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Utility Planning: Integrating Distributed Energy Resources for a More Robust Future

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An effective way for utilities to address unprecedented market challenges is to completely transform the well-established, traditional utility function of planning. Adapting utility planning processes to more accurately and flexibly accommodate ever-growing amounts of distributed energy resources (DERs) can reveal strategic opportunities for long-term business success.

Increasing DER penetration and flattened load growth have been putting steady pressure on traditional utility business models and rate structures. And now, regulators across the country (in California, New York and Minnesota) are requiring utilities to consider DERs in the integrated resource planning process. That is, utilities must assess the potential of DERs to replace or delay investments in new utility-scale generation and traditional transmission and distribution grid additions.

This pressure presents an opportunity for utilities. By developing more comprehensive planning activities that accurately assess the role of DERs, utilities can get out in front of business challenges, thus empowering them to capitalize on opportunity, rather than merely responding to external forces.

Fragmented Planning Falls Short

At most utilities, the departments for generation, transmission and distribution each have separate teams for planning, with their own processes and priorities. Meanwhile, strategic planning typically happens at the C-suite level. Such fragmentation can foster a limiting perspective on both the opportunities and obstacles that DERs can present to utilities in a changing market.

Historically, utility planning processes have treated DERs principally as a net load reduction, since DERs connect to utility distribution networks. This approach can have some influence on longer-term projections for generation investments and bulk power purchases. However, it tends to overlook important business and operational opportunities.

“Solar now must be considered in its full detail,” said Michael Mount, Director of Solutions at Pace Global. “Addressing DER as a load reduction may have been acceptable at very low solar penetration levels. But in many regions, the contribution of distributed solar has grown so large that its variability and unique characteristics can no longer be oversimplified as load reduction. Especially when they are controllable, DERs such as solar-plus-storage, aggregated demand response and microgrids must be treated as a resource — for supply, transmission and distribution.”

Inside and outside of utilities, people commonly

underestimate the value of solar photovoltaics (PV), since solar production typically contributes little or nothing to morning and evening system peak demand. This misunderstanding can skew generation planning.

“Meeting system peak is a key utility priority, but it’s not the only one,” said Mount. “Utilities are also under pressure to meet numerous planning objectives, such as serving customers at a reasonable cost, reducing greenhouse gas emissions, meeting state renewable energy requirements, and more. All of these objectives must be considered in utility planning decisions.”

Bridging internal silos can help a utility appropriately value current and future DERs on their system. In addition, this can better position a utility to leverage game-changing technologies and future market opportunities.

Currently, battery energy storage holds this potential. As battery storage continues its rapid price reductions, it is poised to support further growth in wind and solar energy because it will make these resources more manageable. In Hawaii and Arizona, recent project announcements for delivered energy costs of solar-plus-storage projects are low enough to position this combined technology as a viable (or nearly viable) alternative to fossil fuel-fired central power plants.

Bridging silos is also crucial for setting priorities for grid modernization, managing uncertainty around DER penetration, and making wiser bulk power choices.

Planning Tools to Enhance DER Integration

Effective utility planning is the process of asking, and answering, the right questions. Some key current questions about DERs include:

- What level of DERs can the distribution system accommodate, and where?
- What are the locational net benefits of DERs?
- How might DERs be deployed or managed to offset use of peaking generators, reduce or eliminate the need for T&D capacity expansion, increase grid capacity or improve reliability and resilience?

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- How, where and when would it make the most sense to invest in grid modernization that would accommodate DERs more flexibly, and with greater control and visibility?
- How do grid modernization investments that enable increased DER hosting reduce the need for investment in generation?

Enhanced data and technology can help answer these questions. However, current utility planning tools and processes typically don't integrate well across departments. They're designed to address different objectives, with different data, across different time frames.

"Right now, utility planning models and processes for transmission, distribution and generation are not always connected well," said Vicinus. "Siemens has recently developed planning tools that combine the transmission and distribution capabilities. System integrators also are helping to drive this process. But so far, no model has been developed that integrates generation well, too. It's a challenge to get all of these different models, and different planning staffs, to communicate effectively with each other. However, that must — and will — change in the near future."

The main challenge of integrating generation planning with T&D planning is that, traditionally, generation planning has been an aggregate analysis peering 20-30 years into the future. In contrast, distribution planning examines data at the feeder level. This data must be far more granular, and this process examines only a handful of key load conditions or key hours across the planning period.

In contrast, DERs nudge generation planners to think more in terms of daily operations. "DERs are forcing resource utility planners to consider supply resources that are smaller, more distributed and more variable in production output. This means that utilities must account for substantial changes not only in how they serve load, but where they serve it from," Mount said.

"Utilities must also consider how to transition operations away from existing fossil fuel-fired generation resources," Mount continued. "Increased contributions from intermittent resources bring new operating requirements for fossil plants, such as more frequent and rapid ramping, and reduced operating hours. Some markets may even see negative power pricing: generators paying the market for the privilege of

generating power during periods of peak renewable production."

Leadership for Improved Planning

The growth of DERs is a leading reason why utility business models must evolve, to an extent comparable to the way the telecom industry has shifted in recent decades. Enthusiastic and involved C-suite leadership is essential to foster necessary cooperation and integration across the enterprise.

"All utilities are heading in the same direction with DER growth. It's just a matter of how fast," said Mount. "If utility executives don't embrace and address this industry transformation, then planners are more likely to miss opportunities, or to select investments that rapidly become obsolete."

Where is a good place to start when reorienting planning practices? One practical option is for the strategic planning team to focus on DER impacts and options — such as microgrids, energy storage and aggregation, as well as control options for distributed generation storage and demand reduction. This can motivate operational departments to gather and analyze more information than was required when DERs were treated as load reduction.

"Siemens is helping many utilities start down the road to transforming how they handle planning. You absolutely can begin with what you have now," said Mount. "You don't have to throw out all your models and methods and start over. You can progressively migrate toward more integrated and automated processes."

A helpful first step that Siemens recommends is to conduct a "gap analysis" for utility planning capabilities. For instance, in the next two to three years (and beyond), which models, data, software and processes will a utility need to accurately assess and address emerging needs? Consultants can help familiarize utility planners with newer tools and strategies, and how they might be used.

"The planning process is only as good as the data you put into it," Vicinus emphasized. "Transformation must begin at the strategic plan level. That will support the need for new infrastructure to support planning: more smart meters, new models and improved data integration."

“With enhanced planning tools and integration, a greater goal can be realized: real-time (or near real-time) planning. This leverages modeling and automation to enhance day-to-day operations.”

Better Planning Yields Better Operations

With enhanced planning tools and integration, a greater goal can be realized: real-time (or near real-time) planning. This leverages modeling and automation to enhance day-to-day operations.

“Ultimately, integration of planning and operations will be required,” said Mount. “Real-time planning supports operational decisions. For instance, say you’re facing an impending contingency condition, and considering options such as demand reduction or activating a fossil-fired unit. Real-time modeling can help to assess other available options that might relieve system issues. At the very least, this could minimize the amount of demand reduction needed.”

In the figure below, Siemens demonstrates how integrated DER planning tools and information can feed operational systems, in a continuous loop. Streamlining these processes, along with building appropriate interfaces between systems, helps utilities reap the full value from distribution grid assets, while ensuring greater reliability.

Models can support effective planning only if they’re kept up-to-date. Thus, clear processes for updating the models are essential — especially when these same models also can support daily operations.

Siemens Advanced Utility Planning & Operations Platform

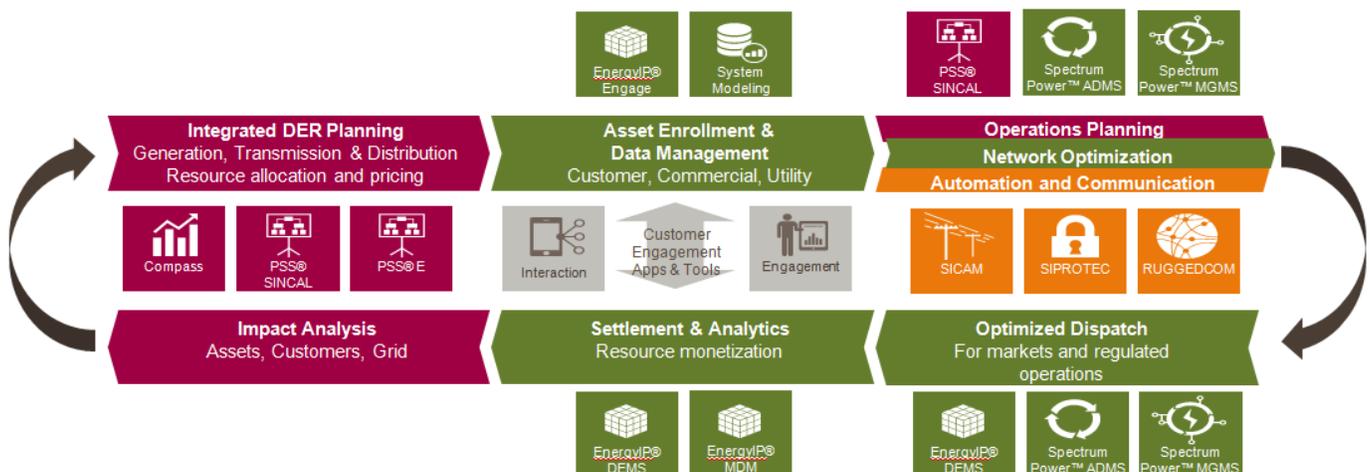


Figure 1. Siemens Integrated DER Portfolio

However, many utilities aren't quite at that point yet. For instance, often the model for a distribution feeder gets updated only when the utility receives a request for an interconnection on that specific feeder. Effective operational decisions require much more frequent updates to planning models; data should be near real-time. Regardless of DER penetration, most utilities have room for improvement in how they manage models and data.

"I met with one utility that took the time to model how DERs were affecting their feeders. After they finished the study, they put the analysis on a shelf and forgot about it," said Hugo Bashualdo, Senior Manager, Distribution Planning and Microgrids at Siemens. "A year later, a feeder developed a problem — but the engineer who did that study was no longer in that department. So, they spent additional time and money to redo that study from scratch. And since they still have no update process in place, that revised study will probably get shelved and forgotten, as well."

Clear processes for updating models and verifying the data they include encourages staff ownership of accuracy. Substantial engineering time is wasted when models are not verified. Confirming field data about assets, loads and DER is an essential step that can be integrated into everyday operations, and changes can be registered as they occur.

"The core issue is about people and processes, not technology," said Bashualdo. "If people don't have a feel for the process and principles, it doesn't matter which technology you deploy; it will be useless. But with support from leadership, and good processes, planners and operators can make much better choices every day."

Conclusion: Roadmap to Integrated Planning

Integrating DERs more effectively into utility planning, and ultimately using planning tools to inform operational decisions, requires changes to utility culture, processes and technology.

As utilities navigate these changes, they might consider these key questions:

- What coordination currently exists between the strategic planning team and department-specific planning teams?
- Which planning activities might be streamlined or strengthened by implementing clear processes and automation?
- How might your utility benefit from applying planning tools and processes to operations, via digitalization?
- How can your operational teams better integrate real-time planning concepts into daily operations?

Siemens offers a structured approach to guide utilities through this evolution, including comprehensive capabilities supported by robust software tools.

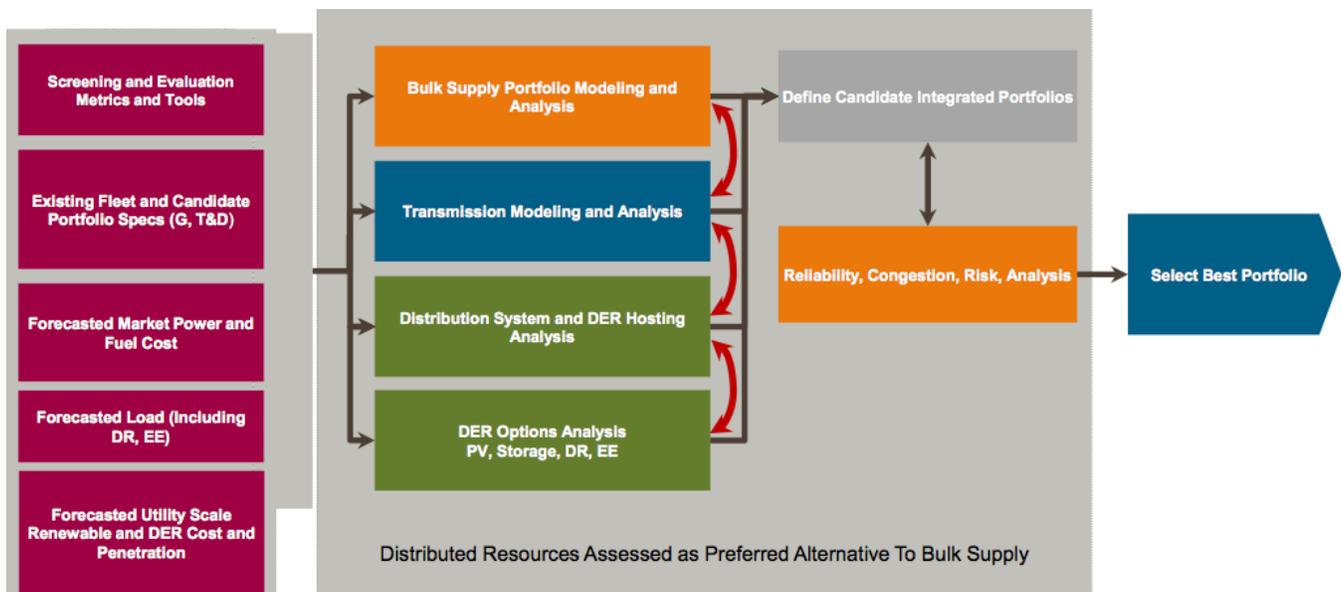


Figure 2. Siemens methodology for comparing DERs to bulk power supply

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