Distributed Generation and DER Management: Market Perspective

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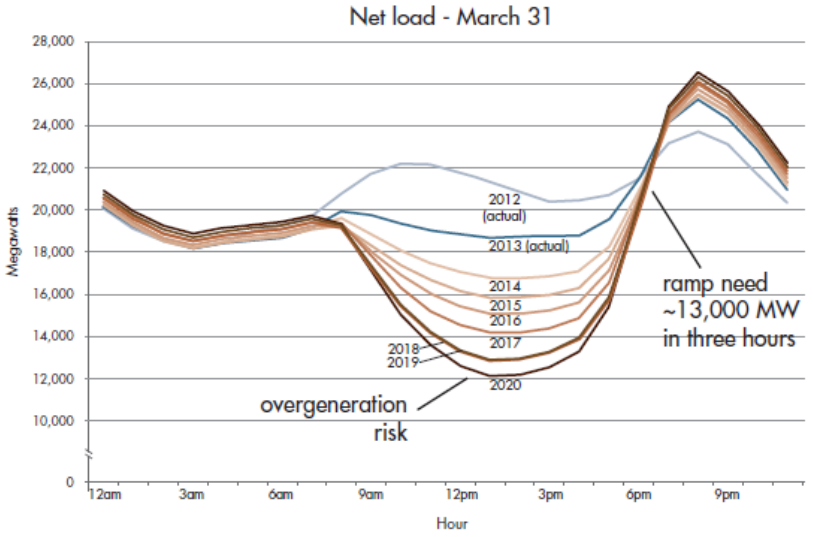
Scale of CA Challenge Over Next 10 years

Shift in Resource Mix and Location is Increasing Variability Requiring System Flexibility and More Tightly Coupling of T&D

- ~50 GW System Peak
- AB 32 GHG Requirements to 1990 levels
- 16+ GWs of load center generation shutdown due to retirements
- Increase in RPS from 33% to 50% RPS?
- Zero Net Energy Building Codes
- 12 GWs of Distributed Generation
- 2+ GWs of Storage
- 3 GWs of Demand Response
- 1.5 million Zero Emission Vehicles



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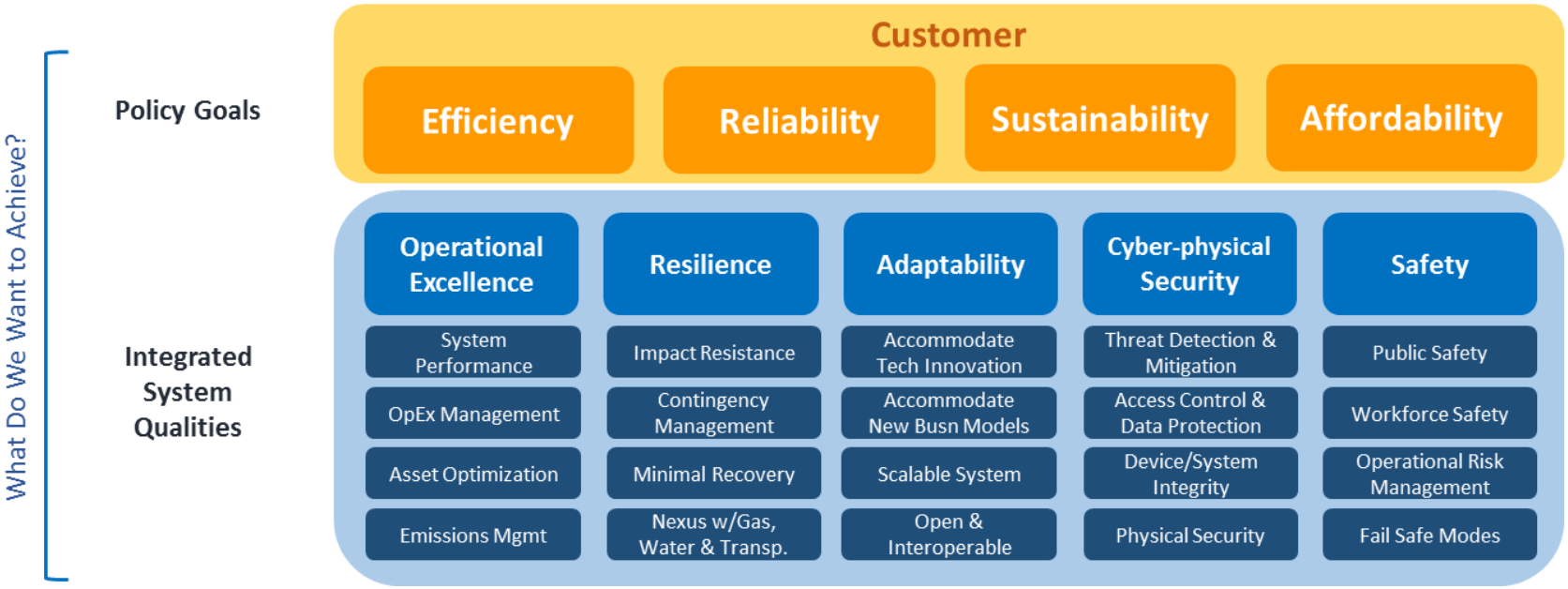
What Do We Want to Achieve?

Distribution system and related operations is being asked to address changing customer expectations and an increasing range of policy objectives



These objectives lead to a wide range of potential distribution system qualities that are ***driving the need for integration, not disaggregation***

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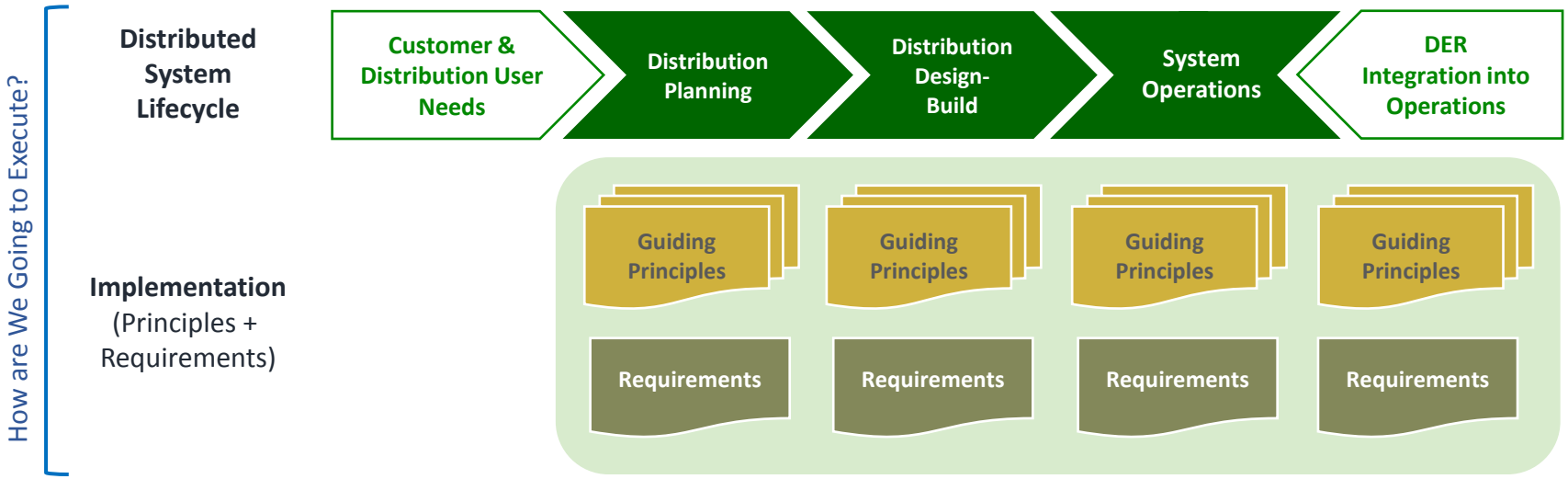
Translate Policy & Customer Needs into Practice

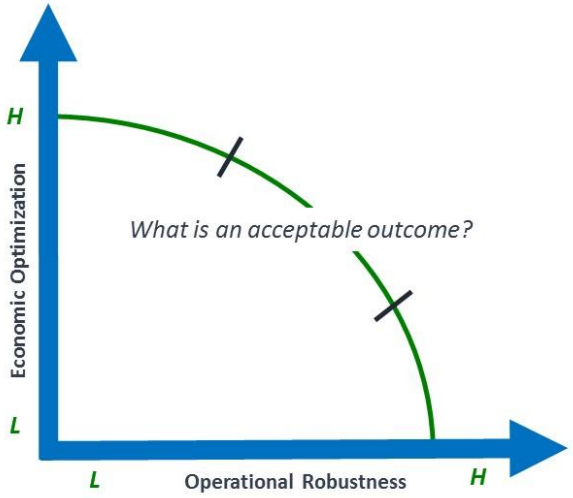
Fundamental change is needed in distribution processes and practices related to ***Planning***, ***Design*** and ***Operations*** to integrate and benefit from DER at scale

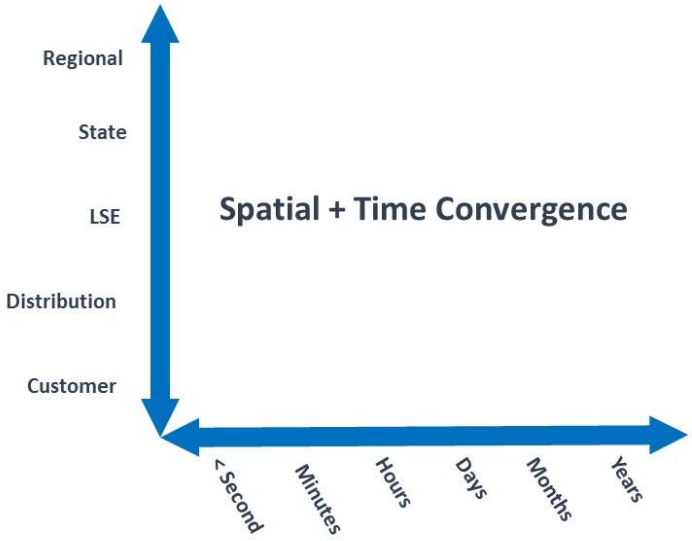


Each aspect involves utilizing new technology to assess, build and operate a more distributed power system

Planning: What Are We Seeking to Optimize?

- Scenario-Driven Integrated Planning Analysis Framework
  - Clarify Value Maximization or Cost Minimization
  - Reconcile locational benefits with system benefits
- Standardized methodology and tools for distribution planning
  - Engineering models and tools should address all relevant power system characteristics and dynamics for a well defined distribution area and inter-related local transmission system consistent with best practice
- Qualified access to grid asset and operational planning data
- Integrated Multi-stakeholder Distribution Planning Process





Design for the Future

- Evolve grid to an open network
  - Create a node-friendly distribution network that is open, visible, flexible, reliable, resilient and safe
  - Incorporate full operational risk mitigation considerations into physical designs and protection and control systems leveraging DER/microgrid
- Modular designs & distributed architecture
  - Leverage systems engineering methods to create more modular design to address differences in technology lifecycles to mitigate stranded costs
  - Employ distributed architecture for operational systems to address scale issues involving integration of edge devices
- Align deployment timing with customer and policy needs
- Align utility technology adoption

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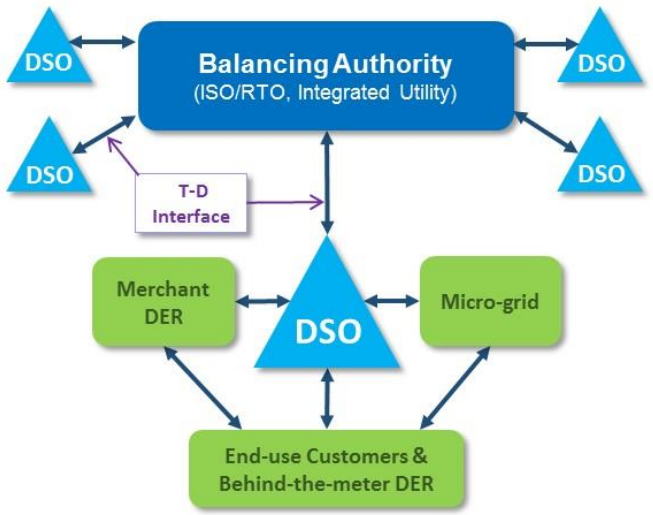
Operations: Distribution System Operator

- Provide safe and reliable distribution service
  - Define minimal utility DSO functional related responsibility and accountability for physical operations of a local distribution area
  - DSO should provide T-D Interface reliability coordination with ISO for a local distribution area.
  - DSO should provide physical coordination with the TSO for energy transaction across the T-D interface.
- Provide neutral marketplace coordination
- Situational awareness and operational information exchange
  - Operational information and communication standards are needed for “plug and play” DER integration
  - DSO operational system architecture and related requirements should be developed to guide implementation
  - T-D operational information interface requirements should be assessed current ISO protocols and standards
- Avoid conflicts of interest through functional separation

Future “Integrated Distributed” Electricity System
(High-DER, Multi-directional energy flows & Multi-level optimizations)



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DER Services: Realizing the Value

- Fully address DER participation in wholesale markets and resource adequacy
- Unbundle distribution grid operational services
  - Identification and prioritization of differentiated distribution grid operational services should fully support grid operations, asset utilization, capital investment and meet policy requirements
  - Definition of service performance characteristics and related performance requirements should use technology neutral methods
- Transparent DER value identification and monetization
  - Distribution services value identification and monetization methods should provide reasonable results for all stakeholders including net benefits for ratepayers.
  - Distribution tariffs and/or procurements for flexible DER should be fully expanded to enable DER to support grid operations.
- Open access and low barriers to DER participation
  - The cost of integrating flexible DER should not be a barrier to participation. Alternative solutions should be considered.
  - Transaction processes including scheduling, verification and settlement should not be a barrier to participation.

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