

U.S. DEPARTMENT OF
ENERGY

Office of
Electricity



Office of Electricity Activities

US Department of Energy

Briefing for the State Energy Advisory Board

April 26, 2019

OE Mission

- **Provide national leadership to ensure a secure, resilient and reliable energy delivery system.**
- **Develop technologies to improve the infrastructure that brings electricity into our homes, offices, and factories.**
- **Support development of the federal and state electricity policies and programs that shape electricity system planning and market operations.**
- **Drive electric grid modernization and resiliency through research, partnerships, facilitation, and modeling and analytics.**

Key OE Priorities

North American Energy Resiliency Model

Megawatt Scale Grid Storage

Revolutionize Sensing Technology Utilization

Resilient Transmission Assets

OE R&D Program

Grid Controls and Communications	<i>Transmission Reliability and Resilience</i>	Synchrophasors		Advanced Grid Modeling	High-Fidelity & Low-Cost Sensors
	<i>Resilient Distribution Systems</i>	Advanced Distribution Systems	Advanced Microgrids	Dynamic Controls and Communications	
Grid Systems and Components	<i>Transformer Resilience and Advanced Components</i>	Advanced Power Grid Components			
	<i>Energy Storage Systems</i>	Energy Storage			

Focus of OE Technical Assistance Efforts

1. Focus TA around specific pressing issues where guidance, frameworks, and roadmapping would prove useful:
 - a) Technology investment strategies for grid modernization
 - b) Decision frameworks to guide resilience investments
 - c) Integrated planning processes (resource, transmission and distribution)
 - d) Economic evaluation of resource alternatives (portfolios)
 - e) Operational coordination across the bulk power, distribution, customer and merchant domains
2. Focused collaboration with N-Groups and internal DOE partners on addressing key issues

N-Groups

The N-Groups provide a platform to collaborate on important issues*

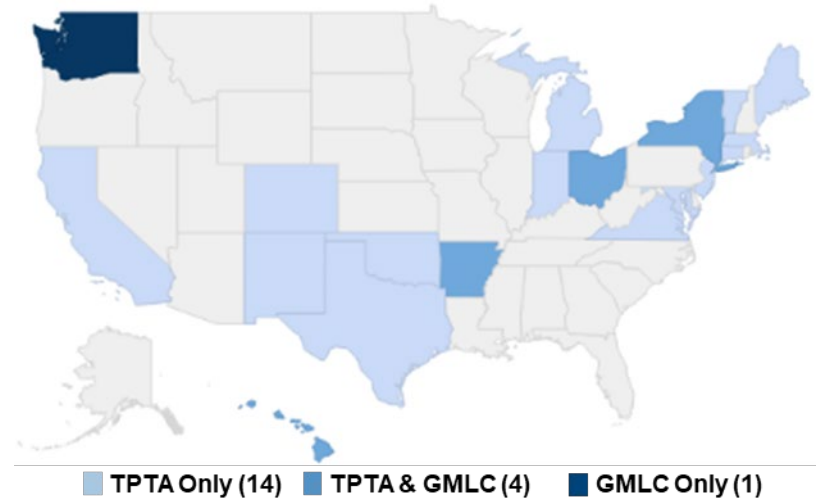
Organization	FY19 Focus
NARUC – National Association of Regulatory Utility Commissioners	Performance-based regulation and compensation mechanisms, rate design, electric vehicles, TA to Puerto Rico, integrated resource and distribution system planning (with NASEO)
NCEP – National Council on Electricity Policy	T-D coordination (incl planning, operations, and markets), grid evolution and modernization
NASEO – National Association of State Energy Officials	Grid modernization planning, advancing utility-scale storage, bulk power system modeling and planning, Stafford Act changes, electricity and natural gas issues, integrated resource and distribution planning (with NARUC)
NGA – National Governors Association	Smarter States – Smarter Communities Learning Lab, utility incentives, integrated distribution system planning, grid resilience
NCSL – National Conference of State Legislatures	Grid modernization and DERs, integrated resource planning, Energy Supply Task Force (incl natural gas delivery, nat gas and electricity market convergence, infrastructure challenges, workforce development, resilience)
NASUCA – National Association of State Utility Advocates	Fundamental training on many topics, incl distribution system planning and operations, application of new technologies

* through webinars, one-day seminars, workshops, conferences, reports, and co-managed initiatives

LBNL Technical Assistance to States

Direct TA Delivered to 19 States in FY18

(additional states served through regional workshops)



FY 18/19 TPTA-Funded Assistance:

- Approaches for using advanced metering infrastructure data for load forecasting and program evaluation for Indiana URC
- Training courses for state regulators and staff on distributed resources and state RPS for the MSU Institute
- Time-varying value of efficiency analysis for Michigan PSC
- Workshops on integrated resource planning practices for the Michigan PSC
- Briefing on the application of DERs for improving resilience for the New England Conference of Public Utility Commissioners
- Workshop on application of energy efficiency programs & policies for Hawaii PUC and SEO symposium
- Provided demand response resource assessment and modeling assumptions for Western Interconnection regional transmission expansion planning study
- Provided long-term electric utility planning assumptions to Western Electricity Coordinating Council via LBNL's Western Utility Resource Planning Portal created for WIEB
- Organized 5 regional workshops on integrated distribution system planning (with GMLC funding)

FY 18/19 GMLC-Funded Assistance:

- 3rd party demand response (DR) aggregation (AR)
- Utility investor valuation framework/incentives (CA)
- Performance-based regulation (HI, NY, RI, VT)
- Cost recovery mechanisms for DR (MN)
- Revenue decoupling (MT)
- Cost recovery for grid modernization (OH)
- Cost recovery for resilience & security (PA)



Future Electric Utility Regulation Series

A series of reports featuring *differing opinions* on major current and near-future electricity policy issues that are *not* settled.

These reports take a unique point-counterpoint approach to highlight different views on the future of electric utility regulation. Completed topics:

1. Electric Industry Structure and Regulatory Responses in a Distributed Energy Resources (DERs) Future
2. Distribution Systems in a High DER Future: Planning, Market Design, Operation and Oversight
3. Performance-Based Regulation in a High DER Future
4. Distribution System Pricing with Distributed Energy Resources
5. Recovery of Utility Fixed Costs: Utility, Consumer, Environmental and Economist Perspectives
6. The Future of Electricity Resource Planning
7. The Future of Centrally Organized Electricity Markets
8. Regulatory Incentives and Disincentives for Utility Investments in Grid Modernization
9. Value-Added Electricity Services: New Roles for Utilities and Third-Party Providers.
10. The Future of Transportation Electrification: Utility, Competitive Market and Consumer Perspectives
11. **Forthcoming: Utility Investments in Resilience**

<https://emp.lbl.gov/projects/feur>

DSPx Scope

Next-Generation Distribution System Platform (DSPx) Initiative is working with state commissions and utilities across the country

Phase 1: Modern Grid Report (began late-2015)

Volume I: Maps Grid Functionality to Objectives

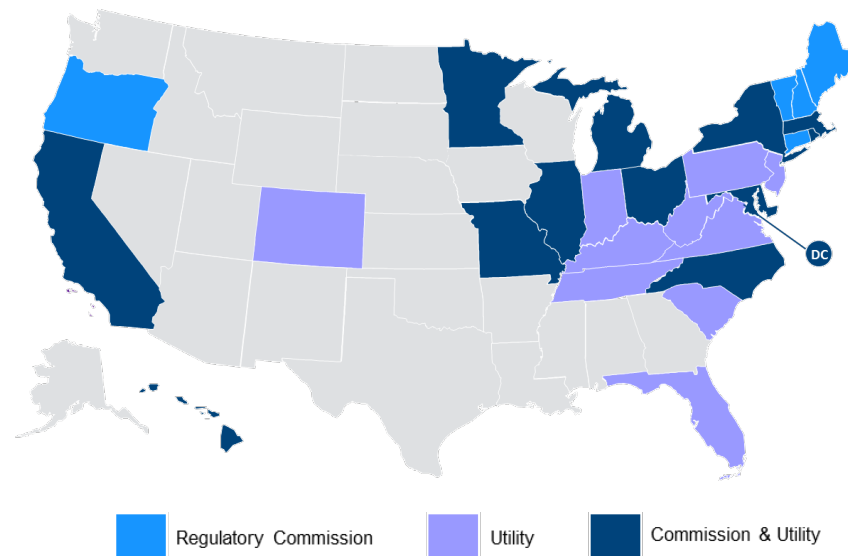
- Grid architectural approach that maps grid modernization functionality to state objectives within a planning, grid operations & market operations framework

Volume II: Assessment of Grid Technology Maturity

- Assessment of the readiness of advanced grid technology for implementation to enable functionality and objectives identified in Volume I (with technology adoption curves)

Volume III: Implementation Decision Guide

- Design and implementation considerations for deploying advanced grid capabilities: application of grid architecture, economic evaluation approaches, sourcing, proportional deployment

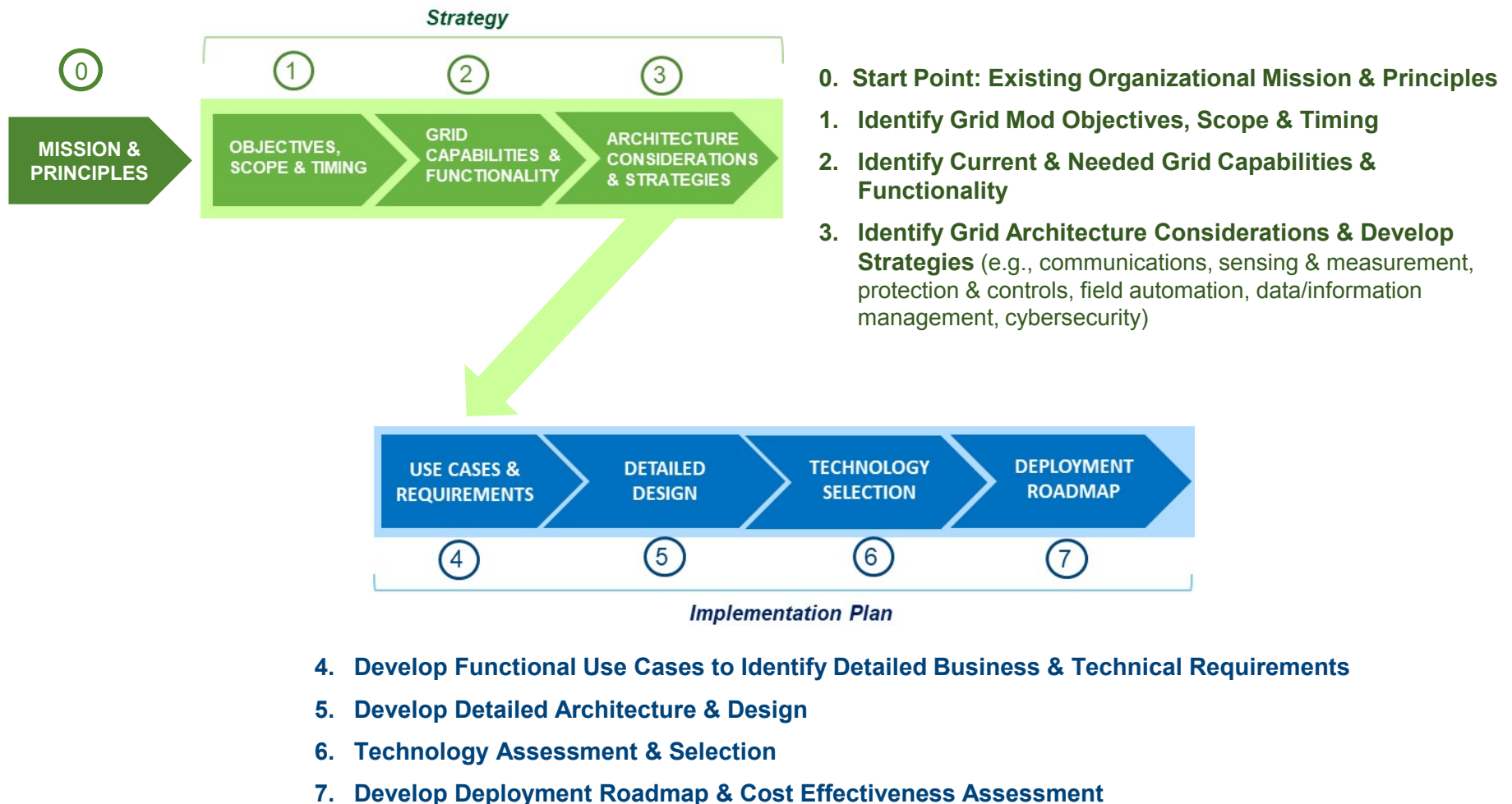


Phase 2: Modern Grid Guidebook (began in 2018)

- Provide a systems framework for the development of grid modernization strategy and investment roadmaps
- Cost-effectiveness approach
- Future grid workshop with EPRI (March 20-22 in Charlotte)

Grid Modernization Framework

Grid modernization strategy should inform the technology roadmap



Architecture Manages Complexity

The engineering issues associated with the scale and scope of dynamic resources envisioned in policy objectives for grid modernization requires a holistic architectural approach



So, pick-up a pencil



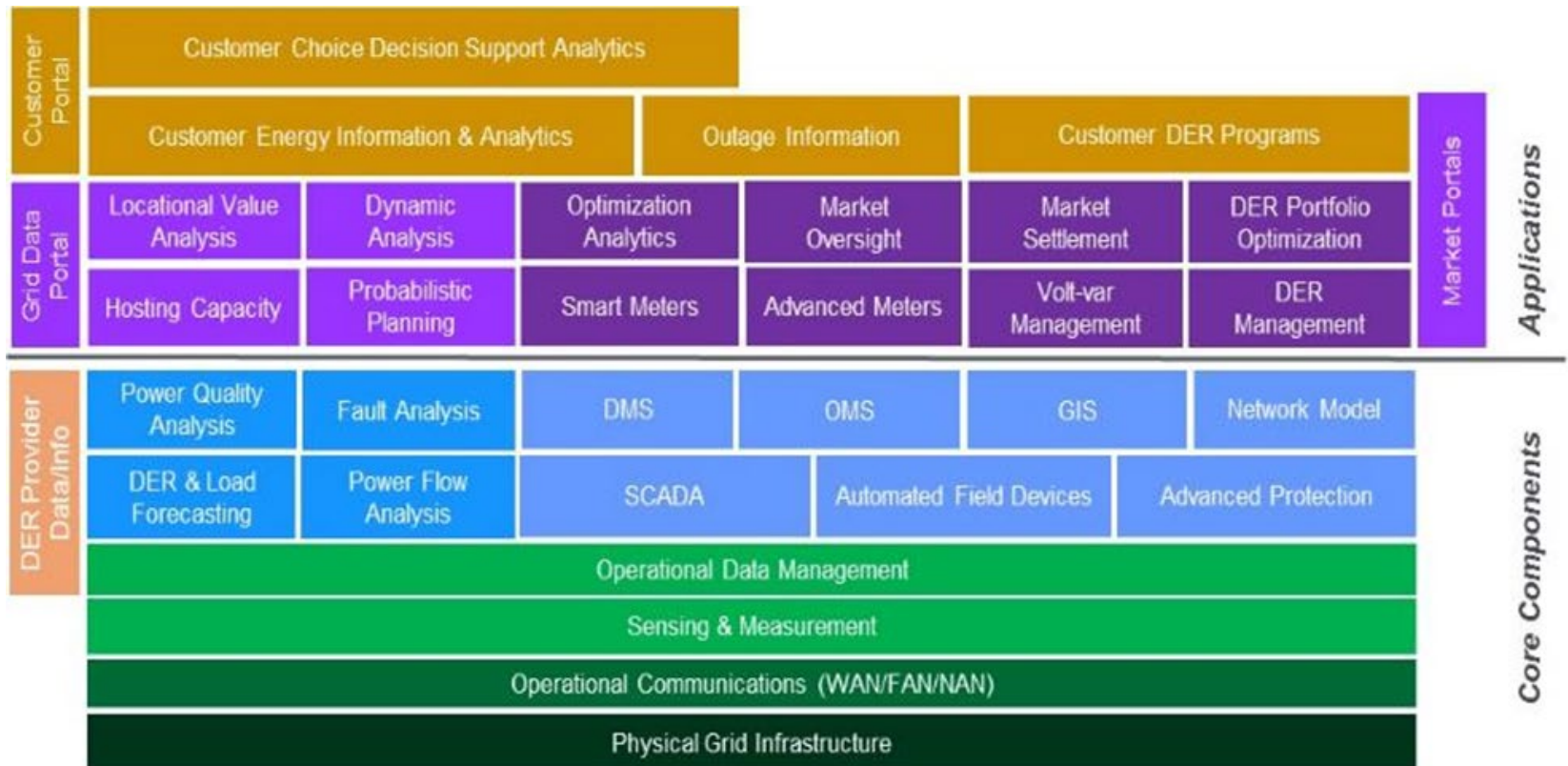
Before trying to
hang windows



Resist temptation to start with technology choices

Distribution System Platform

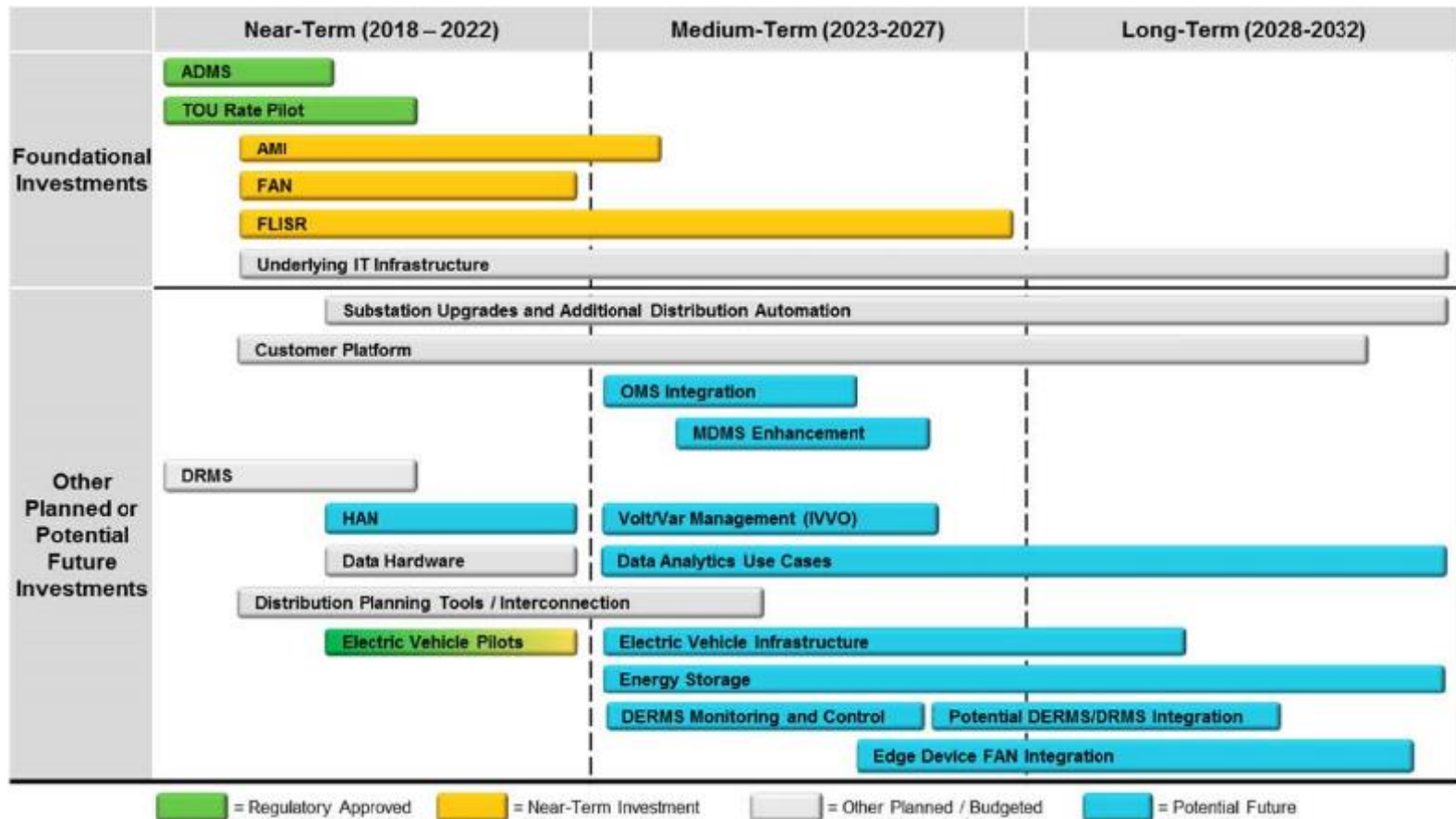
Core components are foundational; applications layer on this foundation as additional functionality is needed



From DSPx, Volume 3 – Decision Guide

Sequencing of Investments

15-year view of the planned and potential advanced grid investments presented in the Xcel Energy 2018 Integrated Distribution Plan



From the Xcel Energy 2018 Integrated Distribution Plan. Link:
<https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showPoup&documentId={E098D466-0000-C319-8EF6-08D47888D999}&documentTitle=201811-147534-01>

Guidebook Outline & Development Timeline

Summary Outline

I Introduction

Purpose of Guidebook, systems orientation, and structure of report

II Planning a Modern Grid

Role of integrated distribution planning to inform strategy development and implementation planning

III Modern Grid Strategy Development

Describe strategy development steps incl. architectural strategies

IV Modern Grid Roadmapping

Describe implementation planning process steps incl. technology management

V Grid Modernization Investment Economics

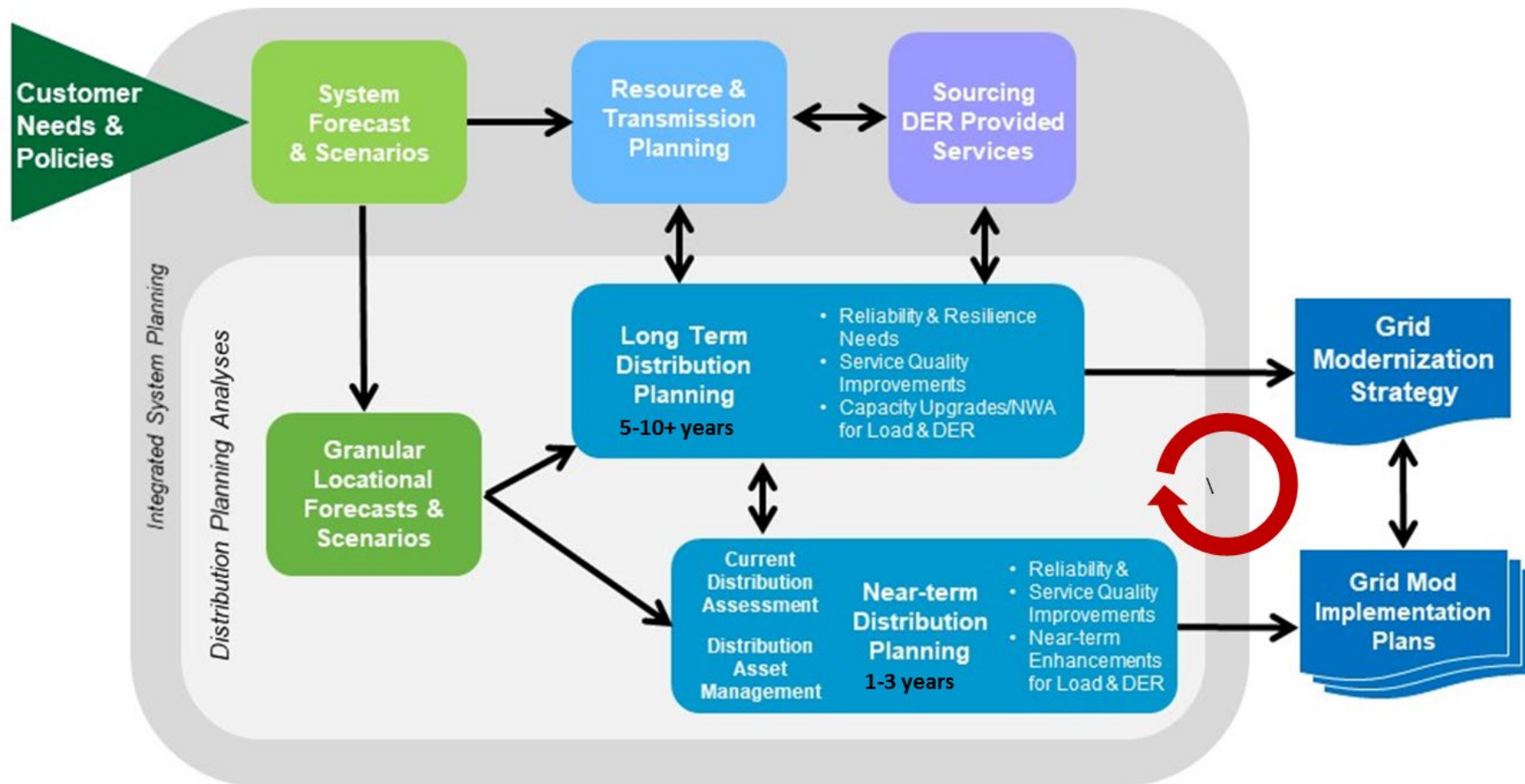
Expand on Vol. 3 framework including economic “lifecycle” of grid mod investments

VI Conclusion



Integrated Planning

Integrated planning identifies “Where”, “When” and “How Much”



Source: P. De Martini

NARUC-NASEO Task Force

Planning processes are uncoupled and do not permit a comprehensive assessment and optimization of bulk-level and distribution-level resources

- NARUC-NASEO Task Force on Comprehensive Electricity Planning convening state PUCs and energy directors in a 2-year initiative to align distribution, resource and transmission planning processes
- 16 states: Arizona, Arkansas, California, Colorado, Hawaii, Indiana, Maine, Maryland, Michigan, Minnesota, North Carolina, Ohio, Puerto Rico, Rhode Island, Utah, Virginia
- DOE providing organizational support, analysis and content development
- April 2019 workshop priority needs identified:
 - Grid modernization planning framework
 - Incorporating resilience into planning
 - Forecasting load/DER uptake, and scenario analysis
 - Resource options evaluation and optimization

Task Force Co-Chairs



Hon. Jeff
Ackermann, CO



Dr. Laura Nelson,
UT

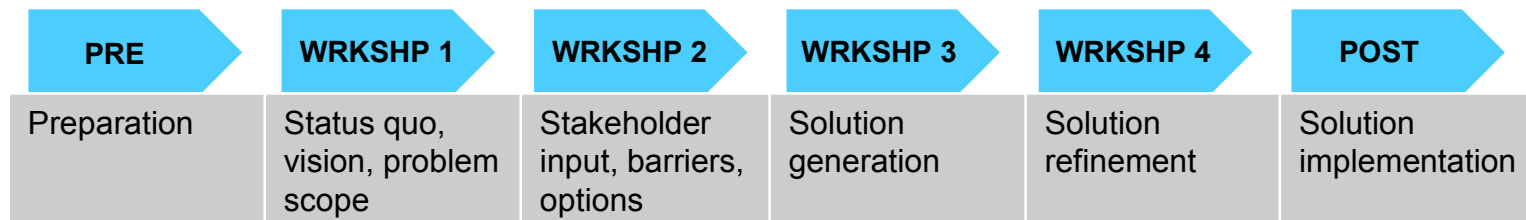
Task Force Co-Vice-Chairs



Hon. Beth
Trombold, OH



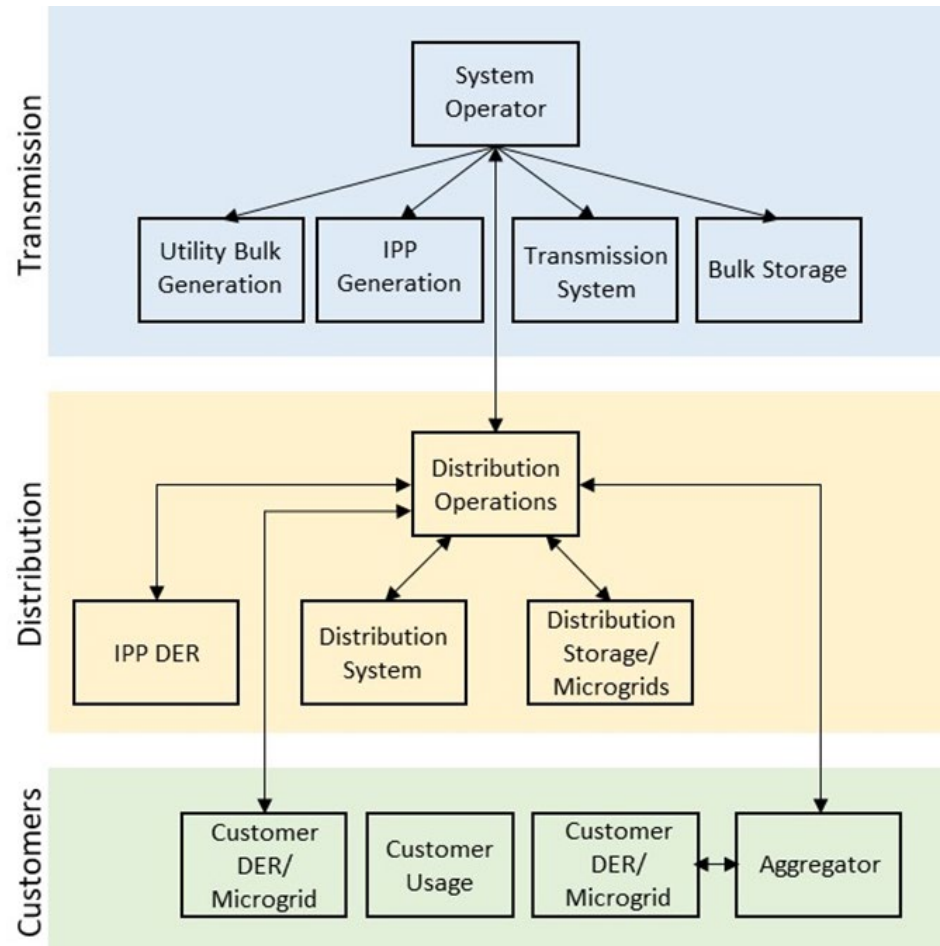
Andrew McAllister,
CA



Coordination Framework

A coordination framework should identify roles, responsibilities and information sharing requirements

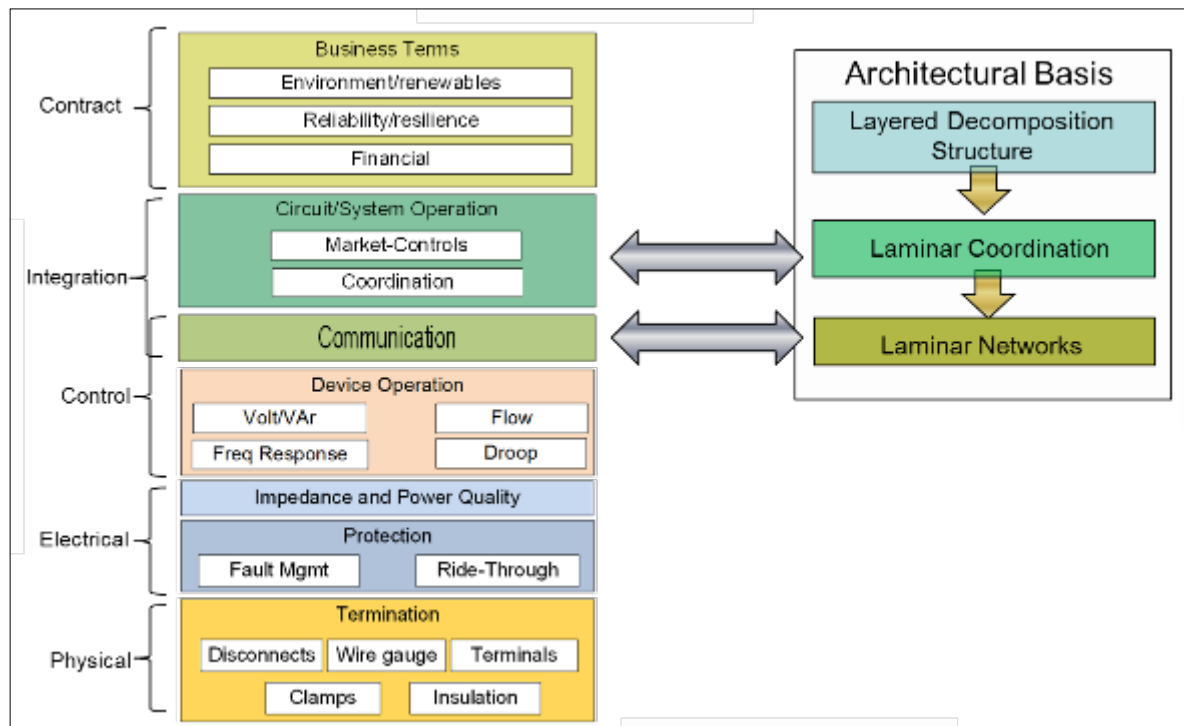
- TPTA has applied grid architecture principles to examine and compare emerging coordination models world-wide and in the U.S.
 - Observability
 - Scalability
 - Cyber security vulnerability
 - Layered decomposition
 - Tier bypassing
 - Hidden coupling
 - Latency cascading
- TPTA developing an evaluation process and set of decision-making guidelines to address evolving needs for greater coordination, including:
 - A rigorous stakeholder process (internal & external)
 - Developing a general distribution grid code
 - A maturity assessment of relevant standards and technology gaps



Transactive Grid Codes

Transactive Grid Codes contain physical and electrical requirements; control, communication and integration terms, and business rules

Transactive Grid Code Stack



Written by utilities to tell prosumers, building energy managers, energy service organizations, device/system vendors what requirements they must meet

From JD Taft, Architectural Basis for Highly Distributed Power Grids: Frameworks, Networks, and Grid Codes, PNNL-25480, June 2016

Thank You

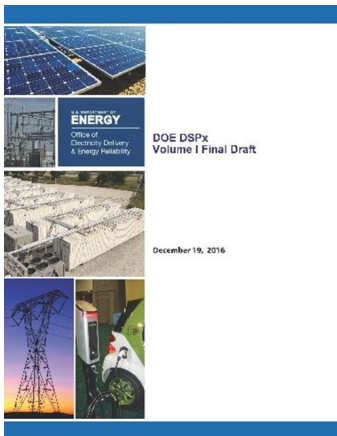
Contacts:

Catherine Jereza, catherine.jereza@hq.doe.gov

Joe Paladino, joseph.paladino@hq.doe.gov

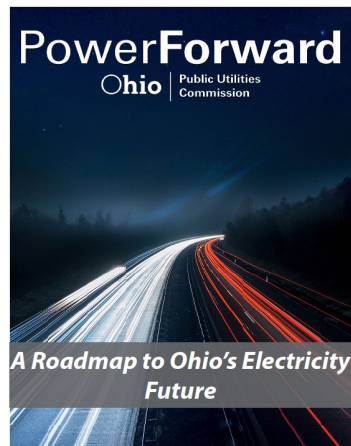
References:

Modern Distribution Grid Report



<https://gridarchitecture.pnnl.gov/modern-grid-distribution-project.aspx>

PUCO Grid Mod Roadmap



<https://puco.maps.arcgis.com/apps/Cascade/index.html?appid=59a9cd1f405547c89e1066e9f195b0b1>

**LBNL Future Electric Utility Regulation
Series Website:** <https://emp.lbl.gov/future-electric-utility-regulation-series>

PNNL Grid Architecture Website:
<http://gridarchitecture.pnnl.gov>

Grid Modernization Strategy Using DSPx



www.hawaiianelectric.com/gridmod