U.S. DEPARTMENT OF ENERGY

Office of Electricity Delivery & Energy Reliability

Considerations for a Modern Grid

Joe Paladino

U.S. Department of Energy

Hawaiian Electric Companies

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Modern Grid Evolution

Customer needs and policies drive grid capabilities and corresponding enabling business functionality and technology

● New
● Existing

Functions	Grid Capabilities: Reliability, Safety & Operational Efficiency	Grid Capabilities: DER Integration	Grid Capabilities: DER Utilization
Market Operations	●	●	●
Grid Operations	●	●	●
Planning	●	●	●

Distribution Platform Capabilities

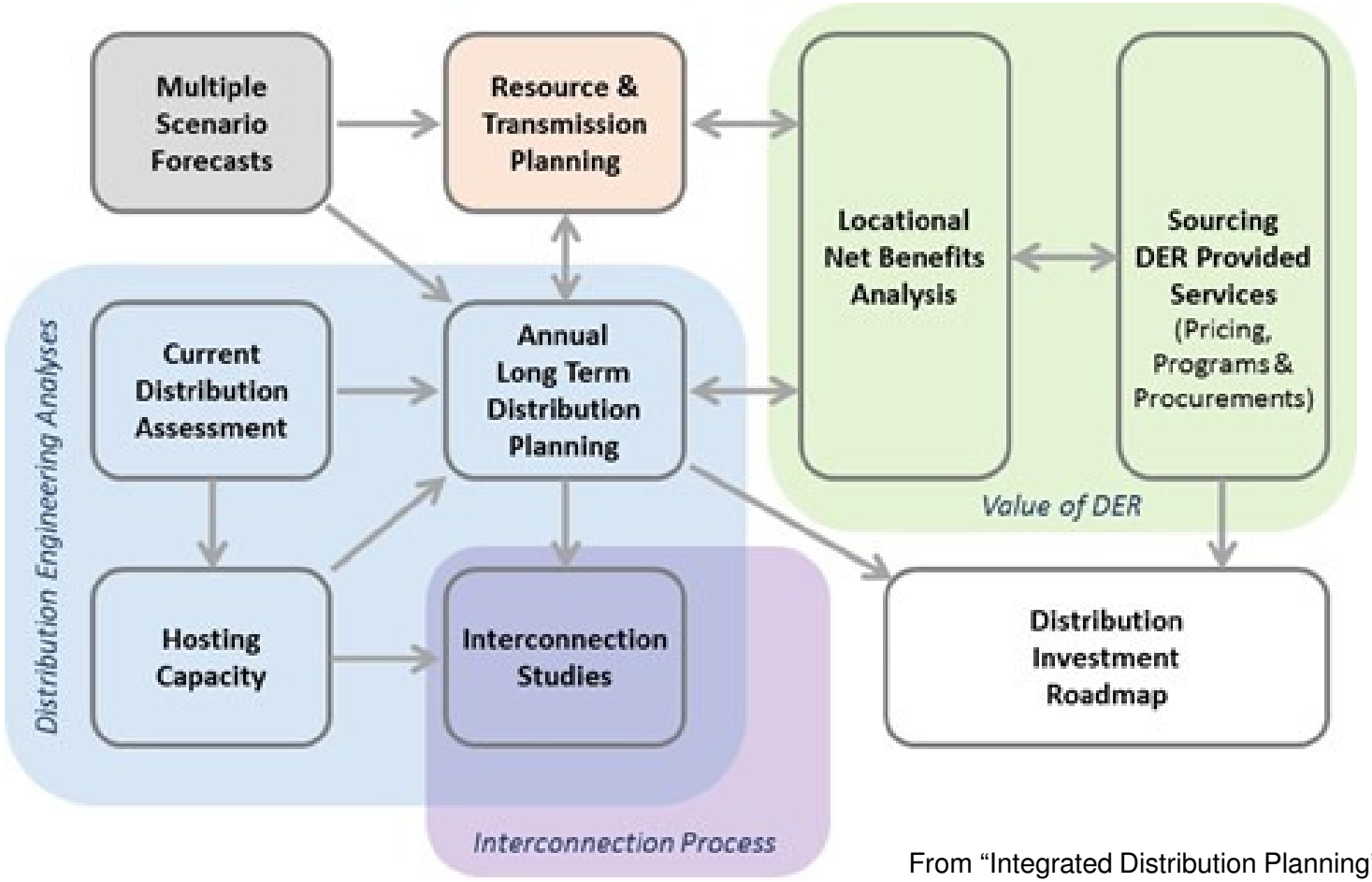
Capabilities derived from State policy objectives

Distribution System Planning	Distribution Grid Operations		Distribution Market Operations
Scalability 3.1.1	Operational Risk Management 3.2.1	Situational Awareness 3.2.2	Distribution Investment Optimization 3.3.1
Impact Resistance and Impact Resiliency 3.1.2	Controllability and Dynamic Stability 3.2.3	Management of DER and Load Stochasticity 3.2.4	Distribution Asset Optimization 3.3.2
Open and Interoperable 3.1.3	Contingency Management 3.2.5	Security 3.2.6	Market Animation 3.3.3
Accommodate Tech Innovation 3.1.4	Public and Workforce Safety 3.2.7	Fail Safe Modes 3.2.8	System Performance 3.3.4
Convergence w/ Other Critical Infrastructures 3.1.5	Attack Resistance/Fault Tolerance/Self-Healing 3.2.9	Reliability and Resiliency Management 3.2.10	Environmental Management 3.3.5
Accommodate New Business Models 3.1.6	Integrated Grid Coordination 3.2.11	Control Federation and Control Disaggregation 3.2.12	Local Optimization 3.3.6
Transparency 3.1.7	Privacy and Confidentiality 3.2.13		

From DSPx Volume 1 – Customer and State Policy Driven Functionality, version 1.1, March 23, 2017

Integrated Planning Considerations

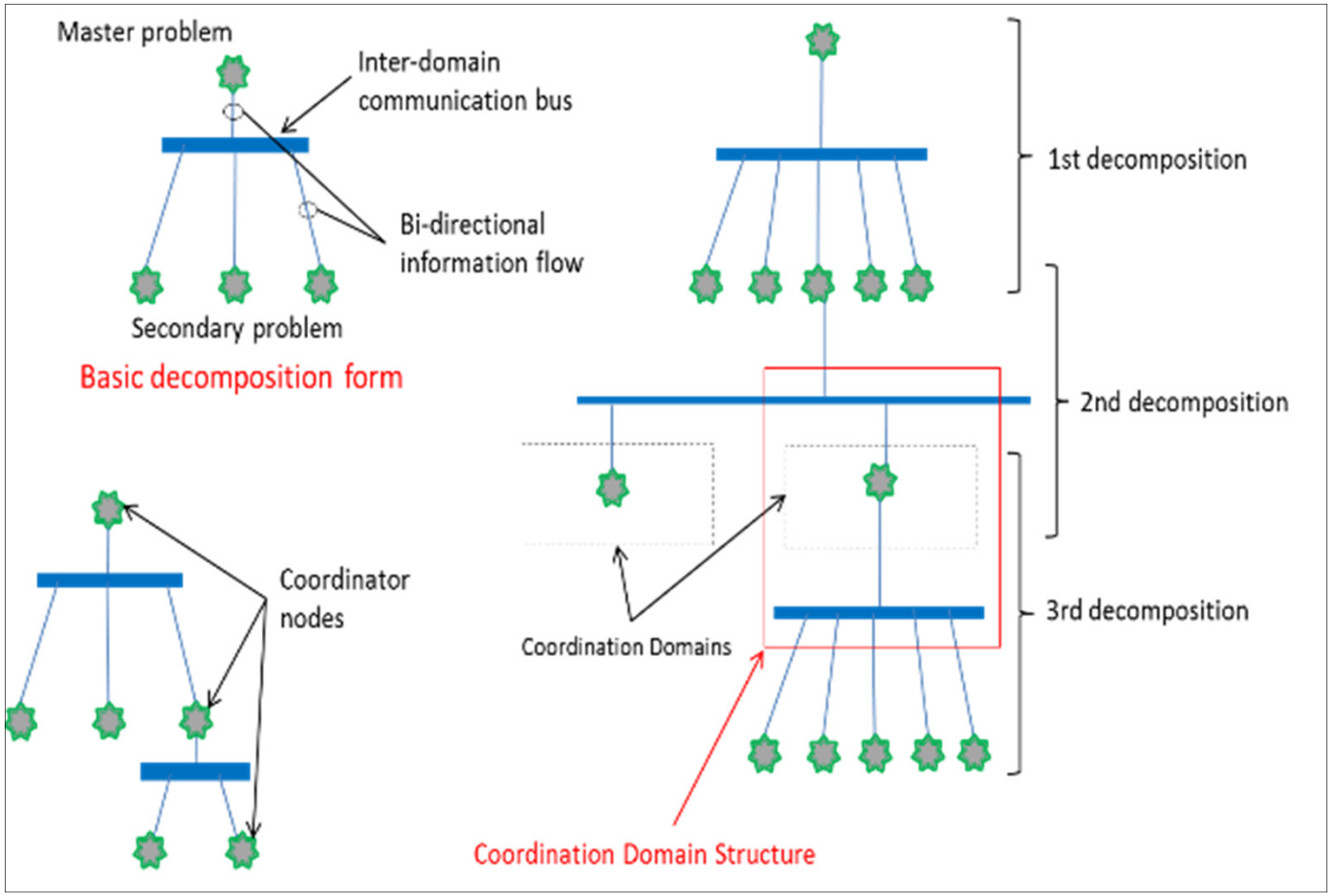
Integrated planning and analysis needed within and across the transmission, distribution and customer/3rd party domains



From "Integrated Distribution Planning", August 2016, prepared for the MN PUC, ICF International

Architectural Considerations

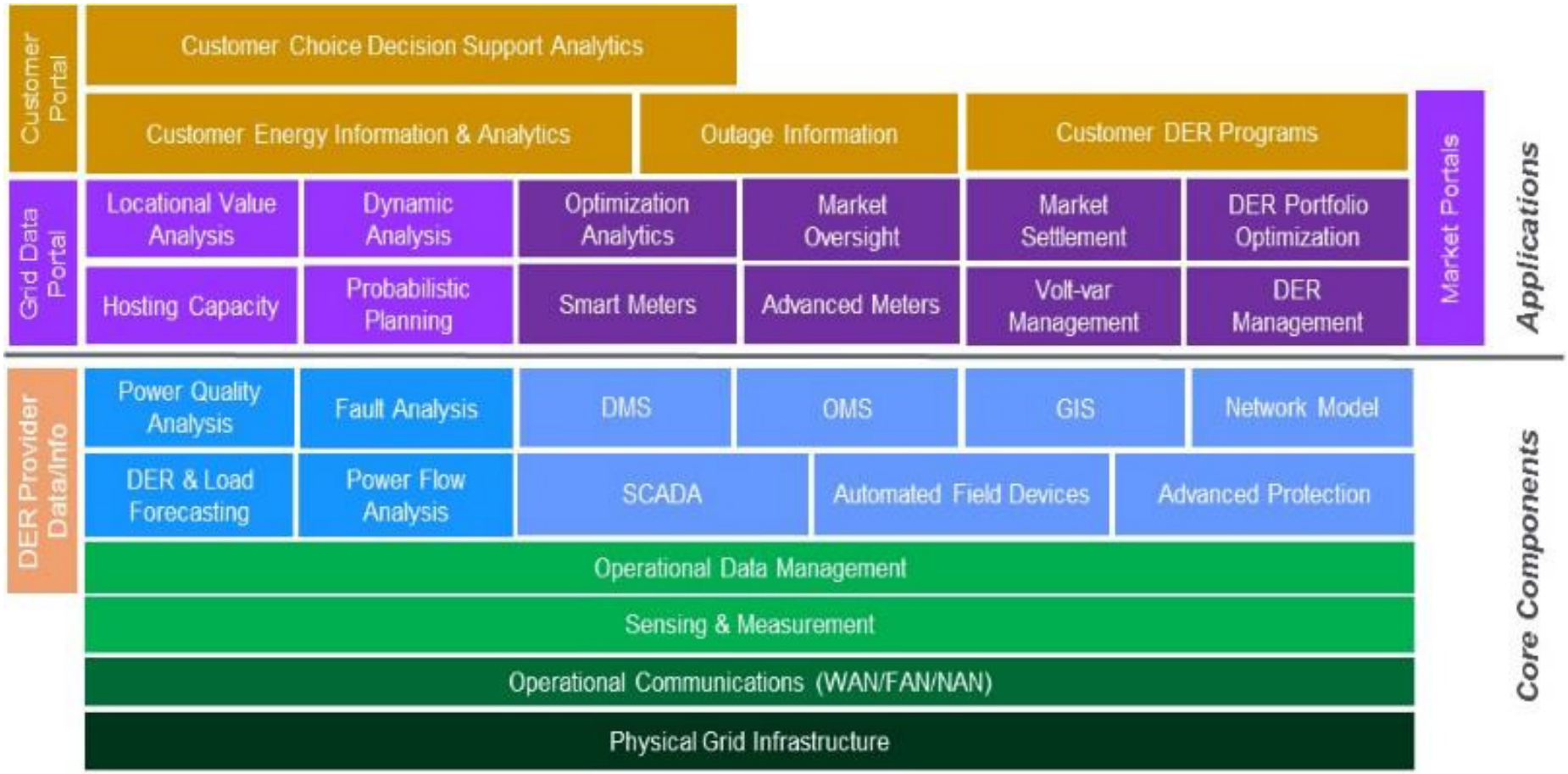
Laminar coordination framework enables scaling and optimization at both local and system levels



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

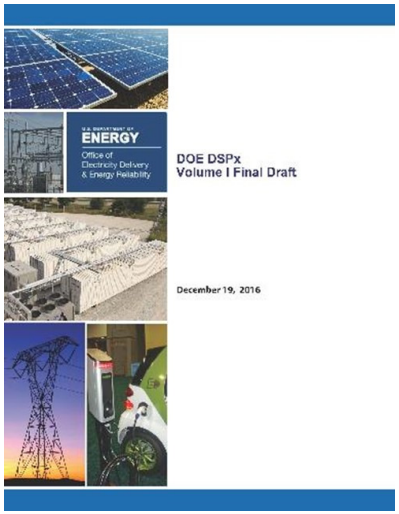
Platform Considerations

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

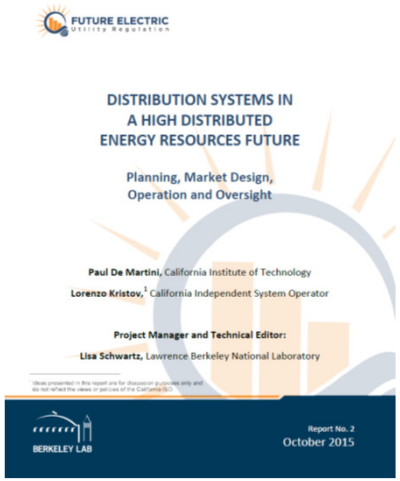


From DSPx, Volume 3 – Decision Guide, under review

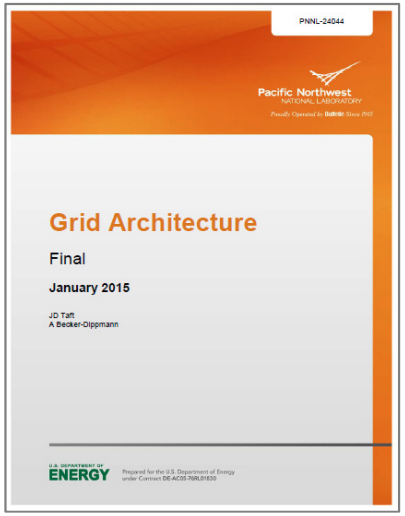
References

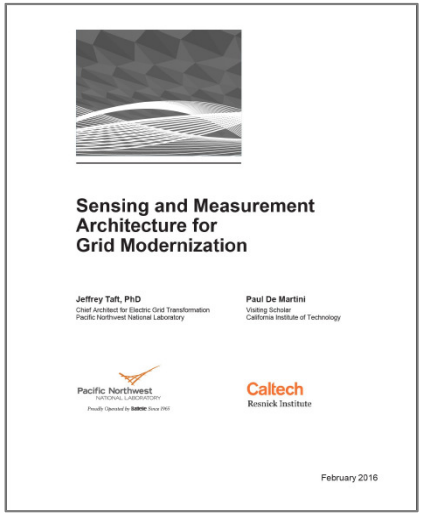


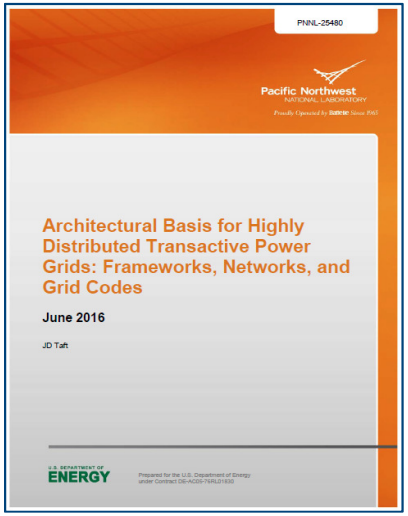
www.doe-dspx.org



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







gridarchitecture.pnnl.gov