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Chairman Murkowski, Ranking Member Cantwell, and distinguished Members of the Committee, I appreciate the opportunity today to discuss the status of Puerto Rico's electric grid and proposals for the future operation of the grid.

The U.S. Department of Energy (DOE) is the lead for providing energy-related expertise to the Federal Emergency Management Agency (FEMA), interagency partners, and the Administration as part of DOE's emergency response activities. DOE serves as the coordinating agency for Emergency Support Function #12 - Energy (ESF-12) under the National Response Framework and as the Sector-Specific Agency for Energy under Presidential Policy Directive 21. In addition, DOE is a primary agency for the Infrastructure Systems Recovery Support Function under the National Disaster Recovery Framework. As the lead for ESF-12, DOE is responsible for providing information and analysis about energy disruptions and for helping to facilitate the restoration of damaged energy infrastructure.

DOE Involvement in Puerto Rico Response and Restoration

DOE'S Office of Electricity Delivery and Energy Reliability led DOE and ESF-12 response and restoration efforts for Hurricanes Irma and Maria in Puerto Rico. Restoration efforts continue and as of April 30th, approximately 98% of customers (1.44 million) were restored and all 78 municipalities are at least partially energized.[1]

Over the course of the 2017 hurricane season, the Department provided numerous personnel to support response and recovery efforts. These included bilingual public information personnel to provide life safety and life sustaining communications, subject matter experts as part of FEMA's Incident Management Assistance Teams, technical advisors in electrical distribution, transmission, generation, energy efficiency, renewable energy, and related topics to advise the United States Army Corps of Engineers (USACE) and personnel to support the National Response Coordination Center, several Regional Response Coordination Centers, and state emergency operations centers.

[1] http://status.pr/

DOE continues to maintain close coordination with FEMA, and two subject matter experts from our Power Marketing Administrations remain deployed to provide technical support to USACE with restoration planning, cost estimates, validation, and quality assurance. DOE also continues to have a responder deployed under the National Disaster Recovery Framework to support FEMA recovery activities and to coordinate with industry about ongoing mutual assistance to support restoration efforts.

DOE Involvement in Puerto Rico Recovery

Throughout the restoration and recovery efforts, the people of Puerto Rico have shown tremendous strength and perseverance as they restore and rebuild their homes. Leveraging the electric grid to spur economic growth in Puerto Rico's various communities and economic sectors, including health care, manufacturing, tourism, and agriculture, is essential to revitalization. Essential services from energy-enabled critical infrastructure, including waste, water, telecommunications, and transportation, must be operational to support safety and health, and likewise, manufacturing must be functional to support economic vitality.

A strong recovery and revitalization is important to the territory, as well as the Nation. Maintaining and enhancing the affordability and resilience of the electric grid, at fair and reasonable costs, will provide service and value to the region. Yet, no single investment in energy infrastructure at one point in time will achieve resilience. The energy infrastructure of Puerto Rico must be designed, built, managed, and maintained in such a way to withstand likely stresses, ameliorate disruptions when they inevitably occur, recover quickly, and incorporate lessons learned into post-event planning and operations. This is a continual process of improvement, one involving a reassessment and adaptation of solutions and technologies to address changing needs.

And as DOE begins to wind down support for restoration efforts, we have begun to transition to recovery activities to address the long-term resilience and reliability of Puerto Rico's electric grid.

Technical Assistance for Microgrids

One effort is with several of our National Laboratories, which are employing our Microgrid Design Tool to examine the feasibility of microgrids. This capability will allow the optimal siting of distributed energy resources that could potentially enhance reliability and resilience of the electric system. This ongoing work explores the viability of microgrids to support critical infrastructure, remote communities, and industrial facilities.

Industrial facilities play an instrumental role in restoration and recovery efforts due to their support of local communities and their economic impact on Puerto Rico. The Labs have completed preliminary microgrid assessments for industrial facilities that are on Puerto Rico Industrial Development Company (PRIDCO) sites, provided technical input and reviews for PRIDCO's "Industrial Microgrid Solutions in Puerto Rico" Request for Information, and provided assistance to Puerto Rico Electric Power Authority (PREPA) activities related to

microgrids and distributed energy resources. These microgrids have the potential to offer PREPA further operational efficiency and reliability for Puerto Rico's electric grid.

Near-Term Grid Modeling Support
Another DOE effort is through grid modeling to support the rebuilding of a more resilient electric power grid system in Puerto Rico. This endeavor will develop a near real time dynamic model of the Puerto Rico power system that will not only be used as an operational tool but for planning purposes as well. This modeling effort will provide technical insight into the resiliency objectives, allowing for coordination and communication of potential solutions across stakeholder groups. Working in partnership with FEMA and the U.S. Department of Housing and Urban Development (HUD), DOE seeks to facilitate collaboration with PREPA as they plan future investments and determine where financial resources will be most beneficial in strengthening Puerto Rico's grid and increasing its resilience.

DOE Support for Interagency Efforts
The multi-Laboratory modeling effort will also inform priorities of immediate concern to better prepare Puerto Rico for the upcoming storm season. This work will define short-term actions that can be taken now and during the upcoming hurricane season, as well as longer-term infrastructure investments that can have lasting effect. The types of issues that will be addressed include models for predictive failure analysis; system characterization and interdependencies, *e.g.*, fuels, generation asset placement, and telecommunications; resilient infrastructure investment scenarios; mobile storage and backup generator placement; and distribution system improvement opportunities.

Strategizing an Electric Energy Policy and Regulatory Framework
The Southern States Energy Board (SSEB), in association with DOE, is working in coordination with the governor and legislature of Puerto Rico to establish a reliable, affordable, and sustainable electric energy grid system, and to develop a policy and legal framework to provide a regulatory process for possible privatization efforts. Working in collaboration, SSEB will present Puerto Rico with various options and recommendations for the electricity and other utility sectors.

DOE Report on Energy Resilience Solutions for the Puerto Rico Grid
DOE has completed its Report on Energy Resilience Options and Potential Solutions for the Puerto Rico Grid. This report provides recommendations to FEMA and PREPA that reflect principles of resilience and are intended to inform investments in energy infrastructure in Puerto Rico. Recommendations address near-term actions and potential long-term actions that will require further analysis to make optimal investment decisions.

The interdependencies across sectors, assessment of potential alignment, and sequencing of funding across different agency programs that support various sector infrastructures will require significant coordination. The report also notes where the results of analysis are needed to articulate resilience-related, investment-grade suggestions regarding the design and specification of the electricity system in Puerto Rico.

Although some of the additional analysis necessary to support those resilience principles is underway, recommendations that can be acted on today to improve the performance of the system ahead of the 2018 hurricane season are as follows:

1. The Governor and PREPA should immediately ensure that updated, effective mutual aid agreements are primed to quickly provide support during the next event.

2. The Incident Command System should be trained and utilized during a response.

3. The Puerto Rico Energy Commission (PREC) should coordinate a joint study with the Puerto Rico Telecommunications Board to determine and enforce safe loading requirements of distribution poles carrying both electric and telecommunications infrastructure.

4. Electricity transmission towers installed specifically for temporary emergency restoration should be considered for replacement, potentially by monopoles; many of the round monopole structures survived the 2017 storms.

5. The PREC should finalize microgrid regulations, and establish effective and efficient interconnection requirements and wheeling regulations with PREPA. These regulations will allow customers to design their systems to add reliability and resilience to PREPA's system.

6. The Commonwealth Energy Public Policy Office, in coordination with other appropriate Commonwealth agencies, should consider drafting an updated Energy Assurance Plan, which will provide for an Incident Management Team as well as other important components. Besides preparing for the next hurricane season, acting immediately will allow for leveraging the presence of Federal staff in the Joint Field Office and the Federal data collection efforts that have been underway since September. Finally, the SSEB may be able to facilitate peer-to-peer information sharing and lessons learned among Puerto Rico's neighboring governments and utilities.

Several potential DOE recommendations require further analysis prior to finalization. However, the analysis should be conducted, to the extent practical, with the support and engagement of PREPA, and is best suited as follows:

1. Power Flow – assesses power system operations, including generator dynamics and protective relay coordination [used to identify power system needs, evaluate technology options, and help prioritize resilience investments, *e.g.*, transmission enhancements]

2. Production Cost and Capacity Expansion – informs economic dispatch strategies and long-term planning [used to understand how resource investments, system costs, and load are impacted by key policy and technology sensitivities]

3. Microgrids, Energy Storage, and System Segmentation – identifies where clusters of generation and load provide maximum community benefit [used to identify prepositioning of emergency generation, local hardening of infrastructure, and adjustment of emergency procedures]

4. Cross-Sector Infrastructure Interdependencies – characterizes reciprocal relationships within the energy sector, *e.g.*, electricity-petroleum; electricity-liquefied natural gas, as well as cross-sector infrastructure such as telecommunications and/or water [used to investigate supply disruption impacts and identify mitigation approaches]

DOE is committed to working with FEMA, other Federal agencies, the Commonwealth of Puerto Rico, and PREPA to incorporate its near and long-term recommendations into local infrastructure projects. The end goal is a modern and resilient energy system that can serve as the robust engine for Puerto Rico's economic revitalization.

Conclusion

I am proud of the work we are doing to address the long term restoration and recovery efforts in Puerto Rico and grateful for the hard work of DOE's emergency responders during the 2017 hurricane season. We have made progress, but there is still more to do. Over the next several months, DOE's primary focus in Puerto Rico will continue to be working with our partners to support the mission of strengthening the power grid and critical infrastructure for the island.

Thank you, and I look forward to your questions.