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Considerations for Designing and Operating Transactive Grids and Microgrids

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Outline

- Definitions of grids and microgrids
- Architecture and structure of transactive grids
- Market and control considerations
- Business considerations

Physical Grids and Microgrids

- Examples:
  - Building microgrids
  - Neighborhood microgrids
  - Office and Industrial microgrids
  - Military microgrids
  - Devices microgrids
  - Regional grids such as the Western Interconnection
  - Continental grids
- Physical Grids/Microgrids fluid structure

Architecture and structure of transactive grids

- A *transactive grid* is a *physical grid* where transactions coordinate parties' grid related investments and operations
- Transactions are binding contracts for grid products
- Keep product definitions simple
- Unbundle energy and transport products
- Virtual Top Node (VTN) Virtual End Node (VEN) structure for DR limits transaction partners and the realizations of the benefits of transactive grids

Market and control considerations

- Forward and spot transactions coordinated investments and operational control.
- Completely centralized control is impractical
- Hierarchical aggregation – end use DR and distributed resources aggregated as virtual power/storage plants and dispatched by a TSO and DSO – complex, approximate, conflicting and dependent on estimated baselines
- Two-way retail subscription tariffs for energy and distribution transport with automated bilateral transactions including peer-to-peer – recommended

Business Considerations

- Value is internal to actors especially for retail and distributed generation and storage
- To support liquidity two-way transport must be a separate product from energy products
- Early adopters will drive the adoption of transactive grids
- Microgrids are moving out of innovations to early adoption
- Transactive energy can help mitigate the risks of early adoption by providing more transaction opportunities to achieve the full benefits of microgrids.
- Using transactive energy to self-organize supports defense-in-depth mitigation of cybersecurity and privacy risks.

Conclusions

- Microgrids are the live test-bed of new technologies such as storage and transactive energy
- Diversity in technology, customers and developers and local markets challenge the central control model.
- Transactive microgrids enable site-based decision making with coordination
- Peer-to-peer markets pose challenges to current regulatory models but are easily solve with transactive energy
- Regulatory changes to encourage local energy markets are critical to our energy future