Testimony

of

Katherine Hamilton

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Good morning. My name is Katherine Hamilton. I am the Chair of the firm 38 North Solutions and serve as Chair of the World Economic Forum's Global Future Council on Clean Electrification. Thank you to Chair Castor, Ranking Member Graves, and the entire Select Committee for inviting me to testify before you today regarding clean energy resilience and reliability in the United States. I started my career designing grids at a utility for a decade and thus understand how our electric grid works and that both investment in that infrastructure as well as openness to technology innovation and customer engagement are necessary for the transition to a clean, resilient, and reliable grid. This testimony explores what will make our grid and communities more resilient and how resilience has been partially incentivized in the Infrastructure Investment and Jobs Act and will be even further enhanced by final passage of the Build Back Better Act.

I. Reliability and Resilience.

First, I would like to differentiate between reliability and resilience since they are often used interchangeably but are different in important ways. Reliability is the

characteristic of being there all the time, 24/7, 365 days a year. Resilience, on the other hand, is the ability to recover quickly from interruption. Our electric grid has been designed for reliability--power plants, transmission lines, and distribution systems that are available and operating at all times—and yet, that system is becoming less reliable, leading to a downgrading of utilities by Fitch Ratings.[1] This drop in reliability can be tracked to weather-related climate events—wildfires, ice storms, unprecedented flooding, extreme heat and cold—that have been inexorably increasing in frequency and damage as a result of greenhouse gas emissions. Throughout the U.S. this physical risk from lack of resilience is compounded by the economic toll on our communities. Lawrence Berkeley National Laboratory studied the cost of these disasters—not just to the grid, but to the economy—and found that if the Bay Area in California lost power for 1-2 weeks, as much as $1-2 billion of economic output from downstream, non-utility activities would be lost in the region.[2] Importantly, resilience and reliability are now linked and must be considered together. And even more importantly, technology solutions exist today to address both while also reducing greenhouse gases that have led to the need for that resilience.

II. Technology Solutions.

In response to the need for more resilience, utilities have been examining their ability to ensure grid safety and climate resilience, with many investing billions of dollars on equipment, technology, and updated systems to help withstand extreme conditions.

[1] Bloomberg article here: https://www.bloomberg.com/news/articles/2021-11-08/u-s-power-grid-becoming-less-reliable-due-to-extreme-weather

[2] Lawrence Berkeley National Laboratory paper, page 24: https://eta-publications.lbl.gov/sites/default/files/hybrid_paper_final_22feb2021.pdf

These comprehensive risk management programs include expanded vegetation management, line clearance, and system inspections as well as system hardening and undergrounding. When I led the GridWise Alliance, I testified before the Senate about the importance of smart grid technologies to economic growth and significant funding was deployed in the American Recovery and Reinvestment Act for technologies that could increase visibility on the electric grid. The co-benefit of this funding was that, thanks to smart grid technologies, today it would not take a year to determine that a branch falling on an electric line in Cleveland could bring down the entire Northeast grid.[3] A decade later, we have even more sophisticated technologies and applications at our disposal and yet many of those are not being deployed at scale. For example, transmission tie lines between regions can allow for seamless flow of electrons between areas that have power available and those that are experiencing outages. Had there been ties from Texas to other states or even between states like Alabama, Louisiana, Mississippi, and Arkansas, the recovery time from Winter Storm Uri could have been significantly reduced. When Hurricane Ida hit Louisiana in August of 2021, the lack of appropriate investment in transmission hardening and distributed resource solutions became even starker with widespread outages impacting over a million people and lasting for weeks.[4] Digital awareness combined with grid enhancing technologies could play an important role in grid resilience strategies by continuously monitoring overhead lines to ensure they are within safe operating limits and alerting operators when there are anomalies which pose risks to grid reliability or public safety.

[3] See article: https://www.cleveland19.com/2020/08/14/years-later-blackout-that-impacted-million-people/
[4] https://www.reuters.com/business/environment/why-hurricane-ida-crippled-new-orleans-power-grid-2021-09-04/

Distributed energy resources are particularly well suited to providing resilience. In the U.S., experience in storms and other weather-related events has proven out that demand response and other consumer-sited resources can provide crucial resilience services[5] and research has only confirmed the importance of customer-side solutions to keeping grids operating during extreme temperature events.[6] During Winter Storm Uri, extreme cold increased demand for electricity by 8% while causing generation and transmission resources to become inoperable. Blake Shaffer, a professor of economics and public policy at the University of Calgary, told Marketplace Morning Report that, after Uri, so much of the conversation was about the supply side. "Our research sheds light on demand," Schaffer noted. "The sensitivity of demand to cold temperatures has risen a lot. Utilities and regulators need to consider demand when planning for future power system needs."[7] As far back as Hurricane Sandy, microgrid technology in New York and New Jersey enabled university campus facilities to continue operation in the face of massive power outages.[8] 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

[5] Multiple FERC filings from Advanced Energy Management discuss examples of resilience, one such example: https://aem-alliance.org/aema-files-reply-comments-in-resilience-proceeding/
[6] https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3980881
[7] https://www.marketplace.org/shows/marketplace-morning-report/lessons-learned-from-the-power-outages-in-texas/
[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
[9] See blog from Nest thermostats: https://nest.com/blog/2017/08/10/solar-eclipse-meet-the-nest-thermostat/

service as seven gas peaker plants, often the most inefficient and emitting resources. All of these technology solutions and applications are available today and often simply need investment gaps filled or market signals put into place to make the grid more resilient, leading us to a discussion of federal policy.

III. Policy Solutions.

While the U.S. excels in technology innovation, public policy is foundational to filling gaps, crossing "valleys of death," scaling technologies, catalyzing industries, and sending market signals to the private sector that will then put to use that innovation. The bipartisan Infrastructure Investment and Jobs Act ("infrastructure bill") makes available significant funding for grid modernization, energy storage, and resilience. These grants will provide a strong underpinning for the clean energy transition and increase resilience of the grid. Last month the Administration launched the Building a Better Grid initiative which will execute on this legislation. As highlighted in this initiative, formula grants, competitive grants, and competitive awards would focus on enhancing grid resilience by upgrading transmission infrastructure. Investments in transmission infrastructure include increasing the capacity of existing lines, using advanced technologies to minimize transmission losses and maximize the value of existing lines, and building new long-distance, high voltage transmission lines. There is new funding for the deployment of technologies to enhance grid flexibility in the Smart Grid Investment Grant Program, which specifically calls out advanced transmission technologies and their ability to integrate renewable resources and create real-time situational awareness as a means of

providing a more resilient grid. Other programs in the infrastructure bill that are important for resilience are electric vehicle charging infrastructure, energy efficiency, and appliance electrification, all of which allow for real-time management of customer load as a flexible grid resource.

In addition to the infrastructure bill, however, it will be crucial to pass in the Senate what the House passed in the climate portion of the Build Back Better Act ("BBB"). While the infrastructure bill will provide direct funding for innovative projects and manufacturing, the complementary BBB offers market mechanisms to spur private sector investment in resilient technologies and applications. The cost of damage from natural disasters in 2021 was $145 billion;[10] Hurricane Ida alone cost $75 billion.[11] A Deloitte report from last month estimated that the cost of climate change could cost the U.S. $14.5 trillion by 2070.[12] As a recent Boston Globe headline read: "Compared with climate inaction, Build Back Better is downright cheap."[13][14]

One program that was passed several times in the House, including in the Build Back Better Act, is the Greenhouse Gas Reduction Fund, originally passed as the Clean Energy and Sustainability Accelerator. This non-profit entity would be seeded by the government but sit outside the government to provide creative investing solutions to scale zero carbon technology deployment. Many state-level green banks, which are structured

[10] https://www.ncdc.noaa.gov/billions/summary-stats/US/2021
[11] https://www.ncdc.noaa.gov/billions/
[12] https://www2.deloitte.com/us/en/pages/about-deloitte/articles/press-releases/deloitte-report-inaction-on-climate-change-could-cost-the-us-economy-trillions-by-2070.html
[13] https://www.bostonglobe.com/2021/12/21/science/compared-with-climate-inaction-build-back-better-is-downright-cheap/?p1=StaffPage
[14] These findings were summarized in an Evergreen Action article: https://www.evergreenaction.com/blog/why-we-cant-afford-not-to-pass-the-climate-investments-in-build-back-better

on a state level the way a national level entity would be set up, are already financing critical energy infrastructure to ensure grid resilience and support those most vulnerable to power outages. This investment includes financing microgrids for local governments, and clean back-up power for affordable housing communities. In other cases, investments are made to directly harden structures against damaging weather caused by climate change. For example, the Solar and Energy Loan Fund in Florida provides financing not just for solar panels and efficiency measures, but also for roof hardening to make the home more resilient to hurricanes. This, in turn, lowers the home's insurance costs, with the savings used to pay back the loan.[15] Senate passage of this bill would enable investments such as these to be made in states and communities across the U.S. through the Greenhouse Gas Reduction Fund.

Rebates for electrification are part of the BBB and are essential to engaging customers and providing access to clean and safe electric technologies for low- and middle-income communities. If electrification is planned and deployed correctly, reliability and resilience should increase, not decrease. In fact, in a study released by the American Council for an Energy Efficient Economy,[16] the analysis showed an increase in reliability as a result of a combination of energy efficiency and electrification (which included heat pumps at a minimum, but in some cases heat pump water heaters, induction stoves, and electric vehicles). [17]

[15] https://solarenergyloanfund.org/loan/wind-resilience/
[16] https://www.aceee.org/sites/default/files/pdfs/programs_to_electrify_space_heating_brief_final_6-23-20.pdf
[17] See testimony at FERC: https://www.ferc.gov/media/panel-1-katherine-hamilton-world-economic-forum

One of the most important market tools in the BBB is tax credits. 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, New Jersey, and Virginia that have robust energy storage targets in place. The investment tax credit inclusion of interconnection costs will enable smaller community solar projects to be cost-effectively deployed in neighborhoods where rooftops are not always suited to solar or where consumers do not own their homes. Opening the tax credit to microgrids will also directly impact resilience. Communities throughout the country are already installing microgrids to provide backup services in case of outage. Some examples include a microgrid at the Sonoma Valley Unified School District that will achieve bring more solar online, participate in wholesale markets, and charge electric school buses;[18] an Oakmont, California 1800 acre senior community of 3,204 homes, 24 businesses and a fire station, that has experienced nine public safety power shutoffs in the last four years has been approved to build a microgrid;[19] and the city of Gonzales in Salinas Valley has planned a $70 million microgrid to provide a business park with round-the-clock reliable power at cheaper than utility rates.[20] Projects like these and many more would benefit from this tax credit.

Opening the tax code to transmission would increase resilience on the supply side of the grid by incentivizing transmission technology deployment. Significant losses

[18] https://microgridknowledge.com/front-of-meter-microgrid-sonoma/
[19] https://microgridknowledge.com/oakmont-california-seniors-community-microgrid/
[20] https://www.greentechmedia.com/articles/read/california-town-tests-new-model-for-microgrids-as-a-service

incurred during the Polar Vortex in February 2021--which claimed 246 lives[21] and caused $130 billion in damage in one week--could have been mitigated or avoided had there been more transmission ties to neighboring regions. A technology that would benefit from this credit is advanced high voltage direct current ("HVDC") technology, which strengthens reliability by controlling power dispatch, avoiding cascading outages and improving power quality by quickly adjusting voltage, frequency, and reactive power. Some developers are designing underground cable projects that can further protect them from extreme weather events, including storms, as well as flooding given the water impervious nature of the cable.

Other programs included in the BBB are the Department of Energy's loan program that will open up to additional sectors—such as aviation and maritime—to scale the clean energy transition in other parts of our economy. Funding for state and local governments and tribes will enable communities across the country to accelerate deployment of energy efficiency and electrification technologies. Many other programs are included in the BBB that will send those market signals to the private sector.

IV. Conclusion.

Of course, if we truly want to mitigate the climate crisis and deploy technologies that will be both reliable and resilient, we need to not only execute well on the infrastructure bill and pass the BBB Act, but we also need targeted Appropriations

[21] https://www.texastribune.org/2022/01/02/texas-winter-storm-final-death-toll-246/amp/

funding, regulatory signals through the Environmental Protection Agency, and market structures through the Federal Energy Regulatory Commission. In truth, all agencies in our government can take some responsibility within their missions for leading our nation to a safer, cleaner, more secure future from our climate crisis. With our federal government aligned with the private sector's recognition that swift action must be taken on climate, there is far greater hope that we can reduce the impacts of this crisis on our nation. Thank you for the opportunity to present this testimony; I look forward to your questions.