



Introduction to Puerto Rico's energy transformation: An analysis of key documents and plans towards the reconstruction of the electric system

Tomás J. Torres Placa*, Ramón J. Cao García

ARTICLE INFO

Keywords:

Integrated resource plan
Restructuring support agreement
Fiscal plan
PREPA
Public utility bankruptcy
Public utility transformation under bankruptcy
Alternative policy designs

ABSTRACT

Puerto Rico's electric system transformation depends on the execution of the current energy policy. However, key documents, such as the PREPA Fiscal Plan, do not detail how these transformations are going to be financed, and no analysis is provided for expected economic impacts that should arise from increasing electricity tariff rates to electricity consumers. This paper analyzes the three main documents developed as part of the planning for the Puerto Rico electric system transformation and reconstruction, including potential flaws and its effect on the electric utility. It also links to further studies and analyses developed toward the effect of such plans on Puerto Rico's economy and on the electric utility.

1. Primary documents of Puerto Rico's grid transformation

Three documents comprise the transformation of Puerto Rico's grid, these are: (1) the 2020 Fiscal Plan for the Puerto Electric Power Rico Electric Power Authority (PREPA) (PREPA, 2020)^{1,2}; (2) the Puerto Rico Integrated Resource Plan (IRP) (Siemens Industry, 2019), as approved by the Puerto Rico Energy Bureau on August 24, 2020 (Puerto Rico Energy Bureau, 2020)^{3,4}; and (3) the Definitive Restructuring Support Agreement (RSA) (Definitive Restructuring Support Agreement, 2019)⁵.

These documents not only address the financial and fiscal issues of PREPA, but also set the roadmap for the long-term planning of the utility. Nevertheless, the transformation of the Puerto Rico electrical system needs to take place under the current legal and regulatory framework, including the New Puerto Rico Energy Policy (Puerto Rico Act 17 of 2019, 2019) that establishes clear goals in terms of energy self-sufficiency, a strong regulatory framework, distributed generation

as a priority of system planning, and the integration to the electrical system of other power sources beyond the existing utility, PREPA.

1.1. The PREPA fiscal plan

The PREPA Fiscal Plan, as its name suggests, is the annual fiscal plan of the electric utility which is certified by the Financial Oversight and Management Board for Puerto Rico (FOMB). It provides a thorough analysis of the Puerto Rico Electric System. After the passing of Hurricanes Irma and Maria on September 2017 two fiscal plans have been certified; one on June 27, 2019 and a second one on June 29, 2020. Those plans consider the rebuilding effort required after the passing of the hurricanes in 2017 and the tremors of 2020, as well as the impact of the RSA, in the context of the negotiations held as part of the utility bankruptcy under the Title III of PROMESA.⁶ The fiscal plans also project electricity rates for the next five years, considering information

* Corresponding author.

E-mail address: tjtorresplaca@hotmail.com (T.J. Torres Placa).

¹ 2020 Fiscal Plan for the Puerto Electric Power Rico Electric Power Authority (PREPA), as certified by the Financial Oversight and Management Board for Puerto Rico on June 29, 2020.

² The PREPA 2020 Fiscal Plan is preceded and is mostly based on the 2019 Fiscal Plan for the Puerto Electric Power Rico Electric Power Authority, as certified by the Financial Oversight and Management Board for Puerto Rico on June 27, 2019.

³ The Puerto Rico Integrated Resource Plan 2018–2019 (IRP), Draft for the Review of the Puerto Rico Energy Bureau Prepared for Puerto Rico Electric Power Authority. Submitted by Siemens Industry on June 7, 2019.

⁴ Final Resolution and Order on The Puerto Rico Electric Power Authority's Integrated Resource Plan, CEPR-AP-2018-0001. August 24, 2020.

⁵ Definitive Restructuring Support Agreement (RSA) dated as of May 3, 2019, among the Puerto Rico Electric Power Authority (PREPA), the Puerto Rico Fiscal Agency and Financial Advisory Authority (AAFAF), the Financial Oversight and Management Board for Puerto Rico (FOMB), members of the Ad Hoc Group of PREPA Bondholders, and PREPA bond insurers.

⁶ Although widely mentioned across the document, no specific measures were considered on the 2020 Fiscal Plan to the consequences of the Coronavirus over PREPA operations.

included in the RSA, in the IRP, and as part of the Fiscal Plan.

1.2. Projected electricity rates in the fiscal plan

The 2019 Fiscal Plan projected electricity rates totaling 25.6 cents per Kw-hour in 2024. This reflected costs that include the following: (1) basic revenue requirements, including operating cost, maintenance, fuel cost, energy purchases, subsidies, and bad debt; (2) RSA charges; and (3) proposed additional charges to fund the employee retirement system. The Fiscal Plan also provided Risk Adjustment Rates that consider limited funding from the Federal Emergency Management Agency (FEMA), and not meeting the cost expectation for fuel and renewable energy contracts. Under these circumstances average base rates would be 30.48 cents per Kw-hour by year 2024.

The 2020 Fiscal Plan forecasts 21.3 cents per Kw-hour for FY 2021 and 22.8 cents per Kw-hour for FY 2025. This reduction in forecasted rates happens because rates in the 2020 Fiscal Plan exclude debt, i.e., does not consider RSA charges. Projected rates neither consider Risk Adjustment Rates, included on the 2019 Fiscal Plan, although it considers charges resulting from the proposed Pension Plan Reform⁷.

Neither plan provides specific information in terms of how projected revenues, costs and rates are estimated; that is, the methodology used, data sources and calculations. As a result, there is no way to validate these forecasts. Moreover, the plans report historical values that are inconsistent with values that appear in other official PREPA documents.

1.3. The PREPA RSA

The PREPA RSA proposes an exchange of the current bonds of PREPA for Securitization Bonds, to be guaranteed by the collection of a special charge (named Transition Charge) by a special purpose vehicle (SPV) which in turn is responsible for the issuance of such securitized bonds.

Prior to this RSA there have been two previous debt restructuring agreements, that were not implemented. The first was presented for the approval of the Puerto Rico Energy Commission (now Puerto Rico Energy Bureau) during 2016. That first attempt was made as part of a voluntary negotiation between PREPA and a group of bondholders. It was dismissed by the FOMB in 2017 as part of the PREPA bankruptcy proceeding. The main reason was that raising PREPA's blended rate to anything over 21.4 cents per kWh would greatly increase the risk of reducing economic growth below the minimum amount necessary for Puerto Rico to achieve fiscal and debt sustainability⁸. The second restructuring preceded the current RSA. It was approved by the FOMB on July 30, 2018 as a Preliminary Restructuring Support Agreement between PREPA, AAFAF, the FOMB and the members of the Ad Hoc Group of PREPA Bondholders.

The current RSA consists of two types of bonds, Tranche A and Tranche B Bonds. The Tranche A Bonds have a maturity of 40 years, have an exchange ratio of 67.5 % of principal amount of outstanding Bonds, with an interest rate of 5.25 % to be paid in cash, on a tax-exempt basis. Tranche B Bonds have a maturity of 47 years and an exchange ratio of 10 % of principal amount of outstanding bonds, shall not be required to be tax-exempt, and the interest paid will be 8.75 %, accretion rate for taxable bonds, or 7.00 % in case those would be considered tax-exempt bonds. There will be no cash flow on Tranche B bonds until

⁷ As part of the 2020 Fiscal Plan, two different values are shown in reference of the charges related to the Pension Plan Reform, i.e., Exhibit 37 in Chapter 9 and Exhibit 19 in Chapter 5.

⁸ Declaration of Andrew Wolfe In Support of Opposition of The Financial Oversight and Management Board for Puerto Rico to the Motion of the Ad Hoc Group of PREPA Bondholders, National Public Finance Guaranty Municipal Corp., Assured Guaranty Corp., Assured Guaranty Municipal Corp., and Syncora Guarantee Inc. for Relief from the Automatic Stay to Allow Movants to Enforce their Statutory Right to Have a Receiver Appointed.

Tranche A is paid in full. Tranche B bonds will also receive 100 % of total excess cash flow from the Transition Charge after repayment of the Tranche A Bonds. The interests on Tranche B Bonds will be paid in a principal amount equal to the unpaid balance of such bonds interest due.

1.3.1. Debt restructuring charges are non-bypassable and unavoidable

As described in the RSA, the Transition Charges are non-bypassable, payment shall be obligatory. Customers shall not be permitted to evade the imposition of Transition Charges or reduce their responsibility for Transition Charges by disconnecting and subsequently reconnecting to the electric system.

The RSA defines electricity consumption as the amount of electricity consumed by a customer, regardless of the source of such electricity, including thermal, solar, wind, geothermal or other renewable or recyclable sources, whether owned by PREPA or any successor, lessor or concessionaire, an independent power producer, municipality, cooperative or a customer. This means that unless a consumer is disconnected from the utility for the 47 years of the agreement, all the electricity consumed, regardless of the source, is subject to the payment of the Transition Charge.

1.3.2. The RSA includes a transition charge that increases 64.5 % on its midterm

The Transition Charge starts at 2.768 cents/kWh from years 1–3, then increases to 2.957 cents/kWh from years 4–8 and continues to rise in increments until it reaches 4.552 cents/kWh in year 24. These predetermined increases represent an increment of 64.5 %, during the first half of the RSA. Since the Securitization bonds are guaranteed by the Transition Charge, collected from all customer classes, the 64.5 % increase entails an assumed decrease in electricity consumption in the same amount. It is unreasonable to forecast electricity consumption over such an extended period of time. Consequently, if the projected decrease in demand is not materialized additional revenues will be collected.

In addition, unpaid energy consumption attributable to Contribution in Lieu of Taxes (CILT) for municipalities, public lighting, and low-income housing subsidies and other forms of subsidies are spread and recovered among customers. Recovery of those exceptions, subsidies and credits are capped at 25 % of the Transition Charge. In practical terms, the real value of the Transition Charge is the basic predetermined Transition Charge, plus additional charges to cover unpaid electricity consumption.

1.3.3. Puerto Rico's electric utility RSA limits the role of the regulator

In accordance with the RSA, legislation shall impose, without requiring the approval of the Puerto Rico Energy Bureau or other entity, a non-bypassable and unavoidable Transition Charge that shall be standard to utility securitizations, including any adjustments to the Transition Charge as may be agreed upon in the RSA. The regulator can neither intervene in the amount to be recovered from electricity consumers once the RSA is agreed and certified in court, nor modify such charges even if the consumption of electricity increases, above the projected decrease.⁹

After the Securitization Bonds are issued, the regulator's role with regard to the calculation, modification or imposition of the Transition Charge is limited to the verification of the mathematical accuracy of the Servicer's calculation of the charge and related subsidy charges. The Energy Bureau is also responsible to amend the charges to Behind the Meter Generation (BTMG) customers if the application of such charges is contributing to their defection from the system that is likely to result in changes in revenue.

⁹ It should be noted that the Transition Charge revenue recovery plan assumes drastic reduction in the demand for electricity.

1.3.4. The RSA requires amendments to the existing Puerto Rico legal framework

As required in the RSA, for the agreement to be implemented, Act 4 of 2016, Electric Power Authority Revitalization Act¹⁰ needs to be amended; plus, it needs to be exempted from fifteen (15) laws, the Puerto Rico Uniform Commercial Code and the General Services Administration Reorganization Plan. Important to note is that within those exceptions are key Commonwealth of Puerto Rico laws and regulations:

- (1) The Puerto Rico Uniform Commercial Code, PR-UCC.
- (2) Chapters 4 and 6 of Act 26 of 2017, as amended, known as the Fiscal Plan Compliance Act.
- (3) Act 1 of 2012, as amended, known as the Puerto Rico Government Ethics Act of 2011.
- (4) Act 103 of May 25, 2006, as amended, known as the Act for the Fiscal Reform of the Government of the Commonwealth of Puerto Rico of 2006.
- (5) Act 8 of 2017, as amended, known as the Act for the Transformation of the Government's Human Resources.
- (6) Act 237 of 2004, as amended, known as the Act to Establish Uniform Parameters for Contracting Professional and Consulting Services by Agencies and Instrumentalities of the Government of Puerto Rico.
- (7) Act 197 of 2002, as amended, known as the Act to Regulate the Transition Process of the Government of Puerto Rico.
- (8) Act 78 of 2011, as amended, known as the Electoral Code of Puerto Rico for the XXI Century.
- (9) Act 38 of 2017, known as the Uniform Administrative Procedures Act of the Government of Puerto Rico.
- (10) Plan 3 of 2011, as amended, known as General Services Administration Reorganization Plan.
- (11) Act 230 of July 23, 1974, as amended, known as the Government Accounting Act.
- (12) Act 3 of 2017, known as the Law to Address the Economic, Fiscal and Budgetary Crisis and Ensure the Functioning of the Government of Puerto Rico.
- (13) Act 14 of April 17, 1972, as amended; Law to Establish the Maximum Interest Rate on Bonds, Notes and Other Obligations of the Commonwealth of Puerto Rico, Municipalities, Public Corporations and Instrumentalities.
- (14) Act 2–2017; Law to create the Financial Advisory and Fiscal Emergency Authority (AAFAP).
- (15) Act 5–2017; Puerto Rico Financial Emergency and Fiscal Responsibility Act.
- (16) Act 17–2019, known as the Puerto Rico Energy Public Policy Act.
- (17) Section 6.25A of Act 57–2014. – Puerto Rico Energy Transformation and RELIEF Act, Section 6.25A, Determination of the Rate and Review of Transition Charges and Adjustment Mechanism.

1.3.5. The RSA should be withdrawn from federal bankruptcy court proceedings by the FOMB and the government of Puerto Rico

The RSA, in conjunction with other charges on the PREPA Fiscal Plan, would increase electricity rates to over 30 cents per Kw-hour within the next five years. This represents an increase of approximately 50 % from the average electricity rate in Puerto Rico during 2019.¹¹ As previously mentioned, one of the main reasons the FOMB presented for sustaining the petition of bankruptcy in July 2017 was that electricity rates above 21.4 cents per Kw-hour “would greatly increase

the risk of reducing economic growth below the minimum amount of real economic growth necessary for Puerto Rico to achieve fiscal and debt sustainability”.

Notwithstanding economic harm, the Government of Puerto Rico and the FOMB supported the current RSA and filed motions in court opposing to the evaluation of studies that assessed the effect of the RSA on the economy of Puerto Rico¹².

Puerto Rico suffered a significant economic downturn prior Hurricanes Irma and Maria, as the Gross Domestic Product (GDP) dropped 6.84 % from 2010 to 2017¹³. After the hurricanes Puerto Rico Gross National Product (GNP) and GDP continued to decline, dropping 2.7 % and 2 %, respectively, from 2017 to 2018^{14,15}. Population also decreased during the same period from 3.32 to 3.19 million, a reduction of 3.9 %; birth rate also decreased 14.2 %¹⁶. The FOMB's 2017 assessment remains true today: an increase in electricity rates above 21.4 cent/Kw-hour would significantly Puerto Rico's ability to achieve economic sustainability.

The question is, why does the FOMB and the Puerto Rico Government support the RSA and other charges in the PREPA Fiscal Plan? The answer seems not to be fact-based but politically motivated, since there is no study or assessment that sustains that substantial increases in electricity rates would improve Puerto Rico's economic condition.

1.4. The integrated resource plan

In accordance with current legal and regulatory framework, the Puerto Rico electric utility is required to submit to the regulator for review an Integrated Resource Plan (IRP). The IRP planning period is twenty (20) years and must be reviewed and updated every three (3) years. The Plan should be consistent with the Puerto Rico Energy Public Policy Act, Act 17 of 2019, which establishes renewable energy goals of 20 % by 2022; 40 % by 2025; 60 % by 2040; and 100 % by 2050.

The first IRP review process was conducted in 2015, approving a plan in September 2016. However, after the passing of Hurricane Maria, the Puerto Rico Energy Commission, now Puerto Rico Energy Bureau (PREB), requested to the electrical utility to file a new IRP. The IRP was filed by PREPA on February 13, 2019 and later resubmitted on June 7, 2019.

In summary the 2019 IRP proposed 1800 MW of solar photovoltaic capacity, equivalent to approximately 20 % of current average demand, based on a capacity factor of 0.21. It also proposed 920 MW of battery storage, which is equivalent to 230 MW in a time span of 4 h. In terms of fossil fuels, it considered four new 302 MW combined cycle (CCGT) units (i.e., in Palo Seco, Mayaguez, Costa Sur and Yabucoa), plus eighteen (18), gas turbine peaking units of 23 MW each. Four new Liquefied Natural Gas (LNG) terminals, two in San Juan, one in Mayaguez and one in Yabucoa were also proposed.

The proposed high investment in fossil fuel generation and in natural gas infrastructure was in contradiction with the renewable energy goals in Act 17, 2019. In accordance with the IRP projected total consumption

¹² Case:17-04780-LTS Doc#:1725. Urgent Motion for an Order in Limine Precluding the Official Committee of Unsecured Creditors from Entering Expert Report into Evidence at the 9019 Motion Hearing. November, 2019. Case:17-04780-LTS Doc#:1733. Memorandum of Law of The Government Parties in Opposition to Request of Congressman Raul M. Grijalva, Congresswoman Nydia M. Velazquez and Congressman Darren Soto for Leave to Participate as Amici Curiae “Plus”. November, 2019.

¹³ Puerto Rico Planning Board, Statistical Appendix to the Economic Report to the Governor. March, 2019.

¹⁴ Puerto Rico Planning Board *op. cit.*, Table 9.

¹⁵ It should also be pointed out that Real GNP in Puerto Rico has declined by 20% since Fiscal Year 2007. (PREPA 2020 Fiscal Plan, p. 13.)

¹⁶ Puerto Rico Planning Board, *op. cit.*, Table 31.

¹⁰ Act 4 of 2016 provided the legal framework to file for approval before the Puerto Rico Energy Commission (now Puerto Rico Energy Bureau) the 2016 RSA.

¹¹ 2019 Fiscal Plan, *op. cit.*, pp. 62–68.

for year 2038 of 9012 GWH¹⁷, the proposed natural gas infrastructure supplies all the energy demand needs by the end of the IRP period¹⁸.

For the transmission and distribution (T&D) system, the proposed 2019 IRP included new investment on 115 and 38 KV transmission lines, mainly comprising the development of Mini-Grids. The Plan also includes substation conversions to gas insulated substations (GIS), and undergrounding of feeders on their distribution side. It is important to note that the amount of investment is significantly higher on transmission than on the distribution side.

The cost of the proposed plan was \$14.7 billion, described in the table below as follows (Table 1):

On August 24, 2020 the Puerto Rico Energy Bureau issued the Final Resolution and Order on the PREPA Integrated Resource Plan¹⁹. The Energy Bureau concluded that the preferred resource plan presented by PREPA did not demonstrate economic benefit relative to other plans assessed as part of the process. In consequence, the Bureau approved a Modified IRP and a Modified Action Plan. Natural gas plants and related fuel infrastructure proposed for Palo Seco, Mayagüez and Yabucoa were rejected, only allowing the commencement of preliminary engineering for a new fossil fuel-powered unit and/or energy storage at Palo Seco. The Bureau approved a considerably greater amount of renewables, considering PREPA's proposal of 1800 MW of solar photovoltaic for 2024 versus the approved amount that considered 3500 MW for 2025. The Bureau accepted PREPA's filed load forecasts.

With regard to the transmission and distribution system analysis, the Bureau accepted the Mini-Grid concept, but did not approve the Mini-Grid design/construct, as proposed by PREPA. The Bureau also included, on the Modified Action Plan, a MiniGrid Optimization proceeding to assess costs, benefits, alternative configurations and local distributed resources among other aspects of the transmission and distribution system.

1.5. Grid modernization plan

On October 24, 2019 the Governor of Puerto Rico, together with the Executive Director of PREPA and the Executive Director of the Central Office for Recovery Reconstruction and Resiliency (COR3), announced the Grid Modernization Plan (Puerto Rico Central Office for Recovery Reconstruction and Resiliency, 2019)^{20, 21, 22}. The plan is intended for the reconstruction and modernization of the Puerto Rico electrical system. It was announced that the total cost of the plan was estimated on \$20.3 billion.

After the announcement, the plan was not filed with the PREB, either replacing or supplementing the June 7, 2019 IRP. From the available information it can be seen that the plan differs from the IRP filed with the regulator (PREB) in scope and costs, although there are similarities

¹⁷ Projected demand of 9,012 GWH considers Energy Efficiency and Distributed Generation per Exhibit 3–18 of the Puerto Rico Integrated Resource Plan 2018–2019, *op. cit.*

¹⁸ The four 302 MW combined cycle and eighteen 23 MW gas turbines on the IRP amounts to 1622 MW, equivalent to approximately 10,657 GWH, with a capacity factor of 0.75. This implies that Puerto Rico's base generation by year 2038 could be fully covered by means of the proposed natural gas utility scale generation and fuel infrastructure.

¹⁹ Final Resolution and Order on The Puerto Rico Electric Power Authority's Integrated Resource Plan, CEPR-AP-2018-0001. August, 24, 2020. *OpCit.*

²⁰ Gobierno presenta el plan de modernización de la red eléctrica. El Nuevo Día. October 24, 2019. <https://www.elnuevodia.com/noticias/locales/nota/gobiernopresentaelplandemodernizaciondelaredelaelectrica-2525483/>.

²¹ Grid Modernization Plan for Puerto Rico. Prepared for: Central Office for Recovery, Reconstruction and Resiliency. Working Group Members, Facilitated by Navigant Consulting, Inc., 2019.

²² Although the report has no date the file is dated December 13, 2019. [https://recovery.pr/en/documents/Grid%20Modernization%20Plan_20191213%20\(2\).pdf](https://recovery.pr/en/documents/Grid%20Modernization%20Plan_20191213%20(2).pdf).

in the estimated values for transmission and in the overall generation infrastructure amounts. The main difference between the two plans involves the distribution system (i.e., the allocations of new investment and related scopes of work).

The table below shows the breakdown of the estimated costs on the Grid Modernization Plan per the December 2019²³ report (Table 2).

2. Aspects to consider as part of the proposed PREPA transformation

The previous section considered the official documents that outline the roadmap to transform the electric utility that serve the Commonwealth of Puerto Rico. These documents aim to restructure the state corporation debt, modernize its physical capital and reform its operations. PREPA has total liabilities for \$17.69 billion and total assets for the amount of 9.88 billion²⁴. The proposed RSA provides a reduction of approximately 22.5 % only in the \$8.30 billion power revenue bond long term debt. This reduction is a small fraction of PREPA's total debt.

From a financial point of view, the main goal of any transformation effort needs to be that PREPA, in real value of assets and debt, recover its solvency and be able to access the bond market to finance its share of needed capital improvements. The outcome of the transformation needs to be competitive rates that propels economic development resulting in an overall increment on electricity demand, as compared with jurisdictions of similar economic characteristics and considering Puerto Rico's Gross Domestic Product (GDP) of \$105 billion²⁵. As stated earlier, the PREPA 2020 Fiscal Plan forecasts 21.3 cents per Kw-hour for FY 2021 and 22.8 cents per Kw-hour for FY 2025. This rate forecast excludes debt. The 2019 PREPA fiscal Plan do considers debt and related cost related to PREPA transformation with projected rates for 2024 in the range of 30 cents per Kw-hour. The average electricity rate in the U. S. for September 2020 was 11.07 cents per Kw-hour²⁶.

On the other hand, transformation efforts need to comply with the Puerto Rico energy policy including its renewable energy target of 100 % by 2050, preceded by incremental goals of 20 % by 2022; 40 % by 2025; and 60 % by 2040.

During October 2020 it was announced that the Federal Emergency Management Administration (FEMA) approved \$9.6 billion to repair damages to the electric grid caused by Hurricane Maria in September 2017²⁷. The deployment of those funds will have a direct impact on the overall landscape of Puerto Rico. During December 2020 PREPA completed the 10-Year Infrastructure Plan to be submitted to FEMA as a requirement to outline the proposed investments over the next 10 years²⁸. Nevertheless, the Puerto Rico Energy Bureau recently stated

²³ Grid Modernization Plan for Puerto Rico. *op. cit.*

²⁴ See Monthly Report to the Governing Board for December 2019. <http://aeepr.com/es-pr/investors/Financiamiento/Monthly%20Reports/2019/December%202019.pdf>.

²⁵ In accordance with data form the Bureau of Economic Analysis (BEA) and the Puerto Rico Planning Board, Puerto Rico Gross Domestic Product (GDP) of \$105 billion would be ranked in 38th position as compared with the GDP from other states. <https://apps.bea.gov/iTable/iTable.cfm?7001=1200&7002=1&7003=200&7004=sic&7005=1&7006=xx&7007=-1&7035=-1&7036=-1&7090=70&7093=levels&isuri=1&reqid=70&step=10>, http://jp.pr.gov/LinkClick.aspx?fileticket=-S_qacH_7UdU%3d&tabid=228&portalid=0&mid=1405.

²⁶ U.S. Energy Information Administration (EIA), Table 5.6.A. Average Price of Electricity to Ultimate Customers by End-Use Sector https://www.eia.gov/elecricity/monthly/epm_table_grapher.php?t=epmt_5_6_a.

²⁷ American Public Power Association. Puerto Rico to receive nearly \$10 billion from FEMA to rebuild its grid <https://www.publicpower.org/periodical/article/puerto-rico-receive-nearly-10-billion-fema-rebuild-its-grid>.

²⁸ 10-Year Infrastructure Plan. Puerto Rico Electric Power Authority. December 2020. https://aeepr.com/es-pr/Documents/20201207_PREPA%2010-Year%20Infrastructure%20Plan_vF.pdf.

Table 1
2018–2019 IRP.

Project	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	Totals
Solar Photovoltaics		\$452	\$686	\$848	\$586	–	–	–	–	–	\$2,572
Battery Energy Storage	\$49	\$211	\$594	\$74	–	–	–	–	–	–	\$928
San Juan 10 Synchronous Condenser	–	–	–	\$9	–	–	–	–	–	–	\$9
San Juan 9 Synchronous Condenser	–	–	–	–	\$9	–	–	–	–	–	\$9
Fossil Generation & Fuel Infrastructure	–	–	\$433	–	–	–	\$2,149	–	–	–	\$2,582
115 KV Mini Grid Trans. Investment.	–	–	–	\$2,048	–	\$322	–	\$214	\$138	\$86	\$2,808
38 KV Mini Grid Trans. Investment.	–	–	–	\$1,821	–	\$619	–	\$313	\$205	\$89	\$3,047
Transmission Reliability Investment	–	–	\$383	–	\$408	–	\$360	–	\$449	\$280	\$1,879
Distribution Investment	–	–	–	\$449	–	\$267	\$141	\$55	–	–	\$911
Total	\$49	\$663	\$2,096	\$5,248	\$1,003	\$1,209	\$2,650	\$581	\$792	\$455	\$14,746

Source: IRP Part 10.

Table 2
Grid Modernization Plan (\$ Million).

Project	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	Totals
Transmission & Substations	\$168	\$318	\$590	\$530	\$572	\$752	\$727	\$947	\$947	\$947	\$6,498
Distribution	\$302	\$583	\$633	\$633	\$633	\$584	\$584	\$584	\$584	\$584	\$5,704
Generation & Fuel	\$112	\$531	\$2,504	\$234	–	–	–	\$486	–	–	\$3,867
Technology	\$56	\$244	\$496	\$612	\$365	\$62	–	–	–	–	\$1,835
DER & Microgrids	\$136	\$360	\$572	\$313	\$58	\$62	\$63	\$64	\$63	\$64	\$1,755
Security	\$40	\$32	\$38	\$31	\$29	\$30	\$24	\$22	\$22	\$22	\$290
System Operations	\$23	\$65	\$92	\$35	–	–	–	–	–	–	\$215
Emergency Preparedness	\$25	\$42	\$10	\$10	\$10	\$10	\$5	–	–	–	\$112
Operational Efficiencies	\$1	\$4	\$8	\$3	\$1	\$1	\$1	\$1	\$1	\$1	\$22
Regulatory & Policy	\$3	\$4	\$3	\$2	–	–	–	–	–	–	\$12
Total	\$866	\$2,183	\$4,946	\$2,403	\$1,668	\$1,501	\$1,404	\$2,104	\$1,617	\$1,618	\$20,310

Source: GridMod Plan.

that the 10-Year Plan was not in accordance with the Approved IRP and in Resolution and Order dated January 25, 2021 required PREPA to revise the Plan to correct its noncompliance²⁹.

The expected economic and financial consequences of the roadmap on the Puerto Rican economy and PREPA’s financial outlook are analyzed in a separate paper³⁰. The success of PREPA’s transformation depends on the execution of the current legal and regulatory framework. Unfortunately, key documents, such as the PREPA Fiscal Plans, do not detail how these transformations are going to be financed, and no analysis is provided for expected economic impacts that should arise from increasing electricity tariff rates to PREPA consumers.

Declaration of Competing Interest

The authors report no declarations of interest.

References

Definitive Restructuring Support Agreement, 2019. Dated as of May 3, 2019, Among the Puerto Rico Electric Power Authority (PREPA), the Puerto Rico Fiscal Agency and Financial Advisory Authority (AAFAF), the Financial Oversight and Management Board for Puerto Rico (FOMB), Members of the Ad Hoc Group of PREPA Bondholders, and PREPA Bond Insurers. <https://drive.google.com/file/d/1OMnHcCEAIXCOXH3kYoyqql77C2VFHdX2/view>.

PREPA, 2020. Fiscal Plan for the Puerto Electric Power Rico Electric Power Authority, As Certified by the Financial Oversight and Management Board for Puerto Rico on June 29, 2020. <https://drive.google.com/file/d/1paRgy0dJBkUH4-5ev7z2SuR0dii18g9/view>.

²⁹ Review of The Puerto Rico Electric Power Authority’s 10-Year Infrastructure Plan - December 2020. Determination on alignment with the Approved Integrated Resources Plan and Modified Action Plan. NEPR-MI-2021-0002. <https://energia.pr.gov/wp-content/uploads/sites/7/2021/01/20210125-MI20210002-RO-10-YR-Plan-1.pdf>.

³⁰ Tomas Torres and Ramon Cao (2021). Viable Transformation of an Electric Utility? The Case of the Puerto Rico Electric Power Authority. Paper Submitted to the Electricity Journal.

Puerto Rico Act 17 of 2019, 2019. Puerto Rico Energy Public Policy Act. <https://aeepr.com/es-pr/QuienesSomos/Ley17/A-172019%20PS%201121%20Politica%20Publica%20Energetica.pdf>.

Puerto Rico Central Office for Recovery, Reconstruction and Resiliency, 2019. Grid Modernization Plan for Puerto Rico. Prepared for: Central Office for Recovery, Reconstruction and Resiliency (2019). Working Group Members, Facilitated by Navigant Consulting, Inc., 2019. Although the report has no date the file is dated December 13, 2019. [https://recovery.pr/en/documents/Grid%20Modernization%20Plan_20191213%20\(2\).pdf](https://recovery.pr/en/documents/Grid%20Modernization%20Plan_20191213%20(2).pdf).

Puerto Rico Energy Bureau, 2020. Final Resolution and Order on The Puerto Rico Electric Power Authority’s Integrated Resource Plan, CEPR-AP-2018-0001. August, 24, 2020. <https://energia.pr.gov/wp-content/uploads/sites/7/2020/08/AP20180001-IRP-Final-Resolution-and-Order.pdf>.

Siemens Industry, 2019. The Puerto Rico Integrated Resource Plan 2018-2019, Draft for the Review of the Puerto Rico Energy Bureau, Prepared for Puerto Rico Electric Power Authority. Submitted on June 7, 2019. <https://energia.pr.gov/wp-content/uploads/sites/7/2019/06/2-IRP2019-Main-Report-REV2-06072019.pdf>.

Further reading

Cao García, R.J., 2019. An Independent Evaluation of the Definitive Agreement for Outstanding PREPA’s Debt, of PREPA Fiscal Plan and a Modest Proposal. August 27, 2019. <http://tomastorresjuntaaee.com/wp/wp-content/uploads/2019/09/Final-Report.pdf>.

Cao García, R.J., 2020. An Independent Evaluation of PREPA’s Financial Sustainability and Its Impact on the Proposed Restructuring Support Agreement, PROMESA Proceedings and Funding Scenarios on PREPA Planned Capital Investments. May 19, 2020. <http://tomastorresjuntaaee.com/wp/wp-content/uploads/2020/06/AN-INDEPENDENT-EVALUATION-OF-PREPA%E2%80%99S-DEBT-SUSTAINABILITY-05-19-20-Final.pdf>.

Kury, T.J., 2019. Many electric utilities are struggling – will more go bankrupt. Conversation 2019 (May (3)). <https://theconversation.com/many-electric-utilities-are-struggling-will-more-go-bankrupt-113458>.

PREPA, 2019a. Fiscal Plan for the Puerto Electric Power Rico Electric Power Authority, As Certified by the Financial Oversight and Management Board for Puerto Rico on June 27, 2019. <https://drive.google.com/file/d/18wh7W-dch5Lnr-gKJZMtxp-DJ1NYBQw/view>.

PREPA, 2019b. Monthly Report to the Governing Board for December 2019. <http://aeepr.com/es-pr/investors/FinancialInformation/Monthly%20Reports/2019/December%202019.pdf>.

PREPA Independent auditors’ report Audited financial statements. PREPA Independent Auditors’ Report Audited Financial Statements Required Supplementary Information and Supplemental Schedules for the Year Ended June 30, 2017. [https://aeepr.com/es-pr/investors/FinancialInformation/Annual%20Reports/Financial%20Statements,%20Required%20Supplementary%20Information%20and%20Supplemental%20Schedules%20\(2017\)%20\(RE-ISSUE\).pdf](https://aeepr.com/es-pr/investors/FinancialInformation/Annual%20Reports/Financial%20Statements,%20Required%20Supplementary%20Information%20and%20Supplemental%20Schedules%20(2017)%20(RE-ISSUE).pdf).

- Puerto Rico Energy Bureau, 2017. Final Resolution and Order. Review of Rates of The Puerto Rico Electric Power Authority. <https://energia.pr.gov/wp-content/uploads/sites/7/2017/01/Final-Resolution-and-Order.pdf>.
- Puerto Rico Planning Board, 2019. Statistical Appendix to the Economic Report to the Governor 2018. <https://jp.pr.gov/Portals/0/Economia/Informes%20Econ%20B3micos%20al%20Gobernador/Informe%20Econ%20B3mico%20al%20Gobernador%20y%20Ap%20ndice%20Estad%20ADstico%202018.pdf?ver=2019-05-03-093612-820>.
- Puerto Rico Planning Board, 2020. Statistical Appendix to the Economic Report to the Governor 2019. April, 2020. Table 1. <https://jp.pr.gov/Portals/0/Economia/Informes%20Econ%20B3micos%20al%20Gobernador/IEG%202019%20622.pdf?ver=2020-06-22-094350-680>.
- Salanié, B., 2000. *Microeconomics of Market Failures*. The MIT Press, Cambridge, Mass.
- US District Court for the District of Puerto Rico, 2019a. Case:17-04780-LTS Doc#:1725. Urgent Motion for an Order in Limine Precluding the Official Committee of Unsecured Creditors From Entering Expert Report Into Evidence at the 9019 Motion Hearing. November, 2019. <https://dm.epiq11.com/case/pr1/dockets/1725>.
- US District Court for the District of Puerto Rico, 2019b. Case:17-04780-LTS Doc#:1733. Memorandum of Law of the Government Parties in Opposition to Request of Congressman Raul M. Grijalva, Congresswoman Nydia M. Velazquez and Congressman Darren Soto for Leave to Participate As Amici Curiae "Plus". November, 2019. <https://dm.epiq11.com/case/pr1/dockets/1733>.
- Wolfe, A., 2019. Case:17-04780-LTS Doc#:149-2. Declaration of Andrew Wolfe in Support of Opposition of the Financial Oversight and Management Board for Puerto Rico to the Motion of the Ad Hoc Group of PREPA Bondholders, National Public Finance Guaranty Municipal Corp., Assured Guaranty Corp., Assured Guaranty Municipal Corp., and Syncora Guarantee Inc. For Relief From the Automatic Stay to Allow Movants to Enforce Their Statutory Right to Have a Receiver Appointed. <http://dm.epiq11.com/case/pr1/dockets/149>.



Tomás J. Torres-Placa (MPL, PE, LPP) is a licensed professional engineer, licensed professional planner and independent researcher. He graduated with honors from engineering at the University of Puerto Rico, Mayaguez Campus. He also has a Master's Degree in Planning from the University of Puerto Rico, Río Piedras Campus. He has experience in government and private sector as well as non-profit organizations. During his career he has worked in the Puerto Rico Electric Power Authority, in the pharmaceutical and high-tech industry and as a consultant. Mr. Torres-Placa participated in the three main initiatives that helped craft the 2019 new Puerto Rico energy policy, including the Public Collaborative for Puerto Rico's Energy Transformation, the Puerto Rico Senate Advisory Committee on Energy, and the Southern States Energy Board Blue Ribbon Task Force. He is former member of the Puerto Rico Planning Board; has lectured in Puerto Rico and abroad, highlighting energy and planning issues; and chaired for two years the Energy Committee at the Puerto Rico Manufacturers Association. On March 2019, he became the Consumer Representative on the Puerto Rico Electric Power Authority (PREPA) Governing Board.

Ramón de Jesús Cao García is a retired professor of the Department of Economics of the University of Puerto Rico (UPR), Río Piedras Campus. There he taught graduate and undergraduate courses in microeconomic theory, public sector economics, statistics, econometrics and cost/benefit analysis. He was also associate dean of academic affair of the College of Social Sciences, Chairman of the Department of Economics, Director of the Economic Research Unit and advisor to the President of the UPR. He is author, co-author or editor of eleven books and more than fifty academic or professional articles published in journals in Puerto Rico, the United States, Latin America and Europe. He has been consultant to the United Nations Development Program, Puerto Rico Manufacturers Association, PR Chamber of Commerce, PR Association of Insurance Companies, PR Office of the Insurance Commissioner, PR Treasury Department, PR Office of the Comptroller, PR Planning Board, among other public and private enterprises and institutions. Presently, he is president of Asesoría y Consulta, Inc., a small economic research firm, doing business for clients in Puerto Rico and the USA.