QUANTA TECHNOLOGY

DISTRIBUTED ENERGY RESOURCES

Advisory Services

Value of DER as Non-Wires Alternatives (NWA)

Distributed energy resources (DER) offer the promise of an alternative to conventional utility investments such as new lines, substations, and transformer upgrades. Meanwhile, non-wires alternatives (NWAs) represent both investments and operating practices by electric utilities to defer or avoid traditional transmission or distribution solutions and may include energy efficiency, demand response, and DERs (including storage). NWAs can be evaluated according to multiple metrics including cost, use cases, dispatchability, and environmental implications. Modern grid planning tools and processes are starting to incorporate NWAs.

DER Valuation

Several states are pursuing formal approaches to valuating distributed energy resources (DER). This valuation of NWAs is in the utility planning stage, the same concept that is the starting point for all such initiatives. NWA analysis includes identifying all value that can be derived from DER, including:

- Energy cost savings
- Emissions reduction and other environmental benefits
- Local customer-level reliability/resiliency
- Avoided T&D capital and operating costs

Avoided T&D costs are the "Value to the Grid" and a focus of much attention.

DERs are connected to distribution feeders (substation secondary-side and lower) but contribute to constraints/violations in either T, D, or both sides of the grid.

DER Valuation

Representative applications of our NWA expertise and methodology is summarized below:

- ComEd: Locational valuation concepts have been developed, formulated, and prototyped; planning tool in process
- IOU (New York State): LMV for sample feeders analyzed to be used in a locational market pilot; assessment of storage pilot projects as NWA; part of their DISP filing
- IOU (Northeastern US): Development of Storage as NWA Planning Tool Suites for distribution and sub-transmission system
- Mid-Atlantic IOU: Assessment of storage as NWA for capital grid project; regulatory filing support
- California IOU: Assessment of storage pilot projects under CED EPIC
- Midwestern IOU: Next-gen planning tool for locational valuation capable of portfolio optimization, as well as thermal violation and reliability analysis of meshed sub-transmission networks

The Spectrum of Approaches

DER is compensated by type, by circuit voltage level, and by region	DER is compensated based on distribution grid needs at a given location and time	DER is planned/engineered to mitigate specific grid issues and can be compared to traditional grid alternatives

The primary tradeoff when moving along the spectrum is accuracy, standardized compensation and ease of administration

DER Valuation Methodologies

DER valuation is based on three principles:

- Efficiency: Where DERs can provide a value to the distribution grid, they should be compensated for doing so. For example:
  - Deferring large investments to accommodate for changes in load or to increase renewables hosting, or to improve local reliability
- Accuracy: DER should be compensated for services they provide to the T&D grid, including:
  - Addressing different characteristics/capabilities of different DER technologies
  - Addressing differences in locational and temporal value of DER
- Equity and fairness: Limit impact to non-participating customers and avoid over-compensation and distorted market signals:
  - Avoid double-counting when some sources of DER value are compensated elsewhere
  - Non-participating customers should not be harmed in terms of cost or grid performance

There are three ways DER can provide value to the grid:

- Real Power: Providing locational load (capacity) relief by reducing net consumption during peak
- Reactive Power: Providing voltage (volt-var) support to maintain voltages within limits
- Reliability/Reserve: Providing standby capacity that can be used during emergencies or to backup variable DER

Quanta Technology has a process to incorporate DER into the NWA valuation framework through the following steps (these can be customized to meet a utility's needs):

- Step 1: Develop forecast scenarios for future planning period. Evaluate T&D system to identify binding constraints that would normally result in capacity projects.
- Step 2: Evaluate the "best" traditional grid investment alternatives to address each binding constraint
- Step 3: Calculate the "Allocated Cost of Capacity" (ACC) for each alternative per the magnitude of the constraint violation (real power, reactive power) on an hourly basis. The ACC must reflect deferral periods, benefit calculation periods, and avoided costs.
- Step 4: For each constraint, use the ACC as a penalty for violating the constraint and solve for Locational Marginal Value (LMV). These LMV are the value of generic DER at each node reflecting each DER's value against the constraints and the ACC
- Step 5: Calculate least-cost generic DER as well as DER portfolio dispatch via an optimal power flow (OPF), using calculated LMVs, specifics of DER technologies, and feeder and DER capacity constraints.
- Step 6: Perform cost-benefit analysis and risk assessment for traditional solutions vs. DER as NWA

Why Quanta Technology?

The value of DER and storage has been formalized or mandated for examination in some jurisdictions. Quanta Technology experts have been leading the industry charge in the Valuation of DER as NWA through direct collaboration with key utilities and our industry-recognized thought leaders. Through this collaboration, Quanta Technology has developed a proprietary valuation software package that provides analysis based on a complete picture of DER value and cost attributes coupled with the necessary mathematical rigor for large capital investments. It also interfaces with most standard utility-planning software. Quanta Technology experts provide independent, objective, and practical advice and develop solutions with unique business, regulatory, and technical expertise and best-practice know-how.

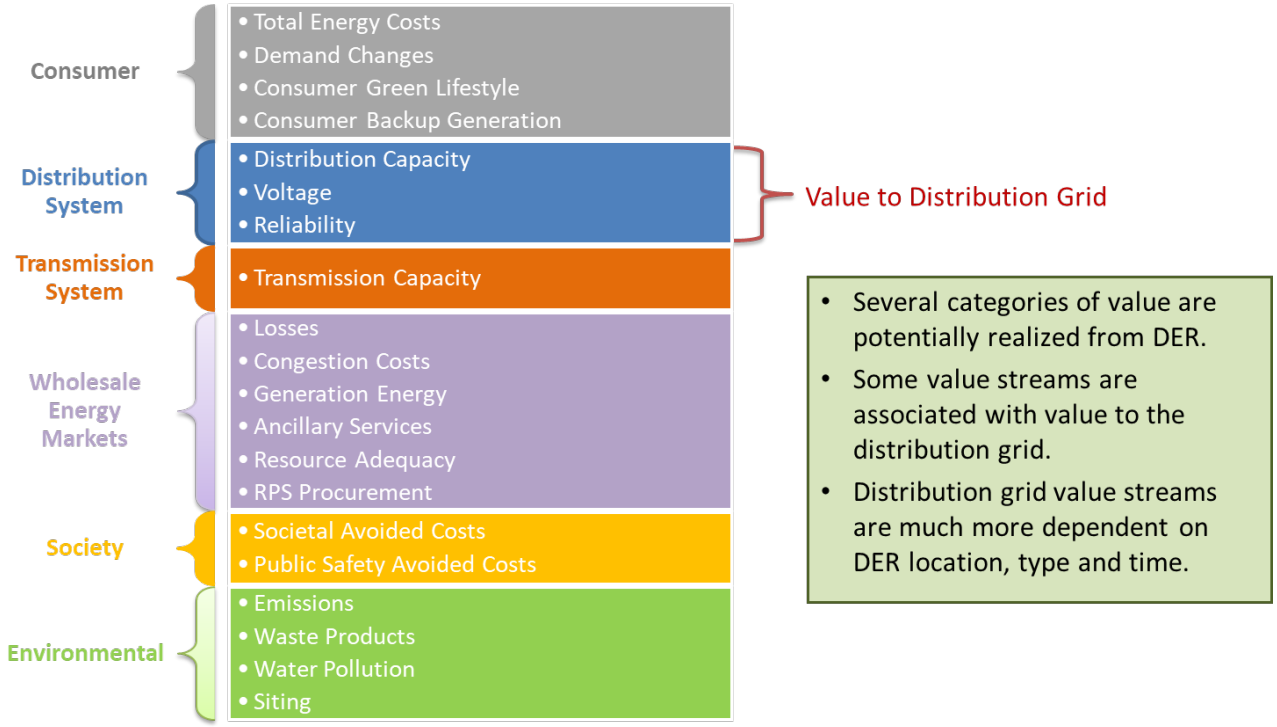
NWA Selection Methodology

There is a spectrum of approaches that can be taken depending on whether a more generalized or more granular approach is required. This is depicted in the figure below. Quanta Technology can work to help assess the best approach for a utility.

NWA Selection Toolset

- Through the collaborative efforts of Quanta Technology, Commonwealth Edison (ComEd), and others – in response to Illinois ICC inquiries regarding value of DER to the grid – a methodology was developed to help determine that the DER value is efficient, accurate, and fair.
- A software tool, DERVT, has been developed to assist in the valuation process. Features of the tool include:
  - All modules and modeling components are transparent and allow evaluation of different concepts and approaches. This provides a unique capability to carefully investigate certain aspects of the methodology and understanding of the problem and the solution.
  - Several features of the tool incorporate automation, flexibility, and computational efficiency.
  - DEVRT can be seamlessly incorporated into a utility's planning process and to serve as an additional analytical utility-planning tool.

Potential Value Created by DER



- Several categories of value are potentially realized from DER.
- Some value streams are associated with value to the distribution grid.
- Distribution grid value streams are much more dependent on DER location, type and time.

About Quanta Technology

Quanta Technology is an independent technology, consulting, and testing company providing business and technical expertise, along with advanced methodologies and processes, to utilities and others in the power and energy industries. Our mission is to provide unparalleled value to our clients in every engagement across the value chain by using advanced software and hardware, laboratories, and custom tools for a holistic approach to practical service and the most insightful thought leadership in the industry.

For Additional Information Contact:

Northeast (USA) and Québec
Mike Longrie: MLongrie@Quanta-Technology.com

South/Southeast (USA) and Ontario
Diana Prkacin: DPrkacin@Quanta-Technology.com

Central (USA and Canada)
Evan Estes: EEstes@Quanta-Technology.com

West (USA and Canada)
Reza Nasri: RNasri@Quanta-Technology.com

International (outside USA and Canada)
David Elizondo: DElizondo@Quanta-Technology.com

Smart Solutions
Practical Results

QUANTA TECHNOLOGY