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"Offshore Wind, Onshore Benefits: Growing the Domestic Wind Energy Industry"

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Chairman Rush, Ranking Member Upton, and members of the Subcommittee:

Thank you for the invitation and opportunity to testify before you today on a potentially bountiful source of emission-free electricity, offshore wind. While I have a considerable amount of experience in dealing with aspects of this resource in my role as Under Secretary and as Deputy Secretary of Energy, today I will be speaking as a private citizen, not in any official capacity, and my testimony is my own opinion informed by over 30 years of experience in the public and private energy policy sectors.

Before I get to offshore wind, however, I think it important to note that energy and commodity prices are at their highest in years. The costs of crude, gasoline, natural gas even propane have increased dramatically over the past several months. Consumers are paying higher costs than they have grown accustomed to when the U.S. became the leader in oil and natural gas production in 2019. Offshore wind will provide electricity to consumers but until our transportation and industrial sectors electrify, consumers will expect to be able to get energy when they need it at affordable prices, regardless of source.

So what's not to like about offshore wind? Winds offshore have been measured to be stronger, more consistent, and more sustainable than onshore winds. Its intermittency is less than onshore wind and can generate more electricity more reliably. These winds are abundant just offshore coastlines where much of the world's populations live and most of our urban energy centers are located. Due to its relative close proximity to this demand load, planning and siting offshore wind transmission appears less complicated than that required to interconnect onshore wind into the bulk power system.[1] These undersea, out of sight, transmission cables can feed emission-free, clean energy directly into our bulk power system avoiding the congestion or access problems we face with onshore generation and transmission. Today's state of the art turbine, blade and platform technologies are able to harness this wind in an extremely harsh environment, generate electricity, and reliably deliver electricity directly into the bulk power system where the demand for energy is the greatest. In fact, the International Energy Agency (IEA) tells us that offshore wind is in a category of its own, "as the only variable baseload power generation technology.

[1] Getting Offshore Wind Power on the Grid | T&D World (tdworld.com)

New offshore wind projects have capacity factors of 40%-50%, as larger turbines and other technology improvements are helping to make the most of available wind resources."[2]

According to the IEA, "offshore wind matches the capacity factors of efficient gas-fired power plants, coal-fired power plants in some regions, exceeds those of onshore wind and is about double those of solar PV." It's "output varies according to the strength of the wind, but its hourly variability is lower than that of solar PV. Offshore wind typically fluctuates within a narrower band, up to 20% from hour-to-hour, than is the case for solar PV, up to 40% from hour-to-hour."[3]

Globally, from 2010 to 2018, offshore wind market increased at a pace of about 30% per year, in part because of improvements in technology and the increase of about 150 new offshore wind projects in development. As expected Europe, primarily the United Kingdom, Germany and Denmark, is the world's leader in offshore wind development but China added more capacity than any other country in 2018. The IEA and World Energy Outlook report tell us that available resources for electricity generation from offshore wind are 18 times more than the total electricity consumption of the world.[4]

Here in the U.S., we have abundant offshore wind resources. It has recently been reported that "the United States has the technical potential to produce more than 7,200 terawatt-hours (TWh) of electricity from offshore wind, which is almost two times the amount of electricity the U.S. consumed in 2019 and about 90% of the amount of electricity the nation would consume in 2050 if we electrified our buildings, transportation system and industry and transitioned them to run on electricity instead of fossil fuels."[5]

As I said, what's not to like? Well, it's very difficult to site, build, connect, and estimate actual costs. One only has to utter "Cape Wind" to cause pause in this enthusiasm. I recall this committee's interest in investigating offshore wind when I was Chief Counsel for Energy and Environment back in the early 2000s when the Cape Wind Project was proposed. A group of offshore wind developers proposed offshore turbines off the coast of Massachusetts beyond state waters that caused then, and continued to cause for many years thereafter, much controversy. Then, we heard from members on both sides of the aisle about the concerns (and benefits) of such project. We decided we should get a briefing from some experts on offshore wind issues and technologies. I recall officials from Denmark and offshore wind industry experts briefed committee and congressional staff on how Denmark achieved its success with offshore wind. We heard how Denmark decided after the global energy crisis of the early '70s that they would no longer be hostage to OPEC countries deciding how much oil and natural gas the rest of the world would get for their energy needs. As part of that plan of independence, the Danish government decided to enact policies and invest and develop offshore wind. Technologies developed, offshore wind was sited and built, and eventually offshore wind of the coast of Denmark became a reality. Today, it provides an emission-free source of power to Danes for over half of their

[2] Offshore Wind Outlook 2019 – Analysis - IEA
[3] Ibid.
[4] Ibid.
[5] Offshore Wind for America | Frontier Group citing EIA data.

electricity. During the Q&A portion of the briefing, I asked how their then policy makers changed policies to accomplish this feat. We were told they had to municipalize offshore wind projects to get local ownership and acceptance.[6] The government had to weigh in to control the process, costs and outcome. As much as we recognize the vital and important role our public power partners play in our robust electric sector, it is unlikely local ownership of offshore wind projects will be the solution in the U.S.

With this experience and background, years later, as Under Secretary of Energy, one of the first announcements we made following my confirmation was the creation and funding of a National Offshore Wind Research and Development Consortium.[7] We had a regular blog featuring updates on the Department's efforts and the unique challenges and technologies in offshore wind development.[8] The funding announcement led to the competitive selection in June of 2018 of the New York State Energy Research and Development Authority (NYSERDA) to lead and administer the consortium comprised of some of the largest offshore wind developers, technological experts from our labs and universities, as well as state interests to coordinate progress.[9]

A few months later, I attended a G-7 Energy Ministerial meeting in September 2018. A recent report by the International Energy Agency on offshore wind potential was presented and was discussed by the ministers.[10] The report identified the potential off the coasts of the U.S. recognizing the difficulties of the past but the renewed interest in the states of Massachusetts and New York. The report analyzed the role the oil and gas industry could play in the design, construction and deployment of offshore facilities, including the necessary floating platforms in the deeper waters of the Pacific Ocean. China was reported as growing both in offshore wind development but also technological development and supply chain supplier of materials necessary in the manufacturing of offshore wind turbines. Some of the European energy ministers talked to me about the inability of the U.S. to harness its own offshore wind potential. They thought it would be a great opportunity for allies to help one another as technological leaders and to reduce emissions. I was able to report on DOE's efforts to develop both technological and regulatory paths forward and added to the sense of optimism that together we could unlock the potential of offshore wind. Indeed, the ministers agreed offshore energy development should continue to be a significant contributor to the energy mix and to energy security and officially gave its support to the IEA report.

The enthusiasm at the Department and our labs about the development of offshore wind in the U.S. continued throughout our tenure. We continued to have detailed and substantive briefings on offshore wind technologies with experts within and outside the department as well as meetings with U.S. developers and other interested parties. In 2019, the Offices of Wind and Water Energy Technologies within the Office of Energy Efficiency and Renewable Energy, along with our National Renewable Energy Lab (NREL), released its "Offshore Wind

[6] Denmark - www.communitypower.eu
[7] Secretary of Energy Rick Perry Announces $18.5 Million for Offshore Wind Research | Department of Energy
[8] WIND ON THE WAVES: FLOATING WIND POWER IS BECOMING A REALITY | Department of Energy
[9] National Offshore Wind R&D Consortium | Department of Energy
[10] 3573-IEAG7offshorerenewableenergy.pdf (windows.net)

Technologies Market Report for 2018 which, like the IEA report, identified opportunities and challenges for offshore wind.[11]

We continued the key role DOE program offices and its national labs play in several areas of offshore wind development working to solve technical issues like the development of national and international design standards; resource forecasting and modeling for next-generation offshore wind turbine and plant technologies; systems engineering of next-generation floating wind turbines and mooring systems; and evaluation and development of technical solutions to environmental and siting challenges associated with U.S. offshore wind energy development.[12] Today, the Department and its labs are able to do this with its high-fidelity modeling using high-performance computers.[13]

We also looked at costs. NREL modelled the costs of certain offshore wind projects using state of the art technologies over 20 years of power contracts and 30 years over the life of the project. The results appeared promising although others dispute the actual costs of the projects and costs to be borne by the customers.[14] Some have estimated the costs of wind projects of New York's coast would be at least $100 MWh to $160 MWh.[15] Others have broadened the evaluation of project costs and consumer costs along the eastern seaboard and have concluded the costs are much higher than reported.[16] And, in Europe, particularly in the U.K. where offshore wind has been operating for years, others are reporting that the actual costs of projects and costs to consumers are likely much higher than disclosed due to lack of transparency in revealing the true costs.[17]

While at DOE we also tried to find forward paths on the Jones Act issues and transmission capacity and interconnection issues at FERC. We had briefings and assigned resources to help evaluate and consider potential solutions to these issues. We had multiple interagency meetings on the Jones Act. FERC initiated a technical conference to get public input and examine its offshore transmission policies to integrate offshore wind into its RTOs/ISOs.[18] Today, it appears the industry is responding to Jones Act restrictions by investing in U.S. flagged vessels.[19]

Well, what can Congress do? In 2005, Congress gave lead authority to the Department of Interior over all offshore energy projects including wind. Congress has sought to address the complicated federal, state and local regulatory processes before. There are plenty of proposals to consider but the Coastal Zone Management Act (CZMA), a statute outside of this committee's jurisdiction,

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[11] 2018 Offshore Wind Technologies Market Report (energy.gov)
[12] Offshore Wind Research and Development | Department of Energy
[13] Ibid.
[14] Cost of Floating Offshore Wind Energy using New England Aqua Ventus Concrete Semisubmersible Technology (nrel.gov)
[15] Offshore Wind Plans Will Drive Up Electricity Prices And Require 'Massive Industrialization Of The Oceans' (forbes.com)
[16] Out to Sea: The Dismal Economics of Offshore Wind | Manhattan Institute (manhattan-institute.org)
[17] U.S. Offshore Wind Energy: Real-World Experience Presents Stark Warning | National Review
[18] SUPPLEMENTAL NOTICE OF TECHNICAL CONFERENCE (ferc.gov)
[19] Jones Act quandary fails to slow US offshore wind momentum | IHS Markit

would require reexamination of the role of the States in the permitting of these projects. And even then, states can ban offshore wind off their coasts in state waters.

In July, the Governor of Maine signed such a law, notwithstanding all the positive reports of offshore wind potential to the contrary.[20] Surprisingly, this about face followed what appeared to be strong support for offshore wind. Just last year, the University of Maine collaborated with NREL to produce a report[21] on offshore wind technology and predicted costs over the life of the project. In 2019, the same Governor signed a law directing the public utility commission to approve an offshore wind project and a subsequent power purchase agreement with the local utility. States banning offshore wind doesn't make it easier, more efficient, or less expensive to consumers to site and operate offshore wind in federal waters.

So we know the complications of siting, constructing, interconnecting, and predicting costs of offshore wind off the coasts of the U.S. We also know from all reports that its potential is unlimited. But we also know what happens when the wind stops blowing. We've seen this movie and it doesn't have a happy ending. As the reports of what happened in the North Sea tell us there were plenty of things to like about North Sea offshore wind: the UK gets 25% of its power from offshore wind; it provides cheap electricity and at times produces more than the UK needs. But about a month ago wind on the North Sea stopped blowing, grid operators turned to natural gas and coal to keep the grid operating. It was reported that because of already tight supplies due to increased demand coming out of Covid-19, lack of fossil fuel storage, and the expense of emission permits to operate, the cost of natural gas hit an all-time high. A retired coal plant, shuttered due to anti-fossil policies, had to be restarted. At least two electricity suppliers went bankrupt. People actually expressed surprise that the wind stopped blowing. Consumers are concerned since the coal plant that was relied upon for baseload power is slated for closure in 2024. The grid operators and policy makers are trying to figure out how to prevent this from happening again. The only good news out of it was that U.S. LNG exporters were able to help keep the lights on in the UK.[22]

Now while the Brits may have been surprised the wind stopped blowing, we have seen this playout in the US with some regularity. When our electric systems are stressed during peak demand during the cold winters and hot summers, grid operators are forced to turn to baseload power and that has been natural gas, coal, nuclear and oil because typically wind and solar cannot ramp up to meet increased demand. The operators during the Midwest polar vortex in 2014 relied on coal. During the 2018 "bomb cyclone" in the east, operators relied on nuclear, and increased coal and oil sources, as plants switched from natural gas to oil.[23] And for the past two summers, DOE has had to issue emergency orders to California to run natural gas units in excess of emission limits to meet high demand.[24] I remind policy makers that our systems need to be

[20] Governor Mills Signs Legislation Prohibiting Offshore Wind Projects in State Waters | Office of Governor Janet T. Mills (maine.gov)
[21] FN 11.
[22] https://www.wsj.com/articles/energy-prices-in-europe-hit-records-after-wind-stops-blowing-1163152825
[23] Additional Pipeline Capacity and Baseload Power Generation Needed to Secure Electric Grid | netl.doe.gov
[24] DOE's Use of Federal Power Act Emergency Authority | Department of Energy

designed to ensure that when people need electricity the most, our system should be designed to provide that power. Not when they *want* it, when they *need* it.

For all the positives of offshore wind, until we have long duration storage battery technology (greater than 10 hours)[25] deployable at affordable costs, offshore wind will be a luxury to most Americans. Some predict that batteries will take the place of traditional power generation today. Our current state of effective battery technology is four hours and it takes years to site, permit and build. Long Duration Energy Storage (LDES), possibly the "holy grail" of grid storage, is still years away from development and deployment. In California, a 4-hour, 350-megawatt battery storage project scheduled to come online in 2022 has been under development since 2015 (a seven-year period for one project).[26] There simply isn't enough storage available to maintain reliability, and even if there was, it would be enormously expensive. A study by NREL in 2019 predicted the cost of 4-hour battery storage ranging between $124 and $328 per kilowatt hour (kWh) in 2030.[27] As comparison, the average cost of electricity here in the District of Columbia is about 12 or 13 cents per kilowatt hour (kWh).[28]

What can Congress consider while it evaluates offshore wind policy?

One is ensuring that the critical minerals and materials necessary in the manufacture of the component parts of offshore wind are supplied here in the U.S. Offshore wind turbines cannot be manufactured without a secure supply of critical minerals, particularly rare-earth elements (REs) (mainly neodymium [Nd], praseodymium [Pr], and dysprosium [Dy]), for the production of permanent magnet electric generators. These rare earth elements are critical operational efficiencies of wind turbines, but they are a scarce commodity with a high global demand. To add to this scarcity, these rare earths are produced only in a few countries making the entire global supply chain vulnerable.[29]

Of course, we've known about this for a while. The Department of Energy has identified the critical materials needed in the manufacturing of wind turbines.[30] The U.S. imports most of its critical mineral commodities. The U.S. "is import-reliant (imports are greater than 50 percent of annual consumption) for 31 of the 35 minerals designated as critical by the Department of the Interior. The U.S. does not have any domestic production and relies completely on imports to supply its demand for 14 critical minerals."[31] Over 75% of the rare earth elements necessary for the magnets in offshore wind turbines are produced and supplied by China.[32] Now would be a good time for the committee to consider H.R. 1599, "Securing America's Critical Minerals Supply Act" by Representative Upton.

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[25] Energy Storage Grand Challenge Energy Storage Market Report
[26] California Scrambles to Find Electricity to Offset Plant Closures - WSJ
[27] Cost Projections for Utility-Scale Battery Storage: 2020 Update (nrel.gov)
[28] Electricity Rates by State » (October 2021) « ElectricRate
[29] Critical Rare-Earth Elements Mismatch Global Wind-Power Ambitions - ScienceDirect
[30] Department of Energy Critical Materials Institute Selects Four Projects to Support Critical Materials Supply Chain Innovation | Department of Energy
[31] Critical_Minerals_Strategy_Final.pdf (commerce.gov)
[32] Ibid.

We know too that renewables, such as wind, can generate electricity to electrolyze water to create green hydrogen. It would be appropriate to support H.R. 1788, "Clean Energy Hydrogen Innovation Act" by Representative Pence.

The other well-known fact, although it is out of vogue to talk about it, is that domestically produced natural gas complements much of the growth in the production of renewables in this country. Natural gas combined cycle units are relied upon across this country for incremental power increases when renewables ramp down (sun goes down and wind stops blowing). Indeed today, almost all new electric generation being built today is renewable and natural gas,[33] with the exception of the emission-free Vogtle nuclear facility in Georgia. Natural gas complements the addition of renewable power on the grid for several reasons: 1) it can be added in incremental amounts to meet generation capacity requirements as intermittent sources stop producing, 2) it can respond quickly to demand changes, and 3) has lower environmental compliance, fuel, and operating costs.[34]

So it is appropriate for this committee to acknowledge the critical role of natural gas and support efforts to promote carbon capture, utilization and sequestration technologies, such as H.R. 1761, "CCUS Innovation Act" by Representative McKinley, and, importantly, H.R. 1600, the "Methane Emissions Reduction Act" by Representative Upton, in order to make better use of our abundant natural gas resources while addressing methane emissions. Of course, to make greatest use of natural gas to get to net zero emission goals, Congress should ensure its delivery. We know the difficulties of siting the pipelines necessary to deliver this abundant, affordable and reliable fuel to where it's needed the most so this committee should consider and support pending bills to do just that. For example, Representative Burgess's bill, "Promoting Interagency Coordination for Review of Natural Gas Pipelines Act" (H.R. 1616) streamlines the natural gas pipeline permitting process at FERC. To ensure that both the U.S. and the U.K. as well as our friends, allies and partners around the world can rely on U.S. produced natural gas rather than Russia, this committee should support and consider the "Protecting American Energy Production Act" (H.R. 751) by Representative Duncan and the "Unlocking Our Domestic LNG Potential Act" (H.R. 1575) by Representative Johnson.

And to make the North American continent as energy independent as we can from the capricious whims of the OPEC nations, this committee should consider and support efforts to strengthen our interconnections with Canada, which provide New England with emission-free hydropower, as well as with Mexico which exchanges electricity and natural gas with us along our borders. To improve the national interests of all three countries, this committee should consider and support the "Promoting Cross-Border Energy Infrastructure Act" (H.R. 575) by Representative Mullin and the "Keystone XL Pipeline Construction and Jobs Preservation Act" (H.R. 684) by Representative Armstrong.

As great as the potential of offshore wind, we have an emission-free source of electricity in nuclear. Congress has spent billions to fund nuclear technology development and deployment ranging from fuel technologies for existing units to next generation small modular reactors to fusion energy. If we abandon our commitment to maintain technological leadership in

[33] Electricity generation, capacity, and sales in the United States - U.S. Energy Information Administration (EIA)
[34] Ibid.

commercial nuclear generation and technology, we will cede new plant design, construction and operation of nuclear fleets around the world to our competitors at best, or Russia or China. These are countries without the statutory obligation to enter into nonproliferation or enrichment agreements with those they are providing nuclear technology.

To that end, this committee should do what it can to ensure U.S. leadership in the nuclear sector both for environmental and for national and global security. It is entirely appropriate and necessary that this committee consider and support the "Nuclear Prosperity and Security Act" (H.R. 1351) to establish and maintain a U.S. strategic uranium reserve to relieve our dependency on countries like Russia for our uranium needs for our commercial fleet, and the "Nuclear Industrial Base Act of 2021" (H.R. 1698) to support our struggling domestic nuclear industry, both by Representative Latta. To address the long overdue need to streamline the unduly burdensome and duplicative NRC review process, this subcommittee should consider and support the "Modernize Nuclear Reactor Environmental Reviews Act" (H.S. 1559) by Representative Duncan, the "Nuclear Licensing Efficiency Act" by Representative Kinsinger (H.R. 1578), and the "Advanced Nuclear Deployment Act" (H.R. 1746) by Representative Hudson.

And to ensure the U.S. remains the leader in the development and deployment of nuclear technology so we do not cede this position to our international competitors or the Chinese and Russians, this committee should act with alacrity to consider and support the "Strengthening American Nuclear Competitiveness Act" (H.R. 1748) by Representative Johnson.

Before this committee spends its precious resources and time considering ways to promote offshore wind which has such regulatory entanglements that Congress can actually do very little without triggering aggressive judicial scrutiny, the subcommittee should focus on doing what it can to promote U.S. jobs and technologies on abundant resources onshore. For example, to make greater use of our abundant hydropower potential, this subcommittee should consider and support the "Hydropower Clean Energy Future Act" (H.R. 1588) by Representative Rodgers to modernize the licensing process and promote innovation for the next generation of hydropower.

To ensure our existing thermal generation fleet is providing reliable, affordable baseload power when your constituents need their electricity the most, this committee should consider and support the "New Source Review Permitting Improvement Act" (H.R. 245) by Representative Griffith to both encourage investment in and allow technological upgrades for industrial facilities and power plants to existing facilities and to use the technology we have to construct high efficient, low emission coal electric generating units.

Finally, to address our dependency on China and other foreign suppliers of our basic resources and component parts on essential goods and products, particularly as we come out of the Covid-19 shutdowns, this committee should consider and support the "Promoting New Manufacturing Act" (H.R. 1855) by Representative Scalise.

Thank you for the opportunity to address you this afternoon and I look forward to answering your questions.