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Chairman Grijalva, Ranking Member Bishop, and distinguished Members of the Committee, I appreciate the opportunity today to discuss the rebuilding and privatization of the Puerto Rico Electric Power Authority (PREPA).

DOE Involvement in Puerto Rico Grid Restoration and Recovery

The U.S. Department of Energy (DOE or the Department) provides energy-related expertise to the Federal Emergency Management Agency (FEMA), interagency partners, and the Administration as part of DOE's emergency response activities under the National Response Framework and as the Sector-Specific Agency for Energy under Presidential Policy Directive 21.

In addition to the Department's role in emergency response, DOE is a primary agency for the Infrastructure Systems Recovery Support Function under the National Disaster Recovery Framework. As the lead for Emergency Support Function #12 - Energy (ESF-12), DOE is responsible for providing information and analysis about energy disruptions and helping facilitate the restoration of damaged energy infrastructure.

Over the course of the 2017 hurricane season, the Department deployed numerous personnel to support response efforts including: subject matter experts and technical advisors to FEMA and the United States Army Corps of Engineers (USACE), and utility line workers from the Western Area Power Administration and Bonneville Power Administration. DOE continues to maintain close coordination with FEMA and the Commonwealth of Puerto Rico.

DOE's support for Puerto Rico did not wane after electricity service was completely restored. Our contributions to the recovery effort in Puerto Rico have focused on modeling, analysis, and technical assistance to support the Commonwealth and the Federal government in the joint effort to improve system reliability and resilience. A strong recovery and revitalization is important to the Puerto Rico, as well as the Nation. A resilient and reliable electric grid will provide enormous benefit to the island.

National Laboratory Modeling and Analysis

The Argonne, Pacific Northwest, Sandia, Oak Ridge, and Renewable Energy National Laboratories have provided technical assistance, analysis, training, and modeling tools to PREPA

and Puerto Rico's Central Office for Recovery, Reconstruction and Resiliency in support of long-term energy sector recovery and modernization. In fact, the National Laboratories have completed various discrete analyses to date in an effort to assist in improving overall resilience in Puerto Rico. These analyses included help in determining the ideal amount of generation for the north side of the island and the optimal siting of microgrids.^{1 2 3 4 5} National Laboratory work has also identified critical assets related to grid protection equipment, and locations for emergency equipment reserves that will improve reliability, disaster resilience, and potentially dramatically lower the cost of power.

Real-Time Modeling Framework

From the outset of our support for Puerto Rico's recovery, DOE seized the opportunity to improve PREPA's visibility into system operations and interdependencies with critical infrastructure through developing an integrated real-time modeling framework. While the model currently relies on data and infrastructure information from Puerto Rico, this framework is designed to be flexible enough to be used in other locations. In addition to providing near-real-time situational awareness, this modeling framework allows Puerto Rico to assess a variety of scenarios and assumptions to inform system planning, hardening, and security.

Federal Interagency Coordination

DOE provides technical advice to its Federal partners through participation in the Recovery Support Function Leadership Group Energy Subgroup for Puerto Rico. The Energy Subgroup for Puerto Rico works to maintain unity of effort and coordination to assist the Commonwealth of Puerto Rico in identifying a modern, resilient, and sustainable electricity grid suitable to the needs of the island. The Energy Subgroup includes FEMA, the Department of Housing and Urban Development (HUD), the Department of the Treasury, and the Executive Office of the President..

DOE continues to provide technical expertise to HUD as they develop the Federal Register Notice that will provide guidance for the Community Disaster Block Grant – Disaster Recovery funds. DOE is committed to advising HUD throughout the life of the grant process.

Support for Energy Policy and Regulation

The Southern States Energy Board (SSEB), in collaboration with DOE, continues to assist the governor and legislature of Puerto Rico in developing a policy and legal framework to pursue potential privatization efforts. SSEB developed consensus-based recommendations in the fall of 2018 through a blue ribbon task force, with members appointed by the legislature and the Governor. Supporting SSEB constitutes the full extent of DOE's involvement with the potential privatization process.

DOE is also supporting technical development of regulatory capacity for the Puerto Rico Energy Bureau (PREB), the island's energy regulator. The tentative timing of providing this support is as follows: on March 14, 2019 the PREB issued a resolution determining that PREPA's Integrated Resource Plan (IRP) – meant to provide an analytic basis for capital investments for the next 20 years – proposes an arbitrary and unsubstantiated set of investments and is therefore not in compliance with the laws and regulations of Puerto Rico.⁶ The PREB ordered PREPA to

re-submit a compliant IRP within 30 days. DOE provided funding to the National Association of Regulatory Utility Commissioners (NARUC), which, together with SSEB, provides advice and training to PREB to support their numerous responsibilities in evaluating the IRP, reviewing aspects of the privatization process, and providing day-to-day regulatory oversight of PREPA.

DOE Report on Energy Resilience Solutions for the Puerto Rico Grid

DOE published the *Energy Resilience Solutions for the Puerto Rico Grid* report on June 20, 2018.⁷ The report provides thirty recommendations for the Government of Puerto Rico and PREPA to consider incorporating into its recovery plans, including the plan Congress required from FEMA to support the Commonwealth. The recommendations reflect principles of resilience and are intended to inform investments that use Federal appropriations in the energy infrastructure in the Commonwealth of Puerto Rico. These recommendations are based on DOE's analysis, expertise, and extensive industry consultation. These recommendations address near-term and potential long-term actions that will require further analysis to make optimal investment decisions.

On March 25, 2019, the Puerto Rico legislature passed Senate Bill 1121, the Puerto Rico Energy Public Policy Act. The new law sets a very ambitious renewable energy target of 100% by 2050, up from just the 2% installed today, and includes numerous provisions supporting distributed generation, the privatization process, and grid resilience.

Investment Considerations for Puerto Rico's Recovery

Despite large Federal investments to date, the Puerto Rico electric system remains vulnerable due to a legacy of under-investment, poor maintenance, and questionable management practices, as well as remaining damage from Hurricane Maria.

With its stakeholder partners, DOE conducted an analysis of the factors that could contribute to a successful recovery. The principal finding of DOE's analysis is the cost and reliability benefits of increasing **natural gas generation capacity in the San Juan metropolitan area**, to include the current Palo Seco generating site. DOE's analysis found 1,200 to 1,600 megawatts (MW) of capacity would greatly enhance the reliability and disaster resilience of Puerto Rico's power system, while lowering power commodity costs island-wide.

Total system costs could potentially fall through this single set of investments while at the same time enabling PREPA to catch up on deferred maintenance without raising rates. Moving to natural gas generation could also help bring PREPA into compliance with EPA's Mercury and Air Toxics Standards. DOE believes increasing natural gas generating capacity in the San Juan area would be one of the single most valuable investment for PREPA's long-term recovery. However, pursuing this investment may be at odds with the island's energy policy should the Governor choose to sign the Puerto Rico Energy Public Policy Act

The near complete lack of industry-standard **vegetation management** greatly exacerbated damage to the transmission system during Hurricane Maria. While PREPA has awarded contracts for vegetation management in recent months, more must be done to protect local and Federal investment in the electrical system.

Eighteen **substations** were significantly damaged by Hurricane Maria, and poor maintenance at many others leave the system susceptible to the potential failure of these critical components of the grid. The National Laboratories have identified the most critical substations for maintaining integrity of the grid and providing power to critical loads across the island.

Much of the **high voltage transmission** system repaired during the restoration process is fully functional as new, highly reliable assets. Targeted enhancements of the transmission system – especially along corridors identified as critical by the National Laboratories – would complement the recent Federal investments in Puerto Rico’s transmission system and improve the reliability of the system.

Incremental investments in advanced metering infrastructure, communications technology, smart grid devices, and grid monitoring and control systems would vastly improve the functioning of the **distribution system** – increasing reliability, reducing transmission line losses, and enhancing revenue collection.⁸

Using sophisticated modeling techniques that combine grid infrastructure analysis with location of critical loads and interdependent infrastructure, the National Labs identified ideal locations for **microgrids** that would greatly improve delivery of public services – to include emergency response, water/wastewater, and hospitals –during an island-wide or isolated power outage scenario.

The single most important element regarding any new investments in Puerto Rico is the presence of a skilled, knowledgeable **workforce** capable of operating and maintaining an advanced energy system like the one envisioned by Puerto Rico. If this challenge is ignored, it will undermine any investments made to the Commonwealth’s power system.

Through mutual aid, Puerto Rico can leverage planning and operations expertise at peer utilities on the mainland, facilitated through the Large Public Power Council (LPPC). The LPPC is comprised of 27 of the largest consumer-owned utilities in the United States and already has strong working relationships with PREPA. DOE continues to coordinate with LPPC in support of PREPA.

Another key pillar of workforce development is professional and vocational training to develop a workforce pipeline at the robust systems engineering programs at the University of Puerto Rico that will provide workers to the utility industry in Puerto Rico. DOE is coordinating with university leadership to provide guidance and expertise on the development of targeted energy workforce development programs.

DOE is also working in coordination with the Corporation for National and Community Service (CNCS) to address energy sector workforce development issues facing Puerto Rico. This multi-pronged approach – working with industry stakeholders, the University of Puerto Rico, and CNCS – provides Puerto Rico with the opportunity to ensure the workforce of today is ready for the challenges of tomorrow.

DOE believes a set of foundational investments, ranging from new natural gas generation capacity to investments in human capital, will provide immediate reliability benefits to Puerto Rico and lay the foundation for the Commonwealth to achieve its vision for its energy transition over the coming decades.

Preparing for the Upcoming Hurricane Season

The Incident Command System (ICS) is the industry-standard approach to emergency response that improves coordination and the cost-effectiveness of incident management. This structure was used by FEMA, USACE, and partner utilities during the restoration of the grid following Hurricane Maria. Documenting and exercising use of the ICS for emergency response efforts would greatly improve PREPA's ability to effectively coordinate a large number of restoration crews from utilities across the nation. DOE stands ready to support PREPA in adopting the ICS approach.

Conclusion

I am proud of the work DOE is doing to assist in long-term recovery efforts in Puerto Rico. DOE is committed to working with our Federal agency partners and the Commonwealth of Puerto Rico to achieve near and long-term progress in achieving a stable, resilient and cost effective energy infrastructure. Our ultimate goal is to enable a transition to a modern and resilient energy system that can serve as the robust engine for Puerto Rico's economic revitalization.

Thank you, and I look forward to your questions.

Endnotes

¹ Pacific Northwest National Laboratory, *Improving Resilience of Puerto Rico Electric Infrastructure (Transmission)*, Official Use Only, October 2018. In this report, PNNL provides preliminary recommendations for improving grid resiliency based on power flow contingency analysis, voltage stability analysis, and dynamic contingency analysis, utilizing system models and data from PREPA. PNNL's Dynamic Contingency Analysis Tool (DCAT) was used to analyze dynamic behavior and cascading sequences resulting from major generation and transmission outages that could arise from extreme hurricane-related events. Trusted commercial tools, PSS/E and PowerWorld, were also used. More than 50,000 contingencies were studied, including a hurricane contingency scenario comprised of six stages of line outages. This analysis was provided directly to PREPA.

² Argonne and Pacific Northwest National Laboratories, *Multi-Lab Modeling Support for Critical Loads in Puerto Rico*, Official Use Only, October 18, 2018. ANL and PNNL identified the location and interconnected infrastructure of several classes of critical loads in Puerto Rico and used modeling, analysis, and industry expert consultation to prioritize resilience enhancing investments that support continuity of electricity supply to those facilities. This analysis was provided directly to PREPA.

³ Sandia National Laboratories, *Using Energy Storage to Support Puerto Rico's Transmission System*, September 2018. This report examined the most critical near-term issues with the transmission system, frequency regulation and response, and analyzed the impacts of incorporating energy storage systems of varying sizes with the goal of immediately minimizing load shedding while laying the foundation for future renewable energy integration. The analysis concluded that 240 MW/60 MWh of energy storage would stabilize system frequency sufficiently to avoid loss of load for rapid load changes or generation outages up to and including loss of the largest generation unit on the island. Based on current industry average storage costs we would estimate a budgetary cost to implement the initial power-focused energy storage capacity would be \$100–125 million. This analysis was provided directly to PREPA.

⁴ Sandia National Laboratories, *Analysis of Microgrid Locations Benefiting Community Resilience for Puerto Rico*, September 2018. An analysis of microgrids to increase resilience was conducted for the island of Puerto Rico. Critical infrastructure throughout the island was mapped to the key services provided by those sectors to help inform primary and secondary service sources during a major disruption to the electrical grid. Additionally, a resilience metric of burden was developed to quantify community resilience, and a related baseline resilience figure was calculated for the area. To improve resilience, Sandia performed an analysis of where clusters of critical infrastructure are located and used these suggested resilience node locations to create a portfolio of 159 microgrid options throughout Puerto Rico. The team then calculated the impact of these microgrids on the region's ability to provide critical services during an outage, and compared this impact to high-level estimates of cost for each microgrid to generate a set of efficient microgrid portfolios costing in the range of \$218–917 million. This analysis was provided directly to PREPA.

⁵ *Investment Considerations for Puerto Rico's Power System Recovery* (formerly *Phased Approach to Puerto Rico's Power System Recovery*). Based on analysis performed by the National Laboratories, OE has developed a set of investment considerations for Puerto Rico's power system recovery as the basis for improved resilience, renewable energy investments, and lower costs.

⁶ Resolution and Order, *In Re: Review of the Puerto Rico Electric Power Authority Integrated Resource Plan*, Puerto Rico Energy Bureau, Case No. CEPR-AP-2018-0001 (Mar. 14, 2019), available at <http://energia.pr.gov/wp-content/uploads/2019/03/Resolution-and-Order-CEPR-AP-2018-0001-6.pdf>

⁷ U.S. Department of Energy, *Energy Resilience Solutions for the Puerto Rico Grid* (June 2018), available at https://www.energy.gov/sites/prod/files/2018/06/f53/DOE%20Report_Energy%20Resilience%20Solutions%20for%20the%20PR%20Grid%20Final%20June%202018.pdf

⁸ David Wells, *Current/Proposed Communications Plan for Puerto Rico*, August 14, 2018. OE has evaluated PREPA's communications system and provided recommendations on network configurations to improve day-to-day as well as emergency communications, building upon existing equipment and protocols. Enhanced communications capabilities will support system reliability and resilience, as well as provide a means of emergency communications for FEMA and the Puerto Rico Emergency Management Agency. This analysis was provided directly to PREPA.