CPV + WDG = Successful Model for Utility-Scale Solar Energy Deployments

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Solar technology and energy market dynamics have intersected to create the perfect conditions for a new, deployment-friendly model for generating and distributing energy – the wholesale distributed generation (WDG) model. Concentrated Photovoltaic (CPV) solar power technology makes the model work for utilities and consumers, providing the economics to support projects.

The WDG model, which is based on networks of small power facilities feeding local distribution networks, is a practical response to the energy industry’s current state, future needs and economic realities. WDG infrastructures are comprised of 20-megawatts (MW)-and-under renewable energy projects that are interconnected to the distribution grid, with all energy production sold to a utility. Unlike most existing energy generating facilities, power plants in WDG infrastructures do not feed the grid from transmission lines, resulting in a reduction of the financial and environmental costs associated with long distance transmission. In contrast with the WDG model, large-scale renewable energy projects, often referred to as “central stations,” have failed to deliver the energy the economy needs. Central station renewables depend on the availability of capacity on transmission lines, which is constrained. New transmission lines can take more than a decade to build, and permitting battles over the conversion of pristine lands into energy farms can delay or kill large projects.

WDG is the alternative to the central station model, and CPV solar is a key component that will make it succeed. Concentrated photovoltaic (CPV) technology is cost efficient and energy dense. It is a proven and developed source of renewable energy, and the most capable technology for generating utility-scale power reliably at times when it is needed most – during afternoon daylight hours. In addition, CPV solar is the most efficient renewable technology, utilizing cells that convert roughly 40% of the sun's available energy into electricity, instead of the 14 – 15% converted by traditional PV technology. A CPV project can deliver the same amount of energy from an area up to 50% smaller than other PV technologies. A 20 MW CPV project serving roughly, 20,000 homes fits on less than 100 acres. Generation of more energy per acre makes CPV a particularly good fit for WDG, where generation nearer to the load also means that land is scarcer and more valuable.

CPV, when compared to concentrating solar thermal (CSP), has compelling advantages in a wholesale distributed generation (WDG) model. CPV uses no water in the production of energy, requires far less land, and uses the land more efficiently. CPV has the flexibility to scale up and down in size, from under 1MW to over 100MW, allowing it to meet the demands of larger central stations. Conversely, CSP deployments are typically 50MW or larger and require large amounts of water and vast open spaces of flat land.

Regardless of which solar PV technology ends up in WDG infrastructures, the only way utilities can meet growing demands for energy and their renewable portfolio standards (RPS) mandates in the required timeframe is to implement a number of utility-scale PV solar energy projects in the 5-20MW range. Development, financing and construction of multi-100MW projects simply cannot happen in time to meet renewable targets and capacity needs. Deployment of a portfolio of projects in a WDG model is the solution.

 The most compelling advantage of CPV solar in the WDG model lies in the ability of smaller projects to get financing. As engineers and technologists, our natural inclination is to view issues like solar and WDG from the technical standpoint. In reality, it's financing and permitting that often determine whether renewable energy projects move ahead. Because smaller projects can fit more easily and flexibly into the transmission/distribution infrastructure, there is far less risk associated with them, which translates into lower financing costs.

The market for utility-scale solar PV implementations in the 2-20MW range is growing, with more than 25 such projects completed recently in the United States and many more in the pipeline or at the RFP stage. Solar energy systems distributed across a service territory make sense to banks and other investors. Smaller projects typically require a $8-$80 million investment versus to up to a billion dollars or more for a 200MW-plus project.

There are still some barriers to widespread adoption of solar PV in a WDG model. Interconnection processes for solar and other forms of renewable energy generation in a WDG model can be made more streamlined. As solar penetrates deeper into the grid, utilities must find a way to compensate for its inherent intermittency. Unpredictable market structures and pricing and overlapping and inconsistent regulation also pose challenges for solar and other renewable projects.

Nevertheless, given the current state of America's energy infrastructure and the economic climate, the WDG model offers compelling advantages over updated versions of the centralized model. Simply swapping large-scale renewable energy sources into the grid to replace retired fossil fuel power plants is not the answer. The time required for development of central stations, very high capital costs, and the obstacles to building transmission lines from areas that can support large-scale facilities, make centralized energy projects impractical solutions for meeting utility energy and reliability needs, and regulatory mandates. Solar facilities working within WDG infrastructures combine proven technology and sensible economics into an energy system for the future.

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