CASE: CEPR-IN-2017-0002 - ENERGY COMMISSION INVESTIGATION REGARDING THE STATE OF PUERTO RICO'S ELECTRIC SYSTEM AFTER HURRICANE MARIA

Microgrid Solutions for Puerto Rico's Energy Needs

Introduction

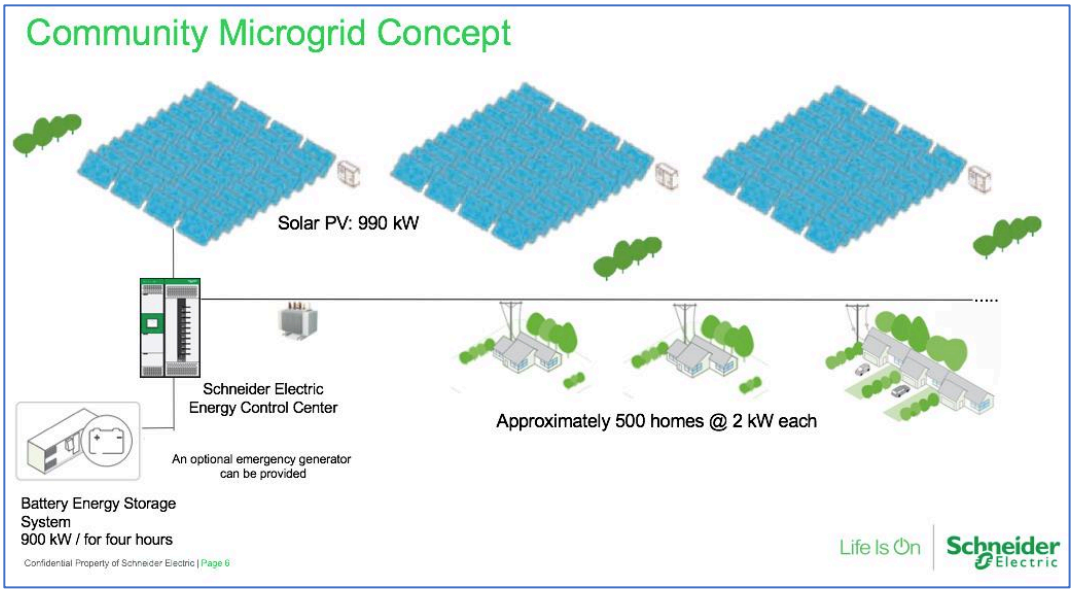
As Puerto Rico rebuilds its energy system in the aftermath of Hurricanes Irma and Maria, we note the Puerto Rico Energy Commission's interest in microgrids as a way of addressing, in particular items (ii) of your opening paragraph, "correcting vulnerabilities and strengthening the energy system" and (iii) "elaborating and implementing a new energy model for Puerto Rico".

Schneider Electric, Quanta and IBM have joined forces to propose the exploration of microgrids as a way to improve the resilience of the energy system, reduce the dependency (and costs) of the system's dependence on imported fuels, reduce its environmental impact; and create community engagement and employment. This response outlines our suggestions for how to proceed.

Microgrids and their benefits.

Microgrids - local configurations of energy generation, typically solar in sub-tropical locations, but also wind and various forms of waste-to-energy, combined with energy storage - are an increasingly important element of the "smart grid". They are especially suitable for island communities because they provide cheaper power than may be possible from generation with imported fuels. Puerto Rico obtains nearly half its energy from imported diesel, for example, and this is a major factor behind its relatively high electricity costs, understood to be $18.2-21.9 cents per kWh depending on class of customer. In so doing they can make a significant local economic contribution.

Solar microgrids can be hurricane-hardened (as for example with an installation in US Samoa, recently financed by Department of Interior and the American Samoa Power Authority - ASPA), and as the Case acknowledges, they can enhance resilience by providing redundancy and reducing or eliminating the impact of grid failures perhaps many miles from the local communities that would otherwise be affected. As they are based on renewables, microgrids are also typically cleaner and easier on the environment than other methods of generation, and they may be able to tap into sources of funding aimed at environmental improvements. A conceptual schematic of a typical community microgrid installation is shown below:



Depending on circumstances microgrids may be connected to a central energy grid, in order to provide additional energy as agreed with the grid operator (in this case PREPA), or to draw energy from it when local resources are insufficient. While they represent a disaggregation of the current system, it is important to understand that with modern control technologies, microgrids need not represent a loss of control over it.

In creating and installing a microgrid, as you recognize, it is vital to address the issue of its ongoing operation, care and maintenance, so that the system is sustainable through time. Typically, these needs can be met by establishing some form of cooperative to own and operate the system, with its associated billing and customer relationship functions, in order to provide for engagement by its customers, and create a shared incentive to operate the system for the benefit of the community. Our proposal addresses this issue.

Policy Recommendations

We therefore recommend an approach to microgrids with two simultaneous tracks, as follows.

a) Formulate a microgrid strategy

As also implied by Appendix 1 of the Case, we recommend that the Government of Puerto Rico, in conjunction with DOE, FEMA and other relevant federal agencies, should commission a study to develop a strategic view of microgrids that would accomplish the following:

- Identify the types of communities that they might help, based on population, housing type, economic activity, public facilities (such as clinics or schools), energy loads, topography, prevalent weather and other factors.

- Create a “reference architecture” for microgrids: identify different configurations for the different circumstances identified above, and how they should be hurricane hardened, with potential suppliers for major components.
- Propose a pro-forma cooperative ownership, governance, and management structure with roles, responsibilities, policies and rules: as noted, we believe this to be essential to the long run sustainability and performance of each microgrid. This element also needs to include an evaluation of different possible charging structures.
- Identify an integration approach with the redeveloped central grid – how microgrids can help the island-wide picture, how they will or will not connect to the grid, and how the combined system(s) should be managed and operated from the perspectives of the technologies required and of the organizational and procedural framework.
- Related to the above, propose an island-wide regulatory structure for the microgrids, integrated with that for the central grid.
- Identify financing methods suitable for co-operatives.
- Identify potential timescales.
- Identify benchmark installation and operation costs for each microgrid configuration identified; benchmark revenue potential from each; integration costs; financing methods and associated costs; and thus, the ROI for microgrids at both the community and the island scales.
- From the above, identify the total potential for microgrids within Puerto Rico.

We believe that this strategy work could be completed provisionally in six months. It would then be informed by learnings from the pilot implementation proposed below, before being returned to for updating in the light of the pilot experience after 12 to 18 months.

b) Test and learn.

In parallel with a) above, we recommend proceeding with a pilot or test implementation of a microgrid.

We suggest that Puerto Rico nominates a willing community as a location to create the pilot. This installation might be of the order of 500 households, or an equivalent combination of local businesses, local facilities such as a school or clinic, and residential use. It would be based on a community solar installation in the range of 1.5-2 MW. It would be supported by battery storage; and it would include the distribution infrastructure (primary and secondary grids, switchgear, protection, automation/control systems etc), and networked “smart meters” to monitor and bill for usage. Additional users, and additional energy sources such as waste generation, may be added at a later time, as may additional community uses for the network itself such as localized internet access.

We recommend that the pilot also includes the governance mechanism, in order to create learnings to inform the strategy as to the best way to manage and sustain microgrids over time. We suggest working with the community to create an ownership, management, service and financial structure based on the energy co-operative model advocated by the National Renewable Energy Co-operative

Association. This will include back office systems such as billing, energy system management, customer support; and all required training. We see this as essential to avoiding the fate of many external technology projects in post disaster situations of falling into disrepair and disuse for lack of adequate support and local commitment. We also see it as a way to transfer skills to the island.

With the appropriate financing the pilot microgrid should be able to provide power equal to, or cheaper than PREPA's current rates, while providing additional benefits of resilience, community enablement, cleaner power and some local employment. The microgrid will cost of the order of $10 million over 10 years to design, build (including creation of the co-operative) and operate. It could be financed by a combination of grants and low interest loans to the cooperative, with lenders repaid over a period of years from usage charges. Quanta, Schneider and IBM are already exploring the creation of the pilot and are willing to donate substantial time and equipment pro-bono, and pursue the additional funding to enable the project to proceed.

Conclusion

We believe that our proposals will point the way for Puerto Rico to move forward with a power system that is more resilient, more reliable and more sustainable. We will be pleased to discuss it further.