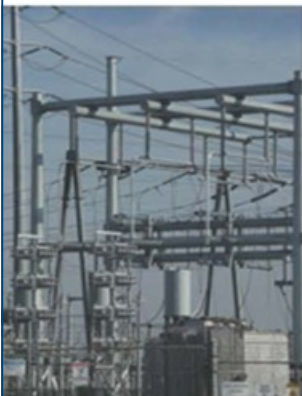


U.S. DEPARTMENT OF  
**ENERGY**

Office of  
Electricity



# Grid Modernization Considerations

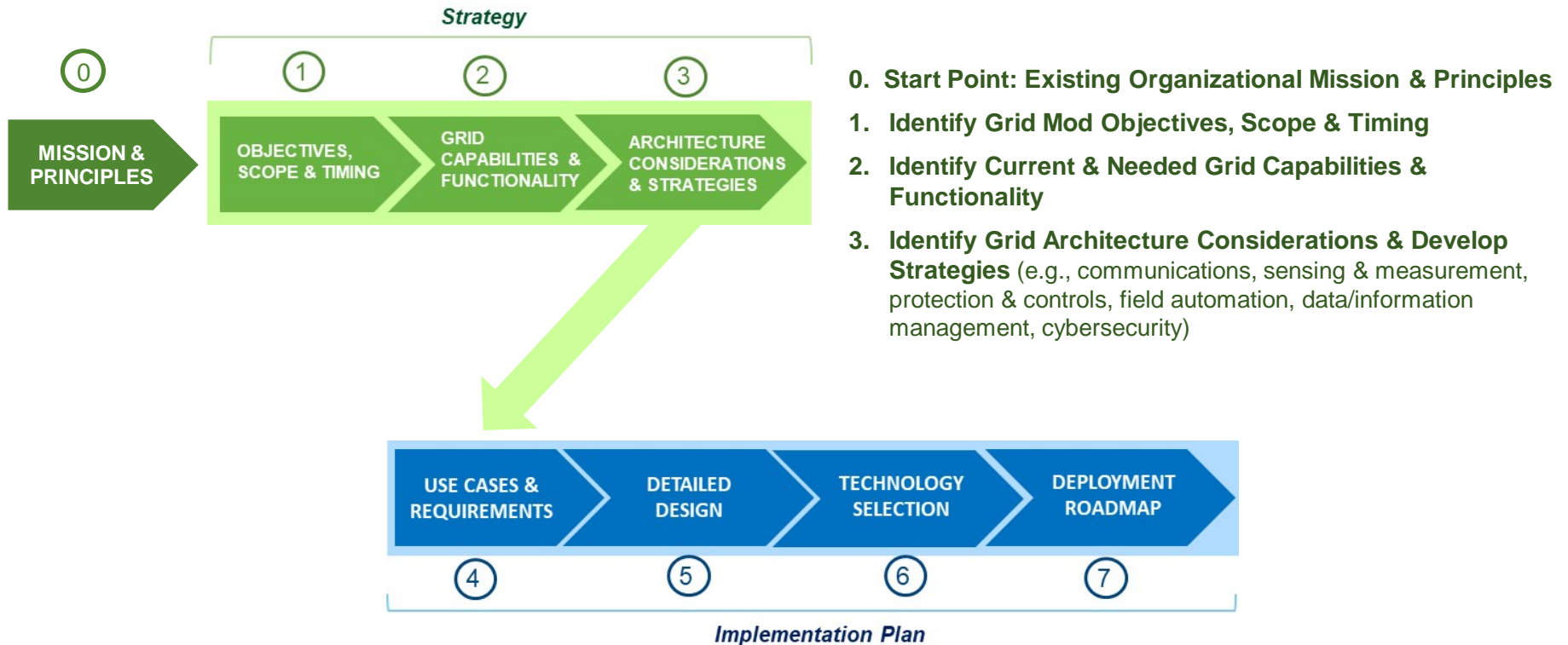
US Department of Energy

National Academies of Science, Engineering, and Medicine

May 13, 2019

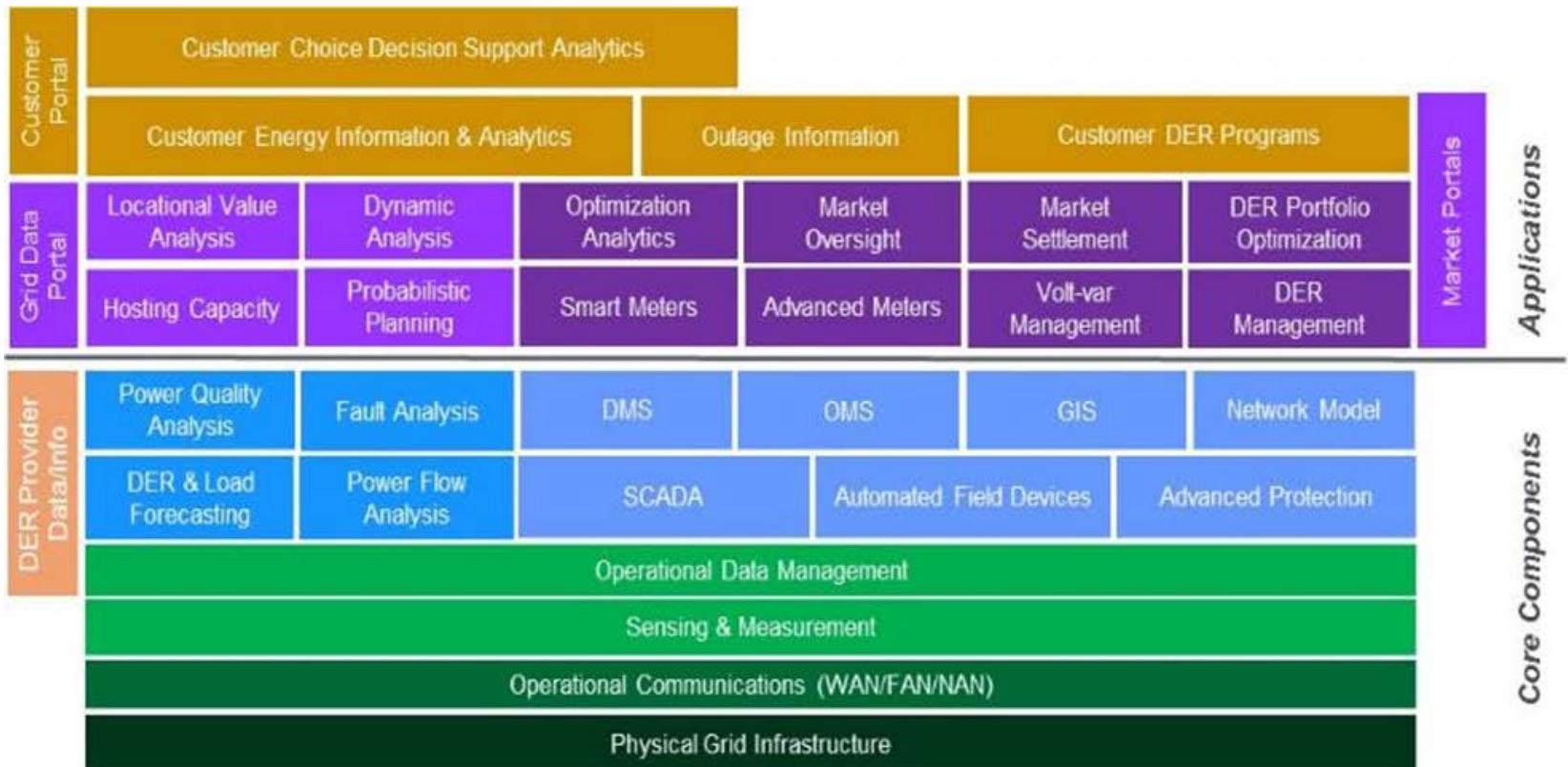
# Grid Modernization Framework

Grid modernization strategy should inform the technology roadmap



# Distribution System Platform

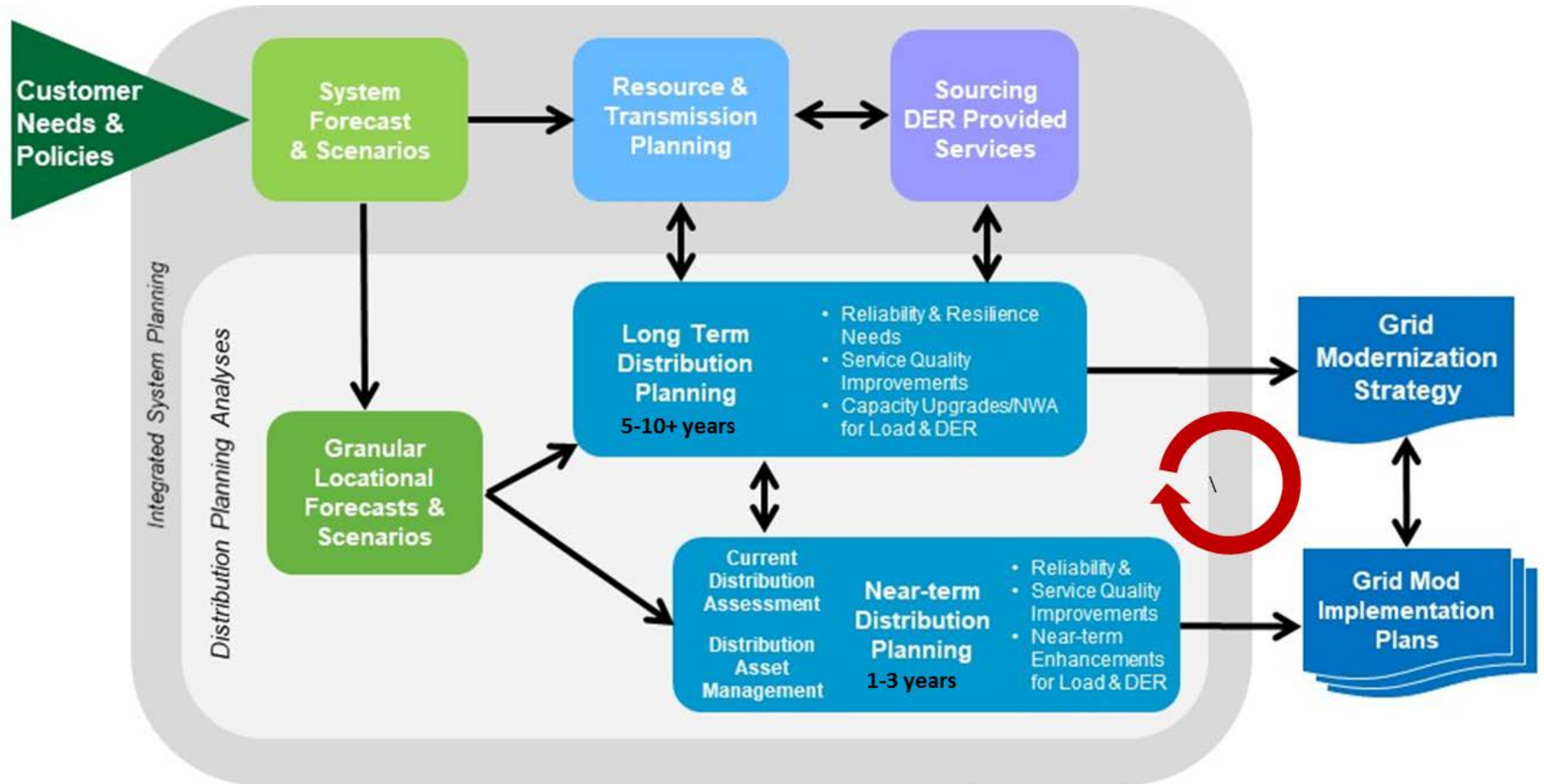
Core components are foundational; applications layer on this foundation as additional functionality is needed



From DSPx, Volume 3 – Decision Guide

# Integrated Planning

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



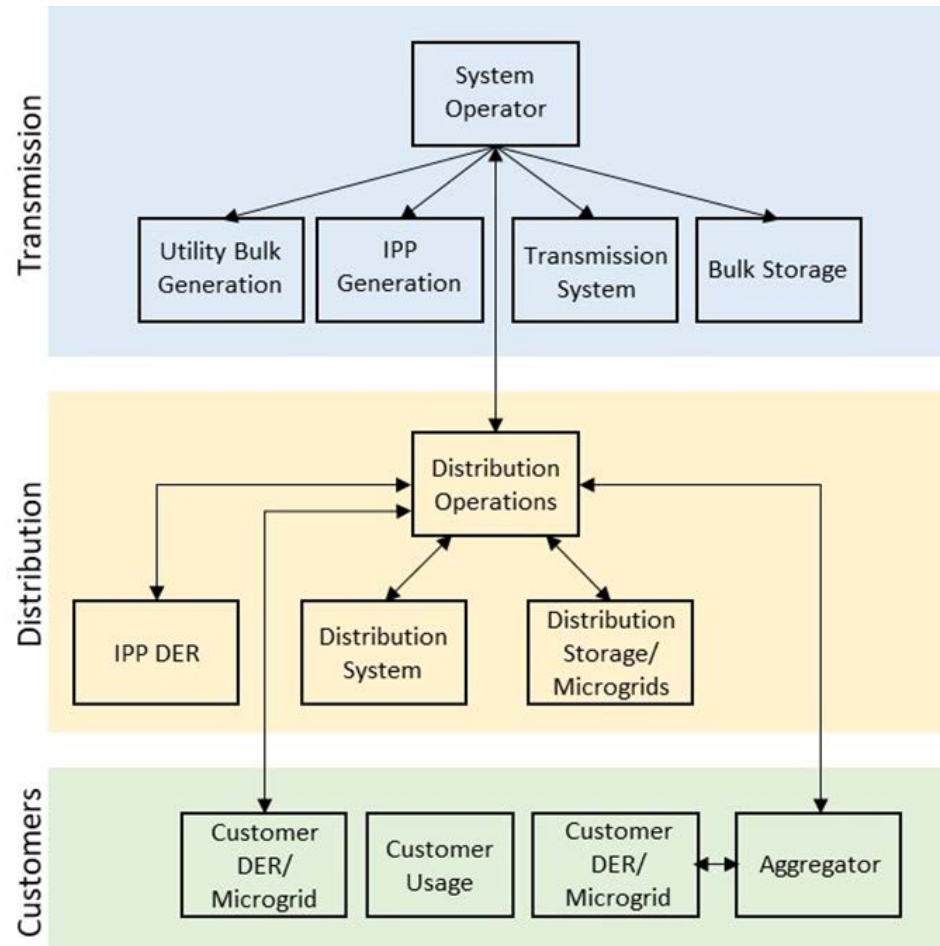
Source: P. De Martini



# Coordination Framework

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

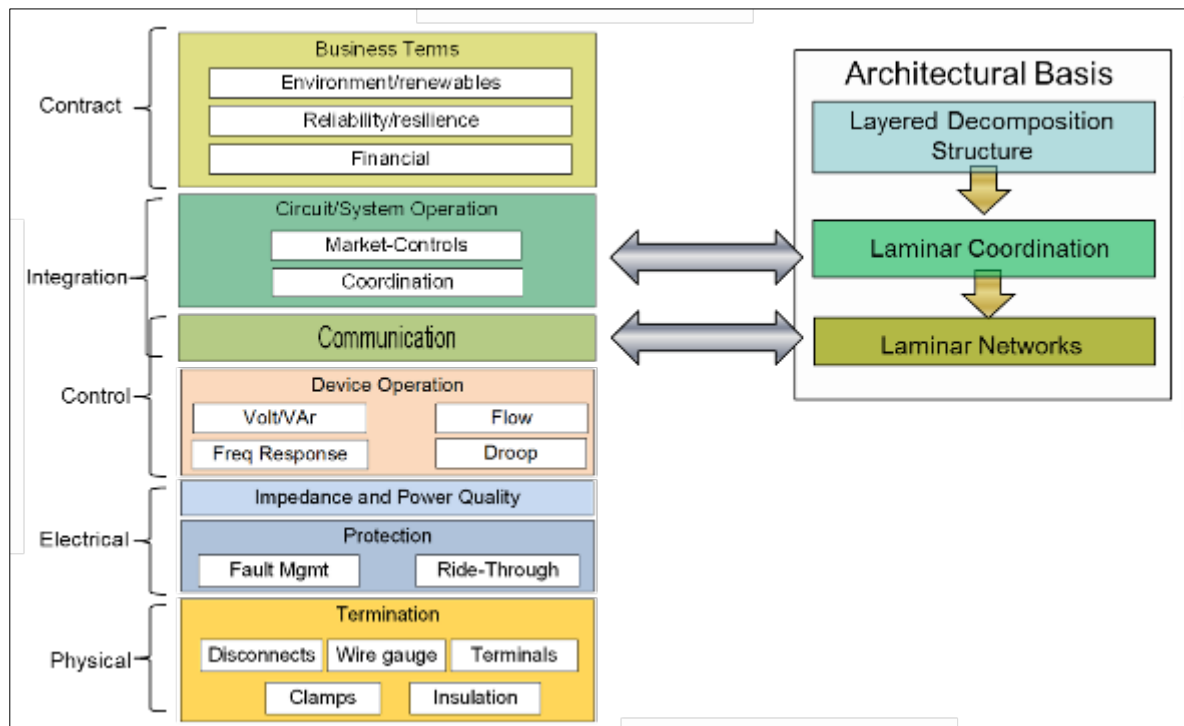
- TPTA has applied grid architecture principles to examine and compare emerging coordination models world-wide and in the U.S.
  - Observability
  - Scalability
  - Cyber security vulnerability
  - Layered decomposition
  - Tier bypassing
  - Hidden coupling
  - Latency cascading
- TPTA developing an 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

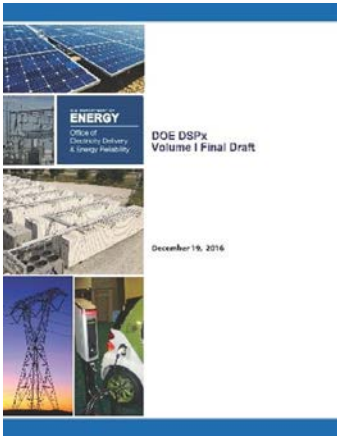
## Contacts:

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Joe Paladino, [joseph.paladino@hq.doe.gov](mailto:joseph.paladino@hq.doe.gov)

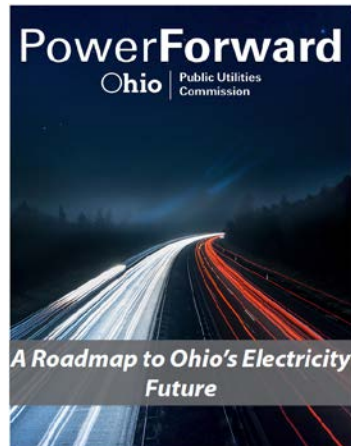
## References:

### Modern Distribution Grid Report



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

### PUCO Grid Mod Roadmap

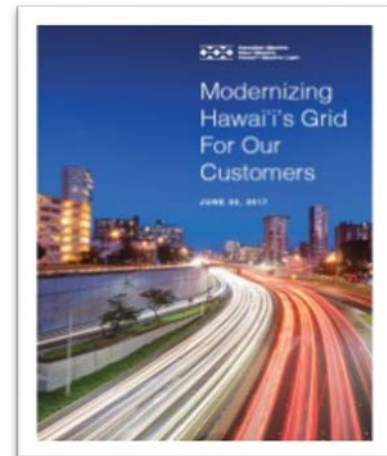


<https://puco.maps.arcgis.com/apps/Cascade/index.html?appid=59a9cd1f405547c89e1066e9f195b0b1>

**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](http://www.hawaiianelectric.com/gridmod)