Micronesia off-grid energy storage

Q: With microgrids growing in popularity, confusion exists about the true definition of a microgrid. Can you explain the difference between a microgrid and a smartgrid? What are the best power sources for microgrids?

A microgrid is a smart grid on a small scale, in terms of electrical load and generation. A microgrid can take advantage of different DG (distributed generation) technologies, such as wind turbines and photovoltaic cells (PV). The more DGs interconnected in the microgrid, the more resiliency can be achieved. However, the intermittent nature of renewable resources makes the operation of the microgrid more difficult. Energy storage devices are necessary to smooth power generation of renewable resources.

Q: Part of your doctoral thesis and some of the work at National Grid dealt with the problem of "islanding." Tell us about the software you"ve developed that helps evaluate the risks of islanding.

Islanding can be defined as a condition in which a DG remains energized in a localized area while the remainder of the electric power system loses power - a situation that can cause damaging surges and danger to linemen who might not realize that power is still present.

The national standard requires a loss of grid connection to be detected by DGs within two seconds, leading to an immediate trip of the DGs from the electric power system. So before we can connect DGs, we must evaluate the risk of violating that requirement.

There are several over-simplified screening procedures currently used to evaluate the risk of islanding. I designed software, based on the MATLAB platform, that provides an in-depth evaluation of the risk of islanding by modeling the distribution system and pinpointing the conditions that could cause islanding.

I used the software I developed on four projects while working for National Grid. With the software, I"m able to determine how to prevent an islanding situation. An example of a solution is using a direct transfer trip - a signal sent from a substation to a microgrid - alerting it to disconnect.

Social welfare is finding a solution which pleases all interested parties involved, such as the system operator, end-users, and all companies involved in producing and delivering electrical power. Environmental concerns, such as greenhouse gas emissions, are another interest. If we can find a solution for a power system that could lead us to maximize social welfare, we can provide a win-win.

Q: How have changes in the national energy market over the years, such as restructuring of the electricity market in the 1990s, affected the development of alternative sources of power?

Currently, electricity is being traded through different market structures. Those market structures have been

designed in order to remove monopoly and its negative consequences. Supplying electric power through a market increases competition and efficiency. One way to improve efficiency and reliability is using DGs in power system planning and operation, especially DGs using renewable resources which may be more aligned with the needs of end users and avoid the requirements for building large central generation facilities.

During the last decade, smartgrid and microgrid concepts have been the center of attention in the U.S. electric sector. Environmental concerns, efficiency, sustainability, and resilience are the main motives for upgrading the current power system in the U.S.

However, we are behind Europe. It goes back to the history of oil prices. When the price jumped, Europe started talking about what to do. They are also more concerned about the environmental impact. For the U.S., the restructuring of the electric sector was the turning point. The need for efficiency prompted that - our aging infrastructure, the monopoly, the cost of electricity.

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