Leveraging ADMS to Maximize Renewable Benefits

Solar is the most abundant renewable energy source available, but the ability to harness it and distribute it alongside existing sources of energy is new territory for many utilities and ISOs.

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The amount of solar on the grid – particularly solar in distribution networks – is increasing rapidly, and accurate forecasting of this variable resource is critical for maintaining an efficient and reliable network.

There's expected to be a massive growth in distributed solar power generation. According to Penn Energy Research, global distributed power generation is predicted to achieve a compound annual growth rate of 12 percent between 2013 and 2019. Whether distributed solar plays a large role on your grid now or is expected to in the future, it's important to determine now how it will impact your electrical distribution system so you can ensure reliable planning, adequate generation and efficient dispatch.

This paper will discuss how innovations such as advanced distribution management systems (ADMS) can provide you with unprecedented visibility and modeling tools, especially when combined with weather forecasting, to maximize the benefits of distributed generation. We'll also examine how ADMS manages and optimizes related network assets, including:

- Distributed generation (DG): Dispersed generation, typically less than 10 MW
  - Controllable DG: Combined heat and power, generators, hydroelectric (to a lesser extent)
  - Non-controllable DG: Wind and solar
- Energy storage systems: Battery banks, compressed air systems, thermal storage systems, pumped hydro, etc.
- Distributed energy resources (DERs): A combination of DG and energy storage systems located throughout the distribution network
- Microgrids: Units on a network that have their own generation, load, and storage that can optionally disconnect from the grid and continue to provide power

Benefits and challenges of incorporating DG, DER, microgrids and energy storage

Assets like DG, DER, microgrids and energy storage can help enhance local grid reliability, avoid transmission losses and flatten the load profile. They support the use and integration of clean, renewable energy in a number of ways that benefit grid efficiency and reliability.

- DER and microgrids can be sources of power during peak hours to help shave peaks while meeting demand
- DER and microgrids can also help produce a continuous power supply, even when renewables aren't producing
- Energy storage can mitigate sudden changes in the contribution from renewables, keeping power consistent

The benefits are clear and many, but successfully integrating these assets into the grid is challenging. Renewables can create increased variability, unforeseen impacts on voltage profiles, reverse power flows and more complex protection schemes. Other challenges include:

- Difficulty in determining the source of certain network problems such as whether high/low voltages are caused by DG or by normal loading conditions
- An unclear understanding of the best locations for connecting large DG/DER/microgrid resources to the network
- No clear direction on how to maximize the operation and value of renewable resources like solar and wind

The common denominator in all of these challenges is a lack of network visibility and real-time asset data, where problems can arise without the ability to foresee or prepare for them.

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Unprecedented visibility with ADMS

An ADMS is a combination and unification of historically separate systems, including DMS, SCADA, OMS, EMS and demand side management. In an ADMS solution, all of these systems run on a common secure platform and database and provide a consistent user interface.

By bringing knowledge of your grid assets, statuses and conditions into a centralized control center, an ADMS provides full, real-time visibility of your network state for monitoring, modeling and managing the resources within it. Key benefits include:

Unified interface

- Fewer data or human errors
- Faster, more informed decision making

Real-time view of grid conditions

- Visualization via geographic, schematic and substation views
- Monitor and advise on better placement of DG, DER, relays and devices
- Reduce voltage in certain parts of the network during high demand times
- Faster outage identification and response

Complete, real-time and off-line modeling of the distribution grid

- Determine the impacts to the grid in the presence of DG, DER and microgrids
- Test negative conditions, such as voltage changes and reverse power flows
- Improve capacity planning

More efficient forecasting and operations

- Near-term (hours ahead) and short-term (days ahead) forecasting
- Applications for medium- and long-term planning
- Dispatch the entire network or localized areas
- Increase or decrease controllable generation (automatically or manually)
- Microgrid islanding to maintain reliable service

About the Authors

Don Leick, senior product manager, Weather solutions, is a senior product manager at Schneider Electric and is responsible for all aspects of the energy weather products for renewables and utilities. Don has more 20 years of product management experience, the last 10 with the weather business unit.

John Dirkman, senior product manager, Smart Grid solutions, provides product and program management for advanced integrated Smart Grid systems from concept through sales, design, development, implementation, and maintenance, driving the technical Smart Grid vision and strategy and ensuring product success in the marketplace. John had been with Schneider Electric since 2002 and has served as product and program manager for a wide variety of Smart Grid implementations.

Optimize DG/DER/microgrid operations with forecasting and modeling

The ability to model, forecast and test the impacts of your DGs/DERs/microgrid assets – before they are constructed or connected – is one of the benefits of an ADMS. How will new units impact your network? What are the repercussions? How will your other assets respond?

Providing numerous benefits, an ADMS allows you to simulate and study your network in a multitude of scenarios that will help maximize your distributed renewable energy sources.

Model DGs/DERs/microgrids with appropriate scenarios

- Connected load flow model
- Short circuit model
- Forecasting models

Offline simulations

- What-if analysis: Forecast future production and compare it with weather forecasts to better optimize assets
- Know what conditions are created in certain scenarios before they happen, such as reverse power flows
- Analyze DG/DER/microgrids in selected network configurations and states, such as maximum production/minimum load or minimum production/maximum load, to determine worst-case scenarios
- Use results to calculate costs/benefits

12%

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Benefits of ADMS and solar forecasting

Solar power is a highly variable resource due to shifting cloud cover and incomplete observations of irradiance or power. With an ADMS and integrated weather forecasts, you have access to more accurate information to make better decisions that help to successfully integrate solar power into your network.

Integrate solar forecasts
ADMS' real-time data and network visibility provide more accurate conditions when forecasting solar resources, helping you optimize the management of these resources.

- Calibrate historical information against historical weather conditions to better match forecasts and future production and better optimize your assets
- Predict the contribution of renewable power over time for better capacity planning
- Improve system reliability and safety while reducing operating costs

Highly accurate solar power forecasts can give you an even broader picture and better understanding of your solar capacity at a given time.

Weather is a driving force behind both your customers' demand as well as solar supply, and integrating this key factor into your ADMS analyses will help you enhance reliability, maximize your use of solar power, make reliable unit commitments and reduce risk.

ADMS: Greater visibility, optimized operations and accurate forecasting

Whether distributed energy sources like solar are already part of your network or are expected to be soon, you will need to prepare. With an advanced distribution management system that provides real-time visibility into grid operations, models future scenarios, and allows you to reliably plan for distributed generation and distributed energy resources, you can avoid costly mistakes that will slow your grid's transformation into a smarter, more diverse and more efficient network.

The ability to model, forecast and test the impacts of your DGs/DERs/microgrid assets – before they are constructed or connected – is one of the benefits of an ADMS.

Life Is On Schneider Electric

Schneider Electric

4701 Royal Vista Circle
Fort Collins, CO 80528
Tel: 1-866-537-1091
+ (34) 9-17-14-70-02
Fax: 1-970-223-5577

www.schneider-electric.com

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