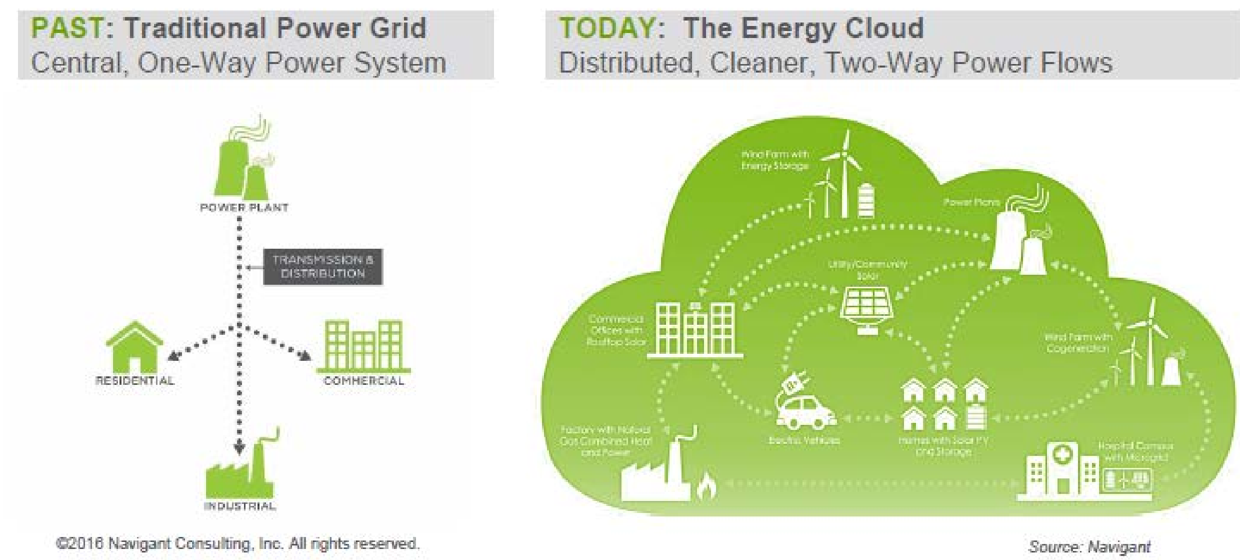
Climate Action Commission | Grid Modernization

Basic overview (including current status)

Grid modernization here refers to the electricity transmission and distribution system that is still at the early stages of a fundamental transition. The transition is from central-generation station in which electricity flows in one direction (from generation to customer end-user loads) to an environment in which electricity generation is distributed (at and near customer locations) and the electrons flow in both directions (to and from end-user 'prosumer' loads). Different terminology is used to describe the environment, including smart grid and the Energy Cloud, but the emerging system attempts to enable cost-effective deployment of new clean energy generation technologies with other new technologies such as batteries and well-managed flexible loads seamlessly integrated by grid operators and new agents like third-party aggregators and storage system developers and grid operators.



Key elements of the new system include a host of new technologies, including **distributed PV**, **battery storage systems**, advanced distribution system technologies like **advanced metering infrastructure (AMI)** and **SCADA** (monitors and controls on distribution system assets like substations). Other important technologies include the software platforms that can be used to dispatch batteries, advanced inverters, and loads for efficient grid operation. Other key elements of the system will likely include **dynamic and time varying pricing**, **locational incentives**, and new actors or agents, like **third-party aggregators and independent developers** that supplement and enhance the role of the distribution utilities and grid operators.

Vermont is already among the national leaders in the deployment of distributed generation, particularly solar PV. One key to the deployment of PV is the participation of third-party (non-utility) providers, but utilities have also been active in this space.   Vermont utilities have a number of pilot efforts looking at and deploying large and small battery storage systems for both added grid resilience and to offer and deploy new services.   Vermont utilities are mapping and engaging around the distribution system challenges that are associated with increasing penetration of distributed generation. Vermont utilities are already engaged in conversations around major areas that are affected by high penetration of renewable generation relative to export capabilities (northern Vermont's "SHEI" area).

Future trends (without additional action):

Future trends will be for added penetration of distributed generation (mostly PV) is increasing congestion on the distribution system network absent either a major grid build out or innovations in planning, incentives and markets helping to promote promising (and cost effective) non-wires alternatives. There is concern that an emphasis on wires solutions will result in more expensive solutions for ratepayers. Future trends suggests that there will be a gradual drift toward more storage solutions from traditional distribution utilities.

Potential opportunities & challenges:

The challenge and promise of flexible new loads (e.g., from EVs, heat pumps, more efficient water heaters, and cooling systems) may not be efficiently integrated into the system with resulting higher cost to ratepayers. Battery storage solutions will emerge at a steady pace, but the full range of potential use may face capital constraints and creativity of just a just a handful of key staff at our distribution utilities. Planning efforts by distribution utilities remain focused on the challenge of central station builds and/or bulk purchase power contracts, rather than managing the new and increasing challenges that are associated with bi-directional flows, locational constraints, time-differentiated mismatches between generation and loads, and limited network export capabilities.

Opportunities exist in the following areas:

- Long range planning re-focused on the integration challenges of renewable energy, and new transportation loads on the local distribution (and sub-transmission) system;
- Capital planning and investment focused on advanced grid requirements of the emerging system;
- Rate design that encourages customer and/or third-party customer or utility agents to manage load;
- Compensation arrangements for net metered systems, standard offer arrangements, and other forms of customer or independently developed projects that are differentiated by time or location to help;
- Utility load management using advanced grid software platforms;
- Third-party aggregators and developers that create value and additional entrepreneurial innovation (beyond that offered by the distribution utilities);
- Strategic development of new flexible loads that potentially provide value to the grid and advance state targets for renewables and GHG reduction;
- Develop market mechanisms that increase transparency and effective participation by customers and third party aggregators and developers.

Technical potential

The technical potential is only limited by existing, but declining pre-existing loads, and potential new loads available from electrification buildings and transportation.

Links for more information