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EXECUTIVE SUMMARY

Product ID: 000000003002019111

Quantifying the Value of Distributed Energy Resources: A Streamlined Method for Determining the Locational Value of Solar PV on the Distribution Grid

Primary Audience: Utility distribution system planners

Secondary Audience: Utility staff involved in DER integration

Key Research Question

What are the categories of value that DERs can provide to the distribution system and which categories have the potential for the highest value? What are potential streamlined methods that could be used to do a system-wide assessment or screen?What are key factors that drive the distribution system value of DERs?

Research Overview

Key considerations for assessing DER value to the distribution system are initially outlined and several DER valuation methods currently in use are reviewed. The steps involved in an example streamlined method for calculating the locational value of solar PV to address thermal overload constraints are then illustrated. The example streamlined method is then applied on two test feeders, and results are presented and compared. PV coincidence factor, or the degree to which PV production overlaps with (and thus reduces) peak load, is discussed with examples of how the coincidence factor can be calculated along with the factors that impact its calculation. Several modeled sensitives are also provided to illustrate the impact that coincidence factor has on the locational value of PV.

Key Findings

- The first step in determining the value of DER is identifying where and when a utility needs to make an investment or incur an expense in pursuit of its service obligations. For example, a source of value is dependent on the forecast for load growth and the resulting overloads that can be relieved by DER.
- The value of DER is driven by the avoided cost of the next best alternative that can adequately serve the identified need.
- The value of DER is location dependent. The optimal PV size tends to be lower for nodes where the hosting capacity for PV is lower. Locations towards the end of the feeder, downstream of all overloads provide more value than those further upstream. In some locations, PV has no value because the size of PV needed to mitigate overloads exceeds the hosting capacity and would require more upgrades than it would avoid.
- The value of DER is dependent on the size of DER deployed. The optimal PV size for maximizing value tends to be the minimum size that can relieve overloads without necessitating additional upgrades to increase PV hosting capacity.
- The PV coincidence factor plays a significant role in determining PV value. If peak load occurs in the middle of the day or early afternoon, the coincidence factor of solar can be high. However, if peak load occurs at night, the coincidence factor of solar is zero. For instances when solar may help reduce the peak load, there are diminishing returns to the peak load reduction as solar penetration increases. Further, while there may be little to no adequacy of solar to reduce peak load at the customer level, the coincidence factor may be higher for assets that serve many customers and take advantage of load diversity. It is therefore important to quantify the feeder specific coincidence factor and contributions from factors such as PV penetration level and the number of customers downstream of overloads to accurately calculate locational value of PV.

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Why This Matters

Rising penetrations of grid-connected DER are spurring interest in developing novel valuation mechanisms for these resources. As a result, there is growing interest in developing streamlined methods that forgo the need for detailed analyses but are able to identify potential locations on the distribution system where NWA projects can provide value.

How to Apply Results

The streamlined methodology can be employed by utilities and applied to distribution feeders to identify locations where DER can provide value.

Learning and Engagement Opportunities

- This analysis will be implemented in subsequent versions of the DRIVETM tool. Updates are available via the DRIVE users group (3002011081)
- The supplemental project "Modernizing Distribution Planning Using Automated Processes and Tools" (3002014735) is developing a tool for automated distribution planning which includes detailed NWA analysis that could be informed by the streamlined methodology developed in this report.

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Programs: Integration of Distribution Energy Resources (P174D), and Distribution Operations and Planning (P200E)

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