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INTRO TO VALUE OF DER

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OUTLINE

- What are Distributed Energy Resources?
- How does DER affect the distribution grid?
- Potential Value Created by a DER
- How to measure DER value?
- Value is Locational
- Need for a Framework to Assess Value to the Grid
- Conclusions

WHAT ARE THE DISTRIBUTED ENERGY RESOURCES?

The IEEE 1547 Standard defines DER as: “a source of electric power that is not directly connected to a bulk power system. DER includes both generators and energy storage technologies capable of exporting active power to an EPS. An interconnection system or a supplemental DER device that is necessary for compliance with this standard is part of a DER.”

This definition is general and includes generation resources including inverter based and rotating machines, as well as energy storage devices. Because DER is not connected to the transmission system, it typically refers to smaller amounts of generation or storage. Though it does not have a direct export capability, demand response is often considered in the DER category.

HOW DOES DER AFFECT THE DISTRIBUTION GRID?

DER can provide contribute to benefits of distribution grid by:

- Providing real and reactive power to areas where otherwise the forecasted demand would surpass the system's capacity or to address reliability or correct voltage on feeder, requiring grid investments

DER integration also possess challenges to grid that was not originally designed to host DER, potential challenges may include:

- Voltage (overvoltage, flicker)
- Thermal (over current)
- Protection (coordination, loss of reach, back-feed)

POTENTIAL VALUE CREATED BY A DER

CONSUMER	Total Energy Costs
	Demand Charges
	Consumer Green Lifestyle
	Consumer Back Up Generation
DISTRIBUTION SYSTEM	Distribution Capacity
	Voltage
	Reliability
TRANSMISSION SYSTEM	Transmission Capacity
WHOLESALE ENERGY MARKETS	Losses
	Congestion Costs
	Generation Energy
	Ancillary Services
	Resource Adequacy
	RPS Procurement
SOCIETY	Societal Avoided Costs
	Public Safety Avoided Costs
ENVIRONMENTAL	Emissions
	Waste Products
	Water Pollution
	Siting

Value to Distribution Grid

- DER value is realized by various parties.
- Several categories of value are potentially realized from DER
- Few value streams are associated with values to distribution grid
- Value streams realized are dependent on DER location and type

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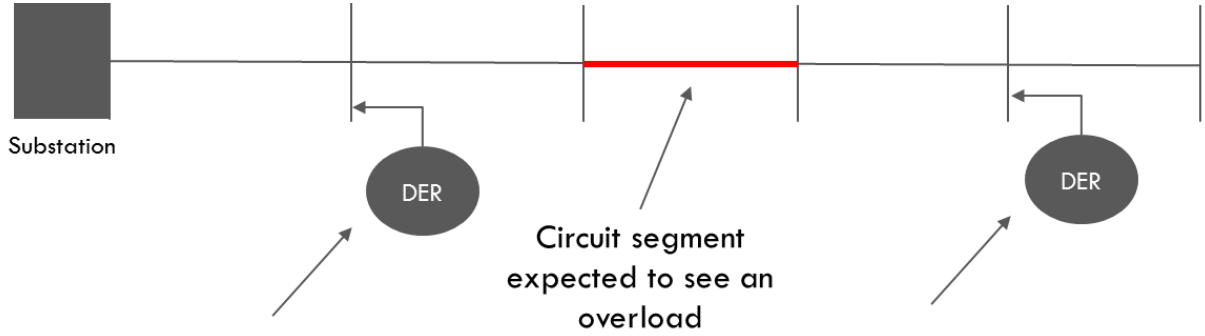
HOW TO MEASURE DER VALUE TO DISTRIBUTION GRID?

- Much of the value DERs provide varies not only by each of the approximately 5,500 feeders on the ComEd system, but potentially within a given feeder.
- The reason is that if we need additional capacity to meet peak demand, that capacity is needed to provide electricity to a particular set of customers in a specific location.
- That capacity is also needed at a precise moment when the peak demand is present. In other words, when the DER is available has a significant impact on its value.
- We then identify how much traditional grid improvements (e.g. replacing transformers) would cost to address the projected overload. We use this to identify how much monetary value the DER provides in avoiding distribution investment.

VALUE IS LOCATIONAL



Upstream DER: Provides no value to mitigate projected overload.

Downstream DER: May be able mitigate projected overload depending on the DER type (i.e. generation pattern).

- The value of DER to the grid cannot be determined by system, or even necessarily feeder averages.
- If there are no constraints on the feeder (e.g. segment that is expected to see an overload), DER will have no value in deferring a distribution investment.

NEED FOR A FRAMEWORK TO ASSESS VALUE TO THE GRID

A framework for assessing the Value to the Distribution Grid needs to:

- Establish a value of DER to the Distribution Grid only
- Provide a mathematical formulation to calculate the Value of DER based on the location
- Provide a mathematical formulation to calculate the Value of DER compared to annualized cost of traditional distribution investment
- Utilize annual hourly ("8760") time-series analysis to calculate the Value of DER, which means that the time profile of DER output will be considered to understand the temporal impact
- Be able to consider all DER types and should treat them fairly what, where and when the DER provides
- Avoid under/over compensation of DERs and consider the cost to integrate in parallel with the benefits

CONCLUSIONS

- Accurate DER valuation is a complex process
- Not all DERs are able to provide Real Power, Reactive Power, and Reserves as core products to the grid at all times.
- Value of DER to the grid is largely dependent on DER capabilities, as wells as location, and time of production? (What?, Where?, and When?)
- Detailed engineering analysis is needed to establish a value reflective of deferral of costs associated with traditional upgrades