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THE INTEGRATED GRID

REALIZING THE FULL VALUE OF CENTRAL AND DISTRIBUTED ENERGY RESOURCES

DOE, Value of DG Workshop
September 30, 2014
Washington D.C.

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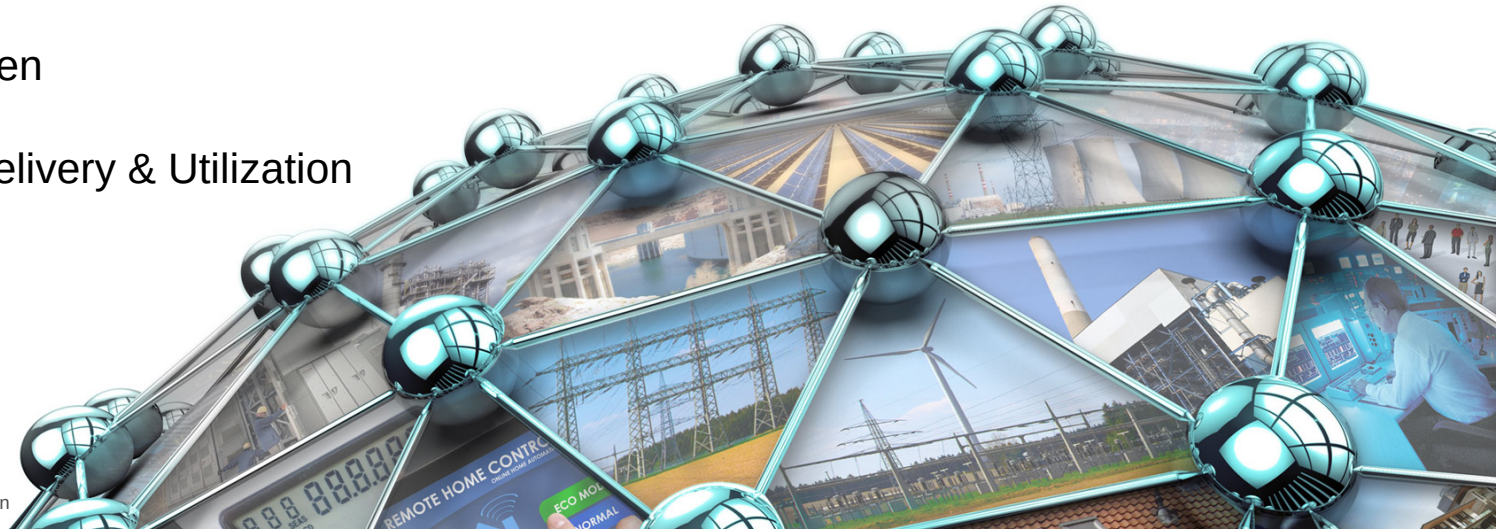
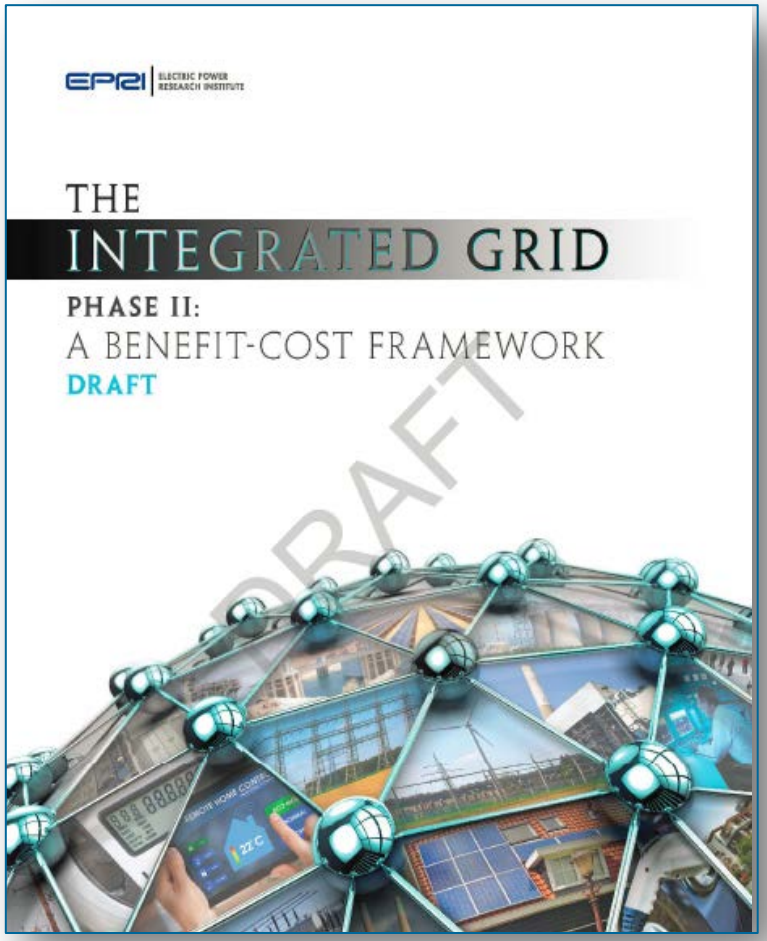
Director
EPRI Power Delivery & Utilization



Integrated Grid Status

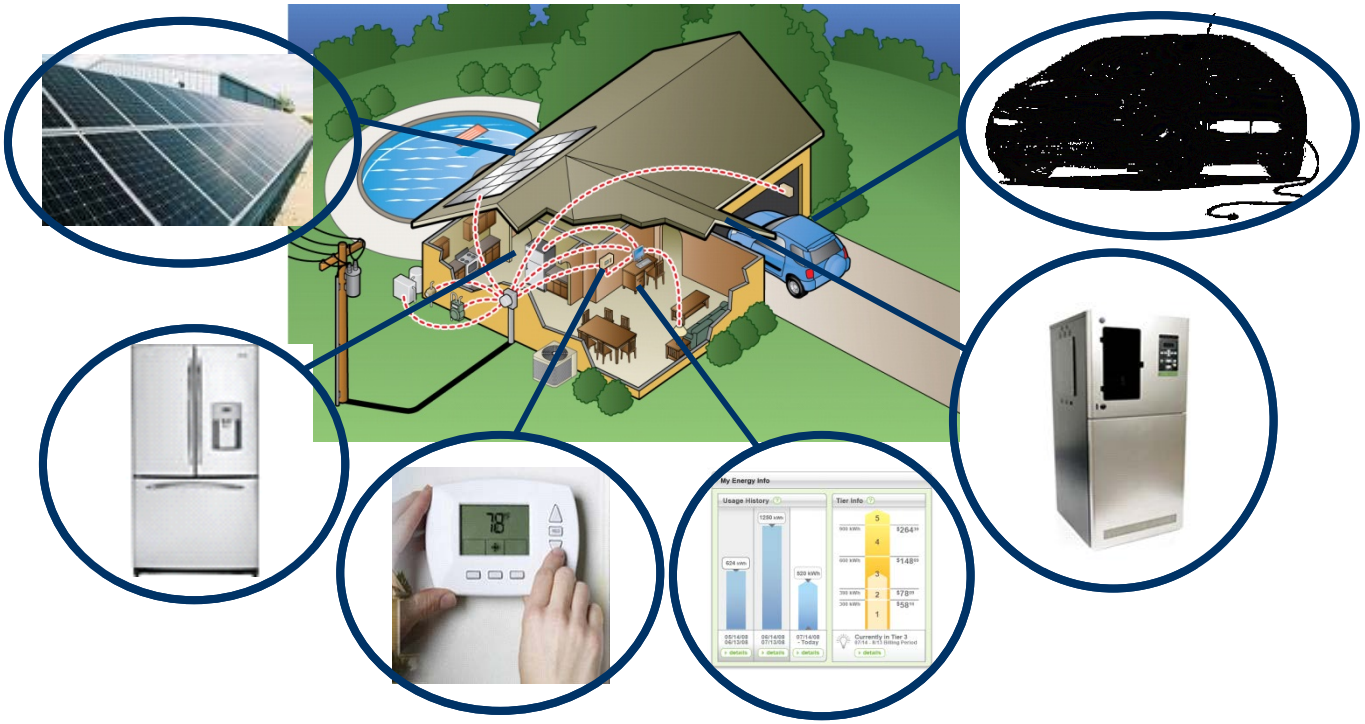


- ✓**Phase I** Concept Paper & Initiative Launched 02/2014

- ✓**Phase II** In progress
  - ✓ Initial Draft Framework completed 08/2014
  - ✓ Draft being distributed for external Industry & expert peer review 09/2014
  - ✓ On-line Community launched 08/2014
  - ✓ Publish target timeframe 11/2014

- **Phase III** Working with members on potential scenarios to be analyzed

The Integrated Grid is about *Enabling the Customer*



The integrated grid allows **Local Energy Optimization** to become part of **Global Energy Optimization.**

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Action Plan

Framework for Evaluation of Grid Modernization Investments

Interconnection Technical Guidelines

Integrated Grid Planning & Operations

Ongoing Industry Collaboration and Tech Transfer to Inform Stakeholders including Policy & Regulation

Action Plan

Framework for Evaluation of Grid Modernization Investments

Interconnection Technical Guidelines

Integrated Grid Planning & Operations

Comprehensive, Transparent, Repeatable Methodology

Defining the Scenario - Assumptions

Markets and Policy

- Subsidies and Incentives
- Utility Obligations
- Reliability Requirements
- Energy and Capacity Markets
- Ancillary Services and Flexibility

Bulk System

- Resource Mix and Characteristics
- Capacity Resources
- Transmission Characteristics and Plans
- Technologies (HVDC, etc)
- Costs and limitations for new build

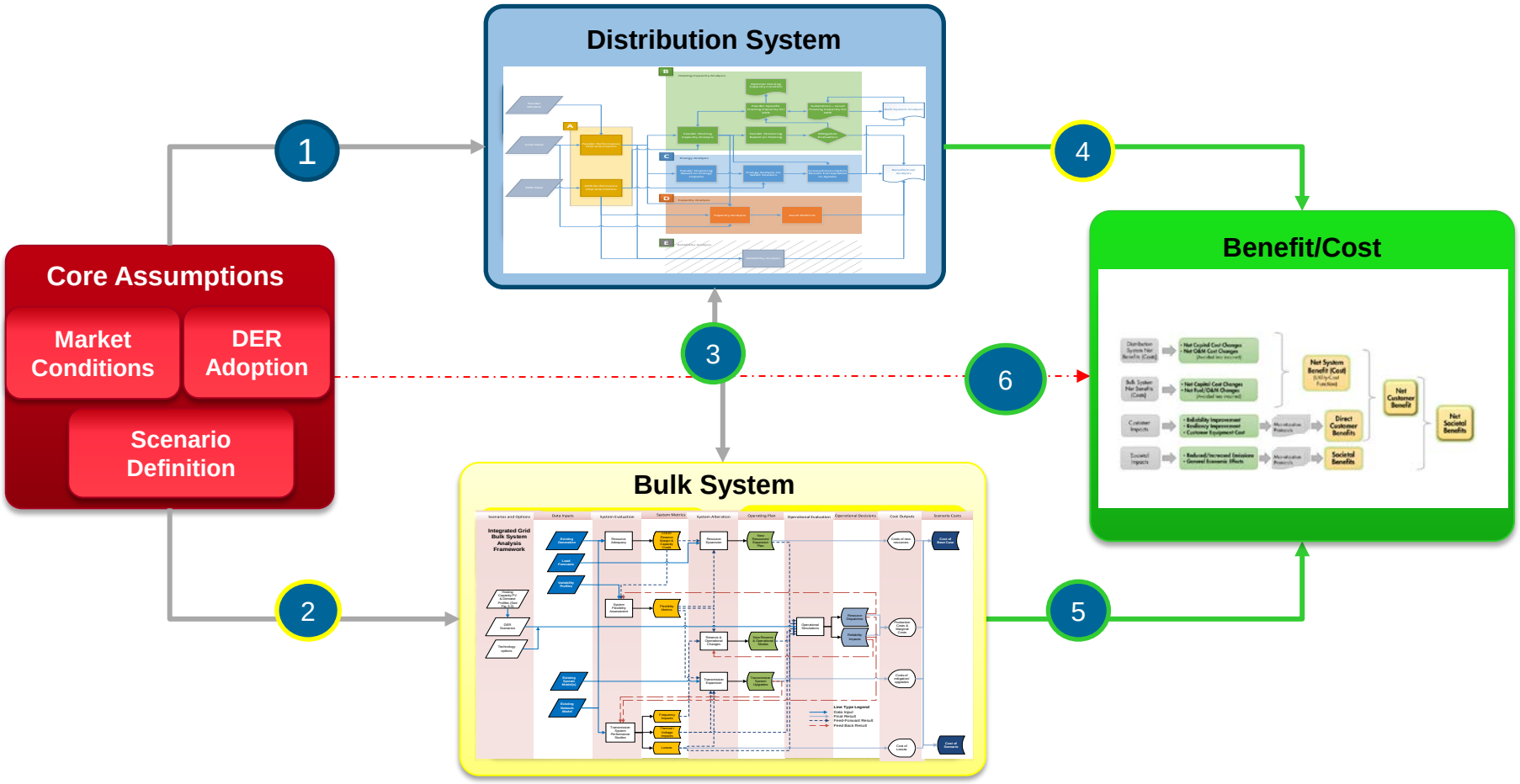
Distribution System

- Expected Renewable Penetration
- Load Growth, Efficiency
- Technologies (voltage control, smart inverters, etc)
- Distributed Generation and Microgrids

Societal Factors

- Cost of Carbon
- Value of Reliability
- Market Structures
- Energy Efficiency

Integrated Grid: Benefit Cost Framework



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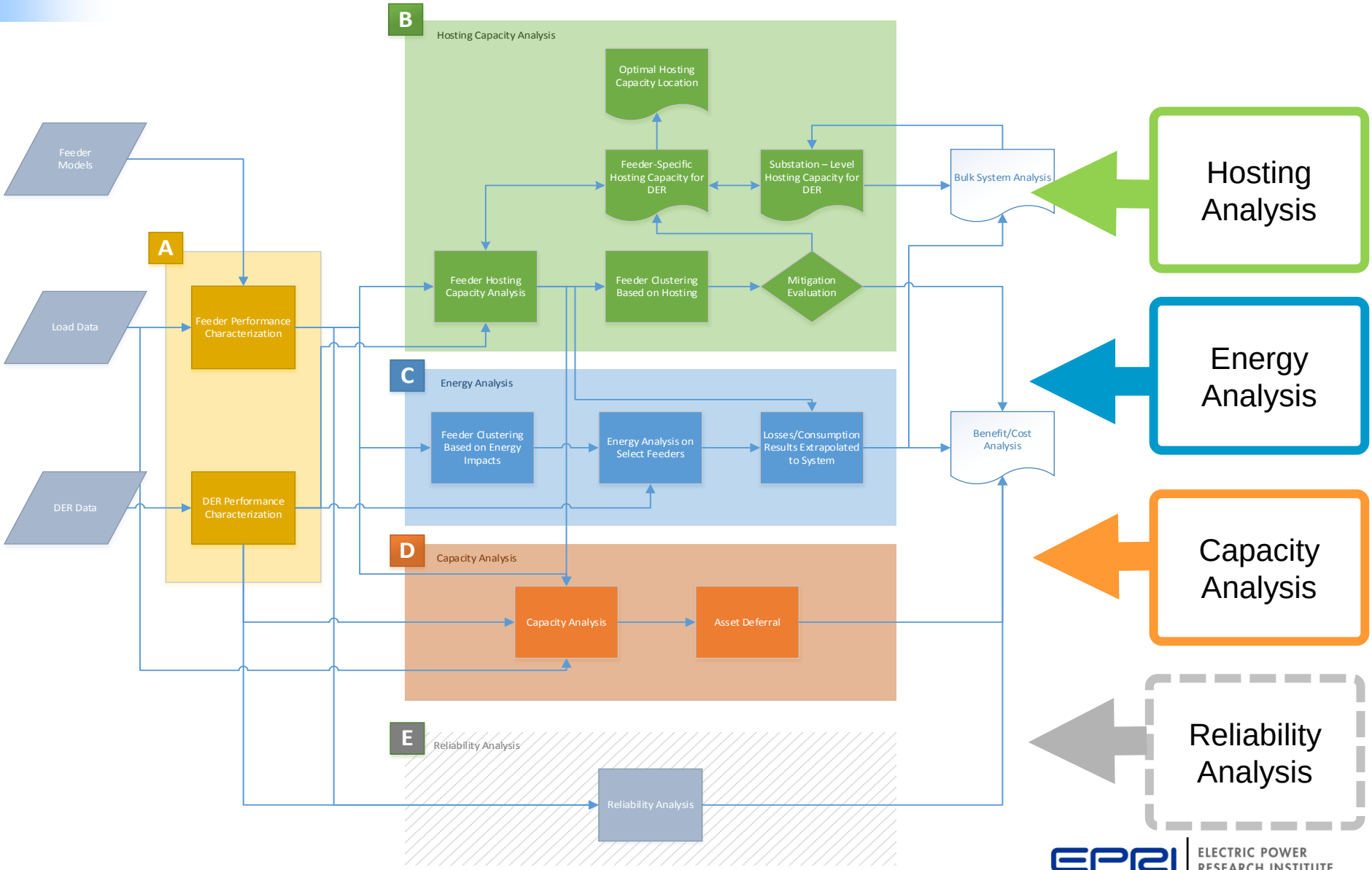
Distribution Framework Flowchart



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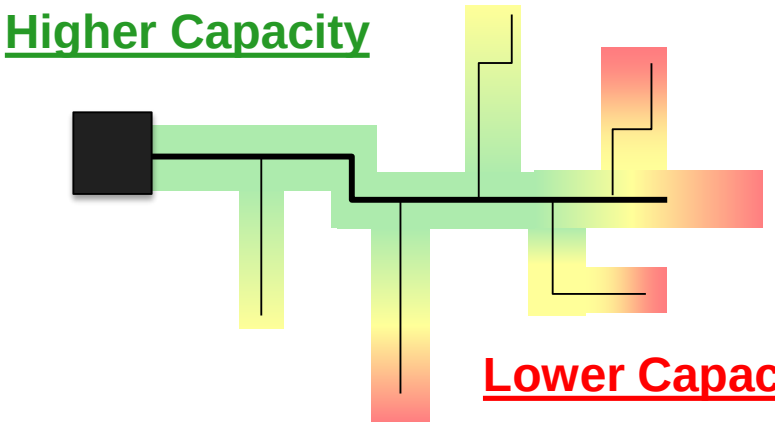
Integrated Grid: Distribution Network

- Maintain service quality and reliability
- Impact of DER
- Different distribution network characteristics
- Location matters



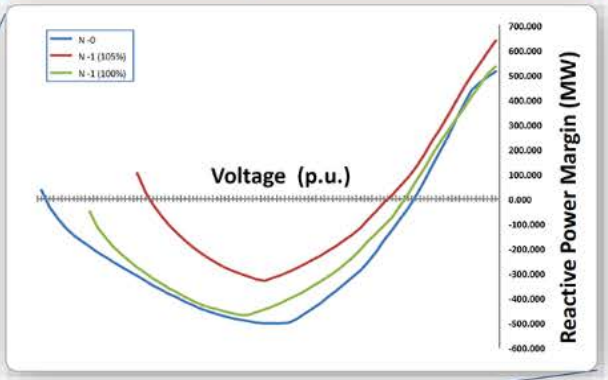
Impact/value assessment must consider
unique distribution characteristics
&
location of DER

What is DER hosting capacity?

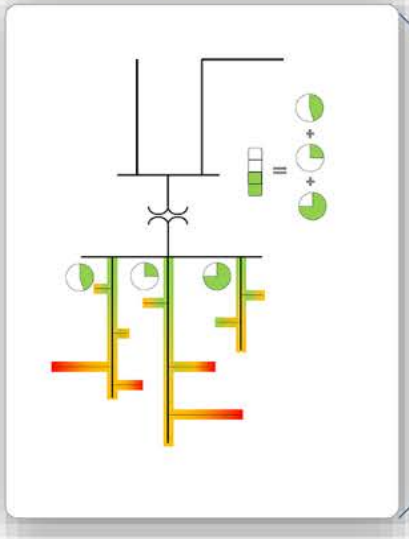
The amount of DER that can be accommodated without impacting system reliability or power quality

DER Impacts Not Just on Distribution Network

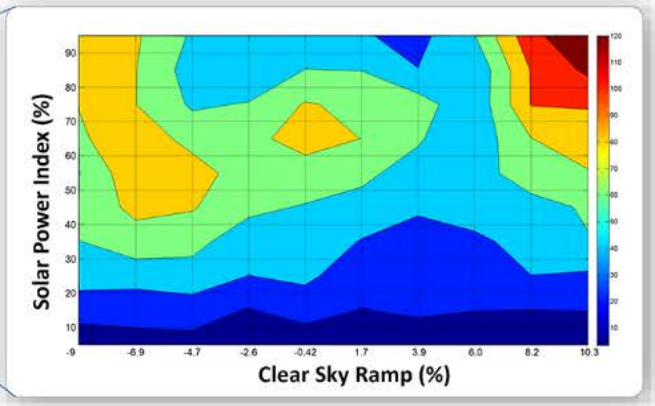
Voltage and Frequency Stability Assessment



Distribution Hosting Capacity Assessment



Flexibility and Reserve Assessment



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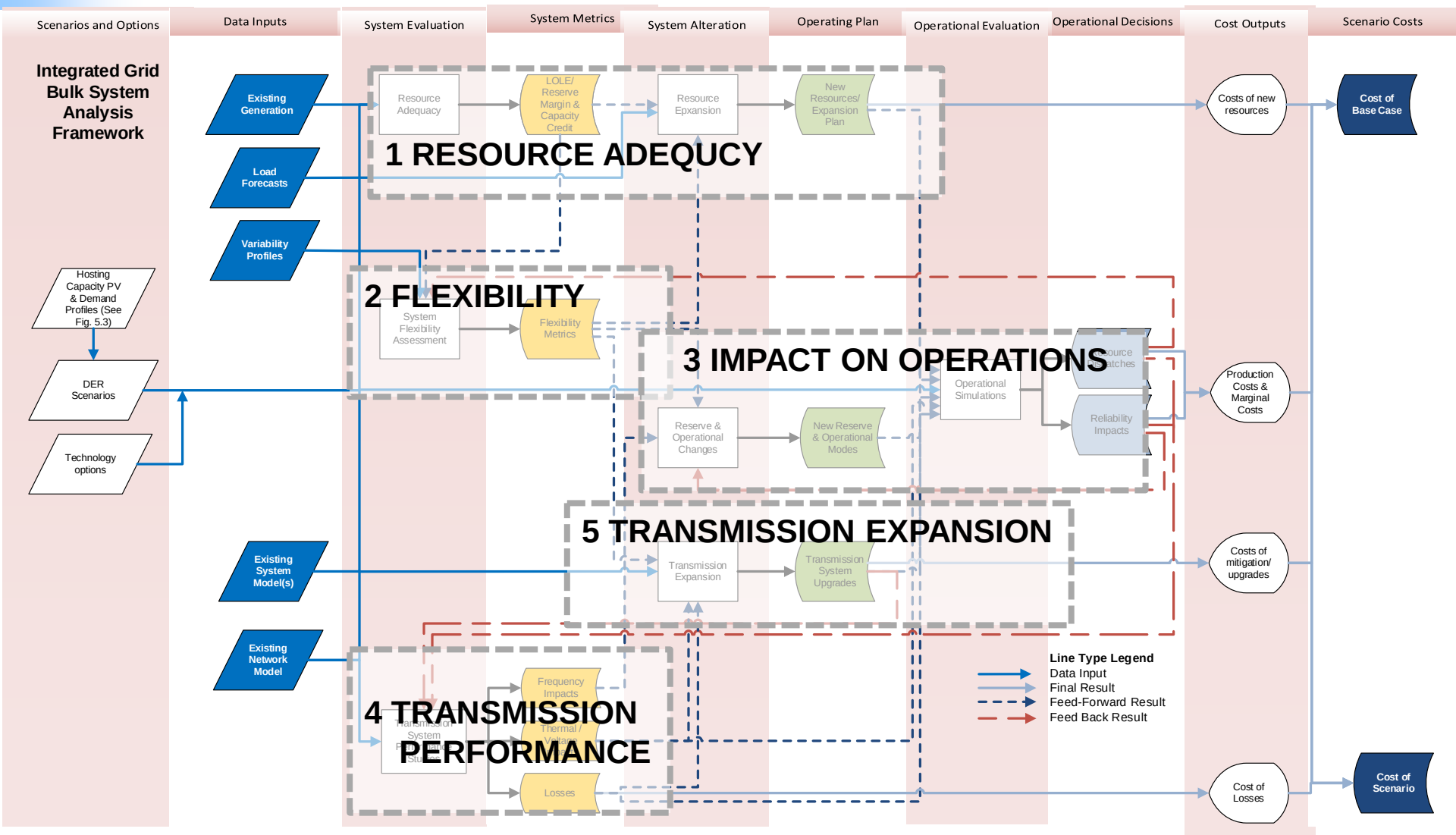
Integrated Grid: Bulk System



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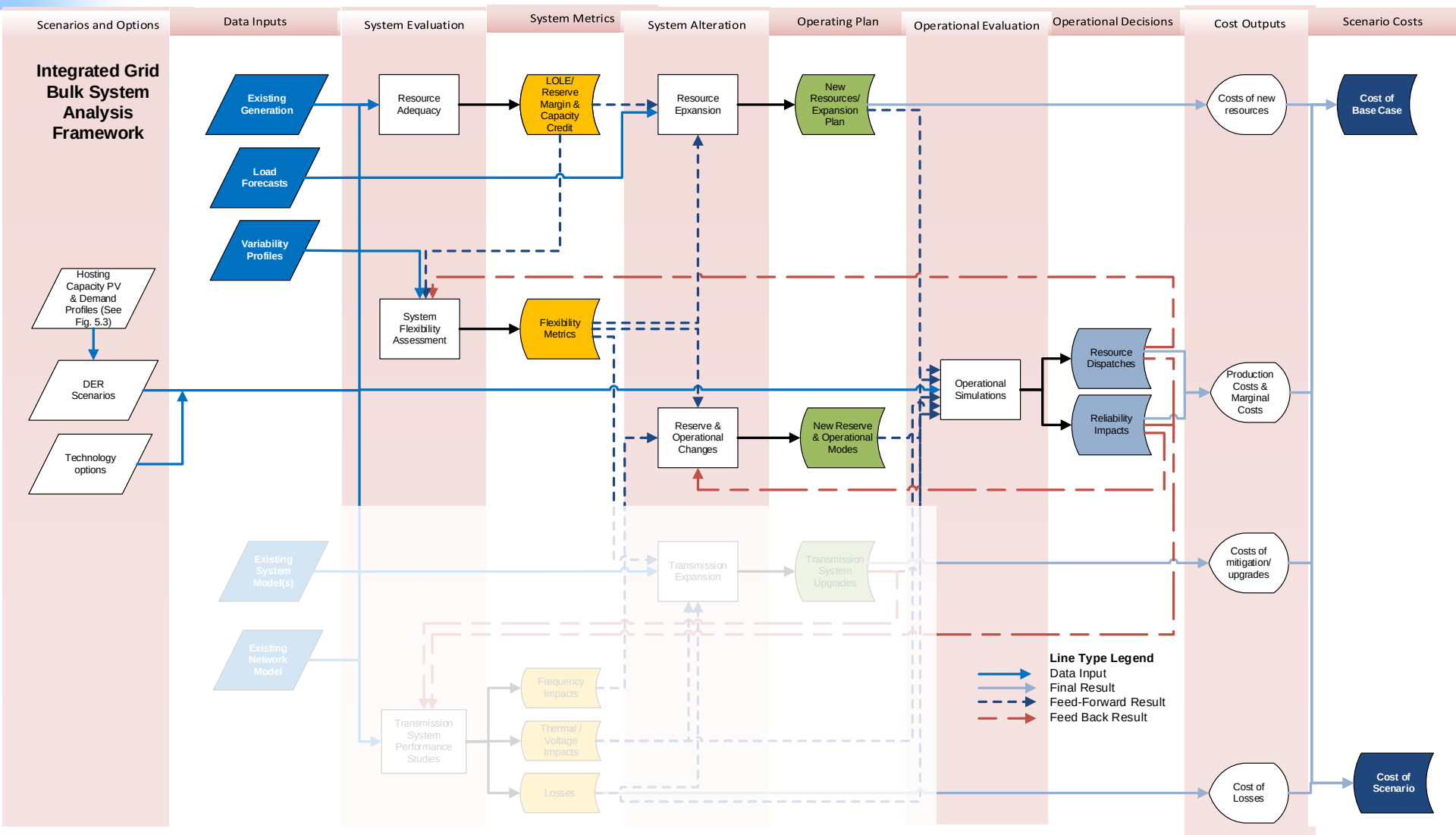
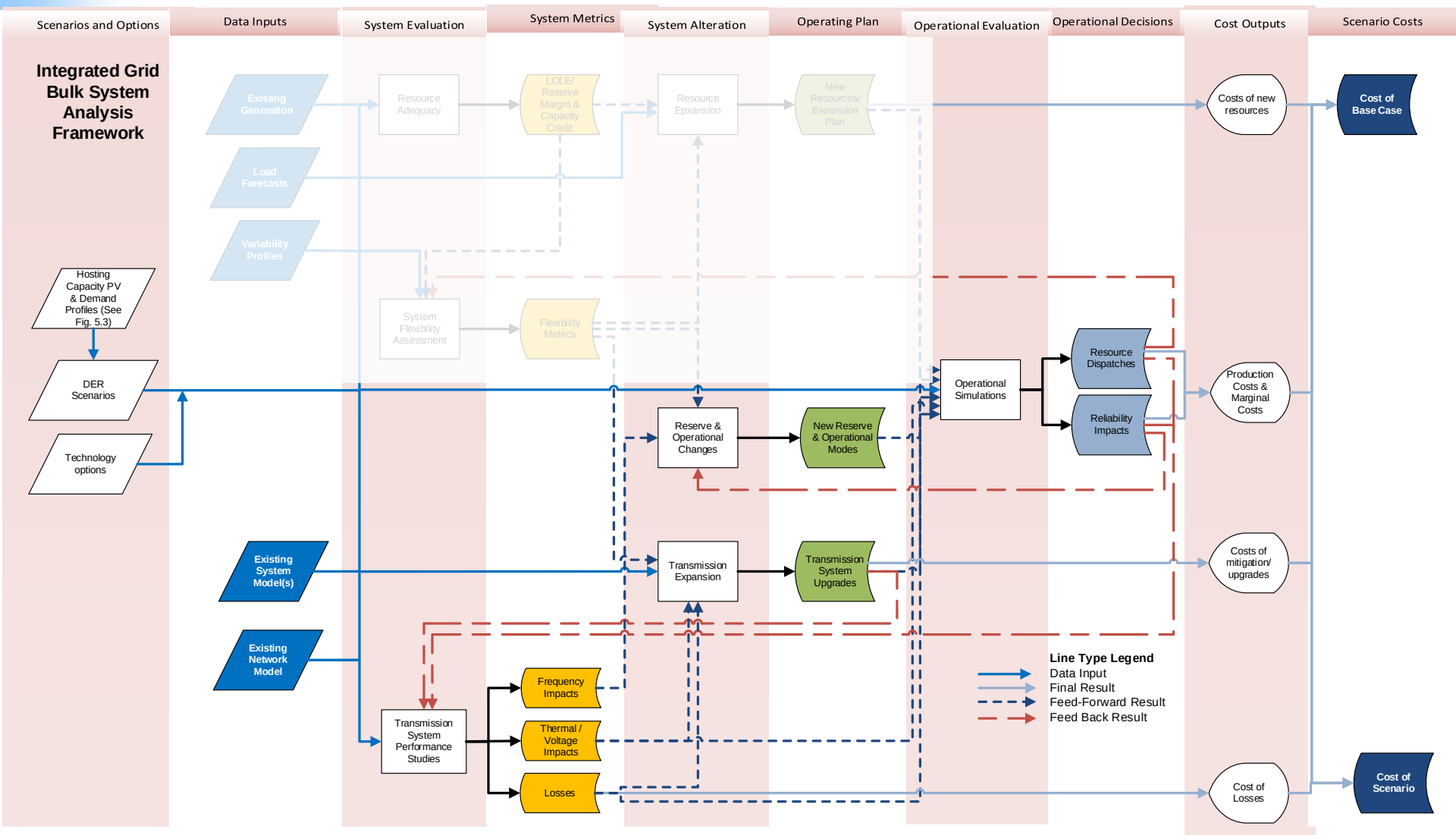
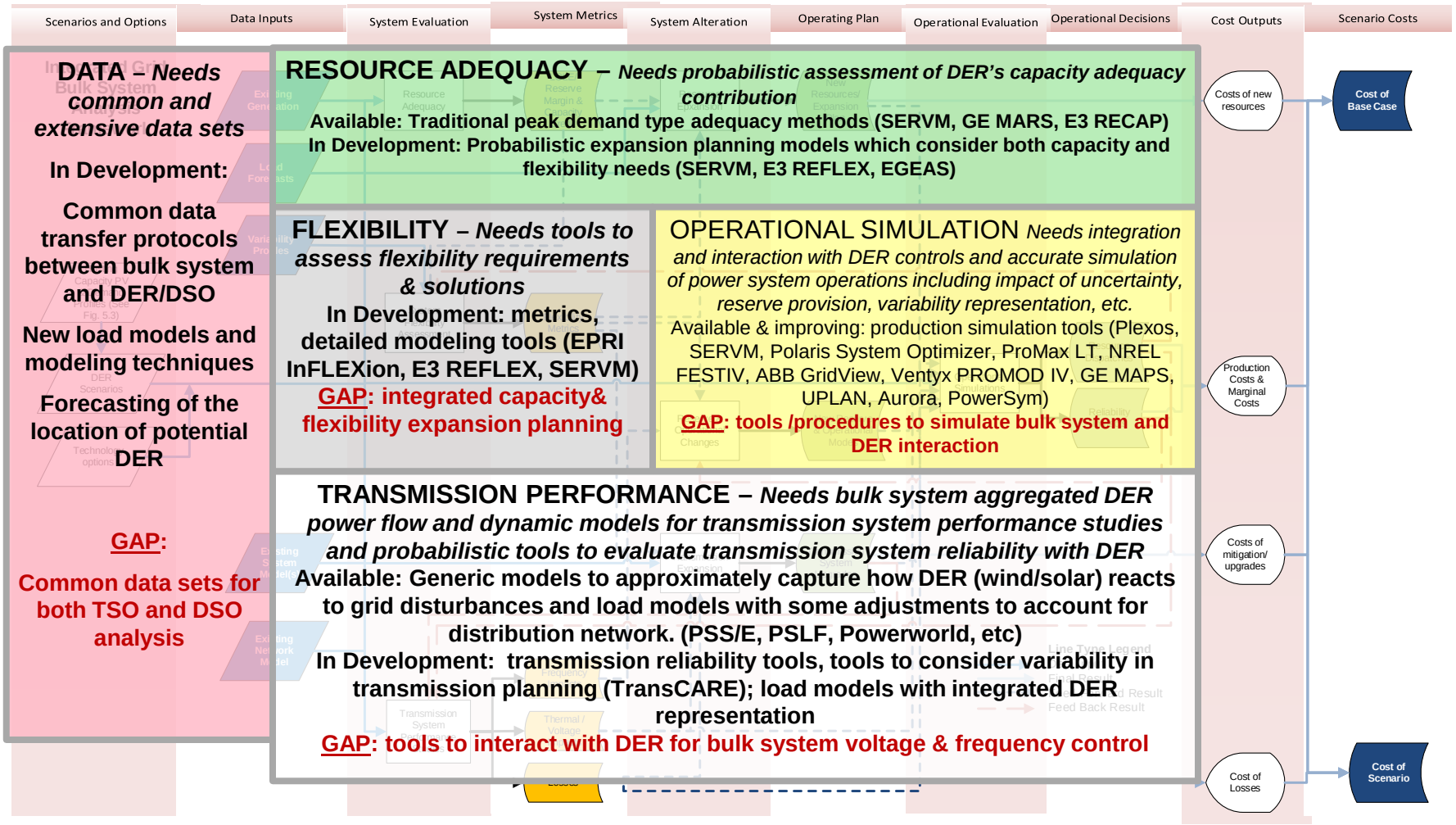
Integrated Grid: Tailored Study Path IPP



Integrated Grid: Tailored Study Path TO/TSO



Integrated Grid: Gaps Exist



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Critical Research Areas to Close Gaps

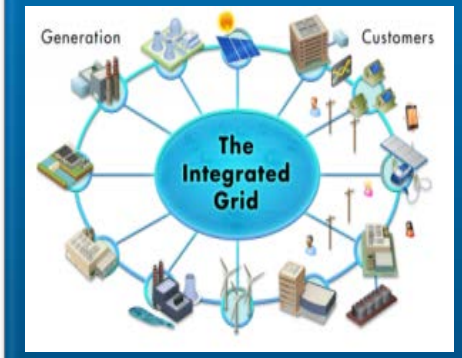
Architecture for the Integrated Grid

- Information & Communication Infrastructure
- Enterprise Interoperability
- Distributed Controls
- Open Application Platforms
- Cyber Security

Integrating the Customer

- Energy Efficiency
- Voltage Response
- Demand Response
- Local Generation & Storage (EV)
- Resiliency
- Customer Services
- CIS

Integrated Planning and Operations



- Integrated Models
- Advanced Simulation
- Real Time Systems
- Distributed Controls & Demand Response
- Risk-Based
- Forecasting & Analytics
- Visualization

Advanced Asset Management

- Sensors & Communications
- Advanced Analytics
- Maintenance & Diagnostics
- Reliability & Resiliency
- Visualization & Decision Support

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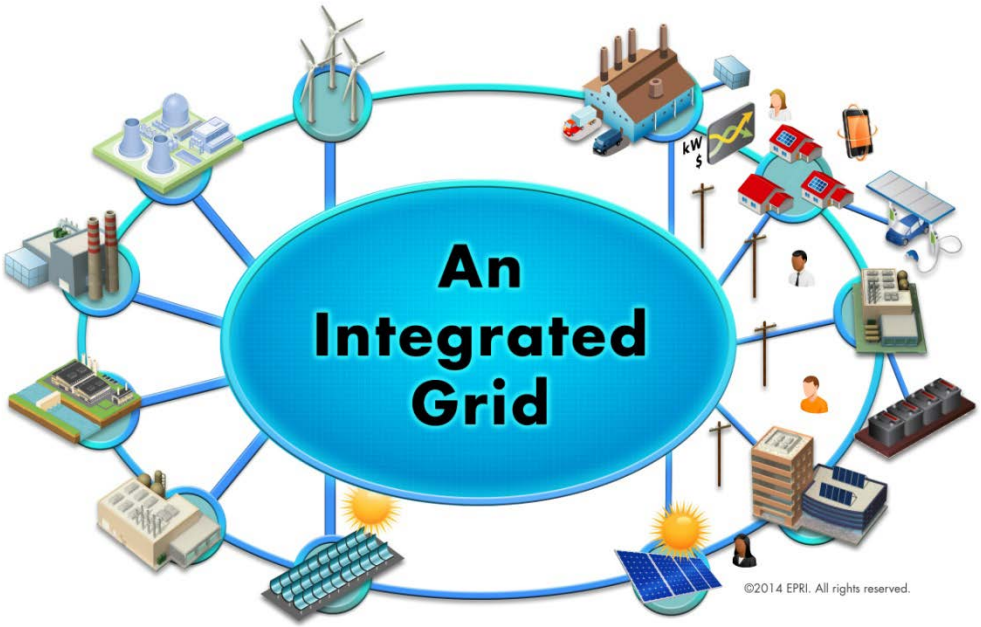
Next Step: Assess the Technologies & Apply the Framework in Pilot Applications

1. *Advanced Voltage Control*
2. *PEV Infrastructure*
3. *Distributed Storage*
4. *Large Scale PV*
5. *Large Scale PV with Storage*
6. *Customer Technologies*
7. *Microgrids*



Pilots will help in refining the framework & help guide future research

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THANK YOU

Together…Shaping the Future of Electricity

http://integratedgrid.epri.com/

For Additional Information on Phase II Contact

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