Testimony

of

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Good morning. My name is Katherine Hamilton. I am the Chair of the firm 38 North Solutions and the non-profit Project on Clean Energy and Innovation. Thank you to the Chair, Ranking Member, and the entire Select Committee for inviting me to testify before you today regarding the deployment of renewable energy in the United States.

Whether your goal is to mitigate climate change, increase resilience, improve the economy, or lower consumer costs, clean and renewable energy resources provide those solutions. You have heard from the solar and wind industries and I would note that other renewable resources—hydropower, geothermal, ocean and tidal, and biomass—should also be considered part of the equation to provide clean generation sources.

Today I am here to talk about the flexible technologies and applications that will connect all of these resources, getting more value out of every kilowatt-hour we generate, while allowing us to fully reach 100% clean energy deployment and enabling all Americans to benefit from this energy transition. I started my career with a decade designing grids for a utility, was a Certified Energy Manager and directed energy and water efficiency programs at the National Renewable Energy Laboratory, and later ran

the GridWise Alliance, focused on deploying smart grid technologies. Those experiences taught me how our grid works and that more than generation sources and wires are needed to make it function at its full capacity. During those same decades, innovation that had originally been limited to the utility has been democratized such that entrepreneurs throughout this country have developed new technologies and applications that can change the way we participate in the electric grid. We now need all of these technologies to work together to mitigate climate change, and the good news is that we have most of those technologies today.

Let us look first on the grid side of the system. Flexible grid technologies such as phaser measurement units, dynamic line ratings, capacitor banks, and Volt/VAR Optimization allow for more efficient and effective sensing, control, and management of the power flowing through our transmission lines. Even broadband, to which many of our rural communities still do not have access, can serve as an enabler for renewable energy and other energy technologies. Grid scale energy storage—from batteries of all chemistries, to flywheels, to flow batteries and longer duration pumped hydro and chemical storage—will enable the storage of vast quantities of renewable energy generation, preventing overbuilding these resources and essentially allowing them to function as what we think of as "baseload" generation. Already, energy storage batteries have been installed to replace natural gas peaker plants in California,[1] proving the cost-effectiveness of a technology that produces no greenhouse gases. Within the decade we will see long duration chemical storage plants able to drop into the footprint of and

[1] Article on peaker plant replacement projects can be found here: https://www.utilitydive.com/news/storage-will-replace-3-california-gas-plants-as-pge-nabs-approval-for-worl/541870/

replace entire coal and gas fleets with inexpensive, non-toxic, and non-emitting grid scale solutions.

On the customer side of the meter, consumers—from industrial plants to commercial businesses to homeowners--can choose the type of energy they consume while controlling their costs. Flexible distributed energy resources such as demand response, energy efficiency, smart inverters, batteries, thermal storage (from hot water heaters, for example), fuel cells, combined heat and power, microgrids, electric vehicles, and geothermal heat pumps can all contribute to the customer not just being a load on the system, but actually becoming part of the resource, allowing the supply and demand sides to become interchangeable. In other words, while we think of grid side resources as being the only source of generation, customer resources—whether by reducing demand or by actually generating energy--can also provide electricity to themselves, each other, and the greater grid.

These flexible resources on both the grid side and the consumer side of the system can be seen as "Non-Wires Alternatives," meaning that they can be installed to defer capital outlay of new lines and substations, saving utility investment and in turn customers money on their bills.[2] For example, in the Brooklyn-Queens Demand Management project, the utility, ConEdison avoided a $1.2 B substation upgrade by deploying demand response, energy efficiency, and distributed resources.[3] On the

[2] A collection of case studies of Non-Wires Alternatives projects can be found here: https://e4thefuture.org/wp-content/uploads/2018/11/2018-Non-Wires-Alternatives-Report_FINAL.pdf
[3] Article about BQDM program can be found here: https://www.utilitydive.com/news/despite-failures-coned-targets-more-energy-savings-from-non-wires-pioneer/547725/

transmission side, under FERC Order 1000, in the transmission planning process, flexible technologies that can avoid build-out of transmission should be considered.[4]

Customers have seen tremendous economic benefits from flexible demand-side resources. On the PJM grid in the mid-Atlantic, customers collectively saved $11.8 billion in one year alone through demand response.[5] In another example, in its Distributed Energy Resource Roadmap, the New York Independent System Operator stated it "believes that providing resources with the flexibility to meet wholesale and distribution system needs will deliver the maximum benefit to New York electricity consumers."[6] Baltimore Gas and Electric's SmartEnergy Rewards program, in which Maryland customers lowered their energy usage in response to signals from the utility, is estimated to have avoided $93 million in transmission capital expenditures and $72 million in distribution capital expenditures—savings that are then passed along to the customers.[7]

Resilience is a key component of a flexible clean energy future. The ability to fail fast, and then recover fast, is particularly suited to distributed energy resources. As far back as Hurricane Sandy, microgrids in New York and New Jersey enabled university campus facilities to continue operation in the face of massive power outages.[8] When hurricanes hit Texas, Florida and North Carolina, distributed solar and demand response

[4] Summary of Order 100 can be found here: https://www.ferc.gov/industries/electric/indus-act/trans-plan.asp
[5] Link to PJM Market Monitor report can be found here: https://aem-alliance.org/aema-reacts-strongly-market-monitor-report/
[6] "DER Energy Market Design: Dual Participation". New York Independent System Operator, Feb 2018, 2019.https://www.nyiso.com/documents/20142/5256593/DER%20Energy%20Market%20Design%20Dual%20Participation%20022819.pdf/cfaf3647-4b77-a706-b86d-24129d460ecf.
[7] Report on this program can be found here: https://www.utilitydive.com/news/behavioral-demand-response-gives-baltimore-gas-and-electric-a-business-reas/546895/
[8] Article on Princeton's microgrid can be found here: https://www.princeton.edu/news/2014/10/23/two-years-after-hurricane-sandy-recognition-princetons-microgrid-still-surges

were able to stabilize the grid and prevent surges when power was restored. During heat waves in California, hundreds of energy storage facilities at office buildings in San Francisco were called to operate collectively as a "virtual power plant," reducing demand on an over-taxed grid. During the solar eclipse in 2017, over 750,000 programmable thermostats were lowered by their consumers to reduce demand by 700 MW as solar systems across the country were displaced in the temporary darkness.[9] Those thermostats alone provided as much grid service as seven gas peaker plants, often the most inefficient and emitting resources. Given the start of wildfire season in California and the calling of public safety outages, microgrids and other distributed resources will only become more important. Flexible distributed energy resources have proven to provide resilience when the grid needs it the most.

Now the question becomes, what can Congress do to support these flexible technologies? We know from experience that tax policies like the Investment Tax Credit and Production Tax credit have been instrumental in deploying solar and wind energy, bringing down costs through scale and allowing more consumers to have access to these resources. In the same manner, clarifying the tax code such that energy storage can have access to the **Investment Tax Credit** will be important to driving down the cost of energy storage of all types, opening up new markets in dozens of states and offsetting the cost of deployment in states like California, New York, Massachusetts, and New Jersey that already have energy storage targets in place.

In addition to tax policy, **financial instruments** will be important to providing certainty and driving investment in U.S. grid innovation. Those tools could include a federally-managed financial institution like a Green Bank to provide capital for low

[9] See blog from Nest thermostats: https://nest.com/blog/2017/08/10/solar-eclipse-meet-the-nest-thermostat/

carbon infrastructure projects, supporting community development and providing a path like securitization to retire coal plants.[10] Public-private partnerships and cost-sharing, originally required with the Recovery Act grants, defrayed the cost of advanced metering and other smart grid technologies to utilities and their consumers. Grants in lieu of tax credits and raising the cap on Weatherization funds to install solar and other distributed resources, could provide financial means for lower income customers to access clean energy.

Goals for deployment of clean energy, such as with Renewable Portfolio Standards and Clean Energy Standards, have been implemented in 29 states, three territories, and the District of Columbia and have spurred development of renewable energy.[11] States like New Mexico, Nevada, California, and Washington; mayors of 216 cities as diverse as Madison, Wisconsin, Salt Lake City, Utah, and Orlando, Florida; utilities like Xcel, Idaho Power and Green Mountain Power; and corporations[12] like Bank of America, Anhueser-Busch, and Walmart, have all made commitments to transition to 100% clean energy. Based on the Sierra Club's Ready for 100 campaign, one in five Americans lives in a community that has committed to 100% clean energy.[13] Targets for energy storage in states like California have created tangible economic opportunities—over 200 companies doing business in the state—supporting good union jobs while lowering consumer bills from demand charges. A **federal clean energy standard** that allows flexible resources, such as energy storage and demand response, to participate and

[10] In Colorado, a bill was introduced in the state legislature to securitize the closure of coal plants with a bond mechanism: https://leg.colorado.gov/bills/hb19-1037
[11] Map of states with RPS goals can be found here: http://ncsolarcen-prod.s3.amazonaws.com/wp-content/uploads/2018/10/Renewable-Portfolio-Standards-2018.pdf
[12] Corporations with 100% renewable energy commitments can be found here: http://there100.org/companies
[13] Ready for 100 website with list of mayors can be found here: https://www.sierraclub.org/ready-for-100

receive credit for integrating renewables, will not only allow for full implementation of renewables, but also will create economic benefits and enable participation by customers of all types.

Research and development programs at the Department of Energy ("DOE") and other federal agencies have been crucial to developing renewable energy technologies. In my seven years at the National Renewable Energy Laboratory, I worked with scientists and engineers developing new chemistries and technologies, and then testing them in partnership with innovators in the private sector. Programs like ARPA-E have asked questions about big problems and supported start-ups with solutions to these problems.[14] The DOE Offices of Electricity and Energy Efficiency and Renewable Energy and the national laboratories still play an important role in testing and demonstrating new flexible grid technologies. In addition to basic research and development, our federal government has a role in programs that are cross-cutting and that support modeling, analysis, planning, and technical assistance to regulators, utilities, and solutions providers. "Soft" costs like interconnection and permitting continue to be barriers and increase the cost of integrating clean energy resources; the DOE can be instrumental in providing assistance in those areas.

The federal government is the nation's largest landlord and should be positioned to lead by example in the energy transition. Ensuring that the government's own facilities are deploying flexible resources will increase their resilience to both natural disaster and physical threat. The **Federal Energy Management Program** at DOE serves an important role in developing best practices for federal buildings and partnering with

[14] Testimony before Congress on success of ARPA-E can be found here: https://science.house.gov/imo/media/doc/Testimony%20to%20Subcommittee%20on%20Energy_Williams.pdf

agencies, utilities, and the private sector to deploy clean energy projects. The Department of Defense has several initiatives, including the **Strategic Environmental Research and Development Program (SERDP) and Environmental Security Technology Certification Program (ESTCP)**,[15] that test technologies that will allow their permanent bases as well as those in the field to become more efficient, secure, and clean. All of these programs should be supported to increase clean energy penetration while reducing emissions at sites.

The electric grid—whether from the transmission level or on the customer side—is part of our nation's physical and economic infrastructure. Access to electricity is considered a right of the citizens of the U.S. and it should be considered of national interest to implement policies supporting the efficient, cost-effective, safe, equitable, and clean build-out and use of the electric grid. **Broadband** for all consumers should be a priority; Internet access allows consumers to fully participate in renewable and all of these flexible distributed resources. In addition to consumers needing information to understand and control basic energy use, solar installers also prefer to monitor systems via internet and automatic demand response cannot operate without an on-line connection. **Standards and codes** are also critical to moving industry forward, providing a baseline of certainty and best practices for innovative and efficient products and solutions, while lowering the cost of those products for consumers.

It is crucial that our Federal Energy Regulatory Commission ("FERC") issue a final rule on the **Distributed Energy Resource rulemaking** to give flexible resources access to competitive markets. Over the past decade, Orders on demand response (Order 745) and energy storage (Orders 755, 784 and 841) have allowed resources that provide

[15] For more on these programs, see: https://www.serdp-estcp.org

specific services to the grid to be paid for those services. In the case of demand response, states like Pennsylvania and Maryland have been able to aggregate consumer load, offsetting the cost of peak power while allowing consumers to directly benefit from lower prices. These state-based programs do not have to conflict with federal policy; in many cases distributed energy resources can provide services to both the utility on a local level, while also delivering other or similar services to the wholesale market. All of those flexible services should receive appropriate compensation, no matter what part of the grid they serve.

Finally, and perhaps most importantly, we will need to be thoughtful in designing our energy transition, ensuring that workers and the communities in which they live that were built around mines and other fossil fuel facilities--and on whose shoulders our industrialized nation was built—are taken into consideration. These talented and motivated people of all ages and skill sets should be brought into the future of our electricity grid with **training programs** and access to these technologies.

For nearly a decade, the National Renewable Energy Laboratory has been working collaboratively with other laboratories, universities, industry, and non-governmental entities on the Renewable Electricity Future Study to analyze high penetration of renewable energy on the U.S. electric grid.[16] In those publications, flexible resources such as those I have been discussing are seen as key to getting close to 100% renewables. My purpose here has not been to debate whether we can or cannot get to 100%, but to instead raise the possibility that we have the tools to do so and that by deploying those flexible resources throughout the grid, we can fully integrate renewable

[16] See more on the RE Futures Study and subsequent papers here: https://www.nrel.gov/analysis/re-futures.html

energy. Whether we combine demand response with wind turbines or energy storage with solar power, or whether we give consumers the ability to manage and use their electricity as they see fit—it is all part of the electricity system that can and should be 100% emission free.

As my friend and colleague Jigar Shah wrote in his book, *Creating Climate Wealth*, climate change solutions pose "the greatest wealth creation opportunity of our time.[17] By setting public policies that incentivize both renewables as well as all the flexible resources that connect those resources throughout the grid, we will be able to use U.S. innovation to become 100% clean, manage our costs, allow for consumer choice, increase resilience in the face of natural disaster—all while providing certainty and stimulating economic growth for all. I am an eternal optimist, but I fully believe that with smart policy and political will, our nation has the ingenuity to make that transition.

Thank you for your interest in climate change solutions and in the opportunity to present this testimony. I look forward to your questions.

[17] Shah, Jigar, *Creating Climate Wealth: Unlocking the Impact Economy*, ICOSA Publishing, 2013.