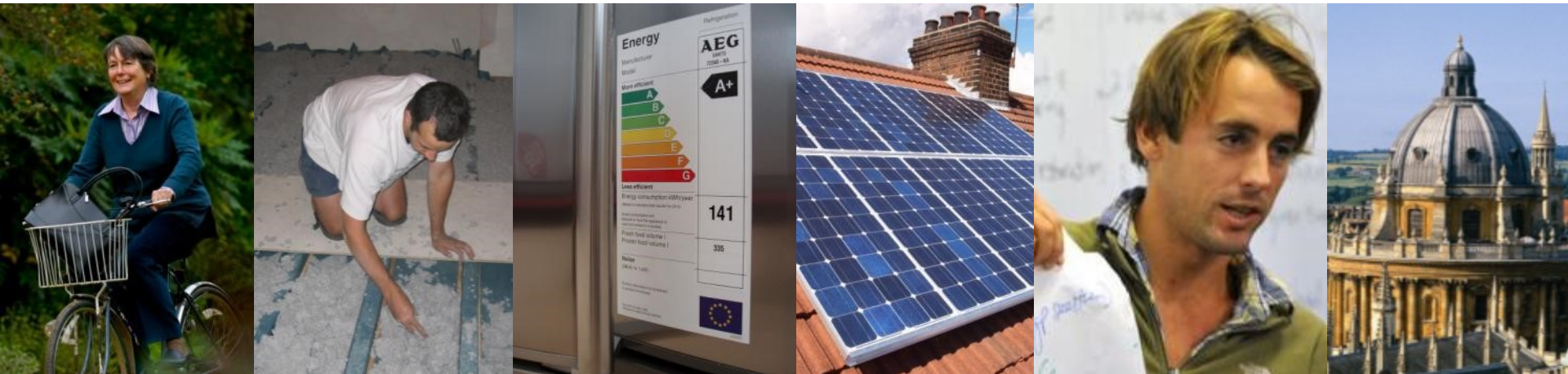




# Energy efficiency in forward capacity market: experiences in ISO New England, PJM and the UK

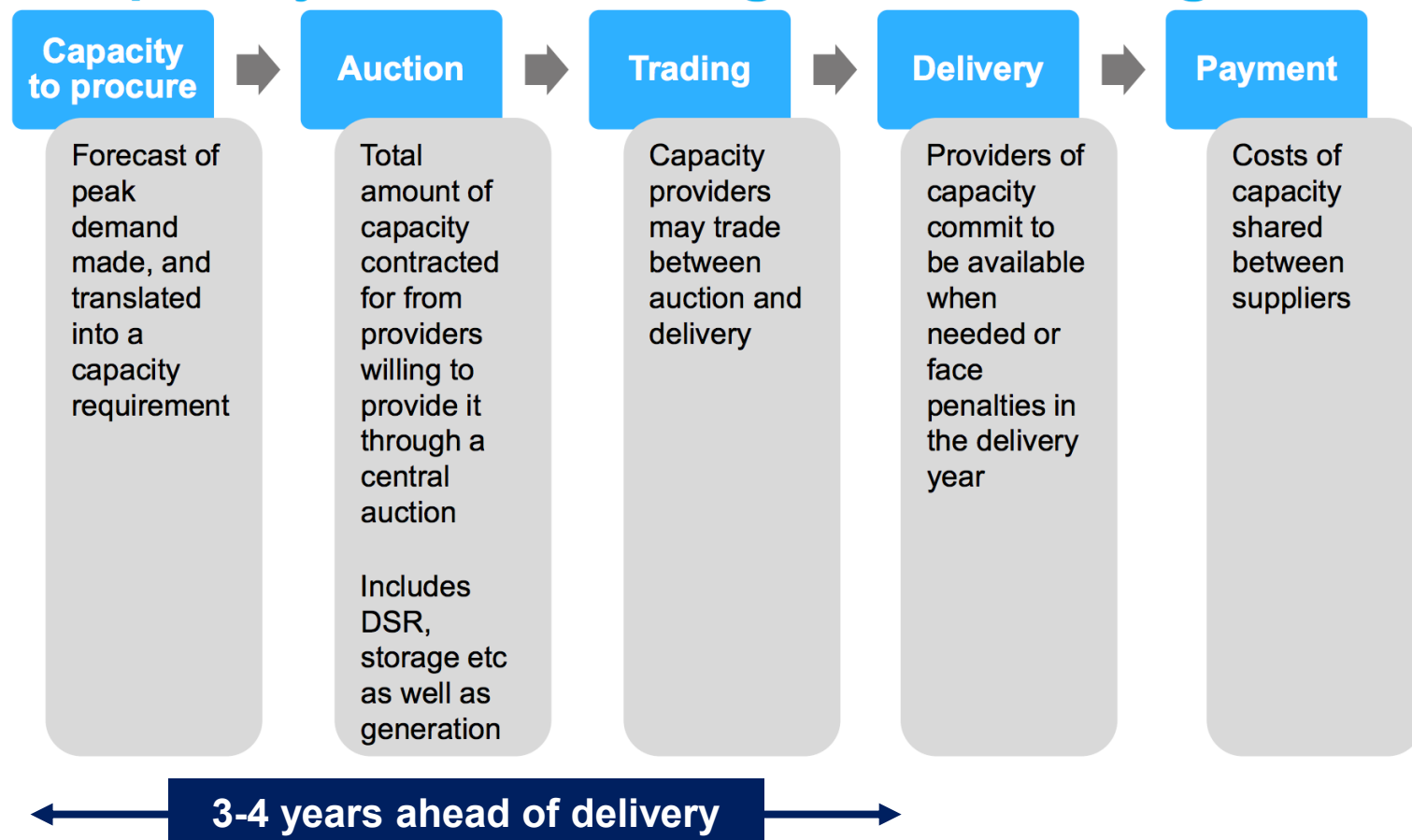


# Agenda

- **EE in forward capacity market**
- Difference of EE and DR in capacity market

**Forward capacity market uses auctions to procure resources to meet projected peak demand and reserve requirements in future years**

## Capacity Market – high-level design



# Energy efficiency (EE) can reduce system peak demand, thus a resource for meeting capacity adequacy

EE can achieve permanent or 'non-dispatchable' peak demand reduction

## Total capacity needs



Generation capacity



Demand response



Energy efficiency

Capacity product for EE is defined as average reduction in demand over specific system peak hours

	Forward years	Peaking season	Capacity product defined as the average demand reduction on working days in...
<b>ISO-NE</b> From 2010	3 years	Summer	<b>On-Peak:</b> 1pm-5pm in Jun-Aug and 5pm-7pm in Dec-Jan <b>Seasonal peak:</b> during real-time system peak hours <sup>1</sup> in Jun-Aug and Dec-Jan
<b>PJM</b> From 2012	3 years	Summer	<b>Basic Capacity</b> (2012-20): 3-8pm in Jun-Aug <b>Capacity Performance</b> (2018-): Lower of 3-8pm in Jun-Aug, and 8-9am and 7-8pm in Jan-Feb
<b>GB</b> From 2015	1 year	Winter	4-8pm in November-February

Electricity Demand Reduction (EDR) Pilot

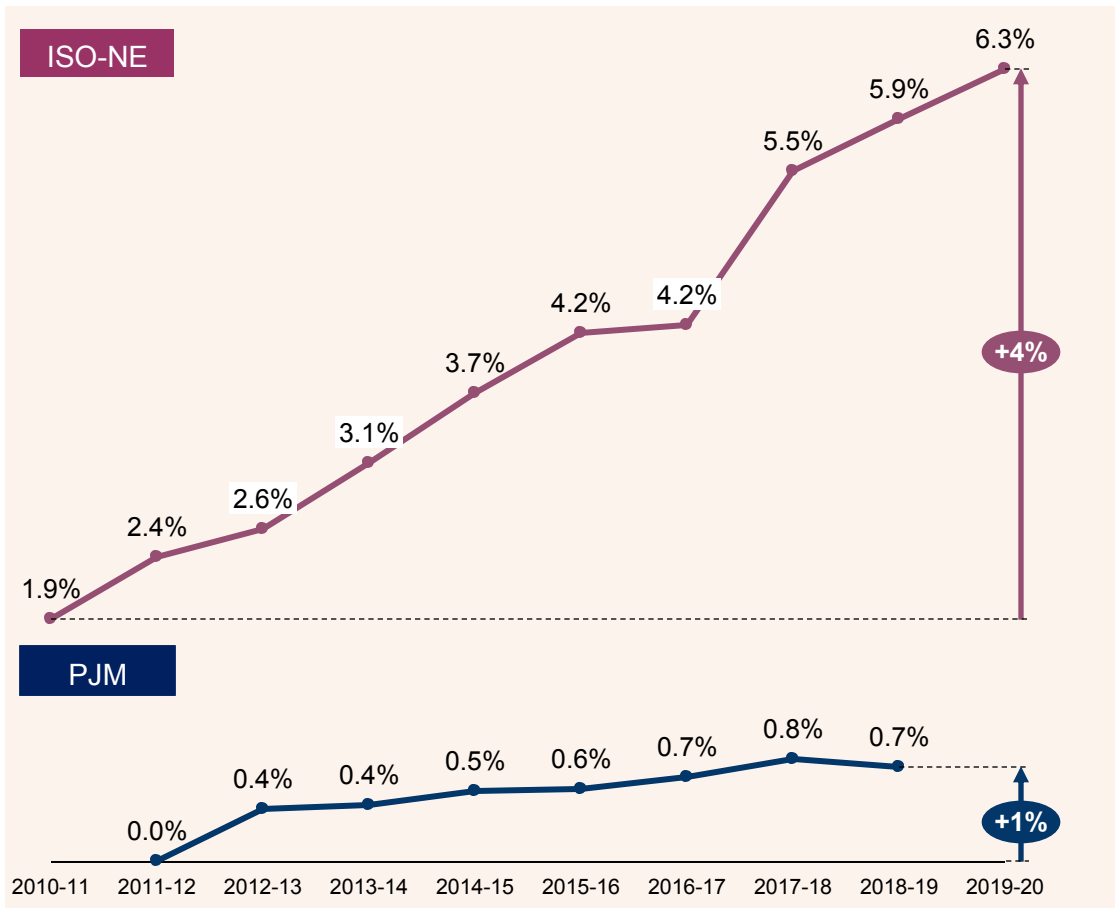
- Evaluation, measurement and verification (EM&V) of peak demand savings uses a combination of 'deemed' and measured approaches

<sup>1</sup> Real-time hourly system load is equal to or greater than 90% of the most recent '50/50' system peak load forecast for the applicable season

# Participation of EE is primarily driven by regulatory obligation to improve energy efficiency at customer end-uses

## ISO-NE leads in the procurement of EE in forward capacity markets

EE in main capacity auctions  
Unit: % of total cleared capacity



## Regulated utilities are main contributors

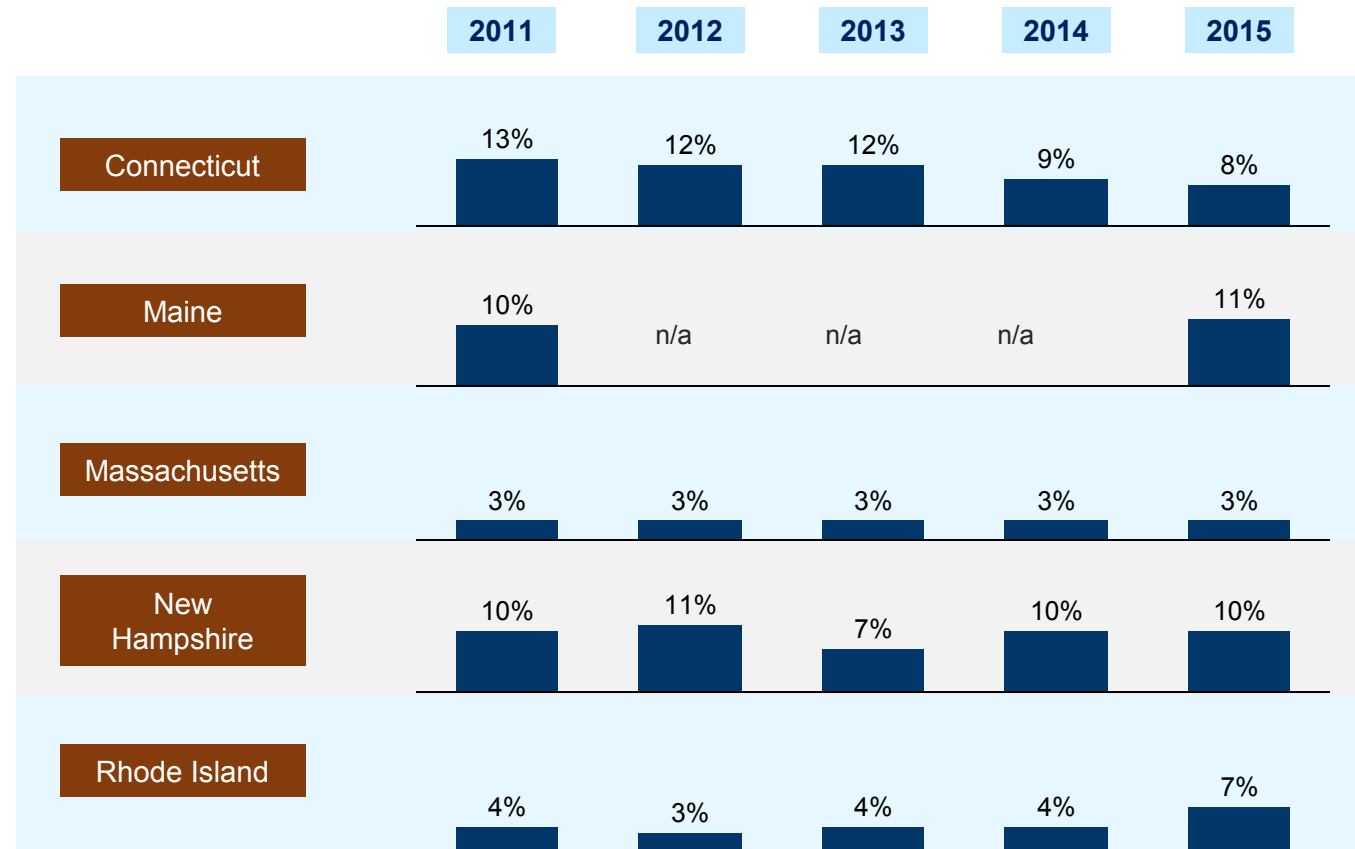
- A** Participation mainly from **obliged utilities** – in ISO-NE, >94% of EE in main auctions for 2012-20 is from obliged utilities<sup>1</sup>, with share growing to 99% for 2015-19
- B** **Strength of regulatory obligation for EE** – level of utility obligation for energy savings tends to be higher in states covered by **ISO-NE** (median **1.6%** of annual sales in 2014), as opposed to those by **PJM** (median **0.6%** of annual sales in 2014)
- C** **Shorter eligibility of EE in PJM limiting financial returns** – in PJM, EE resources are eligible to participate for up to 4 years, whereas in ISO-NE, resources are eligible as long as they are operational

<sup>1</sup> Includes 'quasi-government' entities obliged to undertake energy efficiency projects

# Capacity market may not be adequate as a primary funding to drive EE

## Capacity payment makes a small contribution to the costs of obliged utility EE programmes

Capacity payment as % of expenses of obliged utility energy efficiency programmes in 5 states of ISO-NE (2011-15)

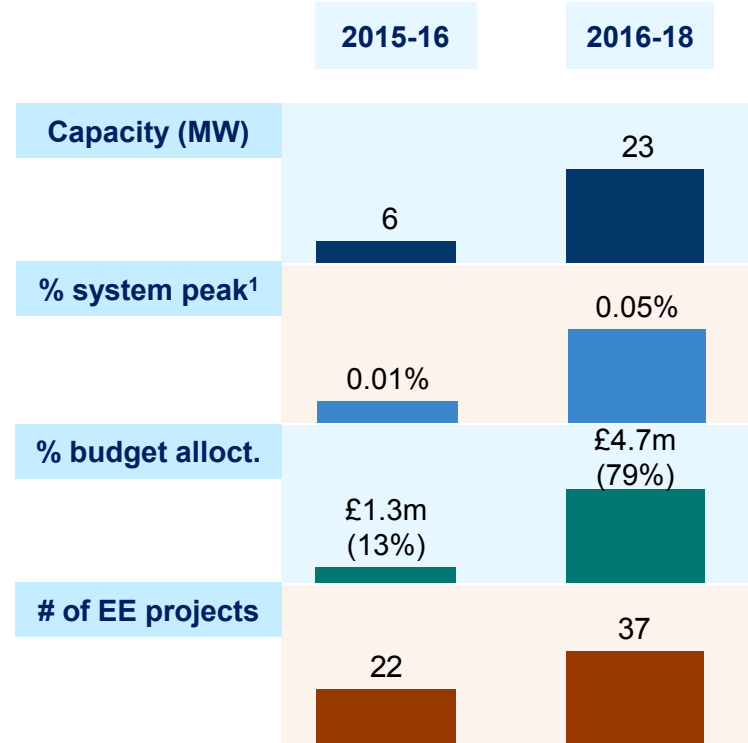


**A** Motivation to seek capacity revenues to lower levy charges on customer electricity bills to fund utility EE programmes

**B** In Vermont, capacity payment is channelled to support utility programmes focusing on thermal efficiency

# Electricity Demand Reduction (EDR) Pilot in the UK is limited in incentivising EE projects

## Uptake of EDR funding is low...

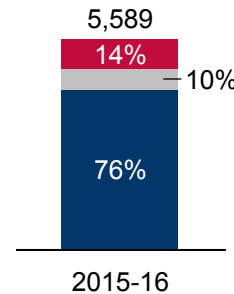


60% of budget allocated for projects delivering in 2017-18

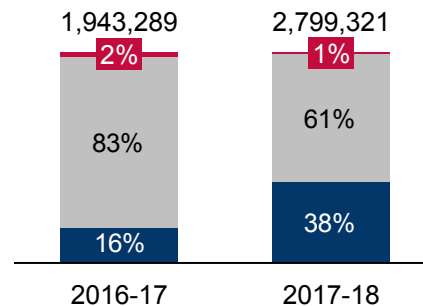
## ...mainly targeting non-residential lighting

EDR (2015-16) peak savings by participant  
Unit: kW

- Local authorities
- Aggregators
- C&I



EDR (2016-18) allocated budget by participant  
Unit: GBP



**A** Inadequate drive for electric EE from **energy supplier obligation** limits size of potential to bid into EDR

**B** EDR design creates **barriers**

- Minimum 50kW peak savings
- Application and M&V (e.g. focus on peak savings)
- Risks related to auction
- Minimum payback (2 years)

Lighting projects covering >98% of peak savings or allocated budget


1 GB system peak demand at ~50GW

# Agenda

- EE in forward capacity market
- **Difference of EE and DR in capacity market**



# DR and EE differ in their capacity delivery and drivers

 'Deep-dive' in next page



**Energy efficiency**



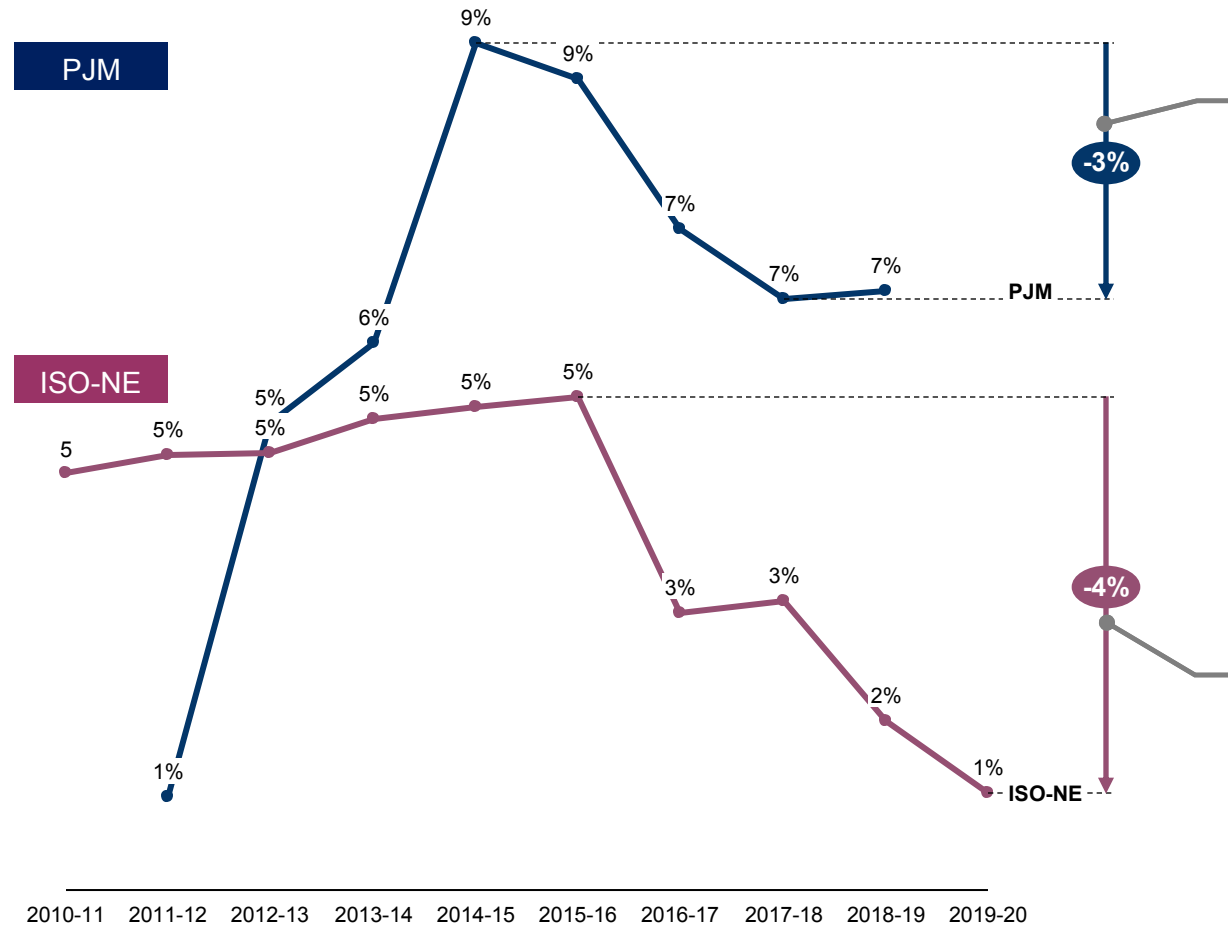
**Demand response**

<b>Nature</b>	<ul style="list-style-type: none"> <li>▪ <b>Permanent</b> peak savings</li> </ul>	<ul style="list-style-type: none"> <li>▪ <b>Temporary</b> peak savings</li> </ul>
<b>Key Parameters</b>	<ul style="list-style-type: none"> <li>▪ <b>Average</b> demand reduction during peak hours</li> </ul>	<ul style="list-style-type: none"> <li>▪ <b>Speed, duration and frequency</b> of reduction</li> </ul>
<b>Driver</b>	<ul style="list-style-type: none"> <li>▪ Regulatory <b>energy supplier obligations</b></li> </ul>	<ul style="list-style-type: none"> <li>▪ Response <b>requirements</b></li> <li>▪ Capacity <b>price</b></li> </ul>

# High performance requirements limit potential for DR participation

## Participation of DR in ISO-NE and PJM drops due to more stringent performance needs

Unit: % of total cleared capacity



### Changes in requirements

- Procurement caps for limited DR
- DR response lead time shortened from 2 hours to 30 minutes
- Must-offer' requirement to offer into day-ahead energy markets
- Near real-time performance data reporting to PJM
- Removal of auction floor price
- Higher penalty in Pay-for-Performance design