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Utility-Sponsored Solar Gardens Heat Up … but There's a Price

By Barrett Buechler

New community solar programs, combined with utility-scale and rooftop solar projects, are expected to drive the growth of solar energy in 2016 by 119%, according to a quarterly report published by GTM Research and the Solar Energy Industries Association.[1]

GTM Research backs its forecast numbers by noting that 25 U.S. states currently have a minimum of one community solar project online with 91 projects and 102 cumulative megawatts installed through early 2016. Analysts predict that the U.S. community solar market will add an impressive 1.8 GW over the next five years.

The anticipated growth is an opportunity—and a challenge—for utilities across the country.

Energized Connections

Solar gardens are typically small, with a photovoltaic (PV) solar capacity around 1MW. Key to the spread of community solar gardens is virtual net metering—a technique that allows the PV solar system operator to interface with a nearby utility.

The development of solar gardens is particularly prevalent in states like Colorado, Minnesota and California due to extensive community interest and accompanying legislation. For example, in 2013, Minnesota passed wide-ranging solar legislation requiring investor-owned utilities to generate 1.5% of their power from solar by 2020, with 10% of that amount to be produced from systems of 20 kW or less. It also established a framework for new community solar programs, particularly for customers in Xcel Energy's service territory. Minnesota's Community Solar Garden program allows developers to build up to five, co-located 1MW PV projects that will interconnect to Xcel's distribution system.

Surprising to many, the challenge of community solar project implementation is not in the design of the garden or the use of PV cells, but in how the primary utility controls, protects and communicates with the solar garden network.

Control, Protect and Communicate

When evaluating plans for interconnecting solar gardens, utilities conduct comprehensive studies that are focused on feasibility. They must find answers to key questions, such as:

- Is there enough stability to manage significant PV drops?
- How does the local utility tell the solar farm to turn off power?
- How is the network protected from voltage fluctuations?
- What provisions will be in place to avoid potential islanding situations?
- How are the utility and owner going to communicate with PV unit controllers?

As part of the interconnection study, engineers will review the solar garden developer's application, design an approximate feeder model, and study the impact of the proposed PV site per distributed generation requirements defined by the utility or by industry standards.

To determine the allowable installed PV size at these sites, engineers evaluate many factors that can affect the capacity of a given location. These factors include cases that may produce the potential for islanding, steady-state voltage violations, excessive voltage flicker or equipment overloading.

[1]GTM Research, Q2 2016 U.S. Solar Market Insight

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These studies—which assess areas such as the mandatory curtailment of allowable capacity—result in updates to PV control requirements and recommendations for reasonable utility upgrades that developers may find cost-effective. Recommendations moving forward might include reconductoring distribution lines, upgrading equipment with higher-rated devices, installing additional capacitor banks throughout the feeder distribution system, and even optimizing PV locations.

In larger installations, some form of communication must also be set up between solar gardens and the utility to ensure that solar gardens can be taken offline to avoid potentially hazardous and unsafe situations. For instance, a solar garden that remains online during a fault could cause a safety concern at the fault location and even put a lineman in danger.

Additionally, if a solar garden remains operational while the utility is out of service, it could damage customer equipment due to the quality of the power provided. Utilities do not typically trust an automated PV controller to monitor and manage these conditions, which further supports the necessity to develop some way to take the PV solar site offline as needed.

A Stable Framework

Many small investor-owned utilities, cooperatives and municipalities do not have access to resources available to large utilities like Xcel Energy. Consequently, smaller organizations rely on industry-standard practices and guidelines, such as IEEE 1547 and IEEE 1453 standards established by the Institute of Electrical and Electronics Engineers, California Public Utilities Commission's electric Rule 21, and chapter PSC 119 of the Wisconsin Administrative Code.

Adherence to such measures are great tools for design, but without the benefit of experience in actual implementation, utilities risk implementing unfavorable system conditions for themselves and/or their customers.

For example, utility companies typically have highly accurate data on transmission lines—but that's not the case with distribution lines. Distribution lines are not typically mapped in software capable of performing voltage studies because in the past this level of sophistication was not required. This translates into a daunting challenge for both large and small utilities, and requires companies to build more sophisticated distribution models to allow an accurate analysis of PV solar installations throughout electrical networks.

To circumvent the need to develop individual studies, a full-system analysis is required to quickly evaluate a given location for a PV solar garden. The cost associated with this extensive modeling and subsequent implementation is costly and will likely need to be funded in part by either the developer, utility customers or through legislation.

An effective community solar garden program will incorporate a resource plan. This enables the parent utility to safely evaluate distributed generation interconnections, and provides the necessary framework for interested groups to reliably request interconnection.

As PV solar gardens grow in popularity, the rest of the country will look to pioneering states like California for guidance. Companies such as Pacific Gas & Electric are already creating sophisticated distribution resource plans capable of analyzing distributed energy resource (DER) installations, and evaluating optimal DER locations on a system-wide scale.

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