Testimony

of

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Good afternoon. My name is Katherine Hamilton. I am the Chair of the firm 38 North Solutions, focused on clean energy public policy, and Executive Director of Advanced Energy Management Alliance, a coalition of distributed energy resource providers and consumers. Thank you to Chairman Lamb, Ranking Member Weber, and the entire Subcommittee for inviting me to testify before you today regarding the Grid Modernization Research and Development Act of 2019.

A lot has changed in the nearly two decades since I last appeared before this Committee. Renewable energy resources are now the cheapest source of electricity[1] and

[1] See article linking to report: https://www.forbes.com/sites/jamesellsmoor/2019/06/15/renewable-energy-is-now-the-cheapest-option-even-without-subsidies/#5d4add3f5a6b

energy storage is able to cost-effectively replace natural gas peaker plants.[2] Innovation has been instrumental in allowing these resources to efficiently, effectively, and safely integrate into the electric grid. While innovation continues in the private sector--with some utilities, and at our universities--federal investment and leadership in research and development is crucial to solving many of our most complex puzzles around grid modernization. The Grid Modernization Act would provide a great deal of that leadership. I will now go through each section of the draft legislation, offering recommendations for consideration in the final bill.

It is appropriate that the first part (Section 3) of the bill focuses on *resilience*. The need for resilience continues to grow given increasing storms, wildfires, droughts, and other climate-related incidents. While reliability is the percentage of availability over time, resilience is the ability to recover quickly from a specific situation; the definition of resilience will be important to set forth as separate and apart from reliability. Thus, as the bill notes, distributed resources, such as microgrids, that can recover quickly from an outage incident and provide continued service to local communities, will be important to increasing community resilience. I recommend that, in addition to metrics on outage duration, data be collected on recovery time, costs of downtime, and customer impact. I would also suggest that a section on risk be developed, mapping out areas at greatest risk both from a physical as well as an economic standpoint. Technical assistance for resilience should also be available to communities and third party providers, many of whom enter into partnerships to invest in and deploy innovative resilience solutions.

[2] See story of gas peaker plant replacement here: https://www.greentechmedia.com/squared/storage-plus/the-puente-saga-changed-the-playing-field-for-energy-storage

Smart grid (Section 4) deployments of phaser measurement units, dynamic line ratings, capacitor banks, and Volt/VAR Optimization have allowed the grid to operate more efficiently and with greater visibility. The year of detective work necessary to determine that the Northeast Blackout of 2003 was caused by a branch in Cleveland would no longer be the case thanks to these technologies.[3] In the smart grid section of the bill, focus is given to modeling, which is greatly needed, based on my experience engaging in Integrated Resource Planning proceedings in states. Modeling assumptions can determine long-term investment in generation resources--that may or may not be necessary—and that are paid for through customer rate increases. While planning models have been improving, most are still sorely lacking in considering demand side resources in the planning process. When I was running GridWise Alliance a decade ago, our vision was a system where the supply and demand sides interacted seamlessly, allowing full participation by consumers of all types to balance more dynamic renewable energy resources on the supply side. Customer-sited resources include 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—all of which can 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. More complete modeling of these distribution resources, would allow for more holistic planning for utilities and system operators, resulting in a more flexible, cost-effective and cleaner grid. As the grid becomes more dependent on renewable resources, it is important that system planning tools can model a

[3] See article on progress over five years here: https://www.scientificamerican.com/article/2003-blackout-five-years-later/

complete year of grid operations, hour by hour, so that grid planners can identify the best ways to manage the seasonal impacts of new resources on the grid. In addition, attention should be paid to customer access and inclusion in the system, enabling customers to access their utility data and use it to control when and how they use their energy.

Technology demonstrations (Section 5) are key to proof of concept, lowering risk, and gathering data for innovative solutions. A concept that has been used in other sectors and to some degree in the utility sector, is a "sandbox", where an area is set aside that is completely free of regulation and where multiple systems, technologies, and approaches can be experimented with removed from penalty and risk to the utility. These sandboxes have been tested in the U.K. and several other countries and to a limited degree in Illinois.[4] Providing grants to states for additional experimentation could lead to more creative solutions.

Advanced *energy storage* (Section 6) has grown tremendously and reduced costs thanks to state policies, such as in California, requiring utility procurements.[5] New technologies have been nurtured and funded at the Department of Energy, including in ARPA-E,[6] although the lack of federal tax credit support has inhibited the industry from reaching full potential in all parts of the U.S. Continued research funding will be needed to test new chemistries and use cases (such as longer duration). Rather than identifying this research as "grid-scale" or prescribing time durations for storage technology operations, I recommend instead stating the problems that should be solved or the

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[4] See article on sandboxes here: https://www.utilitydive.com/news/experiment-without-penalty-can-regulatory-sandboxes-foster-utility-innov/550950/

[5] Additional information on energy storage procurements can be found here: https://www.utilitydive.com/news/california-looks-to-next-steps-as-utilities-near-energy-storage-targets/525441/

[6] ARPA-E runs several energy storage programs: https://arpa-e.energy.gov/?q=project-tech-areas/storage

services delivered, and allow new chemistries and technologies—individually or as a system--be developed that can fit those needs. For example, in addition to bulk power storage, I recommend attention be paid to customer-sited storage that can be aggregated into Virtual Power Plants ("VPP"),[7] providing generation-equivalent resources to the grid. DOE could be helpful on analysis of this VPP potential, modeling of local benefits on the distribution system, and developing business models that include customer participation. The solar industry benefited from DOE R&D on reducing "soft costs"—such as interconnection and balance of system—and the energy storage sector could have similar benefits. Regarding the important topic of battery materials, it should be noted that, while the U.S. has no comprehensive policy on battery end of life reuse and recycling, the technology to recycle lithium-ion batteries exists and is being done today in refining facilities globally.

The *hybrid energy systems* (Section 7) component of the bill is important and is focused correctly. One suggestion would be to incorporate other energy and water nexus technologies in addition to desalination—perhaps to include atmospheric water generation using renewable resources. As with all of these research programs, including private sector entrepreneurs and partners in the equation will enhance development of solutions and results.

Grid integration (Section 8) is key to understanding how all of these systems can interact to multiply the benefits of these innovative technologies for the grid and consumers. Customer-sited resource aggregation (including with electric vehicles), Virtual Power Plants, and Non-Wires Alternatives should all be part of this integration

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[7] See DOE article on Virtual Power Plants:
https://www.energy.gov/sites/prod/files/oeprod/DocumentsandMedia/ABB_Attachment.pdf

portfolio. Non-Wires Alternatives to traditional generation, transmission and distribution resources can be installed to defer capital outlay of new lines and substations, saving utility investment and reducing cost to customers.[8] One example is the Brooklyn-Queens Demand Management project, where the utility, ConEdison avoided a $1.2 B substation upgrade by deploying demand response, energy efficiency, and distributed resources.[9] Additional applications of NWA could be piloted through this DOE R&D program. Experimentation of customer engagement, including through demand response, smart thermostats, blockchain, and other transactive energy solutions, should also be considered. It might also be useful to consider electrification as well as more efficient end use of gas.

In addition to protecting *sensitive grid information* (Sections 9 and 10) and utility security, it will be important to consider consumer data access and privacy. Any standards for consumer or third party access to consumer data should be reasonable, while ensuring privacy of information. While I am not an expert on the cybersecurity portion of the legislation, it is important that all electric and gas utilities—including local distribution companies, transmission/pipeline companies, and generators/producing facilities--meet the North American Electric Reliability Corporation ("NERC") Critical Infrastructure Protection ("CIP") standards.[10] I would also caution against being overly

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[8] 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

[9] 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/

[10] Additional information can be found on the NERC website: https://www.nerc.com/pa/Stand/Pages/CIPStandards.aspx

prescriptive and inadvertently stifling innovation, including the very innovation that could mitigate security risk.[11]

In the section on *considerations* (Section 11), I would add third party solutions-providers, consumers and communities to the list of stakeholder entities for coordination. End users are critical to ensuring that the technologies and experiences resulting from federal research and development will actually work as designed and deliver their intended benefits. I would also recommend that greenhouse gas emission data be collected in all of these programs. While these programs are not necessarily designed to reduce carbon emissions, tracking their impact is still useful as we transition to a cleaner energy future and explore technologies whose greenhouse gas impacts are still relatively unknown.

Finally, I would propose adding a new section to this already substantive bill: one focused more on social science. Given the speed of our energy transition, manufacturing and worker transition is lagging; the U.S. should not only be the leading source of entrepreneurship globally, but should also lead the world in building and deploying new energy technologies. I suggest that research be conducted on how factories could be retooled, power plants repurposed with clean fuels, and workers trained to adjust to new technologies. These activities should be conducted intentionally with public-private partnerships so that the results are realistic and economically beneficial.

As I have witnessed during my co-chairmanship of the Advanced Energy Technology Council at the World Economic Forum, the United States is the global leader on clean and smart energy technology innovation. To continue on that trajectory, we must

[11] A potential model for regulation that is designed to evolve with technology is the National Highway Traffic Safety Administration's rules on Automated Vehicles: https://www.nhtsa.gov/vehicle-manufacturers/automated-driving-systems

sustain our research and development programs in ways that can assist grid operators, utilities, entrepreneurs, workforce, communities, and consumers. Thank you again to the Subcommittee for allowing me to testify, but, more importantly, for showing leadership in grid modernization research and development.

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Katherine Hamilton is Chair of 38 North Solutions, a public policy consultancy specializing in clean energy and innovation. Her firm also manages a non-profit organization, Project for Clean Energy and Innovation. Previously, she ran the GridWise Alliance, was policy director to the Energy Storage Association, and served as an advisor for Good Energies, a private equity company with a clean energy portfolio. Katherine directed American Bioenergy Association, developing renewable portfolio standards in states legislatures, including Maryland and New Jersey. At the National Renewable Energy Laboratory (NREL), Katherine worked in buildings research and government relations. Katherine spent a decade at an investor-owned utility, designing electrical systems for commercial and residential developments. Katherine holds degrees from Cornell University and the Sorbonne. Katherine is Co-Chair of the World Economic Forum's Global Future Council on Advanced Energy Technology and is part of The Energy Gang podcase.