Testimony for the Record

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FOR A HEARING ON

Development and Deployment of Emerging Offshore Energy Technologies.

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Introduction

Chairwoman Murkowski and Ranking Member Manchin, thank you for the opportunity to testify before the committee today.

As the Assistant Secretary of the Office of Energy Efficiency and Renewable Energy (EERE), I oversee a broad portfolio of renewable energy, energy efficiency, and transportation programs. Our program's primary focus is on funding technology research and development through competitive solicitations open to the public as well as management and operations contracts with the National Laboratories, which play a central role in advancing America's leadership in scientific research and development. The knowledge generated by EERE research and development drives down the costs of new technologies, supporting the efforts of U.S. industries, businesses, and entrepreneurs in deploying innovative energy technologies.

Developing technologies that tap into our abundant offshore energy resources play a vital role within the Administration's American energy strategy. With more than 50% of the population living within 50 miles of coastlines, and the coastal and Great Lakes states accounting for nearly 80% of U.S. electricity demand, there is vast potential to provide clean, renewable electricity to communities and cities across the United States using innovative technologies such as offshore wind, marine and hydrokinetic (MHK) technologies, and alternative sources of drop-in fuels for marine shipping applications.

While EERE works on overcoming the technological barriers to these emerging technologies, there are other considerations, such as permitting, that fall outside of the scope of the Department of Energy, that but can hinder the innovation and deployment of emerging offshore energy technologies. There are also increased technical challenges to working in the marine environment, and this can translate into delayed feedback and development of new innovations.

Affordable, reliable energy gives Americans the competitive edge needed to excel in the rapidly changing global energy economy. I am excited to talk with you today about our activities promoting innovation in the offshore energy industry.

Innovations in Offshore Wind Energy

Coastal load centers have a technical offshore wind resource potential twice as large as the nation's current electricity use. With such an enormous untapped potential, coastal states are increasingly looking to offshore wind as a way to provide clean, reliable electricity and to meet their renewable goals. According to the National Renewable Energy Laboratory, the United States had 28.5 GW of offshore wind in the development pipeline at the end of 2019. In the next two decades, offshore wind has the potential to provide power to the East and West Coasts, Great Lakes, Gulf of Mexico, Alaska, and Hawaii by utilizing both fixed-bottom and floating offshore wind technologies.

Because offshore wind energy is poised to become one of the fastest-growing areas of renewable energy development in the next decade, EERE is driving innovation to ensure the affordability

and reliability of this technology. The unique coastal and ocean environment in the U.S., which includes deep water and hurricanes, requires further innovations to realize low-cost installation of wind in these regions. EERE's Wind Energy Technologies Office has two active Offshore Wind Advanced Technology Demonstration Projects, one of which is located off the coast of Maine and is positioned to be the first U.S. floating wind project using commercial technology.

EERE also funds the National Offshore Wind Research & Development Consortium to conduct research and development activities to address technological barriers and lower the costs and risks of offshore wind in the United States. Last month, the Consortium issued its second Request for Proposals (RFP) for additional industry-prioritized offshore wind research and development topics that targeted the areas of large-scale wind turbines, support structure innovation, supply chain development, electrical systems innovation, and technology solutions to mitigate conflicts caused by competing uses of the ocean space. In their first RFP, the Consortium selected 20 awards totaling $17.3 million.[1] The Wind Energy Technologies Office (WETO) works closely with the Consortium to develop their RFP, review proposals, and recommend projects for award to maximize the impact of federal funding.

WETO also conducts cross-cutting research that has the potential to bring down costs in both offshore and land-based applications of wind energy technologies. Those cross-cutting research activities include advanced technologies for ultra-large, ultra-lightweight turbines, breakthroughs in ultra-large blade manufacturing, improved energy forecasting and plant optimization, and autonomous inspection and maintenance systems. To gain a better understanding of the scale of these technologies, GE's Haliade X 12-megawatt and Siemens' 14-megawatt offshore wind turbines stand approximately 260 meters tall and feature blades that are over 100 meters long.

Finally, WETO invests in research and development to develop technical solutions to siting and permitting challenges, including research aimed at informing and developing technical solutions to issues associated with wind turbine radar interference and impacts on wildlife. The office is currently supporting the development of a suite of advanced tools for automated monitoring of impacts of offshore wind on bird and whale species.

Innovations in Marine and Hydrokinetic (MHK) Energy

DOE studies have found that marine and hydrokinetic resources across the U.S. have technical potentials that equate to roughly 30-40% of the nation's electricity load, though these resources differ significantly by region: for example much of the wave resource is on the West Coast, with half in Alaska alone, while the ocean current resource is located in the Southeastern states bordering the Gulf Stream.[2] Wave energy makes up about two-thirds of this opportunity, and it is abundant across all five Pacific states. Tidal, ocean current, and river current resources comprise most of the remaining potential, and they are concentrated, but geographically diverse

[1] https://www.energy.gov/eere/wind/articles/national-offshore-wind-rd-consortium-issues-second-request-proposals

[2] https://www.energy.gov/eere/water/marine-and-hydrokinetic-resource-assessment-and-characterization

resources. These resources range from tidal hotspots in Alaska, the Pacific Northwest and the Northeast to the Gulf Stream that stretches from south Florida to the Outer Banks.

EERE's Water Power Technologies Office (WPTO) leads the way in evaluating new sources of marine and hydrokinetic (MHK) energy, including waves, currents, tides, and ocean thermal resources. The U.S. is one of the global leaders of this new and innovative industry, with more than 75 companies (representing better than a third of all active marine energy companies operating globally) and 150 research organizations working in marine energy research. Marine and hydrokinetic technologies are not yet cost competitive with other sources of bulk power. This is predominantly due to unique engineering challenges of harnessing power from free-flowing water and the cost and time it takes to test and innovate new technologies in the ocean, where single tests can take over a year and any mistake can result in a sunk investment. DOE addresses these challenges in multiple ways: advancing critical early-stage research that sets the technical foundation for all technologies and entrepreneurs; providing direct support to American innovators to design new MHK systems and test them at all scales; and providing access to dedicated infrastructure where devices can be tested quickly, reliably, and cost-effectively, and where lessons learned can be efficiently transferred to the next generation of designs.

In addition to supporting the early-stage R&D that will enable long-term cost reductions and performance improvements, WPTO has also recently undertaken new efforts to explore nearer-term opportunities for marine energy to reduce power constraints for other ocean industries and remote communities with high energy costs.

WPTO launched its Powering the Blue Economy (PBE) Initiative in FY 2019, which supports marine energy R&D targeting maritime markets that could benefit from the early adoption of ocean energy technologies. PBE offers the potential to meaningfully accelerate cost reductions for grid-scale marine energy systems by both providing more opportunities for in-water experience and the potential of attracting additional private capital. The PBE initiative also can accelerate offshore energy development by enabling critical support technologies, such as monitoring systems for offshore oil and gas wells or providing the persistent power needed for underwater vehicles to inspect wind turbine foundations.

In FY 2020, WPTO built on its 2019 analysis and expanded the PBE portfolio to include attracting new universities and solvers through new competitive funding opportunities, investing in foundational research at the national labs, and launching new partnerships and programs within DOE and with federal partners. In 2020, WPTO launched a joint Ocean Observing Prize with the National Oceanic and Atmospheric Administration to generate innovation in marine energy-powered ocean observing platforms. The newest round of the prize is focused on powering solutions for hurricane monitoring at sea.

In July, WPTO announced the winners of the first ever Marine Energy Collegiate Competition. This was the first year of the competition, which is managed by the National Renewable Energy Laboratory on behalf of WPTO. WPTO is now accepting applications of interest for the 2021 competition.

Innovations in Drop-in Fuels Applications for Marine Shipping

Global marine fuel consumption is estimated to be around 330 million metric tons (87 billion gallons) annually (mostly heavy fuels oils) and is expected to double in the next 20 years[3]. The marine shipping sector carries over 80% of global international trade and the sector is one of the single largest consumers of petroleum fuels, especially residual heavy fuel oil (HFO)[3]. Consequently, marine engines are one of the largest emitters of air pollutants. Higher fuel costs, emission regulations, and the additional processing accompanying HFO, may provide a new market opportunity for biofuels, many of which have low sulfur content and are being explored in DOE's Bioenergy Technologies Office (BETO) and Hydrogen and Fuel Cell Technologies Office (HFTO).

BETO has been developing broad capabilities to convert domestic biomass and waste resources into fuels, products, and power to enable affordable energy, economic growth, and innovation in renewable energy and chemicals production. BETO commissioned a multi-laboratory effort to outline these opportunities, challenges, and research needs for marine application, which resulted in the publication of *Understanding the Opportunities of Biofuels for Marine Shipping* by Oak Ridge National Laboratory in December 2018.

Specific conversion pathways under development within BETO's program include pyrolysis, gasification with synthesis gas upgrading, hydro-thermal liquefaction, and biochemical conversion technologies and offer a range of choices for this sector. Hydrothermal liquefaction and fast pyrolysis produce a range of molecules with different combustion properties, including fractions that are amenable for marine fuel applications, either as straight drop-ins or in blends. These fuels contain negligible amounts of sulfur, and are also of interest as a heating oil in the Northeast. BETO is also investigating the scalability of potential biofuel pathways to ensure solutions not only look at the fuel itself, but the entire supply chain to obtain meaningful quantities of these fuels near refuel port cities.

In addition, HFTO is collaborating with WETO through the H2@scale initiative, which envisions affordable hydrogen production, storage, distribution and use across multiple sectors in the economy. A component of the H2@scale vision leverages hydrogen as an enabler to renewable energy, such as solar and wind, including integration with baseload power based on fossil and nuclear energy. For example, by producing hydrogen when power generation exceeds load, electrolyzers, which use electricity and water as input to produce hydrogen, can prevent curtailment of solar and wind, and support grid stability. Through the H2@Scale initiative, HFTO is funding activities to demonstrate the potential of hydrogen in maritime applications.

HFTO also recently released a Request for Information, which closed September 15, 2020[4], in which we expect stakeholder input on topics such as large-scale storage that could be applicable for either onboard fuel or hydrogen transport by marine vessels.

[3] https://www.osti.gov/biblio/1490575-understanding-opportunities-biofuels-marine-shipping
[4] https://eere-exchange.energy.gov/Default.aspx#FoaId9fd3296a-81af-4d17-953b-82f7f5e9718c

Lastly, the Vehicle Technologies Office's battery and electrification R&D are applicable to activities associated with marine electrification that are focused on shorter distance travel such as electric passenger ferries. Washington State Ferries, the largest ferry system in the U.S., are looking at new hybrid-electric 'Olympic Class' ferries capable of carrying 144 cars and 1,500 passengers each in all-electric mode or with a hybrid mode backup. Charging will take place at ferry terminals to maximize the battery-operation. In 2019, Norway had seventeen battery electric ferries in use servicing the inner parts of the Oslofjord. EERE will continue to track the progress of these deployments.

Conclusion

Today the U.S. is producing more affordable and cleaner energy from a wider range of resources than ever before. EERE's investments have advanced America's leadership in the development of emerging offshore energy technologies.

I look forward to working with you to provide American families and businesses with a wider range of energy and mobility options for continuing affordability, reliability, and security of our nation's energy.

Thank you for the opportunity to appear before the Committee today. I look forward to your questions.