White Paper

DER and Analytics:

How are new analytics platforms meeting the critical need to manage distributed energy resources?

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It's no secret that more and more, consumers are taking control of their own electricity generation. In fact, distributed solar capacity has already more than doubled in the past few years. In 2016, it's projected that a new solar photovoltaic (PV) system will be installed every 83 seconds.[1]

The acceleration of distributed energy resources (DER) at more locations along the distribution system is reducing the demand for power from central generation facilities, and it is also creating new challenges for utilities. With increasing penetration of DERs, utilities are facing many technical hurdles. This includes the need to deal with hosting capacity limits or the maximum amount of DER the distribution network can accommodate without impacting system reliability or power quality, feeder voltage regulation and inverter grid support. In addition, increasing DER penetration poses critical business challenges by creating a decline in both electricity sales and utility revenues. A strategic approach to DER integration that accommodates the growth of these new technologies and addresses the impending operational challenges is imperative.

Today, utilities are making huge investments in the smart grid and deploying advanced solutions for metering, billing, outage management, distribution management, revenue protection and customer management. Utilities can maximize the benefits of these investments by leveraging the data from multiple systems and realizing new capabilities, such as spatial visualization of the distribution grid. Spatial visualization is a capability that enables more accurate planning and management of DER integration.

[1] "The Value of an Open Framework for Interoperability at the Edge of the Grid," GTM Research, 9/29/15. Find at: https://www.greentechmedia.com/events/webinars/all

by Dave Connaker

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The Mainstreaming of Renewables

Many factors are driving the growth in DERs. First, distributed power technologies are more compact and affordable than ever before. Second, they have lower capital requirements that enable quicker deployment than large power plants. Other critical factors driving DER growth are state mandates, such as renewable portfolio standards (RPS). All of these factors are pushing utilities to encounter a greater number of DER deployments within their service territories.

Consumers interested in reducing carbon emissions and lowering utility bills are also fueling the growth of solar DER. This growth has spurred in states like Georgia, where legislation has enabled third-party ownership of solar, a financing plan for residential and commercial customers to host solar with no upfront costs or ownership responsibilities. The 30 percent federal investment tax credit for solar energy systems — effective through 2021 — as well as other rebates and incentives offered by many utilities, states, counties and municipalities are also spurring the growth of solar.

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A Cost-Benefit Analysis of DERs

The rise of solar penetration across the United States varies by geographic location. High power costs from traditional generation, coupled with abundant sunshine, have a predictable effect — especially on residential solar adoption. Hawaii, for example, is at the top of the chart, with 21 percent of the state's power now generated from solar and other renewable sources.

Using renewables in the generation mix can also provide significant benefits to utilities. When generation occurs closer to the load, operational efficiencies such as reduced line losses and greater control over load balancing can be achieved. These distributed generation assets can also improve reliability, especially during major weather or capacity events that traditionally cause mass grid outages or brownouts.

Challenges of Integrated DERs

While there are many potential benefits of power generation closer to the load it serves, DER integration and management is not without its challenges. For example, two-way power flows are something the power grid was not originally designed to handle. In addition to safety issues, managing the two-way floor of energy requires information and control at the edge of the distribution network. Sudden swings in output from solar and wind can also threaten power quality and grid reliability, forcing utilities to scramble in order to maintain a steady power supply. That is, unless they are aware and can react.

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The Need for Planning

Planning ahead for DER integration has become more urgent in recent years as more states institute legislation, mandates and RPS goals intended to increase the amount of energy generated by renewables. Recent legislation suggest a clear need for utilities to develop a complete understanding of what integrating DER systems means for existing electric power systems.

Hawaii, again at the forefront, passed a new law mandating that all its electricity be supplied by renewables by 2045. California is also setting new goals, with a new RPS target requiring 50 percent of electricity to be supplied by renewables by the end of 2030. The state of New York's Public Service Commission initiated the Reforming the Energy Vision (REV) process to create a cleaner, more affordable, more modern and more efficient energy system for the state. REV calls for the increased development of distributed energy resources, including rooftop solar.

Utilities concerned about integrating DERs must be ready to address the disruptive effects of renewables on their networks — including reverse power flow and rapid voltage swing — especially at high-penetration levels. Below are just a few of the issues utilities must address when planning for the integration of DERs into the distribution systems.

1 LOCATION OF THE RESOURCES

Excessive renewable generation, like solar or wind, can cause issues such as reverse power flow and voltage variability on the distribution feeder, depending on the time of the day and the weather conditions.

One of the main considerations in deploying renewables is the size and location along the distribution feeder. Multiple scenarios should be modeled and studies conducted to determine whether these resources are optimally located within the distribution territory.

2 ADDITIONAL GENERATION REQUIREMENTS

System operators should be aware of generation requirements at all times in order to supply the necessary load demand while maintaining the contingency reserves.

This necessitates utilizing advanced tools that can accurately forecast the generation the installed DER base can supply.

3 PROTECTION ISSUES

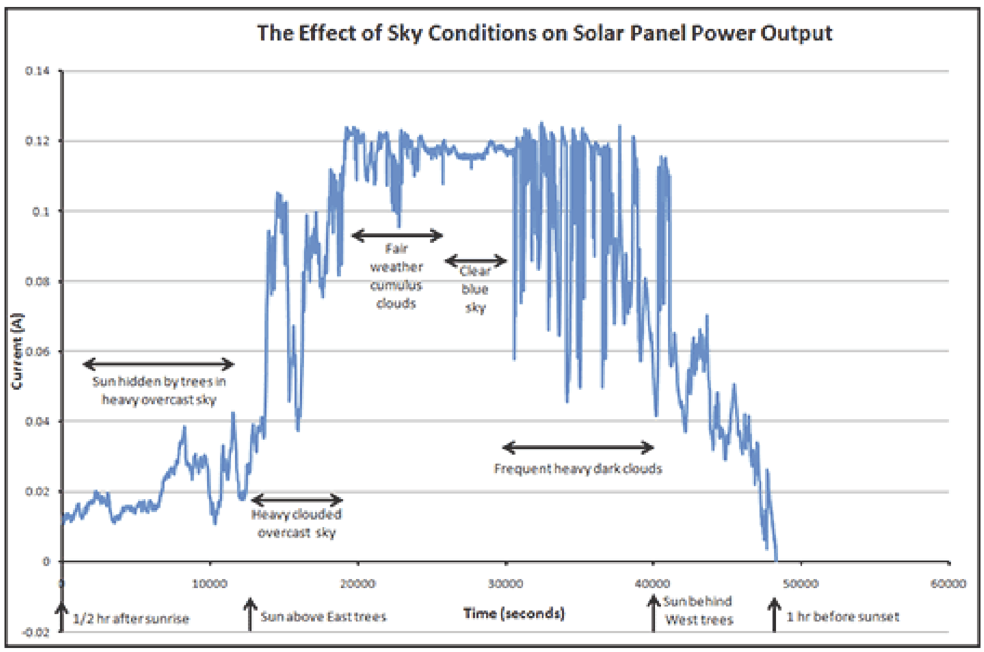
When integrating DERs into the distribution system, potential distribution system protection issues can occur due to reverse power flows back to the grid.

DERs may cause loss of relay coordination and potential over-voltages.

4 POWER QUALITY AND RELIABILITY

Weather events, such as changes in wind speeds and cloud cover, can create intermittencies in wind and solar power generation, significantly impacting a utility's supply and reliability.

These events necessitate contingency plans such as a switching over to backup power sources in order to maintain a continuous power supply.



Source: Vernier.com

5 MANAGING STORAGE

Many utilities are considering including ownership and integration of storage in their strategic system planning in an effort to optimize the distribution system and balance the variability of renewable technologies.

The decision to deploy energy storage on a system-wide level is a complex decision, requiring extensive planning to determine optimal operation of storage alongside other resources.

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Putting Analytics to Work

Many industry organizations and stakeholders are developing new analytics and forecasting tools to position the industry for the growth of renewable energy resources.

National Renewable Energy Laboratory (NREL), a federal laboratory dedicated to the research, development and commercialization of renewable technology, has developed a database of rooftop space that is available for rooftop PV installation at the customer zip code level. Its Solar Deployment System (SolarDS) model is designed to help utilities understand potential PV adoption patterns in their service territories. Other organizations, such as the ISO New England and the California Public Utility Commission, provide models to create scenarios of future adoption based on changes in regulatory policies, financial incentives and other factors affecting customer PV adoption.

In addition, distributed sensing technologies, advanced software applications and analytics platforms can serve as powerful tools for developing DER integration plans and managing DER impact on distribution networks and utility operations.

By implementing advanced analytics tools, planners can gain a better understanding of the implications of adding solar and other DERs to the distribution grid. Utility operators and planners can then quantify potential load balancing and power quality issues, as well as the type and amount of grid investments required to support the addition of these new resources.

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Analytics expose and allow analysis of grid activity — at the edge, the circuit level and the system level — to help utilities visualize voltage distribution over time and across the distribution territory so that they can assess the impact of DER. More importantly, analytics can provide valuable information and insights for making optimal grid improvement decisions. Analytics help utilities make key DER investment decisions by providing valuable insights on DER siting and sizing that ensures the distribution system runs optimally, efficiently and reliably.

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Choosing the Right Analytics Platform

It is critical for utilities to understand the power of analytics to improve grid visibility and operational efficiency when planning for the integration of renewables on the distribution network.

When choosing a platform, it is important to choose an application that can virtually replicate the distribution network. The analytics platform should be able to simulate "what if" scenarios for various levels of DER penetration, as well as accurately model the behavior of the distribution network, including the DERs. The platform should analyze weather patterns, generation profiles and forecast.

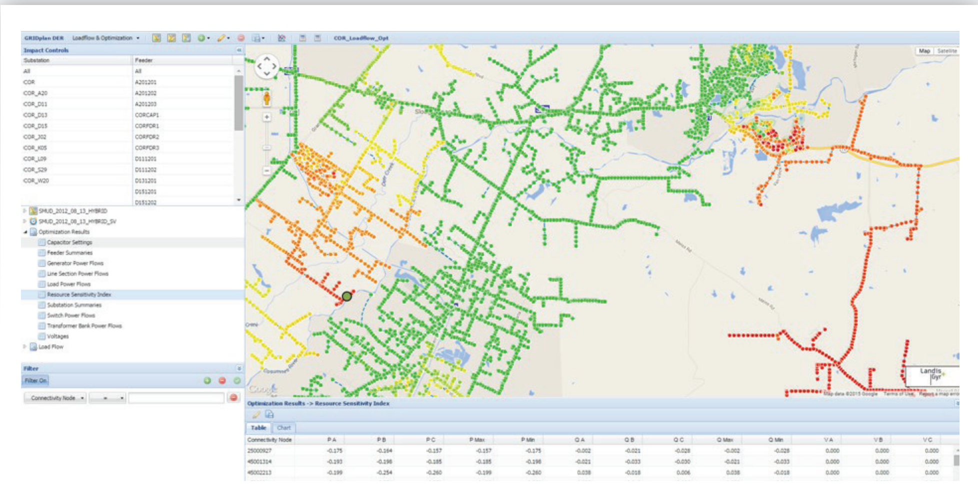
The ideal platform should also be able to build scenarios that simulate and display changing network conditions caused by DERs — including the impact of power flows and power quality in the case of sudden loss of generation by renewables. In addition, a solid platform accommodates the inclusion of battery energy storage into the analysis.

Conclusion

As the proliferation of DERs continue, it is imperative utility planners leverage advanced data analytics solutions to plan for DER integration while maintaining network safety, compliance, reliability and business objectives. No matter the size of the utility, near-real time and long-term analytics applications to proactively monitor and manage the distribution grid are within reach.

Landis+Gyr offers advanced grid analytics solutions to enable utilities to plan and integrate DERs efficiently and reliably. Built on a powerful enterprise platform, Landis+Gyr's comprehensive analytics applications harness the power of data from advanced meters, smart sensors and other systems, compare it to the distribution model using physics-based algorithms and deliver actionable intelligence for optimal network performance and grid reliability. With advanced grid analytics from Landis+Gyr, utilities can turn data into actionable insights and generate quantifiable value.

Landis+Gyr Distributed Energy Resources Solution



Screen shot of the DER Optimizer application, a browser-based, dynamic user interface, which provides comprehensive DER analytics to effectively plan, monitor and manage DER integration.

Manage energy better with unique solutions from industry experts. Contact Landis+Gyr at **futureready@landisgyr.com**