NovaTech
AUTOMATION

Millions of New Grid-Connected Solar Installations Will Require New Monitoring and Control Solutions

Last year the U.S. hit a major milestone in its clean energy transition: there are now more than three million solar installations – mostly on rooftops - pumping clean energy into our homes and onto our electric grid. Solar-generated power could account for as much as 45% of the nation's electricity supply by 2050(1). This proliferation of millions of power generation sources will require new solutions for control and monitoring.

Over a century ago, our electrical power generation and transmission system was designed and built in a hierarchical fashion, and it largely remains so. Huge, centralized power plants – mostly fossil-fueled with some nuclear and hydro - push electrical energy down through substations and transmission lines to electrical consumers and businesses miles away from where the energy was generated. Over the next few decades, most of the fossil power plants will gradually be replaced by a mixture of renewable wind and solar resources. While many of these renewable sources will also be large "grid-scale" plants, an increasing share will be small rooftop solar. By 2050, we may see most of our residential electrical demand supplied from rooftops. To pull this off we will need to create new commercial and technical systems.

New commercial systems will include incentives to drive electrical consumption down when supply is not keeping up with demand. We will see more widespread adoption of dual-use assets such as the Ford pick-up truck that can power a home for three days. We'll also see the emergence of "asset sharing" models, where homeowners can, for example, let others use their charging systems in a pinch. These new systems – probably all app enabled through cell phones - will be challenging to ramp up to full adoption, but the more daunting challenges will be technical.

In the US, converting from a few thousand fossil plants to millions of solar rooftop "mini power plants" will require an expanded system of monitoring, control, and communication. Electrical power systems require a delicate balance between electrical supply and electrical demand. With practically no storage in our current system, the instant electricity is generated, it must be used in some form of "load" such as heat, motion, or sound.

Across the US, 74 "balancing authorities" maintain secure, real-time communication with load-following generating plants, sending plant controllers commands to ramp up or down to keep in synch with electrical load. They also manage bi-directional power flows from adjacent regions and run complex load forecasting and economic models (2). Even with a relatively small number of continuous-producing power plants, the power system is fragile, as evidenced by the occasional brownouts, blackouts, curtailments, and power quality problems we experience when electrical supply doesn't exactly match demand. Expanding this "balancing act" to manage a huge increase in *intermittent and variable* rooftop power sources will require an associated expansion of electrical energy storage and new monitoring, control, and communication systems.

Here is how this expanded system may take shape. Residential solar systems will increasingly include local storage and be integrated into a regional "DERMS" (Distributed Energy Resource Management System) and "ADMS" (Advanced Distribution Management System). This

integration will be through real-time radio communications, much like our revenue metering infrastructure, but higher performance. New communications standards will facilitate simpler integration of dozens of different vendor-supplied inverters and storage systems. Inverters will receive commands to ramp up or down or be forced into modes to provide support for power flow. Storage units will be commanded to absorb excess power or supply needed power. This new “electrical power machine” will be enormous and complicated, but essential to our renewable energy future.

The bones of this future energy grid are already falling into place, and NovaTech Automation, a leader in the monitoring of electrical substations with the Orion RTU, is preparing to be part of it. Our plans include support for the emerging renewable-energy protocol standards, expanded control and monitoring of grid-scale solar plants, and development of smaller radio-enabled Orion DER integration gateways. In upcoming articles, we will share more details.

Stay tuned for our next article entitled ‘**The New Energy Environment – The Role of the New Power Suppliers’** where we will review the new roles for millions of residential *energy consumers* that are rapidly becoming residential *energy producers*.

(1) For more on the future of solar: https://www.energy.gov/eere/solar/solar-futures-study
(2) For more on Balancing Authorities: https://www.eia.gov/todayinenergy/detail.php?id=27152