

FINANCE REPORT: AN ASSESSMENT OF OPPORTUNITIES AND BARRIERS TO SOLAR FINANCE IN PUERTO RICO

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About Us

About The Solar Foundation

The Solar Foundation is an independent 501(c)(3) nonprofit organization whose mission is to accelerate adoption of the world's most abundant energy source. Through its leadership, research, and capacity building, The Solar Foundation creates transformative solutions to achieve a prosperous future in which solar and solar-compatible technologies are integrated into all aspects of our lives. In 2021, The Solar Foundation will merge with the Interstate Renewable Energy Council (IREC), created an expanded nonprofit dedicated to the rapid adoption of clean energy. Learn more at [TheSolarFoundation.org](https://www.thesolarfoundation.org).

About the Puerto Rican Solar Business Accelerator

The Puerto Rican Solar Business Accelerator (PRSBA) is a program to support solar workforce development, finance, and microgrid development in Puerto Rico. In partnership with PathStone, not-for-profit community development and human service organization, it will expand and strengthen the Puerto Rican solar industry and spur the development of a highly qualified workforce. This program is bringing together businesses, community members, other nonprofit organizations, academic institutions, and solar energy advocates to transform Puerto Rico's energy system, working together to achieve a renewable and sustainable future. Learn more at <http://www.thesolarfoundation.org/prsba/>.

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Executive Summary

The Solar Foundation and PathStone Corp. have been awarded a three-year grant by the United States Department of Commerce, Economic Development Administration to support Puerto Rican solar firms through business assistance, workforce development, microgrid development, and financial capacity building. One of the purposes of this grant is to help secure the future of renewable energy and energy resiliency in Puerto Rico by establishing a productive and constructive exchange of needs and opportunities between the financing sector, solar companies, and the residential and commercial sectors that may be considering a transition to solar energy + storage.

To support this outcome, The Solar Foundation has assessed the financial institutions, mechanisms and solar companies that offer financing for solar project development and/or solar consumer loans. Based on a survey of the sector and interviews with financial institution representatives, the report identifies current trends, practices, barriers, and unmet needs to investing and financing solar energy and battery storage in Puerto Rico. This initial assessment will identify areas where The Solar Foundation can follow up with more specific *white papers* as the solar finance stakeholders implement solutions. This combination of initial assessment and theme-specific *white paper* will allow us, by the end of 2022, to identify progress on solutions that are recommended and unmet needs and opportunities remaining when the grant period concludes. During this first phase of conversations with the financial sector, The Solar Foundation carried out about 35 interviews from the different sectors to get an overall picture of the current state of the solar financing sector. In some cases, based on those interviews and review of successful solutions elsewhere, recommendations are made.

Under the Energy Public Policy Act of 2019, Puerto Rico is required to increase its renewable energy portfolio from the current level of about 3% to 100% by 2050. The Solar Foundation has estimated that in order to reach 100% renewable energy, if no further efficiency efforts are undertaken, and consumption remains constant, Puerto Rico would have to design, install, finance and operate up to 16,000 MW of solar over the next 30 years (TSF 2020). That is about 40 times more solar than there is currently installed, both as distributed generation and utility-scale projects.

The magnitude of the challenge is great, but Puerto Rico is not alone. Other countries such as Costa Rica, Finland, Germany, and Denmark are on the same ambitious path and have made significant progress (Resiliency 2018). In the United States, several states have adopted similar RPS goals, including California, Colorado, Hawaii, New York, and Nevada (Center for American Progress, 2019). Such efforts provide Puerto Rico the opportunity to learn from and exchange information with many other states and countries around the world. Interstate and inter-country dialogue should be encouraged in order to share lessons learned and best practices for moving solar-plus-storage forward, including issues of how to finance the necessary growth of solar.

According to the National Renewable Energy Laboratory 2020 benchmark cost-study, *Solar Installed System Cost Analysis*, the cost of residential solar installed per watt was calculated to be \$2.70 in 2018. That is a 64% reduction in cost since 2010 when solar averaged \$7.34/W. We see similar patterns in commercial solar and utility scale solar. Reductions were about 67% in commercial, down to \$1.83/W in 2018. Utility-scale solar has experienced even a sharper decline

in price, down about 80% since 2010 to a current cost per watt of \$1.13 (NREL, 2020). These steep price drops provide a much-improved financial justification for solar adoption and wider deployment.

It's important to note that national price averages on the NREL study do not reflect Puerto Rico's prices for solar. Industry consensus from conversations with local companies put the average price at about 15% to 20% higher in both residential and commercial.

The cost of energy storage in residential solar remains a significant barrier. At an average of around \$500 per MWh of storage, good quality lithium ion batteries add about \$0.09 per kWh over the lifetime of the storage system (Lazard, 2019). This is an important consideration when determining the effective use of incentives, tax credits, and targeted investments. Given the higher cost of solar and the need for storage systems deployed at the distributed generation (DG) sites, customer resilience still needs economic incentives in order to be accessible to a broader socio-economic sector of Puerto Rico.

This assessment report begins with a concise summary of installed solar capacity in Puerto Rico, including both rooftop distributed generation and utility-scale solar farms. It is followed by a section on the current solar workforce and projected needs based on future installed capacity projections.

In Section III, the report then describes the different sources of financing and capital available for solar and solar-plus-storage in Puerto Rico, along with a discussion of trends, current status, and opportunities for expansion. The report covers the importance of finance offered through solar installation companies, federal programs, savings and loans cooperatives, the traditional banking sector, direct social impact investment mechanisms, philanthropic funds, and disaster recovery funds available following Hurricanes Irma and Maria and the 2019-2020 earthquakes. The report reviews the importance of philanthropic donations to support immediate recovery after natural disasters and presents an outline for a blended finance model for attracting investment in critical and essential services in a manner that does not rely solely on philanthropic donations. The report concludes with a general discussion of the findings and some recommendations for moving forward in making solar-plus-storage more widely available to Puerto Rico via robust and sustainable finance options. Appendix A presents a brief chronology of the solar regulatory environment in Puerto Rico and how different regulations and incentives have promoted the adoption and deployment of solar and storage. The in-depth interviews and question guide that has been used as the research tool that directs conversations with solar financing sector is included in Appendix B.

This report is intended for the solar and economic development professional in the private for-profit sector, nonprofit sector, and government. Throughout the report, the audience will find specific recommendations and opportunities to use available financial mechanisms, improve outreach, improve the cross-discipline, multi-sectorial sharing of information between solar experts and finance experts and develop new finance mechanisms that respond to Puerto Rico's socio-economic idiosyncrasies.

The Solar Foundation intends to revisit some of the topics presented in this assessment via issue or sector, or solution-specific *white papers* toward the end of the EDA Program, scheduled for Q4, 2022. The follow-up white papers will serve as a results-oriented end-product from which to measure the progress that Puerto Rico has made on expanding solar-plus-storage investment and financing opportunities for commercial and residential sectors. Lessons learned, solution implementation, stakeholder buy-in and other important parameters of success will be explored.

Section I Snapshot: Solar installed capacity in Puerto Rico

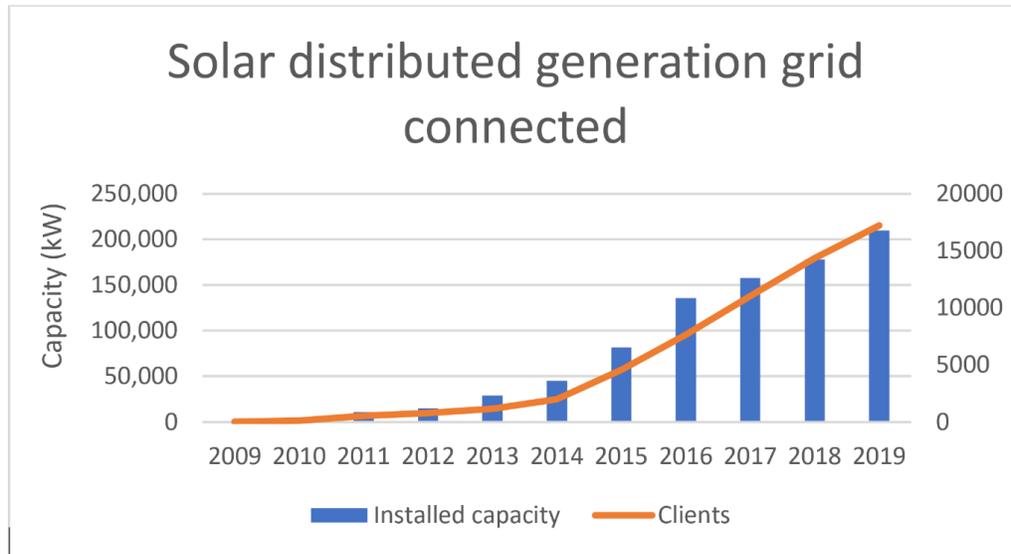
Solar energy currently represents a small portion of electricity generation in Puerto Rico. The Puerto Rico Electric Power Authority (PREPA) reports that the electric sector's cumulative capacity is 4,975.9 MW, distributed as follows: 4,722 MW fossil fuels, 4.8 MW landfill gas, 102 MW wind, and 147.1 MW solar (PREPA, 2020). Solar energy capacity reported by PREPA corresponds to the utility-scale solar farms contracted by this utility and does not include distributed generation. The table below shows the capacity and the location of each solar plant.

Puerto Rico's Utility-Scale Solar Plants

<i>Company</i>	Capacity (MW)	Annual average generation (MWh)	Location
<i>AES ILUMINA</i>	20	38,727	GUAYAMA
<i>WINDMAR</i>	2.1	4,748	PONCE
<i>CANTERA</i>			
<i>MARTINO</i>			
<i>SAN FERMIN</i>	20	29,961	LOIZA
<i>HORIZON</i>	10	22,655	SALINAS
<i>ORIANA</i>	45	84,742	ISABELA
<i>COTO LAUREL</i>	10	-	PONCE
<i>FONROCHE</i>	40	-	HUMACAO
<i>Total</i>	147.1		

Source: PREPA, 2018.

For the last 10 years, Puerto Rico's solar distributed generation has experienced rapid growth. From 2009 to 2019, installed capacity of solar distributed generation connected to the grid increased from negligible amount to in 208 MW. Total solar residential and commercial clients increased at an average rate of 98% every year for the last 10 years, and the average installed capacity increased by 80% every year for the same period (PREPA/AZGroup, 2020). The graph below shows the grid-connected solar distributed generation evolution from 2009 to 2019.



Source: Quarterly compliance report from PREPA, April 2020

Interviews conducted by the team at The Solar Foundation and the Institute for Building Technology and Safety (IBTS) also show there is a significant, but undetermined number of off-grid solar installations and self-consumption installations.¹ For example, after Hurricane Maria, the government of Puerto Rico enacted Executive Order 2017-064, allowing for the expedited installation of solar photovoltaic + storage systems in residences with no requirement to register or obtain permits with PREPA prior to installation (Executive Order, 2017). There are no records of the total installations, clients, or capacity installed in this segment, although local manufacturers and installers have confirmed that hundreds of small distributed generation systems (2.5 – 5 kW) that are not interconnected to PREPA grid have been sold and installed in Puerto Rico during the last five years. Industry representatives report that many of these installations work in self-consumption mode and provide backup to modest critical loads within the household.

¹ **Self consumption** mode refers to the installation of photovoltaic panels, inverters, and energy storage devices that produce the majority or all of the energy the client is expected to consume on-site. The business or residence may be connected to the local electric grid, but a photovoltaic and storage system installed in self-consumption mode is not meant to exchange excess electricity generated by the system onto the grid.

Section II. Snapshot of solar employment in Puerto Rico

Solar energy provides outstanding opportunities for job growth across the United States, including in Puerto Rico. The industry employed 250,000 people nationwide as of 2019, a figure that has grown 167% since 2010 (The Solar Foundation, 2019). What follows is a high-level view of solar employment in Puerto Rico which provides some context for this preliminary assessment of solar finance.

The 10th annual *National Solar Jobs Census* (The Solar Foundation, 2019) ranked Puerto Rico 24th in solar jobs per capita in the United States as of 2019. That year, the U.S. territory had 1,949 solar jobs. The industry sector with the greatest number of jobs in Puerto Rico was installation (34.4% of all jobs) followed by wholesale trade & distribution (30%). Gender distribution for the solar industry in Puerto Rico is 57.8% male and 42.2% female. However, it is likely that the majority of women in the solar industry are not in installation or field jobs but rather in administrative, clerical and indirect support roles. To ascertain the accuracy of this industry-wide perception, TSF carried out a review of the complete official list of certified photovoltaic installers. Our review shows that less than shows that less than 2% are women. (PPPE, 2020).

The Solar Foundation recently published a white paper titled *Puerto Rico Solar Jobs in 2050*, estimating the number of jobs that would be required to comply the Act 17 of 2019, which mandates a 100% renewable portfolio standard (RPS) by 2050. The report found that solar jobs must grow exponentially from the current of about 1,950 to about 19,500 by year 2030 in order to meet these goals. (TSF, Jobs 2050)

Solar related jobs potential accumulated by sector Puerto Rico						
Year	Total Solar Related Job Potential	Installation and Project Development	Wholesale Trade & Distribution	Operations & Maintenance	Manufacturing	All others
2019	1,949					
2025	12,359	7,996	1,483	531	1,706	643
2030	19,905	12,878	2,389	856	2747	1,035
2040	11,918	7,711	1,430	512	1,645	620
2050	671	334	34	168	67	67

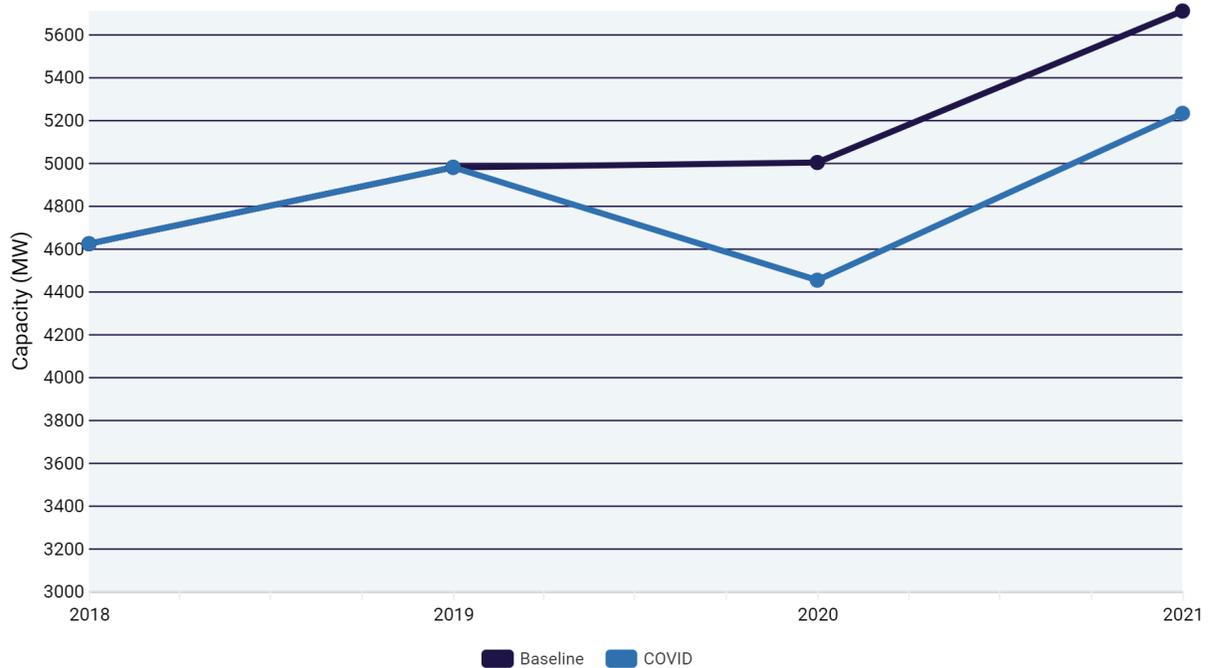
Table 4. Solar jobs growth projections for Puerto Rico

C. Velázquez, L. Jaramillo; “*Puerto Rico Solar Jobs in 2050*”. A white paper by The Solar Foundation as part of the Puerto Rican Solar Business Accelerator. 2020

In 2020, COVID-19 led to setbacks in solar employment throughout the country. The Solar Energy Industries Association reports that based on early surveys, up to 38% of solar-related work stopped as of May 2020 as a direct result of COVID (SEIA, 2020).

U.S. Distributed Solar Market Outlook, Baseline vs. COVID-19 Impact

Distributed solar includes residential, C&I, non-profit, government, and community solar installations



Source: SEIA/Wood Mackenzie Power & Renewables U.S. Solar Market Insight 2020 Q3 & 2019 Year in Review



All reports indicate that Puerto Rico was not immune from these setbacks at the beginning of the COVID-19 pandemic. However, The Solar Foundation’s in-depth interviews with several solar companies in Puerto Rico reflected optimism that the recovery of residential client interest in solar will return to the same level as pre COVID-19. However, concern about the supply chain of solar equipment inventory, as an indirect result of COVID-19 manufacturing disruption, is a preoccupation expressed by many in the industry which may delay the capacity of companies to install projects in a timely manner.

Section III. Financial institution roles on solar lending and solar development

Any discussion about solar and solar-plus-storage financing must begin with a high-level review of the three finance vehicles that are generally used to complete the economic transactions to put solar on rooftops, carports, and/or ground mounts.

Solar leasing employs a third-party ownership model. A company will install, manage, and maintain a solar system on the roof, carport, or ground often for no money down, and the homeowner agrees to make fixed, monthly payments to the company for 15 to 25 years. Though the company owns the solar panels on the roof, the homeowner gets all the electricity created by the system. Given high per-kWh prices in Puerto Rico, this value can be worth more than the monthly payments, especially given the uncertainty of electric grid prices in the future. Additionally, if the homeowner does not utilize all the energy generated by the leased solar panels, it is returned to the grid, and the utility will add an additional credit to the customer's bill. In most instances, the solar equipment provider claims all state and federal incentives, using them to offset the cost of the equipment and installation. This is a commonly used approach by customers who may not have excellent credit scores, or for those who do not have cash for a down payment. Note that some leases are structured to increase monthly payments each year, and so it is up to the consumer to balance exposure to grid price increases with these lease payment hikes.

A power purchase agreement (PPA) is another popular solar financing model that also uses third-party ownership. As with leases, a provider will install, manage, and maintain a solar system and retain ownership. However, rather than paying a monthly rate to rent the system, the homeowner pays only for the energy generated at a fixed (or moderately escalating) cost per kWh, which is generally less than what the local utility charges. Since customers only pay a per-kWh price for what they consume, it is easier to calculate how much money they stand to save. Generally, there is an escalator clause which may increase payments over time. The solar company developing the project receives all rebates and tax incentives. As they mimic the sale of power by utilities, PPAs are only available in states where third-party sales to end consumers are permitted, which includes Puerto Rico.

Loans enable homeowners to purchase and own the panels on their property, which means they can utilize a greater share of the long-term financial benefits a solar system generates, including state and other incentives and utility rebates. Additionally, unlike with PPAs and leases, the property owner's rate will not increase over time. There is a range of loan options available depending on the current and future financial situation. However, as with all loans, the lenders will determine how much money they will lend, the interest rate, and when the loan is due. Offers differ significantly based on applicants' credit history and geographic location. It is worth noting that in Puerto Rico, homeowners who own their own systems cannot receive U.S. federal tax credits for their solar system, even though under the solar leasing and PPA models, the third-party-owners may typically do so (if they are federal taxpayers), and responsible installers will pass along some of the savings to the homeowner. Given that the solar Investment Tax Credit currently is at 26% of total project costs, homeowners who opt to own their systems can end up paying higher lifetime

costs than their citizen counterparts with PPAs funded by mainland investors. However, the tax credit is declining from an initial 30% to 26% in 2020 & 2021, and 22% in 2023. Thereafter, it will decline to 10% for commercial customers and will be unavailable for residential filers.

According to most energy analysts, solar energy is the most inexpensive way to provide electricity to power homes and businesses. The Milken Institute, IRENA, Bloomberg, and Forbes have all recently reported that, even without subsidies, solar is the most cost-effective manner of producing electricity for about two-thirds of the world's markets (Milken Institute, 2019). In Puerto Rico, the case is clear. PREPA's electricity costs over the last 15 years have ranged between \$0.19 - \$0.32 per kWh. Based on the authors' experience, in today's market and prices, a solar system installed and owned by the customer in Puerto Rico, the levelized cost of its energy³ will be about \$0.06 to \$0.08 per kWh over 25 years expected lifetime. With a storage system included, the price may increase to about \$0.14 - \$0.20, depending on the battery chemistry, which still represents a savings for the consumer over expected 25-year lifetime of the installed system.

Yet out of 1.1 million or so available rooftops in Puerto Rico, between commercial and residential, there are only about 20,000 photovoltaic installations registered in the net metering program by PREPA (PREPA Quarterly report, April 2020). Multiple stakeholders also recognize that there are probably another 20,000 or so installed systems that are not in net metering agreement with PREPA, for a total of 40,000 systems installed. Why the anemic adoption of solar in an island that is blessed with solar irradiance?

The upfront capital expenditure to purchase and install solar panels, inverters, balance of system equipment, racking systems, and storage is too steep an entry point for most individuals and families. Therefore, robust and diverse financing mechanisms must exist if the people of Puerto Rico are going to take advantage of solar energy to power their homes and businesses. The potential residential and commercial client must be also made aware of solar financing basics and increase their Energy IQ.⁴ Even though the cost of solar has decreased by more than 60% in the last decade it is still very common to hear people refer to photovoltaic as "very expensive," "not everyone can afford that," etc. An important effort remains in presenting adequate information about competing costs of energy between solar photovoltaic and fossil fuel energy provided by the PR utility.

³ **Levelized Cost of Energy** -The LCOE is calculated as the ratio between all the discounted costs over the lifetime of an electricity generating plant divided by a discounted sum of the actual energy amounts delivered. The LCOE is used to compare different methods of electricity generation on a consistent basis.

⁴ **Energy IQ** – Although it is term coined by Canada to represent a curriculum-linked educational program for all educators, in a broader sense this report uses it as compilation of information and resources for the general public to learn about energy sources, economics, impacts on the environment, energy conservation measures, etc.

PPAs and lease financing, which represent a TPO model, made an early robust run in Puerto Rico. By 2017, when Hurricane Maria hit, at least 10,000 of the 13,000 interconnected systems belonged to a group of channel partners that offered residential PPAs. A couple of important developments occurred that put a strong consumer pause on the adoption of this model for solar financing. Thousands of customers expected to have their grid-tied solar systems provide uninterrupted energy in the aftermath of Hurricane Maria, which knocked out the power grid to 100% of the island. Many were not made aware, customers claimed, that a grid-tied solar system does not provide power during a grid outage without the presence of demand side batteries and an inverter capable of islanding the system from the grid. Client expectations were not aligned with the delivery of technology. More than 95% of the installed grid tied systems did not have batteries attached to them before the hurricanes. Much negative press ensued, and formal complaints were filed to both the Puerto Rico Energy Bureau and the Office of Independent Consumer Protection.

To make things more difficult for the growth and development of the PPA model in Puerto Rico, in PREB final order CEPR-IN-2016-0001 dated 15 February 2019, the formal complaints of 436 clients were found to be with merit and their PPA contract annulled. The PREB held that the customers were not adequately informed about the implications and details of their 25-year solar contracts and that billing procedures did not meet Art. 6.27 of Act 57-2014. This determination caused a public relations problem for many solar companies that were channel partners in the PPA finance model.

Therefore, around the time of Hurricane Maria, the solar industry in Puerto Rico found itself with an anemic debt of financing options since TPO models were being challenged in public perception and at the agency level. The only mechanism showing promise was the Green Energy Fund (GEF) established under Act 83 – 2010, which provided significant reimbursements for residential and commercial projects. However, even that was not a sustainable model, given the bankruptcy-like procedures of the Puerto Rico government as part of the Fiscal Oversight and Management Board for Puerto Rico. Puerto Rico found itself in the aftermath of the hurricane with a depleted GEF and PPA finance models in public question.

For this initial assessment we have interviewed about half of the financial institutions that offer solar financing and most of the solar installation companies that offer PPAs and lease financing to the end user, both residential and commercial. As expected, PPAs dominate the space in terms of market share, accounting for upwards of 75% for distributed generation installs. The remaining funding is distributed between S + L Coops, FCUs, and traditional banks.

Solar financing is not advertised nor marketed aggressively by any of the coops, traditional banks, or federal credit unions in Puerto Rico. In fact, based on a review of their websites, most do not identify solar financing as a distinct product and service they offer. At present, the institutions that lead solar financing in Puerto Rico are Savings and Loan cooperatives and federal credit unions. Only one commercial bank, Oriental Bank, offers solar financing, but in an exclusive agreement with one solar install company.

Cooperatives and federal credit unions offer financial services such as savings accounts, personal loans, and mortgages, among others, at relatively low interest rates that are accessible to people of moderate economic resources. Most cooperatives and credit unions are established in communities

as open models, where anyone from that geographical region can join; or they can be established as a closed model, where only people that work in a particular industry or firm can join. For example, the pharmaceutical industry in Puerto Rico has a savings and loan cooperative operating as a closed model for their employees.

If one were to gauge by the number of financial institutions that offer solar loans, one could argue that few recognize solar energy as an opportunity for their investment portfolios. However, for the preparation of this report, the authors had conversations with dozens of representatives from different financial institutions who said they are cognizant of the importance of solar financing. However, most reported that their client base does not commonly request such specialized products. Furthermore, they still see too many unmitigated risks in solar loans and are waiting for a coherent industry-wide action to share or minimize such risks.

Let’s explore Puerto Rico’s current financing mechanisms available for solar projects.

Cooperativa de Ahorro y Credito (Savings and Loans Coops)

Puerto Rico has 113 savings and loans cooperatives located around the archipelago. These cooperatives provide a variety of financial services to about 1,050,000 members, or 32.6% of Puerto Rico's total population. According to the Corporation for the Supervision and Insurance of Cooperatives of Puerto Rico (COSSEC), the economic power of the coops is significant. As the commercial banking industry has contracted, the coops are actually increasing in economic significance. As of March 2020, 113 coops have 1,050,000 members and \$8.7 billion in savings, shares and reserves. Of that amount, \$5.214 billion are invested in loans and \$1.19 billion in equity. By comparison, in 2016 they had 976,000 members, \$8.73 billion in savings and shares, and \$4.7 billion in loans (COSSEC, 2020). This growth occurred despite the fact that Puerto Rico continued to experience population declines and economic deceleration during the period of 2016-2020. All deposits are insured by the state entity COSSEC up to \$250,000 per member, like the FDIC or NCUA federal insurances. Coops are financial partners that are generally looked at by the population at large as good neighbors and institutions that are close to the needs of the communities they serve. Surprisingly, only a handful of cooperatives have developed and are implementing a service and/or loan product that is targeted for solar financing in Puerto Rico.

Below is a complete list of all coops that were contacted about their solar financing loan options as of September 2020 for this assessment.

Institution Name	Location	Website
Camuy Coop	Camuy	https://www.camuycoop.com/prestamos/proyecto-de-placas-solares/
Cooperativa Sagrada Familia	San Juan	http://sagradacoop.com/
Cabo Rojo Coop	Cabo Rojo	https://www.maximosolar.com/es/ofertas/evolucion-a-energia-solar-con-eguana-technology

Oriental Bank

Caribe Federal Credit Union	Hato Rey	
Isla Coop	Carolina	http://newenergypr.com/costo-y-financiamiento/
Jesús Obrero Cooperativa	Guaynabo	https://www.jesusobrero.coop/prestamos/
Coop Hermanos Unidos	Hato Rey	https://www.cachupr.com/prestamos-para-energia-renovable
CooPACA	Metro/Norte/Sur	https://www.coopaca.com/prestamos

Average term conditions in the industry	Range of marketed solar loans
The average offering is at a 5.3% interest rate for 9.5 yrs.	The marketed solar loan amounts range from \$500 to \$50,000. Over time there has been a progression of offerings starting with only secured loans and now including unsecured loans as well.

Based on our conversations with Coops offering solar loans, we gather the following information:

- The earliest program established for residential solar was in 2013.
- Most of the financial institutions became interested and involved in solar financing because of personal experiences, either because one of their directors had a system installed in their residence or the financial institution had a system installed in their commercial office.
- Volume on a yearly basis varied substantially from one application to a maximum of 30. The maximum total amount for a year was about \$1 million.
- Approval rates range from a low of 56% to a high of 99%.
- They see challenges such as lack of sound business planning and risk mitigation in expanding to the commercial sector.
- Level of payment delinquency is very low. They are not interested in reclaiming solar assets and will work with the customer to make payments.
- The slow process of interconnection and net metering approval by PREPA does not help create a smooth and trustworthy process. Reimbursements and completion payments to installers are delayed, and many times the client has to begin paying the loan prior to the approval of net metering.
- The Green Energy Fund authorized by Act 83 of 2010 provided 30% to 50% of reimbursement for commercial projects under TIER II arrangement. This provided a very good incentive used by several Cooperatives to participate in solar lending. The program became inactive around 2018 and has caused a slowdown in lending applications for some.

It is clear from our discussion with many in this sector that the financial institutions have not experienced the volume of loans expected. This likely explains why only nine out of 113 or 8% of coops currently offer solar loans as a distinct product. They note they would invest more resources and capital in solar financing products and services if they saw increased interest from their customers. Thus, there may be a need for a broader effort to educate consumers about the overall benefits of solar financing and cost effectiveness of solar-plus-storage in their business and/or residence. This educational effort should be carried out independently of any solar company on the island.

Federal Credit Unions

Puerto Rico has 10 federally chartered credit unions, half of them located in the metropolitan area. The others are in Rio Grande, Aguadilla, Quebradillas, and Hatillo. These institutions are listed in the table below. Similar to the coops, they serve a customer base that has membership in a similar occupation or geographical region. Deposits are federally insured up to \$250,000 per member by the National Credit Union Administration.

Institution Name	Location	Website
Caribe FCU	Guaynabo	http://www.caribefederal.com
Borinquen Community FCU	Aguadilla	https://www.bcfcupr.com
Glamour FCU	Quebradillas	http://www.glamourfcu.com
Puerto Rico FCU	San Juan	http://www.prfedcu.com
Puerto Rico Employee Groups FCU	San Juan	http://www.santandercoop.net
Universal Coop FCU	Rio Grande	http://www.universalcoopfcu.com
VAPR FCU	San Juan	http://www.vaprvcu.com
JetStream Federal Credit Union	Carolina	https://www.jetstreamfcu.org/
Baxter Credit Union	Guaynabo	www.bcu.org

Pentagon FCU

Guaynabo, <https://www.penfed.org/>
Hatillo, Ft
Buchanan

Of these, only Caribe FCU offers a financial product that is targeted to the acquisition of solar and/or energy efficiency measures. One out of ten FCUs only constitutes 10%, which is similar to the Cooperativas and is a very low percentage of the total. A targeted effort to identify how to encourage the FCUs to offer more solar financing options is a critical next step.

Community Development Financial Institutions

Community Development Financial Institutions (CDFIs) were established in 1994 by the Riegle Community Development and Regulatory Improvement Act. The purpose of this law was to create a community-based financial institution that could bring private and public funds to invest in low income and minority communities (CDFI Fund, 2020). CDFIs are specialized, community-based financial institutions with a primary mission to promote economic development by providing financial products and services to people and communities underserved by traditional financial institutions, particularly in low-income communities.

This approach sought to combine the best aspects of minority-owned banks that first appeared in the 1880s, federal credit unions that were instituted in the late 30s, community development corporations in the 60s, and nonprofit loan funds in the 80s. The funding source can be banks, credit unions, loan funds, microloan funds, or venture capital providers. These institutions aim to expand economic opportunity in low-income communities by providing access to financial products and services for residents and businesses (CDFI Fund, 2020).

As of this writing, there are 29 entities in Puerto Rico that either have been certified as CDFI or are in the process of being certified as CDFIs. In fact, the US Dept of Treasury approved an assignment of \$3.7 million from the CDFI funds to support the designation of 29 Coops and Credit Unions in Puerto Rico. Three other financial institutions, Sagrada Familia, Camuy Coop and Jesus Obrero Coop were assigned \$2.3 million in order to implement renewable energy and resiliency projects within their constituents (News is My Business, 2020).

The importance of the CDFI investment in low-income communities has been significant. Billions of dollars in capital have been injected into financially underserved communities through a myriad of award programs that include:

a) Bank Enterprise Award (BEA). This encourages CDFIs to make investments in communities where at least 30% of residents have incomes that are less than the national poverty level and where the unemployment rate is at least 1.5 times the national unemployment rate. Because of

Puerto Rico's socioeconomic status, much of the CDFI activity would automatically qualify for BEA.

b) Capital Magnet Fund. Spurs investment in affordable housing and related economic development efforts by mechanisms such as loan loss reserves, revolving loan funds, risk-sharing loans, and loan guarantees. Organizations that receive Capital Magnet Fund awards are required to produce private housing and community development investments at least 10 times the size of the award amount, generating a multiplier effect that means that more low-income people and low-income communities could be impacted.

c) CDFI Bond Guarantee Program. The U.S. Treasury provides a 100% guarantee credit subsidy to a qualified CDFI or issuer to issue bonds for up to 30 years. The CDFI uses the bond proceeds to invest in distressed communities. As of this writing, \$1.6 billion have been loaned out to CDFI through this program. The CDFIs have been able to use this debt to provide capital for the development of larger projects such as charter schools, municipal infrastructure, and housing developments in low-income communities. Puerto Rico's long-term energy needs in remote communities may very well be served by a program such as the Bond Guarantee Program. This is worth exploring further for community solar and community-based microgrids. A search in the CDFI.gov database produced information that no CDFI entity in Puerto Rico has participated in the Bond Guarantee Program since its inception.

d) CDFI Program. Used for capacity building of the CDFI and a dollar-for-dollar match for private funds that are invested. Solar financing in Puerto Rico may benefit from this capacity building program in order to further educate the banking and the coop sector about the particularities of energy economics and cost-benefit analysis of solar to the commercial sector. The Solar Foundation's interviews with the coop and credit union sector found that some were not aware of the opportunities for solar financing that the 100% RPS under Act 17 of 2019 may create for them.

e) New Markets Tax Credit Program (NMTC). Incentivizes direct investment into distressed low-income communities by granting a federal income tax credit of up to 39% to private citizens that invest into Community Development Entities (CDEs). As of this writing, NMTC has resulted in the creation of over 6,000 businesses and has leveraged about \$8 in private investment per \$1 of federal funds. Specifically, for Puerto Rico, three CDEs have created an investment fund totaling \$175 million since 2009. Future reports should dive into an analysis of how the New Market Tax Credit program has been used in Puerto Rico and whether there has been any initiative to use that financial tool for expanding access to solar energy for low-income communities.

Section IV. Initiatives, tools and programs for increased solar deployment in Puerto Rico

This section addresses the different finance models, proposals and initiatives that are currently either being implemented or are available for implementation in Puerto Rico for greater solar deployment.

Opportunity zone investment for solar development

Opportunity Zone investment combines the possibility of socially and environmentally impactful investment with robust capital gains tax advantages for the investor. An investor who is subject to capital gains as the result of an asset sale can take advantage of the tax incentives of investing in a Qualified Opportunity Zone (QOZ) Fund, so long as the investment is made within 180 days of the capital gains event. It is a program created by the federal Tax Cuts and Jobs Act of 2017.

There are three tax incentives for investing in a QOZ Fund — deferral, reduction, and exclusion.

1. Deferral of capital gains invested until December 31, 2026. Note that this benefit, and thus the potential capital recruited, decreases each year after the law was enacted.
2. Reduction of capital gains invested. The cost basis on the original capital gains invested in an QOZ fund can be stepped up by 10 percent after 5 years and an additional 5 percent after 7 years, leading to a 15 percent reduction in capital gains tax.
3. Exclusion of gain on QOZ property held for at least 10 years. It is worth noting that solar system property generally depreciates in value; therefore, this value may not be completely monetized. (US Economic Development Administration, 2020; Urban Institute, 2020)

Financial stakeholders in the solar industry that we have engaged report that Opportunity Zone investment in Puerto Rico has been challenging to date. A review of solar development as a result of OZ at the national level has been limited. Examples to date include:

- a) Greenbacker Renewable Opportunity Zone Fund LLC, a private placement offering that invests in renewable energy infrastructure assets located in designated opportunity zones, announced that its 3.1 MW solar project located in Capitol Heights, Maryland. The project is complete and is now producing electricity (The Di Wire, 2020).
- b) Indiana Opportunity Zones (not finished). Three companies in the state have come together to develop, construct, and own solar assets located in what are known as Indiana Opportunity Zones. According to the timeline, construction wouldn't begin until the fall of 2021, as long as everything moves forward with planning (WKVI.com).
- c) Norfolk Solar Qualified Opportunity Zone Fund. A fund that installs solar at no upfront cost to qualified businesses and nonprofits in opportunity zone areas. Typical PPA terms

are between 7 to 10 years and the fund accomplishes direct community engagement and community education and job creation in the community to fill employment gaps in LMI areas (Norfolk Solar, 2020).

A combination of Opportunity Zone investment with ITC investment, though, may be more attractive, as it may provide marginal additional federal tax benefits that a solar developer can monetize. (Invest PR, 2020)

The intent of the QOZ program is to spur private investment capital into under-invested, economically distressed communities. In Puerto Rico, with a medium household income of \$19,913 and a per capita income of about \$12,451, 837 out of 863 census tracts qualify as low-income Opportunity Zone investment areas. A full 98% of Puerto Rico qualifies as an Opportunity Zone.

Puerto Rico's Economic Development Office has established a goal of \$600 million for capital investments in the Opportunity Zone funds. In order to leverage and maximize that potential for investment, Act 60-2019, which is the commonwealth's Incentives Code, has included the following for QOZ investors and funds:

- A fixed 18.5% income tax rate and a 0% tax on distributions to its owners
- A transferable investment credit of up to 25% of the amount invested in an opportunity fund
- 25% exemption on real and personal property taxes
- 25% municipal construction and municipal license tax exemption
- Expedited permitting process through the Single Business Portal

Recently, the Urban Institute published an evidence-based qualitative insight into the early impacts, successes, and shortcomings of the Opportunity Zones program. The report notes there are not any federally mandated requirements for detailed reporting of where QOZ funds are being invested, what types of projects are being supported, and what communities are being impacted. Other than by news reports and informants, there is no structured way to gauge whether QOZ capital has been reaching low-income communities and improving their quality of life. There is no public database to verify QOZ investments and their impacts (Urban Institute, 2020).

However the researchers at the Urban Institute also interviewed some 70 fund managers, wealth managers, mission-oriented intermediaries, and QOZ coordinators at city and state levels across the United States. So far, there have been about 406 Qualified Opportunity Zone Funds created that have raised approximately \$10.1 billion in equity. An analysis of self-reported projects and experiences by the interviewees shows the following trends which are relevant to solar development in Puerto Rico:

1. Opportunity Zones are catalyzing an ecosystem of community development efforts. Investors, local governments, Opportunity Zone coordinators, and nonprofits are coming together to promote development in low-and moderate-income Census tracks within their jurisdiction. These sort of development coalitions were not a common occurrence prior to QOZs.

2. The Opportunity Zone structure lacks encouragement for resident or community intermediary engagement. Unlike the previous community development programs such as Empowerment Zones and Community Development Block Grants, there is no requirement to listen to the voices of community residents in determining what kind of development they need. There are no requirements for community advisory boards to certify Opportunity Zone projects, nor for comprehensive economic development plans with citizen participation.

3. Many mission-based projects sponsors are struggling to find Opportunity Zone investors. One reason noted is lack of connections to high-net-worth individuals and lack of investment fluency. Another obstacle noted is high transaction costs (legal and other due diligence) that mission-based project sponsors may not have. Moderate deal sizes and modest returns are also noted as obstacles they face. While many mission-driven practitioners project their internal rate of return at 3-7%, they are finding that Opportunity Zone investors are looking for slightly below market rate at 9-12%, or at market rate of 13-16% per year.

Before COVID-19, the Urban Institute report found that Opportunity Zone funds were starting to flow, although the majority went toward real estate development. The Economic Development Department of Puerto Rico now has a unique opportunity to take a fresh look at the program and perhaps establish strategies to attract investors so that funds flow toward energy resiliency in communities and public service sectors.

Renewable Energy Certificates

A renewable energy certificate (REC) is a market-based instrument that represents property rights to the social and environmental qualities or attributes of the electricity that is generated and delivered to an end user from a qualified renewable energy source. Typically, one REC is equal to one MWh of renewable electricity. In mainland mandated and voluntary markets, RECs are traded independently of the underlying electricity. A solar farm in Maryland, for example, can help a REC buyer meet its mandatory green energy obligations in Pennsylvania or its voluntary commitments in California.

A number of mainland U.S. states have mandatory green energy procurement requirements that apply to their investor-owned utilities. In the past, these utility-based purchases of RECs have driven the market. However, in recent years, corporations have started to value the societal and reputational value of either directly procuring renewable energy or buying RECs in one jurisdiction to offset their use of fossil fuel-generated electricity in another. REC income represents a significant boost to an installed solar project by bringing in additional project revenues.

In 2010, Act 82 established the first energy diversification law and created the mandate that renewable energy projects would account for their production of clean energy so that their RECs could be purchased by PREPA. By 2015, only utility-scale solar projects were accounting for their RECs, but no residential or commercial DG projects were participating in the REC market. PREPA alleged in 2016 that it was “not viable” to account for the RECs as accumulated by DGs. The Energy Commission rules that the RECs controversy is outside the purview of the revision of

electricity tariffs but “suggests” that a formal motion be filed and that the Energy Commission would visit the issue if brought up.

The summer of 2019, the Energy Commission, now called the P.R. Energy Bureau (PREB), held stakeholder workshops and information sessions on the establishment of regulations for RECs. The author of this report assisted and participated in the REC workshops. Follow up activities and reviews of draft regulations were preliminarily scheduled but have been put on hold since the COVID-19 pandemic. Recently, the PREB announced that they will be taking up the issue again in early 2021 to oversee a robust enactment of a REC mechanism that may include accounting for DG solar.

In future white papers, The Solar Foundation will track the process of final rulemaking for the RECs in Puerto Rico and how it goes about including all markets in solar that are currently not benefitting from RECs accounting such as DG residential and commercial.

Investment Tax Credit

The federal Investment Tax Credit is at 26% of the eligible project costs as of 2020. It remains an attractive source of equity capital for the development of solar-plus-storage projects of all sizes in Puerto Rico. The tax credit is only applicable to U.S. domestic taxpayers with a federal income or business tax liability. The majority of Puerto Rican residents and/or business owners do not qualify, so ITC capital must thus be recruited from mainland investors. Under Section 48 (ITC) rules, the business that installs, develops, and/or finances the project claims the credit, but it is common to create a pass-through entity to allow its investor members to take the credits. Therefore, there is an opportunity for a solar developer in Puerto Rico or another Puerto Rico-based entity to link up with an equity partner in the United States that can take advantage of this tax credit and inject their capital and pass on savings into the project.

The ITC is based on the eligible portion of the amount of investment in solar property. Both the residential and commercial ITC are equal to a percentage of the eligible basis that is invested in eligible solar property which has completed construction in the year for which the credit is being claimed. For projects that made “safe harbor” expenditures under the ITC before the end of 2019, the credit rate is 30%. The ITC then steps down according to the following schedule:

- 26% for projects that are placed in service or make safe harbor expenditures in 2020 to 2022.
- 22% for projects that are placed in service or make safe harbor expenditures in 2023.
- After 2023, the residential credit drops to zero while the commercial credit drops to a permanent 10%.

To highlight the importance of the ITC for utility-scale solar development in Puerto Rico, we have interviewed developers of a total of about 41 MW in solar farms. As expected, all the developers

said that the ITC provided between 30 to 35% of the project budget and was instrumental in the development of their projects. Clearly, the development of residential, commercial and utility-scale projects in Puerto Rico have been made possible because of partnerships with mainland-based investors who benefit from the ITC.

In our future white papers, The Solar Foundation will analyze how the current ITC ramp down schedule impacts various types of solar-plus-storage development (commercial and utility-scale), given that local developers have to partner with a U.S. mainland-based investor to be able to benefit from the ITC. It will be important to explore how the expectation of a disappearing ITC may impact solar-plus-storage off-takers.

Community Development Block Grants: Disaster Recovery and Mitigation

The executive director of the Puerto Rico Financial Oversight Management Board has stated that federal funds are critical if Puerto Rico is going to recover from the multiple natural disasters that have affected the island since it declared its finances in default in 2016. A General Accounting Office report highlighted that the federal government funded \$3.9 billion in partial repairs and restoration efforts on the Puerto Rico electrical grid after Hurricane Maria and Irma left 100% of the island without electricity (US GAO, 2019).

Under the Community Development Block Grant - Mitigation, the following activities have been included as eligible for funding. The list is not comprehensive, but it gives a flavor of the types of energy projects that can be developed with federal funds and/or leveraged with other funding:

- a. A comprehensive resiliency plan for a community that has had a historically unsatisfactory performance index from PREPA.
- b. Development of technologies (demand response, storage, concentrated solar) that may mitigate future risks from disasters.
- c. Financing for critical infrastructure to allow continued commercial operations, such as a medical tower.
- d. Green or natural mitigation infrastructure development which opens up the opportunity for integrating more solar-plus-storage in natural areas.
- e. Finance for multi-use infrastructure.
- f. Many of the Community Development Block Grant programs must prioritize funding projects that will impact at least 75% of population that are low-to-moderate-income individuals (PR Action Plan, 5th Amendment 2020).

As of this report, the Puerto Rico Department of Housing has begun the competitive process of vetting firms in Puerto Rico to administer the Community Solar and Water Resiliency Installation program (CEWRI). The CEWRI will install residential rooftop solar-plus-storage in thousands of homes that were affected by the hurricanes Irma and Maria. At present, the PRDOH is also scheduling orientation sessions for solar installation companies in Puerto Rico that will design and

install the rooftop solar-plus-storage systems. The total program cost will be \$300 million and expected to fund solar for the critical electrical loads for several thousand homes at a rate of up to 200 per month.

Electric Cooperatives

With the enactment of the Puerto Rico Energy Cooperatives Act in 2018 (see Appendix A), Puerto Rico is promoting the diversification of decentralized energy models to be offered to different sectors of customers. The law lays out in detail the requirements for establishment of energy cooperatives in the island, including the board of directors and articles of incorporation. It establishes that the main objective of an energy coop is to generate, transmit, and/or distribute electric power “mainly” to meet the electric needs and demands of their members and communities. A coop may also enter into agreements to sell electric power to other consumers as well as to sell excess power into the PREPA grid.

For the protection of the customers, it is established that an electric cooperative will be certified and regulated as an electric service company with the Energy Bureau of Puerto Rico, per Regulation 8701, 2016. Importantly, rural electric cooperatives can access debt on favorable terms from the USDA and from the financing arm of the National Renewable Energy Cooperative Association. However, as ambitious as Act 258 is regarding electric cooperatives, there has been a decided lack of specifics to guide nascent organizations in this highly technical field. As the first such initiative in Puerto Rico, it should be closely monitored to see how well it does at attracting investment and capital and in establishing guidelines and regulations for this challenging business.

The authors of this report are aware of two organizations that have gained electric cooperative status in Puerto Rico using this new law. The Cooperativa de Hidroeléctrica de la Montaña (CHN) and Comunidad Organizada de San Salvador in Caguas (COSS) are two such initiatives that have gained traction. COSS installed eight residences with solar-plus-storage systems as their first phase towards a larger project that may provide community-based energy for up to 450 homes in the barrio of San Salvador (Pressreader, 2020).

USDA REAP

The United States Department of Agriculture offers direct grant and loan guarantee programs to bring energy resiliency to rural sectors of Puerto Rico. The program goal is to help increase energy independence by increasing the private sector supply of renewable energy and decreasing demand through energy efficiency improvements. Over time, these investments can also help lower energy costs for small businesses and agricultural producers. The amount of private matching funds for grants changes from year to year, but as of this report, the maximum grant amount that can be requested for a rural business or an agricultural business is \$500,000, or up to 25% of the total renewable energy systems cost. Loan Guarantees can be up to \$25,000,000 and up to 75% of total project cost.

Eligible activities in the renewable and efficiency area include biomass, wind, solar photovoltaic, high efficiency cooling, efficient lighting, variable frequency drive machinery, efficient windows, and high-efficiency irrigation pumps. This program has the potential to continue supporting the development of sustainable businesses in rural areas of Puerto Rico (USDA Rural Development, 2019).

To be eligible for a grant or loan, the business must be located in towns with populations of less than 50,000. Agricultural businesses may be urban if more than 50% of the applicant's income comes from the agricultural enterprise.

It is worth exploring how targeted leveraging of these funds can be used in conjunction with other available financing mechanisms to make solar-plus-storage more accessible to rural and underserved markets in Puerto Rico, such as the commercial food producing sector.

Section V. Beyond philanthropy: Developing a sustainable financing model to provide energy resiliency to critical services infrastructure

Puerto Rico is coming out of a period when its vulnerability to long-term disruption after natural disasters has attracted the attention of hundreds of nonprofit and philanthropic organizations. Hurricanes Irma and Maria in September of 2017 and the cluster of earthquakes between December 2019 and January 2020, coupled with a continuous economic recession since 2006, put Puerto Rico front and center in the arena of organizations seeking to provide immediate emergency and recovery assistance.

Therefore, over the past three years, important philanthropic contributions have helped provide energy resiliency to much of Puerto Rico's social services infrastructure. Based on conversations with nonprofit organizations that have funded solar projects in Puerto Rico, around 110 public schools that are used as emergency shelters during storms have been provided with a solar-plus-storage system for critical loads such as illumination, some refrigeration, and water pumps. Dozens of municipal and rural community centers have also been retrofitted with solar-plus-storage systems that could provide dependable electricity to meet the emergency needs of their residents during future prolonged electric blackouts. Philanthropic donations also supported renewable energy for police and first responders.

The Solar Foundation has contributed to these efforts through the Solar Saves Lives Initiative, which has provided solar and battery storage installations at nonprofit health clinics across the island, ensuring they continue to provide critical services after the power grid goes down. You can read more about the impact of this program at [Solar Saves Lives - The Solar Foundation](#). In addition to The Solar Foundation, the Solar Saves Lives partners include the Clinton Foundation, Direct Relief, the Hispanic Federation, The Rockefeller Foundation, The Leona M. and Harry B. Helmsley Charitable Trust, and the Center for Disaster Philanthropy. Other organizations engaged in philanthropic work include Mercy Corps, Red Cross of America, the Rocky Mountain Institute, Fundación Comunitaria de Puerto Rico, Unidos por Puerto Rico, Resilient Power, and many others. These organizations stand out in providing funds to provide some normalcy and energy resiliency to certain sectors and geographical regions in Puerto Rico.

Based on an interactive map developed by Direct Relief, we can quantify that a total of about \$60 million has led to the development of 402 distributed solar-plus-storage projects with about 12 MW in solar and 9 MWh in storage (PR Direct Relief, 2020). Below is what the Puerto Rico Solar Map visualization tool looks like.



Source: The Puerto Rico Solar Map, 2021

One of the results of these philanthropic efforts has been the design and installation of robust and resilient solar-plus-storage systems at Federally Qualified Health Centers (FQHCs) across Puerto Rico. This initiative is very important because after Hurricane Irma and Maria, up to 4,645 excess deaths occurred as a direct consequence of not having proper medical care for extended periods of time (The New England Journal of Medicine, 2018).

FQHCs are vital to many communities in Puerto Rico because they:

- Serve an underserved area or population
- Offer a sliding fee scale
- Provide comprehensive services (either on-site or by arrangement with another provider), including:
 - Preventive health services
 - Dental services
 - Mental health and substance abuse services
 - Transportation services necessary for adequate patient care
 - Hospital and specialty care
 - Quality and improvement assurance

As of this report, there are 62 FQHCs in Puerto Rico that provide medical care for over 1 million people. About 15 of these centers have already been provided with philanthropic funds, and the

rest remain vulnerable to short-term and long-term blackouts from the grid due to malfunction or natural disasters. Those 15 health centers will be able to provide much-needed assurance that no matter the status of the electrical grid, their patients will have uninterrupted medical and life-sustaining services.



Carlos Alberto Velázquez Lopez, Program Director at The Solar Foundation, with representatives of ISO solar installation company and COSSMA Las Piedras health clinic staff.

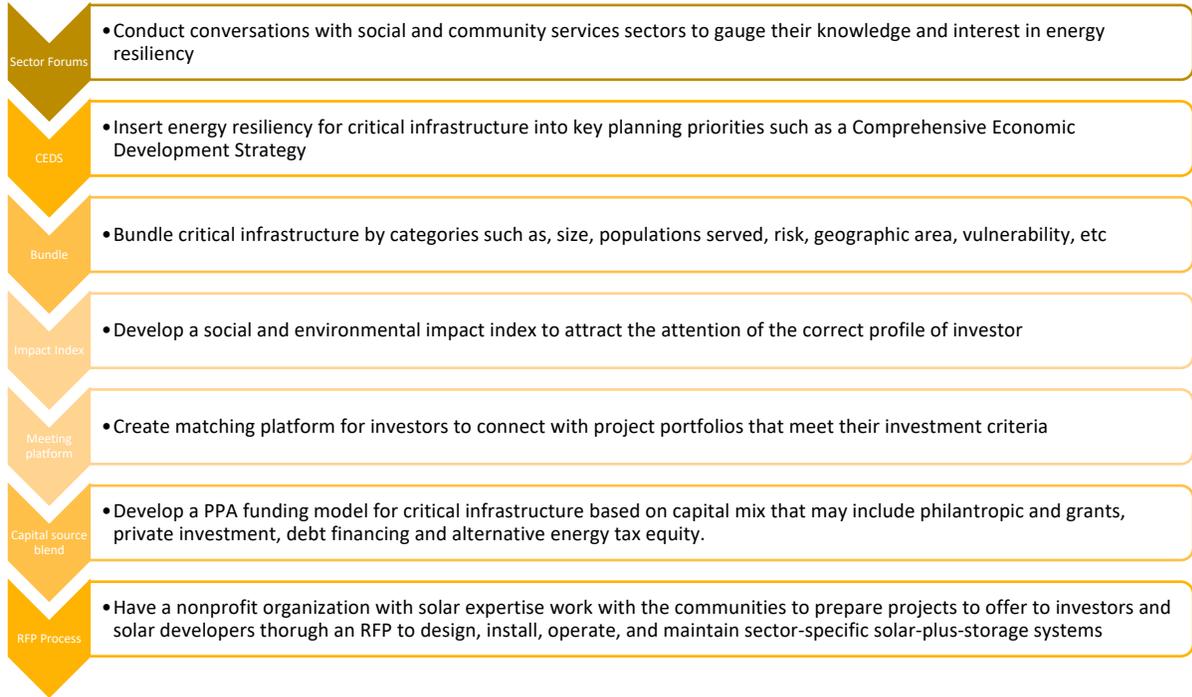
Clearly, much remains to be done. After the September 2017 hurricanes, over 200,000 residential clients went for more than six months without electricity (Castro, 2019). Today, the economic situation of the island has not improved, and social services remain vulnerable. The electrical grid is no better today than it was in August of 2017, one month before Hurricane Irma and Maria (Utility Dive, 2020). The Integrated Resource Plan for modernization of the electrical grid calls for significant reconceptualization of Puerto Rico’s grid, to include dividing the island’s electrical system into eight regional and interconnected microgrid topologies that have islanding capabilities and black start capacities. The question then remains, how can Puerto Rico critical infrastructure gain energy resiliency while long-term structural and economic problems have yet to be resolved?

As we previously stated, the philanthropic sector made direct investments of about \$60 million into resilient solar-plus-storage systems across Puerto Rico. Philanthropic funds alone will not likely be able to cover the need. There are thousands of small commercial and nonprofit buildings that offer essential services to the communities they serve. In fact, in the Puerto Rico Community Energy Resilience Fund concept paper, the authors estimate that there are up to 23,000 critical facilities in all of Puerto Rico and that it would take about 676 MW of solar and 952 MWh of storage to provide resiliency to all. The total estimated cost is up to \$2.6 billion at the current cost

of solar-plus-storage (RMI, 2021). How, then, can we devise solutions and attract investment to fill the remaining funding gaps to meet the broader need?

Within the scope of this report, we recommend the following approach.

Energy Resiliency for Critical Social Services Sector with a Sustainable Finance Model



As has been stated before, after the robust philanthropic response following the hurricanes and earthquakes, there is still a significant need for energy resiliency in the distributed social services and first responder infrastructure of Puerto Rico. Thousands of facilities, including fire stations, police stations, school emergency shelters, community food banks, gender violence shelters, health clinics, community centers, and animal shelters located in remote areas of the island, continue to be vulnerable to short-term and long-term electric outages.

This outline presents a conceptual financial product that could fill the gap and address unmet needs in social services infrastructure that have not been able to afford a market priced solar-plus-storage solution. Clearly, there are many details to work out. For example, what is the correct balance between debt, equity, philanthropic capital sources? How to gauge and minimize credit risks for the off takers? How to address issues of property ownership and rooftop easements? What about security and protection of community-based solar-plus-storage assets? Can CDFIs, OZs and CDBG-DR funds leverage to find affordable solutions?

It is worth noting that as of the writing of this report, two Puerto Rico-based, and two United States- based nonprofit organizations have begun the pre-development stage of a program called

the Community Energy Resilience Fund (CERF). This program seeks to bring in blended capital sources including equity investment, lending, and philanthropic funds to create substantially discounted solar-plus-storage financing for commercial clients that provide essential services to the public (FCPR, 2019).

In future white papers, The Solar Foundation will be able to gauge the success, obstacles, challenges, and lessons learned from efforts such as the CERF. The blending of capital sources and de-risking strategies such as reserves, insurance, guarantees or credit enhancement measures may improve the affordability of solar-plus-storage systems for commercial clients and the nonprofit sector, whose financial status and credit profile make development difficult.

Section VI. Summary of findings and concluding remarks

The Solar Foundation has carried out a methodical and comprehensive look at the solar finance ecosystem in Puerto Rico. We conclude this report with some of the key takeaways.

Solar companies that offer financing to their residential and commercial clients have made a significant contribution to the deployment of solar in Puerto Rico. In conversations with representative of the Solar Energy and Storage Association for Puerto Rico, upwards of 75% of all solar projects in Puerto Rico have been financed via power purchase agreements. () (C. Velazquez, personal communication, August 2020). The PPA and solar lease model lowers or eliminates the upfront costs of solar to the consumer and that has been an important mechanism to put solar on the roofs of thousands of clients whose credit rating, savings or otherwise compromised financial situation does not allow them to fund the system.

Solar companies have been able to make solar more accessible to thousands of residential clients through PPAs. PPAs will continue to be important contributors to the deployment of solar-plus-storage in Puerto Rico, particularly reaching prosumers who do not have access to the upfront capital for equipment purchase and installation. However, to continue to grow and improve their public relations perception that was affected by PREB's ruling against them, they will have to implement various corrective actions. We believe the corrective action should include: a) detailed explanation of the PPA contract and its terms and conditions; b) detailed explanation of how net metering works and that if consumption exceeds solar production during a billing period, the consumer will receive a bill from both the PPA provider and PREPA for electricity consumed; c) a detailed work order that explains what equipment that will be installed, where it will be installed, and the approximated generation of electricity expected from the system; d) a clear billing objection process that complies with Art. 6.27 of Act 57-2014 of an Independent Electric Service Provider.

A flag is raised, however, that with the phase out of the ITC, scheduled for 2024, commercial solar developers and those who install and finance residential solar will see their tax credit drop to 10%. Research by the Solar Energy Industries Association suggests that the ITC has been an important causal factor in the 52% annual average growth experienced by solar energy over the past decade in the United States. Losing that important incentive could negatively impact the availability of affordable PPAs in Puerto Rico.

The Savings and Loans Cooperatives have shown interest and action in providing solar-plus-storage financing on a limited basis. As an observation, a visit to the commercial lobby or the website of any of the Cooperatives, FCU or commercial banks that offer solar-plus-storage financing provide few indications that they offer solar loans. A more robust marketing approach to inform, promote, and engage their members about solar financing would probably generate more interest from their clients.

The solar financing offer could be improved. For coops, we find an average of a 6.0% interest rate over 84 months with a high empirical credit rating of over 700. In an island where the official poverty rate is around 44.9% and the median household income is just about \$20,000, those terms are not particularly accessible to the majority of the population (Data USA, 2018). Are the

cooperatives incorporating methods that can lower their cost of capital or mitigate the risk profile of their members? Are they looking to align the terms of the loans with the useful life of the solar-plus-storage systems?

Similar questions arise for other financing. What actions are the Cooperative Associations taking in Puerto Rico to assist in the development and growth of electric cooperatives that are now beginning to form because of Act 258 of 2018? Are the Community Development Financial Institutions developing a mission to bring solar to low-and-moderate income communities as part of their programmatic efforts? Electric Coops and Solar for LMI communities are fairly recent in Puerto Rico, so the opportunity to improve their effectiveness for solar-plus-storage deployment is important.

At the traditional commercial banking level, we can conclude that there are limited options for solar financing. Only one bank actively offers solar financing as a distinct product, and only with one solar company. Representatives of the solar industry such as ACONER report that traditional banks have been approached about the option of including solar-plus-storage equipment within a home mortgage or refinancing loan. From conversations with the industry, the response has been to raise concern with the vulnerability of the systems to storm damage and theft, coupled with a lack of understanding of solar-plus-storage reliability. These concerns should be addressed in a systemic manner with the banking industry, giving them enough technical detail to assure them of the greatly improved products and services available with today's rooftop solar-plus-storage systems.

Banks could tie the expected 30+ year life of the solar generators with the typical 25- or 30-year mortgage option or refinance option. In 2018 alone, 10,789 homes were purchased in Puerto Rico. That is a sizeable market of homeowners that could finance a solar-plus-storage system under favorable terms if they could be included in a home mortgage or refinance transaction. Both commercial banks and Cooperatives offer personal loans that a solar interested consumer may opt for to finance their solar-plus-storage system. However, terms for a personal loan are generally not attractive enough, nor accessible to higher risk clients in order to provide for a sustainable solar financing model.

Community Development Financing Institutions can increase their impact on solar-plus-storage financing. Given that CDFIs are a fairly recent financial structure in Puerto Rico, they are mostly focusing on capacity building. There are important initiatives being implemented in this space. For example, Inclusiv has partnered up with two Puerto Rico-based CDFIs to launch the Center for Resiliency and Clean Energy, which seeks to develop a consistent and scalable approach to make renewable energy technologies available to low-to-moderate income consumers and community wide energy investment (Inclusiv, 2021).

New CDFI programs need faster certification and new and existing CDFIs need to build capacity. A strong CDFI sector is vital if we are to move from individual solar financing to a larger pool or aggregate pool of customers, as would be the case in community solar or community microgrids. Coops and federal credit unions, particularly those certified as CDFIs, should engage with solar companies in honest discussion about the needs and barriers of each sector. The Puerto Rican Solar Business Accelerator (PRSBA) will be developing focus groups and workshops to bring together

solar representatives and the finance sector to identify and agree on the implementation of strategic solutions. Coops, Federal Credit Unions, and CDFIs could engage with an expert team of debt underwriters to devise a financing strategy that pools the capital of many sources and reduces risks.

As of this report, there are three NGOs and communities that are organizing as Electric Cooperatives. All are in the capacity building and formative stage, with minimal construction and operations, so it was not possible to include an analysis of their performance to date for this an assessment. Future solar finance white papers will provide more in-depth information and share lessons learned, obstacles, and challenges.

Another important opportunity has to do with public comment process leading to the amended action plans on the CDBG-DR. As shown previously, the amount of interest in the Home Energy Resiliency Program greatly exceeded budget allocation for the program. As previously shown, this was the program with the greatest disparity between interest and budget allocated to it. There should be a concerted effort by representatives of the solar industry in Puerto Rico to have a conversation with the HUD and PROH officials to get a broader sense of the potential unmet needs. As of the writing of this solar finance report, PROH has already begun its Request for Proposal process to contract companies to manage the Community Energy and Water Resiliency Installation program from funds appropriated to CDBG-DR.

After the 2017 hurricanes and the recent earthquakes, philanthropic dollars came in to provide immediate energy recovery efforts that restored critical services. However, hundreds of facilities that provide direct service to vulnerable populations remain without such energy resiliency. By leveraging sources of capital as presented in the flowchart laid out in Section VI, attractively priced PPAs may be developed that can offer solar-plus-storage at a substantial discount from the going electricity rate per kWh with PREPA.

Solar-plus-storage development in Puerto Rico will benefit if the financial competency of local solar companies and developers is addressed. Equal attention has to be paid to increasing solar-plus-storage knowledge by the finance institutions. They must know enough about the constantly changing technology and dynamic regulatory aspects of solar so that they may make informed and timely choices about solar finance products and services.

Puerto Rico has adopted a regulatory framework that puts it on the path for 100% RPS by 2050. The importance of developing affordable, robust, and diverse solutions of solar financing could not be more clear or timely. The Solar Foundation and our partners stand ready to assist with outreach, educational efforts, research, and solar industry and finance industry engagement to implement initiatives and programs that will lead to a robust and active solar financing atmosphere in Puerto Rico.

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Appendix A

Chronology and snapshot of the regulatory ecosystem for solar

This appendix provides a summary of the solar-related laws and incentives that have been passed in Puerto Rico since 2007.

Act 114 – 2007 This law authorizes PREPA to establish a net metering program in Puerto Rico for residential and commercial clients. The net metering system allows the interconnection of distributed generation systems and requires a credit in their electrical bills for the energy generated by the installed and permitted systems.

Act 133 – 2016 This act introduced into Puerto Rican law for the first time the legal concept of community solar and microgrids.

Final Microgrid Regulations – 2018 These regulations promote the development of microgrid systems by enabling their implementation through different business and operational models.

Act 258, Puerto Rico Energy Cooperatives Act – 2018 This act promotes the diversification of decentralized energy models offered to different sectors of customers. It determines the requirements for the establishment of energy cooperatives, and establishes their objective to generate, transmit and/or distribute electric power “mainly” to meet the electric needs and demands of their members and communities.

Act 17, Energy Public Policy Act, – 2019 This act establishes a renewable portfolio standard (RPS) of 40% renewable energy by 2025 and 100% by 2050, while at the same time setting a 30% energy efficiency goal by 2040 over projected consumption. It mandates that PREPA issue permits for solar distributed generation (DG) with engineer certifications if equal to or smaller than 25 kW for the sake of expediency. It creates the Green Energy Trust to encourage low-to-moderate income and nonprofit sector electric consumers in Puerto Rico to become prosumers.²

Act 60 Puerto Rico's Incentive Code – 2019 Act 60 consolidates and substitutes for the majority of all 76 laws that were previously on the books in Puerto Rico promoting economic development via tax incentives, subsidies, and special tax credits. Chapter 7 of the new Puerto Rico Incentive Code is dedicated completely to infrastructure and green energy. With respect to solar energy and battery storage, the law states that for 5 years of the enactment of the law or from the registration of the business, a flat business tax of 4% will be the rate for any business registered in Puerto Rico that:

1. Produces, operates and/or sells green energy at a commercial scale

² **Prosumer:** Terminology first coined by American futurist Alvin Toffler in 1980 that identified the future blurring of producers of a service and its users. In solar energy-produced electricity, the term prosumer refers to clients of an electric grid that have distributed photovoltaic generation installed in their homes or businesses in order to produce as well as consume electricity.

2. Is a bulk green energy producer whose energy is consumed in Puerto Rico
3. Is involved in the manufacturing and assembly of green energy systems, including solar-plus-storage equipment and components

This law also details the parameters for the tax treatment of Renewable Energy Certificates (RECs). One REC represents the equivalent of one MWh of electricity generated by renewable energy. Costs incurred in the purchase and closure of RECs can be taken as a special deduction on the gross income of the individual or business, in order to promote the development of future renewable energy projects. (Codigos, 2019)

A number of Puerto Rico laws also include tax incentives that pertain to renewable energy. A summary of these laws and the incentives is below.

Act	Year	Incentives	Applicability
73	2008	This act provides a tax credit for investments in renewable energy up to 50% of a special eligible investment made in Puerto Rico.	General business or any of its affiliates.
241	2008	Grants a new tax credit for tourism investment that facilitates the acquisition and installation of equipment that uses renewable sources. The credit is equal to 60% percent of the total investment.	Tourism
83	2010	<p>Establishes tax exemptions including a) 4% fixed income tax rate on income derived from the production of energy in Puerto Rico; b) 12% fixed income tax rate, c) 100% tax exemption on dividend distributions; d) 4% fixed income tax rate on gains derived from the sale of ownership interests or substantially all the assets of the exempt business, instead of any other Puerto Rico income tax imposed on such gains; e) 90% tax exemption from personal property taxes.</p> <p>Tax Credits: a) 25% tax credit on purchases of products manufactured in Puerto Rico; b) 35% tax credit on purchases of products manufactured in Puerto Rico made from recycled materials; c) Tax credit for job creation during the first year of operations that ranges from \$1,000 per job created in an industrial area of intermediate development (as determined by the Office of Industrial Tax Exemption) to \$2,500 for jobs created in an industrial area of low development; d) In the case of businesses established in the municipalities of Vieques and Culebra, this tax credit is \$5,000 per job; e) 50% tax credit on eligible research and development activity costs; and f) 12% tax credit for royalties paid to foreign entities concerning intangible property used in the exempt business.</p>	Natural and legal person

Appendix B – Research instruments and data gathered for future assessments

The Puerto Rican Solar Business Accelerator has begun a process of in-depth interviews and electronic surveys of the solar financing institutions, including Savings and Loans Cooperatives, Federal Credit Unions, and commercial banks. This will allow us to provide much in-depth information in future solar finance assessments and to work with the solar finance institutions and solar companies to implement solutions that will result in stronger and more diversified options of solar financing.

IDIs guidelines for Cooperatives

Financial Institution Profile:

1. Founding year
2. Total members
3. Cooperative members' requirements
4. Is the cooperative a CDFI?
5. Interviewed position

Institutional Solar loans:

1. Does your bank offer solar loans?
2. If you answer yes, when did you start offering solar loans?
 - a. Solar loan terms, amount, credit score, etc.
 - b. How many solar loan applications do you get per year? How many approved?
 - c. Future modification for solar loans.
 - d. Can you identify growth opportunities in solar loans?
3. If you answer no, why does your institution does not offer solar loans?
4. Is the institution interested in offering solar loans? How does your membership know about your solar financing?

Institutional knowledge and risk perception:

1. Do you want more guidance on solar energy and PV system equipment?
2. If you answered yes to the previous question, what are the areas on which you want to receive more information?
3. Compared to home loans, personal loans, car loans, how is the risk of personal loans perceived?
4. What does your institution do to reduce the risk of solar loans (installation and equipment inspection)?
5. Do you understand that the integration of a professional who inspects the installation of PV systems could reduce the risk of solar loans? (Ex. Elevator Cruz Moya)
6. Does your institution know the permitting process within PREPA for solar loans?

Solar loans advancement solutions

1. Could the process of approving a solar loan be streamlined in your financial institution?

2. If there was a guarantee fund supporting this type of loan, do you think your institution could approve solar loans to clients with lower credit scores?
3. If there was any other credit enhancement tool supporting this type of loan, do you think your institution could approve solar loans to clients with lower credit scores?
4. Do you consider the securitization of solar loans in Puerto Rico possible and feasible?
5. If you answered yes to the previous question, do you think securitization would help advance solar loans?
6. Is your financial institution open to venture capital to develop a bigger residential or commercial project?
7. Has your financial institution experience with solar financing in combination with tax equity?
8. If you answered no to the previous question, would you like to learn more about it?
9. Would the financial institution be open to revised underwriting criteria and incorporate other elements such as past-bill repayment history or the Telecommunication, Electricity and Cable Score (TEC)?
10. Would the financial institution be open to partner with other financial institutions in the U.S. mainland? For example, originate the loan in your institution and then sell it to another institution.

IDIs guidelines Banks

Financial Institution Profile:

1. Foundation year
2. Total of commercial clients
3. Banks' assets portfolio?
4. General commercial clients' profile
5. Interviewed position

Institutional Solar loans:

5. Does your bank offer solar loans?
6. When did you start offering solar loans?
7. Solar loan terms, amount, credit score, etc.
8. How many solar loan applications do you get per year? How many approved?
9. Future modification for solar loans.
10. Can you identify growth opportunities in solar loans?

Institutional knowledge and risk perception:

7. Do you want more guidance on solar energy and PV system equipment?

8. If you answered yes to the previous question, what are the areas on which you want to receive more information?
9. Compared to home loans, personal loans, car loans, how is the risk of personal loans perceived?

Solar loans advancement solutions

6. Could the process of approving a solar loan be streamlined in your financial institution?
7. If there was a guarantee fund supporting this type of loan, do you think your institution could approve solar loans to clients with lower credit scores?
8. Do you think there is an interest between other local banks for solar loans?
9. Do you consider the securitization of solar loans in Puerto Rico possible and feasible?
10. If you answered yes to the previous question, do you think securitization would help advance solar loans?
11. Is your financial institution open to venture capital to develop a bigger residential or commercial project?
12. Does your financial institution have experience with solar financing in combination with tax equity?
13. If you answered no to the previous question, would you like to learn more about it?

Financial key terms for IDIs

1. **Credit Enhancement:** A credit enhancement is anything that improves the chances that financing will be repaid.³ Are the local coops or banks using any credit enhancement tools to lower the risk of default?
2. **Loan loss reserve (LLR)** sets aside (reserves) a certain amount of money to cover potential losses (in case of no repayment). For example, a 5% LLR on a \$60 million loan portfolio would cover up to \$3 million of a capital provider's losses on that loan portfolio.⁴
3. **Loan guarantee** covers the entire amount of a capital provider's potential losses on a portfolio of loans. A guarantee differs from an LLR because it is not capped at the amount of money set aside in the reserve. Federal statute does not allow State Energy Program or Energy Efficiency and Conservation Block Grant funds to be used as a loan guarantee. The federal government provides loan guarantees through the U.S. Departments of Agriculture and Energy as well as several Small Business Administration programs.

³ <https://www.energy.gov/eere/slsc/credit-enhancements>

⁴ <https://www.energy.gov/eere/slsc/credit-enhancements>

4. **Loan loss insurance** is a private insurance product that lenders can purchase or a grantee can purchase on behalf of a lender. Loan loss insurance is similar in some respects to a loan loss reserve in that the insurance covers a portion of the total losses (in case of no repayment), up to some capped amount. The difference is that instead of setting funds aside in a reserve account to cover the losses, the grantee or lender pays an insurance premium to a private insurer. Loan loss insurance is not easy to secure at the moment.
5. **Debt service reserves** are funds set aside to cover potential delayed or defaulted payments on a debt instrument (loan). For instance, a bond might require setting aside a 6-month debt service reserve, or perhaps 10% of the total amount of the bond to cover potential defaults.
6. **A subordinated/senior capital** structure allows two types of capital to be placed into a loan. The first one, subordinated capital absorbs the potential first losses on a loan and might be set at 10% of the total loan amount. Senior capital does not absorb any losses until the subordinated capital is exhausted. This structure acts in some ways like an LLR and serves to attract the senior capital because the subordinated capital takes on the majority of the risk.
7. **Securitization:** The process of transforming illiquid assets (such as the cash flows from a solar lease or power purchase agreement) into standardized, tradable instruments (i.e., securities). Security issuers sell the rights to the underlying assets (via the securities), and the proceeds are used to finance business operations. Issuers pay an interest rate to each investor, the percentage of which is typically dictated by the rating of the securities.⁵
8. **Bonding:** The process of securitizing debt and then issuing it into the capital markets via bonds. By purchasing bonds (and the rights to the cash flows on the underlying debt), investors are in essence lending money to the issuer. The investors are compensated by an interest rate applied to the amount of their purchase payable by the issuer. Bond finance has been used in the marketplace to finance solar projects.²
9. **Underwriting:** lender verifies your income, assets, debt and property details in order to issue final approval for your loan. An underwriter is a financial expert who takes a look at your finances and assesses how much risk a lender will take on if they decide to give you a loan.
10. **Investment Tax Credit:** Solar investment tax credit granted to business that invest in commercial solar project. The credit is equal to 30% of the qualifying costs of the projects.⁶ It is currently at 26% for residential developments under Section 25D and under Section 48 of the tax code. As it stands, it will phase out by 2024. There are efforts to revive it as a multiyear program and include storage.
11. **Telecommunications, Energy, and Cable Score (TEC):** Score is based on a risk model developed specifically for telecom and energy accounts. The basic idea is that your score

⁵ The Potential of securitization in Solar PV Finance

⁶ Implications of the schedule federal investment tax credit

is different for Electricity and Internet / TV service vs. Autos, Homes and Credit Card payments.

Aspects to Explore on the Financial In-depth Interviews

- Solar loans – need to standardize procedures and contracts
- Financial institutions' knowledge about solar energy and equipment. What information about solar and storage does a financial institution need in order to make a well-informed decision about providing financing to solar projects?
- Solar investment risk perception. Are they aware of Rocky Mountain Institute “Solar Under Storm” documents that significantly lower the risks associated with PV projects?
- Confidence in asset performance
- Other underwriting criteria (TEC)
- What kind of assistance do they need from organizations such as The Solar Foundation and IBTS to reach out to their membership/client base to increase interest in solar loans? Marketing, lobby presentations, webinars?

About the Authors



Loraima Jaramillo-Nieves is a Program Manager supporting The Solar Foundation's initiatives in Puerto Rico, such as a workforce needs analysis report, solar and storage demonstration microgrid projects, and the Puerto Rican Solar Business Accelerator. Dr. Jaramillo earned a master's degree in Operations Management and Marketing from the University of Puerto Rico, Río Piedras Campus. She went on to earn a magister in Energy Efficiency and Climate Change and a doctoral degree in Environment and its human and socio-economic dimensions from the University Complutense of Madrid.

Since 2010, Loraima has been studying Puerto Rico's power sector and renewable energy market evolution. Her research explored the pioneers of the renewable energy industry and the community experience, as well as the barriers, market failures, and perceptions related to this industry. She worked at the National Institute of Energy and Island Sustainability at the University of Puerto Rico, where she coordinated the Annual Energy Report of Puerto Rico for 2016 and 2017. In the 2017 report, she co-wrote the chapter with recommendations for rebuilding Puerto Rico's power system after Hurricane María. Dr. Jaramillo also collaborated with community aqueducts providing pollution prevention technical assistance..



Carlos Alberto Velázquez López is Program Director at The Solar Foundation, where he oversees Puerto Rico programs including the Puerto Rican Solar Business Accelerator. As an environmental manager by education, Carlos Alberto has been able to bring an interdisciplinary perspective to problem analysis and solutions. After having completed two tours in the United States Marine Corps, he was honorably discharged in 2006 and quickly transitioned to serving Puerto Rico in the capacity of advising environmental and political organizations on federal, environmental, and energy matters. Instrumental in the early coalitions that advocated for net metering and interconnection of distributed generation in Puerto Rico, he eventually became the managing partner for a local energy and photovoltaic design and installation company. After Hurricanes Irma and Maria, he led an

exemplary team of engineers, financial experts, and community economic development professionals to put together a conceptual design for a community-based renewable energy microgrid. That initiative became the basis for an ongoing energy cooperative model that is in development in rural areas of Puerto Rico.

Carlos Alberto has accompanied the Department of Commerce to missions in Central America as an advisor on microgrid regulations and development. He is an active contributor as a subject matter expert to environmental and climate-related radio shows. He is an active contributor to the PR Bureau of Energy on issues such as energy efficiency, microgrid regulations, and the Integrated Resource Plan. In his free time, he serves as a visionary guidance panelist for the Americas for Conservation and the Arts NGO on their ecotourism and cultural tourism projects being developed in Puerto Rico.

Puerto Rico Photovoltaic Financial Sector Study

In-Depth Interview Findings

May 7, 2021



Prepared for The Solar Foundation
by BuildingInsight, LLC, an IBTS Company

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Introduction

Background

The Solar Foundation (TSF) and PathStone Corporation have been awarded a grant by the U.S. Department of Commerce Economic Development Administration to improve and aid in the growth of the Puerto Rican solar industry so that the island may achieve the objectives laid out in the Puerto Rico Energy Public Policy Act. The Act includes the goal that, by the year 2050, 100 percent of the island's power should be generated from renewable resources.

The Institute for Building Technology and Safety (IBTS) is supporting this work by conducting market research for TSF through its wholly owned research firm BuildingInsight, LLC. Research efforts are focused on identifying and understanding the experiences, perceptions, challenges, and needs of industry stakeholders in Puerto Rico (PR).

In phase one of this project, market research efforts focused on the solar workforce industry including those who develop the technology, sell and install panels on the island, and who train tradespeople in this field. Research efforts included in-depth interviews (IDIs) and an online survey of these stakeholders.

The second phase of this project focused on understanding the Puerto Rico financial sector's ability to provide financing to support widespread photovoltaic adoption, including understanding current financing options provided by the island's financial

cooperatives and banks, the barriers they experience or anticipate, and the resources they need to provide solar-specific financing.

To provide a better understanding of these topics, IBTS conducted 13 IDIs with representatives who work for Puerto Rican financial cooperatives and banks. Results from both phases of the research will support the project's next steps, which include convening industry stakeholders to identify solutions.

Approach

IDIs are a qualitative research method that provides an in-depth understanding of stakeholder experiences and perspectives. Because the purpose of IDIs is to gather detailed feedback from a limited group of stakeholders, results should be viewed in a qualitative frame of reference. This report highlights the key takeaways from IDIs.

IBTS conducted 13 IDIs, including 10 interviews with representatives from cooperatives and three with representatives from banks. IDIs were completed by telephone in February and March 2021. Interviews averaged one hour and were conducted in Spanish.

IDI questions focused on understanding the institutions' current practices with regard to solar financing and explored solutions for increasing solar financing on the island.

Respondent Profile

Respondents represented a mix of public and private cooperatives, a cooperative association, and banks. Profile information for each institution (including number of members/customers, year founded, asset portfolio, and solar loan applications received and approved each year) as well as a map of the institutions' locations, are available in the Appendix.

Banks. Puerto Rico has three banks: Banco Popular, FirstBank, and Oriental Bank. Bank IDs respondents included:

- One from Banco Popular
- Two from First Bank subsidiaries, including one from Money Express and one from Consumer Lending.

Interview requests for Oriental Bank were not answered.

Cooperatives. Cooperative Savings and Loans in Puerto Rico provide valuable financial services—including checking and savings accounts, mortgages, and car loans—to over 1.1 million members, helping meet the financial needs of individuals across the island. They charge members an annual fee; this fee serves as collateral should the member need a loan.



Interview respondents included both private and public cooperatives and a cooperative association:

- **Private cooperatives** limit their membership to those who meet specific criteria. For example, one of the interviewed private cooperatives only accepts individuals who work in the pharmaceutical field and their family members.
- **Public cooperatives**, in contrast, do not limit their membership
- The **cooperative association** interviewed provides support to cooperatives through capital investments.

Each respondent was able to speak specifically to their institution's solar financing practices.

Historical Context of Cooperatives

Cooperatives have a long history of helping those with little to no credit on the island of Puerto Rico providing small loans, mortgages, auto loans and lines of credit. Because they tend to communities, they are interested in their resilience.

With only three banks on the island, most of the lending entities are cooperatives. Nearly all cooperatives interviewed were founded between 1950 and 1980. The interviewed cooperatives all cited public service missions to provide neighbors with the funds they need to get through turbulent times and improve their quality of life. Accordingly, each expressed interest in providing solar funding to ensure their communities are prepared for power outages during natural disasters and are less dependent on the power authority. This philanthropic philosophy distinguishes cooperatives from the banks interviewed.

As noted in the Respondent Profile sections, cooperatives may be public or private; most public cooperatives started as private institutions.

Several respondents noted that Puerto Rican laws protect and promote cooperatives, which have helped their institutions thrive.

Current Practices

KEY INSIGHTS: Solar loan and financial products vary significantly by the institutions interviewed, resulting in inconsistent processes and requirements for borrowers from one institution to the next, and creating disparities in solar availability from one community to the next. Respondents agreed that their institutions consider solar loans high risk, and none felt confident in how to be successful in expanding their solar financing offerings.

Credit Enhancements

The interviewed banks and the cooperatives all provide some type of credit enhancement tools that assist those with poor or no credit to improve their credit. Respondents cited credit cards for these individuals as the most common credit enhancement because, over time, they can help an individual improve their credit sufficiently to apply for larger and longer-term loans, such as for cars and eventually, mortgages. Institutions may also provide small loans to their members or customers to grow credit.

Current Solar Financing Practices

Current Solar Loan Offerings

All interviewed cooperatives and banks provide personal loans. Personal loans are merely loans with credit score requirements for funds that can be used for a variety of purchases. Some of these loans, interviewees attested, may be used for

solar products, but not all cooperatives and banks keep track of that which personal loans were used to purchase.

Solar-Specific Personal Loans and Standalone Solar Financing Products

Standalone solar financing products are a type of loan developed specifically to finance solar equipment and installations; respondents distinguished these from personal loans that can be used for any purpose.

Banks. The interviewee from Banco Popular noted that they have provided standalone solar financing product for the past ten years but most of their clientele is commercial. The respondent noted that solar loan terms for these are typically ten to 12 years, which “provides ample time to see an adequate return on investment.”

Instead of solar loans, Money Express and Consumer Lending interviewees noted that their institutions provide small personal loans to those with poor credit or no credit. Although these loans can supplement solar projects, they are not sufficient to cover an entire solar project. They added that their institutions do not track how many clients use loans for solar projects.

Cooperatives. Among the nine cooperatives interviewed, four provide solar-specific personal loans or standalone solar financial products to homeowners. All loans for solar products take from one to three days to approve.

Cooperatives described solar-specific personal loans as very similar to a standard personal loan, with the exception that the funding be used only to purchase and install solar products. Standalone solar financing products differ from solar personal loans in that they include more robust and stringent processes, such as vetting solar installers, to mitigate the cooperative's risk.

While not all cooperatives disclosed how many applications, they received per year for either a solar personal loan or standalone financing, those that did varied from three to 20 per month with a 60 to 95 percent approval rate.

Credit Requirements and Risk Mitigation for Solar Financing

Banks. For Banco Popular, credit score is most important when determining solar loans for residential customers. For commercial projects, their primary concern relates to the quality of the solar equipment being installed and whether it will produce enough energy cost savings to cover the costs of financing.

The bank's loan officers use a formula to calculate the attractiveness of a particular commercial investment that includes technical considerations such as size of project, the estimated energy it will produce, and the quality of the system and inspection.

Cooperatives. All cooperatives require a high credit score from their clients for a solar personal loan or standalone financing.

Cooperatives noted that, because solar loans are typically in the tens of thousands of dollars and panels cannot be easily repossessed and resold, they consider solar loans high in risk.

The cooperatives that do provide solar loans all require a credit rating above 600; some required a credit rating over 699. Some also require members to provide a utility bill.

None perform solar equipment inspections, but as aforementioned, some do require solar companies to be vetted by the cooperative prior to loan approval.

The degree to which cooperatives vet solar installers depends largely on the type of financing provided. For solar personal loans, it is the borrower's responsibility to find a company they will use to purchase and/or install the equipment. While cooperatives with this type of loan do have an idea of the most trustworthy installers on the island and may even have a list of vetted companies, they do not require borrowers to hire a firm on their list. They may instead do the vetting prior to loan approval.

Conversely, for standalone solar financial products, the process is much more structured. Cooperatives vet the solar companies, assure installation is completed, and some go so far as assuring homeowners' insurance includes the cooperative in case the panels are destroyed in a weather event. Their interest

in providing such a robust product is to share and thereby minimize their risk.

All cooperatives that offer a solar-specific personal loan or a standalone solar financing product keep track of the loans and the products purchased with the funds so that, should the person default on payments, they know they must repossess the equipment. However, respondents seemed inexperienced with and uncertain about how to repossess equipment. More on this topic can be found under [Paths to Increasing Solar Financing](#).

Connectivity to the Electrical Grid

None of cooperatives that offer a solar personal loan or a standalone solar financing product deal with connectivity with the Puerto Rico Electric Power Authority (PREPA); they rely on the solar company to make all the arrangements.

Demand for Solar Loans

There is a difference in opinion between cooperatives and banks on demand for solar loans on the island.

Cooperatives agreed that demand has grown and for this reason they want to provide more solar-specific financing options.

However, the interviewee representing Banco Popular noted that, since they started offering solar loans ten years ago, demand has neither increased nor decreased.

“Although there has been greater interest for solar systems over this time, the cost of systems has decreased. [But] coupled with government incentive programs, the need for bank loans has not increased,” said the respondent.



Barriers to Increasing Solar Financing

KEY INSIGHTS: While the financial risk of offering solar financing is a big concern for respondents, most also cited their lack of expertise and understanding of the technology, industry, and government processes as a key barrier.

Lack of Expertise and Understanding

Interviews indicate that insufficient knowledge and expertise in PV systems, the solar industry, and related government processes can decrease the likelihood the institutions will offer solar loans. Most cooperatives and banks agreed the PV industry is very new and there is still much to learn before feeling confident about the technology and its financial risks.

Lack of Expertise about PV Technology

Respondents agreed it is important to become informed about the solar industry, noting its ability to help communities become more resilient. However, not all were sure how to become more informed.

Banco Popular's interviewees said that its loan officers have become familiar with some technical aspects of photovoltaic systems, and that they also rely on independent, third-party experts to consult with and advise on technical aspects of systems. Several cooperatives indicated being proactive in seeking information about photovoltaics to try and understand the market and the technology.

Conversely, Money Express and Consumer Lending's interviewees, which do not provide solar financing, noted that they lack the knowledge about the solar industry necessary to structure a solar financing product.



“ We are interested, but we don't have information about the market or its potential. - Bank Executive

Uncertainty about Repossession and Resale of PV Equipment

Respondents indicated they would like to understand, and feel confident about, how to repossess solar equipment, which parts can be resold, and the process for reselling. One cooperative that just began financing solar systems in November of 2020 said they have not yet had any problems, but do not know what they would do if the client were to default.

When asked to compare to other types of loans, such as automotive, they agreed the two cannot yet be compared, largely due to the differences in repossession and resale.

Poor Understanding of Government Processes

Most respondents, regardless of whether they provide or do not provide any solar financing, expressed a lack of understanding PREPA connectivity with solar installations. Those that provide solar financing all agreed that they leave PREPA connectivity to the solar installation companies. Those that work only with specific solar companies rely on these companies to be knowledgeable about PREPA.

Respondents noted awareness of previous government incentives for Puerto Rican residents to buy and install solar panels, with several cooperatives noting that their members took advantage of the solar credits when the program was active. One noted that these incentives were difficult for residents to obtain due to the bureaucratic application process.

Most believed these incentives no longer exist, and some voiced concern about a possible future solar tax that could negatively impact those purchasing or using solar energy.



Financial and Business Concerns

When asked about barriers to providing or increasing solar loans, both cooperative and bank interviewees cited financial or business drawbacks such as poor return on investment, the possibility of equipment being damaged by disasters, and concern that their reputation may suffer if the solar loan programs do not work out well for members or customers. Some added that no process exists to temporarily shut off solar-generated electricity if the borrower defaults on solar loan payments. Most cooperatives, regardless of whether they provide financing, are concerned and unsure about what to do if a client defaults.

Respondents who offer some type of solar financing shared concern for the cost of solar equipment and installations. They explained that, because loans to finance these systems are so large, their institutions must require that borrowers have high credit scores. Making these loans available to a greater population (with lower credit scores) would therefore be risky.



Mistrust of Installation Companies. Most cooperative respondents were concerned that some solar installers are not trustworthy and may leave clients with uninstalled systems and debt.

“These are new products for all of us cooperatives. How trustworthy are these panels? How durable? We are worried that in four or five years’ time suppliers won’t respond to the client, [or] the client stops paying. These loans are very expensive. Where will we sell these if we repossess? We can sell cars very quickly. Everyone wants a car. Solar is so much more difficult to resell. This worries our sector; we don’t know the trustworthiness of the product brands. It would have to be four, five, six, seven, eight years until we can determine which brands to finance and which not to. We know not to finance certain brands of cars; certain brands depreciate a lot. But that’s a market more than 60 to 100 years old, it’s different, our world is getting to know solar brands.”

- Cooperative Manager



Paths to Increasing Solar Loan Financing

KEY INSIGHTS: All interviewees want to learn more and hope to be able to offer or improve their solar financing offerings in the future yet cited their lack of understanding and expertise in the solar industry as barriers to doing so. Accordingly, they were very interested in additional education, training, and resources to overcome this barrier, and they shared a strong interest in receiving education from organizations like TSF. Interviewees were also very interested in the benefits of risk sharing or having a guaranteed fund.

Affinity for Increasing Solar Financing

Most interviewees noted that they want to make solar financing more widely available, particularly to individuals with lower credit scores who comprise much of the institutions' member and customer base. All respondents said they would be very interested in understanding solar tax equities and having continuous updates on possible tax credits for solar projects.

Respondents from both banks and cooperatives had a high level of awareness of the potential benefits that would result from expanding their solar financing options, including:

- **Meeting member demand.** Cooperatives reiterated that member demand for solar loans has increased, which is spurring cooperatives' in providing them.
- **Provide alternatives to generators.** Most cooperatives interviewed provide financing for generators, but many noted that solar technologies provide more energy independence and lower energy costs for residents and businesses than generators.
- **Help businesses become more resilient.** In particular, the cooperatives that offer solar financing options for businesses expressed interest in growing this line of business.



If there were a guarantee fund supporting this type of loan, there would be no issue; we would accept people with lower credit scores. Cooperatives are here to help the community.

- Cooperative Executive

Risk Sharing

Among respondents who want to provide solar financing to individuals with lower credit, all agreed this could happen if solar companies share the risk, and if a guaranteed fund were to be made available.

One interviewee noted that their cooperative, due to concerns about the trustworthiness of solar installers, designed their solar financing product in conjunction with a single installation firm to ensure that both the cooperative and the company share liability. The interviewee noted that the cooperative is willing to work with other solar installers, as long as the risk is shared.

Needed Information and Resources

Interviewers asked respondents to discuss what information and resources would help them provide or increase solar financing, and what organizations such as TSF can do to help.

All respondents, especially cooperatives, expressed a desire for information that will help them better understand the solar industry and solar technology. Many went so far as to request in-person or webinar-style classes or roundtable sessions. All said they would like ongoing information.

Respondents were very receptive to receiving information and training from TSF. Many asked if TSF would provide customized education to their boards and staff and provide information they can share with their members/clients.

The cooperative association interviewed expressed strong interest in providing this type of guidance to cooperatives.

Respondents noted several specific topics of interest, including:

- Information on available solar technology
- Solar tax equities
- How to connect with potential investors
- Tactics for minimizing risk
- How repossession does or should work
- Home insurance policies and what to require of borrowers
- Best practices for selecting or vetting solar installation companies
- Available maintenance plans
- Education designed for potential borrowers
- Marketing and outreach solutions



We'd like more guidance. We're not very involved in solar so it's important that my officers have basic knowledge, so we can be cautious and help guide the members to a smart purchase, to offer them the benefits, the nuances of battery equipment. We're open to any method of education—to be taught in group, remotely, via email, newsletters...anything you can send us, even teleconference style...these are all new products for us."

- Cooperative Executive

Some cooperative respondents expressed interest in working with other cooperatives to provide a solar financing product.

The executive for Banco Popular (which does provide solar loans) said that, despite being in this business for ten years, they too need assistance in marketing, education, and outreach. This respondent also said the bank is very interested in having a greater pool of subject matter experts and third-party resources available to provide technical guidance and assistance and quality assurance inspections and technical guidance/education for bank staff.

Respondents from the two banks that do not offer solar-specific financing expressed interest in learning more about the solar industry and, in particular, how to provide financing options for low or no credit customers. However, they were less enthusiastic about and had less specific requests for information and resources than other respondents.

Appendix

Respondent Profiles

Respondent Profiles											
Company Type	Company Name	Interviewees' Roles	Year Founded	Asset Portfolio	Number of Members	Personal Loan specific for Solar	Personal Loan NOT Solar Specific	Solar Specific Financial Product	Solar Applications Received per Year	Solar Applications Approved per Year	Interested in Offering Solar Loans
Cooperative	Cabo Rojo	Auditor Interno	1956	\$ 224M	27.6K	✓			Did not wish to disclose	Did not wish to disclose	Yes
Cooperative	Ahorro y Credito Custo Coop	Asesor	1967	\$ 23M	2K		✓		Does not offer	Does not offer	Unsure
Cooperative	BIO PHARMA	Operations Manager	1971	\$ 81M	4.4K	✓			30, about 90% with backup battery	Did not wish to disclose	Yes
Cooperative	CRH	Executive	1996	\$ 91M	9K members; 3,000 nonmembers			✓	180-240	60-65%	Yes
Cooperative	Jesus Obrero	Executive	1959	\$ 81M	11.7K			✓	150	95%	Yes
Cooperative	MAUNA	Executive	1963	\$ 185M	19K members; 20K nonmembers			✓	Did not wish to disclose	Did not wish to disclose	Yes
Cooperative	NAGU	Comptroller	1948	\$ 54M	>12K+	✓			Did not wish to disclose	Did not wish to disclose	Yes
Cooperative	NAGU	Executive	1948	\$ 54M	>12K	✓			Did not wish to disclose	Did not wish to disclose	Yes

Respondent Profiles											
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Cooperative	VEGA	Executive	1953	\$ 330M	37K members; 35K nonmembers		✓		Did not wish to disclose	Did not wish to disclose	Yes
Cooperative Association	FIDE	Commercial Financing Specialist	2002	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Yes
Bank	Banco Popular	Manager	TBA	\$ 40 B ¹	1.7M clients			✓	30	Commercial: Majority are approved Residential: Did not wish to disclose	Yes
Bank	MoneyExpress²	Manager	1996	\$ 12.7B ³	675,000 banking customers ⁴		✓		n/a	n/a	No
Bank	Consumer Lending⁵	Executive	1948	\$ 12.7B ⁶	675,000 banking customers ⁷		✓		n/a	n/a	No

¹ Interviewee did not disclose, however, data is based on 2019 year end annual report located at: [838900_002_BMK_WEB.PDF \(q4cdn.com\)](#) which states Puerto Rico as 78% holder of \$ 52.1 B total assets worldwide.

² A subsidiary of FirstBank.

³ Interviewee did not disclose, however, data is as reported by The Wall Street Journal at: [FBP | First BanCorp \(Puerto Rico\) Annual Balance Sheet - WSJ](#)

⁴ Interviewee did not disclose, however data is reported in the First Bank 2020 year end annual report located at: https://s27.q4cdn.com/212915231/files/doc_financials/2020/ar/Annual-Report.pdf

⁵ Ibid. Their 2020 Annual Report can be found at: https://s27.q4cdn.com/212915231/files/doc_financials/2020/ar/Annual-Report.pdf

⁶ Interviewee did not disclose, however, data is as reported by The Wall Street Journal at: [FBP | First BanCorp \(Puerto Rico\) Annual Balance Sheet - WSJ](#)
Their 2020 Annual Report can be found at: https://s27.q4cdn.com/212915231/files/doc_financials/2020/ar/Annual-Report.pdf

⁷ Interviewee did not disclose, however data is reported in the First Bank 2020 year end annual report located at: https://s27.q4cdn.com/212915231/files/doc_financials/2020/ar/Annual-Report.pdf

Bank and Cooperative Locations

Banks Interviewed



Cooperatives Interviewed

