

T&D Grid Modernization

A Brief Primer on Modernization Activities from Around the Globe

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USAID/USEA Webinar Series on Grid Modernization



EPRI Overview

EPRI's Mission: Advancing *safe, reliable, affordable* and *environmentally responsible* electricity for society through global collaboration, thought leadership and science & technology innovation

Thought Leadership



Industry Expertise



Collaborative Model



Grid Modernization

Utilities around the world are developing strategies to modernize their grids

Key Drivers

Decarbonization
Climate change
Extreme weather
Digitalization
Aging infrastructure

Common Goals

Safety
Flexibility
Reliability
Efficiency
Resiliency
Affordability
Sustainability



Grid Modernization Strategies

Grid Infrastructure

Asset life cycle management

Supporting Technology

Telecom, IT systems, and cyber/physical security

Digitalization

Information, data, and modeling

Operations

Systems, data, controls, and automation

Planning

Methods and tools

Workforce

New tools and skills



Grid modernization spans the industry, from infrastructure to technologies, data, processes, practices, and people.

Grid Infrastructure

Improved safety and resilience are major drivers for grid infrastructure modernization

- Advanced monitoring & sensing for asset health & maintenance
- Advanced overhead structures for reduced environmental impact and improved restoration
- Aerial imagery (UAV) for routine and emergency/disaster inspections
- Voltage Upgrading for meeting load growth requirements



EPRI/Utility Example: [Reducing storm restoration using super structure](#)

Information & Communication Technologies

Scalable, Secure, and interoperable Information & Communication Systems are essential to Operation of the Integrated Grid

- Telecommunications Infrastructure
- Cyber Security Assessment and Planning
- Enterprise Architecture and Integration



Digitalization

Providing actionable information to improve situational awareness and maximize system performance

- Analog to digital
- GIS
- AMI/SCADA/D-SCADA
- Data management
- Network model management
- Artificial Intelligence

Recent [Webinar Series](#) on the Digital Grid



Digital Grid Webinar Series

Modernizing Operations

Ensuring operational reliability and security by maximizing use of existing assets while leveraging new resources and technologies

- Automation and Control
 - Distribution automation
 - Distribution Management Systems (DMS)
 - DER Management Systems (DERMS)
 - Adaptive protection schemes
 - Wide-area damping controls
- T&D Control Centers
 - Pandemic resilient facilities
 - Optimized videowall or display designs
 - Paper-free and manual task automation
 - Improved, modern, modular IT architectures
- Situational Awareness
 - Improved monitoring and sensing
 - Standardized HMI designs and user interfaces
 - Intelligent alarm processing
 - Look-Ahead functionality
- Response & Restoration
 - Fault location, isolation, and restoration
 - Blackstart with renewables
 - Synthetic inertia
- Market Operations and Design
 - New resources (hybrid, storage, DER aggregation)
 - Supply resilience

Modernizing Planning

Focusing on new challenges to ensure safe and reliable services for all customers

- Processes and Criteria
 - Planning criteria
 - Reserve requirements
 - DER interconnection processes
- Tools & Analytics
 - Forecasting
 - Hosting capacity
 - Non-wires alternatives
 - Resource adequacy & flexibility
 - Risk-based analysis
- Grid codes and requirements
 - Voltage/var control
 - Frequency control
 - Inertia response



Addressing new challenges

- System resiliency
 - for high-impact, low-frequency events
- Integrated planning
 - Generation, transmission, distribution
 - Gas, electric, water, transport

Workforce

Equipping the workforce of the future with the skills and resources to meet the challenges of today and tomorrow

- Expanding roles and responsibilities require new skillsets
- Continued and evolving workforce training is essential to acquire and retain top talent



Starting the Grid Modernization Journey with a Roadmap

Why are roadmaps important?

- Structured process to map strategy to a modernization plan
- Defines overarching objectives and new capabilities needed
- Describes where a utility is versus where it wants to be
- Alignment with industry peers
- Defines a logical pathway for modernization – new tools, processes, systems, etc.



Roadmaps help define “no regrets” strategies for modernization, managing cost and risk, and providing customer value.

Recent Grid Modernization Roadmap Projects

Strategic Roadmaps

- Hawaiian Electric
- Southern Company
- Xcel Energy
- CPS Energy (In progress)
- Seattle City Light (In progress)
- TVA (In progress)

Roadmap Assessments

- DTE Energy
- Oklahoma Gas & Electric
- Salt River Project
- Hydro Quebec
- Consumers Energy (In progress)
- Manitoba Hydro (In progress)



Grid Modernization Across the Country

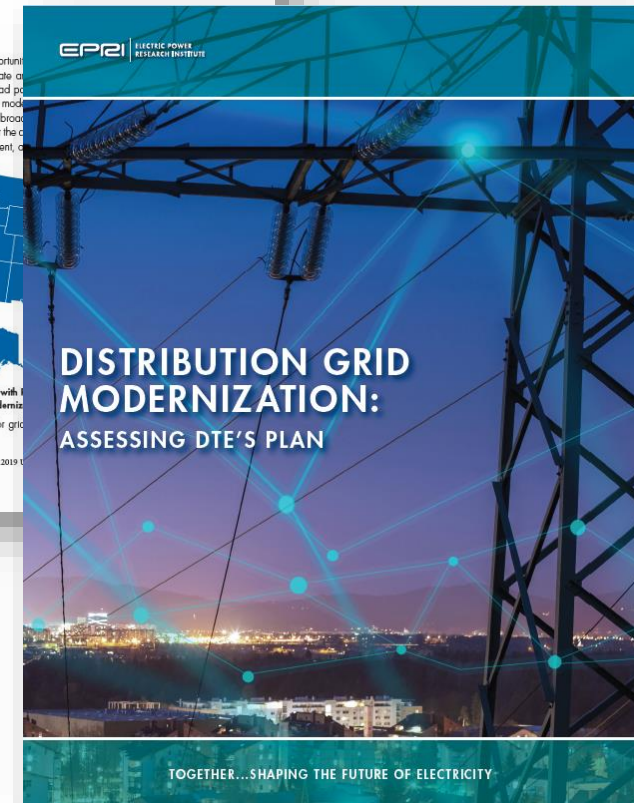
Grid modernization is happening

The distribution landscape is changing rapidly—introducing new opportunities and challenges. This change is being driven by the need to accommodate advanced technologies, changing customer expectations, changing load patterns, and the integration of distributed energy resources. Many utilities and states have launched grid modernization efforts to meet these challenges. Grid modernization is a broad term that generally refers to the application of advanced technology to meet the challenges of a modern grid. A modern grid is more fully integrated—highly flexible, reliable, resilient, and secure.

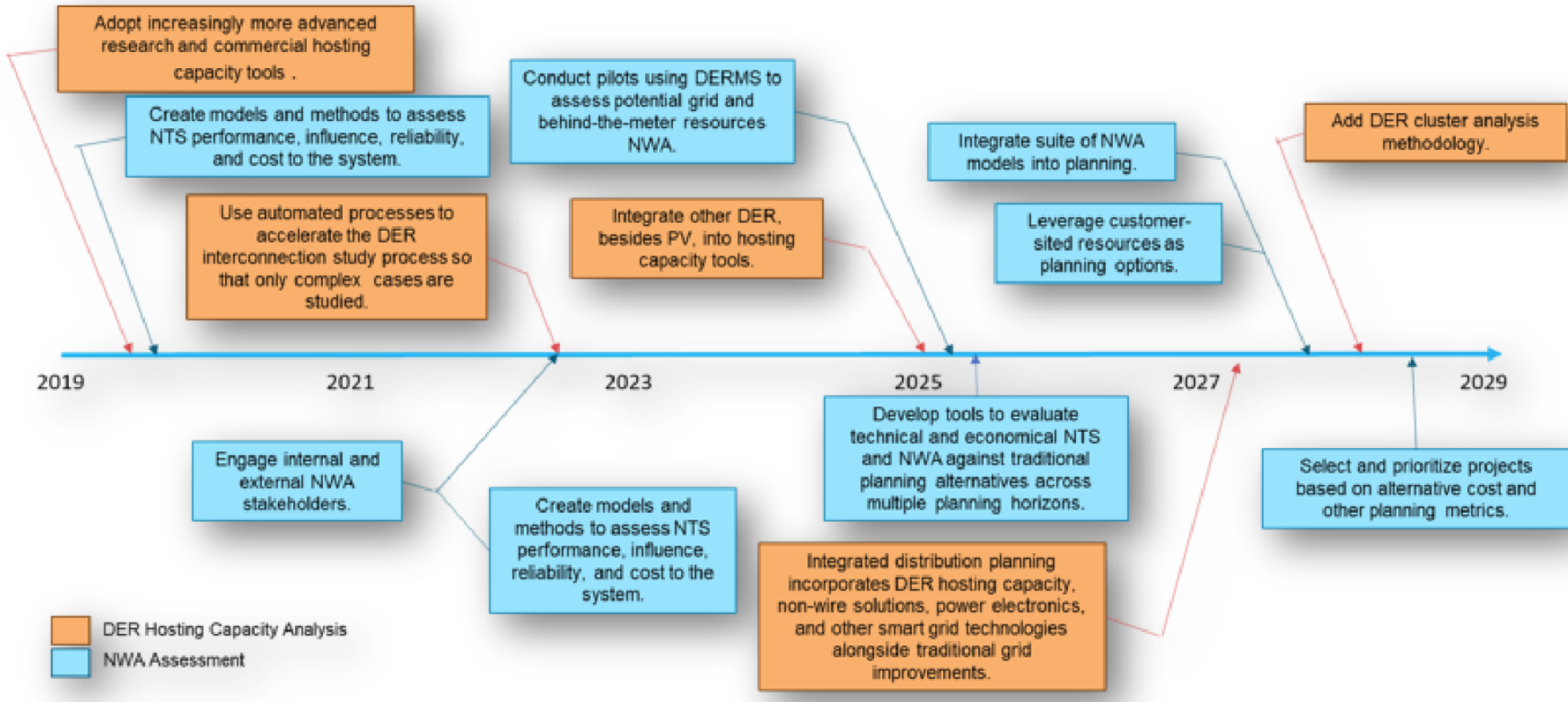
Over the course of 2018 and 2019, almost every state (Figure 1) has had regulatory or legislative efforts underway to modernize the distribution grid.¹ Some states, like California and New York, are several years into comprehensive modernization efforts and are actively integrating smart grid technologies, defining new planning and analytical methods, deploying new technologies to operate the grid, and developing processes to fully integrate DER. In other states, like Minnesota, the grid modernization efforts to date have focused more on future methods and tools for distribution planning. Ohio recently completed an initial roadmap for grid modernization through a stakeholder process called Power Forward. In North Carolina and Virginia, utilities have submitted revised grid modernization plans to their state commissions. In Illinois and Michigan, commissions have initiated more comprehensive modernization efforts and asked utilities to lay out their plans for grid modernization. Stakeholder input can be solicited.

Figure 1. States with Distribution Modernization Efforts

¹ North Carolina Clean Energy Technology Center, The 50 States of Grid Modernization: 2019 Update



Example Roadmap



A blue-tinted photograph of four people, two men and two women, standing in a row. They are all wearing white lab coats with the EPRI logo on the left chest. The woman on the far right is also wearing a white hard hat. They are all smiling and looking towards the camera. The background is a solid blue color.

Together...Shaping the Future of Electricity