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Innovating Utility and Regulatory Processes to Improve Distribution Resilience

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Resilience

- Capability to keep a system running when faced with natural- or human-caused insults
  - Or limit the effects on people and places
- Capability to recover fast if the system is brought down

Outcome Considerations for Resilience

- 24x7 resilience **exposure**
- **Social** priorities – what needs to be protected most, next
  - **Critical services** for public health and safety need more “9s”?
  - Awareness of **vulnerable people**, protection before a disruption and during
- **Scenarios** (still) important, new ones address emergent resilience threats
- All **options**: Continuous improvement in the operator playbook, cost control
  - Connect planning and investment; address capital bias
- **Return on performance** compensates utility for most important outcomes
- **Customer** options
  - E.g. Microgrid as a service, a tariff option from utility or enabled

Resilience

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- Resilience is a scenario-driven assessment
  - From the grid perspective, the focus is on the grid
  - From the societal perspective, the focus is on people and public safety; the grid in one among an array of critical infrastructure

What everyplace with high% of renewable power will need: a flexibility reservoir

- Unlike a water reservoir, where the contents are uniform
- A flexibility reservoir holds an array of flexibility capabilities and sources
  - **Many are DERs**, hosted and in some cases controlled by customers
  - Minimum of cycling fossil fuel generating units if climate is important

- An early effort (20 years ago) to show graphically an array of grid responsive resources in the hands of customers:

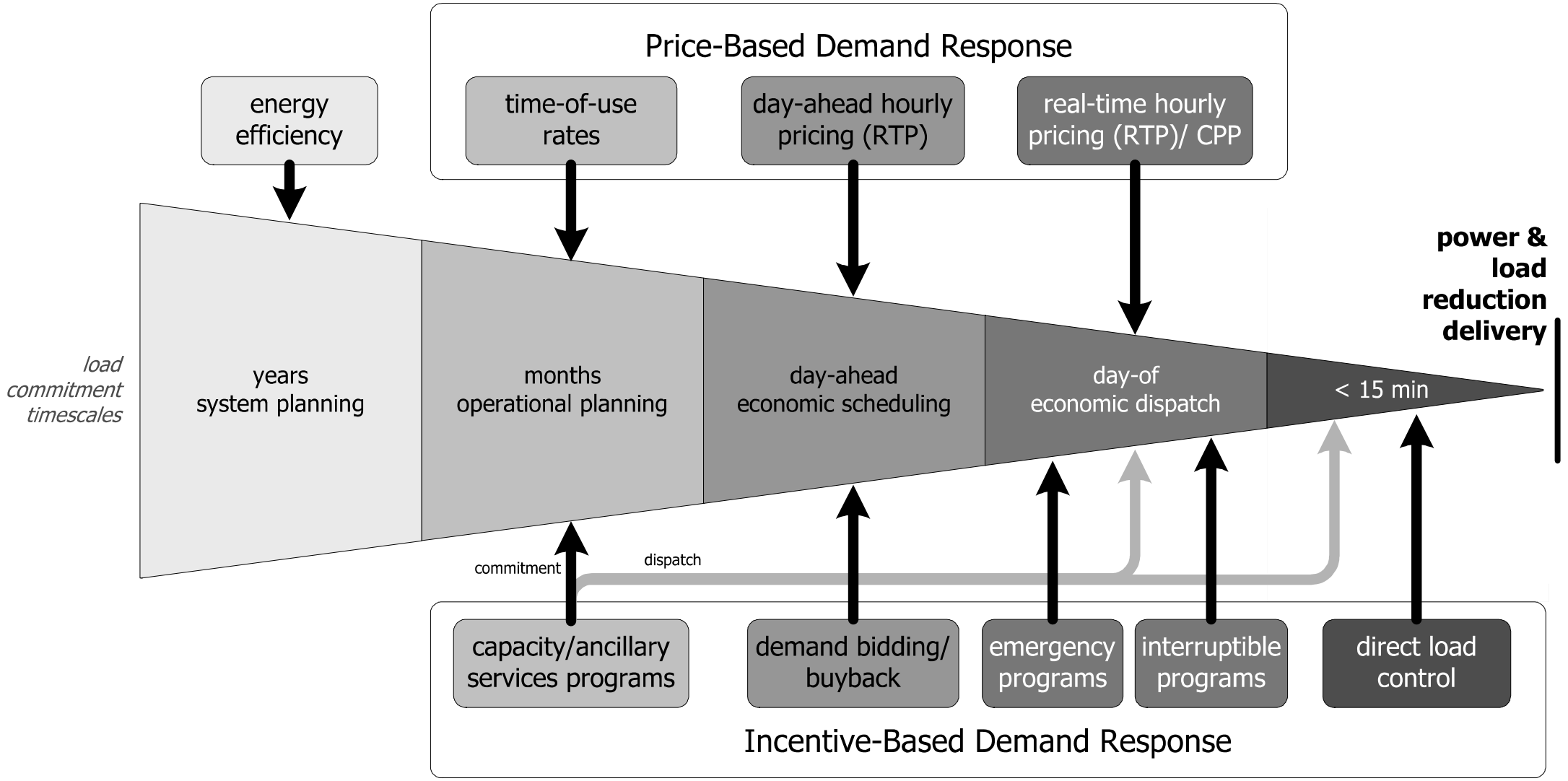


Figure 2-3. Role of Demand Response in Electric System Planning and Operations

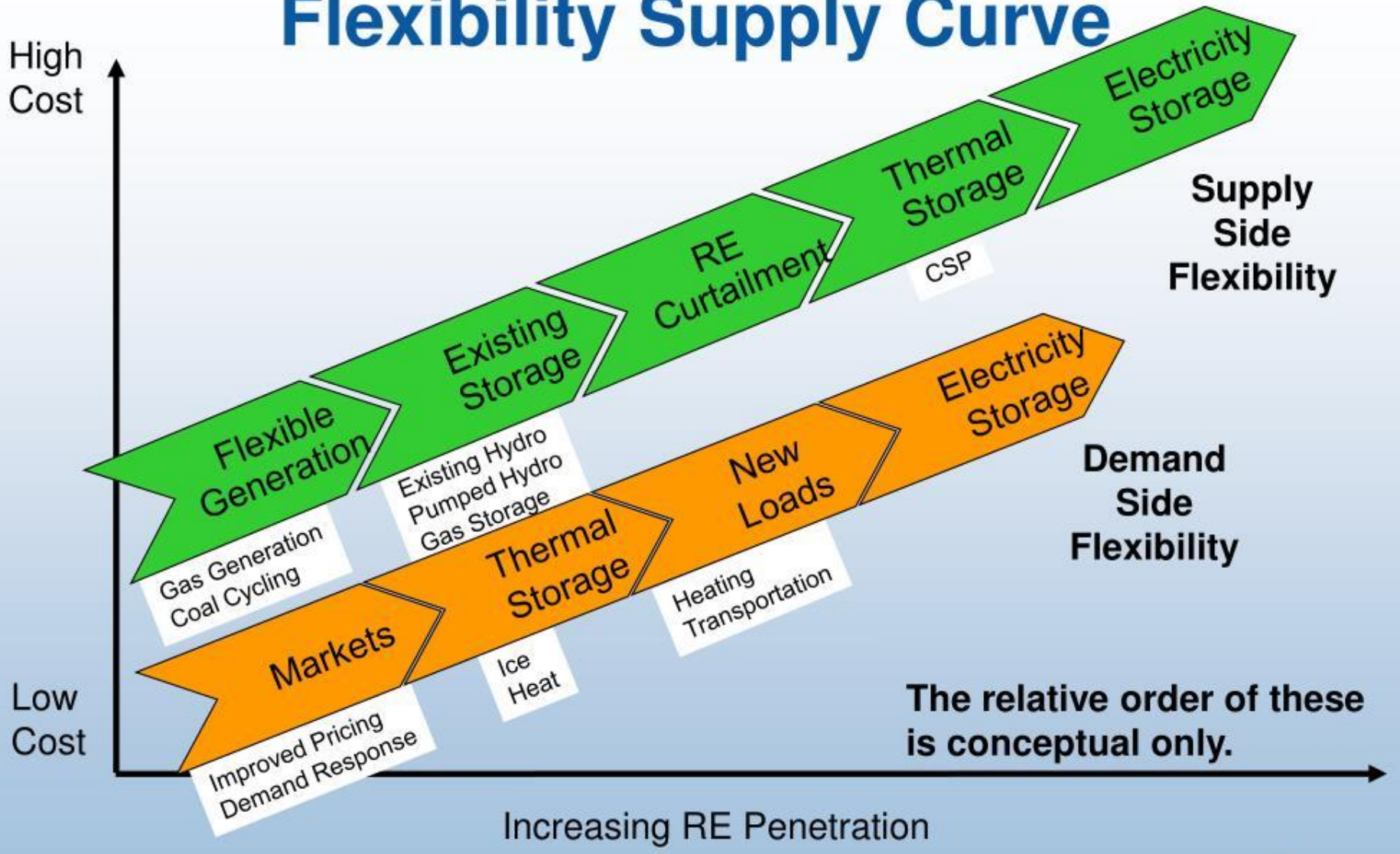
From "Benefits of Demand Response in Electricity Markets and Recommendations for Achieving Them, A Report to the United States Congress Pursuant to Section 1252 of the Energy Policy Act of 2005" by the US DOE, February 2006.

What every place with high% of renewable power will need: a flexibility reservoir

- Unlike a water reservoir, where the contents are uniform
- A flexibility reservoir holds an array of flexibility capabilities and sources
  - **Many are DERs**, minimum of cycling fossil fuel gen units if climate matters
- Good news: technology is advancing, firms are innovating,
  - We are advised to pay attention that these businesses are succeeding and benefits are extending to all
  - Expressing all this graphically and clearly remains a challenge

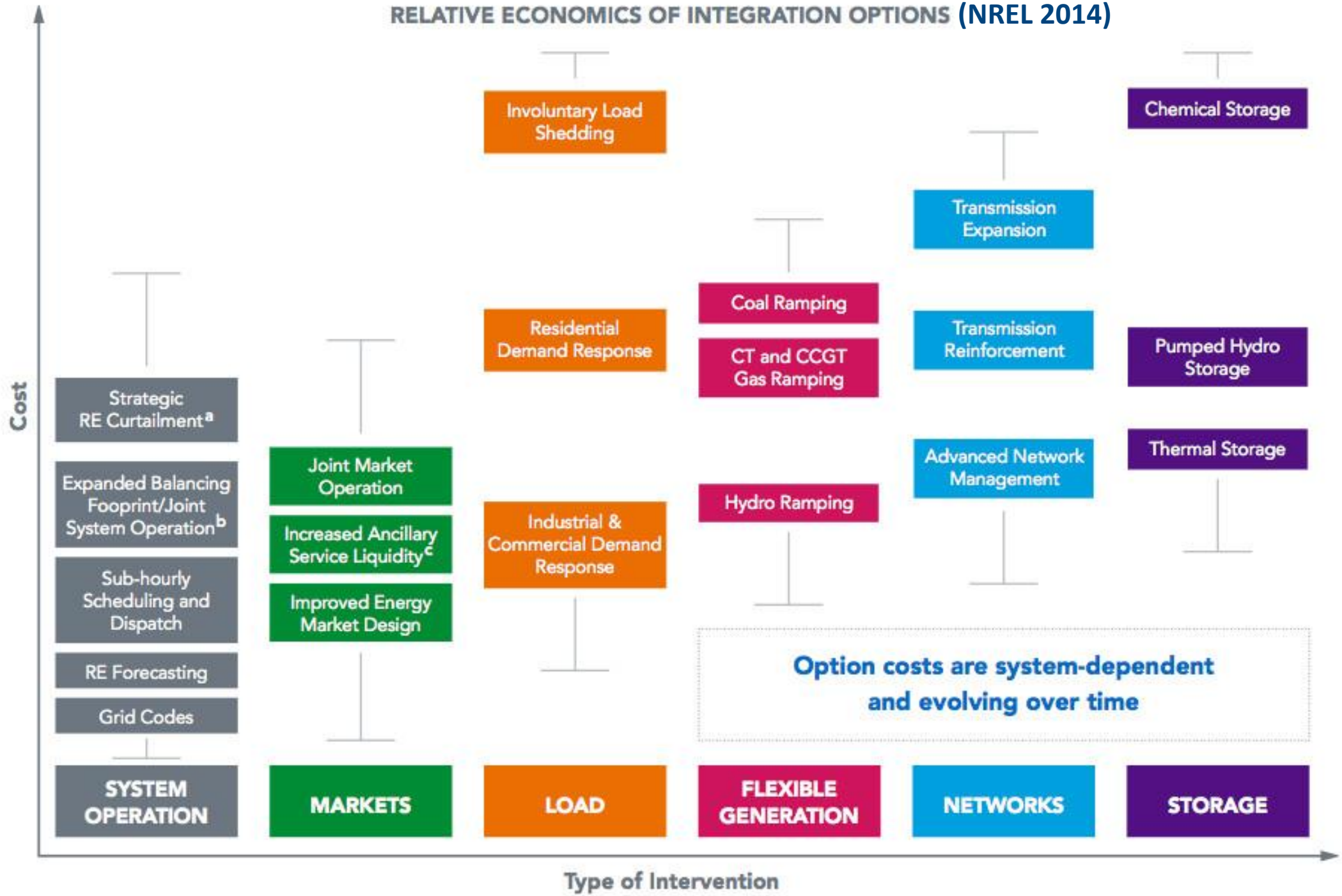
- More recent images of grid flexibility from NREL:

Flexibility Supply Curve

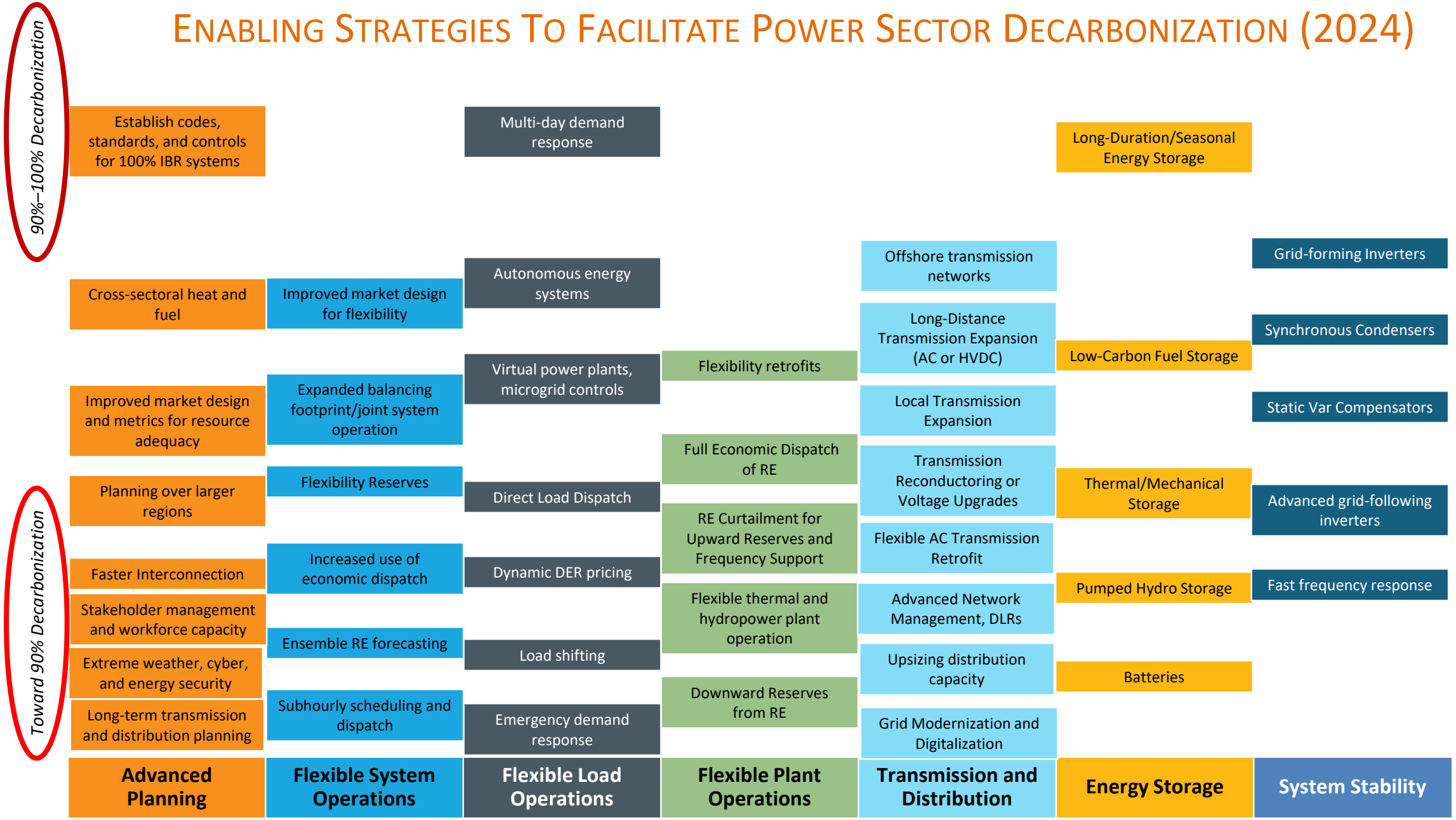


SEAAC Strategic Energy Analysis and Applications Center

https://www.nrel.gov/docs/fy10osti/47187.pdf
2010


RELATIVE ECONOMICS OF INTEGRATION OPTIONS (NREL 2014)
Cost
Type of Intervention
Strategic RE Curtailment[a]
Expanded Balancing Fooprint/Joint System Operation[b]
Sub-hourly Scheduling and Dispatch
RE Forecasting
Grid Codes
SYSTEM OPERATION
Joint Market Operation
Increased Ancillary Service Liquidity[c]
Improved Energy Market Design
MARKETS
Involuntary Load Shedding
Residential Demand Response
Industrial & Commercial Demand Response
LOAD
Coal Ramping
CT and CCGT Gas Ramping
Hydro Ramping
FLEXIBLE GENERATION
Transmission Expansion
Transmission Reinforcement
Advanced Network Management
NETWORKS
Chemical Storage
Pumped Hydro Storage
Thermal Storage
STORAGE
Option costs are system-dependent and evolving over time

Enabling Strategies To Facilitate Power Sector Decarbonization (2024)



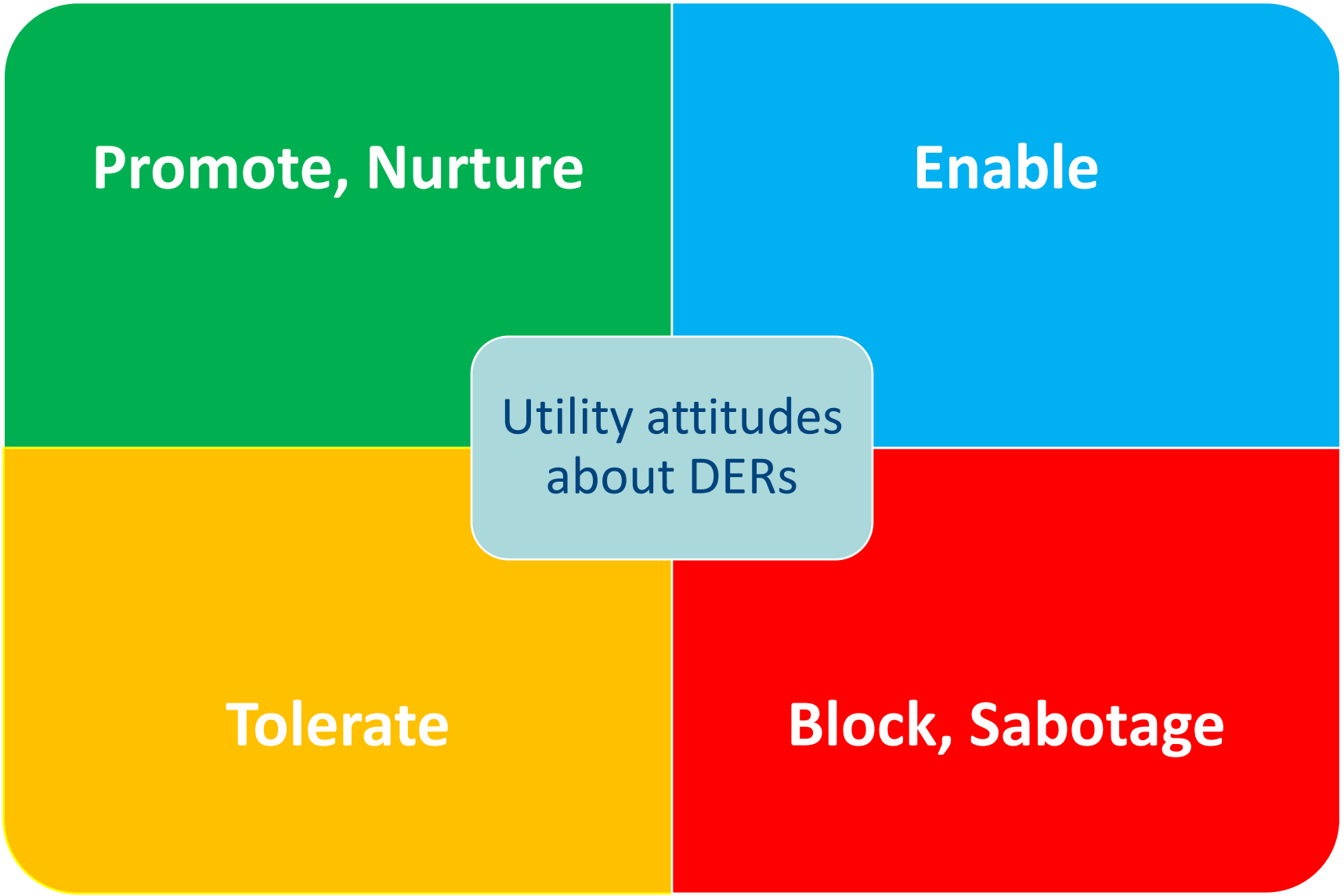
https://www.nrel.gov/docs/fy24osti/91357.pdf

DERs seem (are?) critical for resilience

- DER is a resource – are you taking it seriously, respecting its potential? accepting that diminished control of a small set of assets is replaced by accurate predictability of a population of assets?
- We are all on a learning curve
  - Approaching it from our roles
    - Operating a grid
    - Overseeing a utility
    - Managing a business or household
    - Innovating DERs to be fit for purposes

Utility: a pivotal institution;
where it serves it governs pace and purpose of DERs deployment

So how might a utility respond to DER potential?


Promote, Nurture
Enable
Utility attitudes about DERs
Tolerate
Block, Sabotage

Manifestations

Resilience can be integrated into a DER-focused procurement

- Grid integration of Existing pieces
  - Thermal storage, Grid-integrated efficient buildings
- New pieces
  - Managed charging for EVs, new intermittent electric loads

- New systems
  - DER aggregated systems operated as a unit (VPPs)
  - Microgrids as a service
- New resource procurement methods

Economic efficiency would align decision-maker incentives with societal priorities

- Pricing (rates) is fair, just and reasonable
- Social equity is a priority, vulnerable people are prioritized
  - DERs benefits are not just for those who can afford them (or the grid is lost)
- Regulated company earnings produces necessary capital
- Planning connects directly with investment
- Policy strikes optimal balance between regulation and markets
- Policy connecting wholesale and retail markets (cooperative federalism)
  - Resource adequacy is redefined to reflect capabilities in distinct time blocks

Utility as provider or facilitator of services

- Microgrid as a service
- Resilience as a service
- Premise energy systems as a service

- Consider the NY REV concept (not adopted – yet) of the utility as a **platform** connecting service innovators with customers
  - Fees for making these connections – platform service revenues

Bringing it back to Resilience and regulatory process

- Regulated companies and their regulators will need to engage more and with **forward leaning** intent with the **public safety** apparatus
  - What are the threats?
  - What are the vulnerabilities?
  - What can be hardened?
  - What threats can be diminished through decentralization, diversification, etc?
- How shall this be **integrated into grid planning and investment**?
- How does electrification of critical societal functions change the challenge?
- How will customer capabilities to self-supply be captured, directed and used?

Key Takeaway

Distributed Energy Resources are a principal instrument for grid resilience, and thus, societal resilience. Public Service companies can lead in their efficient deployment with guidance from government.

About RAP

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