

EXPANDED ANSWER 50:

Alternative Energy Production And Sales

Becoming self-sufficient in energy generation and water service is an essential component of becoming independent. Fortunately, we have the opportunity to do this in a most ecofriendly manner.

The self-serving orientation and gross incompetence of the government run electrical and water companies are legion and publicly demonstrated a total collapse during and after Hurricane Maria. The infrastructure is decayed. Electrical interruptions are common, droughts lead to water shortages, and the quality of our water no longer tested and questionably meets EPA standards. We are experiencing a huge crisis.

Representatives claim that the high cost of electricity is caused by the fact that most of the power generation is fueled by oil. The truth is that even after the very high fuel cost is separated out, the remaining \$.14/KWH for distribution, maintenance, and overhead is higher than the total cost, including fuel, of almost all stateside electrical suppliers! Of further importance, while prospective businesses do not like high utility costs, they like unknown future prices and surprises even less.

Electricity used in Vieques has been produced and distributed (via two underwater cables – both at the end of their service lives) by AEE on the main island. The capacity of our system was about 10MW, and we typically used under 7MW. Culebra is linked to the main island through Vieques like a daisy chain through a continuing underwater cable. A backup oil-based generating facility was built in Vieques but was seldom brought on line – even during extended power outages – it failed miserably during both recent hurricanes.

Water is supplied to the island via a pipe from the main island that also continues on to Culebra. Water usage is approximately 600,000 gallons per day for Vieques and 150,000 gallons for Culebra. The service failed during Hurricane Maria and was totally inoperative for over a week.

Examination of the natural resources of Vieques illuminates the incredible potential we have to enter the domestic electrical generation business. Historically, Vieques has been blessed with significant sunlight and strong winds. Research suggests that the best winds and the most sunlight are available on the east end of the island. Considering both solar collection and wind power, studies show that we have “good” conditions as rated by both wind and solar experts. We are not rated “excellent” due to the seasonal variations of winds and clear skies. Proposals for both wind and solar should be solicited and evaluated. The cost of both collection and storage has been dropping dramatically every year to the point that it is a cost-effective alternative to our antiquated petroleum-based service.

Catastrophic failure of the Puerto Rican grid after Hurricane Maria left Vieques without electrical service for four to seven months, depending upon the neighborhood. We were forecast to

remain on unstable backup generators for another four years, however, the transmission lines were temporarily reestablished after almost 15 months. This is so unacceptable as to be criminally negligent. One cannot provide for the citizens, their current businesses, and critical economic development when something as basic as reliable electrical service is unobtainable.

Solar technology can be utilized in both centralized and decentralized (distributed) installations. The advantages of decentralization include: the reduction or elimination of distribution lines, equipment, and costs, as well as reduced vulnerability to storm damage. The advantages of centralization are greater efficiency and a lower original cost for the solar plant. Solar with battery storage is already cost effective in many market areas and could be implemented now in PR if the monopoly-protecting obstacles placed by the power company and government officials were removed.

To begin with, solar backup systems can be efficiently installed immediately on the flat roofs of most existing houses. These are light weight panels with or without batteries. Power would pass through an inverter to convert the DC current to AC which would then be connected to the house circuit breaker panel with a transfer switch which selects either the grid or the solar source. A power conditioner would provide a constant, clean voltage for the devices connected within the house. Batteries would permit continuation of the supply of electricity while the sun is unavailable. The system is scalable: one could have just a couple of panels to run a refrigerator, electronics, a fan, etc., or an extensive system could be installed to cover everything in the house during sunshine and a couple of days of clouds.

Larger scale arrays can be placed in a single area and sized to supply the whole island including backup batteries. Alternatively, to reduce distribution costs, multiple dispersed arrays can be located in or near various neighborhoods and commercial areas. Although much of the distribution system has been damaged by hurricanes, some may be usable, and further development worked around the existing systems. New distribution should be below ground, and existing elevated components should be buried as soon as practical. Government land has already been surveyed to find optimal locations for placement of the array(s). An electrically powered desalinization plant could be located nearby.

Desalinization technology has become less costly through technological advances in the last several years, but it is still more expensive than our current costs of about \$32/month for a typical residence using 6,000 gallons per month (about one half a cent per gallon). Forecasting the exact cost of desalinization is extremely complex and varies considerably based upon many different existing conditions. One of the largest cost components is electricity, but with our own solar generation, we could end up with very favorable numbers. Nonetheless, we should figure that water costs may initially exceed our current charges by up to 50%: a small price for independence, redundancy, and resilience.

Lithium-ion batteries have evolved dramatically, based in no small part on the efforts of Tesla and Solar City. The manufacturing costs of both panels and batteries have been decreasing by

roughly 20% year after year. We cannot afford to invest in the antiquated technology and business model of the AEE power company. ["Clean Disruption" Tony Seba]

Ocean Thermal Energy Conversion (OTEC), a process of extracting energy from the differences in temperatures found in very deep water versus shallow surface water, might be another option. Applicable mainly in the tropics, this form of electrical generation was pioneered in the late 1800's and continued slow refinement over the last century. [Wikipedia] Vieques is surprisingly well suited geographically because it sits within two miles of an off shore shelf of 2500 feet and within 3 miles of 4500 foot deep water. Punta Vaca on the southwest part of the island is about the closest point.

OTEC technology is in its infancy. The theory is tried and true based upon a low efficiency heat engine that converts thermal into mechanical energy to drive electrical generation, and in open cycles, the simultaneous desalination of seawater into drinkable fresh water. The costs are high, but the power is constant 24/7 regardless of the weather.

A half dozen demonstration projects have been successful at producing net power, but nothing yet has been built at a scale of 10MW or above. "Lockheed Martin built a 'Mini-OTEC' off the coast of the Big Island [Hawaii] in the 1970s and recently partnered with Makai Ocean Engineering to build a pilot plant..." [Pacific Business News, Nov 22, 2010]. Lockheed has invested millions in the hopes of becoming a major player, and they were looking for more projects at a larger scale. They have won a 10 MW project in China, but it is not yet on-line. There are others in this industry as well.

Our needs can be met with a 12.5MW system that can deliver 8MW of net electrical power while producing daily 1.25 million gallons of fresh water for both regular and aquaculture use. Financing is included with a power purchase agreement (PPA) with a 20-25 year contract at fixed energy and water costs possibly lower than what we currently pay. This technology is probably too rich for our budgets at this time, unless a great deal of grant money were to become available.