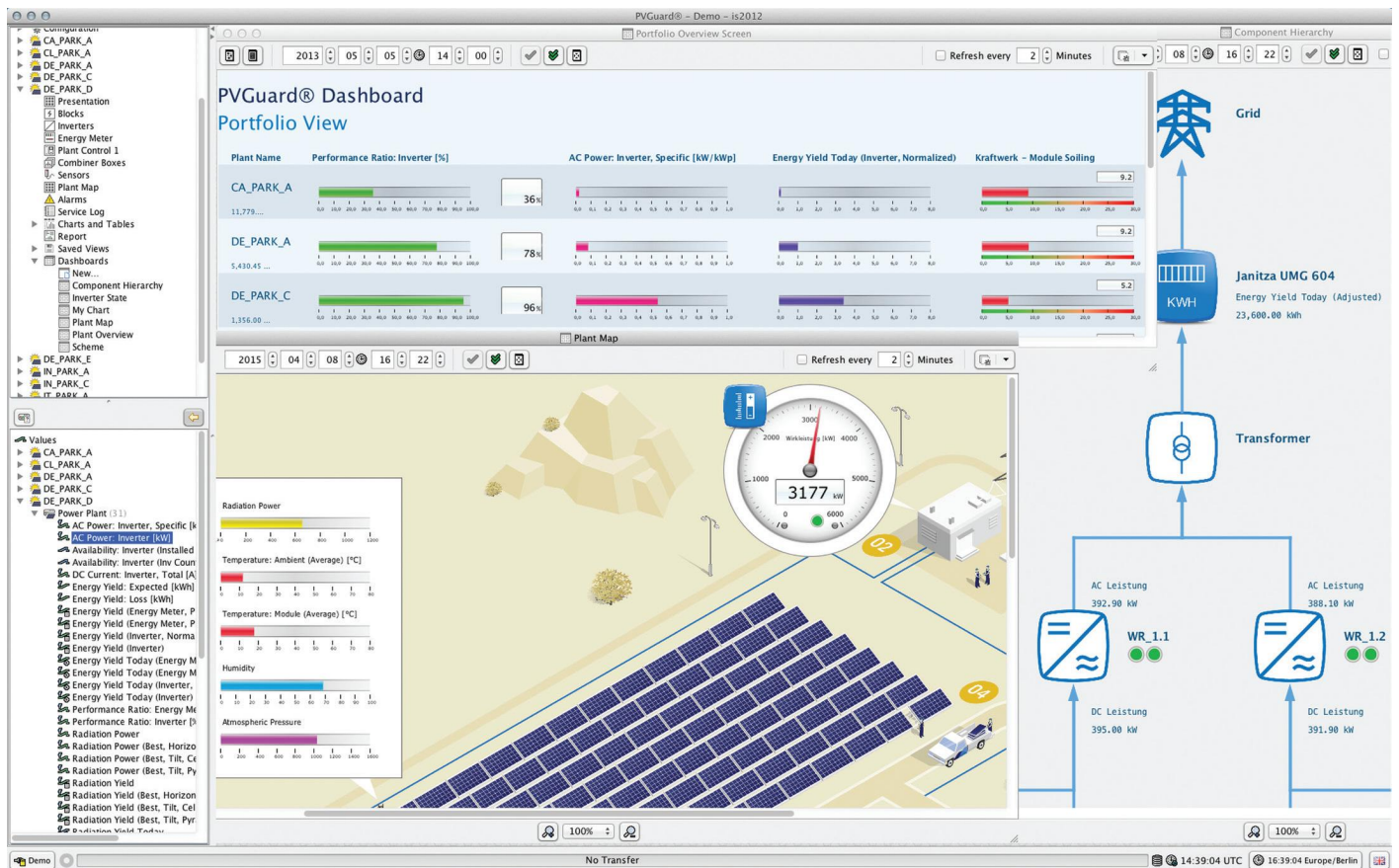# Big data for big solar

Plant control | SCADA technology enables PV plant owners to maintain their portfolios more efficiently and respond to increasingly stringent requirements from grid operators, yet avoid information overload. Sara Ver-Bruggen looks at the state of the art in SCADA systems as PV systems and fleets grow in size

Credit: skytron energy

Supervisory control and data acquisition (SCADA) systems, typically consisting of hardware components such as sensors and data loggers, as well as advanced software, have traditionally been developed to be used with one PV power plant, with each new PV plant being built needing its own SCADA system.

Nowadays, the leading operators and owners of utility-scale PV plants typically own portfolios of many individual plants, or assets, scattered across more than one geographic region or market. This trend this has driven advances in SCADA systems.

Key performance indicators (KPIs) of PV plants are identified in terms of the different pieces of equipment or components, such as strings and inverters, and the output of the plant. These raw measured values are processed, providing operators with an in-depth, real-time analysis of the plant's performance.

Maintenance

As well as measuring PV plant yield and performance, advanced SCADA systems perform critical monitoring for maintenance. It would be expensive and inefficient to employ teams of several people at every PV plant site in a portfolio to check for faults in inverters, cables or panels. SCADA systems pinpoint faults and problems and allow operators to decide how to address these, and schedule in maintenance and repairs, and despatch technicians where needed.

Enertis is a Spain-headquartered engineering and consultancy firm offering services in PV project development through to operations and maintenance (O&M), often working with large operators,

SCADA platforms are invaluable for O&M as well grid-side control of PV power plants.

mainly in the US as well as Latin America, including Chile and Guatemala. The company's own SCADA system, which it developed with a software company, forms a core part of Enertis' O&M services.

The SCADA platform is designed to harness data from a multitude of PV plants and presents key information to clients about their PV portfolio. Clients can access the web-based program, but it is owned and managed by Enertis, as opposed to being sold as an off-the-shelf product.

"One of the issues that we often face is working with clients that have acquired an operational PV plant, which usually has an existing SCADA system in place, perhaps chosen by the project's developer. Some legacy SCADA systems may not be equipped to adequately address the complexity and range of tasks that operators may need," says Luis Collazo Garcia, a

consultant at Enertis.

"In some cases a monitoring system was never installed in the first place. Sometimes, operators may need a system that can work with their entire fleet or want to exchange their existing system if the plant is failing to generate the optimum or desired output," says Jörgen Klammer, managing director of skytron energy, a large provider of SCADA technology, which is now part of First Solar.

Increasingly, according to Klammer, investors are looking to have an independent provider of monitoring and supervision solutions to keep their data separate from the developer.

Driven by scaling back of incentives, where in many markets, energy suppliers and utilities have negotiated hard on power purchase agreement (PPA) prices, reducing the levelised cost of electricity (LCOE) of a PV plant is the goal for many operators, which means rationalising and squeezing costs out of every aspect of costs related to operational expenditure.

"An advanced SCADA system supervising 250MW of assets lets you retain a core team of two or three technicians. You can coordinate how you despatch technicians to assets for repairing faults or dealing with issues, which the SCADA system has been able to detect. This has become a much more efficient way of pinpointing problems or maintenance actions, rather than deploying teams of technicians to check plants and look for failures, especially as plants have grown in size and fleets have grown in size," says Callazo Garcia.

Lightsource Renewable Energy in the UK, which has emerged in recent years as one of Europe's largest PV plant portfolio owners, has been investing in developing its SCADA platform, driven by the company's growing fleet.

"With an increase in fleet size there is definitely greater need for the automation of the calculation of the various KPIs across a large fleet. The manual downloading and checking of data usually inherent in fleet-wide reports becomes too time consuming with hundreds of plants," says Mike Day, a spokesman for the company.

The company is moving towards integrating the monitoring of its own internal SCADA platform, Lightsource Performance and Asset Management (LAMP), with other large data tools to help with this.

"In addition, greater user visualisation of things like inverter availability or string outages is needed as with large fleets it becomes time consuming to 'dig down' into individual sites to check these," says Day.

> "Ease of use is imperative. Whilst SCADA systems can have great amounts of data available to the user, there is no point in having any of it unless it is easy to access and download"

While SCADA deployment can run from tens of thousands of euros into several digits more, good SCADA systems, worth their salt, can reduce O&M costs over the plant's lifetime and enable operators to manage a portfolio of assets from one single location, as opposed to manage each plant as a separate entity.

Companies, like skytron energy and Enertis, have developed SCADA platforms able to handle large portfolios. All plants can be integrated into one data manage-

ment centre, which clients can operate from their own control rooms from any part of the world.

Too much information

However, as SCADA platforms take on more complexity, recording and processing data from every single balance of system (BoS) component in a PV plant across every single asset in a portfolio, too much information and data can be a hindrance.

"Ease of use is imperative," says Day. "Whilst SCADA systems can have great amounts of useful data available to the user, there is no point in having any of it unless it is easy to find, access and download the exact data that the user is looking for. Some of the platforms that exist have great technical attributes, but if the end user cannot work them quickly and easily then they are redundant."

"Good, effective SCADA systems don't just generate data on performance; they can indicate the best action that must be taken, based upon technical and financial inputs. They have become critical tools which influence what decisions are made. This is as important for a company operating several multi-megawatt PV farms or several hundred individual rooftop installations and aggregating these together into a single fleet," says Callazo Garcia.

Beefing up security

Another growing area of importance that providers of SCADA systems have been addressing is cyber security and data protection for clients. Hive Energy, a UK developer of PV plants that is expanding into operating its own assets, is investigating different SCADA offerings and options; cyber security, along with the system's ability to meet the requirements of the National Grid, is high on the list.

"Cyber security is becoming more important. It's not just a question of data security but to avoid power plants being shut down or externally controlled by cyber-attacks," says Constantin Wenzlik, CEO and co-founder of Padcon, which has been providing PV plant developer and operator Belectric with SCADA and web portal platforms since 2008.

Enertis' security strategy has involved the company investing in servers in Canada, which, along with Switzerland, has some of the most watertight data protection and security laws of any jurisdiction.

"There is information bound up in SCADA systems, which plant owners do

Credit: skytron energy
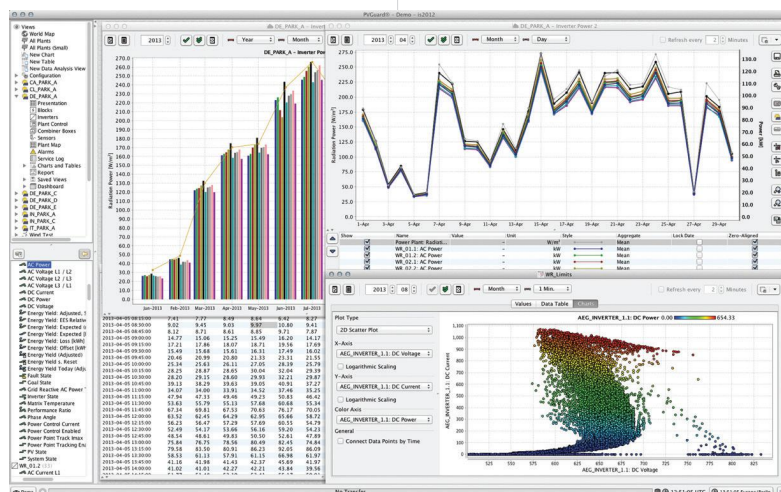
Advanced systems offer a wide range of monitoring and control functions for single or multiple plants.

not want to risk getting into the wrong hands, so we have invested heavily in keeping it secure," says Collazo Garcia.

Klammer says: "Two areas where we have invested has been in network speed/data transfer so that increasingly large packets of data can be handled while still enabling operators to see their fleets operating in real-time and also cyber security for safe and secure handling of data. This is a growing issue, as a PV plant operator with hundreds of megawatts of capacity across its portfolio, which are connected to the grid or several grids, needs to ensure that this sensitive data cannot be accessed or breached by outside parties.

Operators can either store SCADA data, which includes historical data, on their own servers, or – and this is the more common approach – have skytron energy manage the data on its own servers, including virtual servers. In either case, the data belongs to skytron energy's customers and only they have access to it.

Grid-side control

As opposed to simply feeding power into the grid when the sun is shining, PV plants must respond to grid requirements, which vary among different markets.

Skytron energy developed its Skycontrol power plant control system. The interface lets utilities curtail or manage the output from PV plants, partly by pulling together data from multiple blocks or inverters so that this is represented as one single generator to the grid operator.

According to Klammer: "For market integration requirements, which are increasing, skytron energy provides specific interfaces that allow energy trading. In the case of the grid requirements in certain markets, additions to the Skycontrol platform allow PV power plants to act like dispatchable resources on the grid."

He cites Romania as an unusual example of this. "In Romania PV plants over a certain size have to be constantly operated below the maximum possible energy output. In case of a ramp down command, the active power reserve is used to fulfil the grid operator requirement. Otherwise, the PV plant without energy storage can only provide negative regulatory energy."

More generally, the Skycontrol platform offers reporting packages, required for grid curtailment, for instance, where generators are paid not to send power to the grid, so it is important for operators to keep track of these instances.

How a PV plant portfolio owner uses SCADA

Lightsource RE is the largest PV asset owner in the UK, with a portfolio in excess of 700MW, making it one of Europe's biggest PV players. The company has grown its asset base rapidly in recent years, thanks in part to good subsidies for large-scale ground-mount PV plants in the UK and access to financing through its main stakeholder, Octopus Investments. The company has been investing in its own bespoke SCADA-based platform – Lightsource Asset Management Platform (LAMP) – for its monitoring needs as its portfolio has grown.

The platform differs slightly from a traditional SCADA system in terms of control functions, but monitors multiple parameters from the main components of the balance of plant of every single Lightsource site. Data is recorded from every part of the system: the export meters, G59 relay, pyranometers and weather station, transformers, inverters, DC combiner box, down to the individual strings. LAMP monitors the main aspects of these components, and not just basic performance parameters like energy and power.

The system also monitors inverter temperature, power factor and Buchholz relay in the plant's transformer. The LAMP teams use it to complete monthly reports on performance and availability and generally check on plant health. The platform is also the source of data for any calculations made by any department.

The company's monitoring and O&M teams also use the LAMP platform to actively monitor the health of the various parts of the plant. It has an alarm and event system built in that helps in this, flagging up issues as they occur.

Lightsource has developed a bespoke SCADA system for its growing fleet of PV plants.

Credit: Lightsource Renewable Energy

The reporting software packages are flexible so that operators, which in some cases own fleets in different geographic locations, can fulfil local requirements, and are also provided in different languages. Markets include Japan, Europe, the US, Latin America, the Middle East and South Africa.

SCADA investments

The cost of investing in SCADA technology for operators depends on a range of factors, such as the size of the PV plant or asset portfolio and also on the local grid requirements, which dictate the level of monitoring that is going to be required.

Klammer says: "For example, in Germany when the PV market started years ago, there were no grid requirements; power from PV plants was fed directly into the grid. Now, PV plants in Germany have to provide reactive power ancillary services to the distribution grid network, to compensate for voltage drops."

In newer PV markets grid systems are often weaker compared with those in western Europe. In Chile, for example, grid integration requirements are stricter, demanding that PV plants provide various ancillary services to help stabilize the grid. More controls for PV being fed into the grid are needed, so SCADA system investments tend to be more complex and, therefore, costly.

The PV market is continuing to evolve. Systems need to be able to meet the legislative requirements of different markets. So too must SCADA technology, showing owners what they can expect to generate from each of their plants under different financial models, with portfolios often spread over different markets and regions, while helping to optimise O&M activities to further drive down the cost of electricity. ■

Author

Sara Ver-Bruggen is a freelance journalist.