Written Testimony of Alison Silverstein

Before the
Committee on Energy and Commerce
Subcommittee on Energy
United States House of Representatives

Hearing on the CLEAN Future Act
March 24, 2021

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

My name is Alison Silverstein, and I am honored to appear before you today. I have worked as a utility employee, as a regulator at the Public Utility Commission of Texas and the Federal Energy Regulatory Commission, and as an independent consultant. In all of those roles I have worked on advancing power system reliability, resilience, clean energy and related issues. Today I am appearing solely as a private citizen with personal experience of the Texas power crisis in February.

I have been asked to talk about the recent Texas and Midwest power disaster, and what we should learn from that disaster with respect to the CLEAN Future Act.

Your subcommittee is holding a hearing on the Texas disaster immediately before this hearing, so I will be brief in summarizing the points about Texas that I find relevant to the CLEAN Future Act.

The Texas Power Crisis

Key causes of the Texas blackout and water disaster include:

This was not just a Texas problem – although Texas blackouts were much larger and longer than anywhere else, the widespread Arctic weather caused power plants and fuel supplies to freeze up and grid operators to shed customer loads in Louisiana, Kansas, Oklahoma and elsewhere.

Elements across the entire electric generation and delivery system failed due to causes associated with the extreme cold: gas, coal, nuclear and wind power plants; gas production and delivery; and transmission and distribution lines. Having adequate steel on the ground or fuel stockpiled in the yard isn't enough if the plant or its fuel supply freezes up, or the price of that fuel flies so high that the generator can't afford it. We need a diverse and complementary fleet of generation supply sources so they don't all fail at the same time due to common stressors, as so many generators failed us in Texas last month.

The Texas disaster wasn't just about power plants and natural gas deliveries failing – it was also about:

- Texas towns do not have enough sand and chemicals to handle more than one or two road-icing events per year, so Texas roads remained dangerous and impassable for days, slowing preparation and recovery efforts;
- Texas officials and critical facilities (hospitals, water and wastewater systems, pipeline compressor stations, community warming centers, and more) did not assure that those facilities recognized their power needs and role and that utilities knew the location and need of such facilities;
- Those critical facilities did not have any backup power systems with on-site fuel to support them when the grid failed;
- Texas' transmission and distribution utilities have such large circuits that they could not rotate outages among circuits and customers once they protected the circuits containing critical facilities, because those critical facilities circuits used up all of the generation capability that was left on the grid; and,
- Texas' energy industries, ERCOT and city and state leaders did not use the several days of lead time about cold weather forecasts and tight power supplies to warn Texans, using every imaginable means of communication, about the disaster that might be coming and how to prepare for it.

This wasn't just caused by the failure of our energy supply system. Our energy uses and demand contributed to the failure of the grid and to the deaths, discomfort, trauma and economic disasters that followed. A majority of Texas homes have minimal insulation and weatherization so residents can't stay warm in winter or cool in summer without using alot of energy. More than sixty percent of Texas homes use electric heating systems,[1] but most of those are old, inefficient resistance heating that uses too much electricity relative to heat output. Up to half of the ERCOT demand surge on the night of February 14, 2021 (immediately before load shed early on February 15) was likely due to electric heating demand.[2] And many Texas homes and businesses, built before the state adopted energy efficiency building codes, have water pipes with little or no insulation that are more likely to freeze and break.

The Texas disaster has clear, long-lasting equity implications. Poor people live in older, lower-quality, leaky housing in the areas that are most likely to be shut off during a mass load-shed event. They can't afford to improve the quality of their homes, and they suffer from energy poverty because they pay a high proportion of their incomes for even normal power usage. Lower income citizens tend to have more adverse medical conditions and less access to good health care, so they are more likely to suffer medical complications or death from an extended weather event and power shutoff or later from the long-term stress associated with high energy bills.[3]

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[1] Lucas Davis, Energy Institute at Haas, "The Texas Power Crisis, New Home Construction, and Electric Heating," February 21, 2021 .

[2] Ibid.

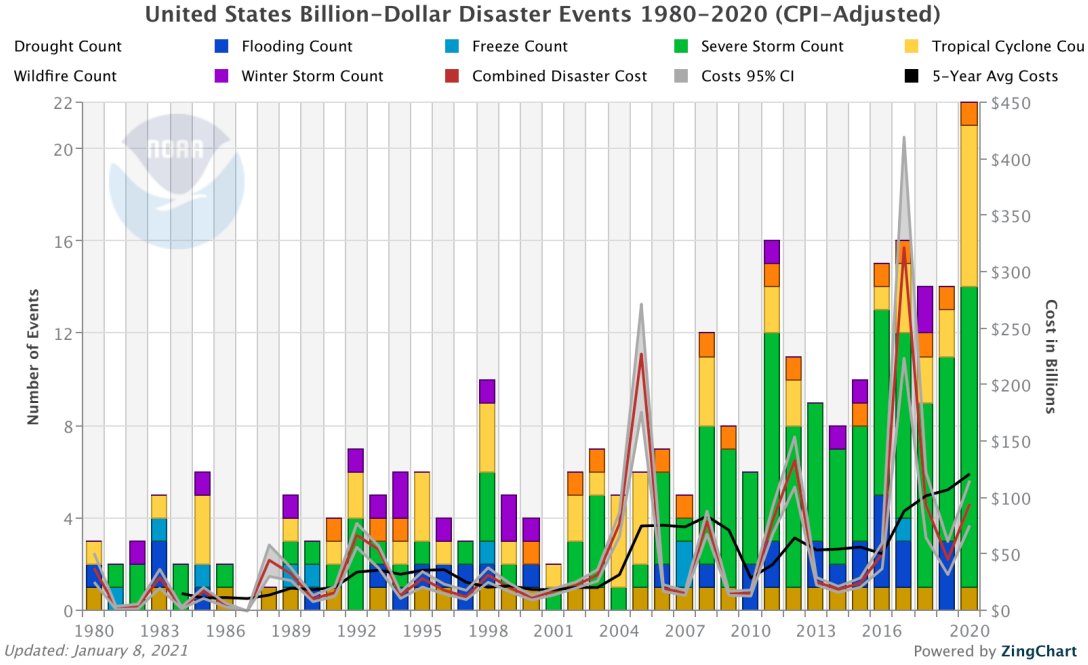
[3] See, for instance, Erick Jones et al., Texas Energy Poverty Research Institute, "Lived Experiences of Winter Storm Uri," March 17, 2021; Ariel Drehobl et al., ACEEE, "How High are Household Energy Burdens? An Assessment of National and Metropolitan Energy Burdens across the U.S.," September 10, 2020; and Sara Hayes & Ronald Denson Jr., ACEEE, "Protecting the Health of Vulnerable Populations with In-Home Energy Efficiency: A Survey of Methods for Demonstrating Health Outcomes," October 22, 2019.

This was a planning and process failure – not just by ERCOT, but by the electric and gas industries, the North American Electric Reliability Corporation (NERC), and by state and federal energy regulators and policy-makers at many levels. ERCOT did not plan for a winter storm this cold that covered the entire state, caused winter load to spike this high, or caused so many power plants to fail. Regulators and reliability organizations have failed at the national level to require broader planning and drills against scarier foreseeable event scenarios. Had they planned better, or drilled with outside stakeholders against more aggressive disaster scenarios, they might have recognized and prepared for more of the interdependencies and weaknesses that ultimately took down so much of the ERCOT system and communities.

ERCOT and Texas utility planners, like their counterparts at NERC and the rest of North America, consistently under-imagine and underestimate the magnitude of what could go wrong. We have built the grid and our homes and communities for the tame weather of the past – we need to anticipate much worse weather conditions and figure out how to build buildings and energy and social systems that better protect us against foreseeable High Impact *Medium* Frequency events. Improved energy system planning will not use only historical weather data, but should also use forward-looking climate change data and models to develop plausible climate risk scenarios for better energy planning and risk management.

There is clear evidence that massively damaging and costly extreme weather events have been hitting the world, and the U.S., with growing frequency and ferocity over recent decades. (Figure 1)

Figure 1 -- Number of Billion-Dollar Disaster Events in the United States, by year[4]



[4] National Oceanic & Atmospheric Administration, National Centers for Environmental Information, https://www.ncdc.noaa.gov/billions/time-series ; cost of disasters adjusted for inflation.

NERC, the electric industry, and even our governments think about these disasters as High Impact *Low* Frequency (HILF) events, which means when a HILF event hits it will cause great harm and they hope it doesn't happen very often. But look at how the number of severe storms, hurricanes and other disasters have been rising every year – the question shouldn't be, will there be an extreme event this year, but rather, what kinds of events, how many, where will they hit, and how bad will they be?[5] We need to stop pretending that each extreme weather event is low probability, and instead start planning and investing as though extreme weather collectively is a High Impact Medium Frequency event. Entities as credible and diverse as the Department of Defense, the Federal Reserve Bank, International Energy Administration, Government Accountability Office and even AT&T have documented the risks of climate change and extreme weather;[6] the electric industry owes it to the nation and our citizens to do no less.

We also need to stop pretending that every type of extreme event is special and deserves its own special kind of preparation. It is true that the measures needed to protect citizens and the grid against a cyber-attack probably won't protect us from a hurricane or polar vortex. But almost every disaster that harms the grid has common consequences – the power goes off most often because either the transmission or distribution systems have been broken (as by hurricanes, tornadoes, winter storms or derechos) or because there wasn't enough generation to meet load. Customers don't care what causes an outage, they just want us to keep the power on or get it back quickly. We can't achieve resilience by hardening the grid against every threat because we can't afford to do so, and it is hard to prioritize among the thousands of preparations and fixes that would be needed. A smarter, more cost-effective risk management approach is to figure out how to protect our grid, our citizens and communities against the common consequences of these various disasters, and fight strategically against the consequences rather than the causes of these failures.[7]

There are many obvious, affordable things we can do to improve resiliency and reduce the consequences and costs of multiple types of disasters. These include more thorough vegetation management, building more redundancy of key lines and equipment, stocking more spares for critical equipment, installing backup power systems for more critical infrastructure, using better cyber-security, modifying industry planning and preparation for a wider range of bad news, delivering better community education and preparedness, improving grid speed and flexibility, better remote distribution sectionalization capability, more real-time situational

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[5] See, for instance, Chapter 2 of the U.S. Global Change Research Program's Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II (2018); U.S. Government Accountability Office, "Climate Resilience: DOD Needs to Assess Risk and Provide Guidance on Use of Climate Projections in Installation Master Plans and Facilities Designs," (June 12, 2019); U.S. Government Accountability Office, "Climate Change is Expected to Have Far-reaching Effects and DOE and FERC Should Take Actions," (March 10, 2021); and insurance company Munich Re on extreme weather risks.

[6] U.S. Department of Defense, The Center for Climate & Security (1990-2020 publications); Glenn Rudebusch, FRSB Economic Letter, "Climate Change is a Source of Financial Risk" (February 8, 2021); IEA, "Power Systems in Transition" (October 2020); GAO, op. cit.; and AT&T, "Road to Climate Resiliency" (2020).

[7] Alison Silverstein et al., Grid Strategies, "A Customer-focused Framework for Electric System Resilience" (May 2018); and The National Academies of Sciences, Engineering and Medicine, "Enhancing the Resilience of the Nation's Electricity System" (July 20, 2017).

awareness tools, and using more energy efficiency to protect people against blackouts, whatever the cause.

What the Texas Power Crisis means for the CLEAN Future Act

The purpose of the Climate Leadership and Environmental Action for our Nation's Future Act (CLEAN Future Act) is to facilitate America's achievement of net zero greenhouse gas emissions by 2050 by addressing climate change at both the sector and economy-wide levels. I support the goals and most of the provisions of the Act. This section outlines some of the lessons the Texas Power Crisis offers for Title II, Subtitles B-F and Title III of the CLEAN Future Act. I will offer some broad observations and a few specific recommendations about particular elements of the legislation.

Most Americans are not good at or willing to imagine or recognize threats, calculate risks, and act deliberately and thoughtfully to protect ourselves and our communities against future disasters through preparation, adaptation, avoidance and insurance. I applaud the authors and sponsors of this legislation for committing to recognize the threats associated with climate change and the necessity of planning, preparing and adapting our energy systems and communities to those threats.

Subtitle B – Federal Energy Regulatory Reform

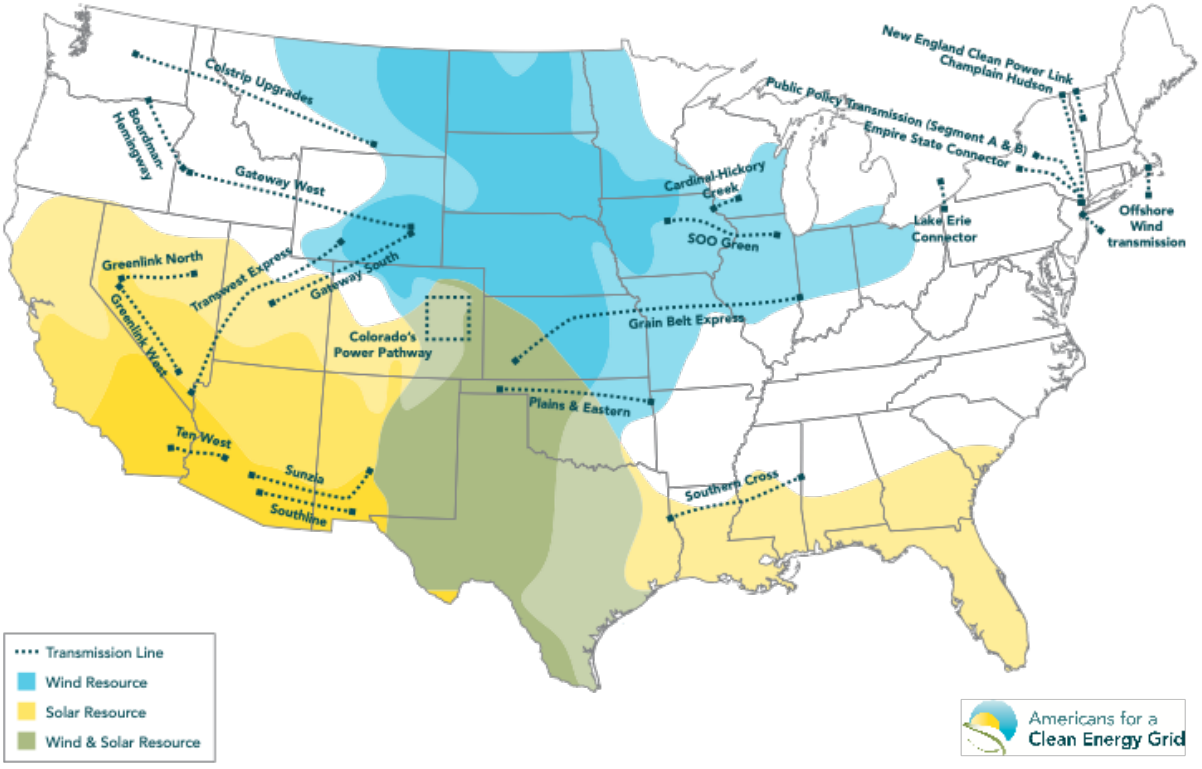
All credible analyses of a highly reliable, resilient, affordable, clean energy future recognize that we need to massively expand the continent's high voltage electric grid, regardless of how much energy efficiency and distributed supply and storage we can deploy. All of the measures in Title II, Subtitle B, Part 1 that facilitate the coordination, planning, funding, siting, engineering, construction and cost recovery of new and technologically enhanced regional and inter-regional transmission are much needed. So too is the recognition in Section 213 that where non-wires options are available to improve power system economics, reliability and/or decarbonization, those options should be encouraged, adopted and funded on an equal basis with transmission.

But these provisions are not enough to make new transmission and non-wires alternatives happen. New, stronger *physical* infrastructure will not appear without significant improvements in new, stronger *institutional* infrastructure to address such challenges as technology development and deployment, planning, siting, permitting, coordination, cost analysis, financing, and cost allocation. There is ample evidence that current FERC and DOE authorities and processes for these purposes are not working: at the end of 2019, 734 GW of new generation projects were sitting in transmission queues unable to interconnect to the grid,[8] and although over a dozen new high voltage transmission projects have been proposed over the past two decades to open up access to new clean energy resources, no projects have yet been built due to our collective failure to get these projects customers and cost allocation. (See Figure 2) This lack of new development blocks rural economic development and restricts electricity flows that

[8] Jay Caspary et al., Americans for a Clean Energy Grid, "Disconnected: The Need for a New Generation Interconnection Policy" (January 2021).

could lower the delivered cost of electricity and improve the reliability and resiliency of a high-renewables grid.

Figure 2 – Proposed regional and inter-regional high voltage transmission lines that could improve U.S. electric resource development, reliability and resilience, but can't get approved and funded
(courtesy Grid Strategies)



We will not be able to achieve the goals of the CLEAN Future Act – energy system decarbonization, improved energy security and national security, a stronger and more equitable economy -- without significant changes to our institutional infrastructure. Needed improvements include:

- The provisions of inter-regional transmission planning section 217 need to be strengthened to give FERC authorities to order investments in transmission construction and allocate costs. These problems are long-standing; a FERC Technical Conference will admire but not solve the problem.
- Transmission planning and interconnection methods must be improved, and that will require stronger FERC authority. The Federal Power Act's "voluntary interconnection and coordination of facilities" language is insufficient to drive and support meaningful nation-wide inter-regional transmission planning, approval, siting and construction. Similarly, we need to assure that states' needs are recognized and respected, but that no individual state can blackball an entire project.

- Transmission benefits assessment is hard because few entities recognize and count all of the benefits of transmission for reliability, resilience, economic growth, job creation, affordability, equity and decarbonization – particularly since many of those benefits accrue outside the planning entity's resource base footprint, customer base or airshed. Partly for this reason, allocating the costs of new transmission among beneficiaries is also hard, and this is what holds up most new inter-regional transmission lines or creation of an entire macro grid. New inter-regional transmission projects should be evaluated as parts of a well-designed portfolio with synergistic impact and benefits, not as stand-alone projects with narrow impacts.
- The nation's regional transmission operators (RTOs) and independent system operators (ISOs) do good regional system planning that gets incremental new transmission built. Forcing all the rest of the transmission owners now outside RTOs to join them, or to create additional RTOs, is unlikely to break open the challenges of building inter-regional transmission. There are no entities with the coordination skills, independence, objectivity and expertise to conduct good inter-regional transmission needs assessments, planning, design, benefits assessment and cost allocation. Creating new transmission planning offices within FERC or DOE will not solve this problem, particularly because FERC has quasi-judicial responsibility over transmission planning and cost recovery. Instead, I recommend that Congress create and fund a Federal Electric Transmission Authority with the capabilities and funds to manage and coordinate national-scale transmission planning, design, and construction. This Authority should work closely with FERC, the states, DOE, and existing industry and reliability authorities to expand, build and adapt a robust transmission network that meets our nation's needs over the long term. This will require decades of effort. Therefore the Transmission Authority must be created by statute to maintain mission, expertise and funding continuity (much like the Federal Highway Administration) and protect it from changing administration policy preferences.
- Massive transmission expansion will not be cheap, but the growing effects of extreme weather and climate change will be far more costly to our nation and the world. The costs of power system redesign and transmission expansion cannot be funded only through electric rates. Rather, we must commit to a federal funding program that pays for a large portion of electric system expansions and improvements as quickly as possible because of their benefits to all Americans over many decades. To choose any other funding option will assure that no such investments are made, and guarantee that our electric system cannot deliver all of the reliability, resilience, decarbonization, economic, jobs, equity and security functions on which our nation relies.

<u>Subtitle D – Electricity Infrastructure Modernization and Resilience</u>

Federal investments in energy research & development and infrastructure have already transformed our economy and our way of life. Federal RD&D efforts have enabled the creation, maturity and deployment of wind and solar generation and gas turbines, a broad suite of transmission and distribution technologies and grid operations tools, fracking, energy storage, electric vehicles, and more. Those technologies have already improved the economics, reliability and decarbonization of our electricity system. At the same time, Department of Energy RD&D projects, particularly the massive investments funded by the American Reinvestment and Recovery Act of 2009, have demonstrated the effectiveness of federal funding

and public-private partnerships to spur private investment in grid modernization. For these reasons, I support the provisions of the Act that further these goals and methods and support significant funding for these efforts.

But we can do even better than some of the provisions drafted thus far. In particular, based on the above observations on the Texas power crisis causes, I encourage you to add requirements for transmission and distribution circuit redesign and to revise the microgrid provisions.

There are few rules for how transmission and distribution circuits are designed, and few that address the conduct of load shed and rotating outages in the case of a major grid emergency. The reason why so many customers sat in the cold for four days in Texas last month is that all the available electricity was flowing to circuits with a few known critical facilities and large numbers of lucky non-critical customers. Until California utilities began redesigning their circuits and sectionalization capabilities to surgically manage proactive shut-offs against wildfire threats, few utilities deliberately designed circuits that could be controlled for granular protection of critical facility loads. We need to make critical facility circuits much smaller and divide non-critical loads between many small chunks of circuits or sections, so that outages can be rotated between many small circuits for short periods, rather than dumping the outage burden onto large circuits for long periods.

This is not an easy task but it must be done. Therefore I recommend that you add a provision to Subtitle D that:

- articulates appropriate goals for smaller circuits,
- funds DOE for research and technical assistance into distribution circuit redesign for emergency management and community resilience, and
- mandates that every state require its utilities to assess the need for and implement appropriate circuit redesign and sectionalization to make future rotating blackouts more fair and operationally effective.

Distribution circuit redesign for more granular and operational sectionalization is closely linked to and could be combined with funding modernization of electric distribution systems to better support distributed energy resources and virtual power plants, two-way power flows, higher loads from electrification, and greater demand flexibility for improved grid operations. The Department of Energy, the National Association of Regulatory Utility Commissioners and the National Association of State Energy Officials have done good work on how to improve and integrate distribution planning to meet these goals,[9] and I hope those ideas and recommendations can be incorporated into the CLEAN Future Act.

Recall that one of the reasons that Texas's natural gas, electricity and water systems failed so disastrously is that few of our critical facilities have backup power capabilities and many of them lost power and failed in the cold. As written, Sections 231 and 236 would fund grants for new microgrid systems to enhance resilience for isolated communities and critical

[9] See materials at NARUC "Task Force on Comprehensive Electricity Planning" (2021).

facilities. That's a great idea in principle, but this program is structured in a way that will prolong the current microgrid paradigm, in which every microgrid is a costly, non-standardized, stand-alone science project.

As now structured, these grants will require every single applicant to spend as much or more time and money to design their project than they may need to actually buy and install the microgrid itself. Over the past fifteen years I have reviewed hundreds of project applications for DOE grant funding for microgrid and other grid modernization projects. Every single applicant proposes to spend significant time and money on site-specific engineering for one-off projects, even though there is little difference other than size between all the water and wastewater systems, or all the hospital applicants, or all the community emergency operations centers or pipeline compressor stations. Grants awarded under this program will spend way too much money on duplicative project assessment, design and engineering work and way too little money on actual microgrids that make our critical facilities and communities resilient.

Instead, I recommend that you restructure this program plan by charging the DOE and national laboratories to develop a standard set of clean, affordable microgrid packages that can operate for at least two days on a stand-alone basis.

- These microgrid packages should contain at minimum photovoltaics, battery storage and low-emissions diesel generation or combined heat and power units and adequate on-site fuel storage, using off-the-shelf components in a standard, expansible configuration with standard inverter and interconnection equipment and standard control and communications protocols (including appropriate cyber-security measures). These packages should be suitable for use at multiple categories of critical facilities.
- DOE should also develop a recommended engineering site assessment methodology, standard interconnection equipment and operational instructions, an economic analysis toolkit for the prospective customer, model projects and references, and a recommended user contract and terms. These materials will help critical facility owners make good decisions and avoid costly, time-consuming mistakes. And most important, they will ensure that most of the grant and private money goes quickly into working microgrids and backup power systems that enhance community safety and resilience, instead of being diverted slowly into engineering consultants' pockets.
- These backup packages should be offered with several requirements:
    1) The critical facility's host utility and grid operator should be able to use these backup power systems individually and in a fleet to support short-duration grid reliability needs, as for resource adequacy, temporary ramping support, or local voltage support.
    2) Every microgrid or backup power system grant should have to meet requirements for regular fuel provisioning, regular performance and emissions testing, and minimum cyber and communications security standards.
    3) Every microgrid grant recipient should receive complementary funding to cover a mandatory energy efficiency audit and some basic energy efficiency upgrades, so the critical facility can use routine and emergency power and money less wastefully.

With theses change, the CLEAN Future Act microgrid grant program could set a new standard and floor for microgrid design, use, cost savings and interoperability, while advancing

community resilience and grid reliability. And once the basic microgrid or backup power system package is available and scalable, the nation could broaden the use of this and competitors' microgrid and backup power systems using grants and preferred financing made available through the Federal Emergency Management Administration and the Department of Agriculture's Rural Utility Service.

This same approach – delay issuance of the grants in order to develop standardized packages of equipment designs and components, widely usable engineering and cost assessment tools, and better instruction toolkits for applicants – can also be used for the proposed Community Low Income and Underserved Areas Photovoltaics grant program offered in Subtitle E, Clean Energy Generation, Section 242, to get good, cost-effective projects out faster into a larger number of worthy communities.

When DOE or other agencies administer these programs, there is no reason why they can't still award grant money to innovative one-off microgrids or community solar projects. But let's use methods and tools like those suggested above to get more bang and community value for our federal energy grant bucks.

Title III – Efficiency

Most of the pathways intended to move our nation toward effective decarbonization assume that we will use massive amounts of clean renewable and other generation sources while electrifying many energy uses that are now fossil-fired. It will be hard enough to plan, build and manage all of the low- and zero-carbon generation, energy storage, distributed generation and high-voltage transmission we will need to serve even current electricity demand; we cannot decarbonize our economy using electrification if we do not maximize the energy efficiency of the homes, factories, appliances and vehicles that we expect to serve with electricity provided through the grid or distributed means. Therefore, I support all of the efficiency elements of this legislation but encourage you to push harder for more energy efficiency delivered to more Americans more quickly.

Remember that the lack of home weatherization in Texas, and the large amount of wasteful, inefficient electric heating in those homes, helped to cause the February blackouts by driving demand so high at the start of the emergency, and then leaking warm air out so people's homes froze without power. Sadly, this contributed to many deaths from hypothermia and carbon monoxide poisoning and extended misery for millions of Texans. When decarbonization advocates recommend extensive electrification of homes, these Texas examples are not the type of electricity uses or residential building shells they have in mind.

Home weatherization uses measures like insulation and caulking to seal up a home. Weatherization can reduce heating demand by 11-14%, and also reduces summer cooling demand. And replacing inefficient electric resistance heating with modern heat pumps will use less energy and less of customers' budgets.[10] Going beyond weatherization, we should develop and implement provisions for passive survivability, so that customers can shelter safely in their

[10] Steve Nadel, ACEEE, "Texas Blackouts Offer a Lesson for Reducing Dangerous Spikes from Energy Demand," February 22, 2021.

homes for longer periods of extreme heat or cold as the inevitable, unavoidable weather-driven power outages continue.

Energy efficiency improves reliability and resiliency for the grid as well as for individuals and communities. For grid reliability, lower demand from energy efficiency means demand is more stable, electricity peak demands will be lower and require fewer supply resources, and the grid is less stressed and easier to operate minute to minute and hour to hour. On the resiliency side, more energy efficiency will lower the stakes for everyone when the grid fails, because people who live in energy-efficient homes will be better protected against hypothermia during winter storms and heat stroke during extended heat waves. Well-designed energy efficiency and demand response can also complement growing renewable energy use, absorbing solar generation output in the daytime and high wind generation at night while facilitating fast, flexible demand response around the clock to support reliable grid operations.

I beg you to modify Subtitles C and D in this bill to focus particularly on how to deliver massive energy efficiency retrofits for low-income and multi-family housing, and pay for some amount of home repair (e.g., for leaky roofs and broken windows) along with aggressive efficiency measures. Traditional block grants, LIHEAP and Weatherization Assistance Programs will not deliver the level or speed of energy efficiency retrofits we need to wring more carbon out of these homes, improve the residents' budgets, comfort and health, and create jobs and economic development for the communities affected. So please invest time and research now to figure out better approaches to this critical equity and economic challenge.

Last, I assume that all of the provisions in this bill are intended to deliver clean energy and its benefits to under-served and under-privileged communities and communities of color. Special efforts will be needed to design and implement effective business development, job creation, training and placement, and other strategies that address equity and justice issues.

In closing, thank you all for your commitment and work to improve our nation's energy infrastructure, security, economics and equity. I hope you find these observations and suggestions useful. Thank you again for the opportunity to testify, and I look forward to your questions.