



Queremos SOL

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WE WANT SUN:

Sustainable. Local. Clean.

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We Want Sun: Sustainable. Local. Clean.

Any notion about transforming energy public policy in Puerto Rico must concentrate preferentially on immediate energy efficiency and conservation measures, together with clean renewable energy¹. Our energy system can be re-powered with 100% clean renewable energy and storage.² Puerto Rico can become a role model for the transition to renewable energy for small island nations and a model of bottom-up transformation for communities in the United States. It can also serve as a model of an integrated energy focus that includes risk reduction, climate change, health, adaptability, equity and democratization. Energy must be understood as a common good and a human right, rather than imposing a privatization model based on market forces that limits active integration of citizens who generate energy and participate in the wealth it creates. The Puerto Rico Electric Power Authority should remain in public hands in order to implement the transformation. The proposed sale and privatization of the system will perpetuate fossil fuel-based generation, impeding the transition to renewables.

Similarly, we cannot let political party structures, power struggles and vested interests of fossil fuels and other interest groups that benefit from PREPA's current structure prevent us from achieving a sensible and inclusive sustainable reconstruction and transformation. And even if reaching 100% renewable energy will take time, it is necessary to embark on the path with commitment and transparency.

We Want Sun presents an energy path towards self-sufficiency and sustainability based on the use of endogenous renewable resources, mainly solar, which promotes local

¹ We define clean renewable energy as energy derived from the sun, wind, sea waves, ocean thermal and hydroelectricity. The incineration of solid waste or waste to energy is not considered renewable or clean energy. Law 82-2010 should be amended to eliminate the incineration of solid waste as alternative renewable energy.

² O'Neill, Efrain (2018); Irizarry, Agustin (2009)

ownership and economic progress by using clean renewable technologies and inclusive structures and processes meant to eliminate partisan political interference and systemic corruption.

II. Executive Summary

We present an **energy vision** aligned with our objectives as a people towards a sustainable, resilient and innovative energy system, based on clean renewable energy, distributed generation and endogenous resources. It is an affordable system, which promotes efficiency, assures equity, promotes ample public participation and the development of local capacity through shared governance and transparency, while at the same time producing local wealth and ownership.

We Want Sun's energy transformation includes:

- **A model for technical transformation** with the goal of achieving a Renewable Portfolio Standard (RPS) of 50% by 2035 and 100% by 2050 and an Energy Efficiency and Conservation Policy Objective of 25% by 2035. This transformation must be based on a clear public policy of: (1) efficiency, conservation and demand management; (2) distributed renewable generation with storage, emphasizing rooftop solar; and (3) accelerated elimination of fossil fuels. A decentralized energy system is proposed that allows individuals, communities, municipalities and cooperatives to have active roles in the ownership of the electrical system assets. The current drive toward new large-scale infrastructure for natural gas under long term contracts creates the risk of overbuilding the centralized generation system and saddling Puerto Rico for the long term with more natural gas than it needs, crowding out the integration of renewable energy. This limitation is aggravated under a privatization structure that mandates the purchase of a specific amount of energy.
- **A model for governance transformation** to maximize transparency and include the voices of multiple sectors of Puerto Rican society that need to be reflected in the energy governance structure. The Puerto Rico Electric Power Authority (PREPA) will continue to have an important role in the electrical system. In the short term, it will continue to supply services through the current infrastructure while initiating a dramatic transformation of its business model to become an entity that:
 - Promotes efficiency and conservation
 - Manages demand
 - Facilitates the development and integration of distributed generation and participates in the installation and maintenance of these distributed photovoltaic systems with storage
 - Manages the interaction and relationship of the various distributed generators and microgrids
 - Participates in the development of large-scale renewable energy and storage and promotes the optimization of the existing hydroelectric system

- Ensures reliable, affordable and safe service for all, and
- Carries out a plan for the development of the electrical system that incorporates the accelerated and orderly withdrawal of fossil fuel-based generators.

It is important to ensure that PREPA will be a functional corporation from the beginning and throughout the transformation. The model presented here seeks greater citizen participation and recognizes the necessity of attracting and retaining the best available human resources. We emphasize that, although the current administration is promoting privatization as a solution to the governance problem, the privatization process established by Act 120-2018 will produce more of the same: bad political deals disguised as energy policy.

- **Options to finance the transformation** using diverse sources of funds and programs in order to achieve an affordable and resilient energy system based on renewable distributed resources. Contrary to the government's rhetoric, the privatization of PREPA is not the only way to attract capital investment for Puerto Rico's electrical system.
- **A comprehensive audit of the debt** (and holding accountable those who participated in illegal debt issuances) **and a debt restructuring** that protects local bondholders (individuals, small businesses, cooperatives) while ensuring a substantial reduction or elimination of debt repayment by PREPA ratepayers in order to achieve an affordable and financially sustainable electrical system. We understand that PREPA is in the process of negotiating its debt. However, rate increases that would result from a significant debt payment will impair the ability of the economy to generate the revenue necessary for an economically viable and environmentally sustainable transformation.
- **Focus on boosting local economic development** by acknowledging that PREPA's key to success will be local energy investments designed to recruit and train Puerto Rican residents, develop careers for local workers, create new business opportunities and as a result have affordable rates for the long term supported by competent professional staff. The economic opportunity of research, development and manufacturing of emergent renewable technologies is acknowledged, as well as the potential economic activity offered by sustainable management of materials needed for renewable systems after the end of their useful life.
- **A strong independent regulator** to protect the public interest and ensure sound and professional energy planning. PREPA operated without a regulator until 2014, when the Legislature created the Puerto Rico Energy Commission (now the Energy Bureau). This entity's budget should be strengthened, and its regulatory authority over contracts should be restored. Also, transparency and rigor should be ensured in the development of the Integrated Resource Plan (IRP) as the planning document to guide investment decisions in order to avoid overbuilding generation in Puerto Rico and to minimize the risk that decreasing electricity sales lead to stranded assets that consumers would be forced to pay for.

We Want Sun's proposal will continue to be strengthened through modeling, additional studies, as well as open dialogue and exchange with citizens (using www.queremossol.com along with

community meetings). Key energy issues that could not be included in this proposal due to time limitations will be developed, including, for example, transportation energy use.

This remains a living document that will continue to be developed by new ideas, technological advances, studies and, more important, public input.

III. Energy Vision for Puerto Rico

It is essential that the energy vision be based on a broader conception of our objectives as a people and we must ask ourselves, as the researcher Edgardo Lander reminds us, energy for what and for whom?³

Transformation should be in the hands of citizens, of the people. Energy should be a pathway towards individual, family and community prosperity. To ensure this, it is important to define a general vision for Puerto Rico's future, which the energy system should serve.

A. Base for developing the energy vision

The Puerto Rico Energy Dialogue Roundtable adopted the vision embraced here: Puerto Rico is prosperous, just, democratic, sustainable and happy.⁴ These elements are defined as follows:

Prosperous: Citizens enjoy stable systems for housing, education, health, justice, security, that allow them to live free and equal in dignity and rights.

Just: Social and material wealth and responsibility are developed and distributed in a way to reduce differences between citizens.

Democratic: This is a society with broad public participation in decision-making. It is a democracy where, having agreed on a common vision, citizens work together to solve problems. In spite of the differences that separate us, there is the certainty of a common destiny that unites us and calls us to care for the welfare of all.

Sustainable: Abundant and healthy natural systems allow present generations to meet their needs, without compromising the possibilities for future generations to meet their needs.⁵ In our vision, development is not the end but an instrument by which to achieve the prosperity and happiness of all citizens. It is important to note that any sustainability strategy must consider the limitations imposed by natural laws and the carrying capacity and resources available on Earth.

Happy: Citizens can determine the future of their lives by building and enjoying all the material and social riches of Puerto Rico including solidarity.

Similarly, to ensure that the energy vision responds to the best interests of the people, it must harmonize the existing technological opportunities with our current economic, social and environmental realities.

Chief among these realities is the rampant inequality that prevails on the Island. As the recent Report on Human Development in Puerto Rico confirmed, the Island has the dubious distinction of being one of the five most unequal societies in the world, and inequality has been increasing

³ Transnational Institute, *Towards democratic energy*, Amsterdam, February 2016, p.11.

⁴ This vision is the product of the work of more than 130 people belonging to a dozen groups. It began to take shape in 1996 in the Industrial Mission with the Alliance for the Sensitive Management of Waste and has continued working on it for the past decades.

⁵ The Rio Declaration on the Environment and Development (U.N. 1992).

since 2005.⁶ Every public policy established in Puerto Rico has the moral imperative to address the abysmal differences that exist between those who have and those who have not.

Likewise, all public policy in current times must focus on adapting and reversing the effects of climate change. This is a challenge that will only become more acute, complicating and limiting the possibilities of future generations, if urgent measures are not taken today. It is well known that the energy sector and particularly the combustion of fossil resources is one of the main contributors to climate change and that centralized generation using fossil fuels represents a great vulnerability in the processes of adaptation to climate change.

The participation of citizens as "prosumers"⁷ of the electricity system can be an important mechanism in improving poverty and inequality in Puerto Rico. To the extent that people become active participants in generating energy, they can also benefit from the wealth that such activity generates. Likewise, clean renewable energy will provide more system resilience as it contributes to the movement against climate change.

B. Declaration of energy vision

Taking into consideration the above, it is urgent the need be recognized for social and technological transition to a new culture of social and environmental justice, based on sustainable practices and technologies that make for a viable, effective and lasting public energy policy in Puerto Rico.

We define and adopt as an **ENERGY VISION**:

- *A sustainable, resilient⁸ and innovative social and material system, based on clean renewable energy, distributed generation and endogenous resources.*
- *An affordable system that promotes efficiency, ensures equality, encourages broad public participation and capacity building through shared governance and transparency, while producing local wealth and local ownership.*

IV. Technical Transformation Model

Although the grid was repaired and electric service restored after Hurricane María, Puerto Rico must still make significant investments in its electrical system to reduce dependence on fossil fuel generation plants. From a technical point of view, we see no reason why Puerto Rico cannot aspire to the same goal as Hawaii, which seeks to get 100% of its electricity from renewable energy by 2050.⁹ Distributed renewable generation located at or near the place of consumption must be

⁶ Puerto Rico's Human Development Report

https://estadisticas.pr/files/Publicaciones/INFORME_DESARROLLO_HUMANO_PUERTO_RICO_1.pdf

⁷ "Prosumers" are defined as producers and consumers of energy.

⁸ "Resilient" is defined as the capacity as the capacity of adaptation of a living being in the face of a disturbing agent or an adverse state or situation and the capacity of a material, mechanism or system to recover its initial state when the disturbance to which it had been subjected has ceased.

⁹ Hawaii's legal goal is 100% renewable energy by 2050, but HECO, its main electric utility, plans to reach it five years before.

included for purposes of calculating compliance with the renewable energy portfolio established by Act 82-2010. Any new law passed should clearly include of distributed renewable energy in the island's electricity-generation portfolio.

Our goal must be to achieve a Renewable Portfolio Standard (RPS) of 50% by 2035 and 100% by 2050, and an Energy Efficiency and Conservation Policy Objective of 25% by 2035.

This transformation model must be based on a clear public policy of:

1. **Efficiency, conservation and demand management.**
2. **Renewable distributed generation with storage.**
3. **Accelerated elimination of fossil fuels.**

Reliance on fossil fuels as a strategy to diversify energy sources only condemns Puerto Rico to dependence on external energy sources and the resulting detrimental impacts on health and the environment. Strategies are called for now to keep the greatest possible amount of capital in Puerto Rico while maintaining social and environmental benefit for citizens. The speed with which the costs of renewable energy and energy storage technologies have declined provide a dual benefit to Puerto Rico: low cost and reliability, both resulting from by radically decentralizing the electric system, and from locating generation near where it is consumed.

A decentralized energy system will also disperse political power, creating opportunities for individuals, communities, municipalities and cooperatives to have more active roles in the ownership of the assets of the electricity system.

The use of renewable energy presents substantial benefits, such as reduced dependence on imported fuels; reduced grid vulnerability for Puerto Rico via diversification of its energy portfolio; creation of jobs and economic benefits and other environmental and social benefits. PREPA, as a public entity adopting a new model of governance and transformation (see below), will serve as the platform for the implementation of the technical transformation model.

A. Efficiency, conservation and demand management

As Puerto Rico seeks to transform electricity generation, it will need to prioritize investment in energy efficiency and demand management. A policy that encourages and rewards conservation and energy efficiency is called for. The more electricity that can be saved through efficiency and conservation, the less money needed to invest in new generation.

Demand response – which refers to reducing peak demand on the electrical system – is of importance in Puerto Rico because that peak currently occurs at night, when solar energy is not available. To the extent that the peak can be reduced, less investment will be required to provide energy at night.

An energy efficiency study conducted in 2013 by the University of Puerto Rico in Mayagüez determined the potential for 15% in energy savings in the residential sector and 10.4% in the commercial sector from 2013 to 2025. Savings from the residential sector by improving the efficiency of air conditioners, solar water heaters, lighting and refrigeration.

In 2016, high-performing states achieved energy efficiencies of 1.5% to 3% per year of total electricity sales, while 22 states achieved savings of 0.5% to 1.5% per year of total electricity sales.¹⁰ Energy efficiency strategies (e.g. switching to more efficient light bulbs) can be ramped up over several years to achieve annual savings of 1.5% and an overall demand reduction of 15% in 15 years.¹¹ Adding energy conservation (e.g. turning off lights) could allow for a reduction in demand of 25% by 2035. STRATEGIES

- Adoption of broad education programs for citizens around the importance of efficiency and conservation, and on the best practices to reduce electricity consumption.
- Significant expansion of the use of solar water heaters in residences and businesses, which also represents an opportunity for local economic development that has not yet been fully exploited.
- Replacement of air conditioners and lighting in the residential and commercial sectors as a strategy to achieve annual savings on the order of 1%. This strategy would be complemented by rooftop solar generation. Incentives should be developed (via bill credits) for commercial and residential customers to install controls on air conditioners and water heaters to reduce demand during peak hours.¹²
- Adoption of discounts and other incentives to residents and businesses to conduct energy audits and/or install more efficient technologies. Such programs are cost-effective in terms of the amount that the utility spends (if the cost for saving each kilowatt-hour is less than the amount it would cost to generate). Electricity costs in Puerto Rico provide great potential for cost-effective energy efficiency. In 2016, the Puerto Rico Energy Commission ordered PREPA to design and implement cost-effective energy efficiency and demand response programs that have not yet been carried out.
- Adoption of a demand aggregators (DA) program modeled after ones followed by utility companies in Europe and the continental United States that are dedicated to identifying users interested in reducing their consumption in exchange for better rates or other economic incentives. DA programs administer "energy resources" and negotiate terms and conditions with the electric utility. PREPA can take the first step and offer these services without intermediaries (resulting in greater benefit and lower cost to the public), so that, in times of grid congestion, or when there are variations in the electricity supply, PREPA can use these services to reduce demand and meet the variations due to reductions in renewable generation, instead of having to generate additional electricity in plants that burn fossil fuels.

¹⁰ American Council for an Energy Efficient Economy (ACEEE), State Rate, 2017. <https://aceee.org/research-report/u1710>.

¹¹ PREPA Supplemental Integrated Resource Plan, April 19, 2016, p. 3-3

¹² Example:

https://www.cpsenergy.com/content/dam/corporate/en/Documents/EnergyEfficiency/requirements_demand_response.pdf

More information: https://www.michigan.gov/documents/energy/Common_Practices_Feb22_522983_7.pdf.

- Implementation of time-of-use rates that are more expensive during peak demand hours and cheaper during non-peak hours to encourage customers to modify their electricity consumption habits.
- Adoption of a prepaid electricity tariff that allows customers to budget for the amount of electric energy they wish to buy, at a discount, and consume over a period. For example, a customer could budget for 12 kWh per day and buy, at a discount, 360 kWh to consume over 30 days. PREPA would send a text message indicating when there is 20% of energy remaining, and the consumer could buy additional electricity (perhaps at a lower discount than the original) if needed. This structure would produce savings to PREPA because, with money in hand, it can buy fuel at a lower cost and can better plan its system operation. It would allow management consumption by customers, encouraging them to stay within an energy budget. In the case of large industrial customers, PREPA would establish agreements to compensate them for reducing consumption by a predetermined amount during peak demand hours.
- Establishing rules that require all domestic and industrial electrical appliances and equipment imported into Puerto Rico comply with the most modern efficiency standards and that require all new legislation be updated annually to the latest technology.¹³
- Mandatory adoption of a conservation and efficiency policy with clear compliance metrics on government agencies and industries with the highest consumption. A task force would be established to work with government agencies, municipalities and industries to help them achieve these objectives.
- Optimization of energy efficiency in buildings through certifications and incentives (Energy Star, etc.) as well as by updating building codes to the Green Building Code and establishing mechanisms that ensure that housing costs remain affordable. Green buildings certification systems adjusted to Puerto Rico must also be developed.
- Explore passive energy conservation strategies inherent in homes and buildings such as thermally efficient sheathing, use of eaves, skylights, proper windows, ventilation and natural lighting, rainwater harvesting, etc. This may be the principle to develop structures that can survive catastrophic events without electricity or water services.

B. Renewable distributed generation with storage¹⁴

A recent study by UPR-Mayagüez on renewable energy resources in Puerto Rico (Achievable Renewable Energy Targets) recommends moving toward greater use of wind, sun, and wave energy, which have the potential to provide more energy annually than was used in Puerto Rico in 2006 alone. Solar and wind are available for immediate use through commercially available technology.

¹³ Example: Energy Star.

¹⁴ It should be emphasized that these systems suffer fewer impacts before extreme events. With hurricane Maria, the systems that were installed properly did not suffer any damage. As we saw with Hurricane Maria, a centralized electrical system is vulnerable to atmospheric events.

The sun offers the advantage of being predictably available throughout the island. Figure 1 shows annual average insolation in Puerto Rico, double the annual solar insolation of Germany, a world leader in photovoltaic energy.

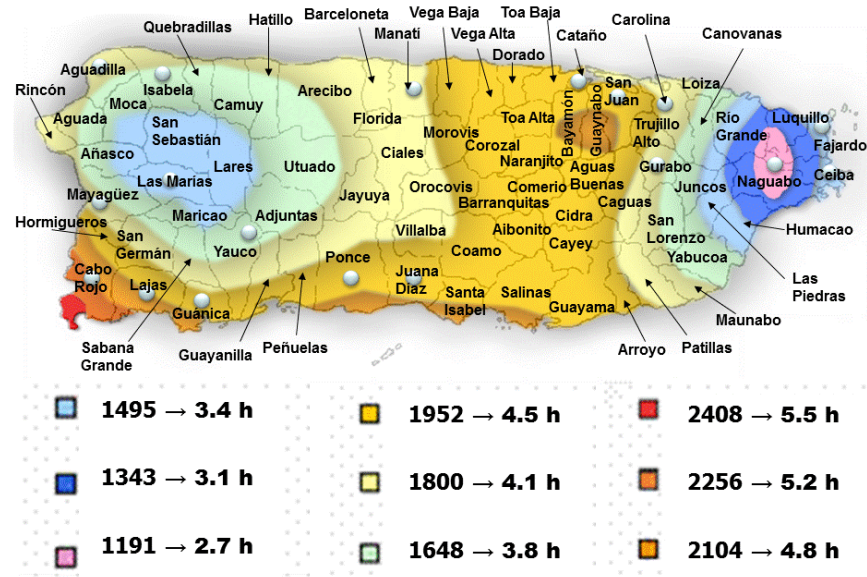


Figure 1: Estimated average insolation in Puerto Rico in kWh/m² per year and the equivalent in hours. (Source: Study Achievable Renewable Energy Targets. <http://www.uprm.edu/aret/>)

Renewable energy systems and storage costs have declined dramatically in recent years. This trend stands in stark contrast to the high prices of renewable energy power purchase and operation agreements (PPOAs) signed by PREPA and currently in operation (at 15.6-20 cents/kWh connected to the PREPA grid and without storage).¹⁵ The average cost of a large-scale solar PPOA in the continental United States in 2016 was less than 5 cents/kWh without storage.¹⁶ In early 2018, a renewable energy purchase agreement for a solar project with storage in Hawaii came in at less than 11 cents/kWh.¹⁷

A 2017 analysis predicted a 36% reduction over the next 5 years in the cost of lithium-ion battery-based energy storage.¹⁸

1. Rooftop Solar

The use of the sun is technologically and economically viable in Puerto Rico. Priority should be given to this "rooftop resource" at the residential, commercial and industrial level, which with distributed and adequate storage, will create no grid-interconnection problems. We estimate that

¹⁵ PREPA Supplemental Integrated Resource Plan, April 1, 2016, Table 5-6.

¹⁶ M. Bolinger, J. Seel, K. LaCommare, "Utility-Scale Solar 2016," Lawrence Berkeley National Laboratory, September 2017. http://eta-publications.lbl.gov/sites/default/files/utility-scale_solar_2016_report.pdf.

¹⁷ Utility Dive, "Kauai utility moves ahead with Tesla, AES storage on road to 70% renewables," June 25, 2018. <https://www.utilitydive.com/news/kauai-electric-co-op-sees-batteries-as-central-to-70-renewables-push/526424/>.

¹⁸ Lazard, Levelized Cost of Storage Analysis – Version 3.0, November 2017.

the cost of providing 75% of homes in Puerto Rico with a minimum level of energy security (1.5 kilowatt of solar backup with a battery storage system of 5.4 kWh) by 2035 would be between \$300 and \$360 million per year, including labor.¹⁹ Such systems could generate approximately 2,500 gigawatt hours (GWh) of power annually or 15% of FY 2017 sales. These systems would result in rates that would not be subject to fluctuations in fuel costs. All in all, due to economies of scale, community-level facilities could produce energy at a lower cost.

The advantages of rooftop photovoltaic systems are many and include the use of existing roofs to prevent new impacts on open spaces, agricultural lands and ecologically sensitive areas. Rooftop solar also reduces the need for large investments in transmission infrastructure and avoids transmission losses. It also reduces maintenance costs of the transmission and distribution network and minimizes impacts on natural resources.

Rooftop solar does not require extensive easements on private properties, and it helps reduce temperatures inside buildings. Rooftop solar installations add value to buildings and promote local wealth. Distributed generation on roofs generates a greater reinvestment in the local economy with a multiplier effect. In addition, it allows citizens to become "prosumers" of energy, not merely consumers, and allows for control by residents and local communities, which is particularly important during power outages of the main grid, as happened after Hurricane Maria.

This strategy has broad civil society support, contrary to large-scale solar facilities on land of agricultural value, protected land, or flood plains, which often face considerable public opposition.

A public policy that promotes installation of these systems would contribute to the training of the country's workforce; decrease the use of the large quantities of water used by fossil fuel plants; reduce the discharge of overheated waters and entrapment of marine species by intake systems; and avoid chemical spills and other pollution by decreasing toxic emissions that include greenhouse gases that cause climate change.

2. Large-scale installation of renewables

Where roof space is not available, large-scale solar facilities can be constructed in suitable areas. A significant impact in the short term could be achieved by building such arrays over shopping center parking areas, for instance, which usually have little aesthetic or environmental value. The main value of such systems would be in their proximity to energy-intensive facilities with large-capacity electric circuits; such systems would also provide shade and help reduce the "urban heat island" effect. Additionally, closed solid waste landfills should be considered as utility-scale solar sites along with contaminated lands (brownfields). Large-scale storage facilities could also be sited in these areas. Installation of large-scale photovoltaic systems on agricultural or ecologically or environmentally sensitive land should not be considered. Public policy should give priority to food security.

3. Integration of distributed energy

PREPA, as a public entity, must be used primarily as an instrument of service to Puerto Rico. As such, it will have to do a better job integrating the views of those who until now have been its

¹⁹ For a 1.47 kW, 5.4 kWh system, the estimated cost is \$5,500, based on 2018 prices.

clients and will become "prosumers" instead. Such inclusion will create important opportunities for changing PREPA's business model.

Matching demand reduction with variations in renewable generation can help increase the presence of renewable energy while maintaining reliable service. We must move from talking about integrating renewable into the grid to start designing a grid for renewable energy and for customers actively participating through demand management programs. This strategy will add flexibility to the operation of the electrical system and allows for use of more local resources.

We must also remember that PREPA, and therefore the people of Puerto Rico, controls the largest fiber optic network on the Island. This network can become the main means toward establishing a smart grid²⁰ in Puerto Rico and a fundamental piece of the reinvention of PREPA and our electrical infrastructure, connecting all users and making possible exchanges of electricity generated on rooftops and broad dispatch of energy savings.

STRATEGIES

- Establishing a clear public policy of prioritizing investment in distributed renewable energy resources and energy storage, including prioritizing federal funding for this purpose.
- Prohibiting measures that penalize the "prosumer" or communities looking to self-supply their own energy. Establishing a clear policy that specifies that interconnected distributed generators, whether they are under net metering or not, will have to pay for the services they receive from the electricity grid.²¹
- Strengthening the fiber optic infrastructure of PREPA and investing in the development of a smart grid to maximize the integration of distributed renewable energy.
- Creating legal structures and appropriate technical assistance programs to support local ownership of decentralized energy resources. Funding should be allocated, perhaps through FEMA or CDBGs (Community Development Block Grants), to provide technical assistance to communities and municipalities that intend to develop microgrids or other electrical systems.
- Providing mechanisms to facilitate opportunities for low- and middle-income communities to establish solar communities and other progressive energy initiatives. (Refer to Section VI for funding mechanisms)
- Creating financial and legal structures that allow photovoltaic panels to be part of property registries.²² Solar panels have a useful life of more than 30 years, which is the

²⁰ "Smart grid" is defined as an electricity supply network that uses digital communications technology to detect and react to local changes in usage.

²¹ The price of these grid services must be established by the Energy Bureau. They must be fair and reasonable, in proportion to the size of the distributed system, and follow the best practices of the industry and jurisdictions that have adopted similar measures. This measure is desirable and is aligned to similar ones in some states and to the recommendations of the Critical Consumer Issues Forum and its document Policy Considerations related to Distributed Energy Resources (July 2013).

²² Abruña, Fernando, *The Absent House: Design, Build and Live in an Ecological House, Appendix 9: Strategies for sustainable systems feasibility*, p.169, 2005.

typical length of time for most housing mortgages. If a house is sold, a transferred deed would include the photovoltaic panels, allowing the cost of panels to be amortized to 30 years, yielding immediate benefits to the homeowner and with a substantial return on investment.

- Provision of adequate personnel for PREPA (interconnection of rooftop solar and other distributed energy systems suffers currently from significant delays due to a shortage of workers required to manage interconnections). Personnel must be trained to have the necessary expertise to expedite interconnection requests.
- Facilitating the integration and adoption of small, residential photovoltaic (PV) systems to become as simple and routine as installing water heaters. In Germany, by way of example, customers register their PV system over the Internet in a process that takes an average of 15 minutes. A large part of distributed generation companies that manage systems up to 1 MW in Puerto Rico are local companies, and they employ local people and move the local economy.²³ By supporting endogenous energy industries, Puerto Rico will be contributing to local economic development and keeping money generated by the production of electricity from renewable sources in Puerto Rico.
- Adopting a strong process of integrated resource planning, as discussed below.

C. Accelerated elimination of fossil fuels

Elimination of fossil fuel-generated electricity in Puerto Rico must be carried out through a well-managed process.

While it is likely that some investment in existing units that operate on fossil fuels will be required to improve the efficiency and flexibility of those units, the current momentum toward the development of new large-scale natural gas infrastructure under long-term contracts creates the risk of overbuilding the centralized generation system and saddling Puerto Rico in the long term with more natural gas than it needs, thus crowding out renewable energy.

This limitation is aggravated under a proposed privatization structure that mandates the purchase of a specific amount of energy.

However, investment should be directed mainly toward storage to allow for the integration of renewables while limiting the use of fossils. The increase in energy storage will enable the continued orderly retirement of units.

The following principles should guide the accelerated elimination of fossil fuels:

- Terminating the operation of the AES coal plant in or before 2027 (when the current contract expires) based on its non-compliance with environmental regulations and public

²³ The Energy Commission (or Bureau) must ensure that the market is fair among local companies so that they do not monopolize the costs of equipment and installation.

health protection.²⁴ No new coal-fired plants should be considered in Puerto Rico. Similarly, the incineration of solid waste or "waste to energy" programs should not be allowed.

- Retiring or limiting the operation of PREPA's generation units with high emission rates (per MWh) or that do not comply with air quality regulations, recognizing the continuing pollution violations and that said regulations are insufficient to protect public health. The integrated resource planning process should guide the accelerated and orderly retirement of these units as renewable energy and energy storage penetration increases.
- Prioritizing small-scale investments to reduce the risk of overbuilding the centralized generation system.
- Improving the efficiency and flexibility of existing fossil fuel units to allow for greater integration of renewables during the transition process. Investment in these units must be the minimum amount necessary to reach 50% renewable energy by 2035 and 100% by 2050. In the process of the integrated resource plan, cost-effectiveness and externalities should be considered in relation to which generation units should be phased-out first, which should be repowered or converted or if necessary which new small generation units should be added at existing plants. No new fossil generation plants should be established. The integrated resource plan should guide the transition from fossil fuels to renewable energy, including the schedule for the retirement of existing units and any needed investment to modernize the existing infrastructure - for example, the maintenance and/or repowering of the existing combined cycles; the placement of smaller units at existing sites, particularly in the north, that operate with more flexibility than existing units; the improvement and maintenance of existing turbines operating on diesel; and/or the location of small units (< 22 MW) in existing decentralized sites. The transition fuel in these cases must be determined based on its environmental-regulation compliance, cost effectiveness and investment required in new related infrastructure alongside the cost of externalities. The infrastructure for the supply of the selected transition fuel should be limited, if necessary, to connect Palo Seco and San Juan. System modeling through the integrated resource planning process with effective community participation will be required to determine which of these options should be pursued.

V. Governance Transformation Model

Current governance of the electrical system does not work.

PREPA has suffered a high degree of politicization, with new governors frequently replacing executive directors and board members and with a high number of political appointees in the administration of PREPA. These patterns have resulted in weak management, a lack of professional energy planning, and numerous contracting scandals.

²⁴ The base of non-compliance already exists to proceed with the cancellation of the AES contract.

Although the current administration is promoting privatization as the solution to the problem, the privatization process established by Act 120-2018 will only produce more of the same: bad political deals disguised as energy policy.

Act 120 establishes the process by which PREPA will sell its generation assets to a third entity; contract with a third party to build new generation; sell energy through a long-term contract; lease the transmission and distribution infrastructure to a private concessionaire and/or contract any other aspect of PREPA's operations. This law eliminates any significant role for the independent regulator and puts the process of deciding the assets to be privatized, issuing the requests for proposals and negotiating the contracts under the control of the governor, PREPA and the Puerto Rico Fiscal Agency and Financial Advisory Authority (AAFAF).

The law does not include any serious effort to reform the PREPA contract process, even though that process has resulted in costly and politically-driven contracts that have plagued PREPA's operations for years.

A. The role of PREPA

PREPA will continue to play an important role in Puerto Rico's electrical system.

In the short term, the Authority will continue supplying services through existing infrastructure while at the same time initiating a dramatic transformation of its business model as it becomes an entity that:

- Promotes efficiency and conservation
- Manages demand
- Facilitates the development and integration of distributed generation and participates in the installation and maintenance of these distributed photovoltaic systems with storage
- Manages the interaction and relationship of the various distributed generators and microgrids
- Participates in the development of large-scale renewable energy and storage and promotes the optimization of the existing hydroelectric system
- Ensures reliable, affordable and safe service for all, and
- Carries out a plan for the development of the electrical system that incorporates the accelerated and orderly withdrawal of fossil fuel-based generators.

This is why it is important to ensure that PREPA is a functional corporation from the beginning until the completion of transformation.

For decades, PREPA's decision-making has been driven by partisan politics rather than any commitment to energy planning in the public interest. Depoliticizing and democratizing PREPA will not be easy. Our view is that there should be as much transparency as possible in this process and that the voices of multiple sectors of Puerto Rican society should be reflected in the governance of PREPA.

With these principles in mind, we propose:

- That PREPA's **board of directors** be appointed or elected to fixed terms and that they be required to have relevant professional qualifications and energy industry expertise. Terms should be staggered. We recommend that three board members be appointed by the governor from lists submitted by: (1) environmental organizations; (2) labor unions; and (3) small business organizations. The governor should have 30 days to either make an appointment or reject the list and request a new one and must be limited to rejecting the list only once. If the governor does not make an appointment within the allotted period, the relevant organizations should appoint a board member directly from their list. Two board members should be appointed directly by (1) the League of Cooperatives; and (2) the Association of Economists. A sixth member should be selected from the engineering faculty of Puerto Rico universities. Two members should be elected by PREPA's residential and commercial customers as consumer representatives, and one should be elected by industrial consumers as an industry representative. Board members may be dismissed only for cause and only if the resolution authorizing dismissal receives more than six votes. The board must have finance and audit committees, and the members of these committees should not overlap.
- That the **executive director** be appointed by the board through an open recruitment process. All presentations made by candidates to the board should be publicly available, and all candidate interviews conducted by the board should be broadcast live and recorded. The board should have just cause before dismissing an executive director. The compensation of the executive director should be capped at 3.5 times the average worker pay at PREPA.
- Reform of **contract and enforcement policies** should systematically address all contract irregularities discovered in audits by the Office of the Comptroller and by the 2016 Senate investigation into the purchase of fuel.
- **Internal restructuring** should be informed by various audits and investigations of PREPA fuel purchase practices that have highlighted the centralization of power and responsibility within its Fuel Office. The board should undertake a structural analysis of PREPA's operations to ensure that potentially conflicting operations are not centralized in a single office, particularly the Fuel Office.
- The Legislature should authorize the creation of a non-profit, membership-based **PREPA Consumer Advisory Board** with access to all information available to PREPA board members, including all internal audit reports, and with the right to a response from the executive director to all written questions and statements submitted by advisory board members and with the ability to compel enforcement by the Puerto Rico Energy Bureau in the event that PREPA does not cooperate.
- **Attraction and retention of an appropriate labor force** through appropriate policies aimed at reducing administrative costs associated with the large number of political appointments within the agency. These practices should encourage and include:
 - Opportunities for workforce training, especially in renewable energy.
 - A deeper investigation into the costs of salary and benefits that PREPA has incurred due to political appointments. Past political appointments have been used to carry

out political functions not related to PREPA's mission; appointees have been placed in technical and operational positions without regard to their qualifications or have been transferred inappropriately to career positions. All of this has had an impact on PREPA's labor budget.

- Acknowledgement of **climate change as central to decision-making**. Climate change has typically been only an accessory in governmental conversations and priorities, even though it brings significant impacts by way of social, fiscal and political effects in Puerto Rico. Climate change must be understood as one of the central forces in the transformation of the energy sector, which is why it is imperative that PREPA integrates adaptation measures in infrastructure planning and that climate adaptation be inserted as a pillar in the design of all public policy, legislation and decision-making processes funded either publicly or privately.²⁵

B. Citizen participation and education

Greater citizen participation provides more diverse points of view and experiences that enrich the decision-making process and that can reduce negative outcomes while ensuring shared benefits, responsibilities and consequences.

Opening and supporting space for citizen participation in PREPA is in the spirit of publicly owned power companies and is vital in achieving baseline levels of agreement informed by inclusiveness and transparency.

In Puerto Rico, citizen participation can be organized at both Island-wide and more regional levels. Public policy can be carried out at the Island-wide level. At the regional level, citizen participation can inform mechanisms tempered by local realities.

PREPA is divided into seven regions: Arecibo, Bayamón, Caguas, Carolina, Mayagüez, Ponce, and San Juan.

Act 57-2014 orders PREPA to provide "mechanisms of citizen participation in each of its regions" and to establish "a continuous program of education for its employees and all customers, which promotes conservation and energy efficiency." That mandate has not been followed, however, and these spaces for dialogue and participation must be opened in the following ways:

1. Education

- An assertive plan for citizen education should be established. Energy conservation and resource issues should be incorporated into school curricula. Alliances should be established between the State Office of Public Energy Policy (OEPPE) with universities and other organizations.
- A bank of experts and companies that can export their expertise, experiences, services and technologies to clients in the Caribbean, Central America, and elsewhere should be established. A search should be conducted for people and

²⁵ The Netherlands, "National Climate Change Adaptation Strategy 2016", <https://ruimtelijkeadaptatie.nl/english/nas/>.

organizations that are already exporting services. Complement with the development of incubators for energy entrepreneurship and creativity.

- Short-term technical programs should be established to develop local entrepreneurs as well as Puerto Ricans who live abroad.
- A broad program of energy and education audits should be developed and aimed especially at small and medium-sized businesses and industry to implement conservation and reduction in electric bills.

2. Participation

- Spaces for citizen participation should be developed and implemented.
- Transparency and honesty should inform processes of participation and results.
- Participation spaces must be maintained so as to develop trust and ensure their survival.
- Initiatives should be informed by context and defining what is desired from each participation space in order to create mechanisms that best meet those objectives. Citizen consultative spaces, in other words, are not the only way to achieve "dialogue with different social sectors that allow for and encourage transparent abuse-free participation."
- Clear communication on what is required of participants and how the information they provide will be used.
- Adoption of various mechanisms to give different groups greater opportunities to participate.
- Availability of the necessary information and training to allow participants to contribute effectively.
- Consideration of the audience when deciding what information and in what format it will be shared.

C. Labor sector participation

To achieve a real transformation, Puerto Rico must attract and retain the best available human resources. Economic and workplace conditions must allow for employee retention and for a retraining process for PREPA employees that follows best industry practices, including the integration of renewable energy and storage into the grid.

Merit, not partisanship, must be the basis of all labor recruitment and promotion.

Electrical industry workers are key to the sort of system change that will lead to a clean energy future. The term "just transition" applies—one that has been used to define societal evolution toward cleaner energy resources and lower-emission economies while guaranteeing sustainable lifestyles and suitable workforce transition.

In a just and equitable transition, affected workers, unions and communities are equal partners in a well-planned and carefully managed shift from fossil fuels to clean energy. A just transition provides employment opportunities for those who have traditionally been left behind and guarantees job security and livelihoods for energy-industry workers. Pensions and health plan benefits are preserved, and workers and members of affected communities have the right to first employment for any work created through the dismantling of fossil fuel energy structures. Workers also receive education and training and ideally are unionized similar salaries and benefits.

A just and equitable transition will commit each level of government and business in a unified effort to maximize public and private investment in economic development and diversification; provides training to the workforce; replaces lost tax revenues; and creates lasting and good jobs that strengthen the economy and support working families, especially jobs related to clean energy, energy efficiency and climate resilient infrastructure. Such transition requires that those responsible for pollution are held accountable for clean-ups so that communities in transition have usable land and clean water.

VI. Financing the Transformation and Supporting Local Economic Development

Several sources of funds are available for the development of an affordable and resilient energy system based on distributed renewable resources.

Contrary to current government rhetoric, the privatization of PREPA is not the only way to attract capital investment to Puerto Rico's electricity system. It should be noted here that PREPA's certified fiscal plan calls for capital investment from the federal government. Specifically, the agency's fiscal plan requires \$12 billion in capital investment from 2018 to 2023, of which 58% is projected to come from the federal government. Most of this federal investment will be allocated to transmission and distribution-system resilience, which consists mainly of extensive infrastructure hardening and some undergrounding of lines but—contrary to common sense—omits any significant investment in distributed generation systems that would bring energy closer to where it is consumed.²⁶

In the current negative-growth economy, PREPA needs financial innovation to rebuild its grid. Even as the Commonwealth moves toward fiscal balance and re-entering the bond market, PREPA would be ill-advised in returning to borrowing practices of the past. To rebuild an electricity system that is financially sustainable will require a mix of federal, private sector, philanthropic, rate-based, and small residential and local business investment.

Renewable energy can create a whole new industry on the Island – one that will create new kinds of employment and careers for Puerto Ricans and new, healthy businesses for Puerto Rico's economy. The era of using rate dollars generated by Puerto Rico and its people and sending those dollars off Island to pay fossil fuel companies and global investment houses cannot continue.

²⁶ Fiscal Plan, Aug. 1, 2018, p. 48.

It is expected that for the next five years, the majority of the money for the transformation of PREPA would come from a broad mix of funding streams supported initially through various federal initiatives (as currently projected in PREPA's fiscal plan). Such funding would be backed, for instance, by a solid energy plan that would make it feasible to raise at minimum \$1.2 billion a year for the next five years through a combination of federal funds (\$550 million), private sector investment (\$250 million), Rural Utility Service loans (\$250 million), ratepayer-funded capital investment (\$100 million) and philanthropic investment (\$50 million).

A. Sources of resources

Some possible sources of resources to achieve the transformation include:

- Funding through the Department of Energy (DOE), the Department of Labor (DOL), the Department of Housing and Urban Development (HUD), the Department of Agriculture (USDA), the Rural Utilities Service (RUS), the Department of Interior (DOI), the Department of Commerce (DOC), the National Aeronautics and Space Administration (NASA), the Department of the Treasury, the Small Business Administration (SBA), and from direct expenditures for large energy demonstration projects, revenue enhancements, workforce development and training in energy efficiency and renewable energy, as well as business development support in these areas.²⁷
- Investment by Puerto Rico electric cooperatives, which have over \$8.5 billion in assets, though only a fraction of those are liquid.²⁸ Energy cooperatives would be eligible to borrow money from the USDA's Rural Utilities Service, like rural electric cooperatives on the U.S. mainland are.
- Investment at the residential and business level, including in both the installation of decentralized energy systems in homes or in buildings of industrial customers and in investment in energy efficiency. Programs of the Department of Energy or HUD could support incentives for residential and small business initiatives. We recommend a sliding scale of incentives, with 100% of capital costs covered for lowest-income customers, decreasing to 20% incentive for customers with incomes larger than \$50,000 per year.
- Investments for larger-scale solar projects once Puerto Rico adopts a clear energy plan with goals that support renewable energy and that maximize rooftop solar. These forms of investment will require participation from the public sector under a robust regulatory system and must comply with land-use requirements, as discussed previously.
- Support from FEMA, which has already pledged to fund a microgrid project for Vieques and Culebra, for which PREPA has conducted an RFP.²⁹ We see no reason why PREPA could not seek more FEMA funds for microgrids in remote areas or in communities with critical loads.

²⁷ See <https://www.energy.gov/eere/education/federal-energy-and-manufacturing-workforce-training-programs>.

²⁸

<https://www.elnuevodia.com/negocios/banca/nota/lascooperativasestanconfiadasantelaadversidadeconomicadelpais-2325266/>.

²⁹ <https://www.elnuevodia.com/noticias/locales/nota/aeerecibe21propuestasparaviequesyculebra-2439281/>.

- Joint capital investment initiatives between local organizations, corporations and private philanthropic entities.
- Approximately \$100 million a year in capital expenditures directly through PREPA rates. We recommend that this income stream be put into a specially designated fund for capital expenditures protected by a first lien on PREPA rates. In addition, the Fund should be supplemented by setting aside a portion of Puerto Rico's oil tax revenues and existing PREPA subsidies for pay-as-you go capital for PREPA.
- Existing tax structures that can be used to create the development of renewable energy systems for low-income people/families. For example, a portion of the tax on petroleum products (the "crudita"), which has a maximum income cap of \$470 million/year, should be assessed for these purposes.
- Some current energy subsidies redirected to create a fund for the installation of rooftop solar systems for low-income people/families. In 2016, PREPA subsidies included \$5.5 million for hotels, \$4.2 million for irrigation districts, \$93.2 million for street lighting, and over \$50 million in various residential and low-income subsidies.³⁰ A reform to this system of subsidies, including the elimination of some, could provide \$10 million per year for solar projects on rooftops in low-income households.

PREPA could recover access to the municipal bond market within the next three to five years. Debt issued by PREPA must be regulated much more rigorously than in the past by establishing strict limits on the agency's ability to borrow, and by establishing transparency requirements when borrowing and accounting for the use of those funds.

B. Auditing and restructuring of the debt

In June 2017, the Financial Oversight and Management Board for Puerto Rico (FOMB) rejected a proposed agreement between PREPA and some of its creditors through which PREPA's customers would have paid more than 90% of the Authority's debt. The board said that the economy could not support the high rates that the agreement would require:

*"Affordable and reliable electricity is central to Puerto Rico's economic turnaround, without which customers will seek alternative measures to satisfy their needs resulting in increased pressure to increase the rates to the remaining customer base, thereby inhibiting growth and long-term viability."*³¹

Nonetheless in the wake of Hurricane Maria, PREPA's bondholders are still seeking the recovery of more than 75% of that debt from PREPA ratepayers.³²

³⁰ Paul Chernick, "Cost Allocation, Revenue Allocation and Rate Design," Puerto Rico Energy Commission Case No. CEPR-AP-2015-0001. November 17, 2016.

³¹ Financial Oversight and Management Board for Puerto Rico, "Junta de Supervisión no aprueba RSA de la AEE," June 27, 2017. https://drive.google.com/file/d/1YYRiabeDgkNimhj5hZ2yU2MYQKISv2_t/view.

³² Financial Oversight and Management Board for Puerto Rico, "Unanimous written consent approving execution of preliminary restructuring support agreement of Puerto Rico Electric Power Authority," July 31, 2018.

Imposing this deal on an economy experiencing negative growth and with electric rates already among the highest in the country would be reckless. Puerto Rico is at an absolute disadvantage compared with other U.S. states. Its electric rates are extremely high, while incomes are the lowest of any U.S. jurisdiction. The following table compares Puerto Rico's electric rates, poverty level, and economic growth statistics to states with higher-than-average electric rates. Puerto Rico is a clear outlier; no state comes close to its combination of high electric rates and poverty. It is plain that an economy with negative or zero growth cannot sustain proposed debt payments that go from 2.3 to over 4 cents per kilowatt hour.

State	Residential Electric Rates, FY 2018 (cents/kWh) ³³	Overall Electric Rates FY 2018 (cents/kWh) ³⁴	Median Income Homes 2017 ³⁵	Real GDP (annual growth rate 2012 to 2017) ³⁶
Hawaii	30.6	27.4	\$73,575	1.8 %
Puerto Rico	22.5	22.7	\$20,078 ³⁷	(1.3%) ³⁸
Alaska	21.8	19.4	\$72,231	(2.6) %
Connecticut	20.8	18.1	\$72,780	(0.3) %
Massachusetts	20.3	17.3	\$73,227	1.9 %
Total USA	12.9	10.6	\$61,372	2 %

Historically, political-partisan mandates imposed on PREPA to keep rates in check have resulted in underfunding of maintenance and capital budgets in order to pay high fuel costs and debt service. From 2002 to 2014, PREPA spent \$23.4 billion on fuel (mostly oil) and issued \$10.1 billion in bonds. Over the same period, PREPA invested \$5.76 million in capital expenditures.³⁹ Consultants to the Puerto Rico Energy Commission in 2016 found that “PREPA's generation, transmission and

³³ U.S. Energy Information Administration, “Electricity Data Browser”, July 2017 to June 2018. <https://www.eia.gov/electricity/data/browser/>.

³⁴ U.S. Energy Information Administration, “Electricity Data Browser”, July 2017 to June 2018. <https://www.eia.gov/electricity/data/browser/>.

³⁵ <https://www2.census.gov/programs-surveys/cps/tables/time-series/historical-income-households/h08.xls>.

³⁶ U.S. Bureau of Economic Analysis, “Real GDP by State (compound annual growth rate)”, 2012-2017.

³⁷ 2016 data. <https://www.census.gov/content/dam/Census/library/publications/2017/acs/acsbr16-02.pdf>.

³⁸ Planning Board of Puerto Rico, Income and Product

2017, <http://jp.pr.gov/Portals/0/Economia/Ingreso%20y%20Producto/Ingreso%20y%20Producto%202017.pdf?ver=2018-06-11-154949-827>

³⁹ Official statements of PREPA power revenue bonds Series KK through 2013A, available at www.emma.msrb.org (Municipal Securities Rulemaking Board). Capital expenditure data from: Official Statement Power Revenue Refunding Bonds, Series OO, PP and QQ, August 12, 2004; Official Statement Power Revenue Bonds, Series WW, June 18, 2008; Official Statement Power Revenue Bonds, Series 2013, August 15, 2013; and Response to Commission discovery request CEPR-AH-05-10, Case No. CEPR-AP-2015-0001

distribution systems are falling apart".⁴⁰ The most recent proposed debt agreement will continue a pattern of crowding out maintenance and capital investment in the electrical system.

In short, the rate increases that would result from a significant payment of the debt would impair the economy's ability to generate the revenues needed for an economically viable and environmentally sustainable electric system transformation.

The only scenario presented in the April 2018 Fiscal Plan that achieved the goal of reducing rates to less than 20 cents/kWh by FY 2023 required substantially reducing the largest line item of PREPA's budget, oil, and eliminating the legacy debt.⁴¹ We advocate a comprehensive audit of the debt (and holding responsible those who participated in possible illegal debt issuances) and the restructuring of the debt in a manner that protects local bondholders (individuals, small businesses, cooperatives), while also ensuring a substantial reduction or elimination of the debt burden for PREPA ratepayers as a critical element to achieving an affordable and financially sustainable electricity system.⁴²

A. Enhancing local economic impact

The key to PREPA's transition success will be investing in a wide range of energy projects coordinated under an Integrated Resource Plan that focuses on renewable energies.

These investments should be designed to recruit and train residents of Puerto Rico, to develop careers for local workers, and to create new business opportunities—and as a result support affordable long-term electricity rates managed by a team of competent professionals.

1. Opportunities

a) *Innovation, research, development and manufacturing*

Puerto Rico has an abundance of clean, renewable energy sources: sun, wind, sea waves, ocean thermal, and hydroelectricity. Technology in each of these areas is advancing continually, with ample space for innovation and improvements in operation, efficiency and system optimization.

Puerto Rico is perfectly positioned to take advantage of its research and development potential for emerging renewable technologies, to determine which of them is appropriate for the Island.

The creation of an Innovation Center in Clean Energy and Environment to undertake research and develop renewable energy technologies could propel an even faster than proposed transition to affordable clean energy. Such a center would concentrate on the development of new technology and new manufacturing methods, which can in turn generate business models for local manufacturing of the required equipment, components and systems (photovoltaic panels, replacement parts, etc.). This would allow Puerto Rico not only to be at the forefront of technological advances but to develop its economy as well. The University of Puerto Rico,

⁴⁰ Energy Commission of Puerto Rico, Case No. CEPR-AP-2015-0001, Expert report of Jeremy Fisher and Ariel Horowitz, November 21, 2016.

⁴¹ PREPA Fiscal Plan, August 1, 2018, p.43.

⁴² Creditors could receive part of their money through other means (bond insurance, lawsuits against oil suppliers, financial advisers, insurers, consulting engineers, etc.).

Mayagüez, should assume the challenge represented by this development opportunity and embark on a path toward integration and collaboration beyond the academic sphere.

b) Sustainable management of materials

Deployment of solar energy requires incorporating sustainable management practices for photovoltaic panels and storage systems once they reach the end of their useful lives.

Meeting this requirement will result in opportunities to create value and seek new economic opportunities for the Island, including the recovery of component raw materials and the development of new local industries for the recycling of these materials.⁴³ Recovered material can be used to produce new photovoltaic panels or sold in global markets, thus increasing security of future supply of raw material.⁴⁴ As an example, components of panels—glass, aluminum and copper—can now be recovered with yields of more than 85%.⁴⁵

Waste management programs will be required to integrate the components associated with the expansion of renewable energy.

VII. Regulatory Structure

A. Need for a strong regulator

PREPA did not have a regulator until 2014, when the Legislature established the Puerto Rico Energy Commission (now the Energy Bureau). The commission 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."⁴⁶

Puerto Rico's electrical system requires a strong, independent regulator whose job is to protect the public interest and ensure sound and professional energy planning. One of the duties of the Energy Commission is to analyze and to approve, reject or modify PREPA's 20-year Integrated Resource Plan (IRP).

An IRP must:

- Provide modeling results for different scenarios for the electricity system under different assumptions about fuel prices, capital costs of different technologies, future electricity sales and other variables so as to make for informed decisions about investments in the system.

⁴³ http://www.irena.org/DocumentDownloads/Publications/IRENA_IEAPVPS_End-of-Life_Solar_PV_Panels_2016.pdf, p. 11

⁴⁴ http://www.irena.org/DocumentDownloads/Publications/IRENA_IEAPVPS_End-of-Life_Solar_PV_Panels_2016.pdf, p. 13

⁴⁵ http://www.irena.org/DocumentDownloads/Publications/IRENA_IEAPVPS_End-of-Life_Solar_PV_Panels_2016.pdf, p. 14

⁴⁶ Act 57-2014.

- Incorporate modeling at the distribution system level to optimize the deployment of distributed renewable energy and ensure that Puerto Rico maximizes the benefit of these resources.
- Guide decisions on construction, purchase and retirement of generation resources, taking into consideration the development of community, cooperative and municipal efforts to self-supply energy.
- Be developed according to a process managed by an independent energy commission so as to ensure transparency and scrutiny of PREPAS's process and to allow other interested parties to provide expert testimony and public comments.
- Be a document on which to build consensus around the future of the Puerto Rican electricity system.

Conversely, the absence of a strong IRP to guide investment decisions creates a serious risk that electricity generation in Puerto Rico will be overbuilt and that declining electrical sales will lead to stranded assets, including plants and other infrastructure, especially long-distance transmission that consumers may well end up paying for.

Another important role of Puerto Rico's electricity regulator is to set just and reasonable rates. This process must include oversight over contracts, including the ability to approve, modify or reject requests for proposals before they are issued; to certify alternative procedures if competitive bidding is not practical; and to approve or reject contracts. Regulatory authority over contracting has been weakened by Act 4-2016 (which essentially forced the commission to approve charges in rates for any debt deal reached between PREPA and its creditors) and by the privatization law Act 120-2018, which removed much of the regulators authority over planned privatization contracts that will influence rates for decades to come.

If, as we propose, the electric system becomes more decentralized and democratic, with more entities, such as municipalities, communities and electricity cooperatives generating and distributing energy, it will require a regulator to arbitrate disputes and ensure just and reasonable rates for the buying and selling of electricity at the wholesale and retail level.

In short, Puerto Rico's electricity regulator requires more support. First, its budget is very low in comparison to regulatory commissions in similar U.S. jurisdictions. The most recent certified fiscal plan for PREPA recommends an annual budget for an independent regulator of \$20-\$30 million per year, or an annual charge on electric bills of \$0.0015 per kWh. The current budget is approximately \$5.6 million. Second, independent abilities to regulate and oversee contracts must be restored. And third, the regulator requires the authority to ensure that operational reforms are implemented by PREPA and all other energy companies (see above section on governance) and that political interference in the agency is minimized.⁴⁷ This requires a process for selecting commissioners like that proposed above for the selection of PREPA's board of directors.

⁴⁷ To do this, the Commission can be given the authority to appoint an Independent Inspector General of the Private Sector (IGISP). An IGISP is an independent firm with expertise in auditing and management that would have the power to investigate and audit the day-to-day operations of the PREPA and report relevant findings and progress to the board of PREPA and the Commission. More information on the use of an IGISP in New York: <https://getnicklaw.com/areas-of-practice/independent-monitoring/case-studies/new-york-racing-association/>.

VIII. Follow-Up and Next Steps

Implementing this proposal will require establishing mechanisms and procedures to determine compliance and to measure the progress in achieving results.

It is essential that, once a proposal is adopted, specific activities are developed in which clear metrics are established to track progress.

Standards for activities, schedules and metrics, as well as program results, must be widely disseminated to the public to ensure that Puerto Rico follows a sensible path toward a new, clean and distributed clean renewable energy system that supplies 50% of the island's electricity needs by 2035 and 100% by 2050.

This proposal will be strengthened through modeling, additional studies, and spaces for dialogue and exchange with citizens (through the website, www.queremossol.com, as well as in face-to-face activities and meetings). Time constraints have kept us from including some key aspects of energy policy here that should be sought out, including with regard to transportation energy.

This remains a living document that will continue to be developed by new ideas, technological advances, studies and, more important, public input.



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