Decarbonized Grid Evolution

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The Office of the Grid

Electricity Delivery System

Office of Electricity

“The Office of the Grid”

Bulk Electricity Generation

Loads and Distributed Generation
The electric power system is undergoing a dramatic structural transformation. The electric grid, a vast complex machine, will require significant re-engineering.

The electric grid consists of multiple, interrelated structures: the physical, cyber, market, industry, and regulatory structures.
Problem Statement

Our ability to transform the electric grid to meet resilience, decarbonization, and equity goals will require a coordinated strategy that does not exist today

- Technological breakthroughs plus advances in system designs* are needed to enable envisioned future requirements.
- There is no central authority for exerting a consistent path for advancing the electricity delivery system, as current planning approaches are fragmented.
- Staged, “least-regrets” strategies for applying advanced grid capabilities/designs for incorporation into investment decisions made by regulators, utilities, and technology developers are needed, but do not exist.
- Formal approaches for incorporating resilience, decarbonization, and equity into utility planning processes do not exist.
- Leadership is needed to set guidelines for planning, market designs, and operational coordination within and across regions of the country and jurisdictions.

* For example, significant gaps remain in our understanding of how to model, simulate, and control systems with millions of intelligent fast-responding inverters
Grid Trajectory Considerations

Grid Trajectory Considerations

Capital Intensive
- Economies of scale
- Large-Scale Generation, High-Voltage AC/DC Grids + Storage
- Rigidity/Britleness

Tight Coupling
- Agile/Flexible
- High DER + Complex Industry Structure

Capital Diffuse
- Network economies
- Microgrids are a key part of the future Electric Delivery System, enabling more decentralization and DER integration
  - Current DER wave: PV, smart buildings
  - Next DER wave: energy storage, EVs, IoT

Next-Generation Electricity Network
- Control of flexible generation and load
- Energy storage
- Synthetic inertia
- Multi-directional power flow
- Varied/variable grid configuration

Strengthening the seam between the Eastern and Western Interconnections to encourage efficient development and utilization of U.S. energy resources.
Thank You

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