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PART II: DEFINING RELIABILITY IN A TRANSFORMING ELECTRICITY INDUSTRY

TUESDAY, OCTOBER 3, 2017

House of Representatives

Subcommittee on Energy

Committee on Energy and Commerce

Washington, D.C.

The subcommittee met, pursuant to call, at 2:00 p.m., in Room 2123 Rayburn House Office Building, Hon. Fred Upton [chairman of the subcommittee] presiding.

Members present: Representatives Upton, Olson, Shimkus, Latta, Harper, McKinley, Kinzinger, Griffith, Flores, Mullin, Cramer, Walberg, Walden (ex officio), Rush, McNerney, Peters, Green, Castor, Sarbanes, Tonko, Loebsack, Schrader, Kennedy, and Butterfield.

Staff present: Ray Baum, Staff Director; Allie Bury, Legislative Clerk, Energy/Environment; Kelly Collins, Staff

Assistant; Zachary Dareshori, Staff Assistant; Wyatt Ellertson, Research Associate, Energy/Environment; Theresa Gambo, Human Resources/Office Administrator; Tom Hassenboehler, Chief Counsel, Energy/Environment; Jordan Haverly, Policy Coordinator, Environment; A.T. Johnston, Senior Policy Advisor, Energy; Mary Martin, Deputy Chief Counsel, Energy & Environment; Drew McDowell, Executive Assistant; Alex Miller, Video Production Aide and Press Assistant; Brandon Mooney, Deputy Chief Energy Advisor; Mark Ratner, Policy Coordinator; Peter Spencer, Professional Staff Member, Energy; Jason Stanek, Senior Counsel, Energy; Madeline Vey, Policy Coordinator, Digital Commerce and Consumer Protection; Evan Viau, Staff Assistant; Hamlin Wade, Special Advisor, External Affairs; Everett Winnick, Director of Information Technology; Andy Zach, Senior Professional Staff Member, Environment; Michelle Ash, Minority Chief Counsel, Digital Commerce & Consumer Protection; Jeff Carroll, Minority Staff Director; Lisa Goldman, Minority Counsel; Dino Papanastasiou, Minority GAO Detailee; Caroline Paris-Behr, Minority Policy Analyst; and Tim Robinson, Minority Chief Counsel.

Mr. Upton. Good afternoon, everyone. This is Part II of "Powering America: Defining Reliability in a Transforming Electricity Industry."

And so we have already done our opening statements. We did them a couple days ago, so we are going to turn to you. I just want to welcome all of you for joining us here today and thanks again for your flexibility in rescheduling this very, very important hearing.

Today, we are going to reconvene with Part II of the Energy Subcommittee's hearing entitled "Powering America: Defining Reliability in a Transforming Electricity Industry."

The second panel of witnesses will provide their insight into how the different attributes of generation resources help system operators protect the reliability of the electricity grid. Especially in light of Friday's announcement this hearing is particularly timely. We are anxious to hear your thoughts.

As you know, your statements have been made part of the record in their entirety and so if you would take no longer than five minutes each and then we will do questions from the subcommittee.

Mr. Durbin, we will start with you, the executive VP and chief strategy officer of API, American Petroleum Institute. Welcome.

STATEMENTS OF MARTY DURBIN, EXECUTIVE VICE PRESIDENT AND CHIEF STRATEGY OFFICER, AMERICAN PETROLEUM INSTITUTE; PAUL BAILEY, CEO, AMERICAN COALITION FOR CLEAN COAL ELECTRICITY; MARIA G. KORSNICK, CEO, NUCLEAR ENERGY INSTITUTE; TOM KIERNAN, CEO, AMERICAN WIND ENERGY ASSOCIATION; STEVE WRIGHT, GENERAL MANAGER, CHELAN COUNTY PUD, ON BEHALF OF THE NATIONAL HYDROPOWER ASSOCIATION; CHRISTOPHER MANSOUR, VICE PRESIDENT OF FEDERAL AFFAIRS, SOLAR ENERGY INDUSTRIES ASSOCIATION; KELLY SPEAKES-BACKMAN, CEO, ENERGY STORAGE ASSOCIATION; JOHN MOORE, DIRECTOR, SUSTAINABLE FERC PROJECT, ENERGY & TRANSPORTATION PROGRAM, NATURAL RESOURCES DEFENSE COUNCIL

STATEMENT OF MR. DURBIN

Mr. Durbin. Thank you, Mr. Chairman, members of the subcommittee, and thanks for the opportunity to testify today on the reliability of our electric grid.

Increased use of natural gas in electric power generation has not only enhanced the reliability of the overall system, it's also provided significant environmental and consumer benefits.

The abundance, affordability, low emissions profile, and flexibility of natural gas and natural gas-fired generating units make it a fuel choice.

There is no question, however, that the bulk power system will continue to rely on multiple fuels including natural gas, nuclear, coal, hydro, wind, solar, et cetera.

For those who believe diversity -- fuel diversity is important for grid reliability, the good news is that the nation's electric power generation portfolio is far more diverse today than it was a decade ago, largely due to the increased use of affordable reliable natural gas.

Government forecasts show that that diversity will be maintained for years to come. However, it's important to remember that fuel diversity in and of itself does not equal reliability.

Reliability is derived from a diversity of attributes and generation, not just the diversity of fuel sources. PJM's March 2017 report, "Evolving Resource Mix and System Reliability," notes, "more diverse fuel portfolios are not necessarily more reliable."

That said, in every meaningful way, the inherent attributes of natural gas fuel generation including dispatchability, security of fuel supply, shorter start times, frequency response, quicker ramp rates, and lower minimum load level, to name a few, make the electric grid more reliable and resilient.

It's important, however, that market rules remain fuel neutral by assigning value to performance-based attributes that contribute to the reliability and resilience of the grid rather than any particular fuel or technology.

Looking ahead, as the committee examines how best to ensure the long-term reliability and resilience --

Mr. Upton. Mr. Durbin, even though I can hear you fine, can you just move the mic a little bit closer to you?

Mr. Durbin. Yes, sir.

Mr. Upton. Great. Thank you.

Mr. Durbin. As the committee examines how best to ensure the long-term reliability and resilience, five factors are essential.

First, as I said a moment ago, natural gas generation enhances the flexibility of the electric grid by providing flexible and fast ramping, which can cycle off and on in a short period.

This helps maintain stability and reliability of the grid as it accommodates an increase in variable renewable energy resources.

Second, government and private sector experts are in agreement that natural gas will remain an abundant and affordable fuel for decades to come.

Third, because natural gas-fired power plants are one of the most cost effective forms of generation to build and operation, wholesale electricity costs have been significantly reduced.

As an example, since 2008 average annual wholesale power prices in PJM have decreased by almost 50 percent.

Fourth, the increased use of natural gas and power generation continues to drive emissions reductions. In 2016, carbon dioxide emissions for electricity generation were at nearly 30-year lows

and EIA attributes 60 percent of the power-related CO2 emissions reductions since 2005 to a greater use of natural gas.

Finally, the geographic diversity of the natural gas system, where it is produced, and how it is transported makes it a reliable and resilient fuel source.

Market forces and public policy are driving the ongoing shift in our nation's power generation mix. Natural gas generation is an important and growing part of that mix.

Collectively, the environmental advantages, reliability, and affordability of natural gas and natural gas generation have allowed it to earn its market share in the power generation space because it provides and will continue to provide reliable low-cost fuel for electricity generation and cost savings to consumers.

The natural gas industry stands ready to work with all stakeholders to ensure our nation's electric grid is reliable, safe, and resilient. We were pleased to join more than a dozen other energy trade associations in a letter to this committee supporting competitive market rules that promote a diverse portfolio through fuel-neutral policies.

Thank you for the opportunity to testify today and I look forward to these questions.

[The prepared statement of Mr. Durbin follows:]

**********INSERT 1**********

Mr. Upton. Thank you.

Mr. Bailey, president and CEO of American Coalition for Clean Coal Electricity, welcome. Nice to see you.

No. No. You needed to hit the button, I think.

Mr. Bailey. Button?

Mr. Upton. Button. That's the most important --

Mr. Bailey. Problem solved.

Mr. Upton. There you go.

Mr. Bailey. There we go. Okay. Good.

STATEMENT OF MR. BAILEY

Mr. Bailey. Chairman Upton, members of the subcommittee, we want to commend you for holding the hearing today and for allowing us the opportunity to testify.

ACCCE represents America's fleet of coal fuel power plants. Through the first half of this year, the fleet supplied 30 percent of the nation's electricity needs.

In 2010, the coal fleet represented more than 300,000 megawatts of electric generating capacity. Unfortunately, more than 100,000 megawatts of coal fuel generating capacity have either retired or announced plans to retire.

These retirements represent one-third of the fleet that existed just seven years ago. A secure electric grid is vital to the nation's well-being. This means the electric grid must be both reliable and resilient.

The coal fleet provides many attributes that help ensure both reliability and resilience. These attributes include fuel security and many other essential reliability services.

It is important to keep in mind that reliability and resilience are not the same thing. Reliability refers to resource adequacy and the security of the bulk power system to withstand sudden disturbances, according the NERC.

Reliability is a well-defined term with agreed upon metrics and attributes. For example, my written testimony lists more

than a dozen reliability attributes. The coal fleet scores well against these attributes. Some of the other resources represented on this panel also score well on reliability attributes.

On the other hand, there are no agreed upon resilience criteria or metrics. Resilience means maintaining a reliable grid in the event of a high-impact low-frequency events or, put another way, low probability disturbances that have catastrophic consequences such as a polar vortex.

Fuel security is critical to both reliability and resilience. Over the past five years, the coal fleet has maintained an average on-site stockpile of 73 days of sub-bituminous coals and 82 days of bituminous coal.

Several recent resorts including those by the National Academy of Sciences and PJM cite the importance of the coal fleet's on-site fuel supply that contributes to grid reliability and resilience.

Despite its contribution to reliability and resilience, the coal fleet faces a number of challenges. These include environmental expenditures, low natural gas prices, mandates and incentives for renewables, out-of-market subsidies and market rules that do not properly value the attributes of the coal fleet.

Market rules are important because almost two-thirds of the coal fleet serves also electricity markets. Last week, DOE took an important step by proposing a rule that directs FERC to adopt

certain electricity market reforms.

The rule would require RTOs and ISOs to adopt market rules to ensure that fuel security, reliability, and resilience attributes such as those provided by the coal fleet are fully valued.

Although we are still evaluating the proposal, it represents a major step towards achieving at least some reforms in wholesale electricity markets.

However, to achieve DOE's goal and prevent more premature coal retirements, these reforms must be adopted quickly. FERC must provide strong leadership and act expeditiously and grid operators must adopt these and other reforms as soon as possible.

Thank you again for the opportunity to testify today.

[The prepared statement of Mr. Bailey follows:]

**********INSERT 2**********

Mr. Upton. Thank you.

Next, we are joined by Ms. Maria Korsnick, president and CEO of NEI. Welcome.

STATEMENT OF MS. KORSNICK

Ms. Korsnick. Thank you very much.

For many decades, the Americas' fleet of nuclear reactors have served this nation by providing clean base load power and support for local infrastructure.

Today, those same plants which support over 475,000 jobs across America are being threatened by energy markets which do not value nuclear's attributes.

This practical and public policy issue must no longer be ignored. I thank Chairman Upton and Ranking Member Rush for holding this hearing. We need an open and honest conversation about what should be done to maintain these important assets.

Last week the U.S. Department of Energy, under the leadership of Secretary Perry, issued a directive ordering FERC to take swift action to address U.S. electrical grid resiliency.

This action is a result of DOE's recent report highlighting the impact that market and regulatory policies are having on base load power plants including our nation's nuclear reactors.

Additionally, the IHS Markit issued a report valuing diversity at $114 billion a year. It's essential this committee encourage FERC and the RTOs to work together to create the market rules for the diverse portfolio that we need.

Unfortunately, current market designs fail to compensate the unique and beneficial attributes of nuclear generation and here

is what I mean.

First, nuclear produces reliable base load power while not emitting harmful air pollutants or carbon dioxide. It produces large quantities of electricity around the clock safely and reliably, operating over 90 percent of the time for the past 15 years. That's higher than any other generation source.

And we provide ancillary services such as voltage, frequency, and reactive power support to the grid. Our reactors are secure hardened facilities which have the fuel to run for 18 to 24 months, avoiding reliance on just-in-time fuel delivery.

This is essential when natural disasters and catastrophic events occur and we help create the fuel and technology diversity that is a bedrock characteristic of a reliable resilient electric sector which helps create affordable and stable rates for consumers.

Let's talk about some real examples. During the 2014 polar vortex, nuclear generators performed than all other forms of generation, operating with an average capacity factor of 95 percent.

More recently, despite Hurricane Harvey's devastating impact on the region, the two south Texas nuclear plants continued operating at 100 percent power during the storm, providing much-needed electricity to police stations, hospitals, and shelters.

And Hurricane Irma ravaged Florida, the St. Lucie Nuclear

Plant on Florida's east coast, operated a reactor at 100 percent power to provide what remained of the grid much-needed power for critical services.

The DOE study did a good job laying out the challenges facing the electricity system and among these are unprecedentedly low natural gas prices, low electricity demand growth, and increased use of variable renewable energy due to regulation and mandates at the state and federal levels, which are creating unintended consequences for all electricity generators but particularly base load plants.

Although DOE found that the markets have met short-term reliability needs at low cost, DOE determined that FERC must reform the markets to address system resilience and long-term grid stability.

Comprehensive reform must resolve two pressing problems. The markets are not functioning well when prices are negative. Reactors are, in fact, forced to pay grid operators to take their power.

And second, market designs fail to compensate nuclear generation with a unique set of attributes that I've discussed. These attributes play an important role in creating affordable electricity for our consumers.

As we've awaited federal action, state solutions have preserved seven reactors and saved thousands of jobs in New York and Illinois and are helping bridge us towards a secure energy

future.

I cannot overstate the need for FERC and the RTOs to expeditiously implement solutions. Since 2013, three nuclear reactors have prematurely retired due to market conditions and another eight reactors are scheduled to prematurely retire for market or policy reasons.

Now, some of these plants will shut down more than a decade before their operating licenses expire, and when a nuclear plant shuts down, the nation irrevocably loses a reliable source of continuous generation and electricity prices and air emissions both increase.

I did not paint a rosy picture today but I painted an accurate one. America's nuclear fleet and all the value it brings to our nation is in clear and present danger without your action.

As China and Russia aggressively attempt to replace our nation as the world's leader in nuclear technology, it's now more imperative than ever that this committee take action.

I applaud your leadership in holding this series of hearings and I look forward to working together to find ways to fix the current market flaws and to ensure America's nuclear fleet not only survives but thrives as part of our nation's diverse and reliable system.

Thank you.

[The prepared statement of Ms. Korsnick follows:]

1 **********INSERT 3**********

Mr. Upton. Thank you.

Next, we are joined by Mr. Tom Kiernan, CEO of American Wind Energy Association.

Tom, welcome back.

STATEMENT OF MR. KIERNAN

Mr. Kiernan. Thank you very much.

Chairman Upton, Ranking Member Rush, and other distinguished members of the subcommittee, thank you very much for the opportunity to testify on behalf of the diverse membership of the American Wind Energy Association.

AWEA represents the entire supply chain of the wind industry from family-owned construction companies in Minneapolis to some of the country's largest utilities to Fortune 500 companies that are increasingly buying our product, wind energy.

The wind industry welcomes the focus on reliability and resilience and we have consistently supported more rigorous reliability standards at FERC and NERC.

Now, this should not be surprising, given our advanced technology, that some of you may not be aware of, now enable wind to provide many if not most of the essential reliability services needed for the grid.

As NERC has noted, reliability and resilience of the grid are good and increasing and that wind energy contributes to providing these reliability services and resilience of the grid.

Wind is not only capable of delivering these services but also has demonstrated a strong track record of doing so and I'd like to share six brief examples, if I may.

First, during the 2014 polar vortex, wind energy was

resilience to cold weather and helped keep the lights on while 13,000 megawatts of coal and 1,400 megawatts of nuclear were forced offline in PJM alone despite having onsite fuel.

Second, and similarly, during the 2011 Texas cold snap, wind energy received accolades from the grid operators while over 3,000 megawatts of coal went offline, despite onsite fuel.

Third, and more recently, most wind plants along the Texas coast continued producing energy as Hurricane Harvey came ashore and were producing as long as the grid was up.

In contrast, two coal units were forced offline and stayed offline due to flooded onsite fuel.

Fourth, grid operators in Texas and Colorado now regularly dispatch the output of wind plants up and down to provide frequency response and balance electricity's supply and demand with a degree of speed and accuracy that exceeds most conventional power plants.

Fifth, during several summer droughts coal and nuclear plants have been curtailed due to inadequate cooling water, again, despite having onsite fuel.

And lastly, Iowa and Kansas now produce more than 30 percent of their electricity from wind, South Dakota and Oklahoma more than 25 percent, and this lastly year down in Texas the main operator produced over 15 percent of their electricity from wind and reliability is at an all-time high with wind providing some of the essential reliability services such as reactive power and frequency response.

I would now like to offer four recommendations for electricity policy makers. In summary, first, rely on competitive markets; second, focus on reliability services, not generation sources; third, do not be distracted by perceived problems; and fourth, promote transmission infrastructure. I will go quickly through each.

First, rely on competitive markets -- competitive markets enable a cost-effective division of labor among energy sources. Each energy source will deliver the reliability services it can provide best and at the lowest cost, resulting in a cost-effective delivery of a stable grid.

Secondly, focus on reliability services, not generation sources. Grid operators should seek to identify and compensate for reliability services and not some fuel characteristics such as whether a resource as onsite fuel.

In other words, focus on the services that the power system needs like flexibility, disturbance ride-through capability, frequency in voltage support, and actual energy production in times of high demand and not the fuel type of the generator.

FERC RTOs and NERC are well equipped to define the services needed.

Third, do not be distracted by perceived problems. I've seen frequent mention of the supposed harmful effects of negative pricing.

As the DOE notes in their recently released grid study,

negative crisis "had had almost no impact on annual average day ahead or real-time wholesale electricity prices," and are also often caused by fossil or nuclear power plants.

And fourth, promote transmission infrastructure development. Building a more robust transmission system is the single most effective tool for improving resiliency.

A strong integrated power grid would provide the same vast benefits as our interstate highway system has in allowing the most competitive businesses to deliver their low-cost products to consumers.

So, in sum, we support the objectives of maintaining reliability and resilience and urge that they be promoted through free and open markets with a focus on reliability services, not generation sources, and a program to promote transmission infrastructure development.

Thank you very much.

[The prepared statement of Mr. Kiernan follows:]

**********INSERT 4**********

Mr. Upton. Thank you.

Next we are joined by Steve Wright, GM for Chelan Public Utility District on behalf of the National Hydropower Association.

Welcome to you, sir.

STATEMENT OF MR. WRIGHT

Mr. Wright. Mr. Chairman, Ranking Member, thank you for the invitation to appear to today. My name is Steve Wright and I'm the general manager at Chelan County, Washington Public Utility District.

Chelan has roughly 2,000 megawatts of hydropower. I'm also representing the National Hydropower Association.

From 2000 to 2013, I was the administrator and chief executive officer of the Bonneville Power Administration, serving under three presidents.

My duty today is to describe the value that hydropower provides supporting reliable service to our nation's electric consumers.

This should be one of the easier assignments given to any congressional witness, given the vast array of reliability, cost, and air emission benefits hydropower provides.

It's important to understand that maintaining reliability involves many complex products and services. These include energy, peak capacity, regulation or frequency response, spinning and non-spinning reserve, voltage control, black start capability and inertia, and particularly important in a world increasingly reliant on variable energy resources, there is a need for flexible capacity.

Many generating resources can provide multiple

characteristics necessary for reliability. But hydropower is best positioned to provide them across the board.

In life we usually have to face a trade-off between quality and cost. Not so with respect to hydropower. Hydropower is generally the least-cost resource available in the marketplace.

Hydropower also produces zero air emissions and represents a least-cost path to meeting both our reliability and emissions national objectives.

The key challenge for hydropower in the coming decade is the lack of policy attention it has received. Hydropower is, for the most part, taken for granted in the marketplace.

This results in significant potential missed opportunities for both refurbishment and new construction. There is a need for a massive reinvestment in what is an aging fleet.

Most hydropower capacity in this country was built from 1930 to 1975. For the most part, the engineering on these projects was excellent and the projects are outliving design life.

We are, however, already entering a period where there is a need to refurbish tens of thousands of megawatts of hydropower capacity.

The decision whether to invest in hydropower refurbishment can be described simply. The cost of refurbishment is compared against other alternatives, taking into consideration prices for energy, capacity, and environmental attributes.

In today's market, energy prices are currently quite low,

in part due to the federal tax policy. Capacity markets are not providing prices commensurate with what's necessary for refurbishment or, in some cases, even maintenance of existing plants.

This is in part due to the difficulty of establishing markets and regulatory regimes for issues such as resource adequacy that address the specific services and actions necessary to maintain reliability.

And the environmental attribute markets are not providing pricing commensurate with aggressive goals or emissions reductions.

New hydropower resources and even many refurbishment projects face a challenging investment environment, given today's pricing. And while low prices sound good for consumers, it would not be if it leads to shortage, price volatility, and reliability problems.

Unfortunately, I lived through the West Coast energy crisis when we experienced fundamental imbalance between supply and demand. Our policy should be developed to assure there is adequate supply to achieve high reliability and reduce the risk of extreme price excursions.

NHA's Jeff Leahey provided testimony before the Senate Energy Committee that identified federal policy that needs to evolve in the following ways to support hydropower.

We need relicensing reform. The, roughly, 10 years required

for relicensing does not compare favorably against the permitting requirements for other generating resources. It needs similar tax treatment to other zero-emission-generating resources and we need further support for research and development.

And I would add to that list support for adequate capacity prices to encourage cost-effective investment. The fundamental problem addressed last week by the Department of Energy is despite best efforts in various regions, markets to this point have not been structured to provide adequate compensation for the various services necessary to assure long-term resource adequacy, reliability, and resiliency.

Underlying federal or state tax and other incentive policies tend to make robust market design even more difficult. The capacity reliability challenge will be -- will vary by region, though.

For example, in the West, with our plethora of variable energy resources, our biggest challenge is providing flexible capacity.

Because it is complex, it will be difficult to address in an expedited process or with a focus as limited as the concept of base load resources. But at the same time, the problem of price formation being inadequate to address reliability needs is real.

Policies that assure adequate resource supply for reliability deserve the attention of policy makers.

So in conclusion, hydropower is the nation's premier

generation source for reliability, cost, and emissions perspective.

Due to its quiet long history and relative success, it has been taken for granted in federal public policy debates. Given what is at stake, hydropower deserves more focus.

Thank you for the time.

[The prepared statement of Mr. Wright follows:]

**********INSERT 5**********

Mr. Upton. Thank you.

Mr. Mansour -- Christopher Mansour, VP, federal affairs for Solar Energy Industries Association.

Welcome. You need to hit that button.

STATEMENT OF MR. MANSOUR

Mr. Mansour. There we go. And members of the committee, I am Christopher Mansour, vice president for federal affairs at the Solar Energy Industries Association. Thank you for inviting me to appear here before you today.

Before I begin, just let me say that our president and CEO, Abby Hopper, regrets being unable to attend the committee today. She's at the U.S. International Trade Commission that's right now having its hearing on the -- remedy hearing for the solar trade case. Further information on this trade case and the threat it poses to our industry is available in my written testimony.

I am testifying today on behalf of SEIA's almost 1,000-member companies and the 260,000 Americans employed in the U.S. solar industry. Solar is a strong driver for the American economy.

In fact, one out of every 15 new jobs created in the United States in 2016 was a solar job. While California leads the way in solar jobs, states like Nevada, Florida, Arizona, Texas, and North Carolina each employ over 7,000 solar workers.

2016 was also a record year for solar deployment in the country. We added 15 gigawatts of solar capacity, double the amount installed in 2015. Solar capacity in the United States now exceeds 47 gigawatts. Solar firms invested nearly $23 billion in the United States in 2016.

Solar was also the number-one source of new generating

capacity in the United States in the last year. In the first quarter of 2016, our country hit an important milestone of installing solar panels on 1 million American homes.

Our industry will double that number to 2 million by 2018 and double it again to 4 million homes by the end of 2022.

Solar is a growing part of our electricity mix, delivering 1.4 percent of the nation's total electrical usage. This is expected to grow to 4 percent by 2020.

Solar has been and will continue to be deployed in a manner that adds to the viability and security of the grid.

Regarding the Department of Energy's recent staff study on grid reliability, we appreciate the willingness of the secretary and his team -- Secretary of Energy, Mr. Perry, and his team -- to listen to our concerns with and our suggestions for the report.

We believe that many of comments were reflected in the final product. In particular, we agree with one of the findings in the report that stated, quote, "While concerns exist about the impact of widespread deployment of renewable energy on the retirement of coal and nuclear power plants, the data do not suggest a correlation," closed quote.

Last week, the secretary sent the FERC a proposed rule to address grid resiliency through cost-based payment mechanisms for certain coal and nuclear power plants.

The secretary cites the need to, quote, "protect American people from the threat of energy outages that could result in the

loss of traditional base load capacity," and specifically identifies the ability to provide voltage support, frequency services, operating reserves, and reactive powers benefits that such generation resources bring to the grid.

SEIA agrees with the secretary that FERC should continue its important work on price formation. We also agree with the assertion that generators -- all generators -- should be fully compensated for the energy, capacity, and ancillary services that they provide to the grid.

Where we do not agree with the secretary is that this rushed rulemaking is the right way to achieve those ends. FERC can and should define any reliability services or products that are missing from the marketplace in a technology-neutral manner.

Healthy competition will yield the most innovative solutions at the lowest prices for consumers while protecting ratepayers from having to shoulder unreasonable and unnecessary additional costs for little benefit.

In my written testimony, you'll find evidence of solar's contributions to grid reliability under both normal operating conditions and during unusual events.

During the recent solar eclipse, grid operators accurately predicted diminished solar output and adjusted generation sources accordingly with no subsequent blackouts or brownouts.

Solar also withstood the past month's multiple hurricanes. Based on what our member companies have told us, very few panels

-- solar panels were actually damaged during these storms.

Moreover, studies by NREL and others cited in my written testimony consistently demonstrate that not only can our regional grids accommodate high penetration of solar and other renewable sources but that solar projects have the ability to provide important services to the grid such as regulation, voltage support, and frequency response during various operating modes.

In closing, we support federal energy policies that promote reliability, security, and fuel diversity. Increased investments in transmission will bring greater reliability and access to more diverse sources of generation.

We look to FERC to ensure that well-functioning wholesale electric -- electricity markets thrive. In parts of the country without RTOs and ISOs, FERC must guarantee open access and nondiscriminatory treatment for independent renewable generators.

Finally, incentivizing significant investments in energy storage deployment on the transmission and distribution grids will increase grid reliability and promote another important resource to systems' operators.

Thank you, and I look forward to your questions. Thank you, Mr. Chairman.

[The prepared statement of Mr. Mansour follows:]

**********INSERT 6**********

Mr. Upton. Thank you.

Next, we are joined by Kelly Speakes-Backman, CEO of Energy Storage Association.

Welcome.

STATEMENT OF MS. SPEAKES-BACKMAN

Ms. Speakes-Backman. Chairman Upton, Ranking Member Rush --

Mr. Upton. You need to use that button, even though --

Ms. Speakes-Backman. I know that. I just forgot.

Thank you. On behalf of ESA, thank you very much for your time today. I would like to begin my remarks by level setting our understanding of the terms reliability, resilience, and flexibility.

Our electric system today is bound to a simple reality of physics. Supply must match demand at every moment everywhere. If it doesn't, then the result is equipment damage, service disruption, or blackouts.

So what we call reliability is really the ability to maintain that match of supply and demand during normal operations, even if they are variable or unpredictable.

What we mean by resilience is the ability to maintain service or restore supply during and after a disruptive external event. Flexibility is critical to both reliability and resilience to ensure uninterrupted power is delivered to consumers whenever and wherever they need it.

Energy storage technologies enable energy to be generated at one time and saved for another time. It is pretty simple as that. The concept enables an enormous amount of capabilities for

the grid, be it supplying backup power, reducing peak system demands, relieving stressed grid infrastructure, enabling higher penetrations of variable generation sources, or maintaining the optimal function of inflexible generation sources.

These capabilities ensure that supply and demand reliably match during normal operations and make that balance resilient to a greater range of threats.

When most people hear the words energy storage they think of batteries, and for good reason. Batteries are everywhere. They're in our phones. They're in our computers, appliances, our cars, and, increasingly, in our electric grid.

There are a variety of storage technologies including mechanical and thermal, and each has its own performance characteristics and best-suited applications. But all do the same simple job of storing energy, effectively decoupling time -- the element of time from supply and demand.

For today, I'm focussing on batteries. There is 800 megawatts of battery storage installed nationwide in -- at grid megawatt scale in 21 states.

Storage technologies, primarily lithium ion, are declining rapidly in cost, dropping by 50 percent every three to four years and projected to continue at this rate.

Driven by these cost declines, the U.S. is forecast to quadruple its installed storage capacity in just five years, representing $3 billion in annual sales.

But more importantly, these sharp cost declines are also -- also mean that storage will get a larger -- get larger and perform at longer durations, increasing their range of applications.

Storage is uniquely flexible compared to all other grid resources. Number one, it promotes the reliability and resilience at all levels of the grid and onsite locations.

It could be owned by utilities, third party providers, or consumers for a variety of services and cost-saving applications -- the only grid resource that can be used both as supply when discharging and demand when charging.

It's capable of near instantaneous response and precise control, ramping to full charge or discharge in milliseconds. It's capable of near -- sorry -- a single installation can perform multiple functions, even interchangeably over time, and it can be deployed quickly at megawatt scale within six months.

I provided several examples in my testimony that you can ask me questions about or what have you. But they include maintaining power quality, onsite power, backup power of solar plus storage during the recent hurricanes, locational grid support, demand response with chillers and water heaters, black start capability to enable other generators to return to normal operations, response to short-run grid fluctuations, avoiding outages from system imbalances, transmission and distribution system support during multi-year upgrades, contributions to resource adequacy meeting peak demands, and quick deployment for broader plant

failures.

Now, we have a lot of values that we can bring to the grid and with all of these capabilities you would think that storage would be much more prevalent in the market today.

But I will tell you, I think it's still hindered from full deployment. Policy and regulations today focus on what we want from technologies rather than performance.

Because of this, they can't keep pace with the innovation and the changing role of the consumer. We see four general themes to improving the performance characteristics of grid reliability and resilience, which can be competitively and cost-effectively met my storage. More details of these recommendations can be found in my written testimony.

And in closing, I'll just say that energy storage is here and it's growing fast. We support market-driven pursuit of -- to improve reliability and resilience.

And I thank you for your time.

[The prepared statement of Ms. Speakes-Backman follows:]

**********INSERT 7**********

Mr. Upton. Thank you.

Last, we are joined by Mr. John Moore, Sustainable FERC Project, Energy & Transportation Program from the NRDC.

Nice to see you.

STATEMENT OF MR. MOORE

Mr. Moore. Thank you very much, Mr. Chairman Upton, Ranking Member Rush, and members of the subcommittee. I appreciate the opportunity to testify here today.

One thing I think I can say after listening to everyone else on the panel is that we all agree that reliability and resiliency is critical as our grid continues to transform and that we need to have the ability to maintain a secure system and then quickly recover whenever extreme weather, physical attacks, or cyberterrorism attack on the grid.

I think, though, that if Hurricanes Irma and Harvey proved anything, it is that no resource actually is perfectly resilient or reliable, and actually some resources have more vulnerabilities than we might think.

In point of fact, several nuclear units suffered during Irma and Harvey and didn't return to service until days afterwards. We've already heard from Mr. Kiernan.

Saturated coal piles forced the power plant to switch over to natural gas, and then distribution and transmission systems also can create havoc with reliability and resilience as we've seen in Puerto Rico and parts of Florida as the grids were knocked offline.

The key question -- and now I'm going to turn to the DOE study because that's the topic of the day -- the key question is whether

massive subsidies of the type that the DOE proposes to -- proposes for the grid would have made any of these power plants more reliable or resilient and better able to withstand natural forces.

No. It actually might have made the problem worse by undermining markets and freezing out other equally reliable and less costly resources.

We can achieve the same level of reliability at a lower cost by first defining reliability services and then deciding -- and then designing markets around those needs. I think you have already heard a couple of witnesses testify to that fact.

Now, to our specific concerns about the Department of Energy's proposal, it would send billions of dollars each year to outdated technologies without any evidence that these payments are necessary.

It would supplant FERC's competitive electricity markets with an anti-competitive command and control system that decides what plants open and close by direction of the federal government.

You know, I wonder what's happened here to states' rights to choose their own resource -- to make their own resource adequacy decisions.

Illinois, for example, restructured in 1997 and made the decision to link to FERC's market design. Now the Department of Energy is telling them too bad, we are going to make your customers pay billions of dollars more for something that they don't want or need. That, to me, is resource adequacy masquerading as

resiliency.

Third, I am very concerned that this would politicize an independent agency in a way never before seen. FERC's independent system of competitive markets to channel customer dollars towards the cheapest generators able to meet customer needs would be replaced with a more arbitrary system marked by market crashes and peaks that could change with every administration.

In this reliability the goal of DOE's proposal could be compromised as politics, not technical assessments, would govern payment for grid services.

So in conclusion, if we want a truly resilient electric grid, moving to a low-carbon future will help us get there by reducing the risk of extreme weather and other disruptive events fueled by climate change.

Focus on grid reliability in resiliency services and next-generation market designs coupled with smartly-planned transmission needed to deliver high levels of clean renewable energy to market, and protect states' rights to make their energy choices.

Thank you.

[The prepared statement of Mr. Moore follows:]

**********INSERT 8**********

Mr. Upton. Thank you all, and now we will move to questions.

I want to be relatively quick on these first two. So last week -- Friday -- DOE issued a notice of proposed rulemaking to FERC with a 60-day timeline. FERC then re-docketed the notice of proposed ruling with a 20-day deadline for initial comments. I would note that a typical FERC proposed rulemaking has a 180-day deadline.

If you were king, what would that number be for this order that came out Friday? And Mr. Durbin, we will start with you, just to --

Mr. Durbin. Well, we joined several of the groups here and others around town making a motion to FERC asking for a 90-day.

Mr. Upton. Ninety-day. Mr. Bailey?

Mr. Bailey. Being king, I don't -- I don't have a number for you, Mr. Chairman. I honestly don't.

What we have said is that this needs to be done very, very quickly. That's all I can say to you.

Mr. Upton. Of course. I probably should have said queen -- queen or king for the day. Sorry.

Ms. Korsnick. That's okay. I am good with king.

Mr. Upton. Okay. All right.

Ms. Korsnick. I think the most important thing is that we allow for the appropriate conversation to play out and at the same token, as we said, there is a sense of urgency.

So I think somewhere in the neighborhood of 60 to 90 days

is appropriate.

Mr. Upton. Mr. Kiernan?

Mr. Kiernan. We support the 90-day approach, as Mr. Durbin mentioned. I'll also just emphasize this needs to be thoughtfully considered.

Obviously, the wholesale power markets -- extraordinarily important and complex, and there needs to be a good healthy thoughtful deliberative process so that we end up with a competitive market that works.

We worry about some rush to judgment that might support one fuel source or another. That is not the right approach.

Mr. Upton. Mr. Wright?

Mr. Wright. NHA doesn't have an official position on number of days. But I think it's pretty clear, I hope, from my testimony that trying to figure out how you get to reliability requires you to provide all those different services that are necessary and that is a complex conversation.

And then in addition to that, it's a regionally-based conversation because we have different issues in different parts of --

Mr. Upton. You're sounding like a politician.

Mr. Mansour?

Mr. Mansour. Mr. Chairman, actually, with the notice that we filed along with some of the other groups here, it was 90 days for the initial comment period plus another 45 for responses.

So and actually, 90 days is probably not sufficient in any case. This is an extremely large undertaking. It's a huge change in the way markets would work and FERC should take their time and they should hold a technical conference on this. They should allow for a maximum amount of public comment and input from a range of stakeholders.

Ms. Speakes-Backman. I will -- well, first, to answer your question I would say -- directly I would say 90 days is -- would be sufficient for us to be able to rush through and answer.

But I will also -- I would also like to add that especially based on the DOE staff report, we believe that resilience should really encompass much more than just fuel supply and so -- and resilience is a -- is a large issue and a large problem that we need to consider.

It's a lot more complicated than simply the fuel supply, and for that reason we think there needs to be more time given to this.

Mr. Upton. Mr. Moore?

Mr. Moore. Sure. It probably doesn't surprise you to -- for me to say that if I were king I'd probably put it in the trash can because I don't think it meets minimum standards of due process in the Administrative Procedure Act, along with the fact that other RTOs like PJM and ISO New England where many of these plants are located are working diligently on this now, in all seriousness.

Mr. Upton. The DOE staff report found that FERC should

expedite its efforts regarding its price formation efforts. Additionally, DOE has recently filed a notice of proposed rulemaking with FERC, as we know, directing FERC to accurately price generation resources necessary to maintain reliability and resiliency.

Yes or no, do you support FERC implementing DOE's filed NLPR as written? Some of you talked about that in your testimony but some of you did not.

Mr. Durbin. If it is yes or no, the answer is no. I, again, think that this was the -- what they asked for on Friday was totally inconsistent with what -- with the study they put out in August.

Mr. Upton. Mr. Bailey?

Mr. Bailey. Yes, sir. With a huge caveat, we are still looking at it. If the two answers are yes or no, I would -- I would say yes.

Mr. Upton. Ms. Korsnick?

Ms. Korsnick. We think it's a good baseline but we think additional conversations need to be had through the rulemaking process.

Mr. Upton. Mr. Kiernan?

Mr. Kiernan. No, we do not, and I would just add an example. The technological advances of wind energy show that you want to allow the markets to compete and evolve and not pick one fuel source over another.

Mr. Upton. Mr. Wright?

Mr. Wright. No on the process. Yes on the substance of it's a good idea to address price formation.

Mr. Upton. Mr. Mansour.

Mr. Mansour. It would have to be no on the process and no on the NOPR itself. Let the markets run.

Mr. Upton. Ms. Speakes?

Ms. Speakes-Backman. No as written.

Mr. Upton. Mr. Moore?

Mr. Moore. I think majority wins. No.

Mr. Upton. Okay. My time is expired.

I yield to the ranking member of the subcommittee, my friend, Mr. Rush.

Mr. Rush. I want to thank you, Mr. Chairman.

Mr. Moore, in your written testimony, you state that the nation's power grid to continue to transform towards a low-carbon future that will improve reliability and resilience by helping to prevent and reduce outages caused by the increase in extreme weather and other disruptions -- events.

You also say that efforts to ensure reliability and resilience during extreme weather should focus largely on the distribution system rather than on any particular type of generation system.

Can you briefly discuss some of the issues learned this historic hurricane season regarding reliability and resilience issues?

Also, can you explain why policymakers should be looking at low-carbon resources and focus on distribution rather than sources of generation?

Mr. Moore. Certainly. First of all, distribution system failures represent far and away the highest number of outages that cause blackouts in the country.

There is no -- absolutely positively no question about that, and that if you can't deliver power from any resource to the customer it's just as good as no power at all. So that's number one.

And number two, as I implied, reducing the carbon -- reducing carbon pollution reduces the risk of the high-intensity types of events that we have seen like the hurricanes last year.

Mr. Rush. Ms. Speakes-Backman, yesterday Bloomberg reported that Sonnen, a generation -- a German, rather, energy storage company is planning to install 15 micro grids in Puerto Rico in order to provide electricity to emergency relief centers.

Additionally, it is reported that Tesla, Incorporated will be sending hundreds of its overall power wall battery systems, and Sonoma, Puerto Rico's largest rooftop solar provider, plans to install batteries to complement its system. We have been told that it will take months to fully restore the island's electricity grid.

But in the meantime, can you discuss how we might utilize these small CO micro grids systems which can be installed quickly

to restore power to a few buildings at a time that will help power hospitals, fire stations, relief shelters, and other emergency shelters during these most difficult times?

Ms. Speakes-Backman. Thank you, sir, for the question, and I believe, sir, that you have the answer. You gave it in your question and I appreciate that.

Solar plus storage and storage plus many resources, as a matter of fact, depending on the location, especially if you've got distributed energy resources, can be a holdover, if you will, while you rebuild the grid to a more resilient phase.

And so this is why we have been cooperating and collaborating with SEIA. Just recently, on Friday and then on Monday, both SEIA and the Energy Storage Association announced a joint effort to request members supply and donate their resources, donate their expertise, and donate their dollars to support the efforts in Puerto Rico, to build micro grids of solar and storage to get us through this difficult time.

Mr. Rush. Do you think that the Department of Energy is -- could do more in terms of helping to encourage and assist in these micro grid efforts?

Ms. Speakes-Backman. Sir, I think that the Department of Energy has continued to serve as an excellent resource for us in research and in working to commercialize batteries for storage.

I think, certainly, there are always things that we can do more to help -- to help understand the applications that can be

made and help to extend the duration periods of storage.

Mr. Rush. So do you also feel as though these micro grid systems are something that we should seriously consider in terms of the future?

Ms. Speakes-Backman. Absolutely. It meets many of the requirements that were laid out in the DOE staff report for resilience beyond fuel -- beyond fuel supply.

So the ability not only to withstand external forces, whether they be weather or other external forces of calamitous events but also with respect to bringing the grid back on and to work within small communities to become islands of refuge, if you will, to be able to supply consumers with the refrigeration for their medicines, for their food, to be able to charge your batteries for your phone and your appliances and your computer to communicate with loved ones.

It's a very important aspect of reliability and resilience both.

Mr. Rush. Mr. Chairman, I yield back.

Mr. Upton. Thank you.

The chair would recognize for five minutes the gentleman from West Virginia, Mr. McKinley.

Mr. McKinley. Thank you, Mr. Chairman. Ms. Speakes, let me just start with you. Thank you for making the definition of reliability. I think so many on the panel have played around with that word.

They use it to fit their definition. Yours was very specific and I appreciate that. Others used it for their own purpose in their definition.

Mr. Wright, I got to you. My concern is shared with you and that is if we -- and as we proceed with the tax reform, one of the concerns is that the tax credit for hydroelectricity at 1.8 cents -- I think it goes up to nearly three quarters of a million dollars per plant to be able to subsidize that -- I am concerned that that type of tax credit could be lost with that.

So we are going to be spending some time on research and make sure that we have those reliability on that. So thank you for bringing that as your point, because I've seen several in West Virginia located there.

Third is on gas reliability. I am, obviously, sitting in the center of the Utica-Marcellus. We are big proponents of it. There are three power plants that are considered in West Virginia to be open.

But my concern has been, and we have been talking again about this tax credit, is how we can do more research into making sure that the gas is the reliable source that Ms. Speakes was talking about because we have had too many outages with gas.

We want it to be -- I can see the tremendous future using gas as a source. But when we see that we have had nearly four -- since -- from 2014 to the first quarter of this year there were 4,000 outages with gas because of the lack of supply -- 4,000 times

that they've had to shut down, not the least of which came out through the polar vortex.

But I think we can -- with research and the R&D we can salvage a lot more of that and bring it more in line. Because in my frame of mind, where I am coming from, nuclear is the most dependable, and I would say gas -- excuse me, coal would be the next and then we would get into some of the others -- fall down through that.

I want to bring gas up to a much more dependable source. But we have got to do the research to make sure that we can get that so that we don't have these outages.

And the last I want to turn to is Mr. Bailey. We had -- Gerry Cauley was here, the CEO of NERC, and he testified here before one of our hearings that, quote, "Markets should review the economic and market factors driving base load generation into early retirement."

Now, that, I think, is the crux of much of this. Are we moving too fast into this arena when we've -- about national security when we don't have power?

We can all talk about -- we have all got our talking points about what happened during the polar vortex and we saw the numbers of plants shut down. Twenty-two percent of PJM shut down that.

So back on what NERC has been challenged -- what FERC has been challenged to do following along what NERC has talked about, is this -- if we are going to be serious in Congress about fuel security, don't you think this concept that has been proposed by

DOE and over to FERC -- is that a reasonable approach that they should be taking?

Mr. Bailey. Mr. McKinley, so right now we are facing the prospect or likelihood of another 40,000 megawatts of coal retirements over the near horizon.

We have had 60,000 in the past. We face another 40,000. We agree with DOE that the markets are distorted. Now, there are a couple things that could be done and they are not mutually exclusive.

One, you could take the approach of DOE to address merchant generation. That's about 60,000 something megawatts as a coal fleet that would be affected -- we are guessing right now -- an educated guess -- that could benefit from this.

There is -- there is a large part of the coal fleet that's not covered that serves wholesale electricity markets. It's not merchant generation.

So we have, in effect -- I am trying to simplify this -- we have a DOE rule that helps merchant coal and nuclear. There are other market reforms that could be undertaken to help those other fuel-secure coal-fired generating units.

The problem we have and the reason DOE set an aggressive schedule -- and I'll come back to my non-answer to Chairman Upton earlier -- is that we have talked to a couple of the grid operators that have the most coal-fired generation in their regions and we simply asked them how long it would take them to undertake market

reforms -- for market reforms that would help base load generation.

One of them told us two years. The other one told us three years. The one who told us two years said no, the guy who said three years is probably right.

So we do -- we do need to have a sense of urgency about this. Ms. Korsnick spoke to it and I would say the same thing also.

Mr. McKinley. Yield back.

Mr. Olson. [Presiding.] Gentleman's time has expired.

The chair now calls upon the gentleman from Saratoga Springs, New York, Mr. Tonko, for five minutes.

Mr. Tonko. Thank you, Mr. Chair.

Thank you to the witnesses also for the insightful testimony this afternoon.

Mr. Moore, your testimony noted that electrical distribution systems are responsible for over 90 percent of total electric power interruptions.

You're sharing the panel with a number of generation resources. Rather than picking winners and losers in generation, can more be done to harden distribution and transmission infrastructure?

Mr. Moore. I think you -- yes, I think utilities, especially in New York in the wake of Sandy and starting in Florida a few years ago started to do exactly that kind of hardening and those are the kinds of utility-focused actions that can be done outside

of market design.

PJM actually developed some generation-specific, I would call them, hardening or resilience standards after the polar vortex that weren't embedded in the markets though had some common sense ideas like making sure your burners worked in the coal -- for the gas plants and things like that -- winter preparation.

So those are the kinds of things that I think customers on the ground would actually, you know, see fast and immediate benefits and would -- actually could be done at relatively low cost. I think we can't forget the consumer in all this.

What we want to make sure is that we are not gold-plating the system in different ways. But we -- I think some -- I think utilities do recognize that our distribution system needs, you know, continuous improvement.

Mr. Tonko. Thank you.

And Mr. Kiernan and Mr. Mansour, do you agree that there are reliability benefits that can be gained through additional transmission estimates?

Mr. Kiernan. I think that's a great question. Yes, transmission absolutely will improve reliability on the grid, resilience on the grid and, frankly, I think supports, you know, virtually all of our sources of electricity.

So it just makes sense to figure out ways to enhance and strengthen and extend our transmission grid for the benefits of the grid and to benefit, frankly, for us to be able to compete

in providing low-cost reliable resilient electricity.

Mr. Mansour. We agree, Mr. Tonko. Absolutely. The more transmission -- reliable transmission that you have in place gives you a range of possibilities to reel in power from various different sources and uses the diversity of fuel that we already have on the grid to the greatest extent possible.

And to answer to your other question on the distribution grid, we feel distributed generation from solar on rooftops is, obviously, a very positive benefit and provides a lot of that hardening, and when you marry it with storage either in a person's home or in their hardware store or in their Wal-Mart, it certainly does increase the ability of the distribution grid to maintain that kind of services.

Mr. Tonko. Thank you. The R Street Institute's response to last week's DOE notice of proposed rulemaking seems to agree with that sentiment. They say, and I quote, "A resiliency initiative should prioritize mitigating transmission and distribution damage and accelerating restoration."

Mr. Moore, R Street also suggests that DOE's proposal seeks to take emergency action on, at best, a low to medium level resiliency issue. Do you agree?

Mr. Moore. I think that it is nowhere near the crisis that some parties have portrayed it to be. So yes, I generally agree that there are other things we can do like that transmission integration that would be -- go a lot further towards improving

the resiliency grid.

Mr. Tonko. Is DOE's proposed rule likely to raise cost to consumers without commensurate resiliency benefits?

Mr. Moore. Sure, so far as I can tell, because it's very hard to predict the full extent of the costs, but our initial calculations say that at least $15 billion a year just from the operating and maintenance costs reflected in the units that could be covered by the rule.

That doesn't include the higher rates of return and -- return on equity, excuse me -- and other things and the additional higher market prices that we would have.

So I think a lot of work is going to be gone -- is going to be put into figuring exactly how bad this would be for the consumer.

Mr. Tonko. Thank you. And much of the discussion today has focused on reliability and resiliency. But I want to bring up another important consideration.

I believe that a modernized grid must also be flexible. Flexibility allows for rapid response and smooth integration of variable resources.

So Mr. Durbin and Ms. Speakes-Backman, can you explain why we should not be overlooking flexibility and how does gas generation and storage's flexibility reinforce grid reliability and resiliency?

Mr. Durbin. Mr. Tonko, if I could, I think -- because I laid

it out in the written testimony as well -- it's one of the higher-valued attributes that natural gas brings to the table here and the flexibility to be able to provide that, that quick ramping flexibility, being able to follow a load, being able -- you know, as variable sources come in, on and off of the grid, you know, a natural gas plant can be up and running in minutes rather than in hours or days.

So, again, I think you can't overlook the need for flexibility as the grid is now integrating additional types of generation sources and technology.

Mr. Tonko. Ms. Speakes-Backman, please.

Ms. Speakes-Backman. Yes. On the -- on the side of resilience, certainly, there is frequency response. There is micro grid islanding. There is black start service so that the centralized generation can come up.

And storage operates from zero to 100 percent in milliseconds and so it's able not only to provide resilience in the -- in times of major outages but it's also able to ride through regular normal operations of frequency regulation.

The important thing to note, though, is there is multiple attributes to resiliency. So I could list those out -- they are in my testimony -- but it's important that they all be accounted for, not just one part of resiliency because, for example, let's say we do have all the 90-day -- 90-day fuel source on hand.

If transmission and distribution is unavailable that's not

helpful. You can't get the power to people, and so you need a more distributed resource in that time.

The whole point, frankly, of resiliency is to plan for the unexpected. And so you have to have multiple solutions available and online and ready to react regardless of what you think the solution -- what you think the problem is going to be.

Mr. Tonko. Thank you.

Mr. Chair, thank you for generous time.

Mr. Olson. Gentleman's time is expired.

The chair now calls upon the chairman of the full committee, Mr. Walden, for five minutes.

Mr. Walden. Thank you very much, Mr. Chairman.

I want to welcome our panelists. Mr. Wright, good to see you again in this capacity.

Last week, I explored the panel of witness -- I asked them whether the wholesale power markets were working to respond to and engage changes in consumer behavior driven by new technologies and other lower cost generation options.

And the answer from most of the panel was to embrace competitive markets and to ensure that the markets do not have a technology bias.

So this week, I want to ask the same question of this distinguished panel. I understand the DOE issued an order on Friday on reliability and resiliency that is certainly helping to get the conversation started and one which we will be actively

overseeing.

But I also understand how complicated these issues are and we shouldn't consider any one issue in a vacuum. There are market forces, economics at play as well as consumer preferences, new technology, jobs, subsidies, regulations affecting environmental externalities and carbon and regionally preferred resources.

So is reliability the only attribute not getting properly valued in these markets and, hypothetically -- let me underscore, hypothetically, if we were able to design the wholesale electricity markets fresh from a blank sheet of paper, what would you recommend?

Who would like to start that? And then I just want to go down the panel. It's the only question I have for you today. Who wants to tackle that first? I am going to get to all of you so --

Mr. Durbin. Mr. Walden, I'll go ahead and start.

Mr. Walden. Thank you.

Mr. Durbin. Again, with a -- with a clean sheet of paper, I think we still need to look at what -- you know, what is it that's brought the -- you know, the value of the grid we have today.

Mr. Walden. Right.

Mr. Durbin. I think we do have a very -- an effective and efficient grid certainly in need of improvement. But I think we can't lose sight of the fact that we certainly look in the last, you know, eight to 10 years -- some of the benefits that we are

really seeing, certainly, from the consumer price perspective.

So consumer benefits or the flexibility of attributes that we just talked about before, that's being driven by market forces. You know, I understand that, you know, natural gas --

Mr. Walden. We also have state regulation coming in. You've got subsidies involved in the markets. I am not saying that any of that's bad but --

Mr. Durbin. No question. No, I am not --

Mr. Walden. -- things are changing.

Mr. Durbin. I am not denying that there are -- there are other forces that I think those are some areas we need -- we need to look at and see are they distorting, you know, the market.

But I think, you know, certainly from a natural gas perspective the fact that we've had market forces allow natural gas --

Mr. Walden. Right. Enormous change.

Mr. Durbin. -- to play a much bigger part and wholesale prices dropped by 50 percent in PJM. So I think more than anything else that's got to be the focus to allow for market-driven fuel neutral policies, going forward.

Mr. Walden. All right. I've only got two minutes for all of you to respond so to the extent you can. And if you have other thoughts past this, please get them to me.

Yes, sir.

Mr. Kiernan. I'll jump in. Tom Kiernan, American Wind

Energy -- the process I would suggest, first, trust the experts -- FERC and NERC and the RTOs -- to establish the specific reliability and resilient services as opposed to other bodies or DOE saying, here's the fuel source we prefer.

Let the experts pick the exact services and then allow us to compete for it, and the reason being, obviously, technologies are moving forward. Each of our technologies are advancing and wind a number of years ago might not have been able to compete well for some technology but right now, I think, we are the best --

Mr. Walden. Very competitive.

Mr. Kiernan. -- at disturbance ride-through capability because of our power electronics. And you want the market to be rewarded for those innovations and advancements. So trust the experts and allow competition.

Mr. Walden. Good. And I know when Mr. Wright was in a previous position we talked about the ebbs and flows of wind energy in the Northwest where a thousand megawatts within an hour could come and go and so then how do you balance that out and make the grid work.

So we heard last week battery storage didn't count in one RTO because it didn't have a flywheel. I mean, so we've got some legacy regulation to deal with.

Mr. Wright, do you have a comment on how we might do this --

Mr. Wright. Specifically, to your question, first of all, I want to strongly endorse technology neutral. I think that is the key.

And then the question is what are the attributes that we want out of our power system. If we want reliability then we would go through the characteristics that are necessary -- the services and products that are necessary in order to produce reliability and then let's make sure that we are providing value associated with that.

If we want environmental attributes out of our power system then we should be clear about what are those environmental attributes that we want out of it and then make sure that we have incentives associated with that.

That clarity around the outcome that we want would be the most useful thing that we could do in terms of better defining what will produce the outcome that consumers want.

Ms. Speakes-Backman. Hi. I would just like to underscore what Mr. Wright said in that if we focus on the performance rather than the technology I think we can get there a little bit faster.

The FERC is -- has a couple of rulemakings that are working toward looking at resilience. States are doing some work but I'll tell you, there is a big -- there is a big difference between when we talk about the difference between reliability and resilience.

Because at the state level, as a former regulator I can tell you we had lots of cost-effectiveness training and

cost-effectiveness tests to ensure reliability but not on the resilience. There were always the out clauses for those major storms.

Well, these major storms are happening more -- more often and with more severity. And the tools aren't necessarily there at the state level to be able to value that.

Mr. Walden. Yes, sir.

Mr. Moore. Sure. Yes, technology neutral, performance focused -- I think FERC has done a very good job of recognizing regional variations and so that needs to continue to occur.

Clearly, I think energy markets have to -- have to move beyond just fuel-based pricing and what we are doing now, I think, you know, focus more on congestion pricing as a bigger component of this and move away from a one-size-fits-all capacity market design.

I am really concerned about the money we are putting into capacity markets. Do we need to put all that money into that market? Can we do something else?

And last, just aggregate -- smaller resources need to be able to participate in the market now. We have many more resources. It doesn't do anyone any good if they've got a nest thermostat or a smart meter if they can't access the markets shaping the price for the day.

Mr. Walden. All right. I know I am way over my time, but this is an important topic, obviously, for the committee. The

chairman, the vice chairman, the staff have done a great job, I think, teeing up these issues as we look at the future of the electricity grid. And so we very much value your input.

And with that, Mr. Chairman, I yield back.

Mr. Olson. The chairman of the Full Committee is never out of time. You always yield back. [Laughter.]

Chairman calls --

Mr. Walden. I've come a long way since I was Mr. Wright's driver, but we will explain that later.

Mr. Olson. The chair now calls upon a gentleman from Iowa, Mr. Loebsack, for five minutes.

Mr. Loebsack. Thank you, Mr. Chair.

I am very proud of my state for a lot of reasons, but Mr. Kiernan knows particularly wind but I'll get to that in a second.

You know, actually Iowa is quite varied in terms of the sources of power that we have. We saw built not that long ago a natural gas plant. We, of course, have a lot of coal. We are exploding on the solar front.

I think we have tremendous potential for hydropower, especially in small streams and small rivers if we can get there at some point. I think they have tremendous potential.

But, clearly, I am very proud of Iowa's wind energy story and its place as a national leader in wind energy production.

And Mr. Kiernan knows it very well -- he mentioned Iowa and Kansas a little bit earlier. My wife and I actually took a little

bit of time away, about a week in August, and we drove up through northwest Iowa.

I can see some of the old lattice-style turbines. They are not very pretty, actually, compared to the newer ones. But and then we went to South Dakota and North Dakota and just saw the tremendous growth in wind energy up in those two states as well.

I have been fighting for a strong wind energy sector in my state since I've been in Congress. I think it's -- not, again, to take away from the other sources of energy but, you know, it's cost effective.

It's been -- it's been a good cost-effective source of energy in Iowa and creates great jobs, continues to -- we continue to work for job growth in this sector. I just think it's real important.

We are upwards of 36, 37 percent of our electricity in Iowa generated by wind. Again, we are growing in these other -- in solar in particular as well.

Well, I really only have one or two questions at most, and for Mr. Kiernan, when it comes to reliability, we have seen this tremendous growth in Iowa.

Have there been particular problems in Iowa when it comes to reliability and other states as well where we have seen this tremendous growth in wind energy?

Mr. Kiernan. Well, thank you for the question. But first, also thank you for your leadership. You've been an extraordinary

champion out there for all different sources but very much for wind and we appreciate that.

Mr. Loebsack. By the way, I forgot -- we have a nuclear power plant at Palo too. I forgot about that.

Ms. Korsnick.: Thank you for that honorable mention.

Mr. Loebsack. Sorry about that. It's not my district anymore. That's why I overlooked it. I apologize.

Mr. Kiernan. But as we are 36 and well on the way to 40 percent in Iowa, there have not been any reliability concerns. And as I mentioned earlier with our newer technology that a lot of folks may not be aware of, we are able to provide most of the essential reliability services. So we have not had a problem on that front at all and I think the grid operators speak to that on a regular basis and I believe Mr. Cauley from NERC last week spoke to that as well. So wind is a very reliable part of a resilient grid and we are quite proud of that.

Mr. Loebsack. And that was my next question about the grid operators, and there hasn't been any particular issues at this point?

Mr. Kiernan. Not that I am aware of, and actually grid operators, whether it's PJM, SPP, but also DOE's NREL have done studies showing that -- NREL came out with a study that we could do well over 50 percent renewable without any issues.

PJM had 35 percent wind energy in one study and then extended it up to 80 percent in another study. So all these studies are

showing that we keep blowing past these artificial ceilings people think for wind or wind and solar.

We are just -- because of the innovation of America, we are just blowing past any perceived barriers and doing it reliably and, frankly, cost effectively for consumers.

As you mentioned, in Iowa and other states, the costs have been flat or coming down as we have added cost-effective wind energy on the grid.

Mr. Loebsack. Great. That's all I have. Thank you very much, and I will yield back the remainder of my time. Thank you, Mr. Chair.

Mr. Olson. Gentleman yields back. The chair now calls upon the gentleman from Illinois, Mr. Shimkus, for five minutes.

Mr. Shimkus. Thank you, Mr. Chairman. Thanks for you all being here.

So I am listening and the question is why are we here -- what's brought us to this time. Everyrone has mentioned reliability, resilience, flexibility as a key component.

But we have also had a tremendously changing market from not just historically of regional monopolies in states. Mr. Moore, you mentioned Illinois. We went to competition.

But we also had a FERC that really allowed a changing of the transmission and the buying and selling across state lines without a change in the actual statutory language by the Federal Power Act.

Everybody would agree with that, right? I mean, we had a hearing last year with -- talking about this and the Federal Power Act was so kind of vague it just -- and some people were applauding that because it allowed this transformation that really did not have the guidelines of a legislative input.

And so now we have new entrants into the market, some -- and they get more competitive but some were incentivized by public policy also, and we are trying to struggle with this new entity that we have and I think public policy folks -- we just have to decide how do we keep focused as some of the commentaries were, what is our goals and our objectives in the future.

But I don't think -- I don't think we should dismiss and in essence maybe penalize a major generation that helped get us here.

When I first became a member of Congress we had three main generation capacities. We had coal, we had nuclear, and we had hydro. Natural gas was too high and wind and solar wasn't -- wasn't there yet. Wasn't in the competitive world.

So now, again, I think our biggest challenge is making a definition without -- everybody knows where I stand. A major nuclear power state. We do have some wind. We have big coal generation.

But I find even in this discussion between the DOE's language, PJM's language, NERC language is a difference in what I used to understand is the term of base load, because my base load debate came out of regional monopolies serving at set area

and what was the demand and who could provide that.

Now base load has some different definitions based upon who you're asking. So whether that's stacked generation or -- so I am going to do what Chairman Walden did, go down the table real quick.

What is your definition of base load or is there a definition of base load and should there be a definition of base load?

Mr. Durbin.

Mr. Durbin. I would suggest that the traditional definition of base load is no longer relevant. I think base load -- you know, the traditional base load plants that we have there are -- continue and will continue to provide an important source to the electric grid.

But I think the grid has now moved to a place because we have now got such advances in technology, that we have got these more flexible, you know, sources there. We have got -- got the, you know, both from a performance, cost, and, you know --

Mr. Shimkus. Let's go quickly. So I want to get down. So --

Mr. Durbin. So my answer is I don't think the traditional definition -- it no longer -- we have got to stay focused on the attributes that are necessary to make the grid reliable.

Mr. Shimkus. Mr. Bailey?

Mr. Bailey. You know, the material I've read recently says, you know, the term base load is outmoded. Maybe the term is.

Maybe it isn't.

To me, the discussion now is, you know, about reliability, resilience, flexibility, that sort of thing. So I've personally sort of moved away from it. But it's a good --

Mr. Shimkus. Let me just -- we won't ever get through everybody so let me just say --

Ms. Korsnick. I am ready. I am ready.

Mr. Shimkus. -- in a regional transmission organization they had -- they still have a base load that they have to, in essence, the demand that they have to meet. Is that true?

Ms. Korsnick. That's true.

Mr. Shimkus. An RTO?

Ms. Korsnick. Yes.

Mr. Shimkus. And do we or should -- and that was from -- Maria answered that -- and should we -- is there -- part of the elephant in the room is do you incentivize those who can provide big percentages of a base load in an RTO? Maria.

Ms. Korsnick. Well, I go back to your first question on what's base load and let's say, you know, you can be there seven days a week, 24 hours a day. Somebody needs to be there all the time and I think there is a, you know, a value for that base load power.

Mr. Shimkus. That's part of the discussion and debate and I am over my time. I've probably put more questions than I probably should have in the whole mix but that's what the hearing

is for.

Thank you. I yield back.

Mr. Olson. Thank you.

The chair now calls upon the gentleman from California, Mr. McNerney, for five minutes.

Mr. McNerney. Well, I thank the gentleman from Texas, and I want to thank the witnesses.

You know, it's interesting the different perspectives that you all are bringing to this. But I think one thing that was in common was that you all felt like the real solution is in true valuation of the different sources of power.

And I am wondering how would we go about achieving a true valuation. I know we'd want to have metrics defining resiliency that would work.

Mr. Moore, could you take a crack at that?

Mr. Moore. Sure. FERC has already, you know, started down this road by creating technology-neutral markets for frequency response, inertia services, voltage support, and things like that -- the whole range of ancillary services.

So there is already a track record. I think the work to be done is on what additional reliability or resiliency metrics we might need to do.

So I think there is a lot -- there is more work to be done. I know that we are already transforming the grid in some places more than other in this country, you know, and doing fairly well.

So I think as new resources come into the market like energy storage, let's look at if there are barriers, as we have already heard, that might exist in some markets.

I can just say that I have not heard one RTO, for example, say that we need a base load unit to meet reliability and resiliency needs of the future.

Mr. McNerney. So it does require some federal involvement then to get there?

Mr. Moore. I think -- I think FERC and the RTOs are looking at this, yes.

Mr. McNerney. So if that were to come about, would the increased penetration of intermittent renewables cause reliability problems?

You can go ahead, Mr. Kiernan.

Mr. Kiernan. If I can jump in. No. I mean, we have got wind and solar that are reliably being added to the grid. We do think base load is kind of an older concept but I will say some grid operators refer to wind as the new base load.

Base load is often -- it used to be referred to as the lowest cost out there and, frankly, in many parts of the regions or the country, on an unsubsidized basis wind is the lowest cost source of new generation. So that's a way a number of folks are thinking about wind. It's just affordable.

Mr. Mansour. I would just use the example of California. Yesterday at noon, California got 45 percent of its electricity

from renewable sources.

Now, that includes solar, wind, who are intermittent, but then some others who are not like geothermal and some others. But California, as you know, serves the sixth largest GDP in the world.

Mr. McNerney. Well, I mean, that's the thing. The nation has different characteristics and I think all of the different sorts of generation will be more preferable in different regions.

So, I mean, there is tremendous new technologies and entrepreneurs that are entering the market. I hear about them all the time on the Grid Innovation Caucus. Mr. Latta and I are co-chairs of that caucus, by the way.

How will this impact the reliability of resilience and flexibility -- this new technology and the new entrepreneurs that we are hearing from?

Mr. Moore? You're kind of the neutral -- you're the only one that's really neutral here today.

Mr. Moore. I'm trying to be as neutral as possible.

Mr. McNerney. As possible.

Mr. Moore. No, I think that innovation really is a driving force here, as you said, and that, you know, FERC's standard is just and reasonable rates without undue discrimination.

As someone has already said, it's a pretty general principle but it's been foundational and really important and it gives FERC and the RTOs the flexibility to change market rules to strike down barriers to new entry and that -- and if they do so in a way that

those resources and those new services can meet grid needs more affordably and cheaply, then so be it. That's what's beautiful about the FERC market design.

Mr. McNerney. Would it be a good idea for federal policies to encourage deployment of the new technologies.

Mr. Moore. I think -- I think we strongly encourage research and development in that area along with next-generation market designs.

I think NREL and the labs have done terrific work on exactly that kind of work in the past and I think to maintain our nation's, you know, leading role in the next-generation modernized grid we need to keep the foot on the accelerator on those initiatives.

Mr. McNerney. One of the technologies that I'd like to see a little more is carbon sequestration.

Mr. Bailey, could you address where we are, what the future looks like in terms of carbon sequestration?

Mr. Bailey. Trying to think of a simple answer to this. You know, carbon capture sequestration is still under development. It is -- it is still very important. The U.S. will probably need it at some point in time. The rest of the world, certainly, is going to need it longer term.

Obviously, we are going to continue work on fossil fuels. The last time I looked at the figures on carbon capture and sequestration was two or three years ago and everyone knows that it is prohibitively expensive. We hope it will not be.

A new coal unit, for example, would be somewhere in the range of $2 billion, and adding carbon sequestration and storage to one, this is -- this is probably badly out of date but it'll give you sort of a scale of magnitude -- it was about another billion.

Now, that suggested we had a lot more work to do on carbon capture and sequestration.

Mr. McNerney. Yes. I just want to finish by saying to my Republican colleagues please embrace carbon sequestration for your own good -- for your own districts' goods.

With that I yield back.

Mr. Olson. Gentleman yields back.

The chair now sees the gentleman from Michigan showed up. The chair calls upon Mr. Walberg for five minutes.

Mr. Walberg. It's called -- thank you, Mr. Chairman -- it's called Michigan sequestration here.

Thanks to the panel for being here. It's important to continuation of the issue we look at for energy.

Mr. Wright, you may or may not know, but we have a fairly major pumped hydro storage facility in Michigan -- in western Michigan, connected to CMS Energy from my district.

Interesting process for me to comprehend. How are pumped hydro storage facilities helping integrate intermittent forms of renewable energy into the grid?

Mr. Wright. Mr. Walberg, I am familiar with that. I am actually a graduate of Central Michigan University and Farmington

Hills Harrison High School. So from your area.

Mr. Walberg. Hey.

Mr. Wright. The pump storage makes huge contribution because what we are trying to do -- there is really radical change happening to the operation of the electric power system today and we shouldn't underestimate the impacts of that change.

We can deal with those impacts if we have time, money, and foresight, and one of the ways that we deal with that is through finding ways to be able to take energy from times when it is being produced and it doesn't produce highest value for consumers and move it into periods when it does.

Pumped storage creates that capability to be able to move the energy in a time when it creates highest value.

Mr. Walberg. I've been interested to watch that as I've learned more about that and absolutely correct, it is a way of in my mind, of producing something that would be produced naturally at many places with hydropower but using it in a way that makes sense to add to that as well and be creative in its usage. So thank you.

Ms. Korsnick, can you explain how onsite fuel contributes to the reliability of the electric grid?

Ms. Korsnick. Yes, certainly. For a nuclear plant, for example, we put all the fuel that we need for 18 to 24 months in the -- in the reactor core. So we are not depending on any sort of fuel delivery.

And so you can just imagine through what we just mentioned, on some of the recent hurricanes or any sort of catastrophic event you're assured that your fuel is there ready to go.

In the case of a nuclear reactor it's already in that core ready to produce the much-needed power any time that it's needed.

Mr. Walberg. I think hardened is a good word that we need to remember relative to nuclear power. Nothing is hardened against everything, I suppose, but it's significantly hardened when we think about nuclear and I think of our plant, DTE Fermi plant sitting on Lake Erie. Fortunately, no tsunamis do we expect there.

But the hardening that's gone on is encouraging, plus, as you've talked about, the ability to store the necessary fuel to have the power.

Go and talk to us about nuclear power support of voltage control. How does it do that and, significantly, what do we see there?

Ms. Korsnick. Certainly. I can actually reflect on my times as an operator in the control room at a nuclear plant and, you know, you'd get a call from the --

Mr. Walberg. I wondered why you were glowing. [Laughter.]

Bad joke. Bad joke.

Ms. Korsnick. You'd get a call from the transmission operator, and just based on the fact that the power plant produces the power that it does, you have the ability to adjust voltage

in support of the grid and you also can adjust what's called reactive power in support of the grid.

And so, you know, this is as a result of the size of the power plant and one of the attributes, quite frankly, that nuclear brings to the grid is these ancillary services.

Mr. Walberg. Thank you.

Mr. Chairman, I yield back.

Mr. Olson. The gentleman yields back.

The chair calls upon the gentleman from Texas, Mr. Green, for five minutes.

Mr. Green. Thank you, Mr. Chairman, and I want to thank both the chairman and the ranking member for holding the hearing today.

Grid reliability and resiliency is something we often take for granted. With Secretary Perry's directive to FERC for a proposed rulemaking for a grid resiliency pricing rule, this issue deserves a lot of discussion. And when Secretary Perry was governor of Texas that's when we expanded our wind power dramatically and it's part of our grid in ERCOT.

I am afraid the latest move may artificially tip the scale and that's something, I think when he comes before our committee we need to talk about.

The secretary has issued a directive to combat what he calls immediate dangers. In the North American Electric Reliability Corp. report from earlier this year made no claim of a grid in crisis from the retirement of coal power plants.

The CEO of NERC testified in June that the state of reliability in North America remains strong and the trend line shows continuing improvement year upon year.

In its 2017 report, NERC did highlight that transition to gas and renewable generation requires new strategy to ensure voltage control, power ramping capabilities, and frequency support.

Storage capabilities are key s those new fuel sources expand their share of the power generation. I want to ask the panel in terms of these newer fuel sources of gas, solar, and wind, what changes have we seen in terms of storage capabilities in the last few years and where is the industry going and how does this address the issue of reliability and resiliency when it comes to fuel sources?

If -- we will start at this end, if you could -- as brief as you can.

Mr. Durbin. Thank you. Thank you for the question.

Mr. Green. I am not a senator. They only give me five minutes.

[Laughter.]

Mr. Durbin. From the natural gas standpoint, one of the strengths that it brings is the robust nature of the entire system. So you've got geographic diversity as far as where we are producing and how it's transported around the country -- 300,000 miles of pipe.

You know, storage facilities all around the country so you package all that together with the -- with the -- and then delivering it to the -- you know, to the end user -- to the generator. You've got a powerful portfolio that they can then pull from to provide that reliability.

Mr. Green. Anybody else? Yes.

Mr. Kiernan. Just from wind's perspective, I mean, we welcome storage on the grid. Obviously, it brings some services that are helpful to the grid.

But to be clear, wind energy does not need storage per se because the grid itself in a way is one large storage system in which the grid operators are compensating one for another. You know, if wind is a little low, they kick in more gas, et cetera. So we welcome storage but it's not needed to add more wind.

Ms. Speakes-Backman. I will just add and echo that, that energy storage on the grid it likes all resources from solar and wind and hydropower to natural gas, coal, nuclear. It spans the entire spectrum of energy.

It addresses short term in fluctuations and it addresses long-term issues of transitioning of the grid. For example, the ability to put storage in a specific location to offset peak periods during the times of transmission and distribution upgrades or to even offset the costs of those upgrades.

And so I would say that while storage can enable more generation from variable resources, it also supports the grid in

those so-called base load resources as well.

Mr. Green. Mr. Durbin, one of the criticisms of gas-fired electrical generators, especially in the Northeast, that they often have trouble getting deliveries of the commodity during cold months and due to pipeline bottlenecks and being put in line behind gas providers for pipeline capacity.

Are there fixes to the existing market rules that would increase your liability when it comes to natural gas or do you see an infrastructure problem?

Someday we may get a pipeline across New York to serve the Northeast. But I think Congress may need to get into that business -- that states can't just stop someone from going across.

But anyway, is there something we can do with that problem?

Mr. Durbin. Yes. First of all, I completely agree with you about New York and happy to help in any way we can.

But I think when you're talking about the Northeast it is both. Yes, there is a constriction -- there is not enough infrastructure in place. I mean, need more pipelines to serve the demand in the Northeast region. There is a reason why they pay more than 50 percent more for electricity than any other region of the country.

Having said that, there are market fixes that can be made and you have generators who, in large part, you know, have interruptible contracts, you know, for their gas. The fact is nobody -- even during the polar vortex, no one who had a firm

contract for gas didn't get their gas. Everyone got their gas.

And so, you know, any outages we referred to was more -- it was contractual outages because they didn't have -- you know, they had interruptible contracts. But I do think that there are things that could be done to allow for generators to enter into.

Sometimes they are not allowed to enter into those types of contracts. The answer is yes, there are solutions.

Mr. Green. And I know I am out of time.

But, Mr. Chairman, let me just mention, when we had Hurricane Harvey coming in, a lot of our problems were there but the nuclear power plant southwest of Houston stayed and -- stayed and continued producing electricity.

So, I mean, that's why we need all the above and have a market that has many different sources.

Thank you, Mr. Chairman.

Mr. Olson. Gentleman's time has expired.

The chair now calls upon the gentleman from Illinois, Mr. Kinzinger, for five minutes.

Mr. Kinzinger. Well, thank you, Mr. Chairman, and I want to thank everybody for being here and thank you for your time. The hearing is particularly timely.

This question I am going to actually ask to Ms. Korsnick. As I mentioned, the hearing is timely because DOE filed a notice of proposed rulemaking for FERC to accurately compensate generation resources like nuclear, which is extremely important

in my district and in my state necessary to maintain reliability and resiliency.

The secretary cited events like the 2014 polar vortex, which, in Illinois and throughout PJM, could have been much worse if it was not for our nuclear fleet.

What challenges does the nuclear industry face when it comes to participation in wholesale electricity markets?

Ms. Korsnick. One of the challenges, for example, and it actually occurs in your states -- some of the other technologies make money besides just from what they get from the market, so, say, from tax credits, for example. And as a result of that, they are interested in putting their power on the grid and it can even be at a low price.

It could be zero. It could be even less than zero, and they are still going to make money because they are going to get that tax credit.

So I think we are all a fan of fair markets. We would just share that the markets in fact are not fair today and that's an example in this case where it's not fair to both sides and in this case when the prices go negative and the nuclear plant is operating, essentially they have to pay the grid operator to take their power.

Mr. Kinzinger. And let me ask you, if this DOE's rulemaking is put into place, if it's implemented, how would that affect the existing nuclear generation fleet?

And let me -- I guess I'll follow on -- if the markets aren't reformed, do you anticipate this trend of early plant retirements will continue and how would that affect grid reliability?

Ms. Korsnick. Absolutely. I'll take your second question first. But if this trend were to continue, yes, you will see more premature closures of nuclear plants and, again, from a nuclear plant perspective, once that decision is made to close that plant, that decision isn't reversed. Once people no longer are licensed, et cetera, and you start going through the decommissioning process, it's not something that you turn around and change.

So these decisions are once and done decisions, which is why we want to be very careful that as a nation we are not making some strategic decisions based on some market challenges that we will later regret.

And so, as you mentioned, the notice of proposed rulemaking from Secretary Perry, one of the things that it does is it recognizes some of the attributes that nuclear does bring to the market in the area of resiliency.

Specifically, they are focused on that 90-day fuel supply as one of the examples that they use for resiliency and some of the other ancillary services like voltage support, et cetera, that can be offered by a nuclear plant.

So it goes to valuing some of the attributes that nuclear is bringing to the market today that aren't being recognized.

So yes, it would be helpful.

Mr. Kinzinger. As well as carbon neutral, I think it's important to note.

In your testimony you discuss that China and Russia are aggressively working to export nuclear technology around the world. It's a big concern of mine. Can you discuss that effort and provide your perspective on how this could actually affect our national security?

Ms. Korsnick. Absolutely. There is 58 reactors being built around the world today. Two-thirds of those are being built by Chinese and Russian design.

The Russians know very well what it is that you get when you build a reactor in somebody's country. You start a 100-year relationship with that country, by the time you design it, build it, operate it, and decommission it.

So they strategically look at the building of these facilities in terms of establishing that relationship, and if you look at the United States, quite frankly, as a result of us allowing our nuclear fleet to begin to atrophy, we are ceding our leadership at the national -- at the international table, quite frankly, on nuclear issues.

That means we have less of a voice on operational excellence. That means we have less of a voice on nonproliferation issues, because all of that comes with the package, if you will, when we build American reactors around the world.

And so, quite frankly, we just need to look strategically at the messages that we are sending, and by shutting down our fleet at home it does not put us in a leadership role internationally and that affects our national security.

Mr. Kinzinger. Yes, and it's hard to take a leadership role when you have less skin in the game than your competitors I think is important to note.

So thank you all for being here. Thank you for participating and, Mr. Chairman, I'll yield back.

Mr. Olson. The gentleman yields back.

The chair now calls upon the gentleman from Oregon, Mr. Schrader, for five minutes.

Mr. Schrader. Thank you, Mr. Chairman. I appreciate it very much. Just to preface my remarks, I am one of those all-of-the-above energy guys. I think that's an important -- you have made that crystal clear, I think, in your testimony to not get locked in on just one source of energy.

Focusing a little bit on the hydro, if I may, with Mr. Wright. You know, some discussion about base load. I do want to make sure that we have -- our lights go on, our heat work, or whatever as time goes on.

Seems like hydro is never talked about as base load. Could you give me your perspective on that?

Mr. Wright. Sure. I think -- I think base load actually is two components. It's a pricing component and it's an

availability component.

So, historically, the lowest cost -- lowest variable cost resource on the system operated as much as you could possibly operate it and those tend to be nuclear and coal plants, and it was also available all the time.

Now what we are finding with variable energy resources -- those lowest variable cost resources tend to be solar, wind, and hydro -- are all operating and we compete, candidly, for market share at the points when lows are low and then we also are operating as much as we can when loads are higher.

So what you really need is to be able to combine those two. You want the lowest cost resources operating but you want to make sure that you have the availability to meet all loads at all times.

And so it's going to take a new concept, I think, beyond -- a new word, because the word that we've been using for our history in the electricity industry, the industry has changed too much --

Mr. Schrader. I know.

Mr. Wright. -- and we are going to have to come up with a new way to describe this.

Mr. Schrader. Could you also comment on long-term versus short-term focus on energy sources? You know, natural gas is a great resource -- very low cost now, total disruptor in the market place putting pressure on our nuclear friends and, frankly, our hydro friends and I think pretty much everybody in the marketplace

-- coal, you name it.

So how do we -- how do we deal with that sort of disruption? I know out in my neck of the woods in the Pacific Northwest people are talking about really having trouble coming to grips with long-term BPA contracts -- our Bonneville Power Administration, which have historically been the backbone of energy up there.

What -- get a comment maybe from Mr. Wright and maybe Mr. Durbin, if that's all right, or anyone else?

Mr. Wright. First of all, we go through cycles in electricity markets. We went through cycles in the late 1990s when prices were really low and then we had the West Coast energy crisis and prices got really high.

And what we struggle with is how do we go through those periods when prices are low and make sure that we maintain the resources that will create best value for consumers for the longest period of time.

In this moment, I think what we are seeing is, as I said in my testimony, low energy prices and low capacity prices. To the extent that we can find ways to be able to think long term -- what is it that will create best value for consumers over the long term both from a cost perspective and an environmental perspective and then we make sure that we have pricing regimes that will support those resources for the long term.

The difficulty that I see right now is that we -- in the market formations that have been put together so far they are too focused

on the short-term. You know, they are too much looking at the next couple of years as opposed to how do we be positioned for the longer term.

Mr. Schrader. Mr. Durbin?

Mr. Durbin. Sure. I, certainly, acknowledge that natural gas and power generation has been a disruptive force. But I would also argue it's been a very positive disruptive force from consumer benefits on the costs of power, wholesale costs of 50 percent, environmental benefits, and emission reductions -- you know, greater reliability to the system itself.

So do we -- are there -- are there ways that we can look at the market rules that are out there to catch up, if you will? Yes, absolutely. But I think, again, we have got to go back -- go back and make sure that what's being valued are the reliability attributes and do that in a fuel-neutral and technology-neutral basis.

Mr. Schrader. All right. Very good.

Last question, if I may, I think, is large-scale battery storage. How closer are we to that? I mean, is it going to happen in the next year or two or is it 10 years off or can you give us a prediction, please?

Ms. Speakes-Backman. It's happening today. It is happening today. There are -- there is currently -- the largest scale battery storage is 100 megawatts for four hours of riding through on the grid scale and that's in North America.

Exponentially, our market is growing. It's grown at the grid scale level by 70 percent in the last eight -- sorry, the costs of grid scale storage has gone down 70 percent in the last eight years for the -- on the grid, and commercial and industrial level those costs have gone down 80 percent in the last two years.

So we are seeing steep, steep drops in the cost. We are seeing states and federal agencies begin to understand the valuation of storage, both on its supply into the grid and its taking off the grid of excess resources and beginning to consider, at least, being able to value that.

And so I say that that time is now. We are able to encourage more penetration of low and no-carbon resources. We are able to take additional power off the grid for those base load resources that are inflexible and can't ramp up and down very easily, thereby extending the life of those resources.

So I think this is happening now.

Mr. Schrader. Thank you very much, and I yield back, Mr. Chairman.

Mr. Olson. The gentleman yields back.

The chair now calls upon the Texan with the patience of Job, the gentrifying Aggie from College Station Texas, Mr. Flores, for five minutes.

Mr. Flores. You've misstated the patience part.

But I am an all-of-the-above resilience and reliability guy. I just noticed my solar system at my house was producing two and

a half times what I was consuming at this point in time. But then it just dropped offline because it got cloudy a few minutes ago.

So for you three at that end of the table, I am glad you're here.

Ms. Speakes-Backman. You should have storage.

Mr. Flores. I am working on it. That's the next. I am waiting for the exponential price decreases that you're talking about. So but I plan to do that.

We have talked a lot today about reliability, resilience, emissions characteristics, inventory, and fuel on board. One of the things we haven't talked about too much is the land environmental impact of the different types of energy.

So I have a question for Mr. Durbin and Mr. Bailey and Ms. Korsnick about if you -- if you could, and you can use whatever metric you want to, but if you have a, let's say, a typical 500-megawatt plant, how many acres does it take of your respective power sources vis-a-vis solar, vis-a-vis wind?

Do you all have those numbers off the top of your head? If you don't, just pass and we will go to the next one.

Mr. Durbin. I don't -- I don't have them with me. We do have them. I'd be happy to provide them for you.

Mr. Flores. Okay. All right. Mr. Bailey?

Mr. Bailey. Pass.

Mr. Flores. Okay. Ms. Korsnick?

Ms. Korsnick. I would just say, roughly, you know, a square

mile is what you would need for -- you said 500 megawatt. It could be a 1,000-megawatt --

Mr. Flores. Okay.

Ms. Korsnick. -- you know, nuclear plant. I guess wind and solar --

Mr. Flores. So it -- okay. What would it be for wind?

Mr. Kiernan. If I can jump in --

Mr. Flores. Sure.

Mr. Kiernan. -- it's interesting, for wind -- for a wind farm it's actually less than 2 percent of the land is used for turbines and foundations. The rest is continued to be used for farming and ranching and other sources at the land -- or other activities the landowner wants.

Mr. Flores. It takes a certain footprint to make that work, though.

Mr. Kiernan. But that is just 2 percent. The foundation or the access roads -- you aggregate that all, it's still just 2 percent and cattle, they don't seem to mind, and the wheat does seem to grow. So it's a wonderful multiple use of the land.

Mr. Flores. Okay. How about the birds? Okay. We will come back to that later. Go ahead.

Mr. Kiernan. Happy to --

Mr. Flores. No, go ahead, Mr. Mansour.

Mr. Mansour. From the standpoint of solar, you know, a 500-megawatt solar facility would probably be somewhere in the

range of eight to nine square miles.

Mr. Flores. Okay.

Mr. Mansour. So it is taking up a lot of room. You'll see those bigger ones, though, on mostly public lands and they are lands that, for the most part, nobody else has any desire to use or, you know, either in the -- now or in the future other than for --

Mr. Flores. And I won't talk about batteries because, I mean -- do you have a -- you had an answer for that?

Ms. Speakes-Backman. Yes, I do, actually.

Mr. Flores. Okay.

Ms. Speakes-Backman. There is no direct air, water, or -- air or water impacts and it's got a minimal footprint. You can put a 30-megawatt battery storage in the -- in the space of a -- spare space of a substation.

Mr. Flores. Okay. Very good.

Mr. Moore. And, Mr. Flores, can I just add, I think I've got the proxy for energy efficiency at the meeting today and energy efficiency takes zero additional land resources.

Mr. Flores. I like your answer. That's good. Yeah. I've gone almost all LED in my home.

In terms of the -- there's -- we have talked a lot about resilience and reliability and one of the things that got my attention a few weeks ago is that there was a large-scale failure in eastern Australia because there was a weather disruption that

knocked the wind offline.

They didn't have enough spinning reserves backed up. And so that implies to me that there is a relationship between the base load terminology that we have used and then also the other non-base-load power.

So my question for this, and I am going to ask this of our three base load folks, if I can, although I guess hydro is sort of base load from time to time -- if you have one megawatt of base load, with your three technologies what would it -- let me -- if you have a megawatt of solar or wind, what does it take in terms of reserves to back that up in your three technologies for base load? No? You want to start first, Ms. Korsnick? Mr. Bailey? Mr. Durbin?

Mr. Bailey. I should turn the mic on them. I think the capacity -- you probably ought to ask solar and wind what the capacity factors are. But they are less than 50 percent, as I recall.

Mr. Flores. Okay. And then --

Mr. Bailey. Maybe 30, 20 percent -- something like that.

Mr. Flores. Okay. I have a question for -- how many were against the FERC proposal, by a show of hands?

Mr. Durbin. The D -- the DOE proposal?

Mr. Flores. The DOE. Excuse me. The DOE request of FERC. I am sorry. Okay. Against. Okay. All right.

And so you would essentially be against putting in pricing

characteristics because of fuel resilient or fuel supply for resiliency purposes.

How do you feel about getting rid of all subsidies for all technologies to have a truly economically neutral technology solution? We will start with wind.

Mr. Kiernan. I'm happy to address that. Thank you.

The production tax credit is being phased out, as you well know, and I am pleased to say the wind industry proposed that, supported that, and as we say, we kind of have tax reformed ourselves. So that's phasing out. We are good with that, and honestly, we do call on our colleagues let's level the playing field and not have subsidies across the board.

I would also, if I may -- you mentioned birds earlier. It's actually only .03 percent of all human-caused bird death are wind turbines.

Mr. Flores. Okay. That's cool.

Mr. Mansour. With solar, again, we are in the same kind of situation. Not exactly the same ramp down for the investment tax credit but with the extension in 2015, you know, Congress gave us an extension with the ramp down in the out years. And our company is -- nobody is excited about having their tax credit go down. But our companies are willing to go along with that.

I would say I think you'd be hard-pressed to find any of the technologies represented up here who haven't received some sort of help from the federal government since their inception with

the possible exception of Energy Storage, which really deserves some.

Mr. Flores. I am into spending R&D for the battery parts. So anyway, I've run out of time. I wish I could go longer. I yield back.

Mr. Olson. The gentleman yields back.

The chair now calls upon the gentlelady from Florida, Ms. Castor, for five minutes.

Ms. Castor. Thank you, Mr. Olson, for yielding and thank you to all of the witnesses for a very interesting discussion. And at the outset, I want to say thank you to Mr. Rush for continuing to raise the important issue of rebuilding or building a new resilient modern grid in Puerto Rico. In the U.S. Virgin Islands we have a once in a lifetime opportunity to do so and I look forward to the bipartisan efforts to protect the taxpayer in the future from another catastrophe.

And I guess Chairman Upton kind of set the tone at the outset with his questions relating to the Department of Energy's notice of proposed rulemaking for their so-called grid resiliency pricing rule.

I'd say, first off, that the time frame set by the DOE is extraordinarily too short for such a transformative impactful type of shift in federal policy that is going to impact all consumers across the country and all businesses, likely shifting huge costs onto the folks we represent at home. So that's --

hopefully, smarter heads will prevail on that time frame.

And then -- but to the heart of the matter, for the DOE to cite economic and national security as the guiding principle for this notice of proposed rulemaking really turns that on its head.

It's -- especially looking at it now through the lens of the most destructive hurricane season that we have had probably in our lifetimes. Maybe Katrina standing alone.

Even Katrina standing alone probably will not rise to what we are going to have to do for the three hurricanes that have hit this year and the other extreme weather events.

What they have put forward at the Department of Energy is a policy for 50 years ago based on the fuel MECS of 50 years ago. It is not a policy for resiliency and modernization for 2017 and the changing energy mix that is out there.

And when they -- when I hear the talk of costs, I always like to remind everyone, yes, they are the finite energy costs that we analyze.

But if you're a person in Texas or Florida or just about anywhere, what you're seeing right now -- rising air conditioning costs because of higher temperatures, your flood insurance is going up, the emergency aid package that all taxpayers will pay, that's going to be a high-ticket item -- property insurance, beach re-nourishment, property taxes, not even to mention the increased cost of carbon pollution.

So this is quite a misguided effort that they need to take

back to the shop and work on it. And I'll give you one example. In the Tampa Bay area just last week the Tampa Electric Company, now owned by Emery, that has been primary -- primarily natural gas but the Big Bend plant is a longstanding coal-fired power plant, they've just announced the largest investment in solar power in the history of the state of Florida.

The so-called Sunshine State -- we are not quite there when it comes to solar power. They are able to do this because not just consumers are demanding it but it makes sense for their bottom line. This is what the market is telling them.

Solar is much more inexpensive now, and I think this is just going to be the first step. You're going to -- Duke Energy has already said they are going to do this. Other utilities are going to do this.

But, Mr. Mansour, with a so-called resiliency pricing rule like this, don't you think if you're favoring certain fuel sources that's going to have a chilling effect on other low-carbon fuels of the future?

Mr. Mansour. Congresswoman Castor, we share your concern both with the timing -- the speed with which this is going forward -- and actually the intent in general.

We feel very strongly that the grid itself right now, yes, it needs improvement. Those improvements should come as a result of market forces that look at and value some attributes in the way that they should be. We think --

Ms. Castor. And this is in a state that does not have a renewable portfolio standard, no renewable goals. So there is not that argument either that we are tipping the scale somehow.

Mr. Mansour. And we share your concern with transfer of lots of money from ratepayers to basically subsidized certain types of generating capacity.

Ms. Castor. Mr. Moore, you've said that you anticipate this would be extraordinarily expensive for consumers and businesses, and you threw out a multi-billion-dollar number.

Do you see the chilling effect as well and there will be a -- we will add in those costs, too?

Mr. Moore. Sure. I see it in numerous ways and I think that to simply pick one attribute over all others and reward that one attribute without any evidence to back it up, those mean that is diverting, easily, billions of dollars a year directly and indirectly, chilling market design and, you know, taking away good dollars that could have been -- you know, the consumers could have hold on to those dollars.

Ms. Castor. So I would say that the true threat to resiliency is the Trump administration's allegiance to the policies and the fuel MECS of 50 years ago.

Clearly, they are favoring fuel sources that are less competitive today. This is going to cost consumers dearly. I cannot believe that in -- while we are still recovering from hurricanes there is no mention of mitigating transmission or

distribution damage in a resiliency rule or how we accelerate restoration after an extreme weather event.

So I trust that the comments to the DOE and FERC will reflect all of these concerns. Thank you, and I yield back.

Mr. Olson. The gentlelady yields back.

The chair now calls upon the gentleman from the Commonwealth of Virginia, Mr. Griffith, for five minutes.

Mr. Griffith. Thank you very much, Mr. Chairman. I appreciate it greatly. I find some of the comments today somewhat interesting.

I, too, am an all-of-the-above kind of guy but, you know, let's take a look at history as we see it in reality as opposed to just with our particularly viewpoint.

I confess up front, my district has a lot of natural gas and a lot of coal. With that being said, Mr. Moore said we don't want to get into a situation where we have, you know, one administration coming in and then another administration coming in.

But in fairness, that's exactly what we have seen because the -- if we would have gone to the market policy, say, 10 years ago that many have advocated today, wind and solar and even battery storage would be in a lot different position because the market kings would have been those forces that have recently been characterized as being 50 years old, and to now have those particular fuel sources castigated to the trash heap of history without recognizing the huge investments that our ratepayers have

put into those and recognizing that that is at least for the next 10 or 15, maybe 20 years a big part of our grid reliability creates some interesting issues.

We are where we are. We need to move forward. I understand that. But it is nice to note that sometimes you have to look at history.

For example, the great state of Florida talks about air conditioning. You know, 125 years ago before coal was discovered in my district, the people came to the mountains to get out of the heat, and they spent months in the summertime getting out of Richmond and Washington and coming to the mountains of Virginia.

It was a big economic source. We have shifted from that to coal and now we are shifting again. But I don't know that we should do it as rapidly as some people want without, I think, risking our reliability.

Mr. Bailey, I got to -- I got to say, you know, I was listening. I wasn't in the room when you actually said it but I was listening on the TV as sometimes we want to do when we are trying to do five things at one time.

And could you tell me again those numbers? Seventy-two days I think I heard that we have -- able to stockpile certain types of coal and 80 something for another kind. Could you go over that again? Because it was just nice to hear.

Mr. Bailey. I would be pleased to. Over the past five years, average coal stockpile at a power plant has been 72 days

for sub bituminous -- 72 days for bituminous and 83 days for sub bituminous.

Mr. Griffith. Yes. Over -- since you ask, over the last nine years, the low has been a little over 40 days and the high has been a little over a hundred days.

So while there may be some difficulties with other things, you can put a lot of coal in the back 40 if you need it to be there for reliability purposes.

Mr. Bailey. There is -- there is a lot. Yes, sir.

Mr. Griffith. Yes. I do appreciate that.

Look, we have got some interesting things going on. I am curious, Ms. Speakes-Backman, if -- if you all consider from your industry standpoint pump storage hydro to be batteries, because that's kind of the way I've been looking at it, and we are looking at putting some of those, hopefully, into some abandoned coal mines to generate some economic development in our neck of the woods and store that.

They are even talking about using some renewable sources -- wind or solar -- to pump it up in the nonpeak periods and then have the water ready to flow down to the lower levels of the mine at the appropriate time when it's peak. Do you all consider that a part of your mission?

Ms. Speakes-Backman. Absolutely. Absolutely, 100 percent.

You know, hydro is one of the early storage technologies.

It helped to offtake the oversupply from base load resources back in the day when it was beginning to be installed.

So we absolutely consider storage as or hydro -- pumped hydro storage as part of our storage infrastructure. Mr. Wright has represented the hydro storage industry quite well and so I focused on batteries today.

Mr. Griffith. And I appreciate that very much and do appreciate Mr. Wright's testimony as well.

In closing, I have to say it's not politically necessarily a positive, but as a conservative Republican I am also a bird watcher. So I am concerned about wind killing birds.

I recognize that it may not be a huge percentage. Clean windows on big office buildings does a lot of damage to birds as well. But I once had a bill on that and tried to solve that problem at least for federal buildings as we renovated as well.

But I do hope that the wind industry and the solar industry will recognize that we have some obligation to make sure we are not whacking or frying the birds as they go over or near our energy facilities.

Mr. Kiernan. Thank you for bringing that up, and I very much share your concern as a former executive with New Hampshire Audubon.

I, as well, am out there birding on a regular basis and I will say the wind industry takes very seriously our strategy to reduce bird take.

And I appreciate the Department of Energy. Actually some of their grants have gone to helping advance new technologies that are being commercially tested as we speak.

So we are hopeful that we can take our low impact and make it even lower.

Mr. Griffith. Thank you very much, and I yield.

Mr. Mansour. Let me just add, on behalf of the solar industry we also work very hard to mitigate the impact on wildlife whether it is avian species or some of the terrestrial ones as well.

So it's -- our companies spend tens and tens of millions of dollars per project to try to mitigate those kind of impacts.

Mr. Griffith. And I appreciate that, and thank you very much and yield back.

Ms. Speakes-Backman. For the record, we don't kill any birds.

[Laughter.]

We are pretty good on that front, too.

Mr. Olson. The gentleman yields back.

The chair now calls upon himself for 40 minutes, five per witness.

[Laughter.]

Okay, you guys passed the test.

This is an important hearing, and that importance was reinforced this week by the Department of Energy's proposal to

FERC on valuing base load generation.

But most importantly, it gives Texans like me a chance to do what we like best -- brag about Texas. Unlike many states, Texas has a very diverse power grid.

We think we have the most diverse one in America. Mr. Durbin, natural gas is number-one for power production in Texas.

Mr. Bailey, it was coal until two years ago. Coal is number two very closely. Ms. Korsnick, we have Comanche Pass and south Texas, two nuclear plants. My colleague, Gene Green, mentioned about south Texas.

Harvey hit in Corpus Christi. The worst part of the hurricane is the northeast side. That part hit Bay City in south Texas. Not one blip of power lost, despite a category four hurricane hitting a nuclear reactor.

Also, we have exploding solar. Mr. Mansour, Army bases -- Fort Hood and Fort Bliss, the biggest ones in the Army are now using solar to power the base. They actually export that to the power grid there locally.

We are number one, Mr. Kiernan, in wind power. Texas is number one for wind. And last spring, as you know, almost half of our power grid was supplied by wind power -- one half for one day.

And back home in my district, a place called Thompsons, Texas, I wish Mr. McNerney was still here because we have what's called the Petro Nova Project. It's NRG's Parish Power Plant and

this is a true carbon capture sequestration for enhanced oil recovery that works.

Working with a Japanese company, we have technology that grabs 98 percent of the CO2 coming from one coal generator. That's viable because about 65 miles southeast is an old oilfield. There is a pipeline that comes by.

So they grab that CO2, put it in that pipeline -- like fracking fluid, repressurized. Hey, they are making money by carbon capture sequestration. But that's rare.

But this diversity does not make the coast immune to problems. In the winter of 2013, we had a big cold snap. Lost two of our coal generators. Had rolling brownouts and blackouts all across the state.

Some days there is not enough wind, and then during Hurricane Harvey, we had way too much wind. The turbines went offline. And these problems aren't hypothetical and they show that there is not one perfect energy source.

And my question just to the entire panel, I'd like to go down the line for the different sources here and I'd like you to describe what's the common cause of unplanned outages where you can't provide power and then talk about how you are addressing those issues.

Mr. Durbin, you're up. Natural gas.

Mr. Durbin. Thank you for the question. As I mentioned to Mr. Green -- as we talked about it, and Mr. McKinley had raised

the issue of outages -- for natural gas and power generation, any outage is being caused not by a lack of supply or a lack of availability but by contracts that -- you know, they are interruptible contracts.

So these are all things that can be addressed, can be -- can be resolved with the natural gas to continue to provide that reliable service.

Mr. Olson. Mr. Bailey -- coal, sir.

Mr. Bailey. Yes, sir.

Well, we talked about the amount of fuel onsite at fuel plants. We think that makes the coal fleet very reliable and subject to very few outages, frankly.

Mr. Olson. Ms. Korsnick, nuclear power, ma'am.

Ms. Korsnick. As I stated, if you look at the nuclear fleet in the United States, we have had greater than a 90 percent capacity factor for 15 years. So I would say in general nuclear has fewer unplanned outages.

We do have a refueling outage every 18 to 24 months on our plants.

Mr. Olson. Mr. Kiernan, wind power, sir.

Mr. Kiernan. If I can start with a contextual observation. Gerry Cauley of NERC a week or two ago commented about the reliability on the grid is good and getting better.

So I just, first, want to observe that this is an important topic. But we don't have an urgent problem. We just need to work

it.

As to wind, it's fascinating because we have wind turbines that are relatively small -- one, two, three megawatts -- and they are geographically dispersed, while there might be a few that go down because the winds are too high in one part of Texas, there are a bunch in another part of Texas that are still rolling along.

So actually our geographic diversity gives us tremendous resiliency that we are adding to the grid.

Mr. Olson. Mr. Wright, solar power, sir. I am sorry.

Mr. Wright. Water.

Mr. Olson. Water guy -- hydro. That's not much for Texas but, please, what's your biggest challenges for the nation?

Mr. Wright. My colleagues from the large public power council.

So you have hydro power in Texas as well. The -- what I would say is, look, anybody that has hydro resources, run them, son, as much as they can because it's the low-cost resource. It's the most reliable resource. It's the air emission-free resource.

The biggest challenge in the hydropower industry is that it's an aging fleet and we need to make investments in that fleet in order to make sure that we continue to be able to get the output from it.

Mr. Olson. Mr. Mansour, finally.

Mr. Mansour. Yes, sir.

Mr. Chairman, I am going to totally ignore your question.

But I am going to follow your lead by bragging on solar in Texas.

We got 1.6 gigawatts right now. We are going to go to another almost 5 gigawatts over the next five years and a lot of that is because the way ERCOT and the Texas market is set up.

Mr. Olson. Keep talking.

Mr. Mansour. Yes. I am not sure. I think it was Mr. Green that talked about some of the work that former Governor Perry did with the CREZ lines.

Yes, that incentivized a lot of wind. Basically, it was the classic build it and they will come. So, you know, the people of Texas put out I think it was $10 billion or more to build these CREZ lines or some -- these transmission lines.

Wind was the first to respond because they were a little bit ahead of us. But solar is catching up and we already employ over 9,000 people in the state of Texas and we are going to be growing in your state.

Mr. Olson. Ms. Speakes-Backman, concentration type stuff.

Ms. Speakes-Backman. I love this question because we are here for reliability and resilience, and for all of these resources along the table.

In fact, Texas has quite a few batteries in place on the grid and just pointing that out. Duke has batteries providing frequency regulation. AEP has batteries that have extended the transmission and distribution life with another 20 megawatts being built co-located with wind, as a matter of fact.

Fort Bliss was among one of the first locations to build micro grid with mission insurance as its -- as its objective. So we are here for everybody. We are kind of like the bacon of the grid. We make everything better.

[Laughter.]

Mr. Olson. You know what Texans like to hear? The bacon of the grid. Mr. Moore?

Ms. Speakes-Backman. I grew up in Ohio. I love bacon.

Mr. Olson. Your comments, Mr. Moore.

Mr. Moore. Sure. Just that people come from all over the world to see how Texas integrates large amounts of renewable energy onto the system.

ERCOT has done a terrific job with it and I think a key reason for the success, to echo another speaker, is the incredible amount of new transmission to pull the grid together.

So given that most outages are caused to the distribution transmission system with the, you know, wires and poles, let's focus on smart design for the system.

Mr. Olson. All those praises for Texas. So join me, the stars at night --

[Laughter.]

And seeing no further members wish to ask questions, I would like to thank all of our witnesses for being here today.

And there is one document for the record. I ask unanimous consent that written testimony of Dr. Susan Tierney in a summary

-- she was supposed to be here but she could not be here -- entered into the record.

Without objection.

[The information follows:]

**********COMMITTEE INSERT 9**********

Mr. Olson. And pursuant to committee rules, I remind members that they have 10 business days to submit additional questions for the record and ask the witnesses to submit their response within 10 business days upon receipt of the questions.

And without objection, this committee is adjourned.

[Whereupon, at 4:23 p.m., the subcommittee was adjourned.]