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ASOCODIS
Asociación Colombiana de Distribuidores de Energía Eléctrica

North American Experiences with Demand Response Resources and Aggregations

7 December 2018
Bogotá Colombia

Scott Coe
GRIDOPTIMIZE
STABLE GRIDS. FLEXIBLE THINKING.

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Load Management Expertise

Leverage practical experience to address evolving industry needs.

Peer-to-Peer Engagement

PLMA brings members together to develop, implement and share proven practices.

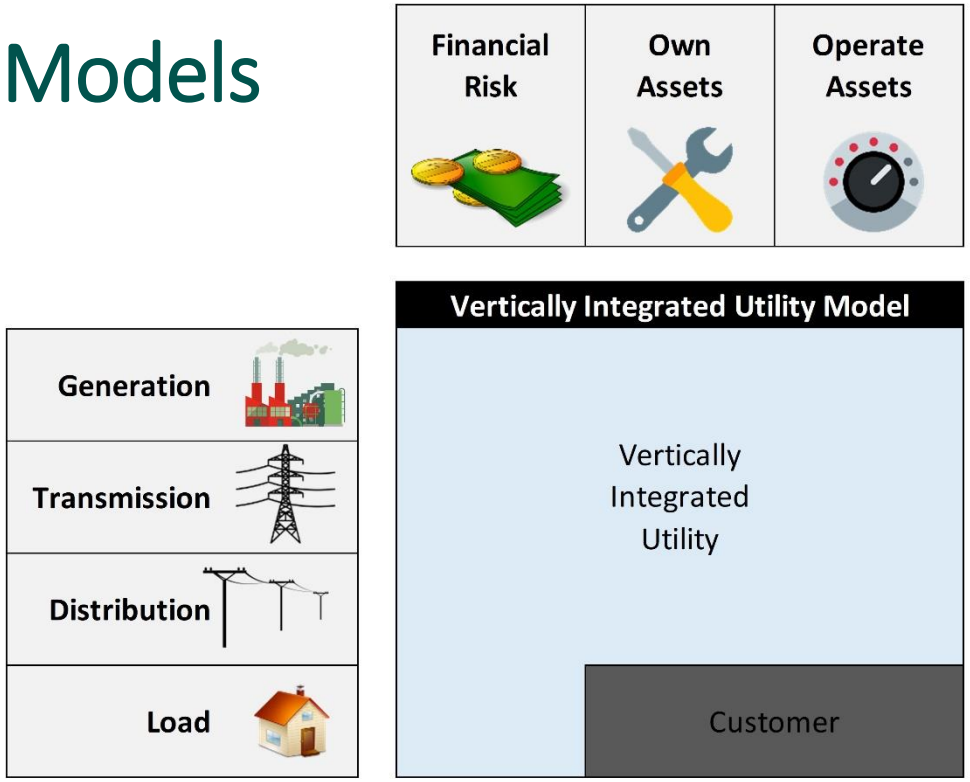
Linking Strategy and Implementation

Help enhance connections between energy thought leaders, strategists and practitioners.

International Interest Group

For PLMA members interested in learning more about innovation outside North America and to provide tailored content for our members from outside of North America

Deregulation Models



DR Program Options

Today's Focus

	Financial Risk	Own Assets	Operate Assets
Generation	Generation Company		Independent System Operator (ISO)
Transmission	T Transmission Owner (TO)		M
Distribution	D Distribution System Operator (DSO)		
Load	R Energy Retailer	A Customer	

M Market Operators (ISOs) allow DR to compete against traditional generation supply

T TO purchases DR services to manage transmission issues

D DSO purchases DR services to manage distribution issues

R Energy Retailer credits customers for providing DR services as a procurement hedge

A Aggregator acts as broker for customers to provide service in any of the above scenarios

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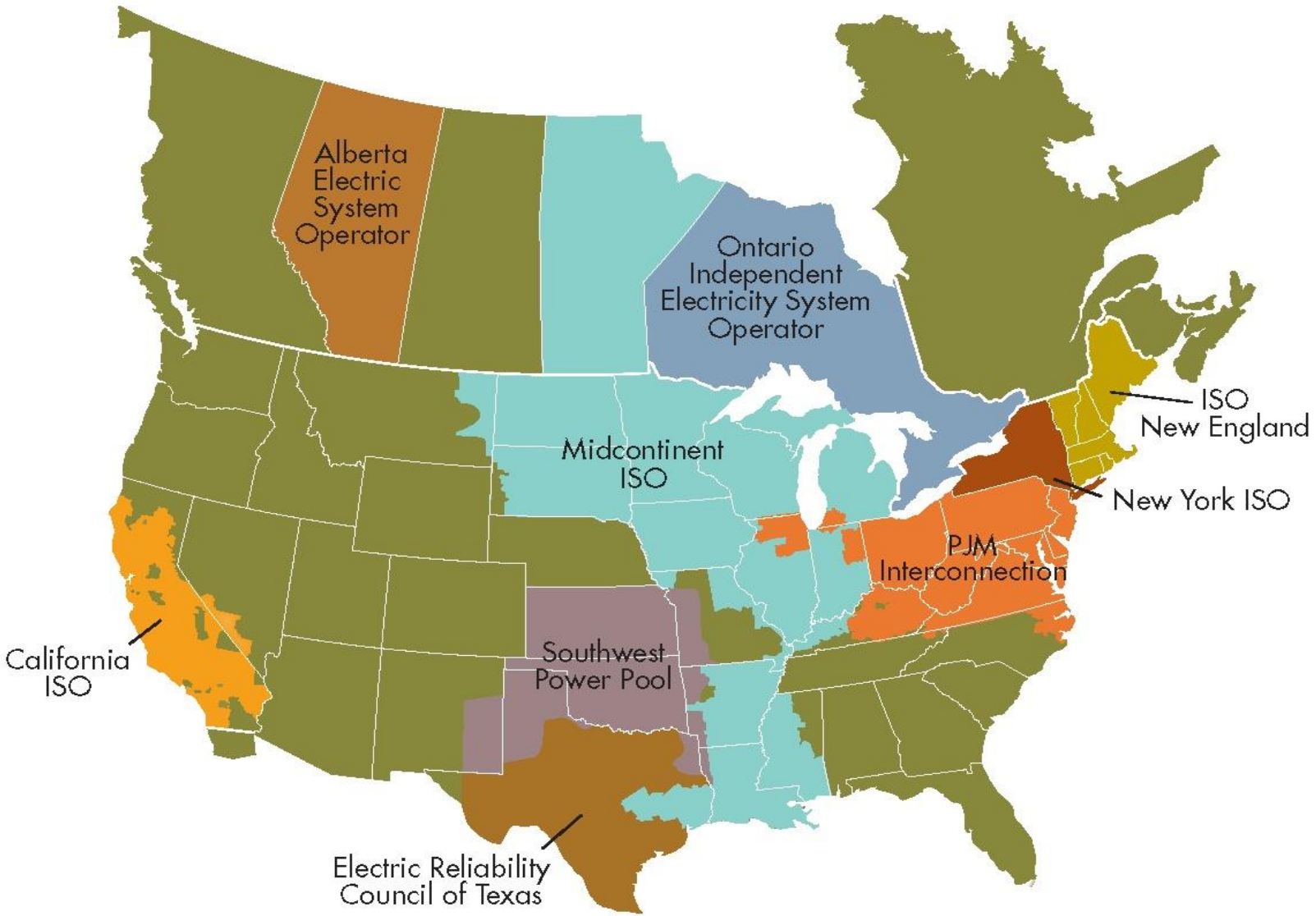
North American ISOs & RTOs



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Retail DR versus Wholesale DR

Retail DR

- Distribution System Operator (DSO) operate unique DR programs
- Each program has constraints, e.g. event duration, maximum calls per year
- Revenues fixed to contract terms
- Each DR resource is effectively competing with other DR resources

Wholesale DR

- ISO/RTO facilitate the wholesale markets
- Market rules are not altered for demand response
- Revenues fluctuate with market prices
- Participation levels directly related to DR offer prices
- DR competes with all other sources, most importantly traditional generation

Benefits of Retail DR

“Natural” Configuration

- Wholesale market are generally for bulk-power resources, not distribution resources
- DSOs can use local resources more strategically, based on location

“Implicit” Demand Response

- Resource can manage peak loads to minimize capacity charges
- Energy retailers can use demand response as a hedge for energy purchases

Benefits of Wholesale DR

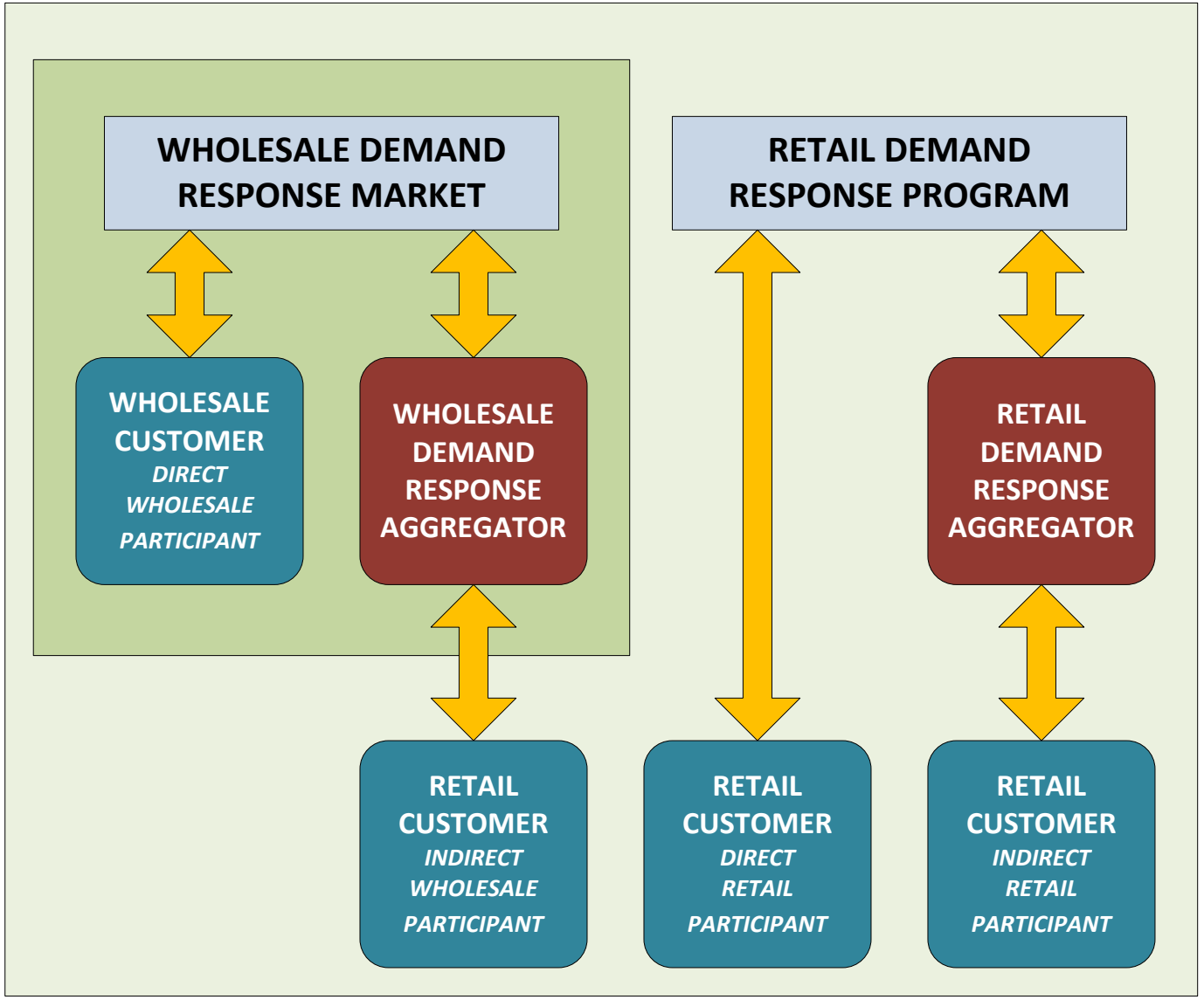
Economic Foundation

- DR value set by markets, not by contractual terms
- Transparent pricing, including historical and forward prices
- Energy, capacity, and ancillary services are available

Level Playing Field

- Economics and reliability requirements are defined
- All resources compete equally based on offer price
- Settlement rules established

Wholesale / Retail Overlap



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“Standard” Market Design

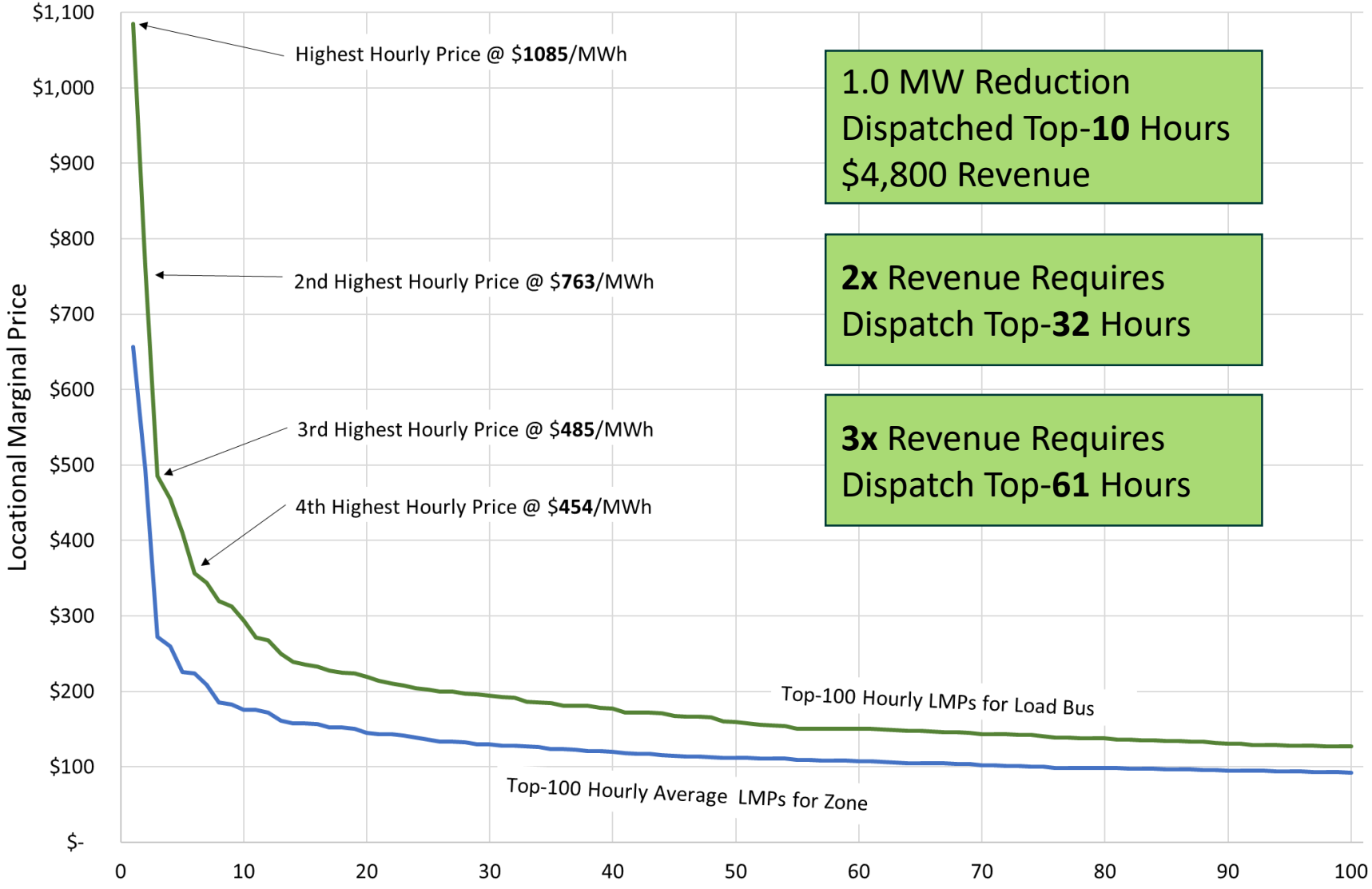
Commodities

- Energy
- Ancillary Services
  - Regulation Service
  - 10-Minute Reserve
  - 30-Minute Reserve
- Capacity
  - Forward Generation Capacity

Timeframes

- Long-Term Forward
  - Years
  - Months
- Short Term Forward
  - Day-Ahead
  - Hour-Ahead
- Near Real-Time

Higher Peaks = Higher Return-on-Investment



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Active versus Stand-By

Active Demand Response

Paid To Change Energy Consumption

- Real-Time Energy Market
- Day-Ahead Energy Market
- Up/Down Regulation Market

All in Current Colombian Markets

Stand-By Demand Response

Paid To Be Available To Change Consumption

- Emergency Response
- 30-Minute Reserve Market
- 10-Minute Reserve Market
- Capacity Market Award Availability

None in Current Colombian Markets

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Active versus Stand-By

Active Demand Response

- Economic Foundation
- Price Trigger
- Dispatch Multiples Times/Year

Stand-By Demand Response

- Reliability Foundation
- Still economically selected
- Dispatch Infrequently
- But, revenue from many hours

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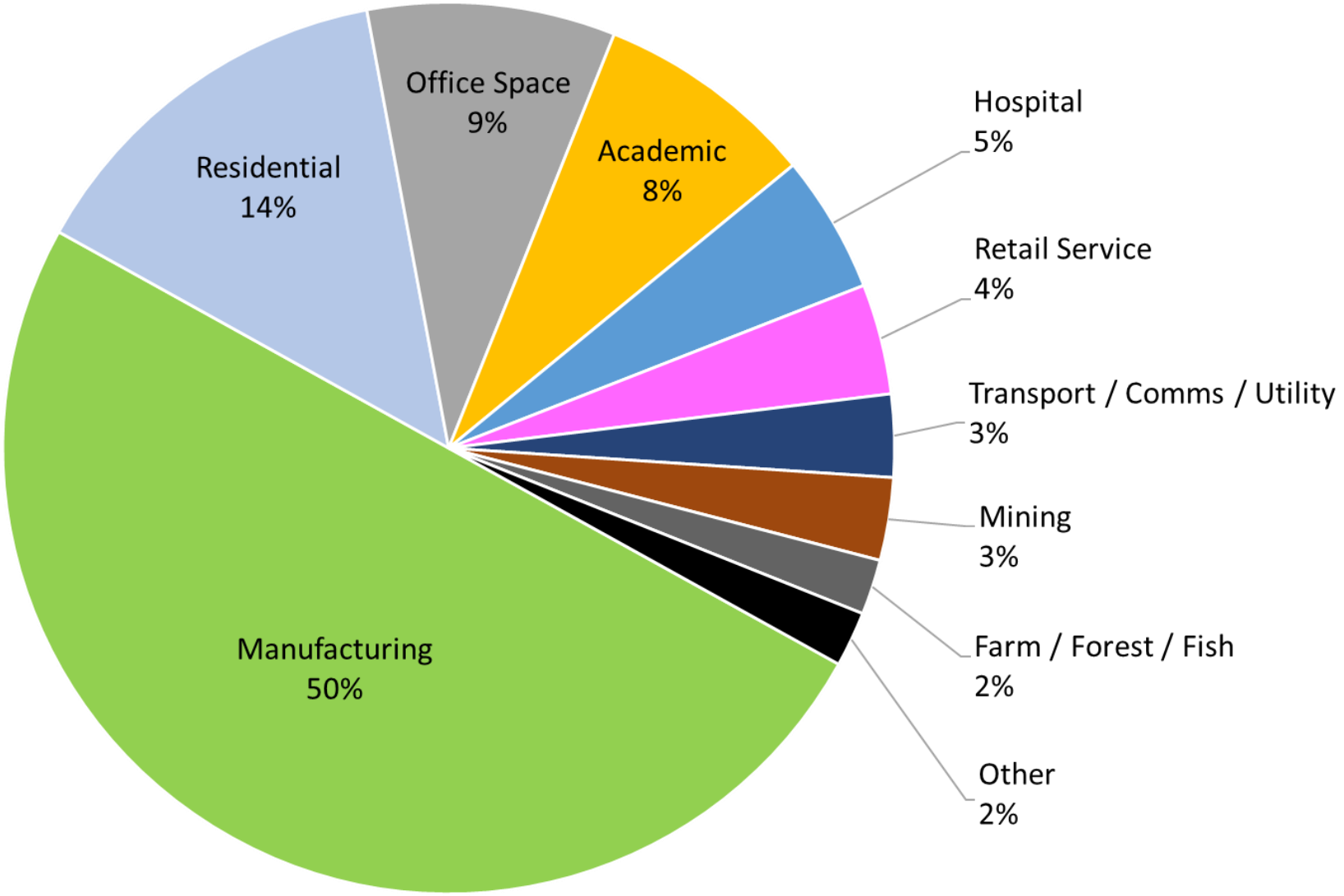
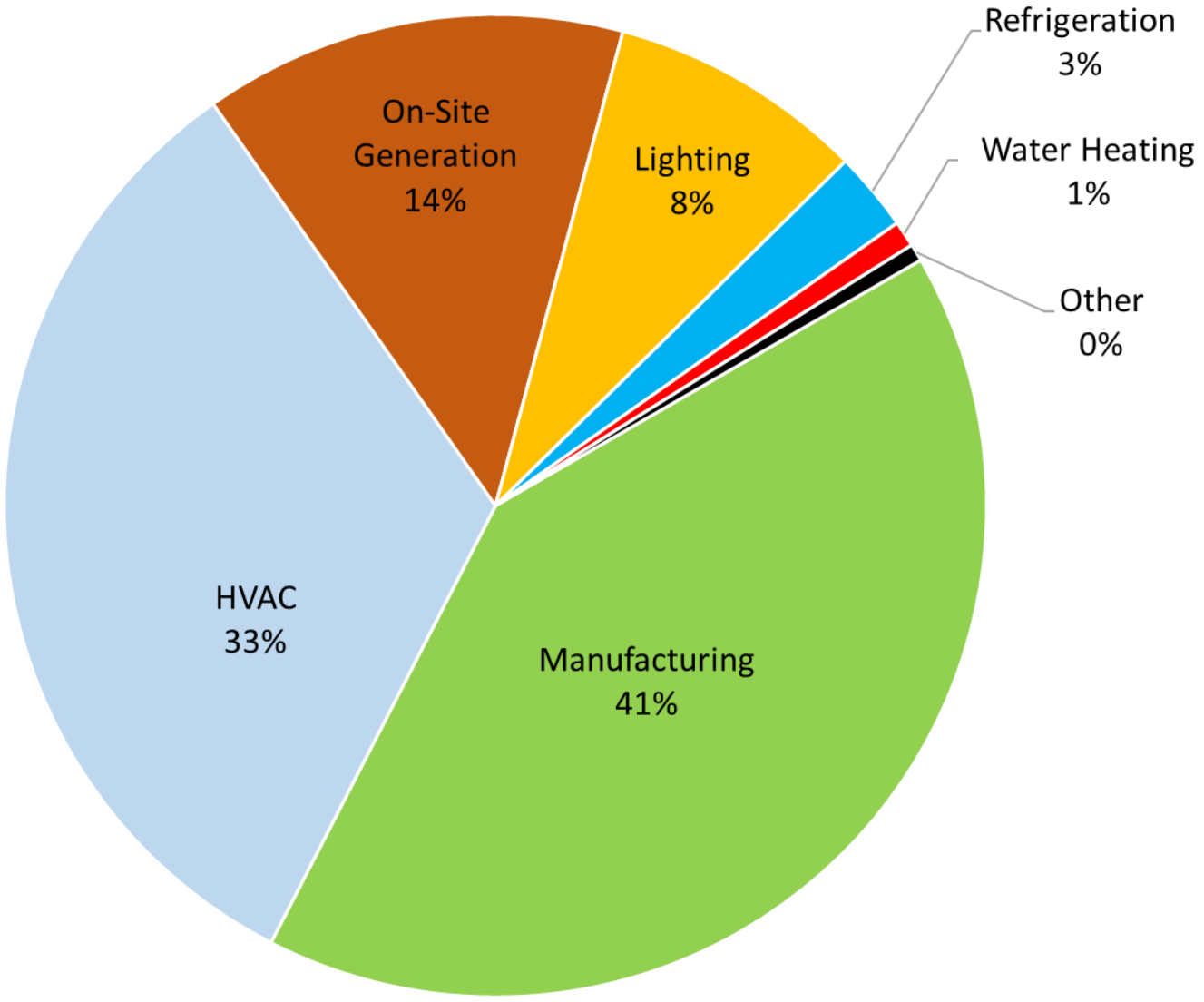
Typical Participation By Customer Segment



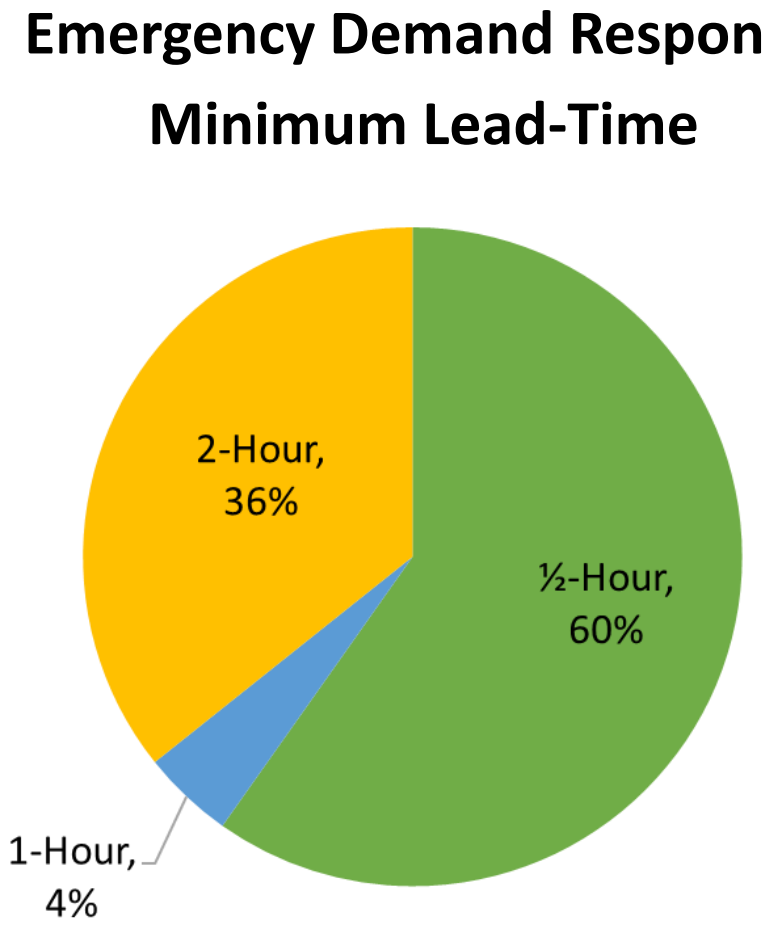
Data Source: 2015/2016 Capacities, PJM Demand Response Strategy, June 2017

Typical Participation By Resource Type



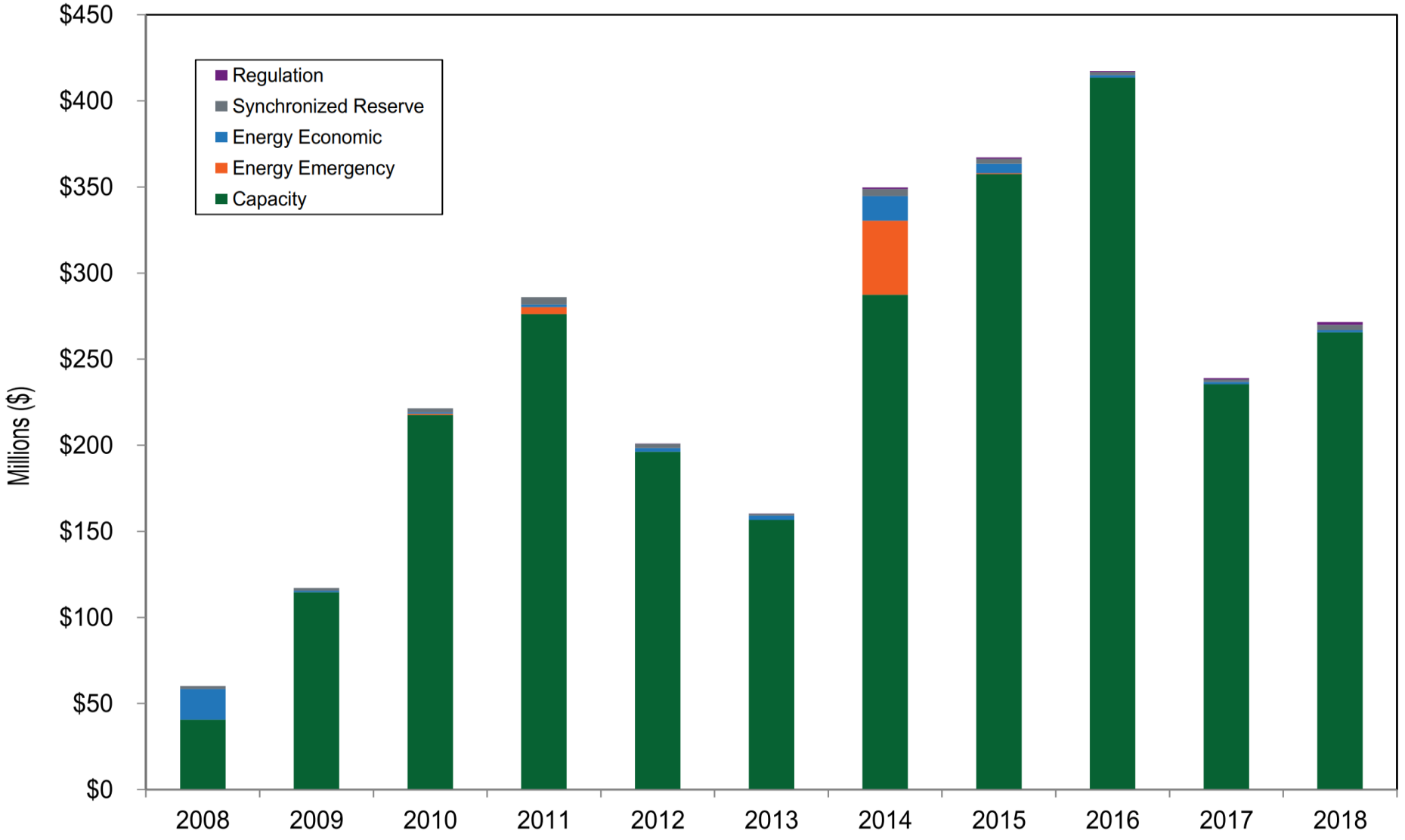
Data Source: State of the Market Report for PJM, 2018-Q2, Monitoring Analytics, LLC

Typical Participation By Lead-Time



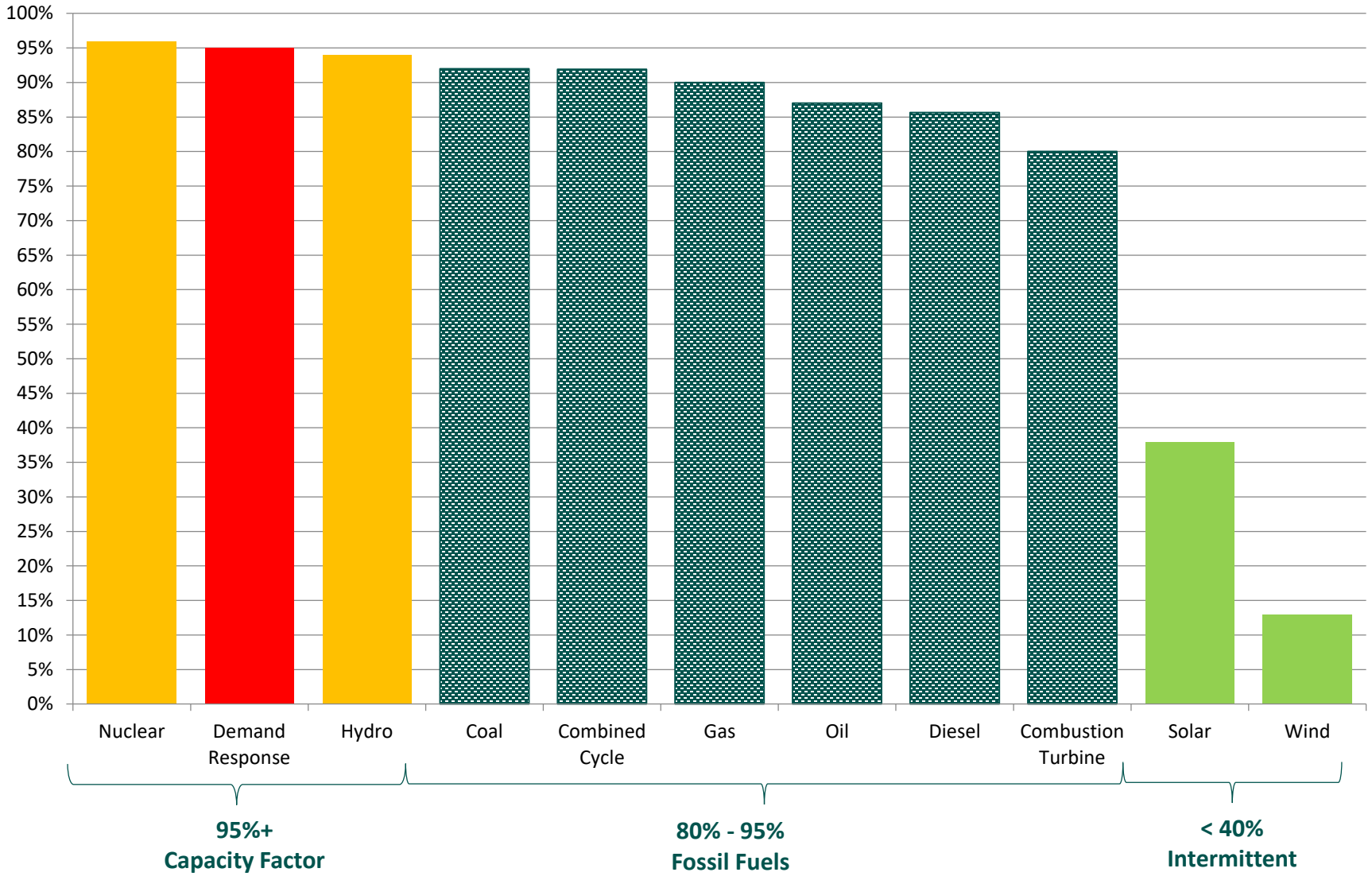
Data Source: State of the Market Report for PJM, 2018-Q2, Monitoring Analytics, LLC

Given The Options: Customers Pick Capacity Market



Source: State of the Market Report for PJM, 2018-Q2, Monitoring Analytics, LLC

Demand Response = High Reliability



Data Source: U.S. Energy Information Administration

Aggregation Function

Aggregating small demand response resources

- System operator pricing algorithms are complex and cannot handle thousands or perhaps eventually millions of resources
- Similar technologies should be grouped so that general market signals (kW reductions) can be translated into physical control signals (switch on/off, change temperature setting, etc.)
- The aggregator simplifies the market the market rules and reduces volatility for customers with less volatile pricing schemes
- Large resources should not be aggregated

Large Demand Resources

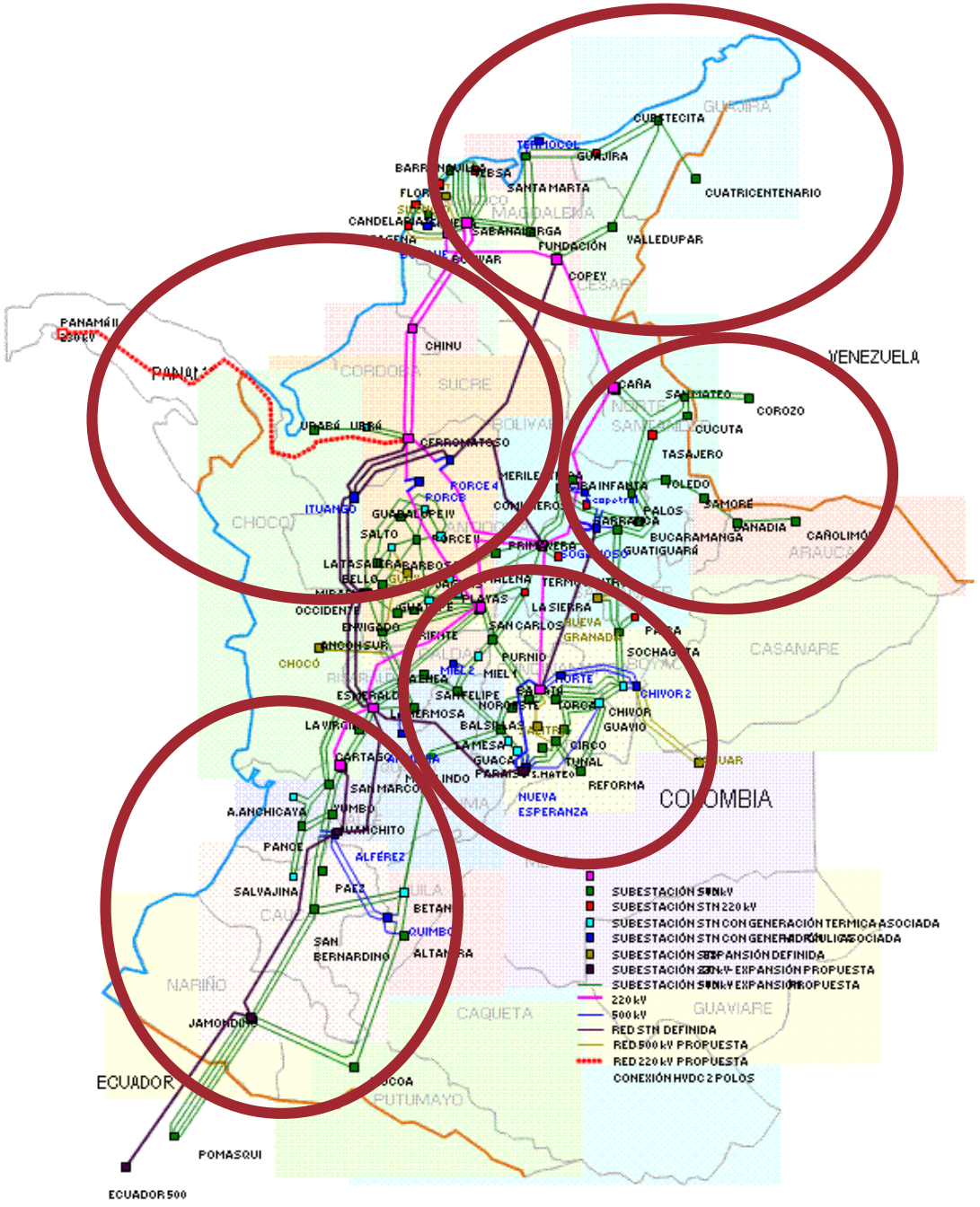
Industrial Demand Response should not be aggregated:

- Connections may be directly to the high-voltage system
- Small numbers of large resources can be modeled in the market operator systems
- Performance monitoring is beneficial to operations
- Settlements should not be “blended” with other dissimilar resources with very different response models

The Limits of Aggregation

XM will need to define <u>zones</u> within which Demand Resources can be aggregated

This helps the system operator to manage transmission constraints



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Aggregator Role

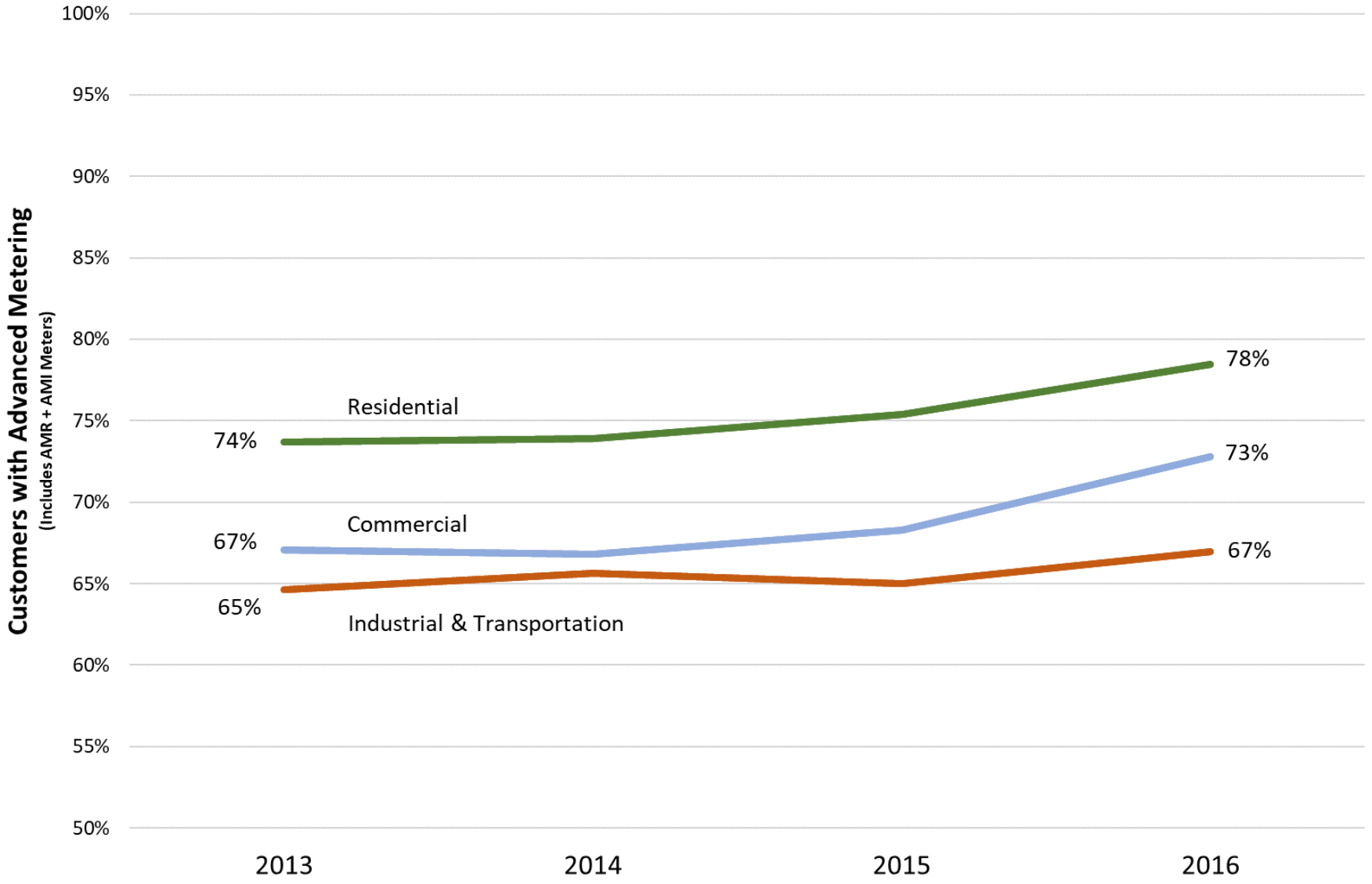
The term “Aggregator” is not an optimal

- The main role is to bring retail customers to the wholesale market
- Large customers may join the market directly, but many will want a “broker” role

“Service Provider” Concept

- The term “Service Provider” is often used to describe this role
- The Service Provider is the entity providing market services, e.g. demand reduction
- The resource owners are customers of the Service Provider, often aggregated

Customers Ready For Demand Response?



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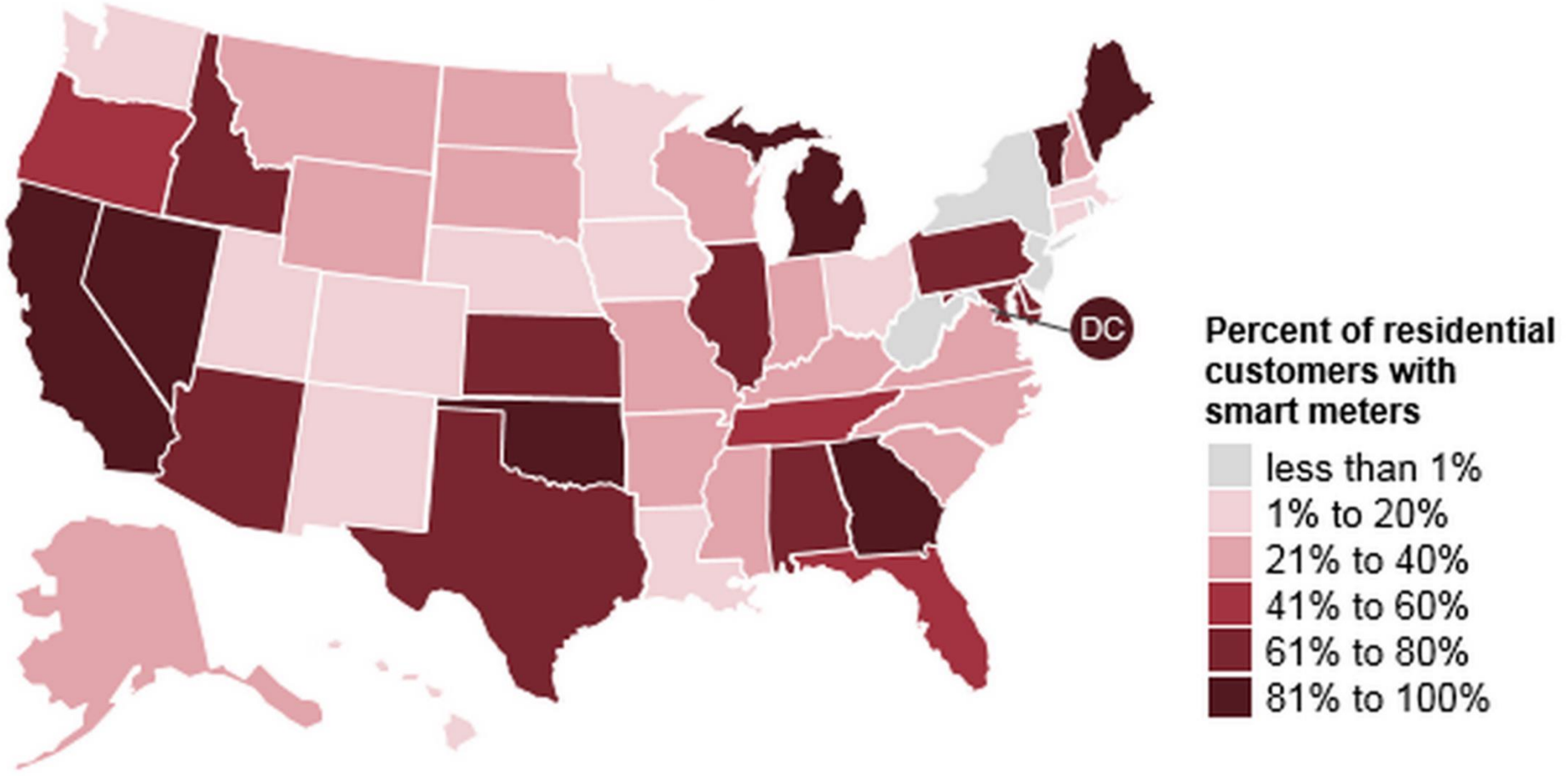
Smart Meters Regional Deployment Variation



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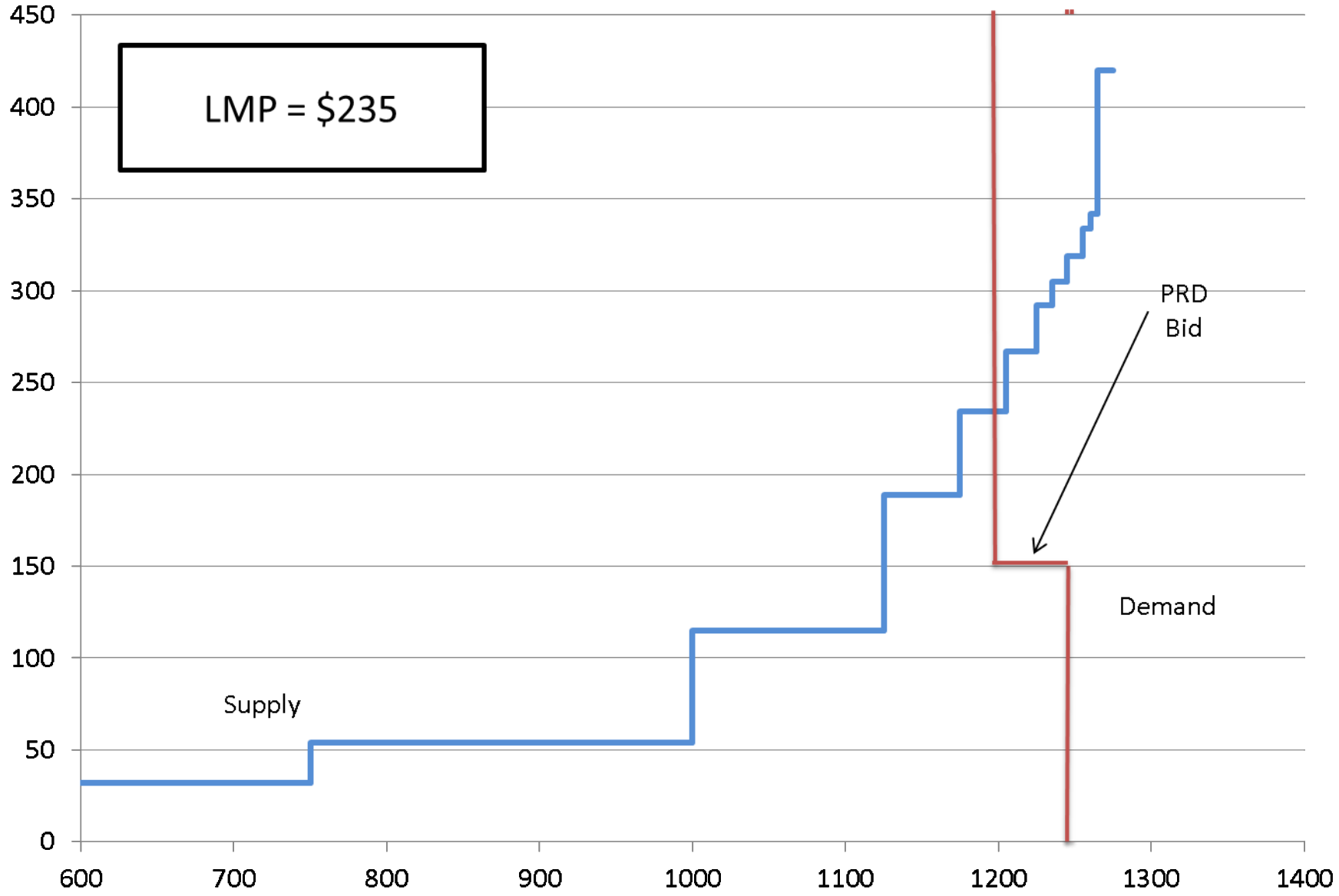
Interval Metering Alternatives

If interval metering is unavailable, can demand response still work?

Yes, for Residential; Maybe, for Commercial

1. Remote-disconnect switches can be used to interrupt loads:
   - Air-conditioning compressors
   - Domestic hot water heaters
2. Smart electronics can provide even better response information
   - Smart thermostats
   - Smart lighting
3. Statistical sampling of interval-meter installations
   - Install meters for a subset, e.g. 10%, to estimate full reduction

Moving from Supply-Side to Demand-Side



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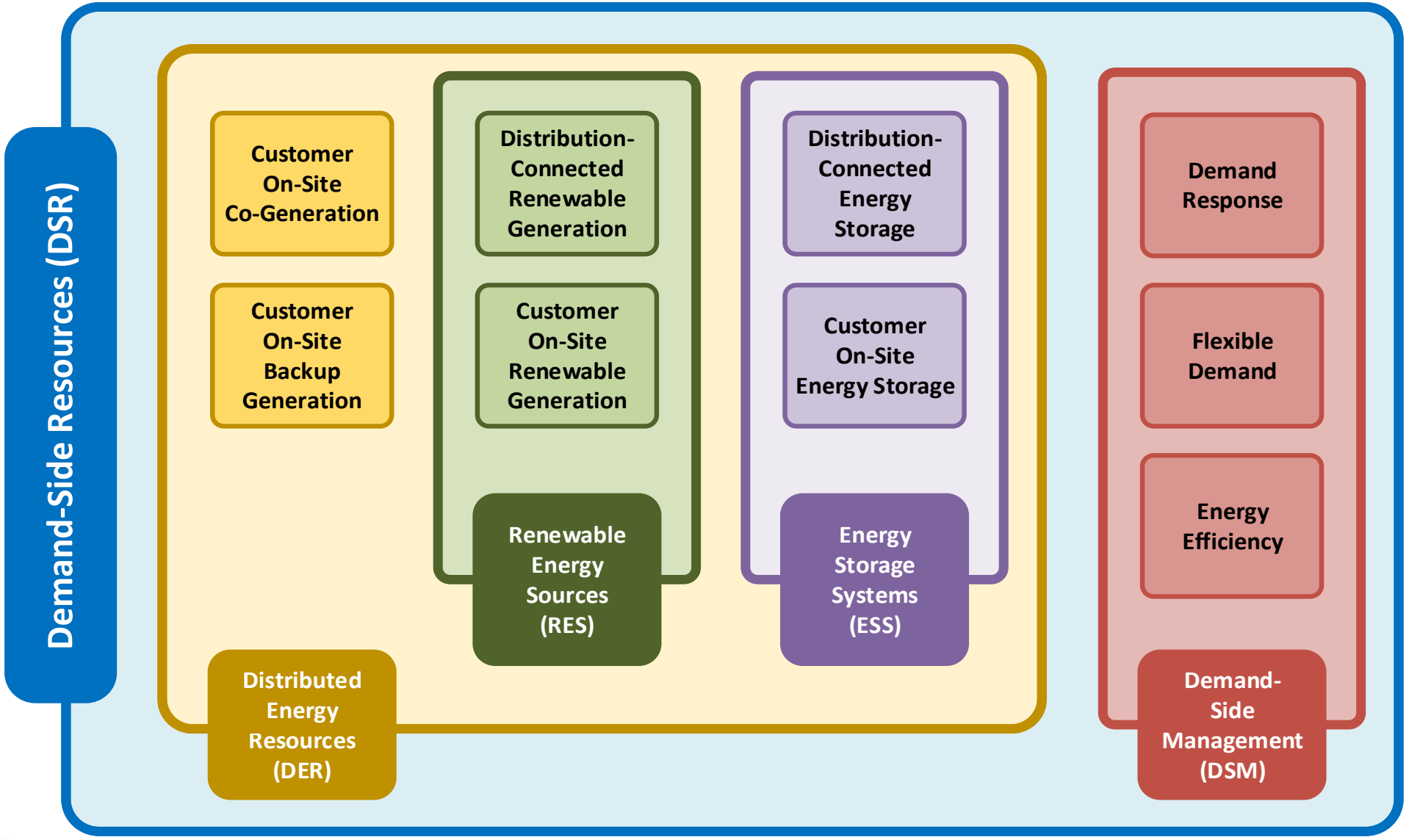
Evolution To Demand-Side Resources



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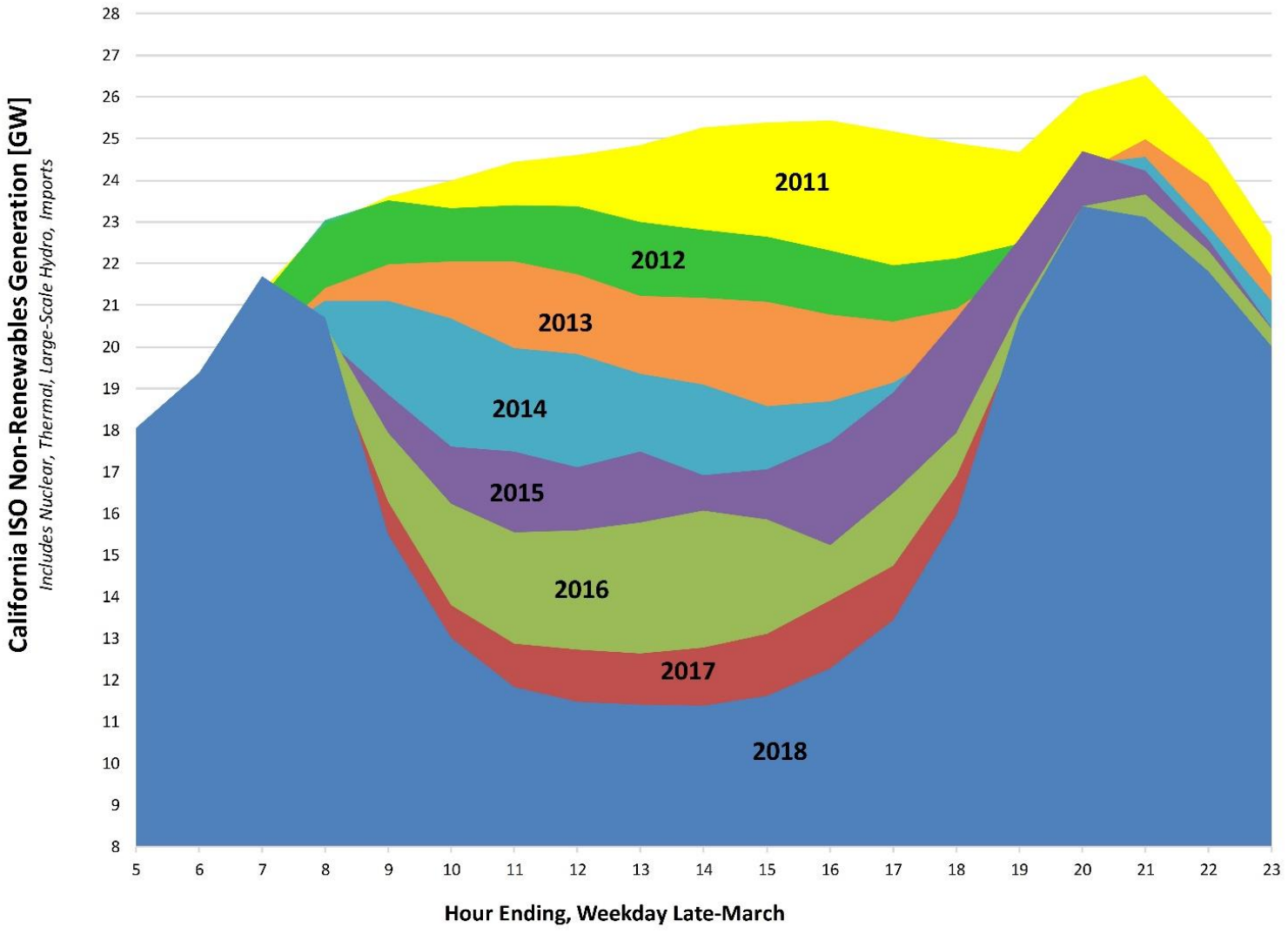
Solar Impacts Increasing Over Time



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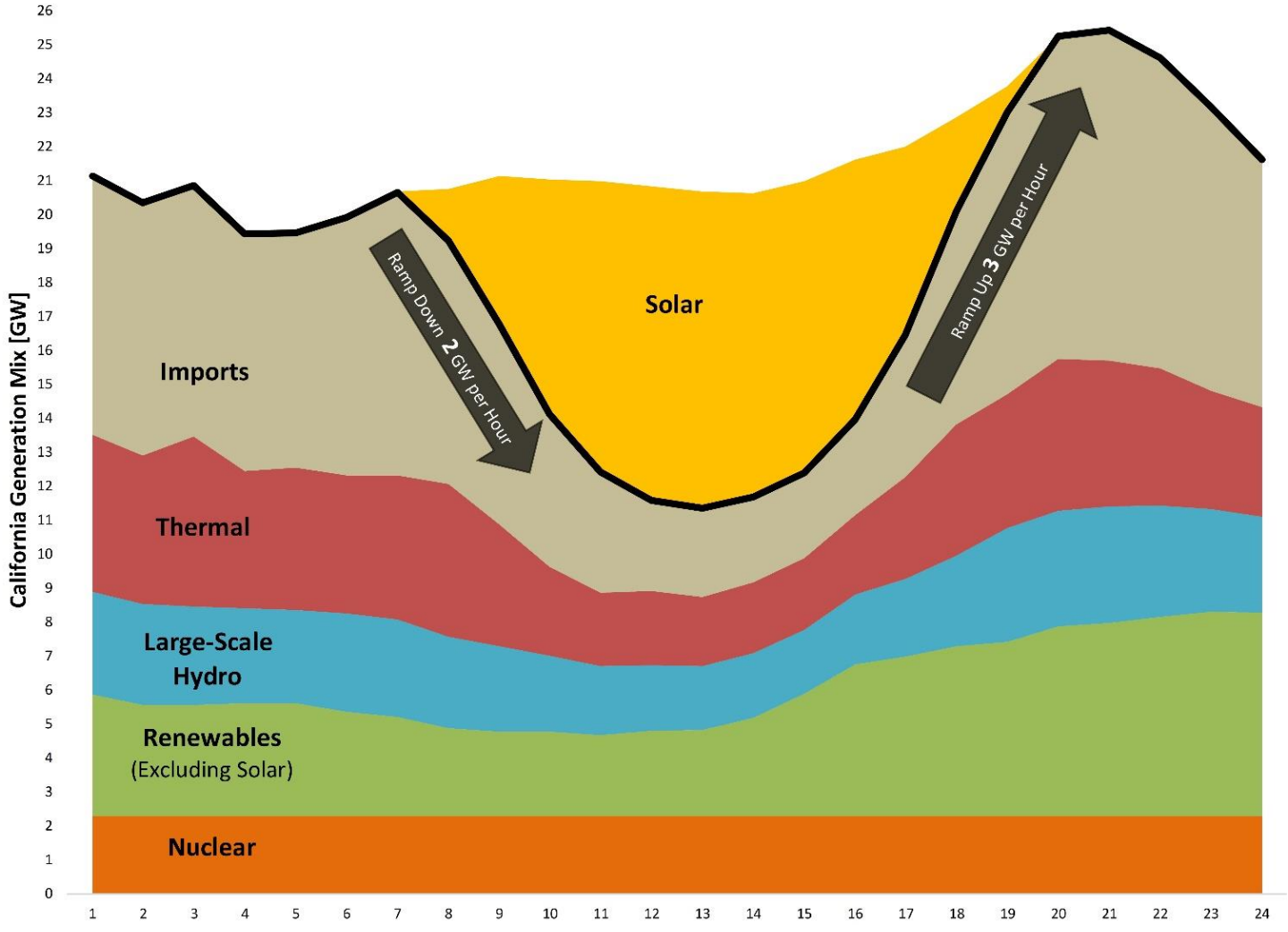
Need for Ramping with Solar Effects



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New Market Products For New Challenges

Example: California Flexible Ramping Product (FRP)

- Designed to procure “flexible ramping capacity in the real-time market to help manage volatility and uncertainty of real-time imbalance demand”
- The amount is based on the net demand curve
- CAISO forecasts the future levels, based on a projection of the net demand curve
- Resources must meet the forecasted levels, but also be available for larger ranges

Conclusions

North America's Current State

- Demand Response is a mature component of all wholesale markets
- Improvements continue, especially with capacity market options
- Most Distribution System Operators also very experienced
- Opportunities still largely untapped for retailers

North America's Future State

- Supply-Side to Demand-Side shift
- Renewable energy means the need for new support services
- DR's future inexorably linked with the future of DERs

PLMA Activities

Learn More at **www.peakload.org**

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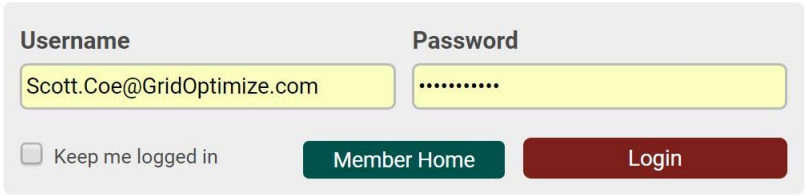

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Thank You

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