Advisory Committee for Energy Transformation

Development of the Regulatory Framework and Public Policy for the Puerto Rico Energy Transformation

Report for the Senate of Puerto Rico

CIAPR-RMI-ICSE-RPRAC-UPR
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01 EXECUTIVE SUMMARY

The Puerto Rico Electric Power Authority (PREPA) is a vertically integrated public corporation, which is currently the sole provider of electric power for Puerto Rico. PREPA serves approximately 1.5 million customers and has nearly 6,000 employees. Based on the Puerto Rico Energy Commission Rate Case for FY 2017, PREPA had total revenues of $3.45 Billion. In accordance with its last Financial Statement of June 30, 2014 Total Assets were estimated at $10.4 Billion, Total Capital Assets of $6.8 Billion and Total Liabilities of $11.7 Billion.

Because of its high level of insolvency, PREPA filed for bankruptcy in Federal Court on July 3, 2017 under Title III of The Puerto Rico Oversight, Management and Economic Stability Act (PROMESA). PROMESA gave Puerto Rico and its agencies access to a workout process akin to U.S. bankruptcy.

Among Puerto Rico's electrical system problems the following stand out: 1) unreliable service; 2) obsolete, poorly maintained and vulnerable infrastructure; 3) poorly diversified fuel mix with high dependency of fossil fuels; 4) inadequate configuration of generation vs. load demand sites; 5) ineffective customer service; 6) outdated systems and information technology; 7) high technical losses and theft; 8) failure to comply with industry and environmental standards; 9) insolvency; and 10) lack of transparency and publicly available information, included but not limited to generation costs and units dispatch costs; marginal cost per generation unit; and cost of service per infrastructure type (i.e., generation, transmission and distribution) and per customer class (i.e. residential, commercial and industrial) among many others.

The aforementioned problems were, to a great extent, exacerbated by the catastrophic damage caused by hurricane María, public discontent with PREPA's recovery process and lack of trust in the public corporation to continue being the sole provider option for Puerto Rico networked electric system customers.

This document provides a summary of discussions of the Senate Advisory Committee for Energy Transformation as a conceptual framework for the recommendations made. The discussion is reinforced with technical information gathered from various sources, including the Department of Energy, and initiatives from many stakeholder groups participating in public and private forums to provide ideas and vision for the transformation goals. The report also incorporates comments and concerns presented by participants of Senate public hearings in advance of the legislation bill. It is important to note that the information contained herein includes the Advisory Committee consensus with regards to the diverse views and perspectives of stakeholders of the energy sector. An effort was made to incorporate what the Advisory Committee considers viable from the stand points of technology, environment, law and economy.

The report provides specific recommendations for the new energy transformation legislation to be enacted during the last quarter of 2018. Those recommendations comprise policy guidelines, objectives for energy transformation and recommendations for the regulatory framework. The guidelines and recommendations are primarily structured under general topics that comprise the Puerto Rico energy system. Objectives for policy transformation goals were provided and particular recommendations are included for legislators' consideration.

02 INTRODUCTION

After the passing of Hurricanes Irma and María the Puerto Rico electrical system was devastated. PREPA estimated that 80% of the transmission and distribution (T&D) system collapsed. As we rebuild our grid, it's not just poles and wires that are needed. We need to reform the system and the institution which produced our legacy electrical system, recognizing at the same time that it was that same organization that brought light and power to all Puerto Ricans since its creation in 1941.

On January 22, 2018, the Governor of Puerto Rico, Hon. Ricardo Rosselló Nevares, announced the government's decision to transform the Puerto Rico Electric System and the Puerto Rico Electric Power Authority (PREPA). According to the Governor, his decision also stemmed from aspects such as deficient and obsolete infrastructure, the reduction of generation demand on the island by 18% over the past decade, including 48% in the industrial sector, and the reduction of PREPA's employees by over 30% over the past 5 years, most of whom were dedicated to the maintenance of the electric grid.

The announced transformation depicted a new model where centralized power generation assets would be sold to private entities, and administration of the transmission and distribution (T&D) system would be transferred to a private operator through a defined-term agreement. The Governor explained that this process would take approximately 18 months to complete. He described the transformation process as follows:

Phase 1: Defining the Legal Framework through legislation and performing market soundings to determine the interest of private companies in participating in PREPA's transformation.

Phase 2: Obtaining offers from enterprises and conducting technical, economic and financial evaluations of these offers.

Phase 3: Negotiating the terms of contract awards of the selected enterprises meeting the requirements of the transformation and modernization of the Puerto Rico energy system.

On March 6, 2018, the legislature initiated two bills, PS 860 at the PR Senate and PC 1481 at the House of Representatives. The stated purpose of the legislation was to enable the transformation of the Puerto Rico Electric System, setting forth the government's policy in regards to the island electric system; and authorizing the legal framework required for the sale, disposition and/or transfer of assets. The bill also established amendments to various laws in order to enable the proposed transactions.

During the course of the legislative process, the proposed legislation received numerous reactions from interested sectors. Most of the objections presented during hearings had to do with the fact that transactions involving the major assets of the island were being undertaken without a preceding regulatory framework to address rules and requirements for those transactions. Also, there was consensus through most sectors that transactions should undergo the scrutiny of a strong energy regulator, as opposed to the drafted legislative language (this consensus was further reinforced later through the responses to the market sounding performed after the initial legislation). Another important response from some sectors was the need for a long-term energy policy to define the future of Puerto Rico's energy system, preventing the economic losses of the past. The Senate considered the recommendations submitted during the legislative process regarding these issues and incorporated many amendments to PC 1481. The amendments had the following main objectives: (1) to include a mandate for the Legislature to adopt a comprehensive Energy Public Policy, (2) to establish a new regulatory framework, and (3) to require the transactions involving PREPA's assets to be certified by the former PR

Energy Commission, now PR Energy Bureau, as in compliance with the developed Energy Public Policy. PC 1481 was finally approved and eventually signed into Law 120-2018 by the Governor on June 20, 2018.

In essence, Act 120-2018, created the legal framework and the mechanism for the transfer of PREPA generation assets and for the establishment of Public-Private Partnerships for any other PREPA function, service, or facilities. It enabled a process to commence informal negotiations with interested parties, market soundings, information requests, and any other means to gather information from possible market participants.

There were two fundamental elements of Act 120-2018. First, the mandate to approve a new regulatory framework and a vanguard energy public policy that would stimulate the modern technologies and alternative energy methods that would include distributed generation, the use of microgrids, and renewable energy, among others. Second, the mandate that in order to complete the transactions involving PREPA assets, a regulatory framework would have to be approved beforehand to provide a competitive model among various participants of the energy sector. Through this approach, monopolies would be prevented both in power generation, energy sources and in energy service to customers.

03 ADVISORY COMMITTEE

Section 9 of Act 120-2018, provides for a Work Group for the Development of the Energy Public Policy and Regulatory Framework. The Work Group's mission is to develop and recommend for approval, these components for the completion of the legislative process that will enable the transformation of the Puerto Rico Energy System. As stated in this section of Act 120-2018, the Work Group would be designated by consensus between the Governor and the Presidents of both Legislature bodies, no later than 15 days after the approval of the act. The Work Group is to be supported with the advice and recommendations from the Southern States Energy Board (SSEB), the Department of Energy (DOE), and any other entity or organization deemed necessary, subject to the constitutional prerogatives of the Puerto Rico Government and its Legislature bodies. In addition, according to the Act, the Governor and the Presidents of both Legislative bodies would each propose four organizations to become part of SSEB's Blue Ribbon Task Force.

03.01 The Work Group

The constitution of the Advisory Committee began to take form during the legislative review and discussion process for the Energy System Transformation Project at the Senate, with an initial meeting held on April 25, 2018. Later in June Advisory Committee was officially constituted.

The Work Group carried out discussions under the general guidance and leadership of Senators Lawrence Seilhamer Rodríguez, Senate Vice-president, and Eduardo Bhatia Gautier, Senate Minority Leader. Consequently, each organization selected members to constitute the Work Group. These were:

- The Professional College of Engineers and Land Surveyors of Puerto Rico (CIAPR)
  - Pablo Vázquez Ruiz, PE, CIAPR President, Chairman
  - Elizabeth Dividú Miranda, Member
  - Manuel J. Vélez Lebrón, PE, Member
  - Esther Maritza Zambrana Cruz, PE, Member

- Institute of Economic Competitiveness and Sustainability (ICSE)
  - José E. Rossi Coughlin, Chairman of the Board
  - Tomás Torres Placa, MPL PE, LPP Executiva Director
  - Fernando Agrait, Legal Advisor
- Rocky Mountain Institute (RMI)
  - Roy Torbert, Member
  - Mike Henchen, Member
- Resilient Puerto Rico Advisory Commission (ReImagina Puerto Rico)
  - Malu Blázquez Arsuaga, Executive Director, Member
  - Juan A. González Moscoso, PE, Member
- Senate Advisors
  - Sylmari de la Torre Toro, Esq., Senator Seilhamer's Legal Advisor
  - Josué E. González Aldarondo, Esq., Senate's Energy Commission Executive Director
  - Ramón Luis Nieves, Esq., Senator Bhatia's Legal Advisor
- Special Advisors
  - Prof. Luis A. Avilés Pagán, Esq., Professor UPR School of Law, Legal Advisor
  - José F. Ortiz Vázquez, PE (since before appointment as PREPA's CEO), Technical Advisor
- Governor's Representative
  - Christian Sobrino Vega, Esq.

The Advisory Committee's goals are to incorporate the views of subject matter experts as well as stakeholder participation from the government, industry, academia and the public. To that end, member organizations of the Advisory Committee volunteered to share results from individual efforts that could be used in the preparation of this document. ICSE and RMI organized a Public Collaborative with over 40 participants representing such sectors in two separate sessions. Published reports such as the *US Department of Energy: Energy Resilient Solutions for the Puerto Rico Grid*, the *Build Back Better: Reimagining and Strengthening the Power Grid of Puerto Rico*, and the *ReImagina Puerto Rico Energy Sector Report* were also used as key reference documents. In addition, the Puerto Rico Senate conducted public hearings in advance of the final legislation drafting to obtain diverse views from additional stakeholders with respect to elements of public policy and regulatory framework for the Puerto Rico Energy System Transformation.

03.02 Assigned Mission

The Puerto Rico Public Energy Policy and Regulatory Framework must be approved by the Legislature within 180 days from the approval of Act 120-2018 on June 20, 2018. That is, no later than December 17, 2018. Therefore, the Work Group's mission is to deliver its report and recommendations on or before the end of October 15, 2018. With the information gathered from the above-mentioned engagements, it is envisioned that the legislature will produce a robust piece of legislation incorporating the diverse views needed to meet the aggressive timeline set forth in the intended transformation of the energy system.

04 BACKGROUND INFORMACION

04.01 Current Legal and Policy Framework

Energy Generation in Puerto Rico dates back to 1893, through the acquisition of the first-generation plant by Mr. José R. Figueroa y Rivera. In 1925 the first public entity for the generation and distribution of electric power was created in Puerto Rico under the name of "Utilización de las Fuentes Fluviales". Its purpose was to make electric energy a public utility, thereby counteracting the lucrative goals of the private enterprises then generating and selling electricity.

By 1941, the "Autoridad de las Fuentes Fluviales" (generation through riverine sources), was created through Act 83-1941. Since then, the public corporation, by its nature, has monopolized the electric power generation, transmission and distribution.

Act 57-1979 changed its name to Puerto Rico Electric Power Authority (PREPA) since the hydroelectric generation was minimal. PREPA was created as a public corporation (not an agency), regulated by its own government board (self-regulated), enabled to sell bonds for its financing, exclusive power to establish energy tariffs, and granted regulatory power over all energy aspects in Puerto Rico. Between 1941 and 1981, it also had the power to acquire private energy entities.

Upon its creation, independent private producers were consolidated under the governmental corporation. The corporation was granted exclusive rights to generate energy in Puerto Rico in exchange for a universal service. PREPA was the sole energy producer in Puerto Rico until the effects of the Federal Law, Public Utility Regulatory Policy Act (PURPA) of 1978. PURPA recognized the obligation of the public energy entities to acquire energy from independent power producers. PREPA later contracted with two independent power producers in Puerto Rico.

Later, the Energy Policy Act of 1992 permitted residential and commercial customers to sell private energy generation. Through the Energy Policy Act, in 2005 PREPA adopted standards for interconnection based on that Law.

Following U.S. statutory changes, several laws and Executive Orders were enacted locally in Puerto Rico to integrate the island with this new trend. On 1993 Executive Order OE-1993-57 incorporates a report prepared by the Energy Cogeneration and Generation Committee. This policy sought to develop aggressive programs for energy efficiency and conservation, developing pilot projects, diversification of fuel sources, use tariff programs, and to increase the generation plants efficiency.

Puerto Rico Act 114-2007 ordered PREPA to establish a program of Net Metering that would permit the interconnection in its transmission and distribution system and the feedback of electricity to customers with installed solar or wind generating equipment capable of generating electric energy in two directions. The program is geared towards residential and commercial customers that install equipment with generation capacity not exceeding 25 KW and 1 MW, respectively. For many years PREPA did not fully comply with this Act. The average interconnection time was 250 days.

Puerto Rico Act 73-2008, for Economic Incentives for the Development of Puerto Rico, ordered PREPA to regulate and implement *Wheeling* for exempted businesses described in the Act by no

later than January 2, 2010. PREPA did not meet this requirement. The Act also ordered the creation of an Energy Transfer Committee that would prepare a report with recommendations regarding wheeling.

Puerto Rico Act 82-2010, Public Policy for Energy Diversification through Renewable, Sustainable and Alternate Energy, adopted a series of mandates, incentives and mechanisms intended to increase the production of renewable energy. The main tool proposed in this Act to attain the policy was the implementation of a Renewable Energy Portfolio Standard. The statement of Policy expressed the following:

> *"It is declared as public policy of the Government of Puerto Rico to attain the diversification of electric power sources and the technology infrastructure through the reduction of our dependency on energy sources derived from fossil fuels, such as oil; reduce and stabilize our energy costs; control Puerto Rico's electricity price volatility; reduce the escape of capital caused by the import of fossil fuels; preserve and improve our environment, natural resources and quality of life; promote the conservation of energy and social wellbeing, through various mechanisms, including the establishment and goals attainment within a mandatory schedule and through economic and tax incentives to stimulate the electric generation activity <u>through renewable, sustainable and alternate energy sources</u>. To that end, the Government of Puerto Rico will adopt a Renewable Energy Portfolio in the form of a compliance schedule, which will apply to every retail energy provider in Puerto Rico". (Emphasis added)*

The mandate for renewable energy was set forth as follows:

2015 through 2019 12%
2020 through 2028 15%

For years 2028 through 2035, providers shall establish a progressive plan that would stipulate the annual percentages, reaching 20% by year 2035.

The Renewable Energy Portfolio Standard was a progressive energy policy anchored on market forces. It promotes the development and incorporation of cost-competitive renewable energy in the energy market and establishes the percentage of the supplied energy that would be produced from renewable sources.

Puerto Rico Act 83-2010, Green Energy Incentives, established the Puerto Rico Green Energy Fund. This fund would be used to stimulate the establishment and development of renewable, sustainable and alternate energy projects in Puerto Rico. Other tax benefits were granted by way of decree to qualifying activities. The Green Energy Fund was enabled to acquire the Renewable Energy Certificates (CER's). So far, the Green Energy Fund has granted over $60 million.

Puerto Rico Act 57-2014, Transformation and Energetic RELIEF (Energy Reform), was enacted on arguments similar to those expressed in the 1993 Puerto Rico Energy Policy, as both address the transformation of the Puerto Rico electric system. Following is an excerpt from the Act:

> *"After more than seventy (70) years of its creation, and more than three decades from meeting its mandate of total electrification of Puerto Rico, PREPA has turned into a self-regulated monopoly that decides tariffs without real fiscal oversight, incurs in operational,*

managerial and administrative inefficiencies, which final cost at the end of the day is assumed directly by the consumer, and maintains an internal governance that lacks the transparency and citizen participation. All this contributes to Puerto Rico being amongst the first positions in regards to energy cost within the US jurisdictions. With this act PREPA's Law is amended to set forth a people's mandate to this public corporation."

Section 1.2, Declaration of Public Policy related to Electric Energy, contains 19 elements of policy intended to become essential for the competitiveness and development of the government of Puerto Rico. The policy elements are as follows:

(a) The cost of the electric power generated, transmitted, and distributed in Puerto Rico shall be affordable, just, and nondiscriminatory for all consumers;

(b) The availability of energy supply shall be guaranteed to the People.

(c) The implementation of the public policy on energy shall be an ongoing planning, consultation, execution, evaluation, and improvement process in all energy-related matters.

(d) The implementation of strategies geared toward achieving efficiency in the generation, transmission, and distribution of electric power shall be sought in order to guarantee the availability and supply thereof at an affordable, just, and reasonable cost;

(e) The safety and reliability of the electricity infrastructure shall be guaranteed by integrating clean and efficient energy and using modern technological tools that promote economic and efficient operations;

(f) The electrical infrastructure shall be maintained in optimum conditions as to ensure the reliability and safety of the electric power service;

(g) The Island shall become a jurisdiction with diversified energy sources and high efficiency electric power generation. To achieve this, it shall be necessary to reduce our dependence on energy sources derived from fossil fuels, such as oil, and to develop short-, medium-, and long-term plans that allow us to establish a well-balanced and optimum energy portfolio for the electrical system of the Commonwealth of Puerto Rico;

(h) The maximum percentage of renewable energy that may be integrated and incorporated into Puerto Rico's electricity infrastructure in a safe and reliable manner and at a reasonable cost shall be identified and kept updated. Moreover, suitable technologies and locations shall also be identified to make such integration feasible in accordance with the best interest of the Commonwealth of Puerto Rico;

(i) The responsibility of the Commonwealth of Puerto Rico, its agencies, municipalities, and public corporations, as well as of natural or juridical persons, is to comply with every environmental law and regulations applicable to the Commonwealth of Puerto Rico in order to preserve the environment and quality of life of all Puerto Ricans;

(j) The Commonwealth of Puerto Rico shall become an efficient and responsible energy consumer and shall promote energy conservation and efficiency in all its branches and instrumentalities;

(k) The sensible, responsible, and efficient use of energy resources in Puerto Rico shall be promoted among residential, commercial, and industrial customers;

(l) Every consumer shall have the right to receive a reliable, stable, and excellent electric power service;

(m) Prices shall be based on the actual cost of the service provided, efficiency standards, or any other parameters recognized by government and non-governmental organizations specialized in electric power service;

(n) A reasonable price that conforms to the market, geographical realities, and the reality of the electric power infrastructure of Puerto Rico, among other factors, shall be ensured for the purchase of energy between independent power producers and PREPA;

(o) Transparency and citizen participation in every process related to electric power service in Puerto Rico shall be promoted;

(p) Electricity bill or service disputes shall be resolved equitably and diligently;

(q) PREPA shall promote the necessary changes in order to become an entity that satisfies the electric power needs of the 21st century-Puerto Rico;

(r) An independent electric power regulatory entity with broad powers and duties shall be created to ensure compliance with the public policy on energy, the provisions and mandates of this Act, and ensure that energy costs are just and reasonable by overseeing and reviewing the rates of PREPA and any other electric power service company;

(s) Every electric power contributions, subsidies, or direct or indirect payments provided by PREPA shall be properly used in accordance with the objectives for which they were granted.

04.02 Energy Regulator

Act 57-2014 created the Puerto Rico Energy Commission (PREC) as the key component for the faithful and transparent execution of the Energy Reform. It was created as an independent government entity in charge of regulating, overseeing, and ensuring compliance with the public policy on energy of the Commonwealth of Puerto Rico. The PREC was empowered to develop a long-term vision for the electricity system and to create the necessary rules and regulations. The PREC promptly initiated three main regulatory proceedings that routed the implementation of an energy regulatory framework in Puerto Rico, these are:

a. CEPR-AP-2015-0002: Integrated Resource Plan for The Puerto Rico Electric Power Authority

b. CEPR-AP-2016-0001: Petition for Approval of Transition Order Filed by the PREPA Revitalization Corporation

c. CEPR-AP-2015-0001: PREPA Rate Review for FY 2017

As part of those proceedings, the PREC established: (1) a Pre-Maria five-year action plan as part of a Modified Integrated Resources Plan (IRP), making PREPA among other requirements exit from or renegotiate out-of-market contracts for renewable energy that had been entered into without regulatory

oversight; (2) a pathway towards the resolution of PREPA legacy debt, opening to public scrutiny PREPA's debt and agreements with bondholders; and (3) held the first ever rate case, establishing a detailed revenue requirement for the utility and evaluated and adjusted the proposed rate in view of consumers best interest. It also initiated many proceeding and enacted regulations that facilitated private capital investment in distributed energy and micro-grids, as a way to assist in restoring power and modernizing the system.

Puerto Rico Act 211 of 2018, created the Public Service Regulatory Board by integrating the Public Service Commission, the Telecommunications Regulatory Board, the Independent Office of Consumer Protection and the Energy Commission (now Energy Bureau). Within the new organization the former regulatory bodies, now regulatory bureaus, receive their funds from an allocation determined by the Puerto Rico Legislature and the Office of Management and Budget. To maintain their independence, the bureaus, especially the Energy Bureau, shall receive their funding independent from the political process. In the case of the Energy Bureau, those funds shall come from PREPA, its successor and the power companies allowed to operate in Puerto Rico.

The island's future energy system should consider community-owned (via cooperatives and other mechanisms) and privately owned distributed energy and micro-grid facilities. The PREB has the expertise and legal authority to develop rules to facilitate competitive development of these resilient renewable resources. They also have the know-how to ensure that deployment of these technologies fits into a long-term vision for both the energy system as a whole and for PREPA.

04.03 Fiscal Oversight Management Board

The Financial Oversight and Management Board (FOMB) for Puerto Rico was created under the Puerto Rico Oversight, Management and Economic Stability Act of 2016. The purpose of the FOMB is to provide a method for a covered territory to achieve fiscal responsibility and access to the capital markets. The Act was enacted pursuant to article IV, section 3 of the Constitution of the United States, which provides Congress the power to dispose of and make all needful rules and regulations for territories.

The FOMB consists of seven members appointed by the President of the United States and one ex-officio member designated by the Governor of Puerto Rico. It is tasked with working with the people and Government of Puerto Rico to create the needed foundation for economic growth and to restore opportunity to the people of Puerto Rico.

With respect to PREPA, and other insolvent government agencies in Puerto Rico, the FOMB has focused on the development of 10-year fiscal plans. However, consensus is that the development of such plans need to be founded on a long-term vision for the energy system. This is attained through the establishment of a clear and purposeful public policy and a regulatory framework that would provide regulators with consistent criteria for the needed development of the electrical system. Long term decisions regarding resource planning need to be made within the context of properly formulated Integrated Resource Plans that would ensure effective investment of capital and promote less dependence on centralized fossil-fuel-based generation located far from demand. It is therefore imperative to ensure cooperation and positive interaction between FOMB and the PREB and avoidance of conflict in their oversight responsibilities.

04.04 PREPA's Fiscal Plan

After an initial certification of the Fiscal Plan for PREPA in April 19, 2018, the FOMB issued a modified Fiscal Plan dated August 1, 2018. In accordance with its mandate the FOMB states: ***"The New Fiscal Plan for PREPA provides a roadmap to shedding this history and emerging from these storms by creating a new power sector for Puerto Rico that will: provide electricity below 20 c/kWh; deliver low-cost, clean, and resilient power; rebuild and maintain a modern, reliable grid; implement operational efficiencies to lower cost and improve service; and establish a fiscally responsible entity***" The new Fiscal Plan also states that it provides for approximately $12 billion capital investment program over the next five years to help achieve the goals of low-cost, reliable, and resilient power. Funding is proposed through a combination of federal funding, private investment, and rates. The plan lays out the approach of attracting a private sector concessionaire to manage the grid, while privatizing generation. The FOMB acknowledges in the PREPA Fiscal Plan that the ultimate form of the transformation will be informed by many elements currently unknown and beyond PREPA's control including market appetite for the transaction and legislative action.

Within the uncertainties noted in the plan, we must highlight the need for a new Integrated Resource Plan (IRP) to reassess the needs under a new set of load scenarios (projected in a considerable decrease for the next five years) to achieve long-term goals of system reliability, fuel diversification, resiliency, distributed energy and renewables integration. An Integrated Resource Plan is a utility plan for meeting forecasted annual peak and energy demand, plus some established reserve margin, through a combination of supply-side and demand-side resources over a specified future period.[1]

PREPA's Fiscal Plan recognizes that as part of the energy reform, safeguards and rate regulation will be put in place via a strong regulator to protect ratepayers and ensure the development of a world class energy system via the establishment of the appropriate regulatory framework (i.e., with clear and transparent key performance indicators (KPI's), targets and milestones, including right-sizing operational costs for the new demand environment; delivering projects efficiently across asset planning, procurement, and construction; lowering long term maintenance costs while increasing reliability through predictive maintenance strategies; and lowering long-term fuel and purchased power costs).

05 ADVISORY COMMITTEE DISCUSSIONS AND INFORMATION GATHERING

This report summarizes the discussions held within the PR Senate's Advisory Committee through numerous meetings convened at the Professional College of Engineers and Land Surveyors of Puerto Rico (CIAPR). The report is also supplemented with the integration of reports, plans and materials from many other sources in order to incorporate the vision of various sectors and stakeholders of the Puerto Rico electric system.

05.01 POLICY DEVELOPMENT

As seen in the background information (Section 04 of this report), the energy policy for Puerto Rico has undergone various transformations over the years and as such, its vision has not served as a consistent basis for the development of the electric system and service. As reported by the Department of Energy: "*Many participants expressed the desire for a single vision for the future of*

[1] Best Practices in Electric Utility Integrated Resource Planning. Regulatory Assistance Project, June 2013.

Puerto Rico's electricity sector. The Commonwealth itself must establish that vision and ensure the appropriate governance mechanisms are available to accurately reflect the needs of customers in that vision, as well as guarantee accountability within the management of the energy sector to honor that vision."[2]

Policy statements shall focus on the maximization of Puerto Rico endogenous energy sources, resiliency, reduction of fossil fuel dependency, elimination of the use of coal and promotion of renewable sources. The system shall incorporate social responsibility for universal access to energy sources, be reliable and environmentally responsible. System infrastructure shall be robust and resilient to the onslaught of catastrophic phenomena and other disasters. Conditions shall provide for affordability and ample access, ease and expeditious response in terms of customer services. Policy should also aim to promote conversion of current centralized generation plants to a model that incorporates distributed generation, is less centralized, and that operates on multiple sources of energy. It should also be free of barriers for the integration of new technologies, allowing for its transformation.

05.02 REGULATORY FRAMEWORK

05.02.01 Role of Energy Regulator as Foundation

As part of the 2014 energy reform, the Puerto Rico Energy Commission (PREC), now the Puerto Rico Energy Bureau (PREB), was required to adopt rules to ensure high efficiency in the generation of electricity based on fossil fuels. This would lead to a more efficient use of fuel and, consequently, to lower energy production costs and to have an impact on reducing electricity bills. To achieve this, PREC was imposed to ensure that at least sixty percent (60%) of the electric power generated in Puerto Rico based on fossil fuels (gas, coal, oil, and others) was "high efficiency", as such term is defined by the Commission, which would include as a main factor the thermal efficiency of the power plant or facility per type of fuel used, fuel cost, and technology, among others. PREC was required to achieve this objective within a period not to exceed three (3) years counted after July 1, 2014.

Another key mission of the Energy Commission under Act 57-2014 was to evaluate the plans that PREPA is required to submit to the new regulatory entity, in accordance with the provisions of the Act. PREPA was required to submit to the Energy Commission an Energy RELIEF Plan regarding its obligation to efficiently generate electric power, improve utility operations, and ensure the integration of renewable energy, among other mandates. PREPA was also required to submit for evaluation its Integrated Resource Plan (IRP) with a twenty (20)-year planning period. By evaluating and following up on these plans, the Energy Commission would be able to guarantee the orderly and integrated development of our electrical system, thus ensuring the reliability, efficiency, and transparency thereof, and the provision of electric power services at reasonable prices.

In May 2015, the PREC finalized the *Regulation on Integrated Resource Plan for the Puerto Rico Energy Power Authority*, which included, among other points, specific requirements as to information and analytic requirements, and performance metric targets. PREPA submitted its IRP in July 2015, which was rejected by PREC, who issued a Modified IRP in September 2016. On October 13, 2016, PREPA filed a Verified Motion for Reconsideration of Provisions of the Final Resolution and Order. On February 10, 2017, the PREC denied most of PREPA's requests, sustaining fundamental parts of it 2016 decision. In its order the PREC states: "*The IRP provided by PREPA was insufficient in terms of the process and mechanisms*

[2] Energy Resilience Solutions for the Puerto Rico Grid, US Department of Energy, Final Report, June 2018

chosen for achieving the results contained therein. Therefore, the Commission is unable to rely upon the IRP filed by PREPA. If the IRP cannot be used for its intended purposes, then it is noncompliant."

In light of the emergency resulting from the hurricane María, the PREC, in its Resolution and Order dated March 14, 2018 in relation to the *Review of PREPA Integrated Resources Plan CEPR-AP-2018-0001*, authorized PREPA to file an updated IRP on October 2018. As explained in the order:

> *"Section 6B(h)(i) of Act 83 provides that "in the case of substantial change in the energy demand or group of resources [the Commission's periodical review process] shall be carried out before the three (3) years provided herein to respond to and/or mitigate such changes." The Commission finds that a review of PREPA's existing IRP (the February 2017 Modified IRP) prior to the three-year term established in Act 83 and Act 57-2014 is warranted in order to determine the effects hurricanes Irma and María may have had on Puerto Rico's resource needs and determine whether any proposed update, revision or modification is necessary to mitigate "substantial changes in demand or group of resources."*

Another role of the Energy Commission, pursuant to Act 57, is to *"approve the electricity rates proposed by PREPA and other electric power companies in the Island, and shall oversee all types of operations, processes, and mandates pertaining to the efficiency of the energy sector of the Island. It shall be the entity in charge of overseeing PREPA and other power producers, promoting the diversification of our energy sources as well as the reduction of energy costs. The Energy Commission shall carry out its regulatory duties steadfastly and effectively, but preventing its actions from impairing PREPA to meet its contractual obligations to bondholders".*

In accordance with this mandate in its Resolution and Order dated July 15, 2016 in relation to *PREPA Rate Review, CEPR-AP-2015-0001* the PREC determined that the petition for such process was completed, and commented PREPA's first Rate Review process. After an intensive process, on January 10, 2017, the PREC issued its Final Resolution and Order. Important to note is that on this proceeding, important aspects of PREPA's operation were deeply discussed comprising Cost of Service, Unbundling, Rate Design, Marginal Cost and others, in similarity with other jurisdictions with a robust regulatory framework. The proceeding also established PREPA's Revenue Requirement as the base for rate setting. As stated on the order:

> *"With this Order the Puerto Rico Energy Commission ("Commission") takes another step in the long, painful process of providing for Puerto Rico an electric company that excels. The process is long because the culture and practices arising from 75 years of monopoly status, subject to continuous and shortsighted political interference but with no oversight by an objective, professional and apolitical commission, cannot be changed quickly.*
>
> *The process is painful because the damage caused by this culture and these practices-damage in the form of deep debt, a deteriorated physical system, demoralized workers, hesitant lenders, skeptical renewable developers and suffering consumers-will require everyone to bear some cost, and make some effort, to solve the problems.*
>
> *This order is another step because we have already issued five orders that signal to consumers, bondholders, renewable developers and government policy-makers that we are committed to making the difficult decisions, required by the facts we face, to cause the Puerto Rico Electric Power Authority ("PREPA") to emerge from its current crisis and realize its*

potential. Taken together, these orders, along with today's Final Resolution and Order, seek to produce the fiscal health and professional excellence PREPA needs to satisfy its obligations to its bondholders and its customers".

Act 57-2014 also established that the "*Energy Commission shall be subject to the Legislative Assembly's strict scrutiny in order to ensure that it fully complies with its duties and responsibilities. If the Commission properly carries out its mandate, the Legislative Assembly may consider attaching or merging it with other public utilities regulatory commissions already existing in the Island".*

Regarding the role of the energy regulator, the Advisory Committee agrees on the following:

- An independent energy regulatory entity, adequately funded, with broad powers and duties, shall be the main element of the Puerto Rico electric system transformation.
- The regulator shall continue to have authority over all electric service companies serving Puerto Rico, including PREPA, its successor and any other electric power company in the Island; including also T&D companies and any other electric power company allowed to operate in Puerto Rico, either public or private.
- The regulator shall ensure compliance with energy policy, having as its main priority the protection of energy consumers.
- The regulator shall exercise high scrutiny on the operations and maintenance of PREPA, or its successor and any other power generator or energy unity servicing Puerto Rico.
- The regulator shall oversee and require PREPA, or its successor, to submit annual reports describing the condition of the grid and its maintenance program.

05.02.02 Performance Based Regulation

On November 15, 2016, the PREC started the proceeding No. CEPR-IN-2016-0002, *the Performance of PREPA.* The proceeding intended to identify opportunities to improve performance of the utility. The process commenced with an initial investigation that comprised several hearings during 2017.

Performance-based regulation (PBR) is also used in other jurisdictions. It includes many tools, most prominently performance incentives that reward utilities for delivering excellent performance but penalize them for doing poorly. It seeks to align utility motivations and profit incentives with policy objectives and the customer interest. In its broadest definition, PBR may include several tools, including:

- Decoupling
- Multi-year rate plans
- Performance Incentive Mechanisms (PIMs) and Key Performance Indicators (KPIs)
- Benchmarking
- Earnings sharing mechanisms

PIMs and KPIs establish specific benchmarks and objectives for utilities to pursue and attach financial rewards or penalties for their achievement. Importantly, PIMs and KPIs themselves will not accomplish goals; they can be poorly designed and, in the worst case, result in perverse incentives.

Performance metrics measure in a transparent manner the performance of the utility. As indicated by PREC during the *Performance of PREPA* proceeding:

> *"The purpose of performance metrics is to provide the utility, the regulator and interested parties a means of measuring in a transparent manner how a utility is performing in a number of key areas that are critical to a well-functioning utility. Periodic reporting of metrics provides the ability to assess whether the utility's performance is satisfactory, whether it has made progress, or whether performance is declining. Performance metrics have several key components: the identification of what is to be measured; the measurement tool used to assess the performance; and the establishment of a target for performance in that category".*

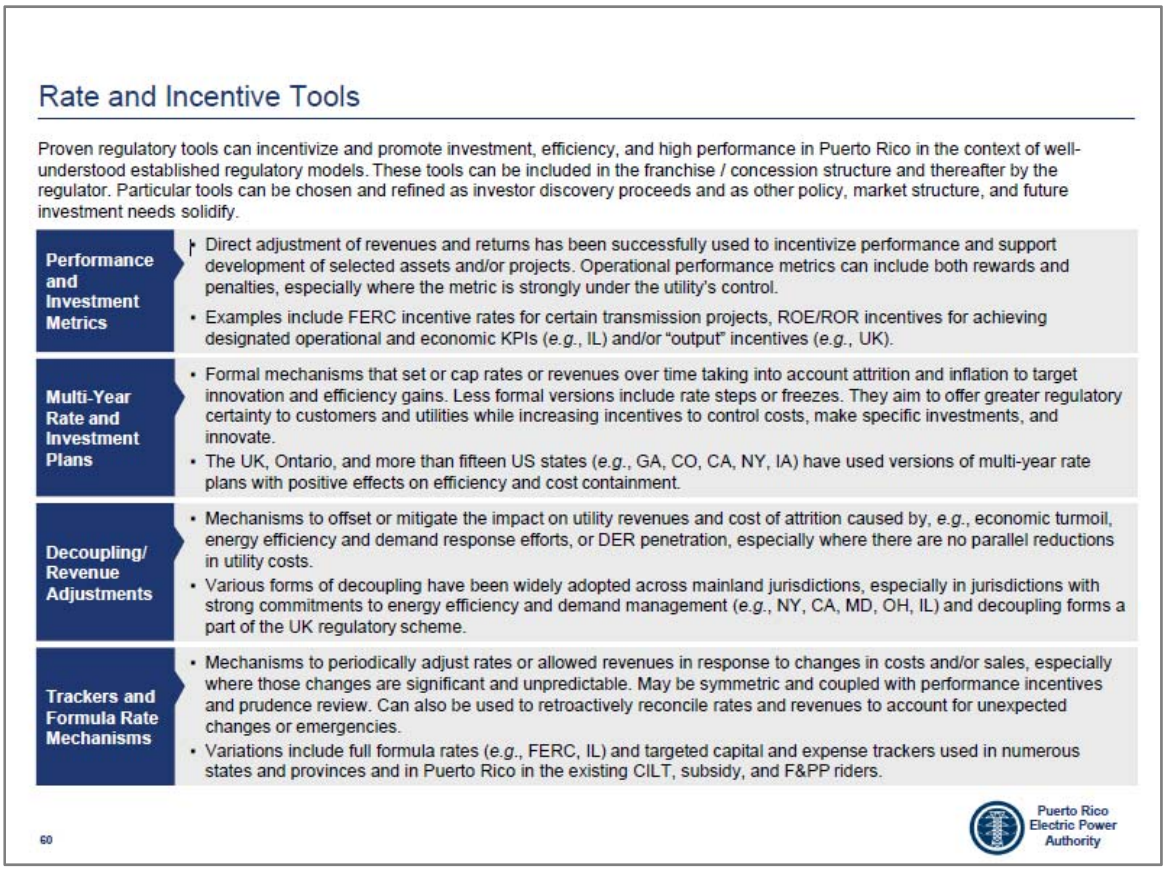
Governor Rosselló's transformation plan, and the FOMB-approved PREPA fiscal plan, envision transferring operation of the T&D system and retail energy service to a private for-profit entity under a concession model. Traditionally investor-owned utilities earn their profit primarily based on the amount of capital they invest. If PIMs are not used or not implemented properly, a utility's incentive to maximize capital investment could result in high costs to consumers and lack important elements such as high quality customer service, reliability and use of modern technologies. This also applies for transmission and distribution (T&D) systems.

As indicated in the NREL and RAP report on PBR (Littell, et al., 2017), well-designed PBR provides incentives for utility performance, and benefits consumers and utility owners alike. The report concludes that PBR has the potential to realign utility, investor, and consumer incentives, and mitigate emerging challenges to the utility business model, alleviate the challenges of and accelerate renewable integration, and even address cyber security concerns. It also states:

> *"PBR that succeeds often does so because it relies on clear goal setting, uses a simple design, makes value of the utility service clear, and is transparent at each step. Alignment of incentives and benefits for customers and ratepayers tends to make the relationship of the cost of incentives and value of performance easier to understand.* ***Metrics that are clearly identified with objective information support ease of implementation, accountability and the transparency of the value proposition to regulators, utility management, customers, policy-makers, and the public****". [Emphasis added]*

PBR has been used in the U.S. and abroad with successes and failures. Many jurisdictions in the U.S. have used PBR to motivate adoption of energy efficiency goals and satisfaction of targets and metrics. For example, at least 26 U.S. states have used performance incentives to encourage energy efficiency deployments. In California, the use of PBR has produced some successes as well as some notable failures. Other states such as New York have undertaken an ambitious effort to transform its regulatory system. New York's effort aims to construct a regulatory system that rewards distribution utilities for high levels of customer satisfaction.

PREPA's modified fiscal Plan of August 1, 2018 includes consideration of performance incentives and suggests specific performance metrics.



Rate and Incentive Tools

Proven regulatory tools can incentivize and promote investment, efficiency, and high performance in Puerto Rico in the context of well-understood established regulatory models. These tools can be included in the franchise / concession structure and thereafter by the regulator. Particular tools can be chosen and refined as investor discovery proceeds and as other policy, market structure, and future investment needs solidify.

Performance and Investment Metrics	• Direct adjustment of revenues and returns has been successfully used to incentivize performance and support development of selected assets and/or projects. Operational performance metrics can include both rewards and penalties, especially where the metric is strongly under the utility's control. • Examples include FERC incentive rates for certain transmission projects, ROE/ROR incentives for achieving designated operational and economic KPIs (*e.g.*, IL) and/or "output" incentives (*e.g.*, UK).
Multi-Year Rate and Investment Plans	• Formal mechanisms that set or cap rates or revenues over time taking into account attrition and inflation to target innovation and efficiency gains. Less formal versions include rate steps or freezes. They aim to offer greater regulatory certainty to customers and utilities while increasing incentives to control costs, make specific investments, and innovate. • The UK, Ontario, and more than fifteen US states (*e.g.*, GA, CO, CA, NY, IA) have used versions of multi-year rate plans with positive effects on efficiency and cost containment.
Decoupling/ Revenue Adjustments	• Mechanisms to offset or mitigate the impact on utility revenues and cost of attrition caused by, *e.g.*, economic turmoil, energy efficiency and demand response efforts, or DER penetration, especially where there are no parallel reductions in utility costs. • Various forms of decoupling have been widely adopted across mainland jurisdictions, especially in jurisdictions with strong commitments to energy efficiency and demand management (*e.g.*, NY, CA, MD, OH, IL) and decoupling forms a part of the UK regulatory scheme.
Trackers and Formula Rate Mechanisms	• Mechanisms to periodically adjust rates or allowed revenues in response to changes in costs and/or sales, especially where those changes are significant and unpredictable. May be symmetric and coupled with performance incentives and prudence review. Can also be used to retroactively reconcile rates and revenues to account for unexpected changes or emergencies. • Variations include full formula rates (*e.g.*, FERC, IL) and targeted capital and expense trackers used in numerous states and provinces and in Puerto Rico in the existing CILT, subsidy, and F&PP riders.

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Puerto Rico Electric Power Authority

Regarding performance base regulation, the Advisory Committee believes that the PREB shall incorporate performance-based regulation tools into its regulatory framework.

05.02.03 Revenue Decoupling

Decoupling is a regulatory tool used to break the link between the amount of energy a utility delivers to customers and the total revenue it collects. Instead, revenues are adjusted so that utilities receive fair compensation to cover utility costs and to ensure a fair return to shareholders regardless of fluctuations in sales. It aims to remove the utility incentive to increase energy sales, and makes the utility's ability to recover its costs more resilient to an environment with declining electricity sales. This mechanism ensures energy efficiency and distributed generation do not adversely affect utility revenue. Under revenue decoupling the consumers' tariff may vary somewhat year to year. The detailed design of decoupling mechanisms is typically established by an energy regulator, rather than by legislation[3].

The Advisory Committee recommends that the new legislation require the regulator to establish this type of mechanism under the appropriate circumstances.

[3] Revenue Regulation and Decoupling: A Guide to Theory and Application. 2011. The Regulatory Assistant Project.

05.03 MARKET RULES

05.03.01 Retail Wheeling

Wheeling refers to the transportation of electric power over the transmission and distribution system, which may be from an independent power producer other than PREPA to an individual customer or group of customers. On August 7, 2018, the PREB, under proceeding Num. CEPR-MI-2018-0010 *Regulation on Retail Wheeling*, issued an order requesting public comment with regards to retail wheeling. As stated on the order:

> *"The Puerto Rico Energy Commission ("Commission"), pursuant to Act 57-2014, has the power and duty to develop and regulate a wheeling mechanism. In so doing, the Commission has the responsibility to "establish the rules and conditions to ensure that wheeling does not affect in any way whatsoever (including technical problems and rate increases) nonsubscribers of wheeling services."*

The PREC order contains concepts such as non-discriminatory open access to the grid, community choice aggregation and default supplier for retail services (or Provider of Last Resort); including questions propelling discussion in terms of bilateral contracts vs. wholesale markets for energy supply procurement and the implementation of an independent system operator among other important concepts. Retail wheeling can and should be a short-medium term option for industrial, commercial or aggregated residential customers that want to pursue other alternative beyond PREPA for their power supply.

It is the opinion of the Advisory Committee that any statement in Act 73-2008 that limits in any form wheeling mechanisms should be amended to clarify that retail or wholesale wheeling is allowed for high efficiency fossil generation in addition to renewable energy resources.

05.03.02 Provider of Last Resort (POLR)

The availability of energy supply shall be guaranteed to the people. The state needs to identify resources and funds for such purposes. Therefore, PREPA or its successor needs to consider its role as Provider of Last Resort (POLR). The POLR is the designated provider of utility services to customers when other service companies do not want or are unable to provide the service. Designating a POLR will improve system reliability and reduce cost. Moreover, to the extent the market is opened to third party suppliers, utility ownership will provide PREPA or its successor with resources needed to supply residential and small business customers not served by the market.

The DOE Report *Energy Resilience Solutions for the Puerto Rico* states: *"…a program of hardening generation assets would ensure continued resilience to weather events, beginning with critical central plants regardless of ownership".* To be able to assume the role of POLR, PREPA or its successor, may continue to own some generation; particularly, peak high-efficiency gas-fired generation, and utility-scale renewable generation.

The Advisory Committee believes that PREPA or its successor needs to be appointed by law or by regulation of the PREB as Provider of Last Resort (POLR).

05.03.03 Subsidies and CILT

In our current legal framework, there are about 30 subsidies and these account for about $80 million annually in Puerto Rico. Surprisingly, it is not a larger amount but the fact is that there is not a line item in Puerto Rico's budget for subsidies. In the end, subsidized parties are financed by ratepayers.

Act 22-2016 provides that all credits, special tariffs, subsidies, and subventions for energy will be revoked if the customer does not pay for two consecutive months unless the electric bill has not been objected formally. Once revoked, customers do not have further rights to the subsidy. Rights are also suspended if the customer has tampered with the electric meter or sabotaged the service. The Law limits the approved subsidies after Act 22-2016, to a term of 5 years. These include:

a. Hotels, churches and social welfare organizations, beneficiaries of the Nutritional Assistance Program (PAN), low income houses.

b. Customers in public housings by dwelling unit: Fixed Tariff and maximum consumption: 1 bedroom dwelling unit: $30, 600 KWh, 2 or 3 Bedrooms: $40, 800 KWh, 4 or 5 bedrooms: $50, 1,000 KWh.

c. Excess is billed at the same tariff as non-subsidized residential customers.

d. Former OEPPE (Office of Public Energy Policy) was required to conduct a study on residential energy consumption.

e. Residential customers: Partial credit on the bill for consumption up to 400 KWh or a maximum bi-monthly of 800 KWh.

PREPA's Organic Act established a mechanism which consisted of making a contribution or payment (or credit) in lieu of tax (CILT) to municipalities in exchange for PREPA's municipal tax exemption. The formula for the computation of such contribution has been revised on several occasions; the most significant change was incorporated under Act No. 255-2004, as amended by Act No. 233-2011. After examining the Payment in Lieu of Taxes (PILT) mechanism in light of PREPA's current fiscal situation and without prejudice to the serious fiscal limitations faced by more than half of the municipalities, Act 57-2014 established a mechanism for municipalities to achieve savings in energy consumption by establishing a maximum annual cap per municipality for a three (3)-year period. It also created a special incentive system for all municipalities that achieve savings in excess of the consumption cap designated; established a standard measurement to compute the maximum consumption cap; provided for the review of consumption caps every three (3) years; and established that the Commonwealth Energy Public Policy Office and the Energy Regulatory Commission shall be responsible for overseeing faithful compliance with the consumption control measures and the adoption of the necessary regulations to properly address CILT-related matters.

Under proceeding Num. CEPR-MI-2015-0003, the PREC established the Regulation on Contribution in Lieu of Taxes (CILT). The regulation was approved by the PREC on October 16, 2015 and amended on September 21, 2016.

Further analyses need to be made in terms of how CILT is best handled in view of current laws and regulation. Rough estimates of the value of the credit granted for municipal energy consumption, public lighting and customer subsidies is in the vicinity of $225 million. The Energy Commission had begun to regulate CILT; and addressed its costs during the FY 2017 Rate Case. The Energy

Public Policy Office (OEPPE for its Spanish acronym) Director and the Federation and Association of Mayors are also key in this discussion.

Public lighting and subsidies as universal energy access to vulnerable customers and life-preserving equipment needs to be addressed. The government should identify sources of funding for those purposes so that the utility and the rate payers do not bear those costs.

The Advisory Committee recognizes the impact of the CILT on the economy of the energy transformation efforts. However, in light of the significant implications to municipalities, the Advisory Committee makes no particular recommendations, recognizing that this topic requires further analyses and discussion.

05.03.04 Rate Setting and Design

Act 83 of 1941 as amended by Act 57-2014 contains the appropriate regulatory framework for rate setting. In Section 6.3 it established that within the duties and responsibilities of the Energy Commission is to "*[e]stablish and implement regulations and the necessary regulatory actions to guarantee the capacity, reliability, safety, efficiency, and reasonability of electricity rates of Puerto Rico;*"

Following that requirement in July 15, 2016, the PREC held the first PREPA Rate Case. After a regulatory process with public participation, in January 10th, 2017, the PREC issued its Final Resolution and Order. During that proceeding important aspects of PREPA's operation relates to rate setting were discussed comprising Cost of Service, Unbundling, Rate Design, Marginal Cost and others, in similarity with other jurisdictions with a robust regulatory framework. The proceeding also established PREPA's Revenue Requirement as the base for rate setting.

The Advisory Committee recognizes the importance of a regulated rate setting process and reinforces PREB's core role of rate setting.

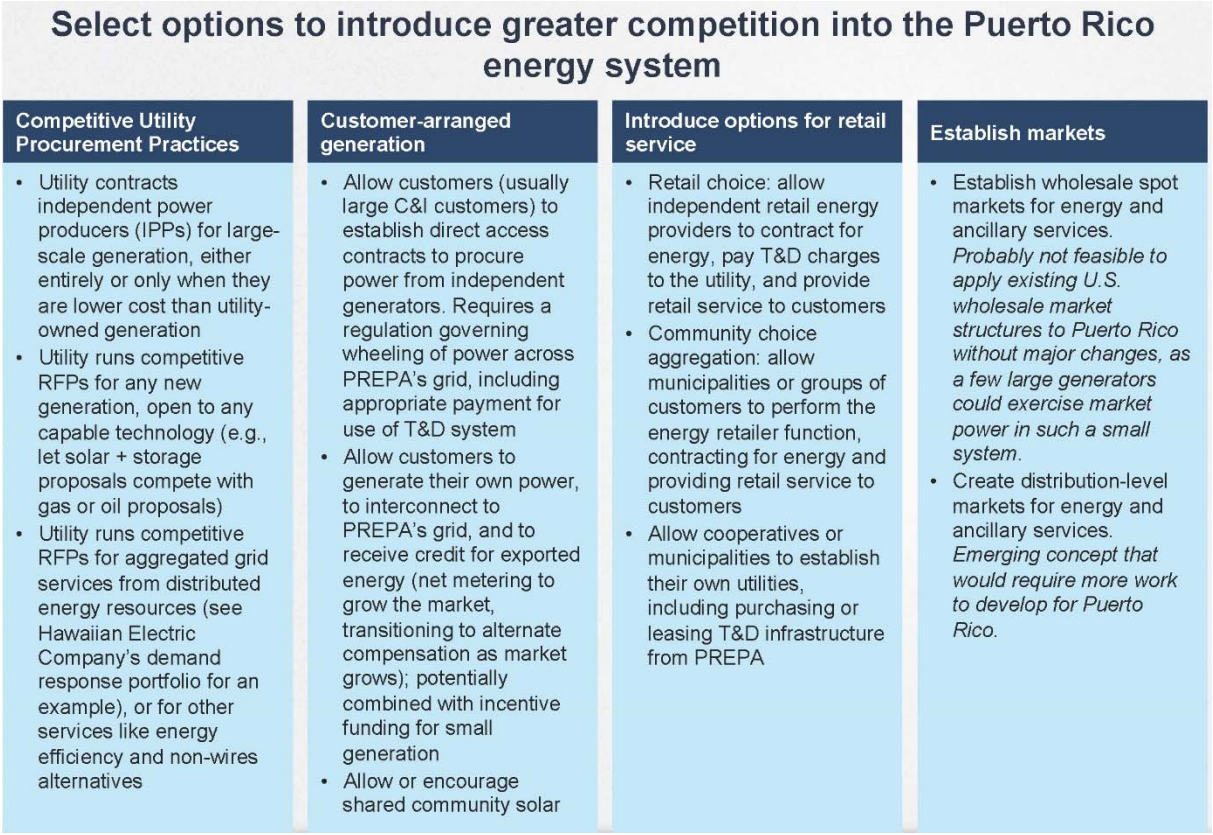
05.03.05 Markets, Competition and Retail Choice

The transformation of the Puerto Rico Electrical System requires a shift from a vertically integrated monopoly towards an electrical system that in the short-medium term allows different options to consumers, per customer class; and in the medium-long term consider more elements of market competition.

Energy customers in Puerto Rico need to have as an immediate alternative self-energy generation comprising an efficient net metering program that considers an expedited certification and interconnection process. Although Act 114 of 2007 allows for the implementation of net metering, the inefficiencies and excessive delays of PREPA disincentive customers to pursue this option. Energy generation systems supplemented with battery storage provide resilience and energy security, which are essential after the passing of hurricanes Irma and Maria. Measures need to be taken to provide for an expedited certification and interconnection process so that customers can depend on the option to generate their own energy through net metering.

Wholesale markets comprising independent procurement and dispatch of energy can be part of further developments that provide benefits to consumers in terms of multiple providers and market

competition. However, bilateral contracts that risk lock-in and crowding out future distributed energy and the development of other alternatives for energy purchase should be avoided.



Source: Rocky Mountain Institute (2018)

Several options exist to introduce greater competition into the Puerto Rico electric power system, as described in the graphic above. Further study would be required for several of these options in order to evaluate their potential to improve the affordability, resilience, and quality of energy service in Puerto Rico. The Advisory Committee recommends the removal of barriers for net metering generation, propelling the increase of distributed generation as a short-term alternative for customer choice; and the strengthening of the regulatory framework and the independent regulator as a foundation for the future creation of energy markets.

05.04 SYSTEM DESIGN

05.04.01 Grid Resilience

General consensus is that a more robust system is necessary, one that would allow for a faster recovery after a disaster. Senate Advisory Committee discussions included several elements that should be considered in meeting the goal of system resilience. Main ideas from group brainstorming were then compared with recommendations in the DOE Report, *Energy Resilience Solutions for the Puerto Rico Grid* dated June 2018. Likewise, recommendations from the report entitled *Build Back Better: Reimagining and Strengthening the Power Grid of Puerto Rico* dated December 2017 were also considered.

Important aspects such as undergrounding of power lines, sectionalizing of the grid, standardization in the distribution infrastructure, controlling vegetation near power lines, relocating transmission lines, interdependence on infrastructure systems and electric poles and towers were discussed under the subject of resilience:

05.04.01.1 New underground lines focused on critical infrastructure

Advisory Committee members agreed that future capital investments to guarantee resilience of the Puerto Rico grid need to consider underground lines with priorities directed towards critical infrastructure and urban centers. These include hospital installations, financial districts, schools, hotels, and basic service infrastructure (such as PRASA), and highly populated areas among others. Similar recommendations were incorporated in the *Build Back Better* report with respect to prioritizing critical infrastructures in view of recovery efforts in the immediate aftermath of a storm event. The DOE Resiliency Report calls for judicious undergrounding of distribution lines in accordance with current regulations.

The Advisory Committee still believes that the investment in underground power lines for selective applications should be of priority. A clear example that provided resiliency during this experience is the 115 kV underground loop in San Juan metropolitan area completed in 2007.

05.04.01.2 Sectionalizing of the Grid

The Puerto Rico Electric grid has the potential to be subdivided into sections that could be serviced with medium and small size generation units and operate as "islands", as required, to sectionalize the grid during emergencies or recovery processes. Within their recommended actions in the DOE report is the analysis of sectionalizing the grid to determine its value. The report addresses selective segmentation to enable system recovery and/or black start restoration (the ability to restore power to a grid section in which all generation has gone offline). The report provides sound recommendations of technologies needed to enable a segmented mode of system operation under section C1D, Selective Segmentation (pages 22-23).

05.04.01.3 Standardization in the Distribution Infrastructure

Many situations developed during the Hurricane María recovery process were related to spare parts inventory levels at PREPA and the variety of distribution voltage levels, especially at urban centers. Urban areas have not incorporated standardization of distribution voltages. To avoid such problems in the future, standardization with national U.S. standards should be considered. The DOE report suggests that USDA Rural Utilities Service (RUS) standards should be adopted where feasible and appropriate to standardize equipment and design, which will aid with replacement in both regular and emergency situations.

05.04.01.4 Vegetation management near power lines

The Advisory Committee discussed the need for the observance of electrical lines right of way and its maintenance. Reductions in maintenance personnel and underinvestment on T&D maintenance has had an impact on the ability of PREPA to maintain cleared access ways and vegetation for transmission and distribution right of ways. This was certainly one of the causes of so much damage in T&D infrastructure from Hurricane Maria. Although devastation resulted in considerable reduction of

vegetation throughout rural terrains, it will grow back quickly and the problem will return to pre-hurricane conditions in just a couple of years if no action is taken to address the problem.

The *Build Back Better* report proposes to institute consistent vegetation management practices along with adequate staffing. The report also states that because of the tropical growth in Puerto Rico, PREPA will likely need to adopt vegetation management practices that are more aggressive than the industry norm. The DOE report also recommends the implementation of industry best practices in a comprehensive vegetation management program to protect the integrity of grid assets. The report presents a few as examples:

- Most utilities trim trees back 10 feet from the circuit in accordance with National Electrical Safety Code (NESC) standards.
- While it is not possible to trim trees for hurricanes, the elimination of overhangs and subsequent tree fall-ins on lines must be a priority and goes a long way toward eliminating tree-related outages.
- It is imperative to have consistent and adequate financial resources to carry out the vegetation management mission. The underlying problem is that vegetation management budgets are easy to cut when the utility faces budgetary issues, so it is crucial to get the company board's approval for a vegetation management program that meets well-defined specifications.
- When engaged in tree trimming, it is imperative to follow tree trimming standards such as ANSI A300 standards, to the greatest extent possible.
- Continuity of tree trimming crews ensures consistent, high quality and adherence to standards in vegetation management for the utility and its customers.

05.04.01.5 Relocation of the transmission lines to areas to be more accessible

The *Build Back Better* report revealed that per PREPA's reports, only 15% of the transmission lines are built to withstand mid-Category 4 storms and the remaining 85% are built to lesser standards.

> *"A key example is the north-south corridor, where damage was extensive, and steep hills and muddy slopes have made access difficult, leading to long repair times. Many transmission corridors, including the North-South line are heavily treed with narrow rights-of-ways. Widening of these corridors is limited due to environmental restrictions to accommodate protected wildlife and vegetation."*

The DOE report also recognizes the opportunity that exists to consider building new transmission corridors along existing roads to facilitate better vegetation management access, as well as quicker access by heavy equipment to repair damaged infrastructure during future storm events. However, DOE recommends that these new transmission lines be considered based on a detailed assessment and modeling and engineering studies. Consistent with the *Build Back Better* report, the Advisory Committee discussions included the relocation of transmission lines along accessible roadside locations to ease access and maintenance. This, however, should be evaluated further after final decisions are made in terms of future grid architecture.

05.04.01.6 Interdependencies among infrastructure systems

Building resilience requires looking at the island holistically, understanding the systems that make up the energy sector and the interdependencies with the other sectors of economic development, housing, physical infrastructure, natural infrastructure, and education, health & social sciences and the risks they may face. The energy sector is a fundamental constituent of the other interdependent sectors. By strengthening resiliency of the energy sector and better understanding the potential shocks and stresses it may face, the island can improve its development in all sectors.[4]

The subject of interdependencies was addressed in the DOE report and represents an important area of consideration for system resiliency. DOE argues that interdependencies among infrastructure systems with electric power can cause cascading failures across various essential services. The report proposes that in order to make efficient investments that mitigate risk effectively and increase the resilience of Puerto Rico, capital planning decisions must address interdependencies between the electric power system and other critical infrastructure that provide much needed services, such as hospitals, water, waste water, waste, telecommunications, and transportation, to counter the cascading effects of power losses.

The report indicates that in order to address interdependencies between electric power and other critical infrastructure, Puerto Rico should conduct, with the engagement of federal agencies as appropriate, an analysis to identify interdependencies and to help coordinate large-scale, regional infrastructure projects. It also states:

> *"Furthermore, given the breadth of interdependencies across sectors, assessment of potential alignment and sequencing of federal funding across different agency programs that support various sector infrastructures, potentially across multiple areas of the islands including Puerto Rico and U.S. Virgin Islands, would be beneficial."*

Recommendations for Policy goals and regulatory requirements in relation to interdependence among infrastructure systems are later incorporated in this report under the subject of *Energy Infrastructure Design, Resiliency, Maintenance and Safety*.

05.04.01.7 Electric poles and towers

Another concern elevated by the Advisory Committee members was related to vulnerability of electric poles and the loading beyond capacity due to multiple utilities attached to them. Current law permits the combined used of electric poles for additional services beyond power, including telecommunications. Legal framework should be reviewed in order to establish a better criteria and controls for safe use of PREPA infrastructure. The DOE report recommends that the Puerto Rico Energy Bureau (PREB) should coordinate a joint study with the Puerto Rico Telecommunications Bureau to determine and enforce safe loading requirements of distribution poles carrying both electric and telecommunications infrastructure.

In terms of wind capacity, DOE recommends that all replaced poles and towers should be of a design and material to survive 150 mph sustained winds. DOE further proposes that if funds are available, electricity transmission towers installed specifically for temporary emergency restoration after

[4] Reimagina Puerto Rico. Energy Sector Report. 2018. Resilient Puerto Rico Advisory Commission.

Hurricanes Irma and Maria should be considered for replacement as soon as practicable, potentially by monopoles.

The *Build Back Better* report makes a solid recommendation that should be considered very seriously in future policy legislation and/or regulation. The report advises that PREPA may need to better manage its distribution pole attachments by performing wind loading studies and requiring attachment owners to fund required upgrades. This Advisory Committee supports this observation.

The *Build Back Better* report also recommended relocating and upgrading up to 350 miles of overhead transmission lines. In addition, it states that at a minimum, structures located in areas prone to high winds should be reinforced to withstand Category 4 storms, including lines along the critical North-South corridor.

Local regulation should be developed considering recommendations of both, the DOE and the *Build Back Better* reports.

05.04.01.8 Risk management planning to address risks, severe events and climate change

The aftermath from Hurricanes Irma and María revealed the state of the risk management capacity resilience across the electricity system and identified a number of opportunities that should be the focus of future design, development and utility planning. First, PREPA or its successor, as the service provider, and PREB, within its regulatory role should focus on addressing current needs by seeking to increase the electrical grid's current level of robustness and reliability to the range of high frequency, routine risks to which it is exposed and to make incremental improvements in their mitigation. Second, significant gains in resilience will come from recognizing and addressing those challenges that the sector is not currently well-equipped to manage, and result from high impact, low frequency events (severe events such as hurricanes, floods, earthquake and droughts) and climate change.

Despite a general consensus regarding the value of enhancing the electricity system's resilience, a number of constraints act to slow or prevent new action. PREB should study concerns regarding the financing of investments in resilience, coordination of action across the diverse group of actors (utilities, regulators, and consumers), and the different scales causing decision-making a complex task. PREPA needs to better understand the likelihood and consequences associated to severe events and climate change, and need to enhance risk management options, technologies, and planning to address a broader range of contingencies. To this end, and the complexities expected with the sector transformation, it is crucial to develop the capacity for viewing, modeling, assessing, and managing the electricity system as an integrated infrastructure network, rather than a collection of discrete components, to advance the overall system's resilience by an integrated long-term mitigation program.

The following recommendations are presented to guide future decision-making to enhance resilience and address the complexities presented above:

- Build PREPA to severe events and climate change, capability to incorporate threats into the IRP, risk assessments and cost/benefit analyses of interventions or management strategies.
- Develop scenario-based planning to explore multiple contingencies to stress test the system and identify gaps in resilience.

- Develop scalable resilience metrics/indicators for the electricity system in order to progress toward risk management and resilience objectives, provide early warning of potential weaknesses in the system and regulate.
- Extend plan and operational standards beyond the traditional reliability requirements into resilient design principles that result in a common basis for electricity infrastructure owners and PREPA to ensure that their system will interoperate with other adjacent infrastructure associated with the interconnected power system.
- Increase PREPA capacity to assess and manage climate changes, population, technology, and societal preferences, and their resulting uncertainties. Understand whether risks are increasing or decreasing and whether those trends vary over different geographic areas within Puerto Rico.
- Promote policies and practices that can streamline assessment and decision-making while enhancing coordination and communication between the different actors.

05.04.02 Grid Architecture

The physical grid architecture refers to the location of generation in relation to load, the transmission required for the system; type of grid, whether a main central grid is to be used or a series of regional mini-grids; and what redundancy exists in the transmission system. The specifics of grid architecture are generally approved through regulatory processes as proposed by utility planning. In Puerto Rico, a resilient electric system can be achieved through a decrease in reliance on cross-island transmission lines, or on the transmission system overall, and the establishment of small scale generation through the island. By matching generation capacity with demand by region, instead of increasing generation in the south, the system could increase generation diversification and resilience and reduce T&D losses and costs.

There have been many different proposals regarding the Puerto Rico grid architecture. Some include sectionalizing the grid into various mini-grids by region. As indicated earlier, all these offer value for resilience. However, the DOE report emphasizes that such alternatives require real in-depth analyses that have not yet been conducted. To support system resilience, legislation should encourage greater use of distributed generation, with the required evaluation and analysis from the state entities empowered by law to conduct such work. Options could include:

- Increasing use of small-scale generation at central and distribution level.
- Resiliency based incentive programs intended to propel distribution generation through photovoltaic solar panels, battery storage systems, and high efficiency generation as Combined Heat and Power (CHP); in addition to enabling community solar and microgrids, among other initiatives.
- Development of the required analysis, guidelines and regulations by PREB and the State Office of Energy Policy.

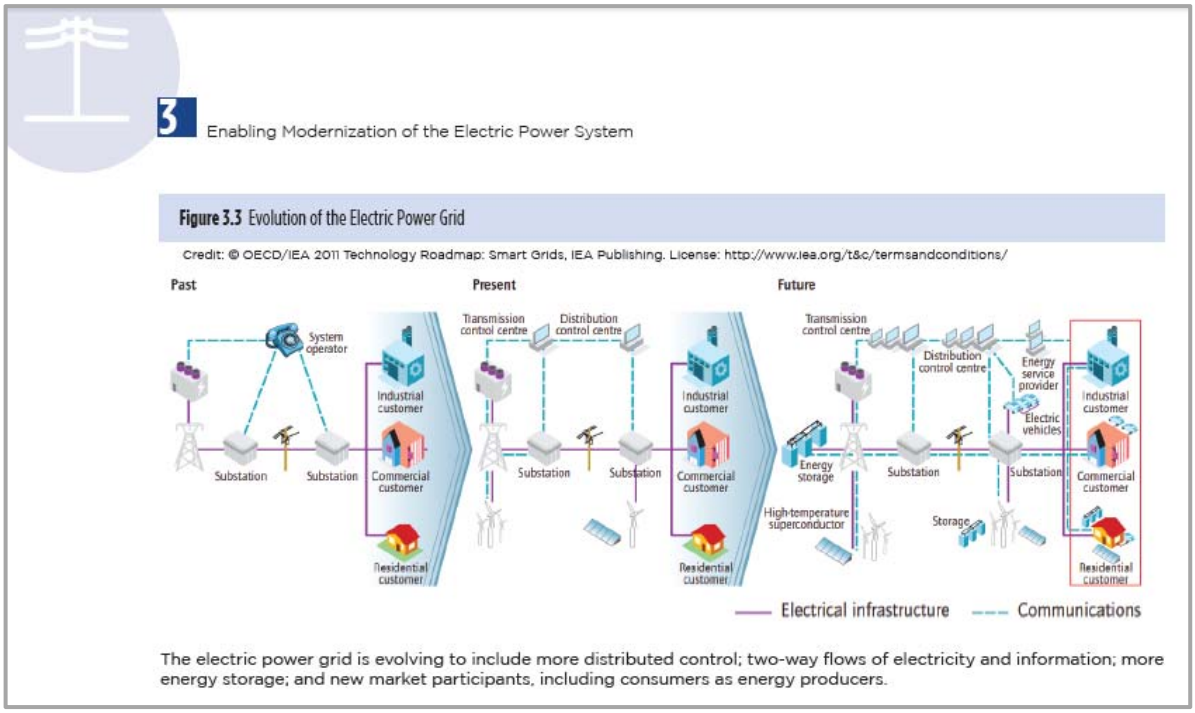
Sectionalizing is not unusual to our electrical system. Presently, selected areas are disconnected from the grid during lack of generation during a power failure. However, greater distributed

energy resources across the island, and new control and automation technology can add resilience to the system, making the grid less dependent on long transmission lines.

05.04.03 Grid Modernization

The DOE *Quadrennial Technology Review*[5] defined grid modernization as one that encompasses the application of intelligent technologies, next-generation components with "built-in" cybersecurity protections, advanced grid modeling and applications, distributed generation, and innovative control system architectures. The report mentions that the Electric Power Research Institute and others estimate this will require $338 – $476 billion of new investment (in addition to investments for reliability and replacement) over the next twenty years.

Specific grid modernization technologies identified in the *Build Back Better* report include Distributed Energy Resources Management System (DERMS) and Advanced Distribution Management System (ADMS); integrated with Fault Location Isolation and Service Restoration (FLISR), Volt-VAR Optimization (VVO), Conservation Voltage Reduction (CVR), and others. Implementation of these technologies normally depend on a technology investment plan developed by the utility under the oversight of the regulator. Adoption of these technologies can offer improved system reliability, resilience, and efficiency, and greater ability to integrate variable renewable energy into the grid. The Advisory Committee believes the Energy Bureau must be empowered to oversee, or to direct, decisions to invest in such technology to ensure it is used for maximum public benefit and that utility investments are prudent.



Source: Quadrennial Technology Review. 2015. U.S. Department of Energy, P. 56.

[5] Quadrennial Technology Review. 2015. U.S. Department of Energy

05.04.04 Renewable Portfolio Standard (RPS), Including Enforcement and Penalties

Puerto Rico Act 82 created a Renewable Portfolio Standard (RPS), requiring load serving entities to supply increasing shares of retail sales with qualified renewable sources at the following levels:

- 12% in 2015
- 15% in 2027
- 20% in 2035

PREPA has not met RPS targets to date. Distributed solar generation currently is not being counted towards RPS compliance. Senate Bill 773, sponsored by Senator Seilhamer, proposed new renewable goals of:

- 15-20% by 2028
- 25-30% by 2035
- 40-50% by 2050

Various discussions and processes have been made to indicate a clear roadmap in terms of Puerto Rico's RPS goals. The most recent effort was the Public Collaborative for the Puerto Rico's Energy Transformation organized by the Institute for Competitiveness and Sustainable Economy of Puerto Rico (ICSE-PR) and Rocky Mountain Institute (RMI). During the Collaborative over 40 participants comprising all sectors of Puerto Rican society co-created a vision for the energy future which included an RPS of 50% for 2035 and 100% for 2050, subject to regulatory proceedings.

Important factors need to be revisited in terms of the RPS value. It should be clearly established that RPS goals also comprise energy generated at distribution level by all customer classes. Act 82-2010 should be modified to clearly provide for all customer classes, included but not limited to residential, commercial and industrial classes, to sell their Renewable Energy Certificates (RECs) to PREPA or its successor.

05.04.05 Imported Fuels, Pipelines and Major Infrastructure Investment

In regards to this matter, the Advisory Committee discussions involved several subjects, which were also evaluated in light of recommendations from the DOE Energy Resiliency Solutions for the Puerto Rico Grid report. The following topics were addressed:

05.04.05.1 Fossil fuel generation plants as a transitional resource

Considering an RPS between 30 to 50% by 2035, high efficiency fossil fuel generation needs to be conceptualized as a transitional phase towards a continuous increase of Puerto Rico endogenous renewable energy sources. With this in mind, fuel options should be based on options cleaner than oil, such as natural gas and other secondary options such as propane.

The Advisory Committee consensus is that public policy should emphasize the transitional role of natural gas towards an increase in the use of endogenous renewable energy resources for power generation, and not allow any large scale gas infrastructure investments in the near term that could lock

in and crowd-out future distributed energy and the development of other alternatives for energy generation.

05.04.05.2 Strategically locate new smaller and more efficient centralized generation

The generation of electricity with smaller and more efficient plants that have a better response to changes in the system would also add to system resiliency. DOE recommendation stands in those lines:

> *"Evaluate the siting of key generation facilities so that, to the extent practicable, they are co-located with key load centers to reduce the criticality of the transmission system when recovering from anticipated extreme events in the future. In particular, analysis on re-powering Palo Seco with alternative fossil fuels is recommended".*

The Advisory Committee believes that consideration should be given to new flexible smaller centralized generation plants with capacity ranging from 100 to 300 MW, comprised of smaller generation units of 50 to 100 MW. Final determinations regarding the sizing of generation capacity should be made within the IRP proceeding with the oversight of the independent regulator.

05.04.05.3 Eradicate the use of coal as a source of power generation

The Advisory Committee recognizes and supports that one of the goals set forth in PR Senate Bill 773, sponsored by senator Seilhamer, is to discontinue the use of coal as electricity generation fuel in order to reduce the green house effects in the atmosphere. The bill intends to prohibit the concession or extension of permits for the establishment of energy producing outfits in Puerto Rico based on the use of coal. Energy policy shall consider to eradicate the use of coal by 2028.

05.05 NEW TRENDS AND ALTERNATIVE MODELS

05.05.01 Microgrids

The DOE defines microgrids as follows:

> *A group of interconnected loads and distributed energy resources (DER) within clearly defined electrical boundaries that act as a single controllable entity with respect to the grid. A microgrid can connect and disconnect from the grid to enable it to operate in both grid-connected and island mode. A remote microgrid is a variation of a microgrid that operates in island conditions*.

Microgrids can provide valuable resilience and continue to power critical facilities, community facilities, businesses or private customers even when the larger grid is unavailable. Microgrids that remain connected to the larger grid can provide many valuable services to the grid and strengthen the entire system. Such services include ramping, demand response, capacity, frequency regulation, and other ancillary services. There is currently no market, tariff, or other mechanism for microgrids to provide this value to the Puerto Rico grid.

Act 133-2016 addresses microgrids, directing the Energy Public Policy Office to establish a plan for the development of microgrids in Puerto Rico, and directing the Puerto Rico Energy Commission (now PREB) to establish a regulatory framework for microgrids. On May 16, 2018, the Puerto Rico Energy

Commission approved the Regulation of Microgrid to provide for the development of Microgrids throughout Puerto Rico. According to PREC, prolonged outages and their impacts on the citizens of Puerto Rico caused by Hurricanes Irma and Maria highlighted the need to foster the creation of microgrids as a means of delivering reliable energy services to customers in need, avoiding the loss of power at critical facilities, promoting customer choice, reducing carbon pollution and spurring economic development while integrating new technology and industry trends into Puerto Rico's energy market. Accordingly, microgrids and other distributed generation resources are a key component of the Government of Puerto Rico's strategy for rebuilding and strengthening Puerto Rico's electric power system.

On January 3, 2018, the PREC published proposed rules for the development of micro-grids under proceeding Num. CEPR-MI-2018-0001, *Regulation on Microgrid Development*. As indicated by the PREC in its resolution, these rules contain the components that the Commission considers necessary for an accurate and reliable environment for microgrids, therefore promoting the development and investment in such systems.

After a regulatory process that included public participation, on May 16, 2018 the PREC approved the final microgrid regulation. In a separate order, also on May 16, the PREC required PREPA to develop a regulation for the interconnection of microgrid systems to Puerto Rico's electric grid, as follows:

> *"On May 16, 2018, the Puerto Rico Energy Commission approved the Regulation of Microgrid Development ("Final Microgrid Regulation") The Final Microgrid Regulation sets forth the regulatory framework required to promote and encourage the development of microgrid systems in Puerto Rico, enable customer choice and control over their electric service, increase system resiliency, foster energy efficiency and environmentally sustainable initiatives and spur economic growth by creating a new and emerging market for microgrid services.*
>
> *An essential component for the successful implementation of microgrid systems as a solution to Puerto Rico's energy needs is the ability of these systems to interconnect to Puerto Rico's electric grid, currently administered by the Puerto Rico Electric Power Authority ("PREPA").*
>
> *Accordingly, PREPA is hereby ORDERED to develop a regulation which shall govern the interconnection of microgrid systems to Puerto Rico's electric grid. PREPA shall file with the Commission, a draft version of the proposed regulation on microgrid interconnection no later than 120 days from the date this Order is notified. Prior to filing the draft regulation with the Commission, PREPA must ensure compliance with Section 2.2 of Act 38-20172 related to public participation in rulemaking proceedings. The draft regulation to be filed by PREPA with the Commission must incorporate any amendments made to the proposed regulation as a result of the public comments received during the 30-day period established in Section 2.2 of Act 38-2017".*

The Energy Bureau has since extended the deadline for PREPA to submit this interconnection regulation until October 31, 2018 and stated their intent to initiate a rulemaking procedure to develop this regulation in the event PREPA fails to comply with this deadline. The Advisory Committee understands that PREB should maintain the authority to establish such interconnection rules, and the authority to establish related tariffs governing both compensation microgrids should receive for energy and services provided to the grid and pricing what microgrids should pay for energy and services received from PREPA.

The PREC microgrid regulation authorized shared microgrids among customers, but did not address several important points:

- The ability for microgrid owners to use (or buy) PREPA distribution lines.
- The terms of sales of energy or grid services between the microgrid and PREPA.

Recent Hawaii legislation (Act 200, House Bill 2110 of 2018) directs that state's public utilities commission to open a proceeding to establish a microgrid services tariff to provide fair compensation for electricity and grid services provided by the microgrid to the utility (or by the utility to the microgrid).

Advisory Committee discussions addressed the opportunities for development of microgrids, which provide benefit especially in remote rural communities and critical infrastructure. Mutual benefits from the main grid to the microgrid and vice-versa should be considered. Grid ancillary services provided from the microgrid to the main grid such as load shifting, ramping, and regulation; and backup power provided from the main grid to the microgrid should and need to be valued. In those terms, the consensus from the Advisory Committee is that connection of microgrids to the main central grid (for backup purposes and to provide ancillary services to the main grid) is essential and offers substantial value to the Puerto Rico electric grid and should be encouraged through appropriate pricing structures, market design, and/or utility programs to support dependable and continuous service to all customers. The PREB should maintain the responsibility and authority to ensure such mechanisms are created to maximize the value of microgrids.

DOE also supports the goal of deploying microgrids to these communities. In its June 2018 report, it states:

> *"While there is economic and reliability value in being connected to the PREPA system during normal conditions, storm recovery and community support can be enhanced through these community-based microgrids in more remote areas of the Commonwealth. In addition, while further analysis is required before developing specific recommendations, microgrid investment has the potential to be more cost effective than alternative system upgrades to harden the system for improved function and reliability".*

Microgrids for critical infrastructure also represent an important application of this technology. This includes installations such as hospitals, schools, emergency shelters and emergency services facilities, airports, and ports. The DOE report also concurs that the services that microgrids provide can support different applications, such as critical infrastructure, industrial sites, and basic service in remote areas.

Recommendations from the Advisory Committee is to consider the following:

a) Connection to the main central grid (as backup and for grid services purposes) should be considered essential and needs be strongly encouraged and incentivized to ensure a dependable and continuous service to customers.

b) PREB needs to develop microgrids interconnection rules, with own resources or through PREPA by means of a regulatory process.

c) PREB needs to assess the value of microgrids services to the main grid and establish parameters for grid services tariff to govern compensation for services exchanged between the microgrid and PREPA and vice-versa.

d) PREB needs to clarify whether cooperatives or municipalities will have the right to purchase or lease PREPA distribution infrastructure to facilitate their microgrid installation. PREB needs the legal authority and enforcement powers to ensure PREPA or its successor meet these expectations in a timely and cost-effective manner.

05.05.02 Community Solar

Community solar projects are generally shared solar plants of modest size (commonly 0.5-5 MW), with multiple customers acting as off-takers[6]. Many community solar projects subscribe residential customers, including those who cannot put solar on their own roofs. Community solar can give more customers access to solar power, including those who cannot install rooftop solar (for instance, those living in apartment buildings, or with unsuitable roofs). It shares benefits with small-scale residential solar. It is preferably located close to load so it does not require use of the transmission system lines. Most community solar policies elsewhere in the U.S. authorize net metering arrangements for community solar subscribers to receive credit on their invoices for shared solar generation.

Community solar is addressed in existing law, under Act 133-2016, which directed the Energy Public Policy Office (now Energy Public Policy Program) to identify best practices for community solar, and directed PREC to regulate community solar projects.

Recommendations from the Advisory Committee in terms of community solar includes:

- Provide net metering arrangements for community solar subscribers, including allocation of invoice credits.
- Requiring the PREB to establish a community solar program, including: (1) to evaluate requirements for low-income customer access to community solar; and (2) PREB to develop a prescribed amount of community solar.

05.05.03 Distributed Generation and Net Metering

Net metering is a common policy that makes it easy for customers to get credit for their solar generation during times when they export power back to the grid. Thirty eight states and four territories offer some form of net metering policies today[7]. Many impose size limits on net metered systems.

In Puerto Rico, Act 114-2007 created the net metering program. Acts 57-2014 and 133-2016 continued to remove barriers to customer participation in net metering. Some states authorize aggregate net metering, allowing a customer with multiple facilities to credit excess generation at one site against consumption at another. In terms of the importance of Renewable Energy Credits (RECs) ownership to meet state Renewable Portfolio Standards (RPS), some states such as Colorado, require a percentage of

[6] Focusing the Sun: State Considerations for Designing Community Solar Policy. Cook and Shah. 2018. NREL, DOE.
[7] State Net Metering Policies. National Conference of State Legislatures. http://www.ncsl.org/research/energy/net-metering-policy-overview-and-state-legislative-updates.aspx

retail sales to come from distributed generation. These RECs are owned by distributed generation customers.

Recommendations from the Advisory Committee in terms of net metering include:

- Distributed energy generated through net metering programs should be part of the Renewable Portfolio Standard (RPS).
- RECs need to be owned by distributed generation customers.

05.05.04 Interconnection

Since February 2017, Puerto Rico possesses modern regulation in terms of interconnection of distributed generators, a regulation that counted with the oversight of the PREC as required by Act 57-2014; and included significant changes as "plug and play" interconnection for distributed generators below 10 KW. Notwithstanding, PREPA has had a poor track record of timely interconnection of customer solar under net metering.

In terms of microgrid interconnections, PREC required PREPA to develop a regulation which shall govern the interconnection of microgrid systems to Puerto Rico's electric grid. In the order dated May 16, 2018 PREPA was required to file with the Commission a draft version of the proposed regulation on microgrid interconnection by mid-September 2018. As indicated previously, the Energy Bureau has since extended the deadline for PREPA to submit this interconnection regulation until October 31, 2018.

The Advisory Committee recommends the incorporation of robust penalties and fines to PREPA or its successor when there exist excessive delays in the certification or interconnection of distributed generators into the electrical system. Concurrently there shall be lawful consequences to the personnel if an act of negligence is proven by the local authorities.

05.06 UTILITY

05.06.01 Privatization, Concession Models and Ownership Structures

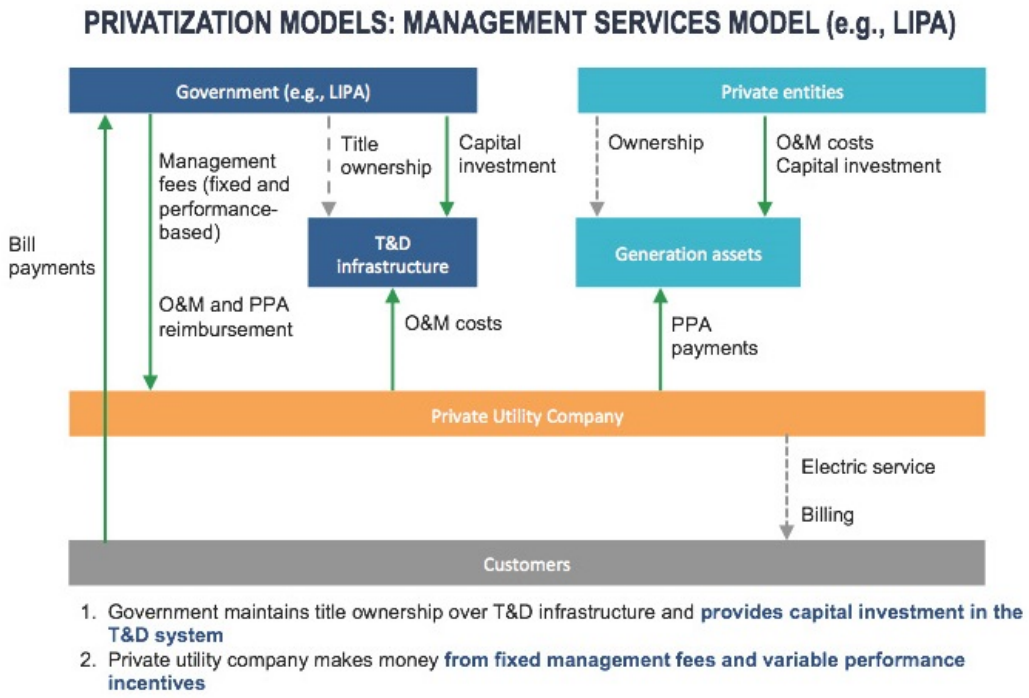
Depending on the model selected on the concession of PREPA T&D system, either an operations agreement or lease of assets, it could have further impact on consumers resulting from the source and cost of capital required for the reconstruction of the grid. The use of an Operation Agreement of the T&D for the concession could allow for the use of federal funds, resulting in less cost of capital required and lesser cost to consumers. An example of this concession model is the Operations Services Agreement between Long Island Lighting Company (D/B/A LIPA) and PSEG Long Island LLC of December 2011. On the other hand, a concession model based on lease of assets could bear additional costs to consumers if it limits the ability to use federal funds for the reconstruction of the grid.

The PREPA Fiscal Plan submitted by the utility to the Financial Oversight and Management Board (FOMB) on April 5th 2018 describes two models for private operation of the Puerto Rican grid, which are depicted below:

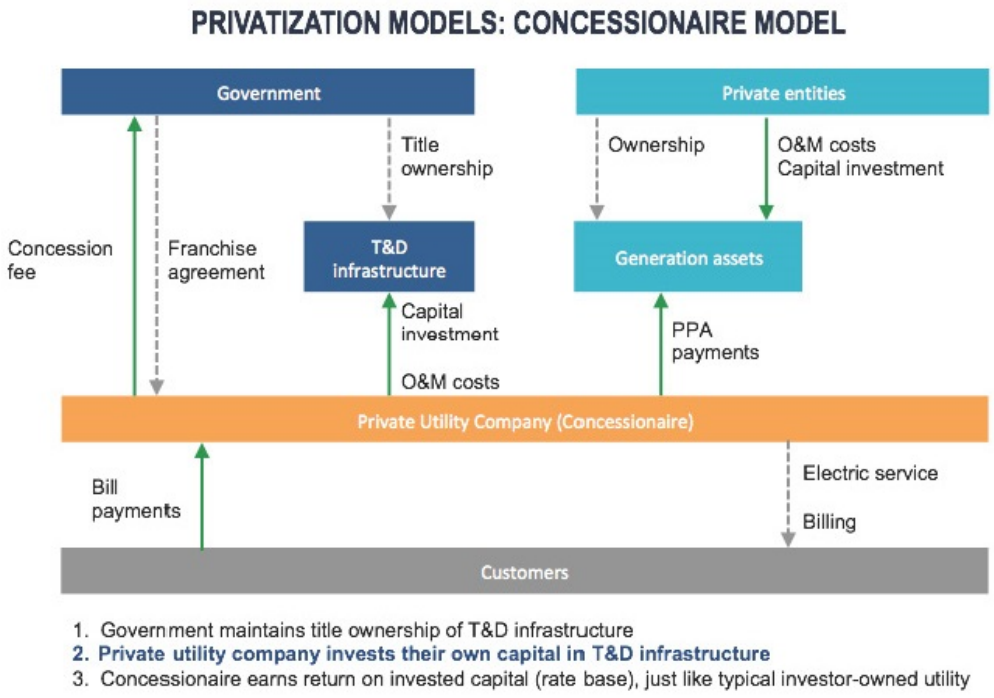
- Management Services Agreement, similar to the Operations Services Agreement between Long Island Lighting Company (D/B/A LIPA) and PSEG Long Island LLC, dated December 2011.

- T&D Concession, similar to a lease of asset agreement, where the concessionaire has the right to collect all revenues and the responsibility to pay all costs generated by the T&D system.

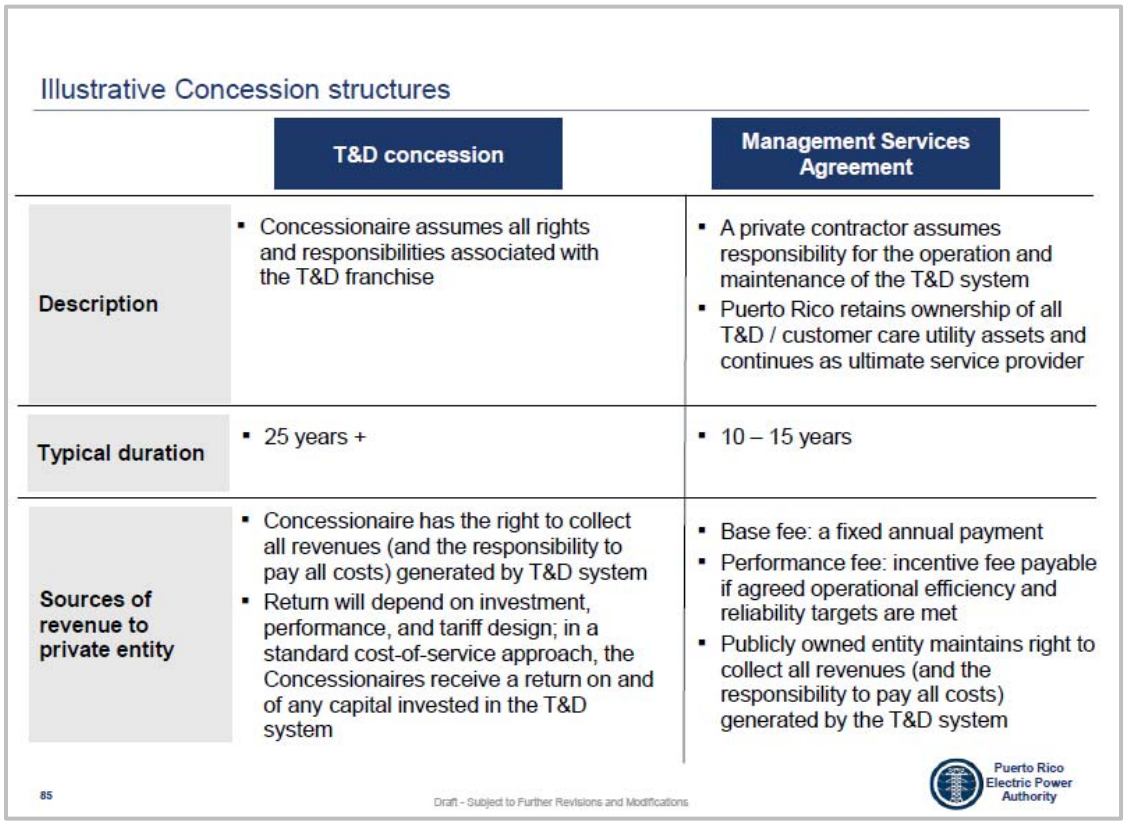
The final approved fiscal plan focuses on the concession model, which differs from LIPA and more closely resembles an investor-owned utility business model.



Source: Rocky Mountain Institute (2018)



Source: Rocky Mountain Institute (2018)



Source: PREPA Amended & Restated Fiscal Plan – Draft, dated April 5, 2018

The concession model, similar to the lease of assets agreement, offers the concessionaire a return on its own capital invested in infrastructure, therefore it closely resembles an investor-owned utility's business model. This elevates the importance of the regulatory framework to oversee this business model, including adoption of performance-based regulation. It also adds complexity and new roles the regulator must perform, including determining the appropriate model for recovering capital and operations expenses, establishing a new rate base accounting structure, periodically determining the concessionaire's cost of capital and approve rate of return, and adopting other aspects of performance-based regulation. Clarity in this regulatory framework may be required in order to execute a contract with a private utility operator.

Other, alternative approaches may include:

- Investor Owned Utility (IOU), comprising the selling of assets for full privatization
- Cooperative electric utility or utilities
- A mix of public utility (as Provider of Last Resource), IOUs in generation, and cooperative or municipal utilities
- Continue the status quo with PREPA as a Public Utility

Recommendations from the Advisory Committee include:

- Because of the importance of a regulatory framework that provide confidence to investors, through this transitional process, the regulatory powers of the PREB including its determination on the Integrated Resources Plan shall not be circumvented by the concession contract, or any other agreement.
- A concession in the form of a Management Services Agreement, could allow for the use of federal funds, resulting in less cost of capital and lesser cost to consumers. This type of agreement or plans that allow the use of federal funds should be prioritized to support low and affordable rates to consumers.
- The PREB should maintain the authority to establish the appropriate rate base accounting structure for any concession T&D operator, determine that concessionaire's approved rate of return on investment, and to adopt performance-based regulation. This authority shall not be circumvented by the concession contract, or any other agreement, and would require sufficient time for review of the concession contract as determined by the regulator.
- Cooperatives should be allowed by law to establish their own local power utilities. This will require a new provision governing how a cooperative entity can acquire or lease electrical distribution infrastructure that is currently owned by PREPA.
- Considering the medium and long term effect of legacy debt payment in the energy demand by all customer classes, with a direct impact on the financial viability of the Puerto Rico electrical system, the effects of PREPA's debt and alternative debt payment mechanisms beyond consumer rate shall be considered within the new ownership structure.

05.06.02 Design and Engineering Standards

The DOE reports that the impact of Hurricane Maria unveiled the importance of design codes and enforcement of those codes. One of the many exacerbating factors during post-Maria recovery was the lack of standardization at both transmission and distribution levels. Nonstandard equipment and spare parts were not readily available from stateside providers. This significantly delayed equipment/material relief from the mainland. Considering this, recommendations from the DOE Resiliency Report, in terms of adopting USDA Rural Utilities Service (RUS) standards, previously discussed in this report should be taken into consideration.

The Advisory Committee considers that clear requirements should be established by PREB to require PREPA or its successor to develop an energy assurance plan, as recommended by DOE Resilience report, including a plan for the use of standardized assets, and plans to supply large quantities of replacement material before and following future disasters. Legislation should also require PREB to develop standards suitable for withstanding extreme weather, such as T&D towers and poles designed to withstand 150 mph wind speed, or similar requirements. It should be noted, however, that the new Puerto Rico Building Code (PRBC 2018) is expected to adopt special wind speed criteria for Puerto Rico. The PR Code Committee is pursuing the development of a special wind region map through "micro zoning", based on topographic data modeling. FEMA has initiated this process through a contract with the National Institute of Standards and Technology (NIST) and the results of this analysis are expected by the end of October 2018. The new PRBC 2018 is expected to be released during early 2019. It is anticipated that wind speeds determined at higher altitudes in the island would mandate a stronger design criteria.

05.06.03 Maintenance Standards

As stated earlier in this report, PREPA's underinvestment in maintenance and vegetation management for years prior to Hurricane Maria contributed significantly to the extent of grid damage. This and other operational matters were exacerbated by PREPA's bankruptcy. Consistent adherence to industry best practices for maintenance and vegetation management could improve reliability and resilience to future events.

Maintenance standards are generally established by utility management with oversight from the regulator. The Regulator may direct utilities to adhere to specific standards, or to allocate a portion of their budget to maintenance, or impose performance incentives or penalties for reliability outcomes. Although specific maintenance standards are not commonly prescribed by public policy, legislation could require or encourage PREB to increase scrutiny around maintenance and require PREPA or its successor to develop a maintenance program. This should also include:

- PREB to oversee compliance on maintenance performance using Key Performance Indicators (KPIs), creating incentives or penalties based on performance.

- PREB to request from PREPA or its successor a regular report describing the state of grid maintenance; providing that in case the grid maintenance is not performed adequately by PREPA or its successor, services will be subcontracted and paid by the utility.

05.06.04 Energy Efficiency and Demand Response

Energy efficiency refers to measures to reduce energy used to provide services to customers. These vary widely, from LED lightbulbs, to building insulation and sealing, to efficient appliances and motors. Most utilities across the U.S. run energy efficiency programs for their customers to meet targets established by legislatures or regulators. In some states, a separate "energy efficiency utility" is responsible for efficiency programs. In accordance with the American Council for an Energy Efficient Economy (ACEEE), as of January 2017, twenty-six states have fully-funded policies in place that establish specific energy savings targets that utilities or non-utility program administrators must meet through customer energy efficiency programs. Energy Efficiency Resource Standard (EERS) in those states mostly range from below 0.5% (Texas) to over 2.5% annual savings (Massachusetts and Rhode Island)[8].

Demand response describes programs that reduce or shift electricity usage during peak hours and change when and how electricity is consumed to better manage the grid. Modern controls and the use of Internet technologies make many devices capable of providing demand response to the electric grid. Demand response can be provided through utility-managed programs, time of use pricing, third party aggregators and market structures.

The Advisory Committee recommends the development by PREB of clear requirements in accordance with national standards to be established for energy efficiency and demand response.

05.06.05 Resource Planning, Procurement, and Contracting

As stated by the Regulatory Assistance Project and Synapse in their publication in regard to electric system planning (Wilson and Bieward, 2013):

> *"An integrated resource plan is a utility plan for meeting forecasted annual peak and energy demand, plus some established reserve margin, through a combination of supply-side and demand-side resources over a specified future period. For utilities, integrated resource planning is often quite time- and resource-intensive.* ***Its benefits are so great, however, particularly to consumers, that utilities are frequently required by state legislation or regulation to undertake planning efforts that are then reviewed by state public utilities commissions"****.*

Best practice for utilities is to use a long-range IRP to inform the range of options and constraints that govern near-term procurement and other actions. This planning tool shall be prioritized and used as the main compass for the transformation of the Puerto Rico electrical system, since it determines, through an orderly evaluation process, key parameters that define the electrical system as peak annual loads, energy demand, and reserve margin. In terms of contracting, the overall objective is to base energy investments or purchase agreements on the comprehensive evaluations performed as part of the integrated resource planning process.

The IRP should dictate that the utility does not commit to several long-term Power Purchase Agreements (PPAs) for assets that are not required, that ultimately will result in higher cost to consumers of all customer classes. This will assure that Puerto Rico does not get tied to Power Purchase Agreements

[8] Energy Efficiency Resource Standard, American Council for an Energy-Efficient Economy, https://aceee.org/topics/energy-efficiency-resource-standard-eers

(PPA) that hinder the development of a modern system that integrates distributed energy and its endogenous renewables resources. In addition to traditional bilateral power contracting in the form of PPAs, non-PPA options can and should be considered for proven generation technologies.

Recommendations from the Advisory Committee include:

- Authorize PREB to reject a generation asset transaction if it comes with a long-term contract that is inconsistent with the approved IRP.
- Authorize PREB to reject procurement proposals that are not consistent with industry best practice.
- Reaffirm the requirement for integrated resource planning and the authority of PREB to oversee this process (already included in Act 57-2014).

06 RECOMMENDATIONS FOR POLICY AND REGULATORY FRAMEWORK

Public policy should express a clear and consistent vision for the future, a vision which transcends political administrations and commits the government, the regulator, and the utility to common goals and objectives for energy transformation. Public policy in Puerto Rico should be broadly consistent with that of highly developed nations, while recognizing Puerto Rico's realities. The vision should be calibrated to a planning horizon of no less than 20 years. It should coordinate other areas of government whose actions affect energy production or its impacts, energy consumption, and energy culture. The establishment of energy policy must be addressed via a continuous process of planning, consultation, execution, evaluation and improvement in all energy matters.

The policy recommendations below stem from previous statutes, especially Act 57-2014, with modified language to address the current Puerto Rico scenario and vision with respect to the energy sector. The new policy should be structured in a way that would provide for setting goals and objectives under key areas of the energy sector. Similarly, clear and purposeful objectives should be set forth, from which metrics can be either established up front or derived for tracking success or failure along the planning horizon. Targets shall be consistent with those established in other laws and endeavors by the Government in other policy related sectors.

Transformation goals describe criteria and guidelines for government decision-making as it relates to various areas of the Puerto Rico energy system. The New Public Policy set forth by Law should adopt the following vision:

"This vision is presented as the foundation of the new energy public policy. It aims to change the energy equation to focus on self-sufficiency and to put the common good and the people, the consumer, at the center of the energy transformation.

The promotion of a vision for the future with a consistent public policy should include transforming the energy sector from big asset management to technology management with the coexistence of small generation capabilities, freely developed by autonomous consumers, and a base generation that is highly flexible and reliable with enough spare capacity to be used as backup, along with a quick increase in renewable penetration.

An energy sector based on distributed endogenous clean renewable energy that is affordable and resilient, promotes efficiency, internalizes climate change and de-carbonization, ensures equity, ample public engagement and capacity building, creates local wealth while maximizing local ownership and provides flexibility for innovation consistent with endogenous clean renewable energy.[9]

Based on that vision, specific goals should be centered in defined areas of our energy system, followed by corresponding objectives where applicable.

In regards to regulatory framework, energy laws in Puerto Rico should be amended, as needed, to take into account: (1) present conditions after Hurricane María; (2) the government of Puerto Rico's privatization intentions; and (3) the involvement of federal aid in the reconstruction process. Key energy statutes in Puerto Rico include the following: Act 83-1941, Act 114-2007, Act 73-2008, Act 82-2010 and Act 57-2014.

06.01 Universal Access to Affordable Energy

Policy Goals

1) The cost of the electric power generated, transmitted, and distributed in Puerto Rico shall be affordable, just, and nondiscriminatory for all consumers.
2) The availability of energy supply shall be guaranteed to the people. The state needs to identify funds for such purposes.

Policy Objectives

a) Count with programs of financial support, funded by the government of Puerto Rico, to ensure that low income/vulnerable customers can obtain a "subsistence" level of electric service.
b) Ensure that life support equipment is served under all circumstances.
c) Reduce subsidies.
d) Identify funds to minimize the impact of PREPA legacy debt on electricity rates.
e) PREPA or its successor needs to be established as Provider of Last Resort (POLR).

Regulatory Framework Recommendations

a) Evaluate amendments to Act 1 of 2011, Internal Revenue Code for Puerto Rico, to provide funds to minimize the impact of legacy debt to energy consumers.
b) Amend Act 83, 1941 to establish PREPA as Provider of Last Resource (POLR).
c) Other recommendations are covered under the existing legal framework. Further evaluation could be done beyond the scope of this report.

[9] Public Collaborative for Puerto Rico's Energy Transformation. 2018. ICSE - RMI.

06.02 Energy Utility Model

Policy Goals

1) PREPA or its successor shall promote the necessary changes in order to become an entity that satisfies the electric power needs of the 21st century-Puerto Rico.
2) The implementation of strategies geared toward achieving efficiency in the generation, transmission, and distribution of electric power shall be sought in order to guarantee the availability and supply thereof at an affordable, just and reasonable cost.
3) Failure of PREPA or its successor to comply with regulatory requirements and legal mandates will be just cause for penalties for the utility and, as applicable, if negligence is proven, lawful consequences at the individual level.
4) Resource planning, regulatory processes and policies need to assure affordable, just and reasonable energy prices. Power Purchase Agreements (PPA) should not hinder the development of a modern system that integrates distributed energy and endogenous renewables resources. Non-PPA options should be considered for proven generation technologies.
5) Energy rates should avoid cross-subsidies and should be based on cost of service per customer class. Energy efficiency and demand response programs should also be implemented to assure the least cost of energy to all customer classes.
6) Puerto Rico shall transition into a private energy service model that does not create barriers for people's choice to become consumers, producers or both (prosumers).

Policy Objectives

a) Energy purchases or contracting by PREPA or its successor shall be based on the following principles:
    1. Energy purchases shall be consistent with the Integrated Resource Plan (IRP) approved by the regulator. Any deviation from such plan must be approved by the energy regulator.
    2. Energy markets, including auctions of long term power purchase agreements should be done under the oversight of the regulator and in line with the approved IRP. This includes high efficiency fuel generation and renewable energy contracts.
    3. PREPA or its successor should pursue FEMA or other federal funds for T&D and energy generation purposes, considering third parties' operation and maintenance agreements.

b) Unbundling Cost of Service
    1. Immediately upon the approval of this law, the PREB shall start a regulatory proceeding towards the unbundling of the PREPA business units comprising generation; transmission and distribution (T&D); and other assets and operations not related to energy generation, transmission, distribution or selling of energy.

2. Concurrently the PREB shall start an investigative proceeding aimed to establish the existing cost of service of PREPA per customer class.

3. The Commission shall submit a report to the Legislature regarding unbundling and cost of service, establishing a detailed procedural schedule no later than four (4) months after the approval of this law.

c) Fines and Penalties for Interconnection Delays

1. Considering that energy resiliency saves lives and sustains the economy during a disaster, the installation of self- generation energy systems, either renewable or high efficiency fossil-fueled, and their integration to the grid is of great importance for the public good. If there exists an excessive delay in the certification or interconnection of those systems into the PREPA, or successor, electric system grid, and that delay is proved to be an act of negligence a penalty of $5,000 per day shall be applied to the utility for each day that it exceeds the regulatory interconnection timeframe. The person in charge of such service shall be referred to the Justice Department in relation to damages resulting from delay.

d) Maintenance and Transition Charges

1. Considering resilience to be an important part of the Puerto Rico Energy Policy, distributed energy generation for all customer classes shall be incentivized and propelled as part of this legislation. In those terms, maintenance and transition (stranded cost) charges should be considered especially in energy consumers that not only consume but produce and inject energy into the grid. Considering this, transition charges should be capped at 0.50 Cent/kWh for customers that use renewable energy or high efficiency fossil systems. Energy consumers that are not connected to the grid shall not be responsible for any transition (stranded cost) charges.

2. In terms of existing maintenance and system related charges, the PREB shall review the volumetric charge imposed on the FY 2017 Rate Case proceeding to net metering customers and determine if this charge should proceed under the current Post-Maria scenario, or if it should be replaced by a smaller volumetric or fixed charge of lesser amount.

e) Local Energy Investment

1. Investment of local capital pursuant to the development of energy generation projects, either high efficiency or through renewable sources, needs to be promoted through local tax incentives.

2. Income resulting from investment in energy projects in Puerto Rico should be subject to a fixed tax rate of four percent (4%), similar to Act 20, 2012.

f) Retail Wheeling

1. Any statement in Act 73-2008 that limits in any form wheeling mechanisms should be derogated, to clarify that retail or wholesale wheeling is allowed for high efficiency fossil generation in addition to renewable energy resources.

Regulatory Framework Recommendations

a) Evaluate Act 120 of 2018 to avoid circumvention of the independent regulator and of the IRP.

b) Amend Act 83 of 1941 to provide for the unbundling of the PREPA generation, transmission and distribution operations; and authorize the Puerto Rico Energy Bureau (PREB) to execute such process.

c) Amend Act 57 of 2014 to include within the PREB responsibilities the determination of the cost of service (COS) of PREPA per main operational areas and customer class.

d) Amend Act 83 of 1941 and Act 114 of 2007 to include penalties for delays in the interconnection to PREPA for net metering and other related purposes related to distributed generators (DG) interconnection. This shall include referrals to the Justice Department in case of individual negligence.

e) Evaluate amendments to Act 4 of 2016, to provide for a cap on Transition Charges. The PREB also needs to reconsider volumetric charges to net metering customers, established during the FY 2017 Rate Case, for grid maintenance purposes within the current Post-Maria scenario.

f) Evaluate amendments to Act 1 of 2011, Internal Revenue Code for Puerto Rico, to provide for incentives for local investments in energy generation projects.

g) Amend Act 73 of 2008 to eliminate restrictions in wheeling mechanisms.

06.03 Energy Regulator and Performance-Based Regulation

Policy Goals

1) An independent energy regulatory entity adequately funded with broad powers and duties shall be the main element of the Puerto Rico electric system transformation. The regulator shall ensure compliance with energy policy, having as its main priority the protection of energy consumers through the determination of just and reasonable rates, and the safeguarding of investor confidence via the timely recovery of prudently incurred costs.

2) The regulator shall exercise high scrutiny on the operations and maintenance of PREPA, or it successor. Performance proceedings shall be completed by the regulator and key performance indicators (KPIs) shall be established, as well as incentives and/or penalties based on performance as required during such proceeding.

3) The regulator shall oversee and require of PREPA, or its successor, annual reports describing the condition of the grid and its maintenance program.

4) The regulator shall pursue the use of performance-based regulation and alternative earnings mechanisms such as revenue decoupling or other mechanisms by PREPA, its successor, and any other electric service utility servicing the island, to achieve the metrics and goals set forth by the public policy.

5) Through revenue decoupling, shift the paradigm that the utility that generates the most has the greatest profits. This mentality becomes an impediment for energy efficiency and other customer-sided generation.

6) Integrated Resource Planning (IRP) shall not be circumvented by any regulation, law or policy unless approved by the regulator, pursuant to a review involving intervenors, communities, private sector representatives, and the public.

7) A performance-based incentive and penalty mechanisms shall be established to apply to the tariff process to replace traditional compensations to electric service companies.

Policy Objectives

a) The regulator shall be funded by a yearly set aside of PREPA or its successor of twenty million dollars ($20,000,000) from its income, to be transferred to a special account established by the Department of the Treasury to defray the operating expenses of the regulator. Beginning on Fiscal Year 2018-2019, PREPA or its successor shall annually remit from these resources the sum of ten million dollars ($10,000,000) to the Department of the Treasury on or before June 1st. The balance of the ten million dollars ($10,000,000) shall be remitted to the Department of the Treasury on or before December 1st of each year. Any other person or electric power service company that earns profit from the generation of electric power shall pay a fee to the Commission that shall not exceed point twenty-five percent (0.25%) of its annual gross income earned from the provision of such services in Puerto Rico.

b) On or before six (6) months from the enactment of this law, the regulator shall establish by regulation performance-based incentives and penalties that directly bind the revenue of electric service companies[10] to their compliance with performance-based metrics that segregate and sever the direct link between revenues allowed and investment levels in order for monies to be invested in a cost-effective manner for the benefit of the costumer.

   During the development process of the incentives and penalties based on performance, the regulator should consider, among other criteria, the following:

   1. The volatility and affordability of electric service rates;
   2. Economic incentives and investment return;
   3. The reliability of the electrical service;
   4. Customer service, including options for managing electricity costs available to customers;
   5. Customer access to the information systems of the electric service companies, including but not limited to public access to information on the aggregate use of energy produced by consumers and access to information by individual consumers about their electrical consumption; and

[10] This requirement shall not apply to electrical service providers organized as cooperatives.

6. Fast integration of renewable energy resources, including the quality of the interconnection of resources located in consumer properties.
7. Investment to maintain assets and systems health to reduce the hazards and the impacts to social, environmental and financial performance

c) The regulator shall establish within six (6) months of the enactment of this law, a regulation for the implementation of revenue decoupling for PREPA or its successor. This regulation shall include as a minimum the ability of PREPA to earn income from energy-related activities throughout all customer classes such as: (1) energy efficiency programs, (2) installation and maintenance of photovoltaic solar systems and battery storage systems; and (3) other services to be determined by the PREB

Regulatory Framework Recommendations

a) Amend Act 83 of 1941 and Act 120 of 2018 to increase PREC budget to twenty million dollars ($20,000,000) through a direct funding mechanism via a PREPA set aside.
b) Amend Act 57 of 2014 to include within the PREB responsibilities the implementation of performance base incentives and decoupling programs.

06.04 Energy Culture, Education, Research and Development

Policy Goals

1) Responsible and efficient use of energy resources in Puerto Rico shall be promoted among all customer classes, including residential, commercial, and industrial customers.
2) Efforts must be implemented to educate the public on energy efficiency and peak demand in order to alter energy demand and consumption by customers as Puerto Rico transitions from primarily heavy centralized generation to increasing use of distributed generation through renewable and high efficiency sources.
3) Reinforce research and development to maximize the use of our endogenous source of energy, solar energy.

Policy Objectives

a) Develop mechanisms to support research and development programs including renewable energy microgrids simulations and feasibility analysis (based on photovoltaic and other types of solar and renewable energy); comprising also battery storage and high efficiency solar generation.

1. Funding for Research and Development. To support the goal of maximizing our endogenous source of energy, funds need to be allocated for research and development in that area. It is recommended to include legislation language to require PREPA, its successor and any other electric power service company that earns profit from the generation of electric power to pay a fee that shall not exceed

point fifteen percent (0.15%) of its annual gross income earned from the provision of such services in Puerto Rico. In the case of PREPA, this amount will be limited to one million dollars ($1,000,000) per year. These funds would be transferred to an account established by the Department of the Treasury and administrated by the regulator, in coordination with the University of Puerto Rico, aimed at establishing research and development programs including renewable energy micro-grids simulations and feasibility analyses (based on photovoltaic and other types of solar and renewable energy); comprising also battery storage and high efficiency solar generation

Regulatory Framework Recommendations

a) Amend Act 83 of 1941 to require that new inter-municipal microgrid projects are evaluated by the existing UPRM microgrid laboratory, in coordination with PREB during its evaluation process.

b) Amend Act 83 of 1941 to provide one million dollars ($1,000,000) through a direct funding mechanism via a PREPA set aside to establish research and development programs for renewable energy micro-grids simulations and feasibility analyses, and battery storage and high efficiency solar generation. Funds will be transferred to an account established by the Department of the Treasury and administrated by the PREB, in coordination with the University of Puerto Rico.

06.05 Energy Generation, Efficiency and Demand Response Programs

Policy Goals

1) In the short to medium term, the island shall become a jurisdiction with diversified energy sources. To achieve this, it shall be necessary to reduce the dependence on energy sources derived from fossil fuels in a transition towards renewable sources. In the long-term, development should be planned on the use of endogenous energy sources.

2) Centralized high efficiency generation needs to be oriented towards the use of multiple fuels to provide flexibility.

3) Demand-management programs shall be established that contemplate a diversity of short, medium, and long-term programs and provide effective incentives to consumers with an approach that facilitates behavior change in consumers that may result in a reduction of costs and greater stability and reliability in the operation of the network.

Policy Objectives

a) Coal should be completely eradicated as source for energy production in Puerto Rico by 2028 and shall not be part of any energy mix for power generation purposes in Puerto Rico thereafter.

b) As part of the IRP approval process, including the IRP to be submitted in October 2018 to the regulator (PREB), the regulator shall establish clear demand management and

energy efficiency goals, including the reduction of the existing peak load, of 3000 MW during year 2016.

c) The regulator (PREB) shall establish by regulation energy efficiency goals that will progressively ensure that Puerto Rico reaches a thirty percent (30%) energy efficiency by the end of the IRP planning period. The regulator could also be able to use the services of a third party to manages energy efficiency programs and assists in the control of compliance with the established annual goals.

d) The PREB shall establish by regulation specific goals for the reduction of the peak demand by a minimum of 17%, equivalent to a peak load of 2,500 MW, in a 5 years action plan within the approved IRP. Concurrently the PREB shall implement demand management programs, including rate setting mechanisms.

e) PREPA or its successor, as applicable, shall submit within six (6) months from the approval of the IRP, energy efficiency and demand response plans for the PREB approval. The plans should focus on the benefits that all costumer classes could receive as a result of temporarily reducing their energy consumption during peak hours. These plans should include increments of progress with defined dates that contemplate a diversity of short-, medium-and long-term programs and provide effective incentives to consumers with an approach that facilitates behavior change in consumers who may result in a cost reduction and greater stability and reliability in the operation of grid.

Regulatory Framework Recommendations

a) Amend Act 83 of 1941 to eradicate coal as source for energy production in Puerto Rico by 2028, providing that it shall not be part of any energy mix for power generation purposes in Puerto Rico thereafter.

b) Amend Act 57 of 2014 to include, as part of the IRP review process and as part of the PREB regulatory duties and responsibilities, the implementation of energy efficiency, demand response and demand management programs, requiring that PREPA or its successor, as applicable, shall submit within six (6) months from the approval of the IRP, energy efficiency and demand response plans for the PREB approval. Those programs should have the recommended goals of:

   1. Reduction of the peak demand by a minimum of 17%, equivalent to a peak load of 2,500 MW, in a 5 year action plan within the approved IRP.
   2. A reduction on energy demand of thirty percent (30%) energy efficiency by the end of the IRP planning period.

06.06 Environmental Responsibility and Climate Change Adaptation

Policy Goals

1) There should be full compliance by PREPA or its successor with every federal and state environmental law and regulation applicable to Puerto Rico.

2) A clear reduction in the use of fossil fuels should be pursued, minimizing greenhouse effects, and supporting Puerto Rico's initiatives in regards to climate change, mitigation and adaptation.

Policy Objectives

a) Reduce the energy generation greenhouse emissions in a real, permanent and quantifiable manner in at least forty (40%) percent from the levels of 1990 by 2035.

b) Reduce the general consumption of energy per capita at least one (1%) percent annually until reaching a total of ten (10%) percent.

c) Prohibit the concession of permits and/or contracts for the establishment of enterprises based on the use of coal in order to eradicate its use completely by 2028.

Regulatory Framework Recommendations

a) Recommendations are covered under the existing legal framework and under Senate Bill 773, currently under the consideration of the House of Representatives. Further evaluation could be done beyond the scope of this report.

06.07 Public Sector Use of Energy

Policy Goals

1) The government of Puerto Rico shall promote energy conservation and efficiency in all its governmental instrumentalities.

2) The government of Puerto Rico should pursue the rapid deployment of light emitting diodes (LED) technology for public lighting to reduce overall cost of municipal and state government lighting, while at the same time addresses the problem of light pollution.

3) Regulator's oversight on the Contribution in Lieu of Taxes (CILT) Regulation should be enforced for its compliance. The impact of CILT can and shall be clearly established in the utility rate case as part of the revenue requirement determination, as done during the FY 2017 Rate Case.

Policy Objectives

a) PREPA or its successor in coordination with the Energy Public Policy Program shall implement energy efficiency plans to reduce the energy consumption in all Puerto Rico government entities and installations at least one point five percent (1.5%) annually until reaching a reduction of a minimum of twenty percent (20%) by year 2025. Plans to be approved by the PREB as part of the IRP review.

b) Conversion to one hundred (100%) percent LED public lighting shall be mandatory by 2025.[11]

[11] Ensure CDBG-DR funds budgeted for grid reconstruction are reserved for this purpose.

c) Promote solar lighting in public venues.

Regulatory Framework Recommendations

a) Recommendations are covered under the existing legal framework and additional recommendations within this report.

06.08 Distributed Energy, Energy Storage and Technology Integration

Policy Goals

1) The Puerto Rico Renewable Portfolio Standard (RPS) needs to establish the percentage of renewable energy that will be integrated into Puerto Rico's electricity infrastructure. Suitable technologies and locations should be identified to maximize such integration.
2) To promote resiliency and the modernization of the distribution grid, the Puerto Rico RPS needs to incorporate energy generated by renewable means at the distribution level through microgrids and net metering among other means.
3) PREPA or its successor must comply with interconnection standards, including expedited proceedings under the 2017 Regulation to Interconnect Generators to the Distribution System of PREPA, and provide an effective process to minimize interconnection times.
4) PREPA, its successor, and independent power producers, must identify their own unique vulnerabilities and design mitigation options tailored to their specific information technology (IT) and operational technology (OT) networks. This should comprise elements of cybersecurity. Network and components of the electrical system shall have the necessary protection so that they are not vulnerable to cyberattacks that affect service to consumers.
5) The corresponding studies shall be carried out to establish the specific energy storage goals that best meets Puerto Rico's needs

Policy Objectives

a) Renewable Portfolio Standard (RPS): RPS shall achieve 30% of renewables by 2025 and 90% no later than 2050.
    1. For each calendar year between 2020 and 2035, the regulator should carry out the necessary processes, including the issuance of bids or competitive procedures for the purchase and dispatch of renewable energy, so that Puerto Rico complies with the Energy Resources Portfolio included below:

Year	Minimum Percent (%) of Renewable Energy	Maximum Percent (%) of Non-Renewable Energy
2025	30%	70%
2035	50%	50%

2040	70%	30%
2045	80%	20%
2050	90%	10%

2. The compulsory amount of renewable energy to be applied will be obtained by multiplying the percent corresponding to the year, as shown above, for the total electric energy, expressed in megawatt-hours (MWh) sold in the same natural year.
3. The regulator may limit, by regulation, the percent of renewable energy that may be used for compliance with new local and federal legislation.
4. For purposes of demonstrating compliance with the above, the amount of electric power sold during each calendar year coming from an existing hydroelectric plant will not be counted as part of the total volume of electricity sold.
5. Current legal framework needs to be amended to clarify that renewable energy certificates (RECs) produced at distribution level are considered part of the RPS. It needs to be clear that all customer classes, included but not limited to residential, commercial and industrial classes, are authorized to sell their Renewable Energy Credits (RECs) to PREPA or its successor.
6. In a complementary manner, without affecting the application of any new or existing regulation, the regulator shall also establish the creation of a system for recording and tracking Renewable Energy Certificates (RECs), taking into consideration the acquired rights, if any of producers of energy that have RECs. For such purposes, the regulator shall have all necessary and appropriate powers to comply fully with the purposes of this law, specifically including, but not limited to, the following:
    a. Require the registration of all sources of energy;
    b. Require and obtain from any person under his jurisdiction any necessary and pertinent information to carry out and fully implement the objectives of this law;
    c. Establish, by regulation, the requirements for documentation, registration and verification of RECs;
    d. Formulate and implement strategies designed to achieve, directly or indirectly, compliance with the goals established here;
    e. Contract or subcontract for any legitimate purpose that allows it to comply with the public policy of this law, and to achieve specialized tasks, without abdicating its role and governmental responsibility, including hiring professional services of consultants, economists and lawyers, among other professional services, to assist you in your governmental function.

b) Battery Storage: As part of the IRP approval process, including the IRP to be submitted in October 2018 to the regulator (PREB), the regulator shall establish specific storage goals that best meet Puerto Rico's needs. Among others, the regulator should consider the following criteria:

1. Associated costs and long-term benefits;

2. Storage-derived network stability and resiliency;
3. Added energy efficiency that can be obtained from the use of technology;
4. Types of technologies available, their useful life and the flexibility they offer in the face of changes in the network infrastructure;
5. Ability to be used as a generation resource by eliminating the need to build new or additional infrastructure; and
6. Efficiency in its use to facilitate demand management programs.

c) Safety and Security Standards: The regulator shall establish by regulation the standards with which the electric service companies must comply to ensure that the safety and security of the electrical grid is guaranteed. To the extent possible, such standards shall be similar to those in force in the industry.

d) System Hardening and Reliability: The regulator shall have six (6) months from the effective date of enactment of the new energy transformation law to conduct a study whereby it can determine the specific improvements that the network needs to become reliable, stable, resilient, with sufficient flexibility to accommodate the integration of different sources of renewable energy, different types of clients and varied demand patterns as well as emerging technologies, all in compliance with the public energy policy set out in this law. This plan shall apply to all entities governed by this law which are owners or operators of electrical infrastructure in Puerto Rico, including but not limited to PREPA and its concessionaires or successors in interest. The study should use relevant information included in the Integrated Resources Plan most recently approved by the PREB. Among others, as part of the study, the regulator should consider the following criteria:

1. Associated costs and long-term benefits;
2. System stability;
3. Added energy efficiency that can be obtained from the use of technology;
4. Types of technologies available, their useful life and the flexibility they offer in the face of changes in the network infrastructure;
5. Ability to be used as a capacity resource by eliminating the need to build new or additional infrastructure; and
6. Efficiency in its use to facilitate demand management programs.

Once the regulator completes the study, the electric service companies, including PREPA, or the successor as network operator, as applicable, shall submit to the regulator a specific improvement plan with a work schedule, as well as any relevant information for its evaluation, of the modernization plan. This plan shall be complementary to the IRP and shall not delay its implementation.

e) Distributed Energy Resources (DER):

1. In addition to the installation of renewable energy systems in the distribution grid, distributed generation can also be achieved through high efficiency generation systems, such as Combined Heat and Power (CHP) and other high efficiency

generation means, through natural gas and other clean fuels. Presently natural gas, and other gas fuels are highly taxed. This taxation shall be eliminated when such fuels are used in high efficiency generation systems.

2. A portion of the RPS must result from distributed generation. In Puerto Rico the need for resiliency makes this indispensable. For this purpose, 50% of the RPS must be sourced from distributed generation as defined by PREB.
3. For values of distributed generation above 25% of total generation, the PREC should establish a regulation, to be in line with the requirement on this report towards compliance of 90% renewable energy within a second IRP period.
4. The PREB shall include within the current IRP (to be submitted by PREPA in October 2018) projections of distributed energy resources (DER) every five years until the end of this IRP period. These projections shall consider plans and regulations included under this law.

f) Distribution System, Smart-Grid and Microgrids Infrastructure:

1. Our distribution grid was severely affected after the passing of Hurricanes Irma and Maria, where 80% of the grid collapsed. The distribution grid needs to be rebuilt in an orderly manner in view of the public interest. Resiliency and redundancy shall be part of the reconstruction of our electrical system.
2. Utilization of Federal disaster recovery funds shall emphasize on underground power systems in the urban centers and critical infrastructure at all 78 municipalities.
3. PREPA should be required to submit a plan that considers the construction of underground power systems for urban centers. This plan shall be approved by the PREB and shall consider the implementation of smart-grid technology to be used as the base for micro-grid systems installation. This plan should be incorporated into the IRP as part of a five-year action plan.
4. A minimum of energy generation by photovoltaic systems and battery storage by consumers of all customer classes shall also be prioritized in programs established by the Puerto Rico Housing Department, the Housing Financing Authority and any other PR state agency, office or bureau.

g) Microgrids:

1. Microgrids are already part of Puerto Rico's legal and regulatory framework. Grid ancillary services provided by the microgrid to the main grid such as energy storage and voltage regulation, and backup power provided from the main grid to the microgrid should be valued.
2. Connection of microgrids to the main central grid (for backup purposes and to provide ancillary services to the main grid) should be considered essential and needs to be strongly encouraged and incentivized to ensure dependable and continuous service to customers.
3. PREB needs to assess the value of microgrids services to the main grid and establish parameters for grid services tariffs to govern compensation for services exchanged between the microgrid and PREPA and vice-versa.

4. PREB needs to clarify whether cooperatives or municipalities will have the right to purchase or lease PREPA distribution infrastructure to facilitate their microgrid installation.
5. Considering the benefits of the restoration of hydroelectric plants in terms of energy generation and resiliency, the development of a process for the transfer of hydroelectric assets to municipalities needs to be considered.

h) Community Solar:

1. Net metering for community solar subscribers, including allocation of invoice credits, needs to be provided.
2. The PREB should develop a regulation to establish a community solar program, including:
   a. Evaluating requirements for low-income customer access to community solar, and;
   b. Prescribed amounts of community solar.

Regulatory Framework Recommendations

a) Amend Act 82 of 2010 to:

1. Establish a new RPS as indicated in the table under item (a) of this section for 30% RPS by 2025 and 90% by 2050; and
2. Clarify that that renewable energy certificates (RECs) produced at distribution level are considered part of the RPS. Provided that all customer classes, included but not limited to residential, commercial and industrial classes, are authorized to sell their Renewable Energy Credits (RECs) to PREPA or its successor.

b) Amend Act 1 of 2011 to eliminate taxes applied to fuel used in CHP and high efficient generation and emergency generation in all customer classes.

c) Amend Act 82 of 2010 to establish that 50% of the RPS must result from distributed energy resources (DER) up to 25% of the total Puerto Rico generation. Above 25% of total generation, the PREB will regulate the percentage of RPS will be required to be DER.

d) Amend Act 114 of 2007 and Act 133 of 2016 to allow net metering as part of community solar projects.

e) Amend Act 57 of 2014 to establish a process for the transfer of hydroelectric assets to municipalities. The process for the transfer of the assets needs to include the submission of a plan by the municipality that explains and justifies business model and technical aspects of the proposed development of the asset. The plan needs to be approved by the PREB as a requirement for the transfer of the asset.

f) Amend Act 57 of 2014 to include within the PREB responsibilities:

1. Establish specific energy storage goals as part of the IRP approval process;
2. Establish security and safety standards within (6) months of approving this law;

3. Establish system hardening and reliability plans, within six (6) months after approving this law.
4. Establish regulation to determine the percentage (carve out) of distributed energy on the RPS above the threshold of 25% of the total generation. Act 82 of 2010 is proposed to be amended to establish that 50% of the RPS must result from distributed energy resources (DER) up to 25% of the total Puerto Rico generation
5. Establish a grid service tariff to govern the compensation for services exchanged between microgrid and the main grid. Within this regulation the PREB shall prioritize, incentivize and require, as needed, the interconnection to the main grid of any microgrid.
6. Establish a procedure for the lease or purchase of PREPA distribution infrastructure by microgrids; and
7. Establish regulation to create community solar programs, including requirements for low income costumers, as applicable, and overall program requirements.

06.09 Energy Infrastructure Design, Resiliency, Maintenance and Safety

Policy Goals

1. The safety and reliability of the electricity infrastructure should be guaranteed by integrating clean and efficient energy and using modern technologies' tools that promote economic and efficient operations.
2. The electrical system infrastructure should be designed to be robust and resilient to the onslaught of catastrophic phenomena and other disasters; and able to respond to fluctuations in demand. Design codes and regulations, in compliance with current nationally recognized standards, should be developed for those purposes. Codes and regulations shall be enforced, as well as safe loading requirements on distribution poles carrying electric and additional services such as telecommunications, cable TV, and others.
3. Electric system planning must address interdependency between the electric power system and other critical infrastructure that provide critical services, such as health (hospitals), potable water, sewer, telecommunications, and transportation, schools, emergency shelters and emergency service providers, plus high density populated areas, to counter the cascading effects of power losses.
4. Plans and strategies for maintaining standardized transmission and distribution (T&D) equipment should be developed for consistency with the U.S. mainland to improve resiliency and help future mutual aid response.
5. Require a comprehensive asset management program to ensure systematic approach and assets health.
6. The electrical system should be maintained in optimum condition to ensure the reliability, resiliency and safety of electric service. PREPA, its successor, and independent power generators shall be required to present to the Puerto Rico Energy Bureau (PREB):

Energy Assurance Plans, Plans for Standardization of Assets, Replacement Parts Inventories, and Plans for Best Practices in System Maintenance.

7. Continuous enhancement to the electrical grid should be developed to promote resiliency and diversification by matching generation capacity with demand by region and by facilitating an effective transition to new technologies and renewable energy sources. For this purpose, the PREB should consider incentives for grid modernization that incorporate adequate technology to meet the transformation goals, but not entailing excessive costs.
8. Resiliency should also be pursued through the construction of underground power lines in critical infrastructure and urban centers and building in redundancy into the electrical network.

Policy Objectives

a) PREPA or its successor shall adopt USDA Rural Utilities Service (RUS) standards where feasible and appropriate to standardize equipment and design, to aid with replacement in both regular and emergency situations.

b) All replaced poles and towers during grid reconstruction should be of a design and material to survive 150 mph sustained winds. At a minimum, structures located in areas prone to high winds should be reinforced to withstand Category 4 storms, including lines along the critical North-South corridor.

c) Within six (6) months of the enactment of this law, the regulator shall establish a regulation that provides for the reconstruction of the transmission and distribution system:

    1. Specifications for the design, construction and maintenance of the transmission and distribution system that includes as a minimum:
        a. Type of poles and "hardware" for these for transmission and distribution based on the stated 150 mph wind speed.
        b. Type of conductors for transmission and distribution.
        c. Underground system requirement.
        d. Transformers and auxiliary equipment.
        e. Energy storage equipment, including batteries, hydraulic storage and others.
        f. Preferred routes for the transmission system.
        g. Sensors for control and monitoring in the transmission and distribution network, counting with "smart grid" technology.
    2. Coordinate a joint study with the Puerto Rico Telecommunications Bureau to determine and enforce safe loading requirements of distribution poles carrying both electric and telecommunications infrastructure. Upon completing the study, provide clear guidelines for the cost of using the poles and easements of the Puerto Rico public electric system for other utilities, such as cable TV, telephony, and others.

d) Telecommunication companies incorporating new lines on existing poles shall be required to perform and certify wind loading studies through a professional engineer. Attachment owners shall fund any required upgrades.

e) PREPA or its successor shall develop, under regulator's oversight, an Energy Assurance Plan, including a plan for the use of standardized assets, and plans to supply large quantities of replacement material before and following future disasters.

f) Within four (4) months of the enactment of this law, PREPA shall present to the regulator, a comprehensive vegetation management program, implementing industry best practices to protect the integrity of grid assets (e.g. ANSI 300). Any PREPA successor or entity in charge of transmission and distribution assets shall meet this requirement within the same time frame from assuming asset management.

g) Within six (6) months of the enactment of this law, the regulator shall conduct, with the engagement of federal agencies as appropriate, an analysis to identify interdependencies and to help coordinate large-scale, regional infrastructure projects.

Regulatory Framework Recommendations

a) Amend Act 57 of 2014 to include within the PREB responsibilities:

1. Adopt and enforce any federal or local regulation as part of their regulatory duties and responsibilities;
2. Establish a regulation that provides for the reconstruction of the transmission and distribution system, within six (6) months of the enactment of this law;
3. Perform a joint study with the Telecommunications Bureau to determine and enforce loading requirements of distributions poles; and establish clear guidelines for the cost of using PREPA's poles and easements;
4. Require from PREPA an Energy Assurance plan, to be reviewed and approved by PREB;
5. Require from PREPA, within four months of the enactment of the act, a comprehensive vegetation management plan, to be reviewed and approved by PREB;
6. Conduct, within four months of the enactment of the act, with the engagement of local and federal agencies as appropriate, an analysis to identify interdependencies as part of the development of large-scale infrastructure projects.

06.10 Customer Service, Public Participation and Utility Transparency

Policy Goals

1. Every consumer should have the right to reliable electric service at affordable rates and an easy and expeditious service response.
2. Electricity invoice or service disputes shall be resolved equitably and diligently.

3. Transparency and citizen participation in every process related to electric power service in Puerto Rico shall be primary value of the transformation of the Puerto Rico electrical system.

Policy Objectives

a) The regulator shall continue to enforce implementation by PREPA or successor of the Transparent Bill included in Act 57-2014, and include a procedure for its compliance. The procedure shall include categorizing based upon the revenue requirement per the last rate case observed. The Transparent Bill needs to itemize the categories of all the different charges assessed to the customer.

b) The regulator shall continue to enforce the publication of statistical and numerical information by the Energy Control Center of PREPA, as included in Act 57-2014, and establish a procedure for its compliance. This included a post every day on the PREPA or successor website of daily peak demand, the daily delivery of energy per electric power generation facility or plant, and any other necessary information or data in connection with the administration of the electric power grid and the operations of electric power transmission and distribution in Puerto Rico.

Regulatory Framework Recommendations

a) Amend Act 57 of 2014 to include within the PREB responsibilities the enforcement of:

    1) The implementation by PREPA or successor of the Transparent Bill included in Act 57-2014, including the development of a procedure for its compliance; and

    2) The publication of statistical and numerical information by the Energy Control Center of PREPA, as included in Act 57-2014, and to establish a procedure for its compliance.

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