

April 9, 2018

TO: Members, Subcommittee on Oversight and Investigations

FROM: Committee Majority Staff

RE: Hearing entitled “Update on the Restoration of Puerto Rico’s Electric Infrastructure”

The Subcommittee on Oversight and Investigations will hold a hearing on Wednesday, April 11, 2018, at 2:00 p.m. in 2322 Rayburn House Office Building. The hearing is entitled “Update on the Restoration of Puerto Rico’s Electric Infrastructure”

I. WITNESSES

- Bruce J. Walker, Assistant Secretary, Office of Electricity Delivery and Energy Reliability, Department of Energy;
- Jeffrey Byard, Associate Administrator, Office of Response and Recovery, Federal Emergency Management Agency;
- Charles R. Alexander, Jr., Director, Contingency Operations and Homeland Security Headquarters, Army Corps of Engineers;
- Carlos D. Torres, Power Restoration Coordinator, Edison Electric Institute; and
- Gene Shlatz, Director, Navigant Consulting.

II. BACKGROUND

a. Hurricanes Impacting Puerto Rico

2017 was one of the most active hurricane seasons on record.¹ This is reportedly the first time in recorded hurricane history that three Category Four hurricanes hit the United States and its territories in the same year.² Puerto Rico was impacted by both Hurricane Irma and Hurricane Maria, the latter causing significant damage to the island. On September 6, 2017,

¹ U.S. Dep’t of Commerce, National Oceanic and Atmospheric Administration, *Above-normal Atlantic hurricane season is most likely this year* (May 25, 2017), available at <http://www.noaa.gov/media-release/above-normal-atlantic-hurricane-season-is-most-likely-year>.

² Doyle Rice, *Not your imagination: This hurricane season has been much worse than usual*, USA TODAY (Oct. 5, 2017), available at <https://www.usatoday.com/story/weather/2017/10/05/not-your-imagination-hurricane-season-has-been-much-worse-than-usual/736649001/>.

Hurricane Irma moved across the Virgin Islands and the northern coast of Puerto Rico as a Category 5 storm.³ Over 1 million power customers and critical infrastructure lost power.⁴ After the storm, the Puerto Rico Power Electric Power Authority (PREPA) successfully restored power for about 70 percent of affected residents.⁵

Two weeks later, on September 20, 2017, Hurricane Maria brought heavy winds and flooding that resulted in catastrophic damage to infrastructure and loss of electrical power to nearly all of the 1.57 million customers in Puerto Rico and 55,000 customers in the U.S. Virgin Islands.⁶ The storm's winds reached over 150 miles per hour and dropped 25 inches of rain on Puerto Rico.⁷ The storm surge and rain runoff from the mountains led to sustained flooding and the island's terrain created funnels for the hurricane force winds, contributing to the extensive damage to Puerto Rico's electric infrastructure.⁸ The damage from both hurricanes resulted in the longest loss of power in the history of the United States.⁹ As of April 4, 2018, 62,000 residents are still without power on the island of Puerto Rico.¹⁰

b. Federal Response for Energy and Infrastructure

i. Overview

The preparation for, response to, and short-term recovery from these storms is dictated by the National Response Framework (NRF), a guide detailing the roles, responsibilities, and coordinating structures for the Nation from federal, state, local, and non-governmental entities. Under the NRF, states set priorities, lead, manage, and drive the overall recovery process and play a central role in coordinating recovery activities, including providing financial and technical support.¹¹ Federal assistance to the states is coordinated through the Federal Emergency Management Agency (FEMA). Working through FEMA, other federal agencies fulfill specific roles and responsibilities through Emergency Support Functions (ESF) and Recovery Support Functions (RSF) under the NRF and National Disaster Recovery Plan, respectively.

³ NY Power Authority, Puerto Rico Electric Power Authority, et. al, *Build Back Better: Reimagining the Strengthening the Power Grid of Puerto Rico*, Dec. 2017, available at https://www.governor.ny.gov/sites/governor.ny.gov/files/atoms/files/PRERWG_Report_PR_Grid_Resiliency_Report.pdf.

⁴ *Id.*

⁵ *Id.*

⁶ U.S. Dep't. of Energy, *Hurricanes Maria, Irma, and Harvey Summary Report*, Sept. 26, 2017, available at <https://www.energy.gov/sites/prod/files/2018/04/f50/Hurricanes%20Maria%20%20Irma%20Event%20Summary%20April%204%2C%202018.pdf><https://www.energy.gov/sites/prod/files/2017/09/f37/Hurricanes%20Maria%2C%20Irma%20and%20Harvey%20Event%20Summary%20September%2026%2C%202017.pdf>.

⁷ See Report, *supra* note 3.

⁸ *Id.*

⁹ *Id.*

¹⁰ U.S. Dep't. of Energy, *Hurricanes Maria & Irma Summary Report*, April 4, 2018, available at <https://www.energy.gov/sites/prod/files/2018/04/f50/Hurricanes%20Maria%20%20Irma%20Event%20Summary%20April%204%2C%202018.pdf><https://www.energy.gov/sites/prod/files/2018/04/f50/Hurricanes%20Maria%20%20Irma%20Event%20Summary%20April%204%2C%202018.pdf>.

¹¹ U.S. Dept. of Homeland Security, Federal Emergency Management Agency, *Nat'l Disaster Recovery Framework*, Sept. 2011, available at https://www.fema.gov/media-library-data/20130726-1820-25045-5325/508_ndrf.pdf.

If the resources required to respond to a natural disaster or incident are beyond the capabilities of the state and the affected local government, the governor may request federal assistance, including assistance under the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act).¹² Under the Stafford Act, if a governor requests federal assistance and it is clear that the event exceeds the abilities of the state and affected local governments, the President may make an emergency or major disaster declaration.¹³ Following the Presidential declaration, the Stafford Act allows the President to provide financial and other assistance to state and local governments, certain non-profit organizations, and individuals to support response and recovery efforts.

President Trump issued disaster or emergency declarations for Puerto Rico and the U.S. Virgin Islands in response to both Hurricane Irma and Hurricane Maria.¹⁴

ii. Agency Roles

When a state requests federal assistance following a disaster, FEMA is responsible for coordinating federal support and public assistance under the NRF. In the energy and infrastructure sectors, FEMA is supported by the Department of Energy and U.S. Army Corps of Engineers.

Department of Energy. The Department of Energy (DOE) is the designated Sector-Specific Agency for the Energy Sector under the National Infrastructure Protection Plan, and serves as the lead federal coordinating agency for Emergency Support Function #12–Energy under the National Response Framework.¹⁵ In addition, DOE is authorized under the Federal Power Act to address electricity shortages and secure the grid, as well as authorized under the Energy Policy and Conservation Act to address fuel supply interruptions with drawdowns from the Strategic Petroleum Reserve (SPR).

During severe weather events, or in response to energy supply disruptions, DOE is responsible for providing clear and consistent communication to deliver situational awareness of energy sector impacts. During emergencies, regulatory assistance and waivers are often used to expedite restoration when the situation warrants. DOE provides a central location for common waivers and special permits for energy response.¹⁶

¹² U.S. Dep’t of Homeland Security, Federal Emergency Management Agency (FEMA), *The Disaster Declaration Process* (last updated Apr. 6, 2017), available at <https://www.fema.gov/disaster-declaration-process>.

¹³ *Id.*

¹⁴ U.S. Dep’t of Homeland Security, Federal Emergency Management Agency, Press Release, *President Donald J. Trump Signs Emergency Declaration for Puerto Rico*, Sept. 18, 2017, available at <https://www.fema.gov/news-release/2017/09/18/president-donald-j-trump-signs-emergency-declaration-puerto-rico>; see also The White House, Statement & Releases, *President Donald J. Trump Approves Puerto Rico Disaster Declaration*, Sept. 10, 2017, available at <https://www.whitehouse.gov/briefings-statements/president-donald-j-trump-approves-puerto-rico-disaster-declaration/>.

¹⁵ See U.S. Dep’t of Homeland Security, Federal Emergency Management Agency, *Emergency Support Function Annexes*, ESF 12 available at <https://www.fema.gov/media-library/assets/documents/25512>.

¹⁶ U.S. Dep’t of Energy, *Energy Waiver Library*, available at <https://www.energy.gov/oe/services/energy-assurance/response-and-restoration/energy-waiver-library>.

U.S. Army Corps of Engineers. The U.S. Army Corps of Engineers (USACE) is the designated Sector Specific Agency for public works and serves as the lead coordinating agency under Emergency Support Function #3—public works and engineering under the National Response Framework. Generally, its role in hurricane response includes debris management, commodities distribution, temporary housing, temporary roofing, emergency power, infrastructure assessment, and support to urban search and rescue.¹⁷

iii. Role of Industry in the Electric Sector

The electric power sector relies on a collaborative, industry-led process called mutual assistance to expedite restoration efforts following an emergency. Mutual assistance establishes a formal process through which companies can request support from voluntary networks of companies and contractors within and across each segment of the industry. The company requesting aid is responsible for providing materials, lodging, and other expenses and compensating responding companies, at cost.

This process has improved over time and is now integral to many companies' contingency plans. For example, Hurricane Irma left more than 7.8 million customers in the southeast continental US without power. Through mutual assistance, more than 60,000 workers from 250 companies across the U.S. and Canada helped restore power to 95 percent of customers within one week.¹⁸

c. Restoration of Puerto Rico's Electric Infrastructure

The restoration of Puerto Rico's electric power infrastructure has been challenged by a confluence of institutional, geographical, logistical, economic, and other factors. Following Irma and the subsequent devastation from Maria, the territory's electric power utility, PREPA did not request mutual assistance. Instead, after Maria, PREPA turned to private contractors to assist with grid restoration.¹⁹ Subsequent to this decision, the Governor of Puerto Rico requested assistance from the federal government and, on September 29, 2017, FEMA issued a mission assignment to USACE to assist Puerto Rico with power restoration efforts.²⁰

Grid restoration is not a typical mission assignment for USACE. USACE, however, had contracting vehicles in place to hire contractors and the procurement and logistics infrastructure to obtain supplies in support of the restoration effort.²¹ On October 31, 2017, PREPA formally requested mutual assistance from the electric power industry.²² Due to a lack of formal mutual

¹⁷ U.S. Army Corps of Engineers, *2017 Hurricane Season*, available at <http://www.usace.army.mil/Missions/Emergency-Operations/Hurricane-Season/>.

¹⁸ Written Testimony of Scott Aaronson, Edison Electric Institute before H.Comm. on Oversight and Govt. Reform, "Bureaucratic Challenges to Hurricane Recovery in Puerto Rico," (March 21, 2018).

¹⁹ See Scott DiSavino & Roberta Rampton, *Puerto Rico Calls on U.S. Utilities to Help Restore Power*, REUTERS, Oct. 31, 2017, available at <https://www.reuters.com/article/us-usa-puertorico-power-new-york/puerto-rico-calls-on-u-s-utilities-to-help-restore-power-idUSKBN1D02FJ>.

²⁰ *FEMA: Army Corps of Engineers to Rebuild Puerto Rico's Infrastructure*, CNN WIRE, Sept. 29, 2017, available at <http://fox43.com/2017/09/29/fema-army-corps-of-engineers-to-rebuild-puerto-ricos-infrastructure/>.

²¹ See DiSavino & Rampton, *supra* note 19.

²² *Id.*

assistance agreements and the lack of a formal incident command structure, among other factors, industry crews did not arrive on the island until January 2018.²³ The request did trigger, however, the appointment of a Power Restoration Coordinator, Carlos Torres, and the establishment of a formal incident response structure to facilitate coordination and work flow across the multiple restoration teams.²⁴ Restoration work is now coordinated through a unified grid-restoration command which includes FEMA, USACE, PREPA, and the island's Power Restoration Coordinator.²⁵

One of the most significant impediments to the restoration of Puerto Rico's electric infrastructure is geography. There have been significant delays due to challenges in obtaining and shipping materials necessary to the island. These issues have been exacerbated by shortfalls on the mainland due to prior hurricane response activities, as well as PREPA's uncertain inventory of existing stockpiles within the Commonwealth. Much of the material and equipment—including, for example, bucket trucks—must be shipped, adding to delays. The island's terrain and location of existing electric infrastructure exacerbate the challenge.

Puerto Rico's electrical grid contains “2,478 miles of transmission lines, 31,485 miles of distribution lines across the service territory, and 334 substations.”²⁶ PREPA is responsible for providing about 66 percent of electricity to the island and purchases the remainder from third parties.²⁷ The electrical power system provides electricity to an area that is about 110 miles east to west and 35 miles north to south.²⁸ Puerto Rico has a central mountain range that reaches about 4,390 feet at its peaks.²⁹ Because most of PREPA's transmission and distribution (T&D) is above ground, it is vulnerable to high winds and landslides associated with severe weather events.³⁰

Power generated by PREPA is concentrated on the northern and southern coast lines.³¹ Aguirre and Costa Sur are the largest and most important power generating facilities, both located on the southern coast of the island.³² This is problematic because most of the demands for power is around San Juan, on the northern side of the island.³³

The separation of generation and load resulted in transmission lines that run over the island's central mountains.³⁴ Many of the lines were build decades ago and do not follow roadways. Instead, transmission towers and lines traverse steep terrain, subject to erosion, covered with heavy vegetation. As a result, towers and lines lack sufficient rights-of-way, which

²³ See David Ferris, *Puerto Rico's Grid Recovery, by the Numbers*, E&E NEWS, Feb. 20, 2018, available at <https://www.eenews.net/stories/1060074219>.

²⁴ *Id.*

²⁵ *Id.*

²⁶ See Report, *supra* note 3.

²⁷ *Id.*

²⁸ *Id.*

²⁹ *Id.*

³⁰ *Id.*

³¹ *Id.*

³² *Id.*

³³ *Id.*

³⁴ *Id.*

cannot be expanded due to local protections for flora and fauna.³⁵ This challenging terrain has complicated restoration efforts, forcing crews to perform difficult work in dense forest, often via helicopters.³⁶

d. Current Status

The impact of both hurricanes caused such substantial damage to Puerto Rico's electrical infrastructure that "a significant portion of the generation, transmission, and distribution system must be rebuilt, including high voltage transmission lines that often survive lower category hurricanes."³⁷ As of early April, the USACE had obtained more than 50,000 poles and more than 5000 miles of conductor wire, with more in the pipeline. In addition, FEMA has obligated approximately \$3.5 billion to electric power restoration in Puerto Rico, including more than \$2.5 billion to USACE and \$990 million to PREPA.

At the peak of recovery efforts, 6,200 workers were in Puerto Rico "repairing transmission and distribution lines across the island, about half of them working for the corps."³⁸ In February 2018, USACE announced that it was initiating a "responsible drawdown" of its workers on the island.³⁹ As of early April, there are fewer than 1000 USACE contractors on the island and between 1000-1500 total workers.

Due to the fragility of the current infrastructure, nearly 1,000 generators provided by FEMA are still being used to power most hospitals and numerous police and fire stations.⁴⁰ As of early April 2018, PREPA reported that "89.2 [percent] of normal peak load and 95.8 [percent] of customers (1,411,086) have been restored. All 78 municipalities are at least partially energized. Approximately 62,000 customers remain without power."⁴¹ Most of the areas still without power—known as Puerto Rico's last mile—are located in "difficult and isolated terrain, from the island's southeast corner through the central mountains and out the northwest coast,"⁴² along with communities on the islands of Vieques and Culebra.

e. Future of the Grid

In December 2017, a report entitled *Build Back Better: Reimagining and Strengthening the Power Grid of Puerto Rico* was published.⁴³ The report, a joint report drafted by numerous organizations from both the public and private sector, outlines a plan to improve Puerto Rico's

³⁵ *Id.*

³⁶ *Id.*

³⁷ *Id.*

³⁸ Frances Robles, *Contractors Are Leaving Puerto Rico, Where Many Still Lack Power*, NY TIMES, Feb. 26, 2018, available at <https://www.nytimes.com/2018/02/26/us/puerto-rico-power-contractor.html>.

³⁹ *Id.*

⁴⁰ *Id.*

⁴¹ Hurricane Update, *supra* note 10.

⁴² Arelis R. Hernández, *In Puerto Rico's 'Last Mile,' Power is Still Elusive as Next Hurricane Season Looms*, WASH. POST, Apr. 4, 2018, available at https://www.washingtonpost.com/national/in-puerto-ricos-last-mile-power-is-still-elusive-as-next-hurricane-season-looms/2018/04/04/00dc0cb4-1e69-11e8-b2d9-08e748f892c0_story.html?utm_term=.2bf006082f95

⁴³ See Report, *supra* note 3.

power grid to withstand winds from a Category 4 hurricane.⁴⁴ In total, the plan estimates that the total cost to modernize the grid will be over 17 billion dollars.⁴⁵ According to the report, rebuilding objectives should include “rebuilding the Puerto Rico electric power system to current codes and industry best practices, hardening for greater storm resiliency, and designing for the future. To harden [T&D] infrastructure, physical and structural improvements to lines, poles, towers, substations, and supporting facilities will be needed to make them less vulnerable to the damaging effects of hurricane winds and flooding.”⁴⁶

Recommendations from the report include:

- Reinforce existing direct-embedded poles with enhanced support, such as perimeter injected concrete grout or other soil stabilization;
- Upgrade damaged poles and structures to a higher wind loading standard;
- Strengthen poles with guy wires;
- Install underground power lines in select areas prone to high wind damage;
- Modernize the T&D system via smart grid investments to make the system less susceptible to extended outages;
- Install automated distribution feeder fault sectionalizing switches to enable fault isolation and reduce outage impact;
- Deploy modern control systems to enable distributed energy resources (DER) integration and encourage their development;
- Adopt effective asset management strategies, such as the targeted inventory of critical spares;
- Institute consistent vegetation management practices; and
- Apply enhanced design standards for equipment and facilities damaged in the recent storms.⁴⁷

III. ISSUES

The following issues may be examined at the hearing:

⁴⁴ *Id.*

⁴⁵ *Id.*

⁴⁶ *Id.*

⁴⁷ *Id.*

- What have the federal agencies learned thus far in the recovery process?
- How can Puerto Rico's electrical infrastructure be improved to prevent future catastrophic power outages?
- What are DOE's plans moving forward as the agency takes on more responsibility for the electrical infrastructure?
- What updates to the electrical infrastructure should be completed before the start of the 2018 Hurricane Season?
- How much will it cost to build a long-term electrical infrastructure capable of withstanding future Category Four hurricanes?

IV. STAFF CONTACTS

If you have any questions regarding the hearing, please contact John Ohly or Lamar Echols at (202) 225-2927.