



Household Emergency Preparedness: Decentralized Community Power for Puerto Rico

Puerto Rico is vulnerable to hurricanes every year, particularly during the months of August and September. Is Puerto Rico prepared for the emergency that an intense hurricane would cause in all the archipelago? What can be done to better prepare the most vulnerable communities?

In one year some of these questions may be answered and the possibility of an intense hurricane to cross Puerto Rico in 2019 or 2020 needs to become a call to action. The purpose of this policy brief is to provide a minimum of direction to short term attainable actions for government institutions to appropriately tackle vulnerabilities in coordination with communities.

AUTHORS

Marcel J. Castro-Sitiriche
marcel.castro@upr.edu

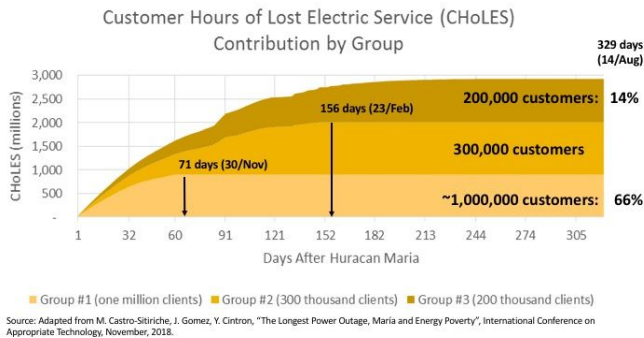
AFFILIATIONS

Department of Electrical Engineering
University of Puerto Rico Mayagüez

Native Power Research Group

The research group works to decrease vulnerabilities with the increase of local energy sources that directly benefits the communities first.

POLICY BRIEF (draft)



Local Context: Impact of Maria

Hurricane Maria left all Puerto Rico without Power for a few days in what resulted in the longest power blackout in history and one of the largest power outage registered in the world when measured by the Customer Hours of Lost Electricity Service (CHoLES). A recent study by the Native Power Research Group determined that one third of the total 3,000 million of CHoLES were due to the last 200,000 customers reconnected to the main grid [1]. This means that only 14% of the customers significantly contributed to the disaster caused by the lack of electricity such as the lost of life that took place in many of those communities that were connected last. The Emergency response to an intense hurricane cannot integrate those 200,000 families because many factors including lack of personnel, difficult access, low population density, time to restoration and lack of resources. Therefore, those 200,000 homes need to be included in the disaster preparedness plan.

Disaster Preparedness: Quick Action

If the last 200k households connected to the grid after Maria had a small rooftop solar PV system with energy storage (for example, 2 kW of PV with 10 kWh of batteries), the blackout would have accumulated 1/3 less of the 3,000 million CHoLES, and the length of the blackout would have been 156 days instead of 329 days [1]. **These 200,000 families should be the main energy policy priority for 2020.** If the last 500k households connected to the grid had a small rooftop solar PV system with energy storage, the blackout would have accumulated 2/3 less of the 3,000 million CHoLES, and the length of the blackout would have been 71 days, which is 22% of the total 329 days that accumulated the longest blackout in history.

Financial Context

There is currently \$436 million from the CDBG-DR funds that are eligible to use for solar home systems (SHS) with batteries [2]. If these funds are used effectively, the total

number of households that could have a newly installed solar home system with battery is between 40,000 and 80,000. An additional \$1,900 million has been identified in future CDBG-DR funds for electric power that will not go to PREPA [3]. The recovery plan for Puerto Rico identified enough funds, between \$4,200 million and \$6,200 million, to provide one million houses with small SHS [4]. The optimal way to use this funds needs to be further analyzed. However, for 2019, if the voucher mechanism identified in the CDBG Plan of Action is extended to could provide the most vulnerable communities with the much needed short term action.

Future Energy: 50% Renewables by 2035

If one million families are empowered with a small SHS of 2 kW of PV and 10 kWh of energy storage by 2035, residential rooftop solar could contribute 17% of the total energy production [1]. The rooftop solar PV potential of commercial and industrial buildings is outside of the scope of this policy brief but it needs to be addressed in a separate document along with utility scale systems. Recent power purchase agreements in Hawaii at \$0.08/kWh for solar plus storage systems at utility scale [5] confirms that a rapid transition to solar power is feasible now. Also, the potential benefits of nanogrids, community microgrids and other distributed power generation strategies need to be integrated in the energy infrastructure planning process.

Conclusion

The short term implementation of the call to action to empower families with small SHS has the potential to reduce vulnerabilities related to power outages. The proposed course of action is the only one that quantifies the potential reduction in Customer Hours of Lost Electricity Service (CHoLES) and could greatly reduce the loss of life in the event that an intense hurricane affects Puerto Rico during the next two years.

References:

- [1] M. Castro-Sitiriche, J. Gomez, Y. Cintron, "The Longest Power Outage, Maria and Energy Poverty", International Conference on Appropriate Technology, November, 2018, Porto-Novo, Benin.
- [2] Gobierno de Puerto Rico, [Plan de Acción Para la Recuperación Ante Desastres: Para la Utilización de Fondos CDBG-DR en Respuesta a los Huracanes Irma y María](#), p. 177, Nov. 18, 2018.
- [3] Gobierno de Puerto Rico, [Action Plan and Amendment Overview](#) p. 2, Nov. 2018.
- [4] Gobierno de Puerto Rico, [Transformation and Innovation in the Wake of Devastation \(An Economic and Disaster Recovery Plan for Puerto Rico\)](#), p. 318, Aug. 8, 2018.
- [5] Emma Foehringer Merchant, [Hawaiian Electric Announces 'Mind-Blowing' Solar-Plus-Storage Contracts](#), GTM, January 4, 2019.