

DSPx: Planning for a Modern Grid

Paul De Martini

Newport Consulting

**Distribution Systems and Planning Training
for Mid-Atlantic Region and NARUC-NASEO Task Force on Comprehensive Electricity Planning
March 7-8, 2019**

Planning a Modern Grid

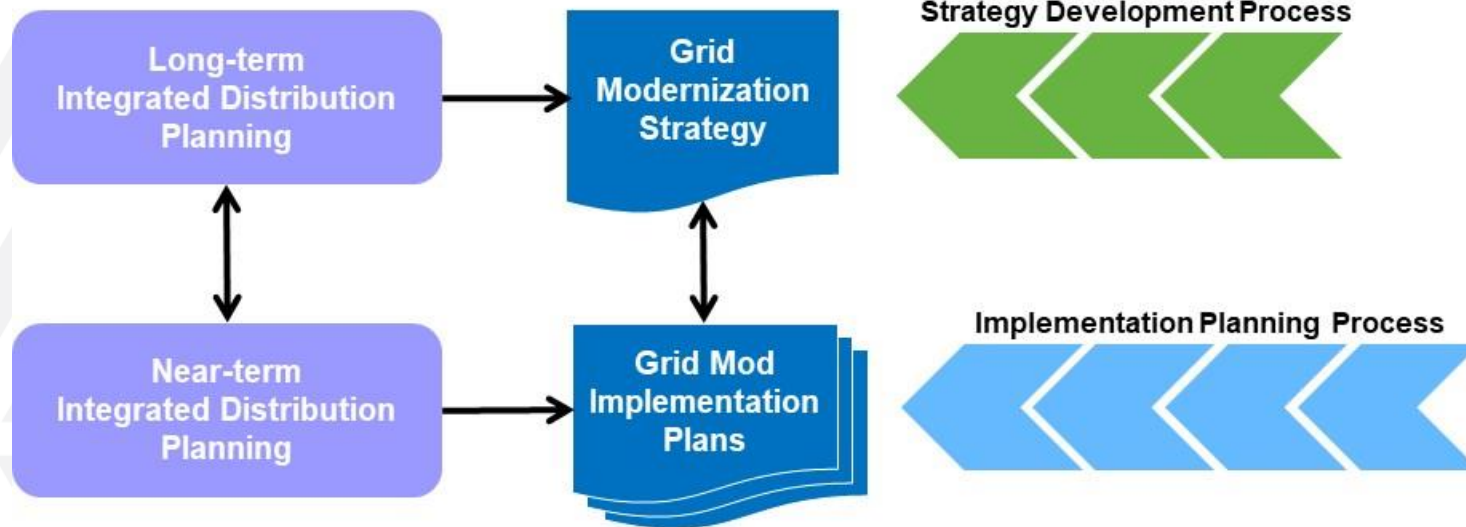
- ▶ The scope of planning has expanded from past practices focused primarily on deterministic load growth, reliability, safety and asset management to...
- Improving Reliability, Resilience, Safety and Operational Efficiency (incl. microgrids)
- Enabling DER Integration (incl. electrification)
- Utilizing DER services for grid operations (e.g., non-wires alternatives)



Integrated Planning & Grid Modernization

Planning for a modern grid is done through two primary processes based on customer needs & public policy:

- Grid modernization strategic planning
- Integrated distribution planning (IDP)

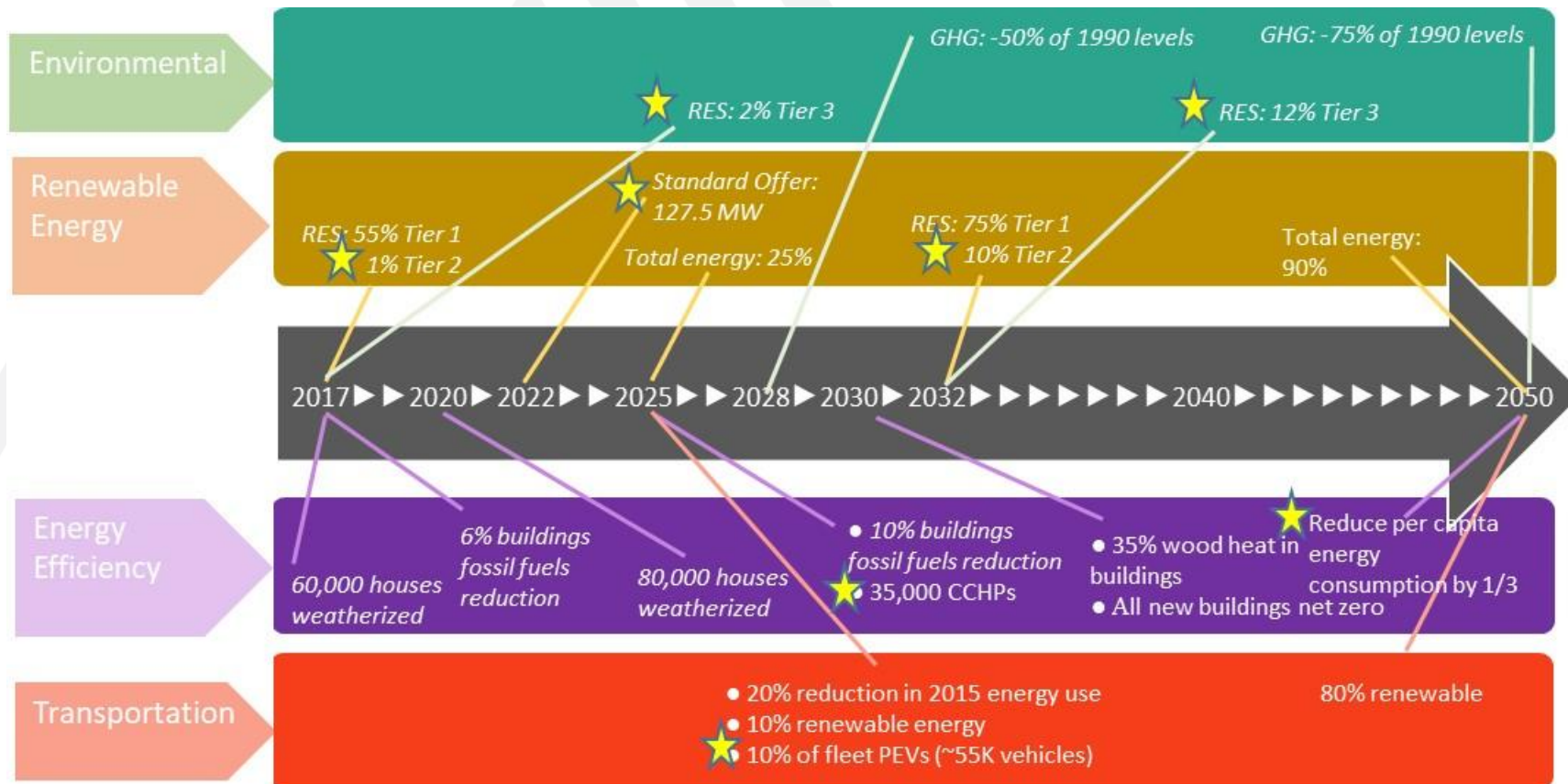


Grid Mod Strategy & Planning Process

Strategic planning process identifies “What”, “How” & “Value”

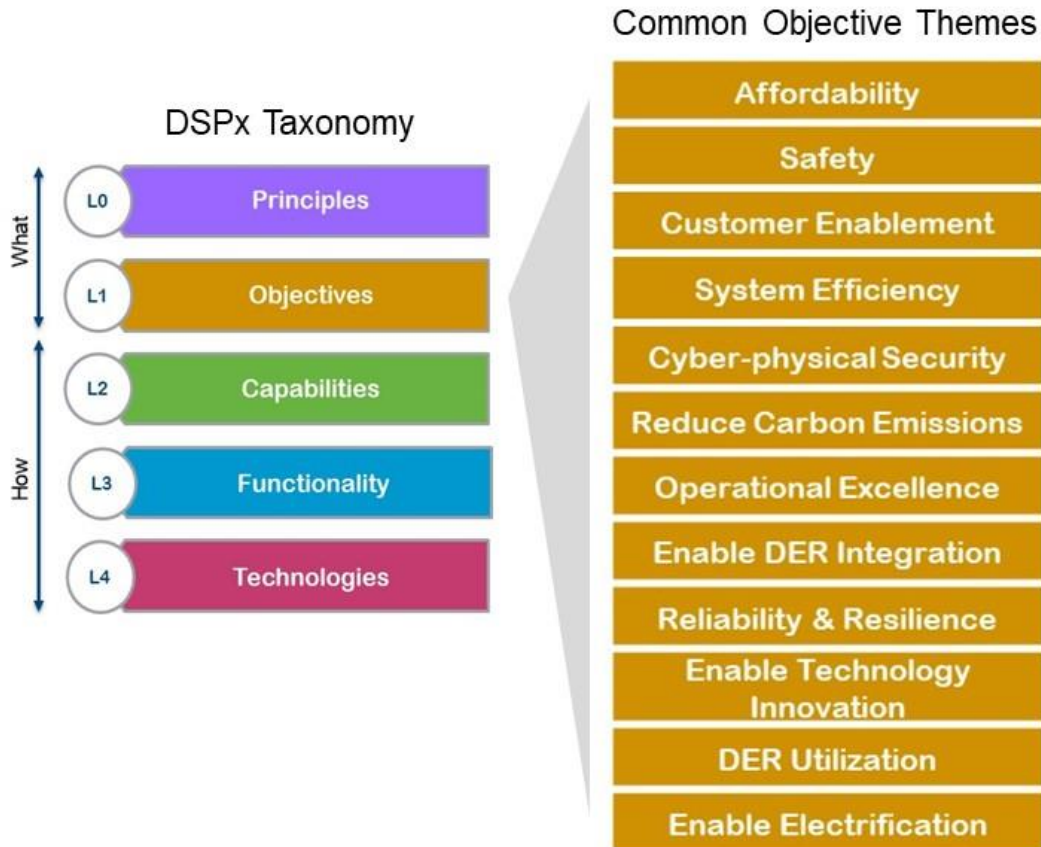


Policy Drivers w/Dist. System Implications



Italics indicate statutory requirements/goals

Objectives Drive Grid Modernization Planning



PUC Ohio example:

- **A Strong Grid:** A distribution grid that is reliable and resilient, optimized and efficient and planned in a manner that recognizes the necessity of a changing architectural paradigm.
- **The Grid as a Platform:** A modern grid that serves as a secure open access platform—firm in concept and as uniform across our utilities as possible—that allows for varied and constantly evolving applications to seamlessly interface with the platform.
- **A Robust Marketplace:** A marketplace that allows for innovative products and services to arise organically and be delivered seamlessly to customers by the entities of their choosing.
- **The Customer's Way:** An enhanced experience of the customer's choosing on the application side, whether for reasons arising from financial, convenience, control, environmental, or any other chosen consideration.

Note: The 'safe, reliable, and affordable' components were included in the mission statement, which was incorporated into the principles of the PowerForward Roadmap.

Modern Grid Capabilities & Functions

Customer Needs & Policy drive grid capabilities and corresponding enabling business functionality and technology

		Grid Capabilities		
		Reliability, Resilience & Operational Efficiency	DER Integration (incl Electrification)	DER Utilization (NWA Services)
Functions	Market Operations	● (New)	● (New)	● (New)
	Grid Operations	● (Existing)	● (New)	● (New)
	Planning	● (Existing)	● (New)	● (New)

Identify the core platform functions and related technologies as well as the applications linked to specific customer needs/policies/value realization

Objectives, Capabilities & Functions

Objectives

Affordability
Safety
Customer Enablement
System Efficiency
Cyber-physical Security
Reduce Carbon Emissions
Operational Excellence
Enable DER Integration
Reliability & Resilience
Enable Technology Innovation
DER Utilization
Enable Electrification

Capabilities

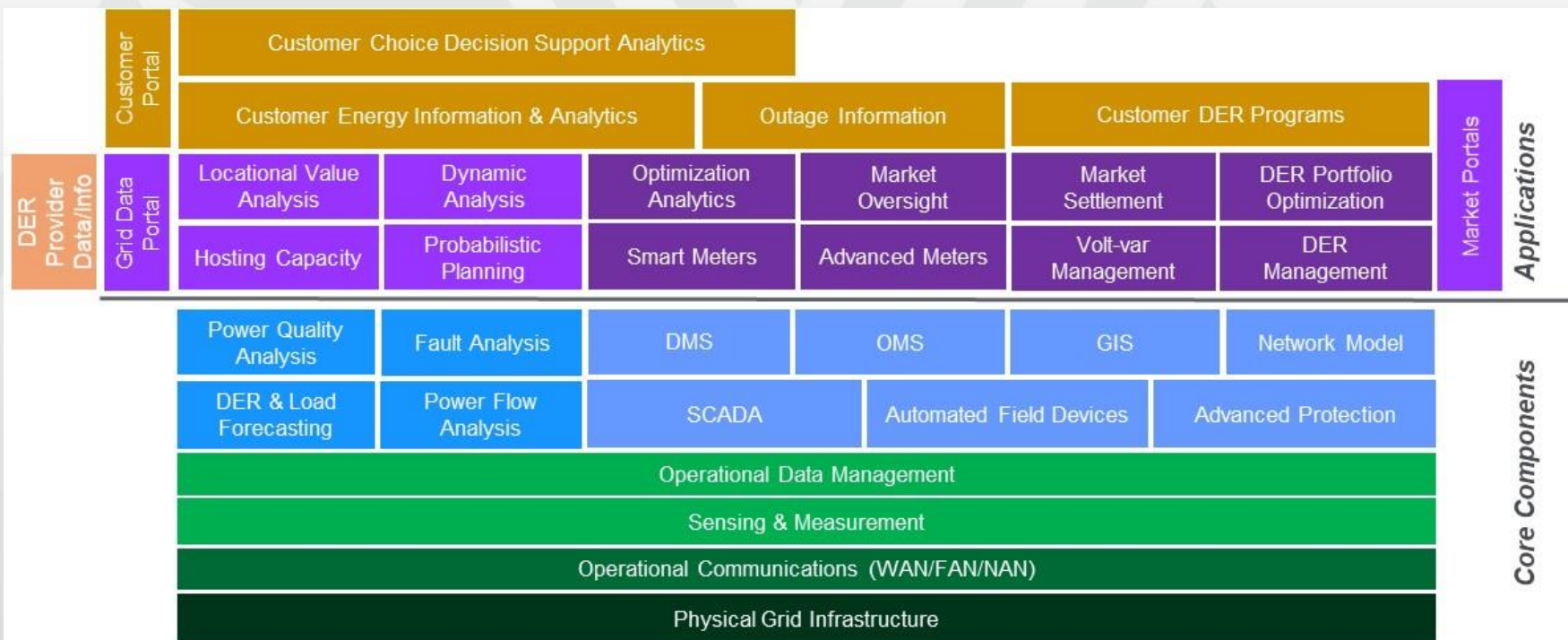
Distribution System Planning	Distribution Grid Operations		Distribution Market Operations
Impact Resistance and Impact Resiliency	Operational Risk Management	Situational Awareness	Distribution Investment Optimization
Open and Interoperable	Controllability and Dynamic Stability	Management of DER and Load Stochasticity	Distribution Asset Optimization
Accommodate Tech Innovation	Contingency Management	Fail Safe Modes	Market Animation
Convergence with other Critical Infrastructure	Public and Workforce Safety	Reliability Management	System Performance
Accommodate New Business Models	Workforce Management	Resiliency Management	Environmental Management
Transparency	Attack Resistance / Fault Tolerance / Self-Healing	Control Federation and Control Disaggregation	Local Grid Optimization
Scalability	Integrated Grid Coordination	Privacy and Confidentiality	
	Flexibility	Security	

Functions

Distribution System Planning		Distribution Grid Operations			Distribution Market Operations	
Short and Long-term Demand and DER Forecasting	Reliability and Resilience Criteria	Observability (Monitoring & Sensing)	Microgrid Management	DER Operational Control	Market Participation Rules	Measurement & Verification
Short-term Distribution Planning	Interconnection Studies	Distribution Grid Control (Volt-var & Flow Control)	Threat Assessment and Remediation	Distribution to Transmission Operational Coordination	Solution Sourcing	Confirmation and Clearing
Long-term Distribution Planning	DER Integration (incl. Distribution Grid Codes)	Reliability Management	Cybersecurity	Distribution to Customer/Aggregator Coordination	Solution Evaluation	Billing
Power Flow Analysis	Distribution System Information Sharing	Distribution System Representation (Network Model & State Estimation)	Physical Security	Operational Telecommunications	Market Settlement	Solutions Portfolio Optimization
Estimation of Distribution Capital Upgrades	Hosting Capacity Analysis	Power Quality Management	Operational Information Management	Simulation	DER Aggregation to Distribution and/or Wholesale Market	Advanced Pricing
Locational Value Analysis	Customer Information Access	Fault Management (FLISR & Protection)	Asset Optimization	Advanced Metering	Market Information Sharing	Programs
Integrated Resources Transmission and Distribution Planning	Analytics	Operational Forecasting	Outage Management	Customer Information	Market Oversight	Dynamic Notification
Multiple Forecast Scenario-based Planning	Customer Information Access (Portal)					Market Security and Cybersecurity
Interconnection Process	EV Readiness					

Grid Mod Platform & Applications

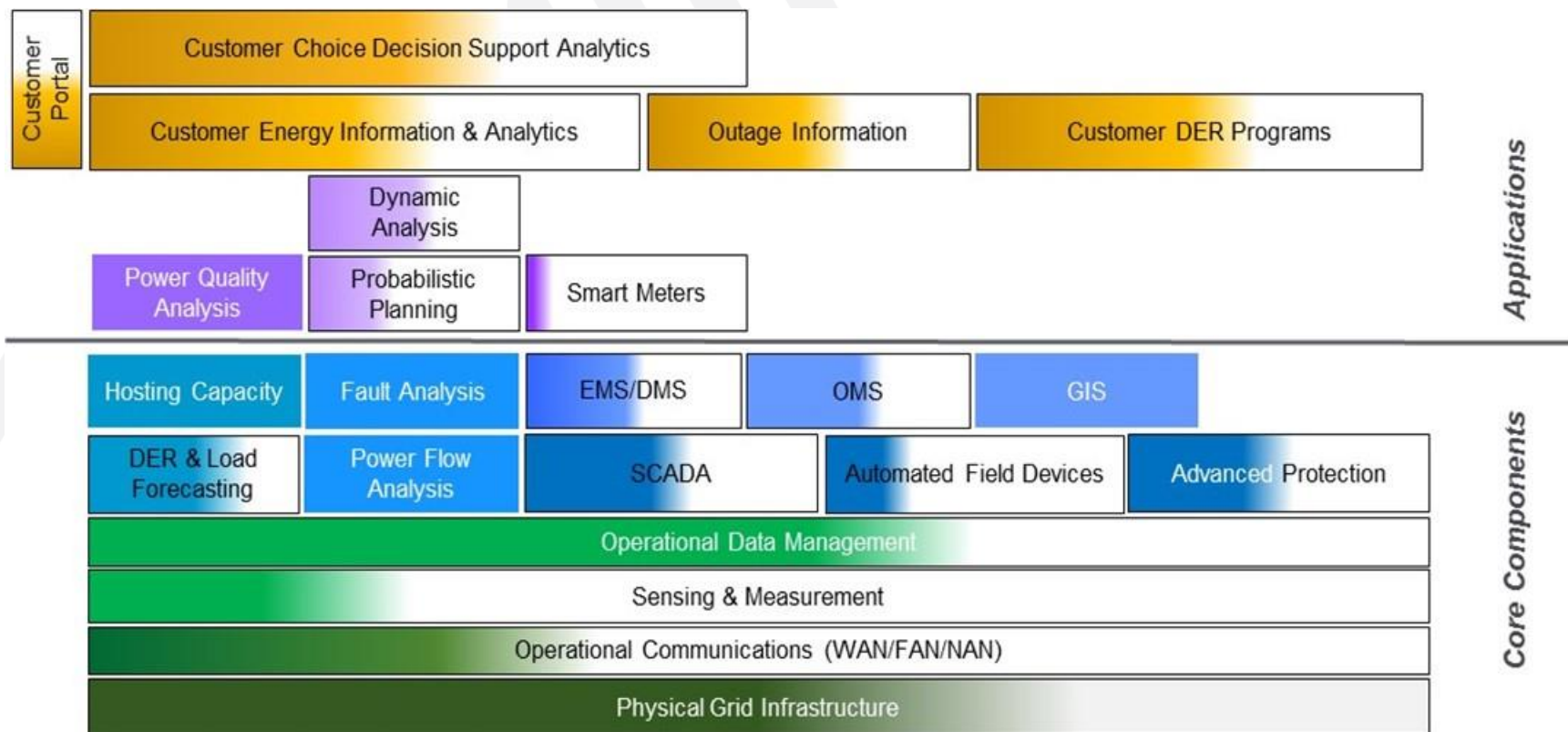
Core components are foundational; applications layer on this foundation as additional functionality is needed



Source: DOE, Modern Distribution Grid, Volume 3

Determine Starting Point

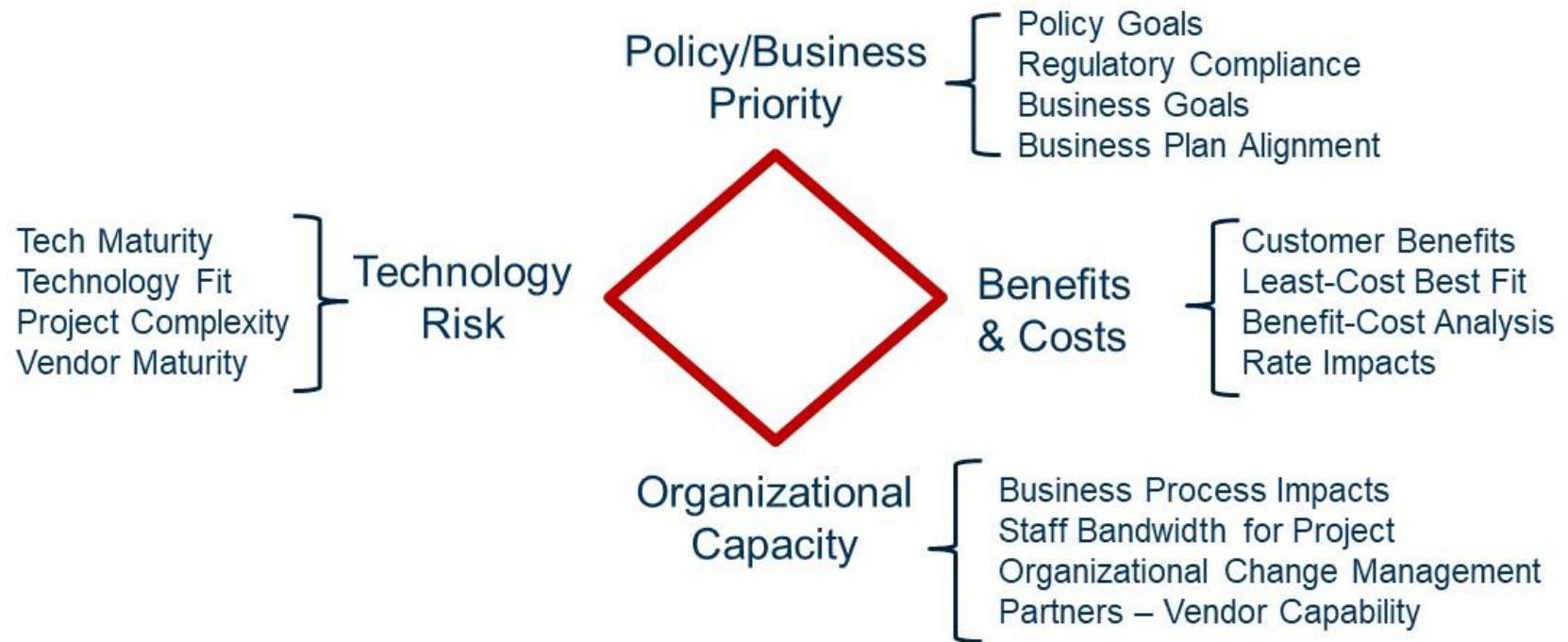
Hawaiian Electric Grid Modernization Strategy example



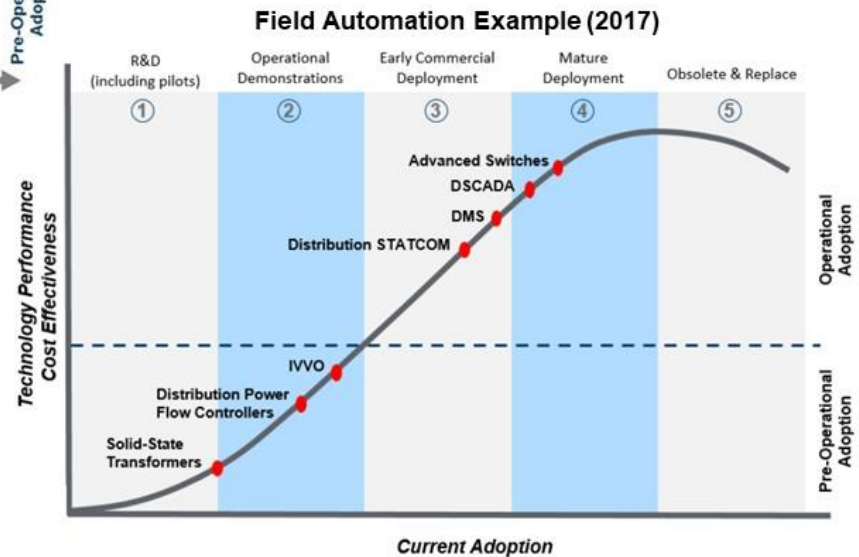
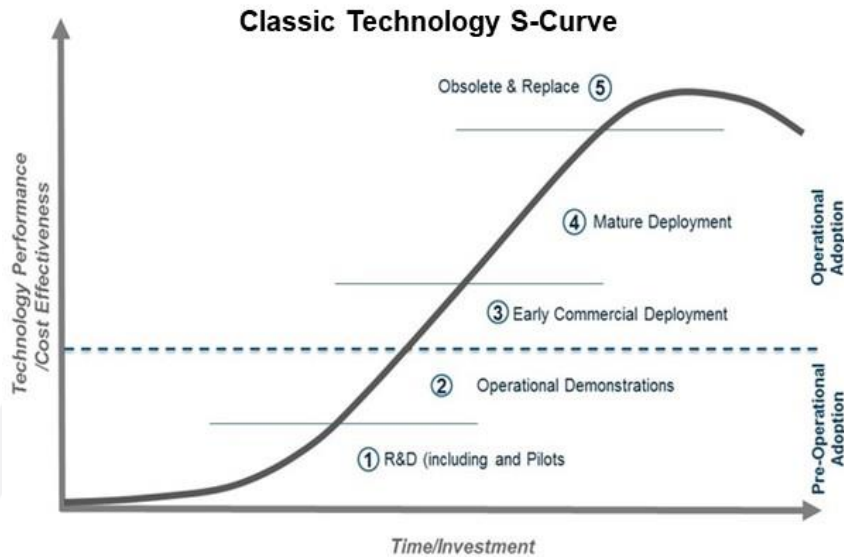
https://www.hawaiianelectric.com/Documents/about_us/investing_in_the_future/final_august_2017_grid_modernization_strategy.pdf

Technology Implementation Decision Criteria

General framework for technology assessment within a stage gate sequence where the evaluation begins with conceptual screening on a set of these criteria and increasingly becomes more detailed and definitive in terms of the quantitative and qualitative assessment



Technology Maturity

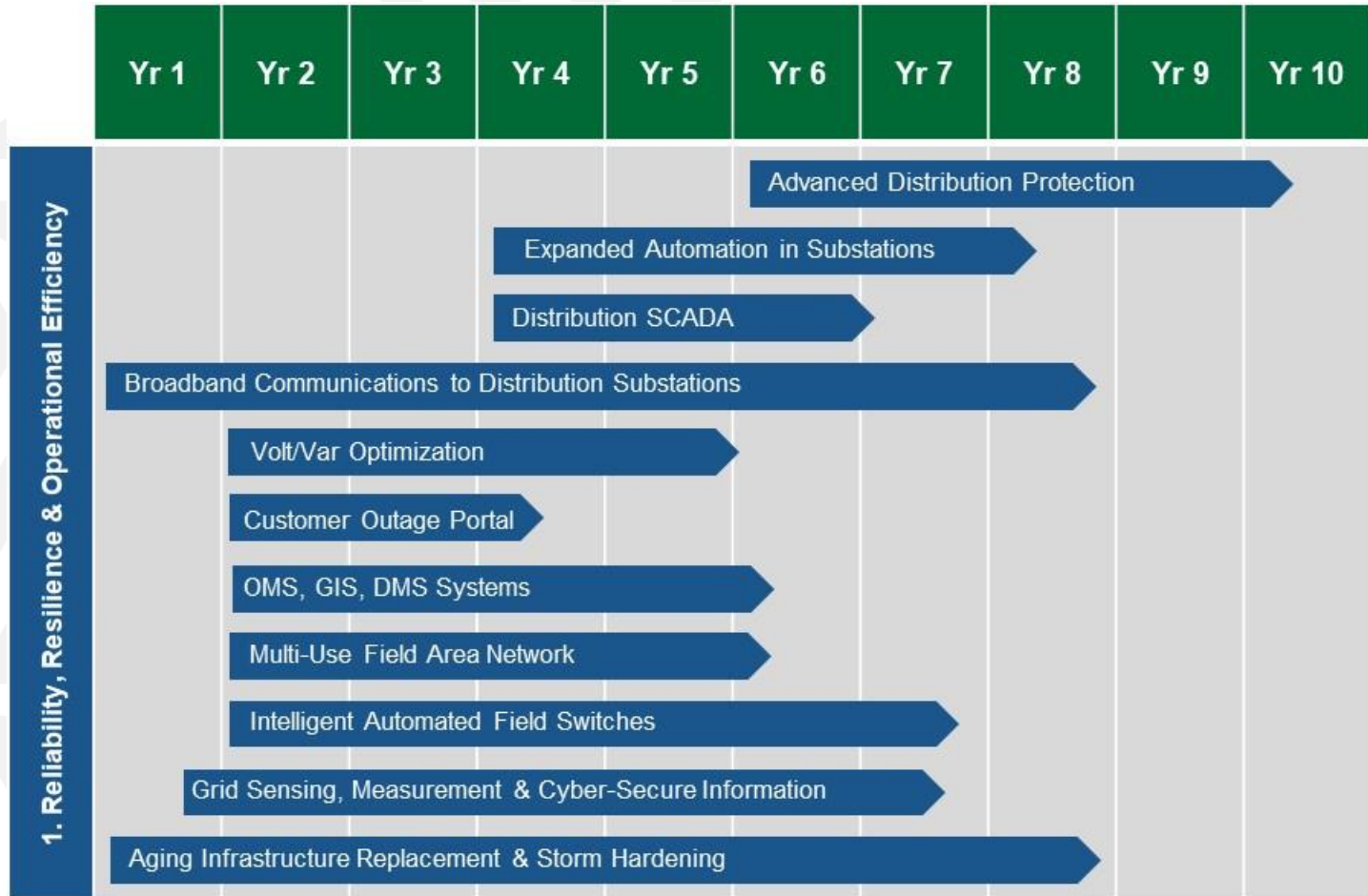


Grid Mod Roadmap

Reliability, Resilience & Operational Efficiency

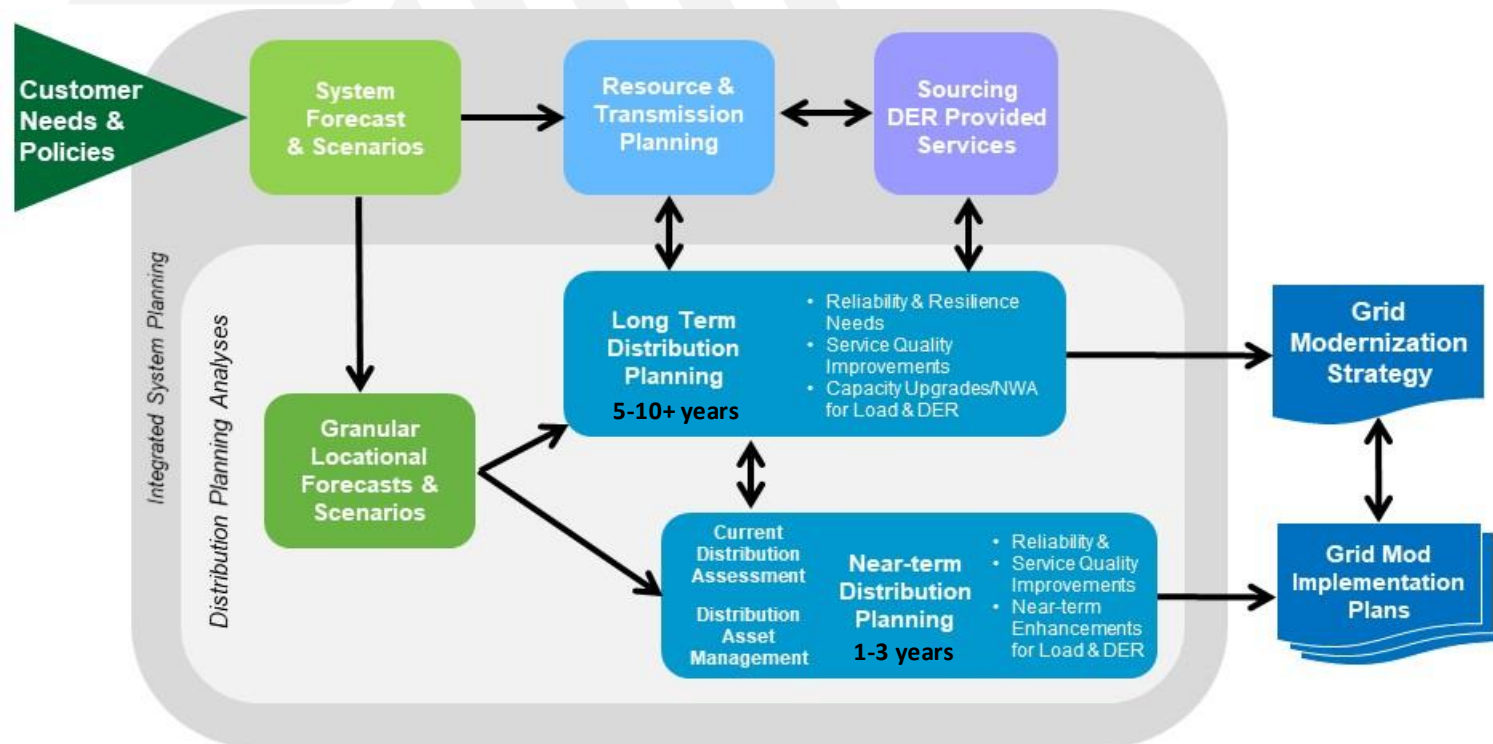


Example of Grid Mod investments that may be needed over a 10 yr planning horizon



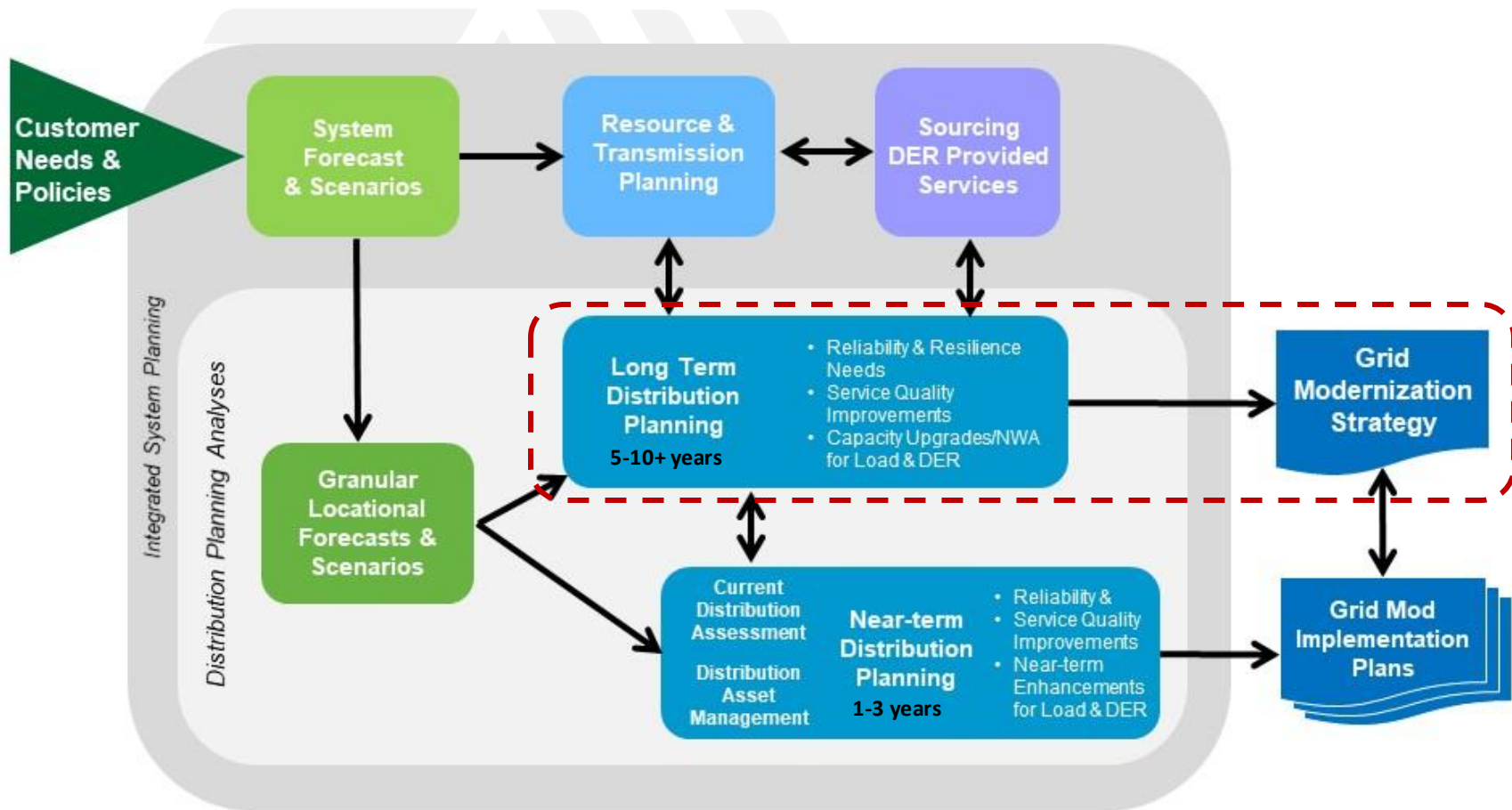
Integrated Planning & Grid Modernization

IDP identifies “Where”, “When” and “How much”



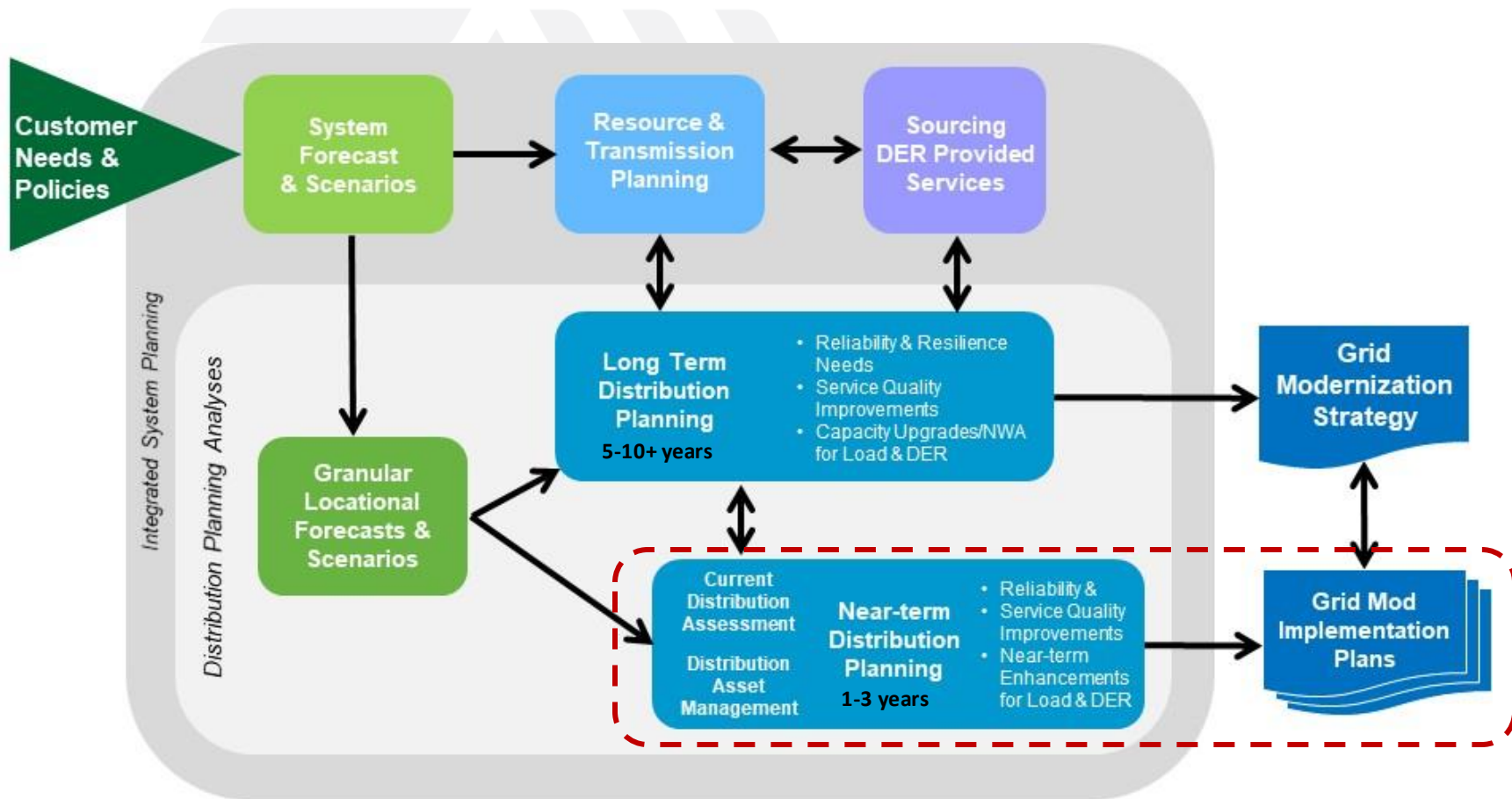
Source: P. De Martini

Integrated Planning & Grid Modernization



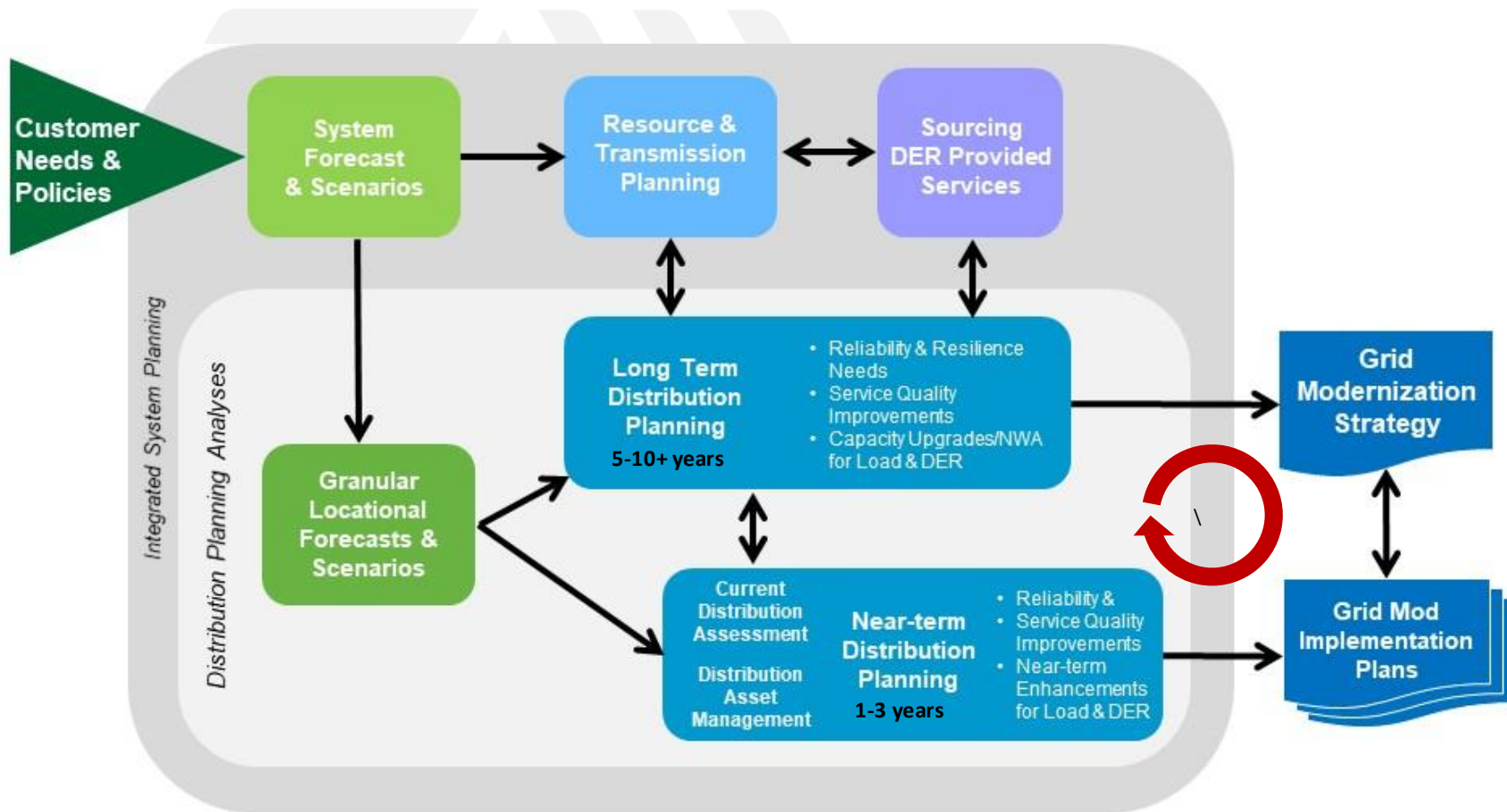
Source: P. De Martini

Integrated Planning & Grid Modernization



Source: P. De Martini

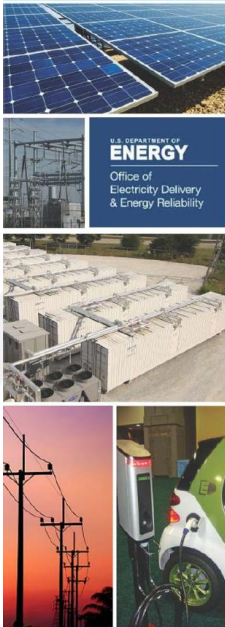
Integrated Planning & Grid Modernization



Source: P. De Martini

DSPx: Modern Distribution Grid Report

3 Volume Report Released in 2017

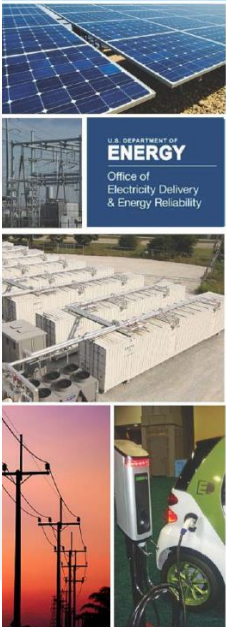


U.S. DEPARTMENT OF
ENERGY
Office of
Electricity Delivery
& Energy Reliability

MODERN DISTRIBUTION GRID

**Volume I: Customer and State
Policy Driven Functionality**

Version 1.1
March 27, 2017

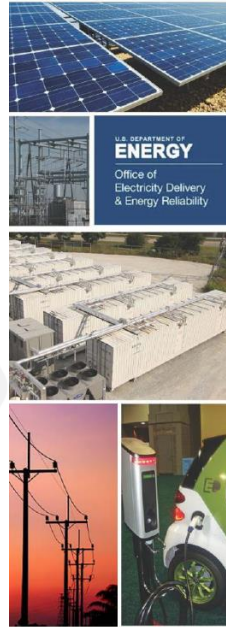


U.S. DEPARTMENT OF
ENERGY
Office of
Electricity Delivery
& Energy Reliability

MODERN DISTRIBUTION GRID

**Volume II: Advanced Technology
Maturity Assessment**

Version 1.1
March 27, 2017



U.S. DEPARTMENT OF
ENERGY
Office of
Electricity Delivery
& Energy Reliability

MODERN DISTRIBUTION GRID

**Decision Guide
Volume III**

June 28, 2017

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