

The Honorable Paul Dabbar  
CEO, Bohr Quantum Technology  
Former Under Secretary  
U.S. Department of Energy  
52 Secor Road  
Scarsdale, NY 10583

Kaitlyn Peterson  
Legislative Clerk  
Committee on Energy and Commerce  
2125 Rayburn House Office Building  
Washington, D.C. 20515

Dear Ms. Peterson:

Thank you for allowing me to appear before the Committee on Energy and Commerce on Tuesday, January 31, 2023, to testify at the hearing entitled "American Energy Expansion: Strengthening Economic, Environmental, and National Security."

Pursuant to the Rules of the Committee on Energy and Commerce, I have been asked to answer additional questions for the record. The questions you sent to me, and answers, are attached. As requested, the format of my responses to these questions are as follows: (1) the name of the Member whose question I am addressing, (2) the complete text of the question I am addressing in bold, and (3) my answer to that question in plain text.

A handwritten signature in black ink that reads "Paul Dabbar". The signature is written in a cursive, flowing style.

Paul Dabbar

## Attachment-Additional Questions for the Record

### The Honorable Michael Burgess, M.D.

- 1. Mr. Dabbar, Texas' population has grown exponentially over the previous decade. With that large increase in population, our grid suffers under tremendous strain because of the lack of investment in baseload power generation. Regrettably, it seems that too much emphasis has been placed on the expansion of renewable capacity. Mr. Dabbar, in your opinion, what role can Congress play in creating a resilient and diverse baseload generation ecosystem?**

The Independent System Operators (“ISO”), including ERCOT, the Texas ISO, have not implemented rules to maintain base load generation as intermittent renewables have been added to the systems. Congress should look to reform the Federal Power Act to direct all systems, including the intra-state ERCOT system, to better support base load generation, especially as intermittent renewables are added. There are various ideas on how to word that requirement. One idea is mandating the ISOs to better model the instability that renewables are adding to the grid, and properly estimate the increasing needs of dispatchable generation as a result. And to formalize contracting or compensation systems for that dispatchable power to ensure that it gets built.

- 2. In your testimony, you discuss reforming certain regulations regarding our nations electrical grid, specifically, reforming regulations concerning Independent System Operators (ISO) that would encourage more baseload generation capacity to be built. Can you speak to those reforms?**

The ISO’s and FERC are mismanaging the supply needs of power sector in many regions of the U.S. Leading in many places to more power plants being retired than are being built. And this increasing supply risk is be exasperated by growing power demand from electrification. This is leading to higher outages and increasing prices.

Given FERC is not currently setting market rules to properly incentivize base load power from being built or maintained, it is imperative that Congress look at FERC reform legislation, including reforming the Natural Gas Act and Federal Power Act

("FPA"). On topics such as strong requirements that natural gas infrastructure get approved, and not disapproved by supposed views on siting that fall outside the intent of Congress, and the West Virginia vs EPA standard. The FPA could be amended to more specifically mandate base load support in ISO rules approved by FERC.

Finally, strong NEPA reform legislation should be looked at by Congress. Including narrowing maximum time frames for reviews. And closing gaps opened by decades of court rulings expanding challenges on the review process.

### **3. What are the benefits of expanding America's LNG exports, both domestically and globally?**

LNG exports domestically have great value to both the U.S. economy, and national security posture.

Energy exports have a significantly positive impact on the U.S. balance of trade.

In addition, jobs from natural gas production, processing, transportation, and liquefaction are very numerous, and they jobs are very high paying. And given these jobs are a form of manufacturing jobs in their regions, they tend to spawn many other local jobs in their communities. And jobs from energy production and sales of gas and oil are far more numerous and higher paying than jobs for renewables.

### **4. What are the current challenges to expanding the production and export capability of LNG?**

The largest impediment is siting of transportation of national gas from production regions to the liquefaction sites on the coast. New pipeline siting is near impossible to accomplish today.

## **The Honorable Richard Hudson**

### **1. What is the government's role in protecting critical grid infrastructures from all hazards, including physical attacks?**

Government has several important roles:

- a. National Intelligence monitoring potential attacks. Collecting that through the various Intelligence Community entities, such as NSA,

- CIA, and through our allied intelligence partners
- b. Communicating with grid owners (private, municipal, and federally owned utilities) about attacks. Including having classified channels that allow prompt notification from utilities when they are getting attacked. And for communicating to utilities when the IC identifies an impending attack.
  - c. Coordinating response to prevent or react to an attack.
  - d. Provide possible counter-attack efforts, including utilizing cyber-attack capabilities of DOD and IC elements (such as Cyber Command)
  - e. Helping provide security standards around power equipment manufactured by countries of risk.
  - f. Helping coordinate recovery from grid or power plant attack incidents.
  - g. Helping develop new software and hardware technologies that are more resilient.
2. **What technologies or methods have been used to ensure the grid remains resilient to outages and disruptions? How should Congress support the industry as they look for more innovative methods?**

Each utility has their own information security program, as does each of the regional Independent System Operators.

However, cyber security programs between the DOE and the utilities, led by the DOE Cybersecurity, Energy Security and Emergency Response Office, is the most important program for grid security for the country. Note, this is a Senate confirmed assistant secretary position, but the administration has decided to not nominate an assistant secretary.

I would note that the electric system cyber response coordinated by DOE is much better developed than pipeline security programs, which is split between the Transportation Department and DOE. And there is much less coordination and partnership between the federal government and the pipeline industry. As a result, the risks to natural gas, oil, and oil products transmission are less addressed.

The in addition to the cybersecurity efforts described in #1 above, the same office at DOE is tasked with helping coordinate emergency response support when storms or other natural disasters effect the grid, in conjunction with the Edison Electric Institute and other trade associations. In general, power

industry emergency response performs well across the U.S.

- 3. In a piece for the Hill this past spring, you said the U.S. can concurrently increase energy availability, reduce costs and reduce emissions. As the Energy and Commerce Committee continues to look for legislative solutions that do all three, what are some the most cost- effective investments we should be looking to make?**

Investment in innovation for new energy technologies is the most impactful and cost-effective investment that can be made by the federal system. The U.S. leads the world by far in innovation for new energy technologies. And those past investments have made significant impacts to concurrently increase energy availability, reduce costs and reduce emissions.

Examples of American energy innovation that accomplished that include nuclear power, solar PV, lithium ion battery chemistry, material gas turbine improvements, 3-D seismic imaging, directional drilling and hydraulic fracturing.

While the last Congress focused on increasing support for deployment of already proven technologies, the private sector has significant resources and more experience for those efforts. But the private sector under invests in early stage innovation. The best place for the taxpayer to invest is where the private sector will never be focused, and that is in early stage innovation and discovery.

### **The Honorable Greg Pence**

**As NERC and MISO continue raising the alarm of a reliability crisis facing our electric grid, the Biden Administration is charging forward with actions to drive out baseload generating supplies. I am concerned that the forced transition to electrification will compound these issues and upend an energy system that has taken over a century to build.**

**Meanwhile, energy demands across the country are expected to continue outpacing energy supplies during times of high demand. For Hoosiers in Southern Indiana, that means less reliable access to energy at a higher price.**

- 1. Do you agree that the overreliance of intermittent energy sources at**

## **the expense of baseload generating units are deteriorating the reliability of our electric grid?**

Yes I agree. It is an undisputable fact from a system engineering analysis that replacing dispatchable and far more available power supply (such as from gas, coal, and nuclear plants), and replacing it with far less available and dispatchable power supply (such as wind and solar) reduces reliability. One can debate by how much in any particular situation, but is a clear fact it reduces reliability, and any debate needs to start from that systems engineering fact. While wind and solar have definite advantages on marginal cost and emissions, they have several engineering, power density, and other downsides compared to other types of generation.

And while lithium-ion batteries have certain performance and cost effective deployment options for localized grid deployment, at \$1.2 million per MW for only four hours of supply at rated capacity, it is far too expensive for large scale, longer term back up.

As renewables increase their penetration in markets, it is therefore important to increase dispatchable power from power plants such as nuclear and gas, or in certain geographies geothermal and hydroelectric could be added. Or we need to develop cheaper and better performing new technologies, such as new battery chemistries, or fusion.

## **2. What sort of actions can Congress take to ensure that grid reliability is prioritized when considering electricity market decisions at the ISO/RTO level?**

The ISO's and FERC are mismanaging the supply needs of power sector in many regions of the U.S. Leading in many places to more power plants being retired than are being built. And this increasing supply risk is being exasperated by growing power demand from electrification. This is leading to higher outages and increasing prices.

Given FERC is not currently setting market rules to properly incentivize base load power from being built or maintained, it is imperative that Congress look at FERC reform legislation, including reforming the Natural Gas Act and Federal Power Act

(“FPA”). On topics such as strong requirements that natural gas infrastructure get approved, and not disapproved by supposed views on siting that fall outside the intent of Congress, and the West Virginia vs EPA standard. The FPA could be amended to more specifically mandate base load support in ISO rules approved by FERC.

Finally, strong NEPA reform legislation should be looked at by Congress. Including narrowing maximum time frames for reviews. And closing gaps opened by decades of court rulings expanding challenges on the review process.

**Indiana has a long, storied history in energy intensive industries like steel and manufacturing. Across Indiana's Sixth District, companies are taking advantage of the expertise of Hoosier innovators to bring back domestic industries and secure global supply chains. However, these entities will need access to reliable, affordable energy supplies like natural gas to stay competitive.**

**1. How are actions by the Biden Administration to inhibit adequate energy distribution impacting manufacturing and industrial sectors?**

Manufacturing facilities many times must use coal or natural gas for their processes vs using electricity. They might be able to use hydrogen in the future, but for many facilities there are no alternatives for foreseeable future.

As a result, as coal is being utilized less because of emissions concerns, the demand for natural gas for manufacturing is going up. And as more manufacturing is being built in the U.S., this adds additional demand for natural gas. In addition, as coal fired power plants are being retired, with more dispatchable & base load replacement generation needed that is primarily using natural gas, that puts even more pressure on natural gas transmission that can affect natural gas availability for manufacturing.

Given FERC, EPA and other government agencies are restricting new pipelines that are needed for manufacturing increasingly, this is

effecting manufacturing several ways:

- Costs for currently installed manufacturing using this type of energy is going up. As more users increasingly compete to use the same pipelines.
- Areas of the country that need new natural gas infrastructure for new manufacturing facilities are less likely to get new manufacturing sited in their region.
- Areas of the country with existing extensive natural gas infrastructure, or have accelerated intra-state-only needed regulatory approvals for that infrastructure, have an advantage for siting new manufacturing facilities.

## **2. Can industries such as steel and manufacturing adequately replace their energy needs with wind or solar?**

Many industrial processes are hard to operate solely with electricity as their energy input. Many need far higher heat input than can be generated by electricity.

Currently many of those can only use natural gas or coal for their processes. There are prospects that hydrogen could be a replacement, currently that is not an energy source that has wide availability. In addition, the cost of hydrogen vs natural gas is materially higher. Additional innovation in hydrogen production, transportation and storage will be needed to have it be a viable replacement resources.

### **The Honorable Russ Fulcher**

**While geothermal covers a small part of our population today, it offers baseload reliability at utility-level scale according to the Energy Information Administration (the EIA). For example, Idaho's Raft River facility can sell up to 10 MW of this clean, reliable energy source. Yet, permitting for new geothermal projects can take 7-10 years.**

- 1. My bill, the Enhancing Geothermal Production on Federal Lands Act, would allow for geothermal development where there are already existing oil and gas leases. Can you speak to how changes**

**like this that remove duplicative red tape can help America return to energy dominance?**

The geology issues that need to be reviewed for oil & gas drill are very similar. Directing agencies reviewing geothermal applications to use already available information, reviews and conclusions from previous oil & gas approvals would be good policy.

- 2. I understand that transmission development is one of the key factors that could limit deployment of geothermal technologies across areas of the West, like Idaho. This is largely due to geothermal being located far from load / population centers and the sheer amount of federal land the transmission lines would have to cross in order to meet demand. What barriers exist to developing transmission to help clean, baseload technologies like geothermal to provide reliable power to the grid?**

In general geothermal transmission access issues are similar to the issues all other types of powers plant have to endure today. The levels of review under NEPA and other siting legislation significantly impede approval processes, and result in many power facilities never being built.

I would recommend that as you look at potential reforms to the Federal Power Act, that you look at mandating accelerated reviews for baseload power such as geothermal.

**Hydroelectric constitutes roughly half of my state's total in-state generation. And, it speaks to the importance of Idaho's dams.**

- 1. Can you discuss any transmission challenges that may occur with getting this highly reliable and clean energy to population centers, given these dams are often nested between large sections of federal land?**

For the most part, hydroelectric facilities in your state and around the nation were built many decades ago, and as a result the transmission to off-take that power was also adequately built quite a long time ago. However, in many areas of the west, additional wind and solar plants have connected to the grid that have historically been

primarily used for those hydroelectric facilities, putting power transmission capacity pressures on those lines. As a result, in those areas, those transmission lines are under more pressure than in the past. It is therefore incumbent on FERC and ISO's to concurrently authorize expansion of transmission as needed when renewables are added, so as the hydroelectric power does not become restricted. If there are restrictions to added transmission capacity on that federal, state, municipal or private land, that should be taken into account before wind or solar are permitted in that location.

**The Honorable Mariannette Miller-Meeks, M.D.**

**Like any engineered system, wind facilities in Iowa and across the country experience some deterioration over the course of their lifetime. For U.S. wind fleets, this degradation involves a step-change in performance after a decade of operation, according to a 2020 study. Unique to the United States, the study shows a significant drop in performance by 3.6% after 10 years. This level of degradation reduces a wind facility's output, increasing the cost of the electricity it produces.**

**The federal government has supported efforts to reduce turbine degradation. From 2016 to 2022, the ARPA-E program at DOE supported a project led by the University of Virginia to design the world's largest offshore turbine that allows blades to deflect in the wind, much like a palm tree, to withstand hurricane-wind speeds, reducing rotor mass and fatigue.**

- 1. Are you familiar with the issue of wind turbine degradation; how big of an issue is it; and are you aware of other opportunities or research to maximize wind turbine performance over time?**

I am familiar that some of the larger wind turbine operators have developed a significant turbine sensing network to real-time identify wearing of their turbines all over the U.S. And they have contributed all that real time data over time to a master artificial intelligence turbine operations and maintenance program that is quite powerful. Those systems have significant value in predicting degradation, and developing maintenance plans far more predictive than direction from the turbine manufactures. That wind turbine degradation data and AI planning has materially improved performance of wind turbines.

**As you know, a controlled nuclear fusion reaction at Lawrence Livermore National Laboratory produced more energy than it consumed in December 2022. The milestone, known as "fusion ignition," is unprecedented, according to DOE. Iowa's last nuclear plant shut down in 2020, but from a national standpoint, nuclear fusion would be revolutionary for the United States.**

- 2. Can you contextualize the recent nuclear fusion breakthrough and how long you believe it will take for the technology to be commercially viable?**

The fusion net-energy generation accomplishment at LLNL was a significant science advancement, and has significant value for the DOE Defense Program stockpile stewardship mission. But facility operational characteristics and net-energy efficiency is still quite distant for a power plant to be made with that specific facility design. In addition, the accomplishment shows that the specific design, Inertial Confinement, has prospects.

It does importantly provide visibility on the fusion plasma dynamics for power plants. Currently there are more commercial efforts for fusion power plants in magnetic confinement, and other designs. And this LLNL accomplishment shows that innovation in the fusion sector is making strides, and worth additional support.

**As you may know, in 2021, Iowa was the second-largest wind power producer in the country and wind turbines generated 58% of Iowa's electricity, the highest wind power share for any state.**

**My colleagues and I are clear that we cannot flip the switch overnight to renewable energy, but I believe we can make investments and address policy gaps to support renewable energy technologies as part of the "all of the above" energy mix.**

**3. Can you please speak to some of areas Congress needs to engage to help support base load fuels and "complementary technologies" as we continue to integrate renewables into the national energy mix?**

In regards to what Congress needs to look at to support base load fuels: The Independent System Operators ("ISO") have not implemented rules to maintain base load generation as intermittent renewables have been added to the systems. Congress should look to reform the Federal Power Act to direct all systems, including the intra-state ERCOT system, to better support base load generation, especially as intermittent renewables are added. There are various ideas on how to word that requirement. One idea is mandating the ISOs to better model the instability that renewables are adding to the grid, and properly estimate the increasing needs of dispatchable generation as a result. And to formalize contracting or compensation systems for that dispatchable power to that it gets built.

In regard to support of "complimentary technologies", in addition to the above, it is clear that in many places of the country, base load power plants name plate capacity are being retired faster than intermittent power plants are being added. And as a

result, there has been a rapid increase in risks and prices in the wholesale power markets. Near term support for available dispatchable power plants at scale for most of the U.S. can only come from natural gas fueled power plants. And given the scale of retirements of coal and nuclear around the U.S., the amount of natural gas plants needed is material, and immediately needed.

Longer term, additional dispatchable might be provided from better battery chemistries than we have today, hydrogen for use in simple cycle or combined cycle turbines, or fusion.