cycle, about 80 percent of that was taken off the market, but 20 percent of the leases, despite paying, you know, a 50 percent higher royalty, we saw a lot of interest in those leases, but the uniqueness in North Dakota, and pursuant to your bill, Senate bill 4227, we have a lot of private land with a very small, *de minimis* federal lease under it. If you do not have that federal lease, despite whether the Federal Government doesn't own any of the surface, you may own a very small percentage of the mineral interest, you cannot continue to move forward with that lease and drill that prospect until you have that federal lease.

Senator HOEVEN. So it would be kind of like Mr. Bissell owning some property in Kauai that he could not develop, even though he owned all of the surface rights and the majority of the mineral rights, but the Federal Government owned the minority of mineral rights and no surface rights. They could hold them up, whether he liked electricity or anything else, right?

Mr. NESS. And Senator, that hurts the surface owner, that hurts the mineral owner, that hurts the royalty owner, that hurts the state, the county, the townships, but primarily, I think, these are significant world-class oil wells that could immediately bring oil production online and grow our production and lower the price of energy—

Senator HOEVEN. And a fundamental question of private property rights, right?

Mr. NESS. Correct.

Senator HOEVEN. Madam Chair, I have some more questions, but I will defer back to you at this point.

Senator HIRONO. Thank you, Senator Hoeven.

Senator Cortez Masto.

Senator CORTEZ MASTO. Thank you. Thank you, Madam Chair.

Let me follow up on Senator King's line of discussion, and just some clarification here, maybe, Mr. Larsen, you can help me. Besides the profits that he was talking about, the \$35 billion in profits that oil and gas have made over the last few months, it is true they also received subsidies from the Federal Government. My understanding is there are direct subsidies to fossil fuel, about \$20 billion annually, about 80 percent of that also goes to oil and gas. Is that about right?

Mr. LARSEN. Yes, that sounds about right.

Senator CORTEZ MASTO. So not only did they keep the profits, but they also get direct subsidies from the Federal Government. So it seems to me those are opportunities for access to capital they need to continue the drilling that they need to do to add to the supply chain and address and help us lower costs globally. So I am open to more facts about that, but just, I am very concerned that at the end of the day, instead of trying to solve this problem, people are profiting on the backs of the very people in my state, in Nevada, where the fuel prices are high.

And let's talk about refining, because my understanding, also, is that these refining companies that have shut down or decided to take an opportunity during COVID to shut down or retool, but I am curious, how many of the refineries here in the state actually refine the oil and gas that is produced in the United States? Or are they prepared to refine the oil and gas that comes out that is imported into the United States? I am curious. Do you know that?

Mr. LARSEN. I actually do not know that information.

Senator CORTEZ MASTO. Does anybody on the panel? I am curious.

Mr. Ness, yes.

Mr. NESS. Senator Cortez Masto, certainly I, you know there are several types of crude oil and different refiners have a different mix. In North Dakota, our single refinery now refines all Bakken, high quality, sweet crude oil. So Louisiana Gulf Coast, 70 percent of our nation's refining capacity needs high quality, Bakken type crude oil, Permian Basin, New Mexico. So other refineries across the country had converted to a heavier crude oil, Canadian crude oil, Venezuelan-type crude oil. So there is a mix. The world is a—

Senator CORTEZ MASTO. So there is—so I guess that is my point is, I heard the conversation earlier with Senator Cassidy talking about refineries and trying to blame the Administration, and actually, I do not think people realize that based on the crude oil, depends on the type of refining that is happening here in this country and a lot of our refineries are refining the crude oil that comes and that is imported to the United States, not necessarily the crude oil that is here in the United States. Is that correct?

Mr. NESS. Senator, you are correct to some extent.

Senator CORTEZ MASTO. Okay.

Mr. NESS. However, our imported crude oil has gone from what was almost 63 percent in 2007, 2008, pre-Bakken, by the way, now down to a very *de minimis* part of around 18 to 20 percent, I believe. And so, you are correct in that regard.

Senator CORTEZ MASTO. Thank you.

Mr. NESS. And I would just say that I would be happy to have someone identify a list for me of subsidies the American oil and gas industry gets because our subsidies are just regular tax incentives to expense—show your expenses off anything. So I would be more than happy to see a chart showing—I am not aware of any subsidies that a Bakken producer gets in North Dakota.

Senator CORTEZ MASTO. You are not aware of any direct subsidies that you get other than tax subsidies?

Mr. NESS. That is correct.

Senator CORTEZ MASTO. Okay. And thank you for that because I will look to the study that shows that there is \$20 billion annu-

ally coming in direct subsidies. And I would be curious, Mr. Larsen, if you know where that—if you have a response to that?

Mr. LARSEN. I, you know, I know a few sources where you could go. I know the Energy Information Administration tracks subsidies for all technologies and fuels, as well as there is always the Joint Committee on Taxation that knows where tax—

Senator CORTEZ MASTO. But to the extent that you have tax subsidies, that is less revenue coming into the Federal Government, but that is more benefits to the oil and gas company, is that correct?

Mr. NESS. Senator Cortez Masto, again, I am not aware of any direct subsidies that—

Senator CORTEZ MASTO. But you get tax credit subsidies?

Mr. NESS. We get the same incentives that any manufacturer would get to expense, you know, show, write off your expenses.

Senator CORTEZ MASTO. So it is a similar type of revenue that you get to keep if you get a tax credit.

I appreciate that. We can talk over and over this.

Mr. NESS. Yes.

Senator CORTEZ MASTO. Let's get to the facts.

Mr. NESS. The facts are, we do not receive direct subsidies on oil and gas.

Senator CORTEZ MASTO. So let me ask you this, because I know that in my state—the clean energy economy is growing across the country, and that has benefited so much in Nevada. We have talked about the cost of solar coming down and we have seen that in the State of Nevada. I also know that this clean energy economy employs thousands of workers in my state, statewide. It offers great paying jobs, union jobs in my state, and those jobs range from power generation to energy efficiency. I do believe that, for the very reason that we are here today and talking about high fuel prices, we need to be energy independent. That is what this means. And to get there, yes, we need a bridge of some sort. We need everybody on the all-of-the-above approach, everybody working to lower costs, including oil and gas and not profiting off of it. There needs to be this concerted effort of everybody working together to make us energy independent for the very reasons we are here today and the reasons that people are suffering at the gas tank right now, at the pump.

But let me ask you, Mr. Larsen or Mr. Bissell, can you speak to some of the economic and job benefits that come from investments in clean energy? Is that our future? Is that going to benefit us moving forward as we make these investments and try to get energy independent?

Mr. LARSEN. I can quickly give a high-level, national take on that. We looked at the employment implications of the kind of long-term tax credit package that looked similar to the Finance Committee's Clean Energy for America Act, and that, on average, over the next ten years, would generate up to 600,000 new jobs in wind, solar, and you know, maintaining jobs in the nuclear industry, and that is just electric power. So, you know, there are other employment benefits that go into other sectors. So that just gives you a rough sense of the magnitude of the opportunity here. That is 600,000 jobs annually.

Senator CORTEZ MASTO. Thank you. I know my time is up. Thank you, Madam Chair, I appreciate it.

Senator HIRONO. Thank you, Senator.

Before I close the hearing, I want to note that oil and gas companies hold 9,000 drilling permits and over 12,000 leases on public lands they are not using. This amounts to more than 20.6 million acres of federal land under lease in which they are not producing oil and gas, and the fossil fuel industry has had subsidies by law, it is actually written in the statutes, billions of dollars in subsidies for decades and decades, whereas on the alternative and renewable side, we have had to continue to renew the kinds of tax breaks, et cetera. So, you know, I think that is the direction we are going into, and as long as we continue to rely on oil and gas, and I realize the oil and gas producing states, it is really hard to get away from reliance on the very thing that you all produce. But at the same time, that kind of reliance when the price is set in the global market, we are going to continue to not become energy self-sufficient because we cannot get away from the global prices. And that is why there really is, for the long term, I would say, a need to move us toward alternative and renewables.

And again, I thank Mr. Bissell from Kauai and congratulate KIUC for its very forward-thinking, risk-taking behavior, which is resulting in positive energy prices for the people of Kauai.

So with that, I want to thank all my members for being here.

Senator HOEVEN. Madam Chair, I do have some questions—

Senator HIRONO. I'm sorry.

Senator HOEVEN. I do have some questions for my other witness.

Senator HIRONO. Oh, I am sorry.

Senator HOEVEN. If that would be all right?

Senator HIRONO. Sure, I thought you were done.

Senator HOEVEN. No.

[Laughter.]

Senator HOEVEN. I said I had some more questions, but I deferred.

Senator HIRONO. Oh, all right, please. I apologize.

Senator HOEVEN. Thank you, Madam Chair.

Senator HIRONO. Okay.

Senator HOEVEN. So Ms. Fedorchak, obviously, the country's needs for electricity are going to continue to grow, whether it is computers or cars or anything else. Where is that electricity going to come from, and where is it going to come from on a reliable basis, if we do not maintain our baseload from all sources, including coal-fired electricity?

Ms. FEDORCHAK. Absolutely, thank you, Senator Hoeven, for that question. I thought I was going to get off really easy.

Senator HOEVEN. Nope. Nope. I knew the Chairman would come back, but she had a few things to do.

Ms. FEDORCHAK. All right. You raise a very good point, and I think that several members have mentioned the need for the all-of-the-above strategy, and that really is very extremely important. The most important thing to remember, you can compare electricity on price all day long, but every megawatt is not created equal, and you have to have dispatchable power unless you just want the power when the sun is shining or the wind is blowing. And nobody

wants that. So Senator King hit it right, we need battery storage. We do not have that yet. And you cannot compare a place like Hawaii to a place like North Dakota. Hawaii has about a maximum, I think, I looked it up, 2,000 heating degree days. North Dakota has 8,000 to 10,000 heating degree days.

So I think even Mr. Bissell would agree that what is needed and possible in the electric grid in Hawaii is very different from what is capable in the State of North Dakota, where we get temperature swings from minus 20 to minus 30 degrees in the winter to 115 degrees in the summer. So, you know, the electric grid has to adapt to that. It has to adapt every second, with the exact amount of electricity that is needed, and the technology simply does not exist today to make that possible with 100 percent renewables. We have to have dispatchable resources fueled by our fossil fuels for the indefinite future until technology allows us to wean off from those.

Senator HOEVEN. So, you know, one of the things we are working on very aggressively, and not only in North Dakota, but other states as well, is things like carbon capture and storage and working on that both for geologic storage, but also for tertiary oil recovery. Again, leading the world in good environmental stewardship while producing more energy, more cost effectively, and more dependably. You pointed out that a federal one-size-fits-all does not work. I think you make that very clear when you talked about North Dakota and Hawaii both doing some really great things. What are some of the keys that, in terms of federal policy, that will really help advance carbon capture and storage?

Ms. FEDORCHAK. Thank you, Senator Hoeven.

Well, first of all, there has to be a commitment by the Administration and other federal agencies that coal is the future, coal is a fuel that we are going to invest in for the future. It is important not just for America, it is important for the world. So we should be leading the efforts to develop that technology here, perfect it, use it in places like North Dakota, apply it in places like India, China, other countries of the world, because this is a global problem.

So the 45Q tax credit that the Senate, and was included recently last fall, passed by all of you and supported, that is huge to support those investments. There are some really big projects occurring in North Dakota. Project Tundra is one that is going to be a commercial-scale, hopefully coal-fired facility with 100 percent carbon capture and storage. That is really exciting. There are other big coal plants in North Dakota pursuing the same technology. So I believe that technology can be proven in North Dakota, and those massive generating units—1,100 megawatts, 600, 700 megawatts of dispatchable power that is invaluable in the winter throughout the country, throughout the MISO region—those will be sustainable long-term with that new technology.

Senator HOEVEN. So these things really can fit together when you look at solar or wind and its intermittent nature, then producing oil and gas, Kauai still has 30 percent oil reliance, combining these things with carbon capture technologies. All these things can come together in a way that makes us stronger if we do not get stuck on this one-size-fits-all from a federal perspective, right? And that we provide the flexibility and the opportunity for

traditional sources of energy as well as some of the renewables, right, on a fair basis?

Ms. FEDORCHAK. Absolutely. That is the main thing I think we are hearing from the grid operators is that we have to have them all.

Senator HOEVEN. Right.

A final question for Mr. Ness. Isn't it the case that now if we are not producing that oil and gas here at home, we end up getting it from our adversaries, places like—and the world, not just us, but the world, whether it is Russia or Venezuela or even the Middle East, OPEC? Isn't that the case?

Mr. NESS. Senator Hoeven, our world needs energy every single day and the world is going to supply that oil and we absolutely are advocating for and supporting our enemies and others by not producing American energy.

Senator HOEVEN. So this is a national security issue as well as an economic issue for our country.

Mr. NESS. This is 100 percent a national, geopolitical issue, and the ability to supply our friends and allies in Europe and across the country with energy is the single greatest opportunity we have to ensure that we have national security and some opportunities going forward in those nations.

Senator HOEVEN. Yes.

I would also, along with the Chairman, like to thank all of our witnesses for being here today. I appreciate it.

Senator HIRONO. I feel as though I have to say one more thing, so I am going to say it. I am glad you mentioned that energy is a national security issue and a global security issue. Yes, it is, and so is global warming and the military has said global warming is a national security and global security issue because it is going to impact the ability of many countries to grow food, and all the attendant issues that will arise with starvation and everything else. So global warming is very much an issue we all need to face also.

Thank you very much, Senator Hoeven, and to each of you.

The members will have until close of business tomorrow to submit additional questions for the record.

So the Subcommittee stands adjourned.

[Whereupon, at 4:15 p.m., the hearing was adjourned.]

APPENDIX MATERIAL SUBMITTED

U.S. Senate Committee on Energy and Natural Resources
Subcommittee on Energy
July 13, 2022 Hearing: *Pathways to Lower Energy Prices in the United States*
Questions for the Record Submitted to Mr. David Bissell

Question from Senator Mazie Hirono

Question: In your testimony, you mention the importance of federal tax incentives in expanding the use of renewables. Could you elaborate on the importance of tax incentives in this area?

Federal tax incentives are extremely important in lowering the cost of new renewable generating sources and, ultimately, lowering the cost of electricity for our members. As a not-for-profit cooperative, KIUC is not eligible for tax incentives for solar projects. In 2014 we began seeking partnerships with renewable energy companies in order to create projects where the ITC could be captured and the savings passed on to KIUC members via long-term, power purchase agreements. This was accomplished with our three solar-plus-storage projects: the Tesla facility at Kapaia, AES Lawai and AES PMRF. The next project set to benefit from the ITS is the \$200 million-plus West Kauai Energy Project (WKEP). AES is the developer and has qualified for ITC at 26%, which will be realized as long as the project becomes operational prior to December 31, 2025. Current pricing on the WKEP PPA is favorable for our members and comparable to other renewable projects in our portfolio. Should the operational date slip into 2026, which is likely given delays on various government approvals needed to proceed, the level of ITC available to the project will reduce to 10%, making project financials much less favorable for our members. This is why we are advocating strongly for an extension of the ITC, or at least an extension on the operational deadline for projects already qualified to receive ITC.

Question from Senator John W. Hickenlooper

Question: It used to be a common knowledge that wind and solar could not achieve high penetrations on our electrical grids. To quote one well-cited, peer-reviewed paper from 2008: "It is generally accepted that the integration of intermittent energy resources like wind energy and photovoltaics into an electricity system cannot exceed a limit of around 20% or 25%." Mr. Bissell, you testified that Kauai's generation comes from 44% solar alone, and is fully 70% renewable. What has been the impact in Kauai on both price and reliability of pursuing such a high-renewable strategy, and what lessons can the Lower 48 states take from your experience?

In 2021, KIUC led the State of Hawaii in renewable generation and reliability, and we currently have the lowest residential rates in the State. In order to successfully integrate high levels of intermittent energy resources like solar, we have increased operational flexibility of our conventional generating fleet to accommodate higher levels of solar energy, added battery storage to mitigate the intermittency of solar resources, integrated grid-forming inverter capability to ensure solar resources perform similar to conventional generators, and added a synchronous condenser to our system. These features can be replicated on other electric grids, including the Bulk Power System that provides service to the Lower 48 states. In addition, the Bulk Power System contains multiple interconnections (which Kauai does not have) that can also help mitigate issues surrounding high levels of intermittent renewables.

U.S. Senate Committee on Energy and Natural Resources
Subcommittee on Energy
July 13, 2022 Hearing: *Pathways to Lower Energy Prices in the United States*
Question for the Record Submitted to Mr. John Larsen

Question from Senator Angus S. King, Jr.

Question: "One of the best tools we have to lower energy bills in my state is community solar, which allows energy customers to subscribe to a portion of a solar project and earn credits on their bills as the project produces power. Community solar also improves reliability and resiliency of the energy system, because the projects are located closer to customers and don't depend on expensive new transmission lines. My understanding is that roughly a dozen states have active community solar programs. Would you support expanding these programs so that all Americans can save money with solar power, no matter where they live?"

Answer: There are multiple policy options that can accelerate clean energy to scale up across the US. Community solar programs, like those in roughly a dozen states are one important option that has shown promise. If more Americans were to have access to community solar programs it is highly likely that more clean electricity will be deployed than if this option were not available.



July 13, 2022

The Honorable Mazie Hirono
Chair
United States Senate
Committee on Energy
and Natural Resources
Subcommittee on Energy

The Honorable John Hoeven
Ranking Member
United States Senate
Committee on Energy
and Natural Resources
Subcommittee on Energy

RE: "Hearing on Pathways to Lower Energy Prices"

Dear Senators Hirono and Hoeven:

Thank you for holding today's hearing to discuss policies that can help lower energy prices for American families. We share your interest on this issue and hope to work with you and your staff on smart policies and sensible regulations that support plentiful production of American energy supplies to meet demand.

AXPC developed the attached document, entitled "Unleash American Energy Production," to help inform discussions about actions that the Administration and/or Congress can take to support stable energy prices.

We look forward to working together on energy solutions for American families and businesses.

Sincerely,

A handwritten signature in blue ink that reads 'Anne Bradbury'. The signature is fluid and cursive, with the first name 'Anne' and last name 'Bradbury' clearly legible.

Anne Bradbury
Chief Executive Officer
American Exploration & Production Council



Unleashing American Energy Production, AXPC Policy Recommendations

AXPC member companies are authors of the great American Shale Revolution – a time in which energy costs went down due to domestically produced oil and natural gas that was unlocked through hydraulic fracturing and horizontal drilling technologies. In the case of supporting stable energy prices, unleashing American energy production is the answer. It's also the answer to good-paying American jobs, lower global emissions, and both energy and national security for our country and our allies. The Administration and/or Congress should take the following actions to Unleash American Energy Production:

1. **Strengthen our nation's energy infrastructure:** To ensure we can meet growing energy demands, while continuing to reduce emissions, Congress and the Administration should promote infrastructure development and protect and foster US refining capacity.

Limited refining capacity and pipeline capacity in much of the country create inefficiencies and drive-up costs. Streamlining the National Environmental Policy Act (NEPA) process and ending the obstruction of oil and natural gas projects will promote certainty and predictability in the permitting process to spur project investment in energy infrastructure. The NEPA environmental review process should be more efficient and consistent, clearly focused on NEPA's central goal of improving agency decision making within reasonable timeframes. The permitting obstruction—sometimes from non-pertinent federal agencies—of energy infrastructure projects should end and layers of duplicative regulation and reviews, such as the multiple reviews for greenhouse gas emissions, across federal agencies for the same project (or to control the same sources) should be eliminated.

The inability to move energy within the US forces consumers to depend on foreign natural gas during high demand periods. FERC should not pursue pipeline permitting policies that hinder the ability to build the energy infrastructure needed to access US resources, make energy more expensive for American families, or impede the permitting of new LNG facilities.

2. **Allowing access to produce on federal lands:** Amidst the global backdrop of high energy prices and skyrocketing inflation, the Biden Administration and Congress should find ways to support federal lands production. The US Department of the Interior should hold regular lease sales, as statutorily required by the Mineral Leasing Act. A historic royalty rate increase, coupled with federal acreage reduction and the omnipresent risk of litigation, will further challenge operators from developing federal mineral resources.
3. **Encourage LNG Exports:** The energy landscape is global and US energy exports are important to our country's role in the market, global security, and our climate leadership in the world. FERC and The US Department of Energy should expeditiously review and approve LNG facilities' permitting applications, so that natural gas can be transported and exported. In addition to supporting the necessary infrastructure here at home, the Administration should promote utilization of US LNG around the world as a cleaner, more responsible choice to alternative energy sources, and support policies that will encourage building additional import capacity around the globe.

4. **Encourage Capital Investments in American Energy Production:** To show the long-term strategic value of investing in our vital natural resources and US energy security, Congress and the Administration should clearly and unequivocally support domestic production of oil and natural gas.

Our industry is committed to transparency, collaboration, and engagement on climate solutions, but that does not necessarily mean that securities laws are the appropriate context for all climate-related disclosures. The Securities and Exchange Commission should reconsider its burdensome climate disclosure proposal, collaborate with our industry, and build on existing efforts underway to further consistency and comparability of climate-related reporting.

5. **Relieve Supply Chain Bottlenecks:** The complex and costly process for drilling and completing a new well in the United States takes time and significant resources, even without the challenges we face from supply chain disruptions and labor shortages. There is a great deal of uncertainty right now about everything from storage levels to additional sanctions to how OPEC producers will respond to increased American production. Inflationary costs, labor shortages, and supply chain disruptions are further hindering increased production. In fact, inflationary pressures are leading to 15-20 percent in additional capital spend just to maintain current oil and natural gas production levels and could go even higher. The Biden Administration should rescind steel tariffs that remain on US allies as steel is a critical component of energy production and work with our industry on reducing supply chain bottlenecks.

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Statement of Rob Larew on behalf of the National Farmers Union
Hearing Before the Senate Committee on Energy and Natural Resources
Subcommittee on Energy on Pathways to Lower Energy Prices

July 13, 2022

National Farmers Union (NFU) appreciates the opportunity to submit this statement, as part of the Subcommittee's hearing on Pathways to Lower Energy Prices, to express its strong support for promotion of renewable fuels, including mid-level ethanol blends, as an important opportunity to address transportation fuel costs today. Supporting ethanol will help ensure consumers have the lowest-cost option at the pump and deliver improved air quality and greenhouse gas (GHG) emissions reductions from transportation.

NFU has more than 200,000 family farmer and rancher members nationwide and organized divisions in 33 states. We have supported family agriculture and rural communities since 1902. Family farms are key to a safe, secure, and stable food system. Biofuel production represents a much-needed market for farmers, particularly at a time when rural America is facing major financial challenges in the farm sector. Domestic utilization of crops for biofuel production helps stabilize and support prices while promoting sound and sustainable agricultural practices, reducing carbon emissions, improving air quality, and enhancing the nation's energy independence and security.

NFU is pleased with this Administration's efforts to get the Renewable Fuel Standard (RFS) program back on track. Despite successes in promoting biofuel production and use and its many benefits, certain administrative actions have undermined the program and moved biofuels backwards. The U.S. Environmental Protection Agency's (EPA) recent action, while not perfect, returns the program to achieving a goal of at least 15 billion gallons of ethanol in 2022 and eliminating the problematic small refinery exemptions that were creating uncertainty and undermining the volume requirements. It also seeks to fulfill the improperly waived renewable fuel volumes from 2016. Unfortunately, EPA will be late again in setting the volume requirements for compliance year 2023, and NFU is supporting enforcement of the volume requirements as envisioned by Congress. We are also pleased that EPA has begun a discussion on its lifecycle GHG emissions modeling, which recognized the significant uncertainty surrounding analysis of land use change estimates, especially when attempting to use satellite data. Recent analysis has shown that ethanol provides much higher reductions in GHG emissions than previously assessed by EPA.

The Administration's actions under the RFS are important to support ethanol production and use. However, more can and needs to be done, which will help address the price volatility in gasoline and increases of prices at the pump being seen today.

NFU has urged the promotion of higher blends of ethanol, such as mid-level blends of E20-E40, which are readily available and the most cost-effective means to move toward higher octane, low-carbon fuels—a widely supported goal. Additionally, ethanol reduces prices at the pump for consumers. According to <https://e85prices.com/> (last visited July 12, 2022), the average price of E10 (\$4.81) is \$0.59 cents less than the average price of gasoline with no ethanol (\$5.40). The average price decreases by another \$0.43 per gallon when increasing the ethanol blend to E15 (\$4.38). Mid-level ethanol blends can provide even greater savings.¹ For example, a station in Wisconsin reported E20 at \$3.65 per gallon and E30 at \$3.90 per gallon. This can be compared to E10 at \$4.40 and E15 at \$4.30 at that same station. At other stations listed, prices for E20 and E30 were reported at prices below E10/gasoline by as much as \$0.80.

In June of 2022, the Lower Food and Fuel Costs Act (H.R. 7606) passed the House of Representatives to deliver relief to American families facing record-high prices at the pump.² Through its Fairness for Farmers campaign, NFU has been working to bring many of the issues addressed by this legislation into the national spotlight, including pushing back against corporate monopolies, broadening market opportunities, expanding processing capabilities, and addressing supply chain vulnerabilities.

NFU strongly supported several provisions in the bill, including provisions to allow year-round sales of E-15 as a step in the right direction in usage of higher-level blends of ethanol. E15 is approved for use by automakers in more than 97 percent of cars and trucks on the road today. The bill would also provide funding to increase infrastructure for biofuels, particularly blender pumps.³ Investment in updated dispensers, tanks, pumps, and components that carry E15 and higher blends will offer all the blend's benefits to more consumers. By June 16, 2022, nine states had indicated they will make E15 available year-round: Iowa, Nebraska, Illinois, Kansas, Minnesota, North Dakota, Ohio, South Dakota, and Wisconsin.⁴ Increased use of ethanol is a boost to rural economies and lowering prices at the pump for consumers. These measures will expand opportunities for farmers while driving down costs for consumers.

While these are important steps, mid-level ethanol blends are also compatible with existing vehicles and should be supported. The use of higher levels of ethanol blends could replace a larger share of petroleum gasoline with high-octane, low-carbon, cleaner and lower-cost fuel today. And it is domestically produced, providing an immediate solution that delivers simultaneous economic, environmental, and national and energy security benefits.

¹ While E85 is reported as having the lowest average price at \$3.72, E85 can only be used in flexible fuel vehicles. See also *E85 ethanol fuel demand grows as gas prices soar*, June 13, 2022, KHOU*11, <https://www.khou.com/article/news/local/e85-ethanol-fuel-demand-grows/69-39788386-437b-4fb4-bbe5-8cac151030e9>.

² NFU June 16, 2022 Press Release, *NFU Applauds House Passage of Lower Food and Fuel Costs Act*, <https://nfu.org/2022/06/16/nfu-applauds-house-passage-of-lower-food-and-fuel-costs-act/>.

³ In addition, the bill includes provisions for competition oversight in the meat and poultry industries and funding for nutrient management and precision agriculture investments, and food system supply chain resilience planning.

⁴ Zack Budryk, *House passes bill to end restrictions on higher-ethanol fuels amid spiraling gas prices*, June 16, 2022, The Hill, <https://www.yahoo.com/entertainment/house-passes-bill-end-restrictions-162142729.html>.

While there are several actions EPA can immediately take up to support mid-level ethanol blends, Congress can also help by passing bipartisan legislation to support use of low carbon, high octane fuels, such as the Next Generation Fuels Act (H.R. 5089). This legislation will improve transportation fuel quality and incentivize vehicle technologies that simultaneously reduce GHG emissions and increase fuel economy. Making mid-level ethanol blends available will move this country toward meeting its long-term goals.

Supporting the RFS and these House bills are steps that can be taken today to give consumers relief. More must be done to continue to support increased use of mid-level ethanol blends, as the most cost-effective, high octane fuel available today.