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September 10, 2018

The Honorable Gregg Harper
Chairman, Subcommittee on Oversight and Investigations
United States House of Representatives
2124 Rayburn House Office Building
Washington, DC 20515-6115

To the Honorable Chairman Harper,

Please find attached responses to questions raised in your May 10, 2018 letter pertaining to my April 11, 2018 testimony before the Subcommittee on Oversight and Investigation hearing on the "Update on the Restoration of Puerto Rico's Electric Infrastructure."

My responses are based on findings and recommendations contained in the December 11, 2017 report titled "Build Back Better: Reimagining and Strengthening the Power Grid of Puerto Rico" prepared on behalf of the Governors of the State of New York and Commonwealth of Puerto Rico. They also are informed by new or additional findings that have become available following the issuance of the report.

Please do not hesitate to contact me if you or any other Subcommittee members would like me to clarify or expand upon any of the responses provided in the attached document.

Sincerely,

Eugene L Shlatz
Director
Enclosure

cc: The Honorable Diana DeGette, Ranking Member, Subcommittee on Oversight and Investigations

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Eugene L. Shlatz

Responses to Additional Questions from the April 11, 2018 hearing on the "Update on the Restoration of Puerto Rico's Electric Infrastructure."

From the Honorable Gregg Harper

1. Do you know of any private companies willing to spend billions to modernize the grid in a situation where they are completely uncertain of payment, population stability and rate stability?

   Response: No.

2. Does Puerto Rico currently have a strong, independent regulator to set rates fairly and keep them stabilized in this uncertain environment?

   Response: Because I am not familiar with the Puerto Rican Energy Commission's position on the current environment regarding rates and grid stability, I am unable to offer an informed response to this question.

From the Honorable Diana DeGette

1. Could you please describe who wrote the Build Back Better report and how they intended it to be used?

   Response: The report was prepared and submitted by an extensive working group comprised of the following entities: New York Power Authority, Puerto Rico Electric Power Authority, Puerto Rico Energy Commission, Consolidated Edison Company of New York, Inc., Edison International, Electric Power Research Institute, Long Island Power Authority, Smart Electric Power Alliance, US Department of Energy, Brookhaven National Laboratory, National Renewable Energy Laboratory, Pacific Northwest National Laboratory, Grid Modernization Lab Consortium, and PSEG Long Island, an agent for and on behalf of the Long Island Lighting Company d/b/a LIPA, and Navigant Consulting, Inc.

   The report is intended to provide the Governors of New York and Puerto Rico, and the Administrator of the United States Federal Emergency Management Agency with information and guidance as outlined in the following excerpts from the Build Back Better report.

   . . . this report provides an assessment of the electric power system storm damage caused by hurricanes Maria and Irma, describes a new system design basis, and proposes redesign and rebuild recommendations for strengthening the power grid of Puerto Rico.

   Our [i.e. the Working Group and Steering Committee] overriding goal is to support the Puerto Rico Governor's Office, PREPA, interested stakeholder agencies, and the Federal Emergency Management Agency in defining first level funding requirements and electric power system rebuild recommendations.

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The Working Group offers a roadmap outlining short-term, mid-term and longer-term actions to implement resiliency and hardening measures that are designed to increase the capability of Puerto Rico's electric power grid to withstand future storms. The recommendations include the modernization of the Puerto Rico electric grid, leveraging proven power system technologies to better contain outages, reduce recovery times, lower operation costs, and enable more sustainable energy resources that will reduce reliance on imported fuel. Additionally, we are recommending the use of increased renewable energy resources, such as wind and solar and incorporating new distributed energy resource technologies, such as energy storage and microgrids to enable energy to become abundant, affordable, and sustainable to improve the way of life for the citizens of Puerto Rico.

2. The Build Back Better report states that the grid should be built to withstand an upper Category 4 event, and proposes 10 measures to achieve this goal. What do you believe are the most important of these recommendations?

   Response: While all 10 recommendations are merited, the first 3 recommendations, which focus on strengthening and hardening of the power delivery system – i.e. transmission and distribution lines and substations - are most critical. Specifically, there is an urgent need to upgrade the high voltage transmission infrastructure. The transmission system is the "backbone" of the electric grid, delivering power from generating stations to substations located throughout the island. The transmission grid must be intact following a storm or emergency event before service can be restored to customers served by local distribution lines. Because of the criticality of the transmission grid, its current susceptibility to damage from storms, and the long lead time needed to plan, design, permit and construct new facilities, it is reasonable to place a higher priority on upgrading the high voltage transmission grid.

3. In your estimation, what are the greatest discrepancies between the current state of the grid and where it needs to be to withstand a Category 4 hurricane?

   Response: As noted in my response to Question 2, the greatest discrepancy is the inability of the existing transmission system, including sections that were repaired following Hurricane Maria, to withstand a Category 4 storm. Unlike lower voltage distribution lines, electric utilities typically design and construct transmission lines in hurricane-prone locations to withstand a Category 4 event. It is noteworthy that relatively few high voltage transmission lines in the mainland U.S. were damaged during Hurricanes Irma and Maria. This is because many of these lines were built to withstand a Category 4 storm. Because Puerto Rico is located in an area prone to hurricane-related damage, high voltage transmission lines on the island also should be capable of withstanding a Category 4 hurricane. Further, the substations that transmit electric power delivered by the transmission grid to local distribution lines should be rebuilt or reinforced to ensure they can withstand wind-related damage or flooding during hurricanes. Several of the existing substations on the island suffered significant damage due to flooding, mudslides or wind.

4. The Build Back Better report suggests it may cost as much as $17.6 billion to rebuild the system at this level? This includes, among other things, $5.3 billion to rebuild overhead distribution lines, $4.3 billion for overhead transmission, and $3.1 billion for rebuilding generation to harden them for greater storm resiliency in the future. How did the Build Back Better Working Group arrive at these estimates?

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Response: These estimates were derived based on the assumption that existing electric facilities would be designed and constructed to withstand upper Category 4 force winds and, where applicable, would be relocated to areas less prone to flooding and mudslides. They were prepared over a relatively short time frame, approximately 6 weeks, and therefore, should be viewed as planning level estimates as opposed to detailed engineering designs. Accordingly, the $17.6 billion includes a 25 percent risk adder to account for items that typically are unknown when preparing planning level estimates. It also includes a 13 percent risk adder to account for the higher cost of materials and construction on the island.

The Working Group prepared these estimates based on the cost of comparable facilities constructed in the mainland U.S., adjusted to account for conditions on the island (e.g. relocating transmission lines to more accessible locations) and the cost adjustments cited above. For some facilities, such as substation reinforcements, the Working Group's estimates were based on upgrades or measures that were successfully implemented following prior storms such as Hurricane Sandy in New York.

The $5.3 billion for distribution assumes about 75 percent, or approximately 1200 lines are rebuilt to a higher design standard; and most of the existing 334 substations are either reinforced or repaired due to damage caused by the storm. The $4.3 billion for transmission assumes about 350 miles of overhead high voltage transmission lines are replaced and rebuilt to a higher design standard, approximately 1000 existing poles are reinforced, and 45 miles of new underground transmission is built. The $3.1 billion for generation assumes that older, less efficient existing plants such as Palo Seco are retired, and a new, highly efficient combined cycle generating plant, along with natural gas infrastructure and delivery facilities, is constructed.

5. Is it possible that issues may arise to cause these estimates to increase?

   Response: Yes. Reasons that costs may increase include the following:

   a) The cost of materials or labor may increase
   b) Ongoing or future studies may indicate additional transmission, distribution or generation facilities may be needed, beyond those outlined in the Build Back Better report
   c) The cost to obtain permits or rights-of-way to relocate or construct facilities may be greater than the planning-level estimates contained in the report
   d) Delays caused by weather, permitting or other factors not under the control or those responsible for designing and construction the facilities
   e) Damage to facilities was greater than what was provided or available to the Working Group at the time it prepared the report.

6. Would the recommendations in the Build Back Better report to modernize the grid lower electricity costs for individuals or businesses on the island? If so, how?

   Response: The Working Group did not address the impact of its recommendations on electricity costs in the Build Back Better report. Therefore, I'm unable to provide an informed response to this question.

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7. How would incorporating battery storage into the Puerto Rico grid improve its resiliency?

   Response: The primary way battery storage improves resiliency is when it is integrated with or used to manage output from renewable energy sources such as wind or solar. The Build Back Better report assumes, per current Puerto Rico renewable energy targets, that a substantial amount of solar and wind generation will be installed over the next decade and beyond. Because solar and wind operate intermittently, batteries (and other types of energy storage) provide back-up power when these sources are not operating or operate at lower than rated levels, thereby making these sources more firm and able to serve electric load during power interruptions.

   Battery storage, when controlled by automated systems or by control center operators, also can quickly adjust electric output, up or down, to respond to rapidly changing electric demand caused either by intermittent renewable energy output or when abnormal events occur on the grid. The ability to respond rapidly to unanticipated conditions is another way resiliency is improved by battery storage. Also, the report anticipates battery storage will be used to support new microgrids, particularly those that rely, in part or in whole, on renewable energy resources. The use of microgrids is included in the report as one method to increase resiliency on the island.

8. What role does battery storage play in minimizing the cost of importing fossil fuels to an island like Puerto Rico?

   Response: Battery storage plays an important role in minimizing cost as, in addition to the resiliency benefits cited in my response to Question 7, it also enables renewable generation to displace fossil fuel generating capacity. Because renewable energy operates intermittently, battery storage (and other forms of energy storage) is essential to maintain sufficient electric generating capacity during hours when renewable energy output is reduced or unavailable. Absent battery storage, fossil fuel generation would be needed to provide back-up power when renewable energy output is reduced or unavailable. Cost savings are achieved due to (1) lower amounts of fossil fuel generating capacity that is needed to reliably meet the electric demand of the island, and (2) the displacement of energy via renewable resources that otherwise would be supplied by fossil-fueled generation.

9. How could battery storage be incorporated into future efforts to increase renewable energy generation the island?

   Response: Please refer to my response to Questions 7 and 8. Specifically, battery storage will enable greater amounts of renewable energy to be installed on the island. Battery storage will be needed if a large amount solar photovoltaic generation is installed, particularly during hours when solar output is high and electric demand is low. During hours when electric demand is low and solar output is high, solar output may need to be curtailed, thereby reducing its value. Battery storage is able to store this excess energy and release it during hours when demand is high; for example, during evening hours when electric demand is high due to air conditioning.