



# **Demand Response Resources in Organization of MISO States (OMS)**

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# Overview

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- **Typology of DR resources**
  - **Existing DR resource contribution: National Overview**
  - **Existing DR resources in OMS**
  - **DR Market Potential: Conceptual approach and some results**
  - **Issues and Next steps**
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# Data Sources



- **FERC DR Survey (*April 2006*)**
  - Includes time-varying tariffs and DR programs
- **EIA-861 Survey (*October 2006*)**
  - DR programs; but unclear if data for time-varying tariffs is included
- **Literature review**
  - PUC reports and presentations
  - Utility presentations/filings at state PUCs
  - Utility Annual Reports
  - Journal articles/Technical reports

# Demand Response Resources



- **Incentive-Based Programs**
  - Direct load control
  - Interruptible / curtailable rates
  - Demand bidding / buyback programs
  - Emergency demand-response programs
  - Capacity-market programs
  - Ancillary-services market programs
- **Time-Based Rates**
  - Time-of-use
  - Critical-peak pricing
  - Real-time pricing

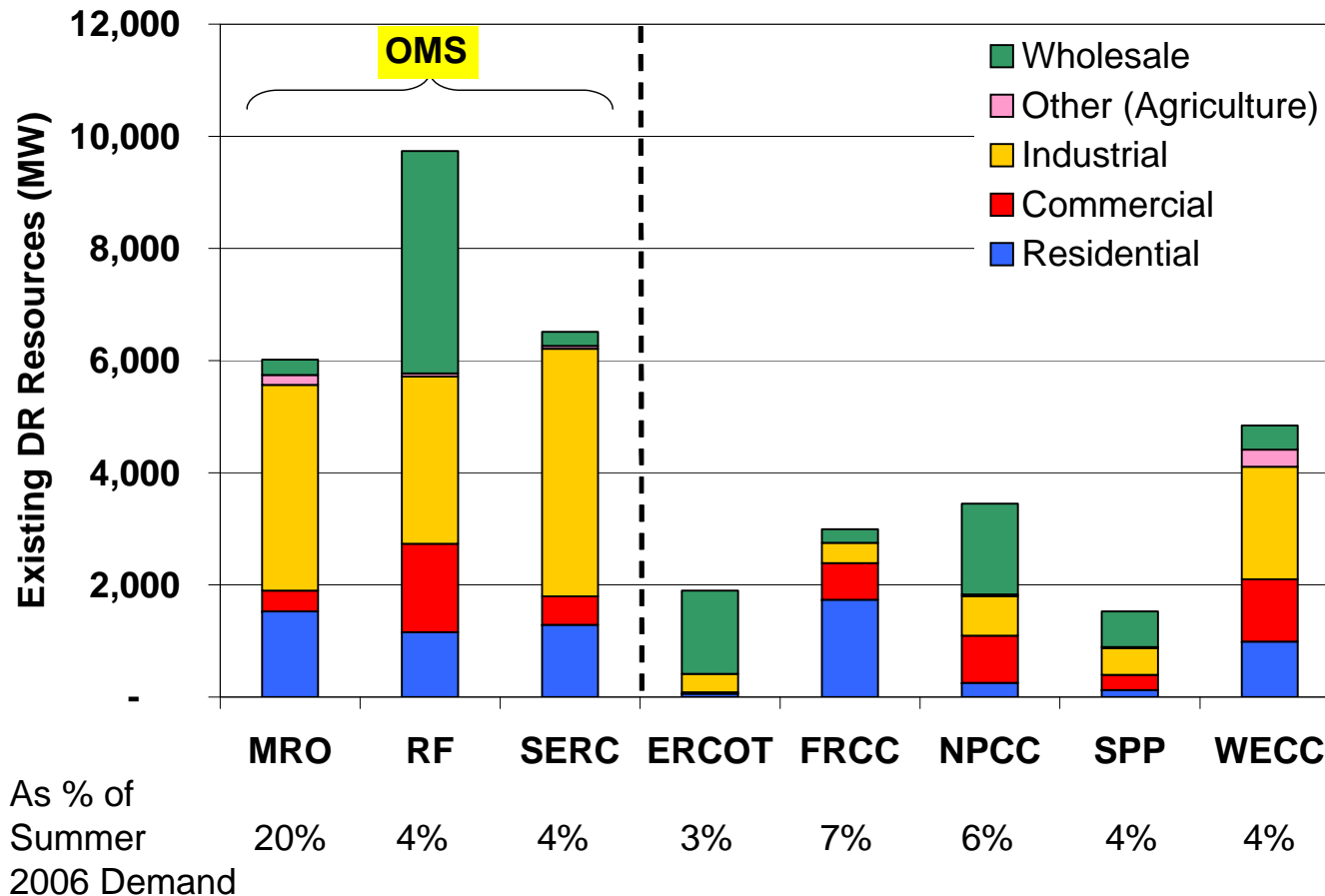
# Existing DR Resource Contribution: National Overview

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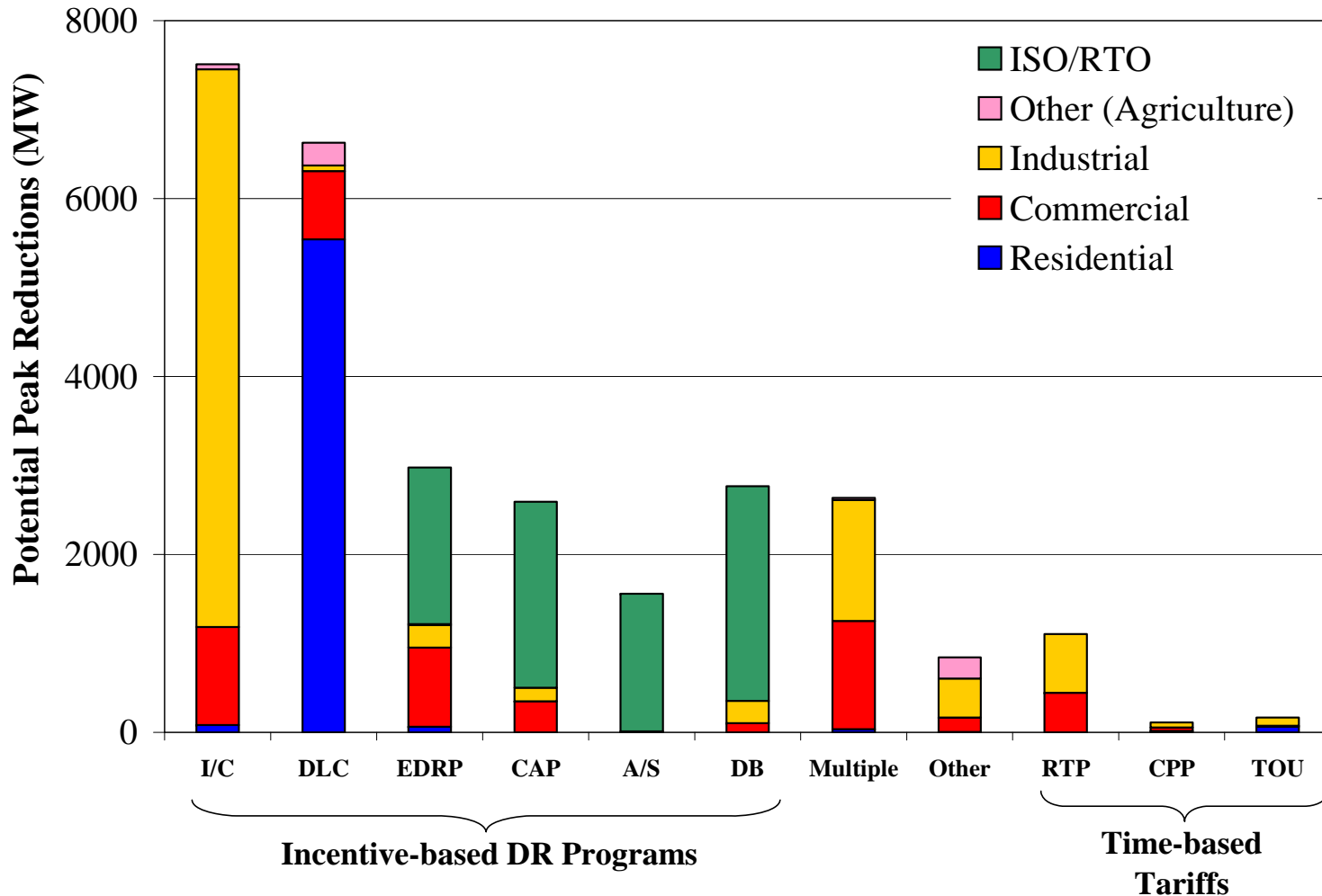
- **DR Resources in 2005: 37,590 MW**
- **Summer 2006 Internal Peak Demand: 743,927 MW**
- **Existing DR resources as percent of U.S. peak demand: 5%**
- **OMS members span three NERC regions:**
  - **MRO**
  - **RFC**
  - **SERC**

# Existing DR Resources in the U.S.



**MRO has the largest existing DR resource relative to its peak demand!**

# Existing DR Resources by Type of Program



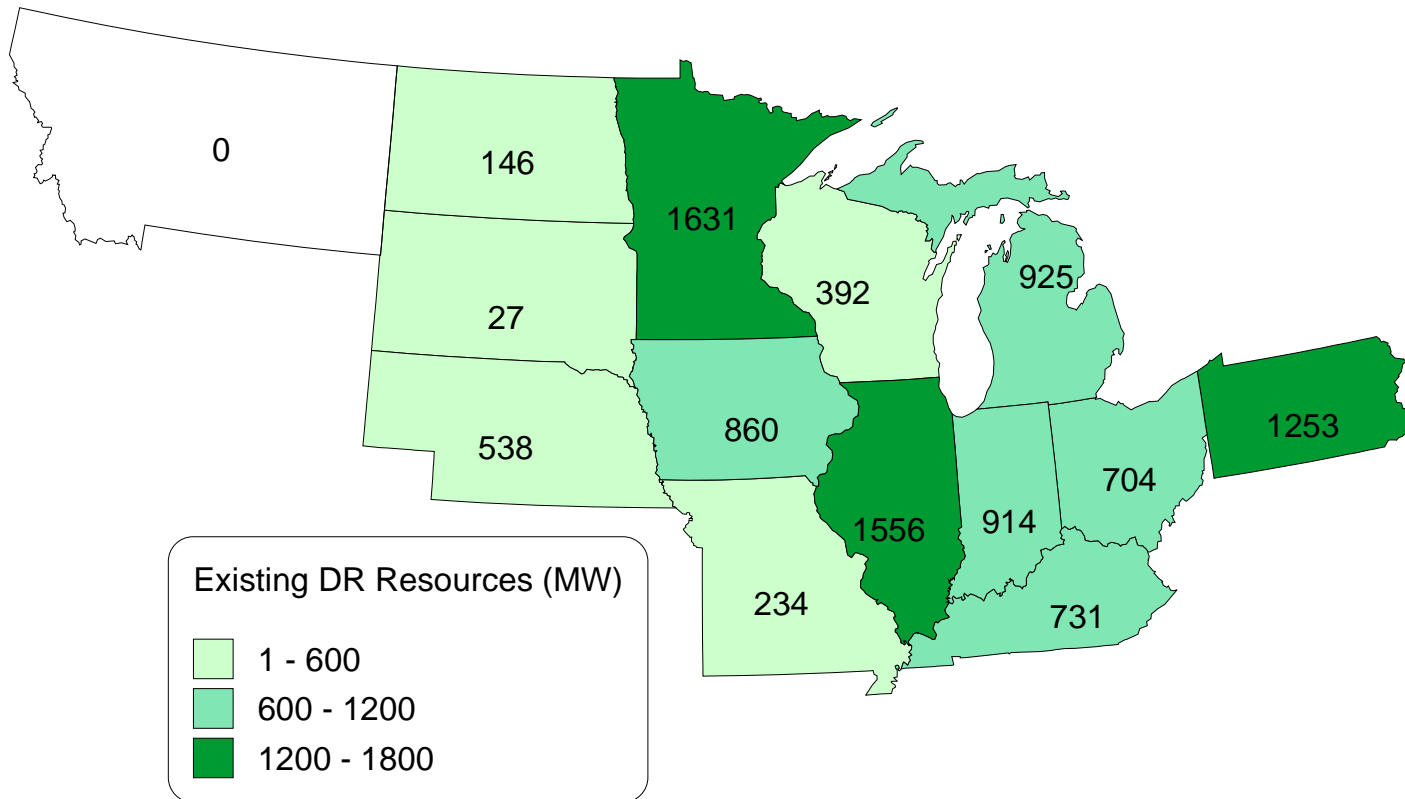
# Existing DR Resources in OMS



**DR Resources = 11,321 MW**

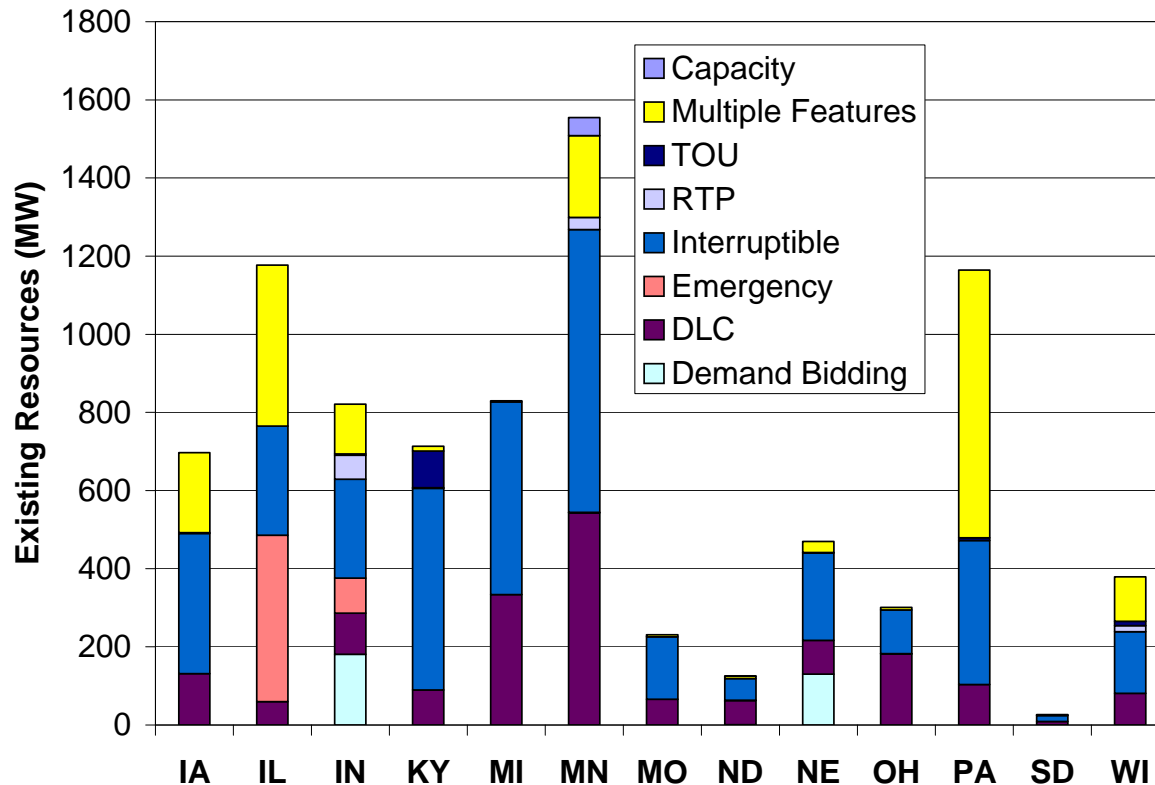
- **Interruptible: 43%**
- **DLC: 23%**
- **Emergency: 7%**
- **DR Programs with multiple features: 20%**
- **Demand Bidding: 3%**
- **Capacity: 2%**
- **Most DR resources in MISO footprint**
- **Some DR resources are enrolled in PJM market:**
  - PECO Energy Co. (340 MW)
  - PPL Electric Utilities (50 MW)
  - Commonwealth Edison (367 MW)

# DR Resources among OMS members



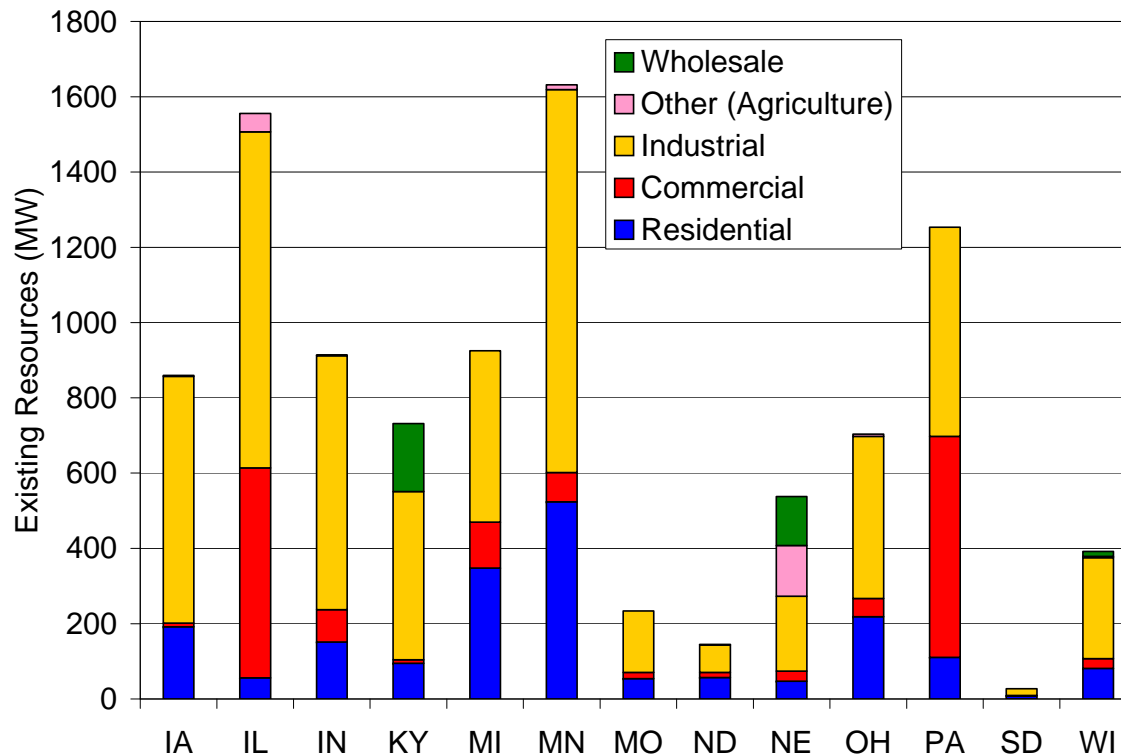
- State-wide breakdown of DR resources available for ~9,911 MW
- Utilities that serve multiple states report another ~1,400 MW of DR (not shown in map)

# Types of DR Resources among OMS members



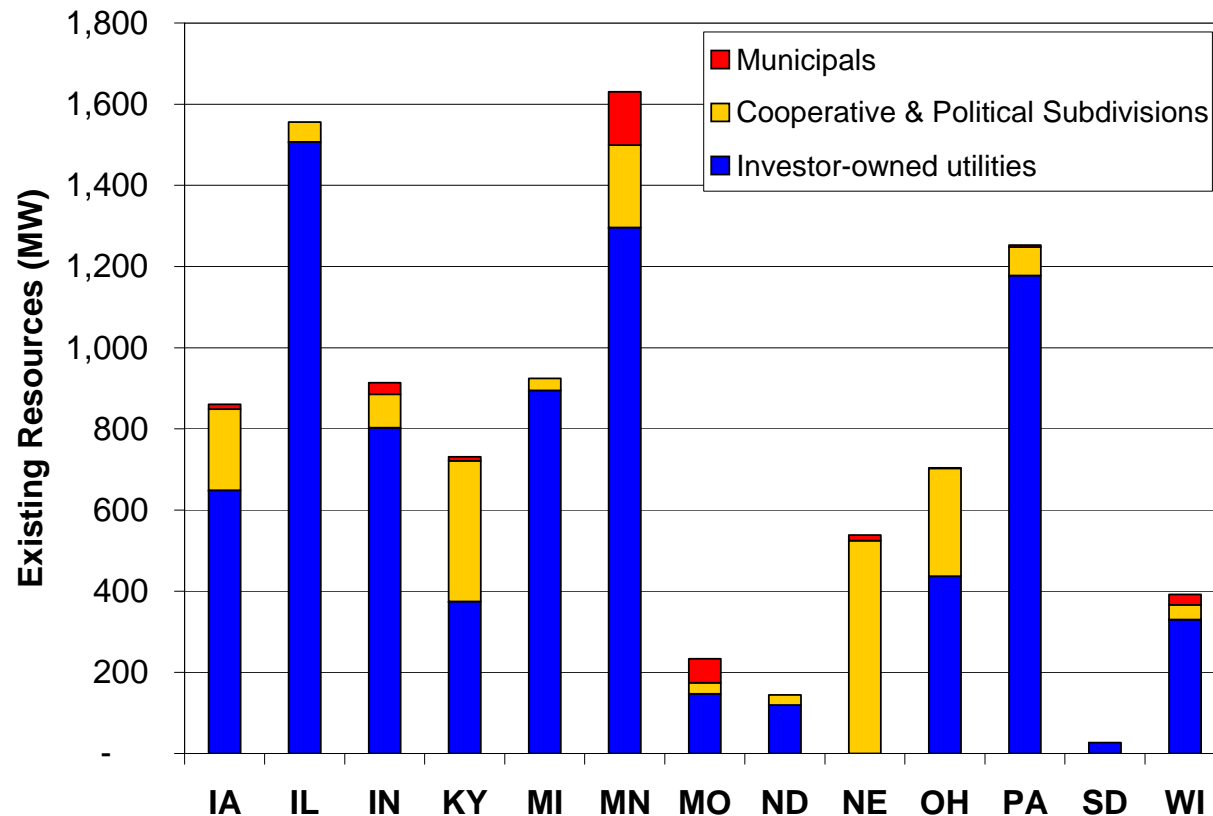
- **DLC and interruptible programs offered in all states in OMS**
- **RTP and TOU rarely treated as “resource”:** typically, utilities only report number of customers enrolled

# DR Resources in OMS: By Customer Class



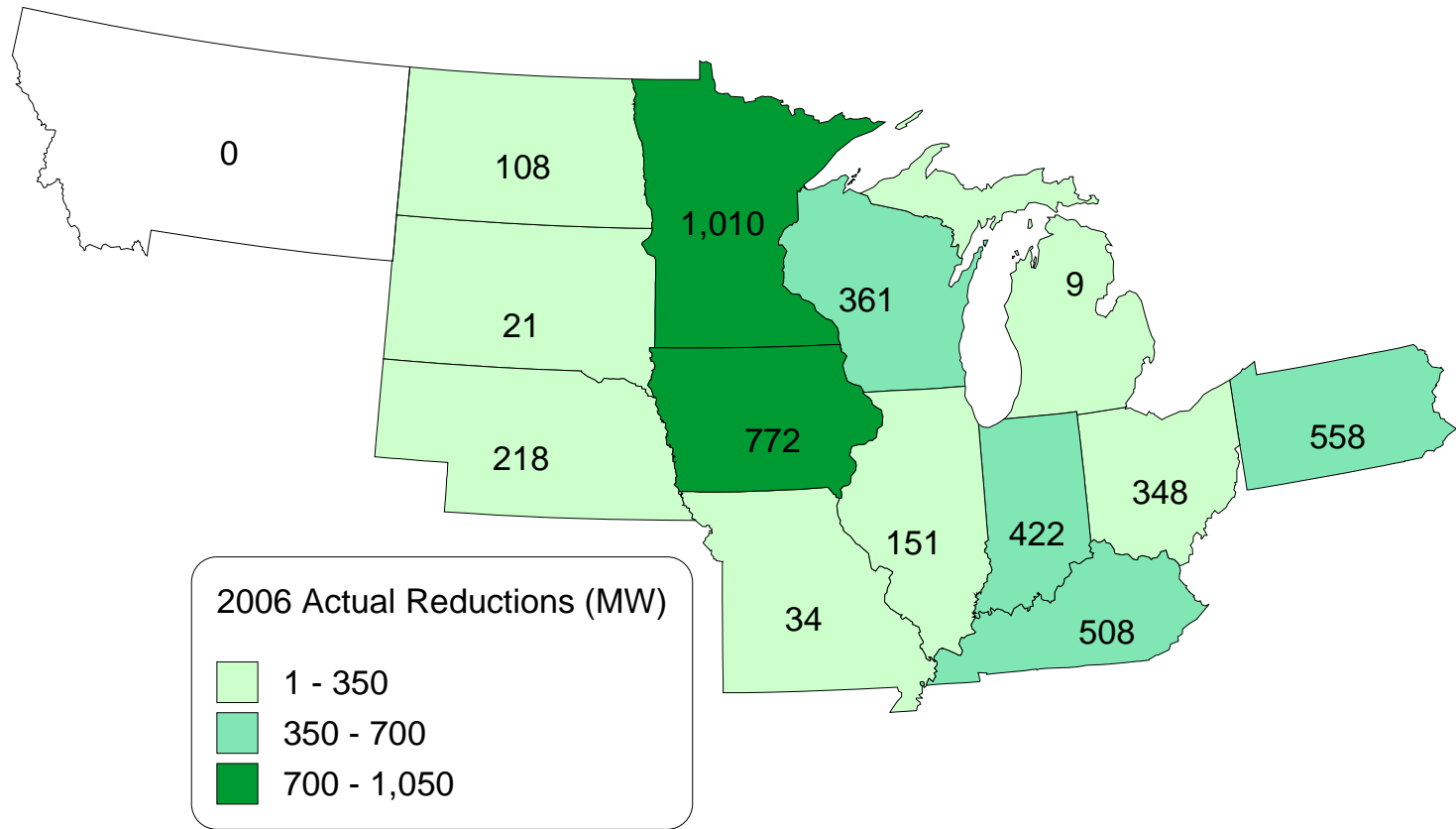
- **Breakdown by customer class:**
  - Industrial customers (60%) Commercial (14%)
  - Residential (19%), Other (Agriculture): 3%
  - Wholesale (4%)

# DR Resources in OMS by type of utility



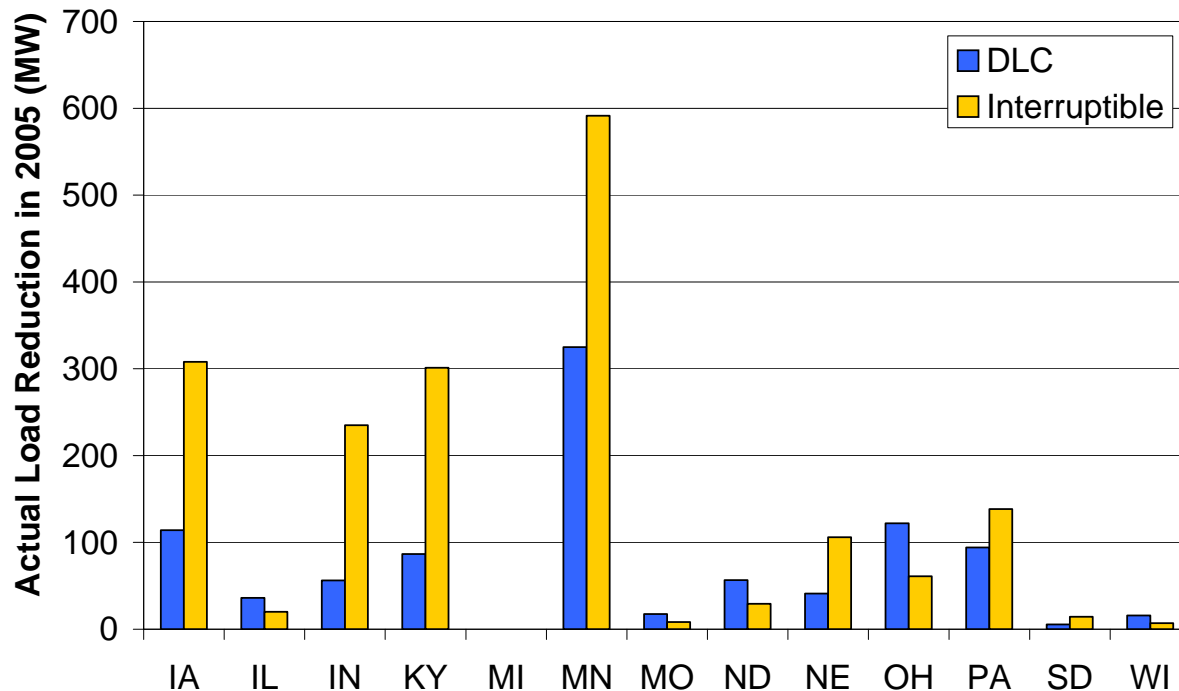
- **Investor-owned utilities account for ~78% of DR resources**
- **Cooperatives and Political subdivisions operate programs mainly in NE, IA, KY, and OH**

# Actual Load Reductions in 2005



- Actual non-coincident load reductions (2005) = 5,248 MW
- DLC accounts for 33%, Interruptible rates account for 43%, and DR programs with multiple features account for 18%
- Utilities that serve multiple states report ~719 MW of DR (not shown in map)

# Actual DR Performance (2005)



## DR Resources:

DLC	131	60	105	90	334	543	65	62	87	182	104	9	81
Interruptible	359	280	253	516	493	724	160	55	223	112	369	15	157

- Utilities in several states do not appear to have called their DR programs in 2005: MI, MO, WI
- In aggregate, DLC programs are deployed more often or perform better when deployed or both (52%) – as compared with Interruptible rates (49%)

# Utilities with 10 Largest DR Resources in OMS



Utility Name	States	Potential Peak Reductions (MW)	DLC	Interruptible	Emergency
<i>Commonwealth Edison Co.</i>	IL	1,236	2%	21%	34%
Northern States Power Co.	MN, ND, SD	1,058	37%	59%	
The Detroit Edison Company	MI	807	40%	60%	
PECO Energy Company	PA	794			
Wisconsin Public Service Corp.	WI, MI	607	8%	47%	16%
PSI Energy Inc.	IN	442	5%	40%	
Indiana-Michigan Power Co.	IN, MI	396		57%	
<i>Ohio Power Co.</i>	OH	359			
Interstate Power & Light	IA, MN, WI	351	11%	89%	
<i>Mid-American Energy Co.</i>	IA	316	17%	19%	

- Utilities in *italics* are PJM members

# Issue #1: Characterizing existing DR resources at state level



Name of Utility	States	Existing Resources (MW)
Wisconsin Public Service Corporation	WI, MI	607
Indiana-Michigan Power Company	IN, MI	396
Dairyland Power Cooperative	WI, MN, IA, IL	184
Wisconsin Electric Power Company	WI, MI	94

- Several large utilities serve customers and operate DR programs in multiple states
- Need to allocate ~1400 MW of DR resources to specific states

# Issue #2: Price-based DR often not reported as “resource”

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- **Utilities often DO NOT collect or provide data on potential reductions from customers enrolled in TOU or RTP tariffs – they report only number of customers enrolled**
  - **~184,000 customers are enrolled in RTP, CPP, TOU tariffs (mostly residential)**
  - **In several cases, utilities report only that a time-varying tariff exists – but no other data**
- **DR Market Potential for time-varying tariffs can be estimated using several methods**

# Issue #3: Improving effectiveness of existing DR resources

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- **Legacy DLC programs and I/C rates need to be harmonized with wholesale markets**
- **Issues**
  - **Do trigger mechanisms for DLC programs include both system emergency and economic conditions?**
  - **Periodic capability testing of existing DR resources?**
  - **Basis for DR incentive levels and/or I/C rate discounts?**
  - **Differences between MISO, PJM as well as utilities not in organized market**

# One Approach for Estimating DR Market Potential: LBNL Study



- 1. Establish study scope—identify target population and types of DR options considered**
- 2. Customer segmentation—identify customer market segments**
- 3. Estimate net program penetration rates—use available data to estimate customer enrollment in voluntary programs and exposure to default pricing programs**
- 4. Estimate price response—develop elasticity estimates for various DR options, customer market segments, and factors found to influence price response**
- 5. Estimate load impacts —use info from steps 2 to 4 to estimate the amount of DR that can be expected from the target customer population at utility at reference price (or incentive level).**

# DR Options Evaluated



DR Option	Description
<b>Optional Hourly Pricing</b>	Dynamic pricing tariff with bundled charges for delivery and commodity Offered on an optional basis by vertically-integrated utilities (usually) Typical rate design: two-part tariff with customer baseline load (CBL)
<b>Default Hourly Pricing</b>	Dynamic pricing tariff with unbundled distribution and commodity charges Offered as default service tariff in states with retail electric competition Commodity component: Hourly price indexed to a wholesale energy market (day-ahead or real-time)
<b>Short-Notice Emergency Program</b>	DR program that offers financial incentives for curtailing load when called on short notice (i.e., 1-2 hours) in response to system emergencies Customer response is voluntary; no penalties for non-performance
<b>Price-Response Event Program</b>	DR program that pays for measured load reductions when day-ahead wholesale market prices exceed a floor Some programs may include bid requirements and/or penalties
<b>Critical-Peak Pricing</b>	Dynamic-pricing tariff similar to a time-of-use rate, except that on “critical-peak” days a pre-specified higher price is effective for a specific time period

# Average Elasticity Values



Customer Market Segment	<i>Demand Response Option</i>				
	Optional Hourly Pricing	Default Hourly Pricing	Short-Notice Emergency Program	Price-Response Event Program	Critical-Peak Pricing
Commercial/retail	0.01	0.06	-0.03	-0.09	-0.10
Government/education	0.01	0.10	-0.02	-0.16	-0.06
Healthcare	0.01	0.04	-0.04	-0.05	-0.01
Manufacturing	0.26	0.16	-0.04	-0.16	-0.05
Public works	0.07	0.02	-0.08	-0.22	-0.08

elasticity of substitution

arc elasticity

# Participation Rates: Selected Values

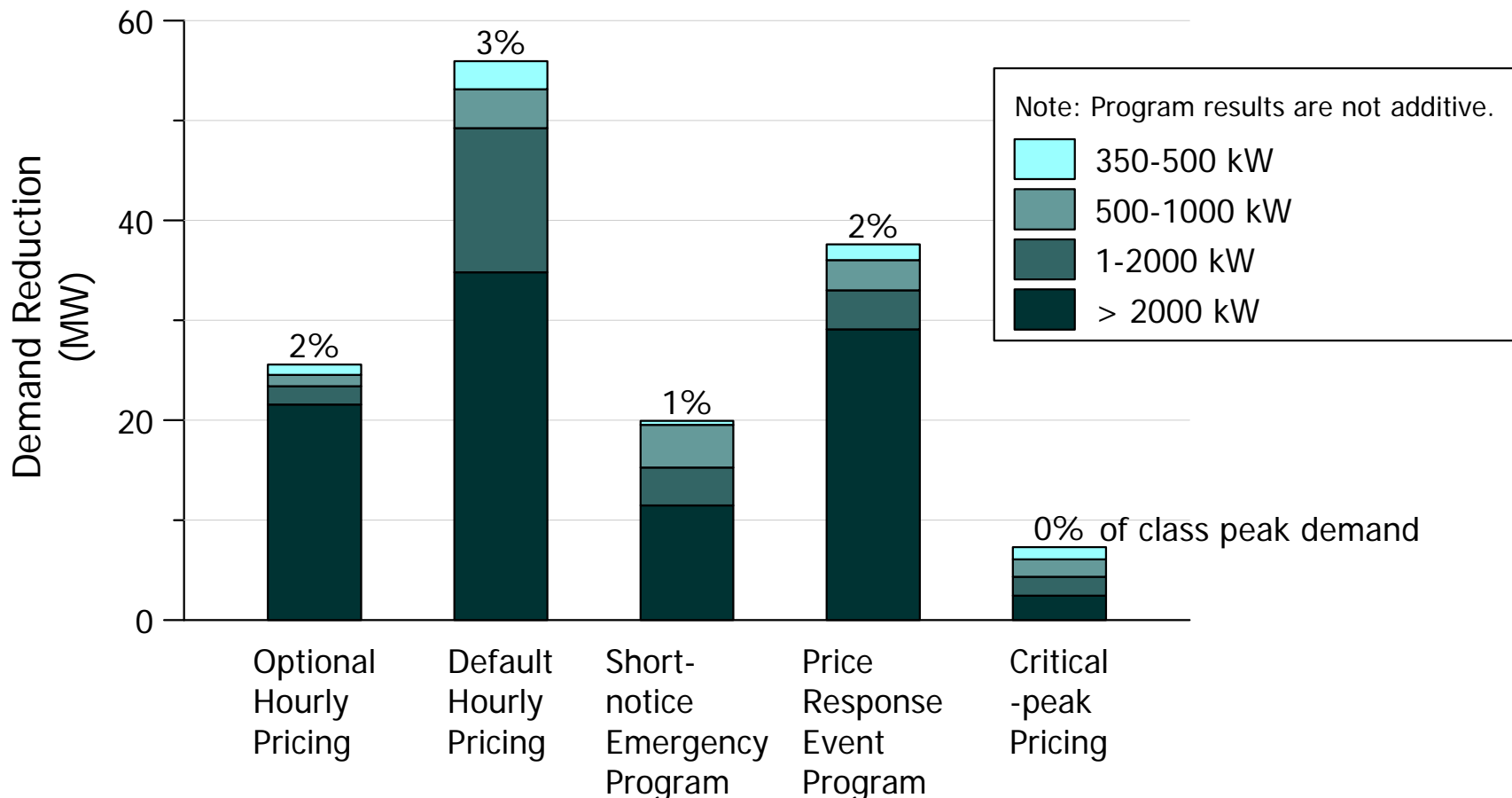


Optional hourly pricing	Commercial/retail	<i>0%</i>	<i>2%</i>
	Gov't/education	4%	25%
	Manufacturing	5%	25%
Default hourly pricing	Commercial/retail	11%	43%
	Gov't/education	10%	42%
	Manufacturing	8%	33%
Short-notice emergency program	Commercial/retail	23%	20%
	Gov't/education	5%	9%
	Manufacturing	15%	23%
Price-response event program	Commercial/retail	1%	6%
	Gov't/education	3%	10%
	Manufacturing	10%	30%
Critical-peak pricing	Commercial/retail	3%	4%
	Gov't/education	4%	2%
	Manufacturing	4%	7%

- **DR participation =**
  - enrollment in voluntary programs/tariffs
  - retention on default pricing
- **Participation rates collected for 5 market segments and 4 customer size groups**
- **Some data were not available—used “expert judgment” (red-italicized values)**

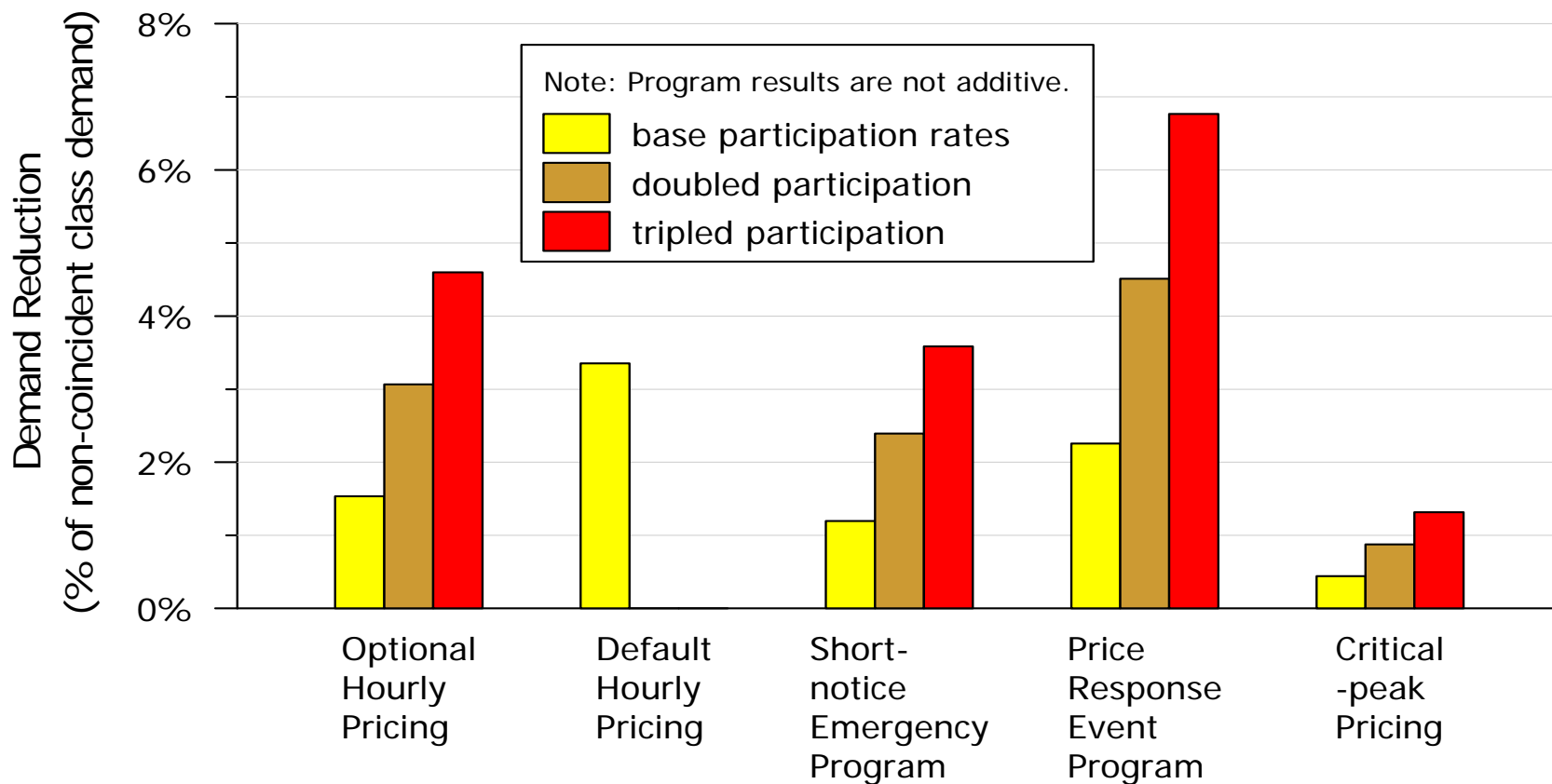
*Red italicized values based on expert judgment*

# Example: Large-customer DR Market Potential at a NE Utility



- **Base case results indicate market potential of up to 3% of class-peak demand for each DR option individually**
- **Largest customers (> 2 MW) provide bulk of load response**
- **Implicit Implication: necessary to target smaller customers too**

# Impact of Program Participation Rates on DR Market Potential



- **With very aggressive marketing (i.e., 3x current participation rates), market potential for 3 DR options increases to ~3 to 7% of eligible large customers' peak demand at this utility (or ~75-165 MW)**

# Summary and Next Steps



- **Large amount of DR resources available in OMS member service territory**
  - **27% of existing DR resources in the U.S.**
- **Main types of DR resources are interruptible and DLC type programs offered by investor-owned utilities**
- **Incentives for offering DR programs vary:**
  - **Participation in organized markets (PJM, MISO)**
  - **ISO-operated DR programs**
  - **State initiatives**
- **Comparative review of “best practices” in DR programs and pricing is logical next step**

# Background slides

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# NERC Regions

