

**GOVERNMENT OF PUERTO RICO
PUBLIC SERVICE REGULATORY BOARD
PUERTO RICO ENERGY BUREAU**

NEPR Received: Sep 7, 2022 9:36 PM

IN RE: REVIEW OF THE PUERTO RICO ELECTRIC POWER AUTHORITY’S 10-YEAR INFRASTRUCTURE PLAN – DECEMBER 2020

CASE NO.: NEPR-MI-2021-0002

SUBJECT: Motion to Submit Responses to Requests for Information Ordered in the August 18 Order

MOTION TO SUBMIT RESPONSES TO REQUESTS FOR INFORMATION ORDERED IN THE AUGUST 18 ORDER

TO THE HONORABLE PUERTO RICO ENERGY BUREAU:

COMES NOW the Puerto Rico Electric Power Authority (PREPA), through its counsel of record, and respectfully submits and prays as follows:

1. On August 2, 2022, PREPA filed before the Energy Bureau a document titled *Motion to Inform Reallocation of FEMA 404 HMGP Funds and Request for Approval of Generation Projects* ("August 2 Motion").

2. Through the August 2 Motion, PREPA notified the Energy Bureau of its determination to reallocate the \$853.2 million available to PREPA under the 404 Hazard Mitigation Grant Program Funds ("404 HMGP Funds") assigned for generation projects as follows: \$490 million for Emergency Generation Peaking Units ("Peakers"); \$190 million for Costa Sur and Yabucoa Black-Start Units; \$138.5 million for fuel conversion of San Juan Units 7 through 10; and \$34.7 million towards small-scale residential PV with storage.

3. On August 18, 2022, the Energy Bureau entered a *Resolution and Order* ("August 18 Order") regarding the August 2 Motion filed by PREPA. In the August 18 Motion, the Energy Bureau directed PREPA to respond to a series of requests for information (RFI) regarding the Emergency Generation Peaking Units, the Costa Sur and Yabucoa Black-Start Units and the small-scale residential PV with storage.

4. In compliance with the August 18 Order, PREPA herein presents the responses to the RFI. **Annex A.**

5. Pursuant to the above, PREPA respectfully requests the Energy Bureau to take notice of the above and schedule a Technical Conference to discuss the submitted responses in good faith to explain the information presented and respond to any questions this Energy Bureau may have regarding the above. A Technical Conference would further allow PREPA to submit, under oath, testimony and technical expertise on how the projects presented with the August 2 Motion are beneficial to Puerto Rico's customers and the resiliency and stability of PREPA's generation capacity.

WHEREFORE, PREPA respectfully requests the Energy Bureau to Take Notice of the responses to RFI in compliance with the August 18 Order and schedule a technical conference to discuss the technical considerations and benefits of the Emergency Generation Peaking Units, the Costa Sur and Yabucoa Black-Start Units, fuel conversion of San Juan Units 7 through 10 and the small-scale residential PV with storage projects.

RESPECTFULLY SUBMITTED.

In San Juan, Puerto Rico, this 7th day of September 2022.

/s Katuska Bolaños-Lugo

Katuska Bolaños-Lugo

kbolanos@diazvaz.law

TSPR 18,888

/s Maralíz Vázquez-Marrero

Maralíz Vázquez-Marrero

mvazquez@diazvaz.law

TSPR 16,187

DÍAZ & VÁZQUEZ LAW FIRM, P.S.C.

290 Jesús T. Piñero Ave.

Oriental Tower, Suite 803

San Juan, PR 00918

Tel.: (787) 395-7133

Fax. (787) 497-9664

CERTIFICATE OF SERVICE

It is hereby certified that, on this same date, I have filed the above motion with the Office of the Clerk of the Energy Bureau using its Electronic Filing System at <https://radicacion.energia.pr.gov/login>, and a courtesy copy of the filing was sent to LUMA through its legal representatives at margarita.mercado@us.dlapiper.com and laura.rozas@us.dlapiper.com.

In San Juan, Puerto Rico, this 7th day of September 2022.

Annex A



GOVERNMENT OF PUERTO RICO
PUERTO RICO ELECTRIC POWER AUTHORITY

I. Emergency Generation Peaking Units

- a. Does [the Puerto Rico Electric Power Authority] (PREPA) believe that battery energy storage resources at utility or distributed scale (standalone or as a complement to emergency peaker generators) can provide hazard mitigation? Explain fully.

Response: The Hazard Mitigation Grant Program (HMGP) is authorized by Section 404 of the Stafford Act, 42 USC 5170c. Per the Hazard Mitigation Assistance Guideline, the HMGP provides funds for eligible mitigation measures that reduce disaster losses by minimizing the vulnerability of communities to disasters and their effects and costs. The measures undertaken during the reconstruction process following a disaster should reduce the risk of loss of life and property from future disasters. HMGP funding is available when authorized under a Presidential major disaster declaration in the areas of the State requested by the Governor. As a result, after the Hurricane María emergency declaration, HMGP funding was made available for conducting mitigation measures in Puerto Rico's generation system. This ensures that the essential service of supplying energy to the population can be promptly restored after a major event. On the other hand, Puerto Rico's electrical system must be comprised of an adequate mix of generation technologies to support and improve the reliability, resiliency, stability, and quality of energy served to PREPA's customers. These objectives shall be achieved during normal and emergency conditions, the latter being caused mainly by major weather events like storms and hurricanes. The Federal Emergency Management Agency (FEMA) funds under HMPG are to improve critical power facilities to reduce vulnerability during disasters and guarantee the continuity of essential services, including fast restoration of these services after such tragedies. The continuity of essential services mainly consists of supplying customers with critical and essential loads 24 hours per day, 365 days per year, mainly done with dependable and stable generation sources that can be controlled and dispatched at any moment. Battery energy storage systems (BESS) serve as a backup, not as standalone or independent energy sources. Thus, BESS needs to be charged from an energy resource. The energy from a BESS resource provides specific services, such as frequency regulation or voltage control. Still, even though it may be dispatched, it does not provide a stable and continuous energy supply, as the BESS needs to be charged every time it is completely discharged after a few hours of use. In addition, it does not provide the minimum needed inertia that the electrical system requires (refer to pages 18 and 19 of PREPA Emergency Generation Feasibility Report - Existing Peaking Facilities). The resiliency and reliability that these systems can offer is time limited and depend on how the BESS is dispatched. For example, a BESS can be dispatched as a base load during a specific time, typically not more



than a few hours. Still, it may also be dispatched during another time to provide an ancillary service. In summary, BESS may not be submitted to FEMA for reimbursement programs as hazard mitigation because the service a BESS provides is a time constraint, only being capable of supplying loads for a very limited time during the day and providing energy for certain ancillary services. The recharge depends on another energy source. Therefore, PREPA determined that it will not submit applications to FEMA for BESS projects.

- b. Does PREPA believe that battery energy storage resources at the utility or distributed scale are reasonable resources for which hazard mitigation grant funding reallocation could be sought? Explain fully.

Response: FEMA funds under the HMGP aim to improve critical power facilities to reduce vulnerability during disasters and ensure the continuity of critical services, including fast restoration of these services after such disasters. After a thorough evaluation, PREPA's expert opinion is that BESS does not comply with the necessary properties to achieve hazard mitigation grant funding. Therefore, PREPA has determined that it will not submit applications to FEMA for BESS projects.

- c. Explain why PREPA has not sought FEMA hazard mitigation grant funding for utility scale battery energy storage at any MW level in the August 2 Motion, yet requests approval for battery energy storage funding when coupled with solar PV at the residential level.

Response: Please refer to answers a & b. BESS has a lifespan of approximately ten (10) years. The HMGP program is not designed for projects with such short useful life. In addition, BESS coupled with photovoltaics (PV) generation systems at the residential level are systems dedicated to a specific customer with an average load of 5kW. These systems are not standalone, are of lower capacity and occupy a smaller footprint area. PREPA's recommendation of the PV systems at the residential level was not intended to be applied across Puerto Rico to all residential customers. Instead, as explained in PREPA's August 2 Motion, the installation of these systems under HMGP is justified for residents at inaccessible remote locations such as the Cordillera Central mountains, who usually are the last customers to receive the power service back after major events.

- d. Re: Figures 2-1, 2-2, and 2-3, Annex B "PREPA Emergency Generation Feasibility Report - Existing Peaking Facilities". Provide data of the equivalent forced outage rate for each of the units seen in the three figures for 2021.

Response: Please refer to Annex A-1.

- e. Re: Figures 2-1, 2-2, and 2-3, Annex B "PREPA Emergency Generation Feasibility Report - Existing Peaking Facilities". Provide data of the equivalent forced outage rate for each of the units seen in the three figures for the first half of 2022.



Response: Please refer to Annex A-2.

- f. Re: Figures 2-1, 2-2, and 2-3, Annex B "PREPA Emergency Generation Feasibility Report - Existing Peaking Facilities". Provide estimates of the expected equivalent forced outage rate for each of the units seen in the three figures for each of 2022 (in total), 2023, and 2024, inclusive of anticipated effects of current and planned expenditures on maintenance and repair of the units.

Response: PREPA will repair one (1) Aguirre Power Plant gas turbine with federal funds. The other combustion turbine units to be replaced under the HMGP will have routine maintenance and repairs with PREPA's necessary maintenance expenses funds until replacement. The equivalent forced outages of existing gas turbine (peaker) units for 2022, 2023 and 2024 are expected to be equal to or higher than the reported for the year 2021 and the first semester of 2022.

- g. Explain why Annex B excludes any role that new battery energy storage systems can play in "Grid Stability and Support" (Section 2.3).

Response: Puerto Rico's electric system is of low inertia. The integration of renewables requires a high rotational inertia system for grid stability. This inertia can only be provided by the kinetic energy coming from the spinning generator mass. BESS does not have that capacity. See Section 2.3, PREPA Emergency Generation Feasibility Report - Existing Peaking Facilities Report, which explains the concept of inertia in more detail.

- h. Explain why the use of battery storage resources should not be included in requests to FEMA for black start and ancillary service support, because their response times indicated by PREPA are "immediate", compared to 3-10 minutes for the SC and RICE units, as noted in the Feasibility Report.

Response: BESS energy supply lasts until the battery is depleted or has no charge. It will not guarantee the continuity of the service 24/7 or critical services after a disaster. For the power system stability and reliability, dependable and continuous generation sources are needed, which can be provided by combustion machines (simple cycle or motors) but cannot be provided by BESS, as batteries can only supply energy during a short period. Even though BESS can provide certain services to the power system, its technology is not a substitute for combustion machine services. FEMA funds are for projects that ensure the service by reducing vulnerability and increasing resiliency against any disaster. Therefore, PREPA decided not to submit applications for BESS for black start and ancillary services.



II. New Black Start Units for Costa Sur and Yabucoa

- a. Submit a detailed report describing (i) the work performed and d set forth by PREPA upon the approval to acquire both Black Start Units close to a year ago.

Response: The engineering studies carried out were originally for the units that would be placed at Aguirre and Costa Sur. Afterward, PREPA identified that, based on the location, in comparison with Aguirre, Yabucoa was a better site and decided to keep Costa Sur as the second location. The Energy Bureau approved this change in 2021. PREPA retained the services of Sargent & Lundy (S&L) to develop studies and general specifications for a request for proposals (RFP), which were completed and delivered to PREPA in March 2022. Afterward, PREPA requested S&L to revise the original cost estimates due to changes and incidences in the market and political stability due to the COVID-19 pandemic and the invasion of Ukraine by Russia. The revised cost estimates were delivered to PREPA in May 2022.

- b. (ii) the result of its efforts and/or current status of both projects.

Response: The project will be developed under an engineering, procurement, and construction contract. The draft for the request for proposals (RFP) bid package and general arrangements for Yabucoa and Costa Sur projects are 90% completed.

- c. (iii) concrete data substantiating the request of additional funds ("Report").

Response: Please refer to the S&L revised cost estimate and basis of estimates for Yabucoa a Costa Sur.

III. Small-Scale Residential PV with Storage

- a. Provide all PREPA-internal work-papers, analyses, presentations, and key communications associated with the allocation of \$34.7 million for the PV plus storage project described.

Response: The project is at an early stage. According to PREPA's initial estimates, there could be a surplus after executing the main HMGP projects, which include the projects discussed in this request for information, the New Black Start Units for Costa Sur and Yabucoa and the Emergency Generation Peaking Units. Currently, this surplus was estimated in \$34.7 million, which PREPA would be able to validate once the procurement process of the HMGP projects is completed. The development of this initiative depends on the project that PREB approves, and that is part of the HMGP projects that PREPA will present to COR3 and FEMA. In the end, two (2) factors will determine how the funds will be used: (1) PREPA's proposals, with leave



of the Energy Bureau, and (2) the results of the competitive procurement processes, when applied to each project. PREPA is developing the concept and studying the data necessary to develop the project. Internal work papers, analyses, presentations, and key communications are unavailable at this stage.

- b. Provide a detailed summary of the number of sites, the quantities of solar PV and battery energy storage (MW and MWh), the locations, and the type and size of load to be served by the proposed solar PV and storage project.

Response: For this project, PREPA determined that the average house in the affected sectors has an average consumption between 3.5kW and 4.5kW. Therefore, it was selected to use a Bimodal Photovoltaic System of 4.3kW and 6.72kW for the project. After estimating the costs of such a system (Annex A-3), each system would have an average cost of \$ 20,948.58. Considering the budgeted amount of \$34.7 million, PREPA can estimate that the number of residences to be impacted would be approximately 1,656. As for the places to be affected, PREPA evaluated a report used in Hurricane María to indicate the progress of energized customers (Annex A-4). In this report, PREPA identified clients from the Central Zone of the main island and that after almost five (5) months of the passage of the hurricane, they were mostly out of service due to the damage that occurred in these mountainous and difficult-to-access areas. The selected feeders serve wards of the municipalities of Utuado, Jayuya, Adjuntas, and Lares, which are described in the report presented.

- c. Explain PREPA's plans for implementation, including timing.

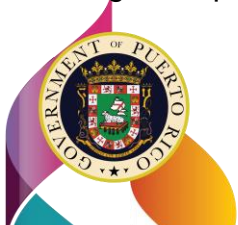
Response: PREPA's plan for implementation and timing depends on the remaining available balance of the 404 FEMA's mitigation funds, mitigation projects approved by the PREB, the cost of those approved mitigation projects, and the authorization from FEMA to use the remaining funds for PREPA's initiative.

- d. Explain how the sites would be chosen and how the energy produced during normal steady state operation will be allocated (i.e., net metering or another compensation mechanism).

Response: The allocation is dependable on the project's development and additional studies and interconnection from LUMA. All installations and operations will be conducted in compliance with current applicable regulations.

- e. Does PREPA plan on reserving the right to access battery capacity to use it for grid support functions during normal operation?

Response: Access to battery capacity to use it for grid support functions under regular operation requires virtual technology. HMGP's grant funds are only for



mitigation purposes. Accessing battery capacity for grid support functions will be done by procuring renewable energy projects, as required in the approved Integrated Resource Plan.

- f. Confirm that the allocation of \$34.7 million for solar PV and storage resources is for the residential sector only and explain in detail why non-residential sector critical load in the "inaccessible sectors of Puerto Rico" is not also considered for this aspect of reallocation of FEMA HMGP funds.

Response: The project that PREPA will submit to COR3 under HMGP is exclusive to low-income sectors with low energy demand, which is the more vulnerable sector. The area considered are those remote, difficult-to-access communities along the central mountainous zone of Puerto Rico. Their electrical services were the last to be re-established after Hurricane María. PREPA intends to provide PV systems coupled with BESS to the maximum customers that the remaining HMPG funds allow. The non-residential sector is not considered because the load typically is higher than 5MW, and the mitigation impact will be less. These other sectors will benefit from other HMGP projects that PREPA has developed and, with the leave of the Energy Bureau, will submit to COR3.

- g. Explain how the MW (PV) and MWh (storage) quantity levels proposed for FEMA HGMP funds reallocation were determined, as opposed to a much higher level of potential solar PV plus battery storage for residential sector load that could become "inaccessible" after a storm and would benefit from on-site resilience provided by the PV and battery storage.

Response:

Please refer to RFI answer III.b.

- h. Provide the draft COR3 initial scope of work (SOW) for this project.

Response: PREPA does not have an initial SOW for this project at this time. The development of the initial SOW is contingent to:

- The Energy Bureau approval of other projects that PREPA will submit to COR3 under the HMGP.
- The final costs of approved mitigation projects.
- FEMA's decision on the use of the potential surplus.



Annex A-1



DIVISION DE PRODUCCION
 INFORME DISPONIBILIDAD
TURBINAS A GAS
 AÑO NATURAL

HORAS EN EL MES:		8760											DICIEMBRE 2021	
PLANTA	UNIDAD	OA	EA	CF	FOR	EFOR	POF	MOF	FOF	EOF	EPFOR	EPSOR	SOEF	SF
PALO SECO	1-1	90.2	87.2	21.6	18.8	9.8	4.1	0.0	5.7	3.0	8.7	4.1	0.0	24.6
	1-2	8.0	7.8	1.6	98.1	92.2	0.0	0.0	92.0	0.2	92.2	0.0	0.0	1.8
	2-1	86.3	85.4	22.2	32.1	12.5	2.7	0.0	10.9	0.9	11.9	2.7	0.0	23.1
	2-2	0.0	0.0	0.0	100.0	100.0	0.0	0.0	100.0	0.0	100.0	0.0	0.0	0.0
	3-1	0.0	0.0	0.0	100.0	100.0	0.0	0.0	100.0	0.0	100.0	0.0	0.0	0.0
	3-2	0.0	0.0	0.0	100.0	100.0	0.0	0.0	100.0	0.0	100.0	0.0	0.0	0.0
	TOTAL	30.7	30.1	7.6	74.8	69.7	1.1	0.0	68.1	0.7	68.8	1.1	0.0	8.3
COSTA SUR	1-1	0.0	0.0	0.0	100.0	100.0	0.0	0.0	100.0	0.0	100.0	0.0	0.0	0.0
	1-2	0.0	0.0	0.0	100.0	100.0	0.0	0.0	100.0	0.0	100.0	0.0	0.0	0.0
	TOTAL	0.0	0.0	0.0	100.0	100.0	0.0	0.0	100.0	0.0	100.0	0.0	0.0	0.0
AGUIRRE	2-1	0.0	0.0	0.0	100.0	100.0	0.0	0.0	100.0	0.0	100.0	0.0	0.0	0.0
	2-2	20.5	20.2	3.8	95.0	73.8	0.0	0.0	79.5	0.3	79.8	0.0	0.0	4.1
	TOTAL	10.2	10.1	1.9	97.5	89.9	0.0	0.0	89.8	0.2	89.9	0.0	0.0	2.1
MAYAGUEZ	1	12.9	12.9	0.0	100.0	100.0	0.0	3.8	83.3	0.0	83.3	3.8	0.0	0.0
	2	84.7	66.2	18.6	25.6	32.1	2.6	0.0	12.8	18.5	31.2	2.6	0.0	37.1
	3	84.1	66.4	15.1	24.9	30.3	3.6	1.4	10.9	17.8	28.7	5.0	0.0	32.8
	4	70.7	60.7	8.0	62.0	39.4	0.0	0.0	29.3	10.0	39.3	0.0	0.0	18.0
	TOTAL	63.1	51.5	10.4	53.1	50.5	1.5	1.3	34.1	11.6	45.6	2.8	0.0	22.0
YABUCOA	1-1	18.3	18.2	1.0	98.6	82.0	0.0	0.0	81.7	0.1	81.8	0.0	0.0	1.1
	1-2	25.8	25.3	2.5	96.1	74.9	0.0	0.0	74.2	0.5	74.7	0.0	0.0	3.0
	TOTAL	22.1	21.8	1.8	97.4	78.5	0.0	0.0	77.9	0.3	78.2	0.0	0.0	2.1
VEGA BAJA	1-1	51.1	50.2	4.3	90.6	50.1	0.0	0.0	48.9	0.8	49.8	0.0	0.0	5.1
	1-2	11.6	11.6	0.0	100.0	100.0	0.0	0.0	88.4	0.0	88.4	0.0	0.0	0.0
	TOTAL	31.3	30.9	2.1	95.3	69.2	0.0	0.0	68.7	0.4	69.1	0.0	0.0	2.6
JOBOS	1-1	86.9	86.4	14.3	47.0	14.1	0.0	0.0	13.1	0.5	13.6	0.0	0.0	14.7
	1-2	91.9	91.0	15.1	33.5	9.6	0.0	0.0	8.1	0.9	9.0	0.0	0.0	16.0
	TOTAL	89.4	88.7	14.7	40.3	11.9	0.0	0.0	10.6	0.7	11.3	0.0	0.0	15.4
DAGUAO	1-1	85.5	84.0	15.1	46.7	16.6	0.0	0.0	14.5	1.5	16.0	0.0	0.0	16.6
	1-2	97.7	94.9	9.3	15.8	5.5	0.0	0.0	2.3	2.8	5.1	0.0	0.0	12.1
	TOTAL	91.6	89.4	12.2	31.3	11.1	0.0	0.0	8.4	2.1	10.6	0.0	0.0	14.3
TOTAL A GAS	46.9	42.2	7.7	67.7	60.3	0.8	0.5	51.8	4.7	56.5	1.3	0.0	12.4	

Annex A-2



DIVISION DE PRODUCCION
INFORME DISPONIBILIDAD
TURBINAS A GAS
AÑO NATURAL

HORAS EN EL MES: 5088

JULIO 2022

PLANTA	UNIDAD	OA	EA	CF	FOR	EFOR	POF	MOF	FOF	EOF	EPFOR	EPSOR	SOEF	SF
PALO SECO	1-1	99	98	7.13	10	4	0	0	1	1	2	0	0	8
	1-2	0	0	0.00	100	100	0	0	100	0	100	0	0	0
	2-1	97	96	7.10	31	7	0	0	3	1	4	0	0	8
	2-2	0	0	0.00	100	100	0	0	100	0	100	0	0	0
	3-1	0	0	0.00	100	100	0	0	100	0	100	0	0	0
	3-2	0	0	0.00	100	100	0	0	100	0	100	0	0	0
	TOTAL	32.62	32.35	2.37	73.43	67.96	0.00	0.00	67.38	0.27	67.65	0.00	0.00	2.64
COSTA SUR	1-1	0	0	0.00	100	100	0	0	100	0	100	0	0	0
	1-2	0	0	0.00	100	100	0	0	100	0	100	0	0	0
	TOTAL	0.00	0.00	0.00	100.00	100.00	0.00	0.00	100.00	0.00	100.00	0.00	0.00	0.00
AGUIRRE	2-1	3	3	0.00	100	100	0	0	97	0	97	0	0	0
	2-2	0	0	0.16	100	100	0	0	100	0	100	0	0	0
	TOTAL	1.45	1.38	0.08	99.92	98.63	0.00	0.00	98.55	0.08	98.62	0.00	0.00	0.08
MAYAGUEZ	1	36	28	6.63	81	72	0	0	64	8	72	0	0	15
	2	71	60	9.77	51	37	6	0	22	12	34	6	0	21
	3	84	72	8.50	43	28	0	0	16	12	28	0	0	21
	4	92	76	11.86	23	24	0	0	8	16	24	0	0	27
	TOTAL	70.88	59.00	9.19	49.60	40.28	1.57	0.00	27.55	11.88	39.44	1.57	0.00	21.07
YABUCOA	1-1	0	0	0.00	100	100	0	0	100	0	100	0	0	0
	1-2	100	99	5.86	0	1	0	0	0	1	1	0	0	7
	TOTAL	50.00	49.48	2.93	50.00	50.92	0.00	0.00	50.00	0.52	50.52	0.00	0.00	3.45
VEGA BAJA	1-1	0	0	0.00	100	100	0	0	100	0	100	0	0	0
	1-2	0	0	0.00	100	100	0	0	100	0	100	0	0	0
	TOTAL	0.00	0.00	0.00	100.00	100.00	0.00	0.00	100.00	0.00	100.00	0.00	0.00	0.00
JOBOS	1-1	90	90	5.18	66	12	0	0	10	0	10	0	0	5
	1-2	91	90	4.64	63	12	0	0	9	1	10	0	0	5
	TOTAL	90.16	89.68	4.91	64.55	11.79	0.00	0.00	9.84	0.49	10.32	0.00	0.00	5.40
DAGUAO	1-1	98	98	5.70	21	4	0	0	2	1	2	0	0	6
	1-2	82	81	4.34	77	21	0	0	18	1	19	0	0	6
	TOTAL	90.04	89.17	5.02	49.03	12.36	0.00	0.00	9.96	0.87	10.83	0.00	0.00	5.89
TOTAL A GAS	49.22	44.65	4.79	66.27	59.67	0.58	0.00	50.20	4.57	54.77	0.58	0.00	9.35	

Annex A-3



Estimado Sistema Bimodal Litio				
Item	precio por unidad	qty	precio	
Conext XW6848	\$ 3,250.00	1.0	\$ 3,250.00	
Mini DP	\$ 575.00	1.0	\$ 575.00	
Discovery 6.6	\$ 5,100.00	1.0	\$ 5,100.00	
SCP/Insight Home	\$ 550.00	1.0	\$ 550.00	
Charge Controller 100	\$ 1,100.00	1.0	\$ 1,100.00	
Breakers DC 100Amp	\$ 45.00	2.0	\$ 90.00	
Placas 430W	\$ 325.00	10.0	\$ 3,250.00	
Rack System	\$ 516.00	1.0	\$ 516.00	
Cableria 4/0	\$ 12.00	2.0	\$ 24.00	
Terminales 4/0	\$ 4.50	4.0	\$ 18.00	
Cablería electrica	\$ 1.50	20.0	\$ 30.00	
panel 120/240 10 breakers	\$ 150.00	1.0	\$ 150.00	
Breakers	\$ 15.00	4.0	\$ 60.00	
cablería #10 para jumpers	\$ 0.20	50.0	\$ 10.00	
Tuberias	\$ 20.00	3.0	\$ 60.00	
miscelaneo	\$ 14,783.00	5.0%	\$ 739.15	
Materiales			\$ 15,522.15	
Diseño/Permisos:	\$ 645.00	1.0	\$ 645.00	
Instalacion:	\$ 1,290.00	1.0	\$ 1,290.00	
Profit:	\$ 17,457.15	20.0%	\$ 3,491.43	
Total:			\$ 20,948.58	
Resumen del Sistema				
Conext XW6848	1.0			
Discovery 6.6	1.0			
Placas 430W	10.0			
Capacidad Banco Bateria:	140.0	Ah		
	6.72	kWh		
Corriente Controlador Carga:	89.6	A		
Capacidad en Placas:	4,300.0	W		

Annex A-4





REGION	DISTRICT	SUB NUM	NAME	PRIMARY KV	FEEDS FROM	SECONDARY KV	FEEDER / LINE	APROXIMATE OF CLIENTS ENERGIZED	CLIENTS SERVED	SECTORS SERVED
ARECIBO	UTUADO	8301	JAYUYA 1	115	36400	4.16	8301-03	0	1060	AAA-EBF CASA BLANCA, AAA-REP REPRESAS LAS DELICIAS, AAA-PP LAS DELICIAS, AAA-EB-1A BO RIO GRANDE 2, AAA-PF BO MAMEYES/SECT LIMON, AAA-REP BO MAMEYES LIMON, AAA-1A BO MAMEYES, AAA-1A SANTA BARBARA, BO JAYUYA ABAJO, BO MAMEYES, BO MAMEYES SECT LAS CASITAS, BO MAMEYES SECTOR LIMON, BO MAMEYES SECTOR YUNES, BO MAMEYES ARRIBA, BO MAMEYES ARRIBA-LAS CASITAS, BO MAMEYES ARRIBA-PARC COLBERG, BO MAMEYES EL HUECO, BO MAMEYES PARC COLBERG, BO MAMEYES SEC LIMON, BO MAMEYES SECT COLBERGH, BO MAMEYES SECT LIMON, BO MAMEYES SECT LOS AJOS, BO MAMEYES SECT SALSA, BO MAMEYES SECT VISTA ALEGRE, BO MAMEYES SECTOR LIMON, BO MAMEYES SECTOR LOS AJOS, BO MAMEYES SECTOR SALSA, BO MAMEYES VISTA ALEGRE, BO MAMEYES-HACIEN RODRIGUEZ, BO MAMEYES-PARC VISTA ALEGRE, BO MAMEYES-PARCELAS COLBERG, BO MAMEYES-SECT PARC COLBERG, BO MAMEYES-SECT PARC COLBERGH, BO MAMEYES-VISTA ALEGRE-CASITA, BO MAMEYES-SECT HOA RODRIGUEZ, BO RIO GRANDE, BO RIO GRANDE LA JALDA, BO RIO GRANDE SECT LA CUESTA, BO RIO GRANDE SECTOR LA CUESTA, BO SANTA BARBARA, BO STA BARBARA-SECT EL PARAISO, BO TETUAN / SECTOR LA GRAMA, BO TETUAN 111 INT, BO TETUAN III, BO TETUAN III-CHARCO EL MUERTO, BO TETUAN SECT EL QUEMAO, BOM- CUERPO BOMBEROS, BOM-BO MAMEYES, COM- ANTENA COMUNICACIONES, DE- ESC. ADRIAN TORRES, DE- ESC. ANTONIA SERRANO, DE- ESC. RAFAEL MARTINEZ, DE- ESC. ANTONIA SERRANO, JARDINES DE JAYUYA, LIMON MAMEYES, JAYUYA, LOS AJOS CARR 141 K9 H2 INT, MAMEYES ARRIBA-SECT LIMON, MAMEYES SECT SALSA, MAMEYES SECTOR LA SALSA, PROJ JARDINES DE JAYUYA, SECT. LOS AJOS, ADJUNTAS, SEMAFORO/FTE A WALGREEN'S, TETUAN III-CHARCO DEL MUERTO, URB ALTURAS DE JAYUYA, URB JARDINES DE JAYUYA, URB JARDINES DE JAYUYA, URB JARDINES DE JAYUYA, URBANO, URBANO-SECT LOMA MASSINI, VISTA ALEGRE
ARECIBO	UTUADO	8302	JAYUYA 2	115	36400	4.16	8302-04	250	1669	46, AAA-EB BO COABEY, AAA-EB BO VEGUITA ZAMAS #4, AAA-EB BO CARICABOA, AAA-EB BO SALIENTITTO #6, AAA-EB BO SALIENTITTO 1, AAA-EB-1A BO PUERTO PLATA, AAA-EB URB. LA MONSERRATA, BO ARENAS, BO ARENAS INT, BO ARENAS/SECT LOS ALVAREZ, BO CARICABOA, BO CARICABOA INT, BO COABEY, BO COABEY NO DNP LEY 152, BO COABEY SECT EL SALTO, BO COABEY SECT RODRIGUEZ, BO COABEY-LINEA MATTEI, BO COABEY CARMELITA, BO COABEY SEC EL PAGAN, BO COABEY SECT EL PAGAN, BO COABEY SECTOR MATTEI, BO COABEY-SECT EL SALTO, BO COABEY/ALMACEN DE CAFE, BO GRIPINAS, BO GRIPINAS, BO GRIPINAS INT, BO GRIPINAS/SECT MANILA, BO LAS ARENAS, BO SALIENTE, BO SALIENTE/CENTRO COMUNAL, BO SALIENTITTO, BO VEGUITA ZAMAS, BO VEGUITAS ZAMAS, BO VEGUITAS-SECT CARICABOA, BO ZAMAS SECT LA CIENEGA, BO GRIPINAS, BO RIO GRANDE/SECTOR EL NUDO, BO SALIENTE, COM- ANTENA CLARO, CONT ENC NO SE PUEDE RETIRAR, DE- ESC. ANGELA CALVANI, DE- ESC. ANGELA CALVANI, GOB- CORP. FSE, NUM 20 URB LA MONSERRATE, PROYECTO PIEDRA ESCRITA, URB LA MONSERRATE, URB MONSERRATE, URB VEGA LINDA, URBANO
ARECIBO	UTUADO	8302	JAYUYA 2	115	36400	4.16	8302-05	50	1240	AAA-EB BO HOYOS PLANES, AAA-EB JAUICA, AAA-EB SANTA BARBARA, AAA-EBA JAYUYA URBANO, AAA-PF BO CANALIZO, AAA-REP BO CANALIZO, BARRIO CANALIZO, BARRIO SANTA ROSA, BDA SANTA CLARA, BDA SANTA CLARA CALLE COLLINS, BO ALTOS COLLORES, BO ALTOS CORRALES, BO ALTOS CORRALES/PARC PONS, BO ALTURA COLLORES, BO CANALIZO, BO CANALIZO SEC JAUICA, BO CAONILLAS ARRIBA, BO CAPAZ, BO COLLORES, BO COLLORES SEC PIZZA, BO COLLORES SECT PIZZA, BO COLLORES SECT STA ROSA, BO COLLORES STA ROSA, BO COLLORES-SECT PIZZA, BO COLLORES-SECT SANTA ROSA, BO CONSEJO, BO CONSEJO PARC PIZA, BO HOYO PLANES, BO HOYO PLANES SECT ALTOS CORR, BO HOYOS PLANES, BO JAUICA, BO JAUICA MONTANER, BO JAUICA/ALTOS COLLORES, BO JAYUYA ABAJO, BO JAYUYA ABAJO-SECT STA CLARA, BO LA PICA, BO PASO PALMAS, BO PASO PALMAS PARC PONS, BO PASO PALMAS PARCELAS PONS, BO PASO PALMAS SECT JAUICA, BO PASO PALMAS SECT PARC PONS, BO PASO PALMAS SECTOR JAUICA, BO PASO PALMAS-COMUNIDAD PONS, BO PELLEJAS LAS CRUCES, BO SANTA BARBARA, BO SANTA ROSA, BO SANTA ROSA INT, BO ZAMAS, BO ZAMAS SECT LOMA OLMEDA, BO ZAMAS SECT STA ROSA, BO ZAMAS INT, BO ZAMAS SECT CIENEGA, BO ZAMAS SECT EL INDI, BO ZAMAS SECTOR CIENEGA, BO ZAMAS-SECTOR LOS ALVAREZ, DE- ESC. ANTONIO ROMERO, IND- KNOLL LLC, JAYUYA ABAJO, LA PICA, URB. ALTOS DEL RIO, JAYUYA, VILLA COLLORES
ARECIBO	UTUADO	8101	UTUADO	38	2400	4.16	8101-03	30	1498	AAA-EB BO CAONILLAS ABAJO, AAA-EB BO LAS PALMAS, AAA-EB BO PASO PALMAS, AAA-EB CANDIDO SALVA 1 RELEVO, AAA-EB CANDIDO SALVA 2, AAA-EB CAONILLAS SUB REPRESA, AAA-EB, BO VIVI ARRIBA, AAA-PF UTUADO URBANO, AAA-TA, BO VIVI ARRIBA, BO CAONILLAS, BO CAONILLAS ABAJO, BO CAONILLAS ARRIBA, BO CAONILLAS-CANONILLAS ABAJO, BO CAONILLAS-SECT LAS CUEVAS, BO CAONILLAS-SECT LA DESEADA, BO DON ALONSO, BO DON ALONZO, BO LAS PALMAS, BO MAMEYES, BO PASO PALMA, BO PASO PALMAS, BO PASO PALMAS UTUADO, BO TETUAN, BO TETUAN I, BO TETUAN 111, BO TETUAN I, BO TETUAN II, BO TETUAN II-CHARCO EL MUERTO, BO TETUAN-SECT TETUAN II, BO VIVI ABAJO, BO VIVI ABAJO-LAS CUEVAS, BO VIVI ABAJO LAS CUEVAS, BO VIVI ABAJO SECT LAS CUEVAS, BO VIVI ABAJO SECT LAS CUEVAS VIVES, BO VIVI ABAJO-SECT LAS CUEVAS, BO VIVI ABAJO/COLINAS DEL VIVI, BO VIVI ARRIBA, BO VIVI ARRIBA SECT PARC RIERA, BO VIVI ARRIBA-SECT LA CUCHILLA, BO TETUAN, CAONILLAS, CAONILLAS LA CEBIA, CAONILLAS ARRIBA LA DESEADA, CAR 140 9613 H8 HO TETUAN, COM. CENTRAL COMUNIC., DE- ESC. CELINA MAESTRE, DE- ESC. MARTA LAFONTAINE, DE- ESCUELA VIVI ABAJO, DE-ESC PASO PALMA, LAS PALMAS, UTUADO, PLANTA HIELO UTUADO, TETUAN I, TETUAN I SECT EL PALMAR, TETUAN II LA CATALANA, TETUANHACIENDA CARBONEL, VIVI ABAJO, VIVI ARRIBA
ARECIBO	UTUADO	8101	UTUADO	38	2400	4.16	8101-04	179	943	AAA-PF-EB SABANA GRANDE, AAA-REP BO SABANA GRANDE, BO CAMPO ALEGRE, BO DON ALONSO, BO DON ALONSO ABAJO, BO SABANA GRANDE, BO SABANA GRANDE - LA SABANA, BO SABANA GRANDE SECT LA SANCH, BO SABANA GRANDE UTUADO, BO SABANA GRANDE-LA SABANA, BO SABANA GRANDE-SECT LA SANCHE, BO SABANA GRANDE-SECT LA SANCH, BO SALTO ABAJO, BO VEGA MILLAN-ENTR SAN JOSE, BO VIVI ABAJO, CAMPO ALEGRE, COM- ANTENA CLARO, COM- ANTENA RADIO REDENTOR, COM- ANTENA WAPA RADIO, COM- ANTENA WDN, DE- ESC. ISABEL M. RIVERA, LOS VAZQUEZ, SABANA GRANDE LA SABANA, SABANA GRANDE SECT LA SABANA, SABANA GRANDE SECT LA SANCHE
ARECIBO	UTUADO	8203	YAHUECAS	38	8100	4.16	8203-01	0	1030	AAA-EB BO TANAMA, AAA-EB LA LINDOSA 2, AAA-EB LA LINDOSA 1, AAA-PF BO GUILARTE, AAA-TA EL NOVILLO, AAA-TA EL NOVILLO 1, BO CAPAZSECT BELVIS ARRIBA, BO GARZAS CENTRO, BO GARZAS CENTRO-AEROP. RULLAN, BO GUILARTE, BO GUILARTE SECT CRUCERO, BO GUILARTE CUESTA HERNANDEZ, BO GUILARTE CUESTA LOS HERNDZ, BO GUILARTE CUESTA PAGAN, BO GUILARTE SECTOR HERNANDEZ, BO GUILARTE-CUESTA LOS HDZ, BO GUILARTE-TITULO V, BO TANAMA, BO TANAMA -SECT LAS CASITAS, BO TANAMA NOVILLO, BO TANAMA SECT EL NOVILLO, BO TANAMA SECT EL VALLE, BO TANAMA SECT NOVILLO, BO TANAMA SECTOR NOVILLO, BO TANAMA VALLE, BO TANAMA-SECT CERRO NOVILLO, BO TANAMA-SECT EL MOVILLO, BO TANAMA-SECT EL NOVILLO, BO TANAMA-SECT GILET, BO TANAMA-SECT NOVILLO, BO YAHUECAS SECTOR EL NOVILLO, BO YAHUECAS, BO YAHUECAS SECT HELECHALES, BO YAHUECAS SECT LA GRUA, BO YAHUECAS SECT TITULO V, BO YAHUECAS-SECT HELECHALES, BO YAHUECAS-SECT LA COLONIA, BO YAYALES, BO-TANAMA SECTOR EL NOVILLO, BO GUILARTE SECT EL CERRO, BO TANAMA PARC. LAS CASITAS, COM- ANTENA MAJAGUAS, COM- ANTENA PRCT, DE- ESC FCO. PIETRI MARIANI, DE- ESC J. GARRASTEGUI RIVERA, DE- ESC. ANGEL MALDONADO BULA, DE- ESC. MARIA CASANOVA, EL NOVILLO, GARZA CENTRO AEROPUERTO, GARZAS CENTRO, GUILARTE CUESTA LOS HERNANDEZ, SECT EL NOVILLO, TANAMA, TANAMA SEC EL NOVILLO, TANAMA SEC NOVILLO, TANAMA EL MAJAGUAL, TANAMA VALLE, YAHUECAS, YAHUECAS SEC LA BARTOLA
ARECIBO	UTUADO	8203	YAHUECAS	38	8100	4.16	8203-02	0	347	AAA-BO GUAYABO DULCE, AAA-EB BO PORTILLO, AAA-PF BO YAHUECAS, AAA PZ BOMBAS YAHUECAS, ARENALES BAIOS/SECT 4 CALLES, BO GUAYABO DULCE, BO GUAYO, BO LIMANI, BO PORTILLO, BO PORTILLO ABAJO, BO PORTILLO SECT PALO SECO, BO PORTILLO-PALO SECO, BO PORTILLO-SECTOR PALO SECO, BO TANAMA, BO TANAMA VALLE, BO TANAMA-SECT TANAMA VALLE, BO YAHUECAS, BO YAHUECAS SECT LOMA SANTA, BO YAHUECAS ARRIBA, BO YAHUECAS INT, BO YAHUECAS-SECT BOQUERON, BO YAHUECAS-SECT GUAYABO DULCE, BO YAHUECAS-SECT LOMA SANTA, CARR 135 K73 H2, CASTANER/HACIENDA LA VALEAR, DE- ESC. AQUILINO RIVERA OLAN, DE-ESC HECTOR RIVERA, K3 H2 BO LIMANI ADJUNTAS, LIMANI, PORTILLO, PORTILLO ABAJO, TANAMA TANAMA VALLE, YAHUECAS SECT HELECHALES
MAYAGUEZ	SAN SEBASTIAN	7902	BARTOLO	38	8100	4.16	7902-01	0	576	AAA- VILELLA II RELEVO, AAA-EB POT Y TANQUE BARTOLO, AAA-EB VILELLA I RELEVO, AAA-EB Y TQ ALEMANY, AAA-PZ VILELLA, BARTOLO, BARTOLO RIO PRIETO, BARTOLO / BASE #2, BARTOLO / FINCA SANTOS SOTO, BARTOLO-SECTOR VILELLA, BO BARTOLO, BO BARTOLO SECT LA CUESTA, BO BARTOLO SECTOR VILELLA, BO BARTOLO/SECT OLIVER, BO CERROTE, BO CERROTE LAS MARIAS, BO MIRASOL, BO MIRASOL CAMINO PAOLI, BO MIRASOL COM CALCERRADA, BO MIRASOL SECT LOS PAOLI, BO MIRASOL-SECTOR VILELLA, BO RIO PRIETO, BO RIO PRIETO LARES, BO RIO PRIETO SECT BOQUILLA, BO RIO PRIETO SECT RULLAN, BO BARTOLO, BO RIO PRIETO, BUENOS AIRES SECT CALCERRADA, CALLE LOS MILLONARIOS, CANCHA DE MIRASOL, CARR 128 K55 H5 MIRASOL, DE- ESC. MANUEL ROJAS LUZARDO, LATORRE/LA VEGA CALCERRADA, MIRASOL, MIRASOL / BOQUERON, MIRASOL / ENT ANGELA VILELLA, MIRASOL SECTOR VILELLA, MIRASOL-SECTOR VILELLA, RIO PRIETO, RIO PRIETO / ALEMANY, RIO PRIETO / ESCUELAS, RIO PRIETO / LOS TORRES, RIO PRIETO FINCA LANGY CORREA, RIO PRIETO/ESTEBAN VARGAS
MAYAGUEZ	SAN SEBASTIAN	7902	BARTOLO	38	8100	4.16	7902-02	0	156	BARTOLO, BARTOLO ANTES DE LA HAC PONS, BO BARTOLO, BO BARTOLO SEC CARBACHE, BO BARTOLO SECT CALVACHE, SECTOR CARBACHE CASTANER
MAYAGUEZ	SAN SEBASTIAN	7902	BARTOLO	38	8100	4.16	7902-03	0	540	AAA-EB BO GUAYO SECT PILONES, AAA-EB GUAYO II, AAA-EB LOS MILLONARIOS, BARTOLO/CASTANER BAKERY, BARTOLO/SECTOR LAS AVISPAS, BO BARTOLO, BO CASTANER, BO CASTANER SECT REGINO, BO GUAYO, BO GUAYO CAMINO LINAS, BO GUAYO-HACIA CASTANER, BO LIMANI, BO RABANOS, BO RABANOS ADJUNTAS, BO RIO PRIETO CERROTE, BO RIO PRIETO SANTA CLARA, BO BARTOLO SECTOR GUANO, BOM- PARQUE BOMBEROS, CALLE CIRILA, CALLE COOPERATIVISMO CASTANER, CASTA&ER SECTOR EL GUANO, CASTANER, CASTANER/CALLE LOS MILLONARIOS, CASTANER/SECT LOS MILLONARIOS, CERRO LAS AVISPAS BO BARTOLO, HOS- CDT CASTANER, LOS MILLONARIOS, POL-CUARTEL ESTATAL, RIO PRIETO CERROTE, RIO PRIETO HCDIA STA CLARA, RIO PRIETO SEC LA URSULA, SECTOR CERRO LAS AVISPAS