

RESOURCE ADEQUACY PLANNING

CLEAN ENERGY REGULATORY FORUM IV

November 8, 2012

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Emerging Markets

Energy Efficiency (EE) Cleared in RPM Auctions

RPM Auction	Total EE Resources Offered in PJM (UCAP MW)	Total EE Resources Cleared in PJM (UCAP MW)
2011/2012 (3 rd IA)	92	78
2012/2013 (BRA)	653	569
2013/2014 (BRA)	757	679
2014/2015 (BRA)	832	822
2015/2016 (BRA)	940	923

Energy Efficiency (EE) Offered/Cleared in 2015/2016 RPM BRA

LDA	Zone	Offered EE*	Cleared EE*
EMAAC	AECO	1.6	1.2
EMAAC/DPL-S	DPL	16.2	15.5
EMAAC	JCPL	-	-
EMAAC	PECO	20.8	14.8
PSEG/PS-N	PSEG	11.9	10.7
EMAAC	RECO	-	-
EMAAC Sub Total		50.5	42.2
PEPCO	PEPCO	56.2	55.8
SWMAAC	BGE	103.6	103.6
MAAC	METED	4.1	3.4
MAAC	PENELEC	4.1	3.4
MAAC	PPL	18.7	14.2
MAAC** Sub Total		237.2	222.6
RTO	AEP	213.9	213.9
RTO	APS	0.8	0.8
ATSI	ATSI	48.1	44.9
RTO	COMED	422.4	422.4
RTO	DAY	2.0	2.0
RTO	DEOK	4.6	4.6
RTO	DOM	7.2	7.2
RTO	DUQ	4.1	4.1
Grand Total		940.3	922.5

*All MW values are expressed in UCAP

**MAAC sub-total includes all MAAC Zones

- Installation of more efficient devices or equipment or implementation of more efficient processes/systems exceeding building codes, appliance standards, or other relevant standards at the time of installation as known at the time of the commitment to the capacity market.
- Designed to achieve a continuous reduction in electric demand at the End-Use Customer's retail site that is not reflected in the peak load forecast prepared for the Delivery Year.
 - Value of EE installation is measured during defined EE Performance Hours
- Fully implemented at all times during the Delivery Year, without any requirement of notice, dispatch, operator intervention.
 - If dispatchable, it would be considered a Demand Resource.

- ✓ EE installation must be scheduled for completion prior to DY
- ✓ EE installation is not reflected in peak load forecast posted for the BRA for the DY initially offered
- ✓ EE installation exceeds relevant standards at time of installation as known at time of commitment
- ✓ EE installation achieves load reduction during defined EE Performance Hours
- ✓ EE installation is not dispatchable

- EE Resource shall be EE project(s) or portion of EE project(s) in a zone that represents the installations of EE during a defined period of time from June 1 to May 31.
- EE Resources are eligible to be offered into RPM Auctions (effective 2011/2012 DY)
- EE Resource may be eligible to receive Capacity Market (RPM) revenue for up to four consecutive Delivery Years.

Installation Period	Fully Installed for Summer	Eligible Delivery Years
June 2007-May 2008	2008	2011/2012
June 2008-May 2009	2009	2011/2012, 2012/2013
June 2009-May 2010	2010	2011/2012, 2012/2013, 2013/2014
June 2010-May 2011	2011	2011/2012, 2012/2013, 2013/2014, 2014/2015
June 2011-May 2012	2012	2012/2013, 2013/2014, 2014/2015, 2015/2016
June prior to DY – May prior to DY	DY	DY, DY+1, DY+2, DY+3

Nominated EE Value represents the ICAP Value of an EE Resource.

- **Nominated EE Value is expected average demand reduction (MW) during the defined EE Performance Hours in the Delivery Year.**
 - EE Performance Hours are between hour ending 15:00 EPT and hour ending 18:00 EPT during all days from June 1 through August 31, inclusive, of such Delivery year, that is not a weekend or federal holiday.
- Measurement & Verification (M&V) Plan describes the method and procedures for determining the Nominated EE Value of an EE Resource and confirming the Nominated EE Value is achieved.
- The minimum Nominated EE Value accepted is 0.1 MW.

- ✓ Submit M&V Plan prior to RPM Auction
 - Single M&V Plan may be submitted to cover multiple EE Resources
 - Single M&V Plan must clearly document the Nominated EE Value of each EE Resource covered in the Plan
- ✓ Establish credit with PJM Credit Department prior to RPM Auction
- ✓ Submit Post-Installation M&V Reports
- ✓ Permit Post- Installation M&V Audit by PJM or Independent Third Party

- Initial M&V Plan (submitted 30 days prior to first auction)
 - Project Description
 - Schedule for project installation and M&V activities
 - Location of EE Resource (transmission zone)
 - Anticipated Nominated EE Value
 - M&V techniques that will be used to determine and verify the Nominated EE Value (i.e., demand reduction) of the EE Resource
 - Parameters to be measured, measurement equipment, monitoring interval, sampling size, and how sampling meets PJM's precision requirements
 - Verification method used to provide evidence that equipment still operating
- Updated M&V Plan (submitted 30 days prior to subsequent auctions)
 - Changes since prior M&V Plan submittal (e.g., changes to project status)
 - Updated Nominated EE Value

- Initial Post-Installation M&V Report
 - Submitted 15 days prior to start of delivery year
 - Changes since prior Updated M&V Plan submittal (e.g., changes between plan and as-built conditions)
 - Documentation of post-installation activities verifying that equipment/systems were installed and still operating
 - Documentation of performance measurements conducted to validate the Nominated EE Value (if applicable in accordance with approved M&V Plan)
 - Documentation that sampling/measurements meet PJM's precision requirements of no greater than 10% relative precision at one-tailed 90% confidence level
 - Updated Nominated EE Value
- Updated PI M&V Report
 - Changes since prior PI M&V Report submittal
 - Same content as Initial PI M&V

- PJM or independent third party may conduct a post-installation M&V Audit of the EE Resource, at the EE Resource Provider's expense, prior to or during the DY.
- If Audit is performed and results finalized prior to start of DY, the Nominated EE Value confirmed by the Audit becomes the PJM approved Final Nominated EE Value used to measure RPM Commitment Compliance during the DY.
- If Audit is performed and results finalized after the start of DY, the Nominated EE Value confirmed by the Audit becomes the basis to determine if any incremental RPM Commitment Compliance Shortfall needs to be assessed retroactively from June 1 of DY to May 31 of DY.
- PJM will provide documentation regarding cost of audit no later than 2 months after completion of the audit.
- M&V Audit Charges to be assessed no later than third billing month after completion of audit.

- Rebate of \$6/6 pack of CFL for Home Depot and Lowes in service territory.
- Anticipate sales of 1 million light bulbs per year
- Gross impact of replacing one incandescent with one CFL deemed to be 50 watts ($75 - 25 = 50$)
 - Coincidence Factor of 8% (PA Technical Reference Manual)
 - In-service Rate of .8 (PA Technical Reference Manual)
 - Interactive Effect of 1.3 (engineering study)
- Net impact of each bulb in watts = 50 watts X $.08 \times .8 \times 1.3 = 4.16$



Typical Utility Offer in the Base Residual Auction for 2015/2016

- Quantity offered is 4.16 MW
 - 4.16 watts per CFL X 1 million bulbs
 - Divide by 1 million to express watts as MW
- Offer price is \$100/MW-day
 - Revenue stream will reduce amount of cost recovery from customers and impact clearing price
 - Need sufficient revenues to cover costs of measurement and verification requirements in Manual 18B
- Applicable clearing price of \$167.46/MW-day
- $4.16 \text{ MW} \times \$167.46 \times 365 \text{ days} = \$254,271.26$
- Credit requirement for Planned Resources

- Actual load reduction value must be measured
- Start with deemed value of 50 watts per bulb
- Loggers installed in 50 homes show a 9% coincidence factor
- Survey of homes with loggers installed reveal an In-service Rate of .9
- Post installation report provided to PJM demonstrates delivery of sufficient MW for the 2015/2016 delivery year
- $50 \text{ watts} \times .09 \times .9 \times 1.3 = 5.27 \text{ watts per installed CFL}$

- RPM Commitment Compliance will be assessed daily during the Delivery Year
- If Final UCAP value of the EE resource is less than the UCAP committed, a Daily Capacity Resource Deficiency Charge will be assessed for the shortfall, unless replacement capacity is specified.
- If an Audit conducted during the Delivery Year reveals a UCAP value of the EE resource that is less than the UCAP value supported by M&V data, a Daily Capacity Resource Deficiency Charge will be assessed for any incremental shortfall retroactively from the start of the Delivery Year.

Daily Capacity Resource Deficiency Charge =



*Daily Deficiency Rate = Party's Weighted Average RCP + Higher of (20% * Party's Weighted Average RCP OR \$20/MW-day)

- Party's Weighted Average Resource Clearing Price (WARCP) for such resource is determined by calculating the weighted average of resource clearing prices for such resource, weighted by a party's cleared and makewhole MWs for such resource.
- If a Party's WARCP for such resource is \$0/MW-day, a PJM WARCP in the LDA is used.
- PJM WARCP is determined by calculating the weighted average resource clearing prices in the LDA across all RPM Auctions, weighted by the total cleared and make-whole MWS in the LDA.
- Charges are allocated on a pro-rata basis to those LSEs who were charged a Daily Locational Reliability Charge based on their Daily UCAP Obligation.
- The Resource Provider may still receive an RPM Auction Credit.

PJM - RPM Auction User Information - Internet Explorer provided by PJM Interconnection

http://pjm.com/markets-and-operations/rpm/rpm-auction-user-info.aspx

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PJM - RPM Auction User Information

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Operational Data

- Advanced Control Center (AC2) Program
- Data Dictionary
- LMP Contour Map
- eTools
- Energy Market
- Reliability Pricing Model
- RPM Auction User Information**
- Capacity Credit Archive
- Price Responsive Demand
- Financial Transmission Rights
- Ancillary Services
- Demand Response
- Market Settlements
- Financial Credit
- Compliance
- Transmission Service
- Operational Analysis

Home > Markets & Operations > Reliability Pricing Model > RPM Auction User Information

RPM Auction User Information

The Reliability Pricing Model (RPM) is comprised of one base residual auction and up to three incremental auctions per delivery year (June 1 - May 31). The information on this page presents general information as it pertains to each delivery year, including modeling information, planning parameters, and summary auction results.

Participant-level information may be accessed via the eRPM system.

[Login](#)

eRPM application information is available on the [eRPM eTools Web page](#).

	Posting Date
CRF Clarification (PDF)	04.15.2011
Implementation of Peak Hour Period Availability (PHPA) Enhancement (PDF)	08.23.2010
06.01.2010 Transition from Non-Unit Specific Transactions (PDF)	05.20.2010
RPM Offers and Commitments by Fuel Type (XLS)	05.25.2011
DPL and PSEG Subzonal LDAs by ZIP Code (XLS)	08.11.2011
Peak Hour Period Availability Charge and Credit FAQ (PDF)	08.24.2011
RPM Base Residual Auction FAQs (PDF)	04.20.2010
RPM Incremental Auction FAQs (PDF)	01.19.2011
RPM Pricing Point Definitions (PDF)	03.25.2011
RPM Brattle Report (PDF)	
RPM Schedule (XLS) - also available in a Web-based calendar	11.15.2011
Key Expected Transmission Upgrades (XLS)	02.15.2007
Annual RPM Penalties (XLS)	09.22.2011

RELATED INFORMATION

- [Reliability Pricing Model FAQs](#)
- [Manuals](#)
- [Industry Resources](#)
- [eTools](#)

RECENT DOCUMENTS

NOV 1 eRPM User Guide 2011 Posted 30 days ago PDF

CONTACT INFORMATION

Need help finding question. [Live chat](#)

For additional information, please contact the Market Monitoring Department.

Website Feedback

Local intranet | Protected Mode: On | 100% | 4:33 PM | Thursday 12/1/2011

Inbox - Microsoft O... Preliminary 2010/20... demand response a... Microsoft PowerPoi... PJM Wired - Home ... PJM - RPM Auction ...

RPM Schedule of Activities is posted on the RPM Auction User Information Web Page.

Activity	Purpose	Cost of Procurement
Base Residual Auction	Procurement of RTO Obligation less an amount reserved for short lead time resources, less FRR Obligation	Allocated to LSEs through Locational Reliability Charge
1 st Incremental Auction	Allows for: (1) replacement resource procurement (2) increases and decreases in resource commitments due to reliability requirement adjustments; and (3) deferred short-term resource procurement	Allocated to resource providers that purchased replacement resources and LSEs through Locational Reliability Charge
2 nd Incremental Auction		
3 rd Incremental Auction		
Conditional Incremental Auction	Procurement of additional capacity in a LDA to address reliability problem that is caused by a significant transmission line delay	Allocated to LSEs through Locational Reliability Charge
Interruptible Load for Reliability (ILR)	ILR Option eliminated starting with 12/13 DY	

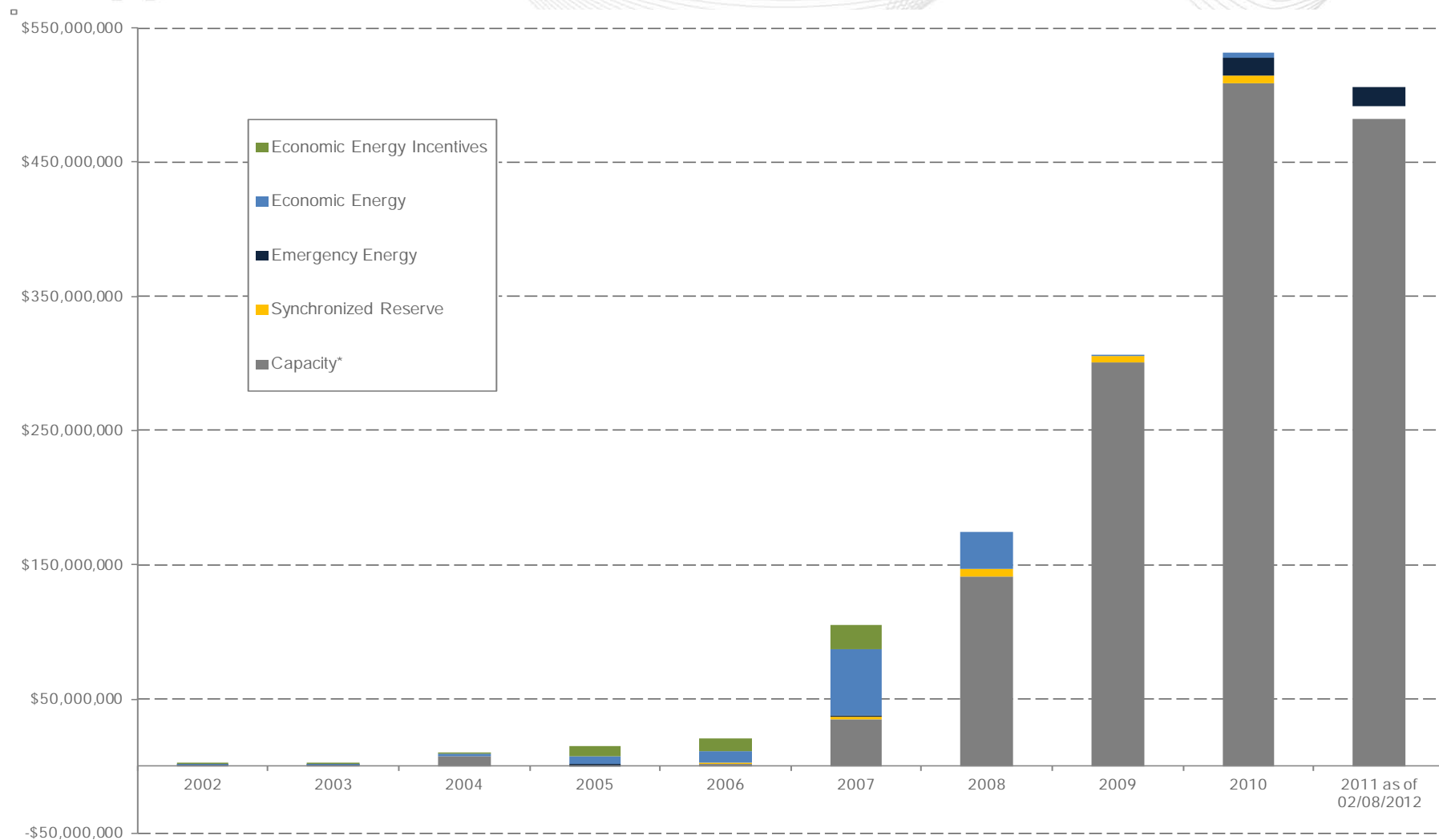
Demand Side Response Overview

The purpose of PJM Demand Response is to enable Demand Resources under the direction and control of Curtailment Service Providers to respond to economic prices.

Demand Response can participate within the various PJM markets:

- *Energy*
 - *Day Ahead*
 - *Real Time*
 - *Dispatched*
 - *Self Scheduled*
- *Ancillary Services*
 - *Synchronized Reserve*
 - *Day Ahead Scheduling Reserve*
 - *Regulation*
- *Capacity*
 - *Offer into auction up to 3 years in advance*

PJM Demand Side Response Estimated Revenue



*Capacity Net Revenue inclusive of Capacity Credits and Charges.

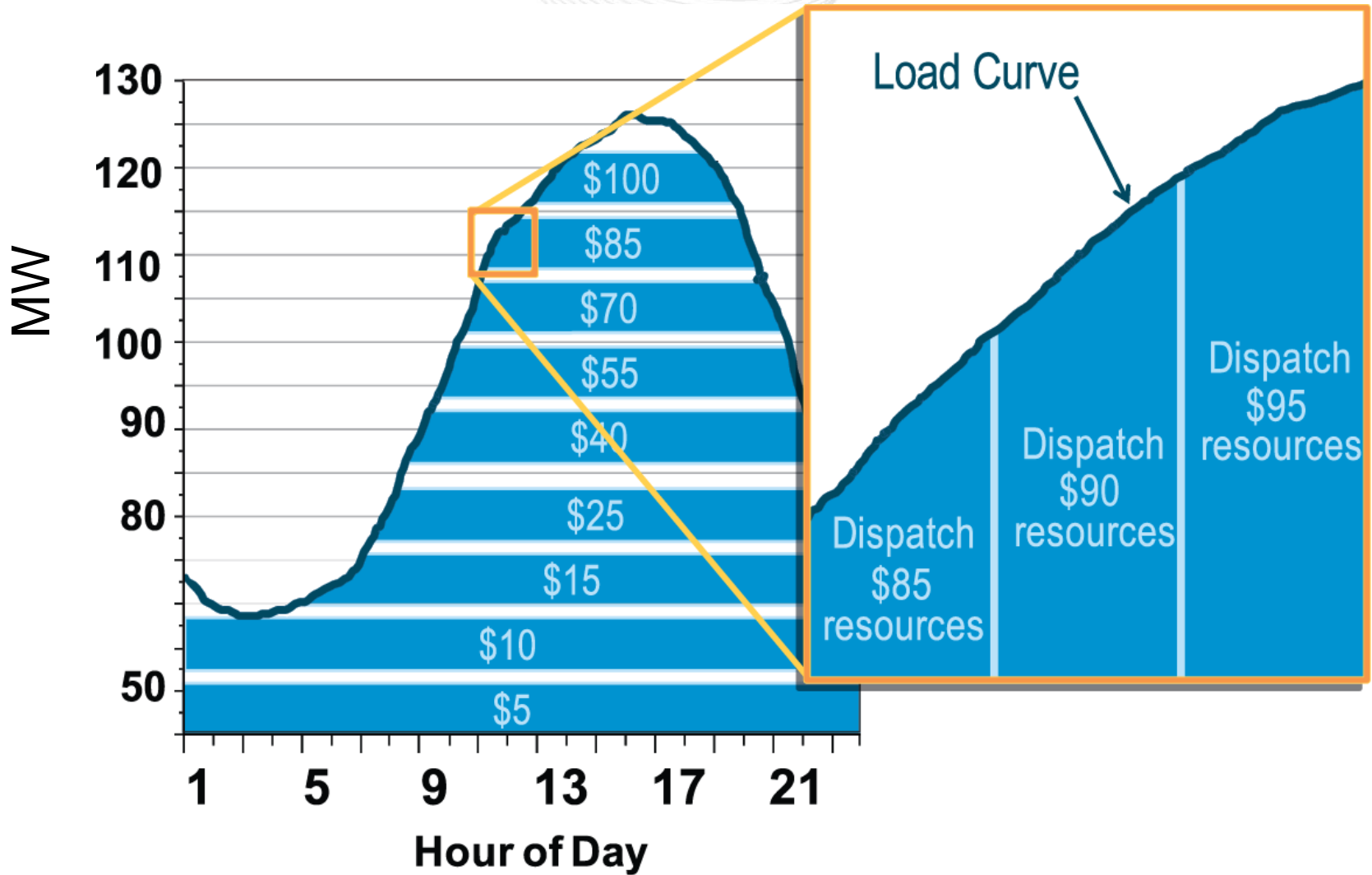
- Availability for up to ten (10) PJM-initiated interruptions during June – September of the Delivery Year.
- Interruptions of up to six (6) consecutive hours' duration between 12:00 PM (Noon) to 8:00 PM (Eastern Prevailing Time) for the months of May through September, on weekdays other than PJM Holidays.
- Load management must be able to be implemented within two hours (2) of notification to the resource provider of a PJM-initiated load management event.
 - Participant will specify either one or two hours during registration process
- Initiation of load interruptions upon request of PJM must be within the authority of the resource provider dispatcher without any additional approvals being required.

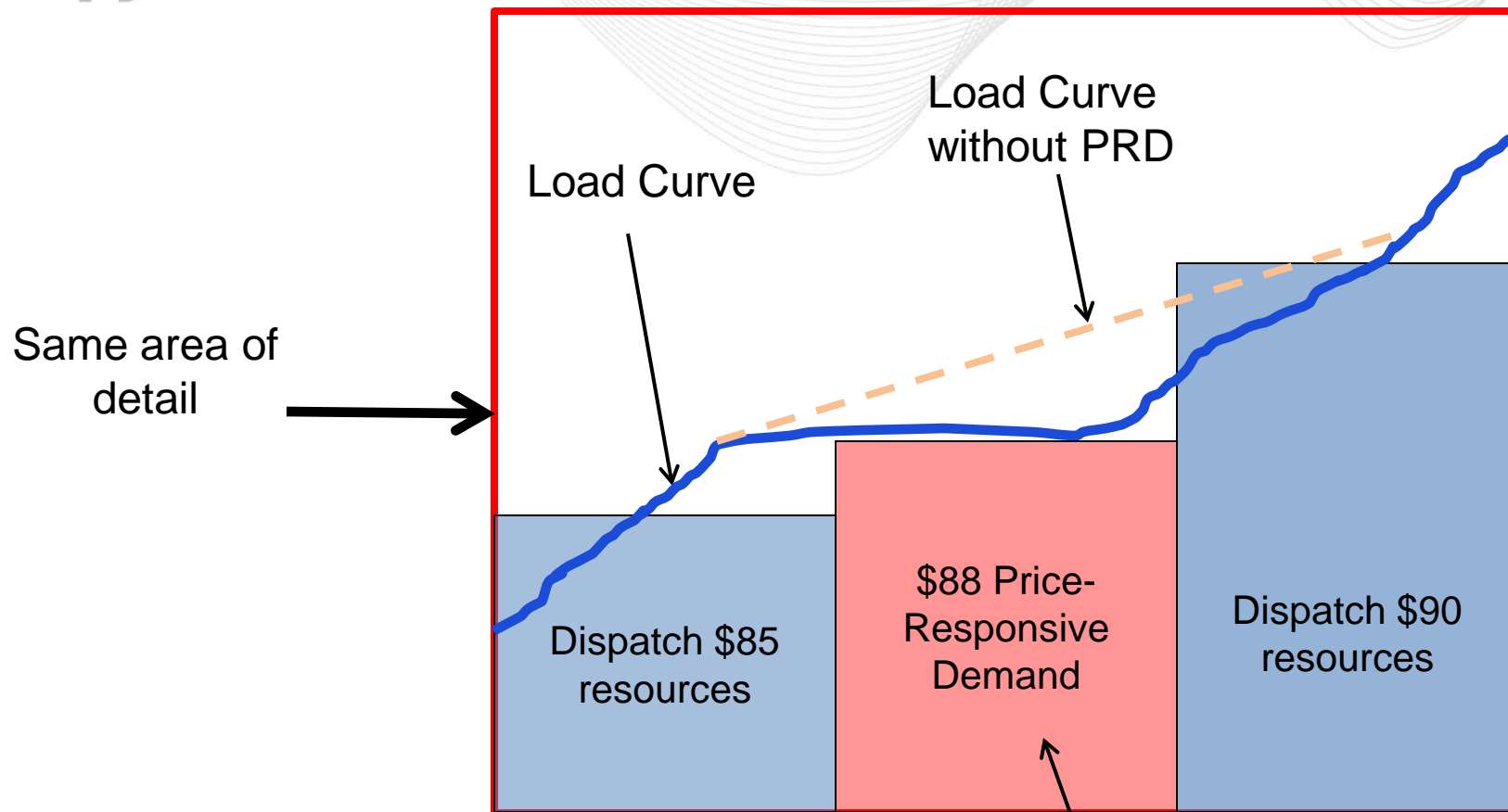
- Effective with the 2014/2015 DY, two additional Product Type will be added:
 - ❖ **Extended Summer Demand Resource**
 - ❖ **Annual Demand Resource**

Three Product Types available beginning in the 2014/2015 DY

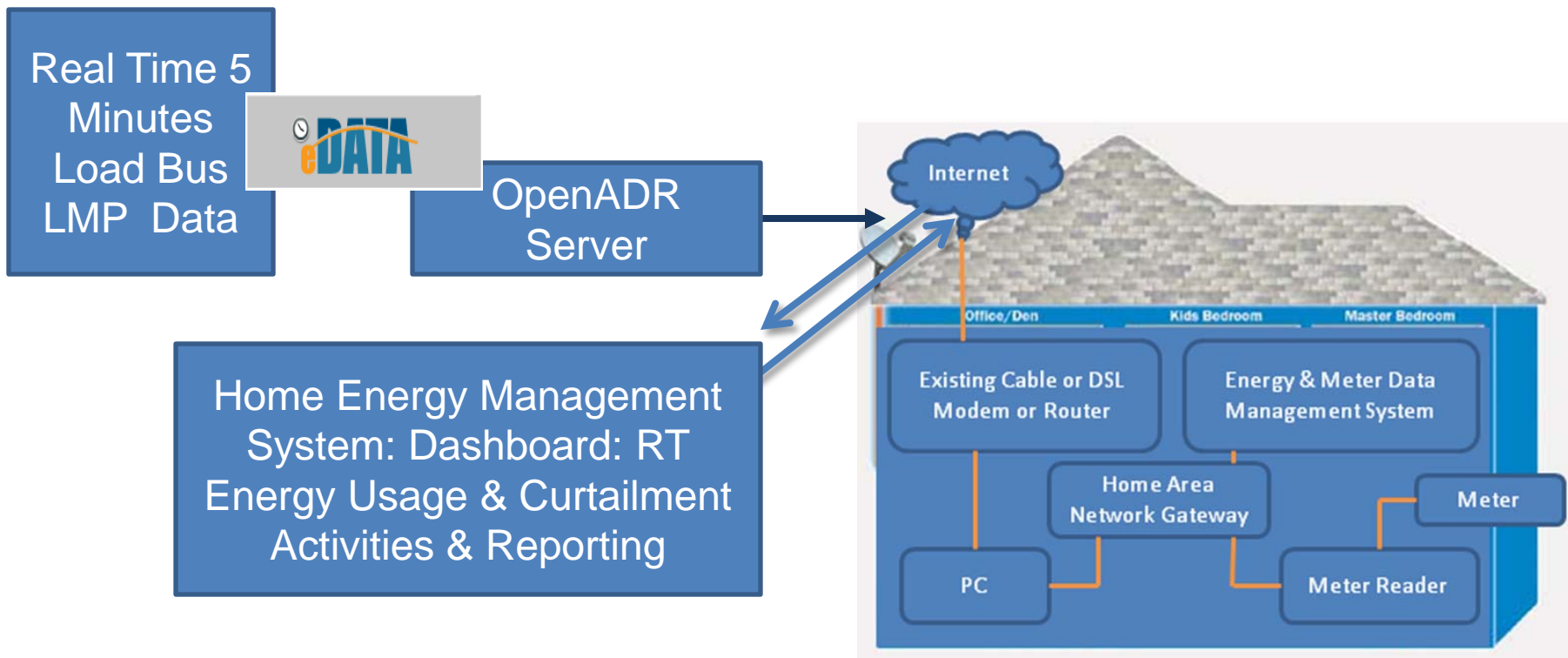
Requirement	Limited DR	Extended Summer DR	Annual DR
Availability	Any weekday, other than NERC holidays, during June – Sept. period of DY	Any day during June-October period and following May of DY	Any day during DY (unless on an approved maintenance outage during Oct. - April)
Maximum Number of Interruptions	10 interruptions	Unlimited	Unlimited
Hours of Day Required to Respond (Hours in EPT)	12:00 PM – 8:00 PM	10:00 AM – 10:00 PM	Jun – Oct. and following May: 10 AM – 10 PM Nov. – April: 6 AM- 9 PM
Maximum Duration of Interruption	6 Hours	10 Hours	10 Hours
Notification	Must be able to reduce load when requested by PJM All Call system within 2 hours of notification, without additional approvals required		
Registration in eLRS	Must register sites in Emergency Load Response Program in Load Response System (eLRS)		
Event Compliance	Must provide customer-specific compliance and verification information within 45 days after the end of month in which PJM-initiated LM event occurred.		
Test Compliance	In absence of the PJM-initiated LM event, CSP must test load management resources and provide customer-specific compliance and verification information.		

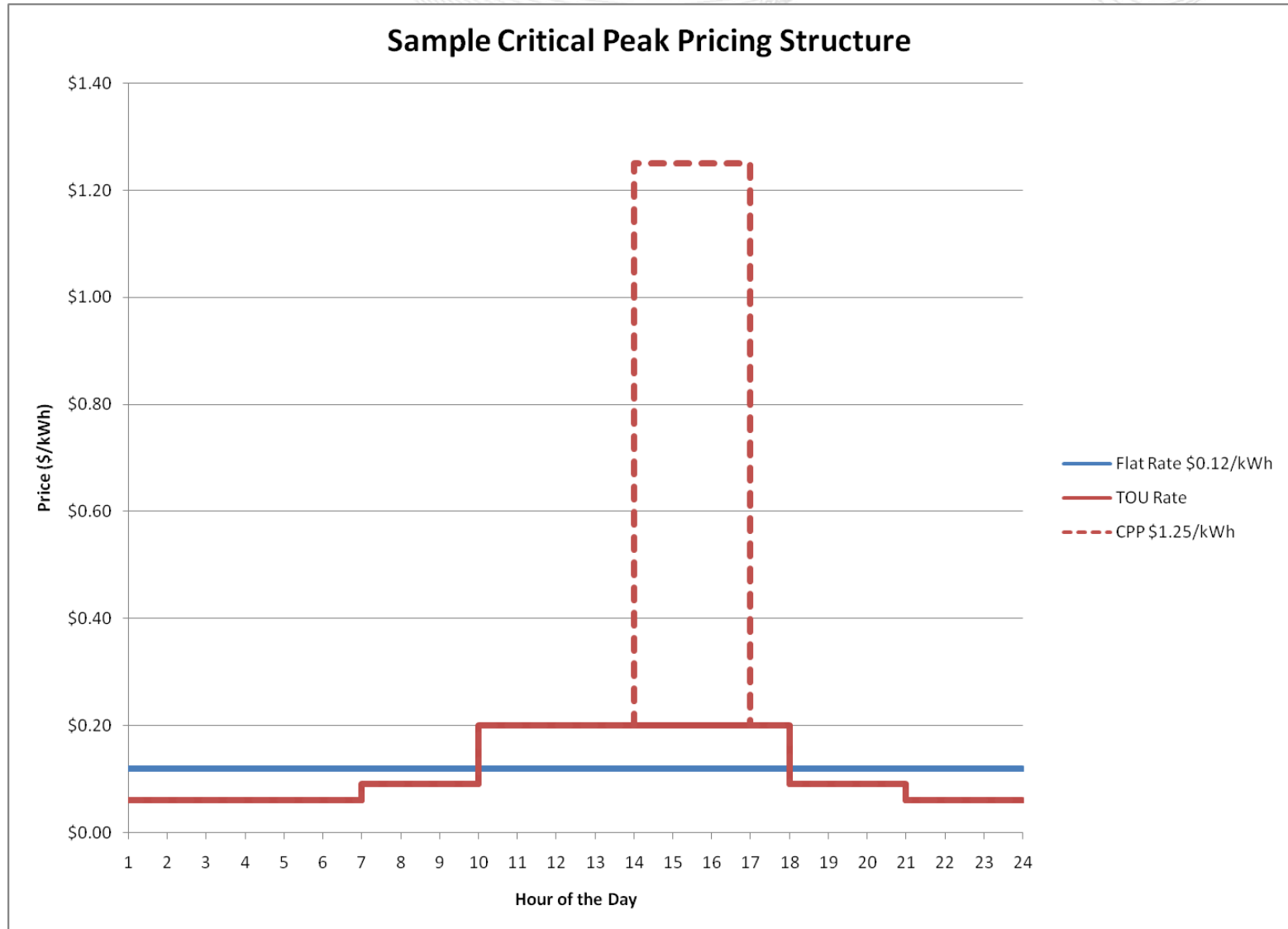
- New option for wholesale participation by load reduction capability
- Market rules require:
 - Metering capable of providing hourly interval usage values
 - Dynamic retail rates that are triggered by nodal Locational Marginal Prices in the PJM energy market
 - Automated response (and supervisory control for capacity market participants that can override automated controls

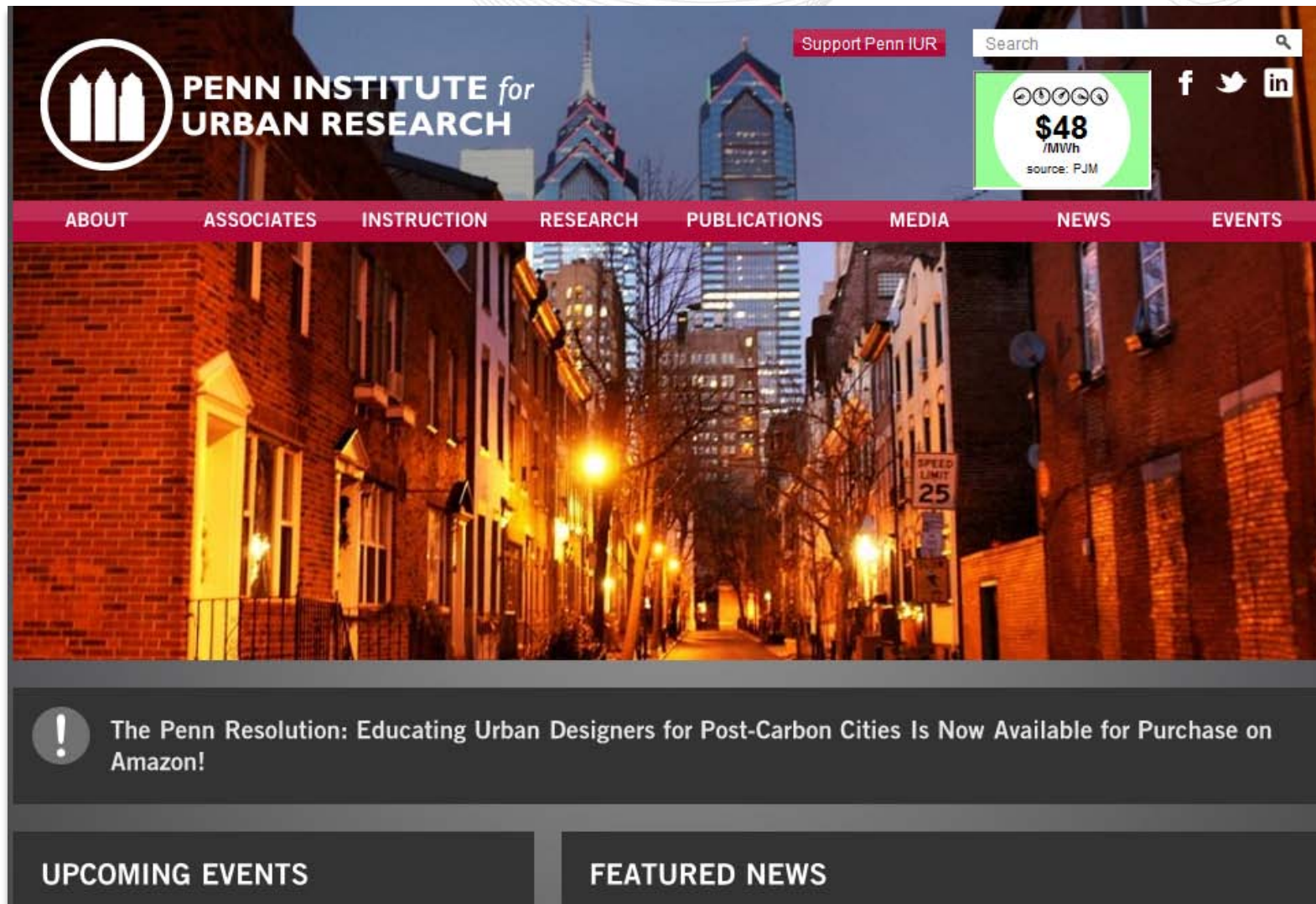




No dispatch of additional resources
due to demand response at indicated
price level







The screenshot shows the homepage of the Penn Institute for Urban Research. The background is a night photograph of a city street with brick buildings and a skyscraper in the distance. The website features a red navigation bar with the following links: ABOUT, ASSOCIATES, INSTRUCTION, RESEARCH, PUBLICATIONS, MEDIA, NEWS, and EVENTS. In the top right corner, there is a search bar, a 'Support Penn IUR' button, and social media icons for Facebook, Twitter, and LinkedIn. A green price ticker box displays a price of \$48 /MWh, with a source attribution to PJM. Below the navigation bar, a dark grey banner contains an announcement about 'The Penn Resolution: Educating Urban Designers for Post-Carbon Cities' being available for purchase on Amazon. At the bottom, there are two dark grey buttons labeled 'UPCOMING EVENTS' and 'FEATURED NEWS'.

PENN INSTITUTE for URBAN RESEARCH

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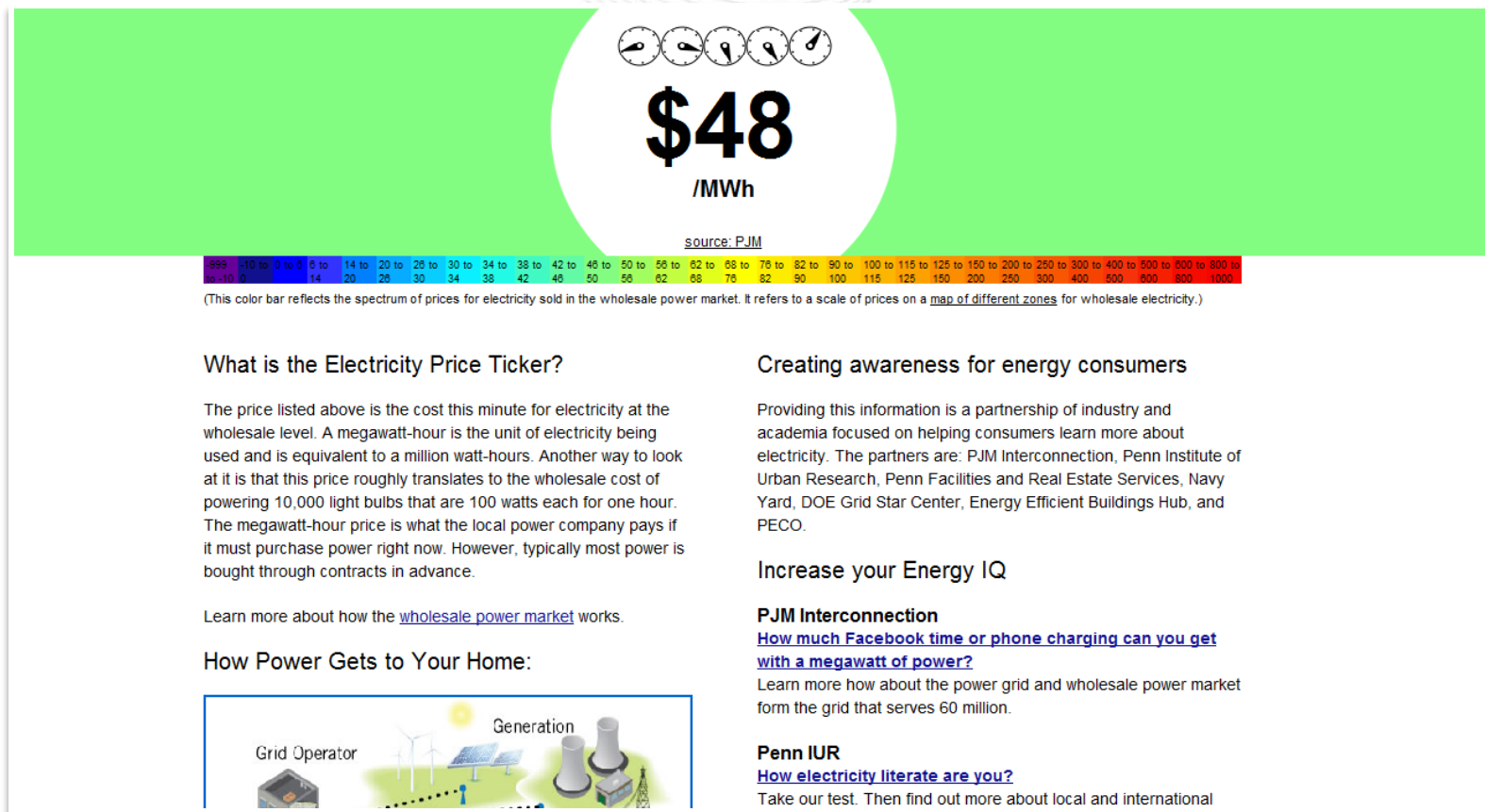
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\$48
/MWh
source: PJM

ABOUT ASSOCIATES INSTRUCTION RESEARCH PUBLICATIONS MEDIA NEWS EVENTS

! The Penn Resolution: Educating Urban Designers for Post-Carbon Cities Is Now Available for Purchase on Amazon!

UPCOMING EVENTS FEATURED NEWS



► What can 1 megawatt hour (MWh) do?

2,222 hours on
fACEBOOK

(100 kWh)

Cool a refrigerator for
3 MONTHS

(150 kWh)

Download
133,320
SONGS

(50 kWh)

The combination
of these uses = **1 MWh**

(1,000 kilowatt hour)

600
Super Bowl
PARTIES

(300 kWh)



5,556
iPhone Charges

(100 kWh)

107
tans at the
TANNING
SALON

(200 kWh)



1,200
pots of coffee

(100 kWh)



Based on a variety of sources. Numbers are estimations and may be rounded.

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DEMAND RESPONSE

Demand Response Monthly Activity Reports

<http://www.pjm.com/~media/markets-ops/dsr/2011-dsr-activity-report-20120110.ashx>

Demand Response Annual Performance Reports

<http://www.pjm.com/markets-and-operations/demand-response/dr-reference-materials.aspx>

ENERGY EFFICIENCY

Reports of Energy Efficiency Cleared in Auctions

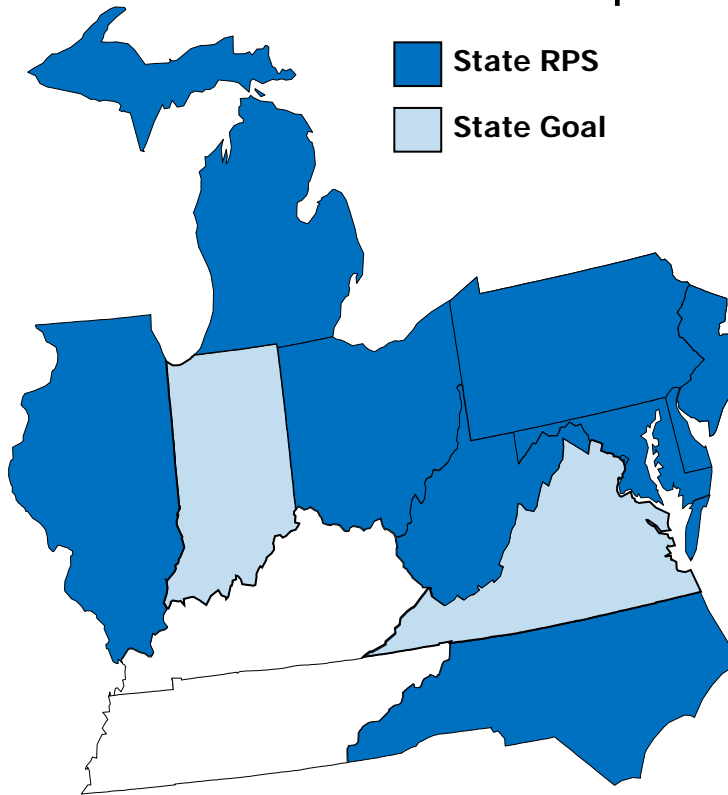
<http://www.pjm.com/markets-and-operations/rpm/rpm-auction-user-info.aspx>

RPM Energy Efficiency FAQs

<http://www.pjm.com/markets-and-operations/rpm/~media/markets-ops/rpm/rpm-auction-info/rpm-energy-efficiency-faqs.ashx>

Renewable Resource Integration

PJM-EIS continues to work with state agencies as programs evolve and additional states implement RPS programs.



GATS certificates required for RPS compliance:

- ☀ NJ: 22.5% by 2021
- ☀ MD: 20% by 2022
- ☀ DE: 25% by 2026
- ☀ DC: 20% by 2020
- ☀ PA: 18%** by 2020
- ☀ OH: 25%** by 2025
- ☀ WV: 25%** by 2025

GATS certificates accepted for RPS compliance:

- ☀ IL: 25% by 2025
- VA: 12% by 2022 (voluntary goal)
- IN: 10%** by 2025 (voluntary goal)

GATS certificates must be imported into the state's tracking system for RPS compliance:

- ☀ NC: 12.5% by 2021 (IOUs)
- MI : 10% + 1,100 MW by 2015

DSIRE: www.dsireusa.org

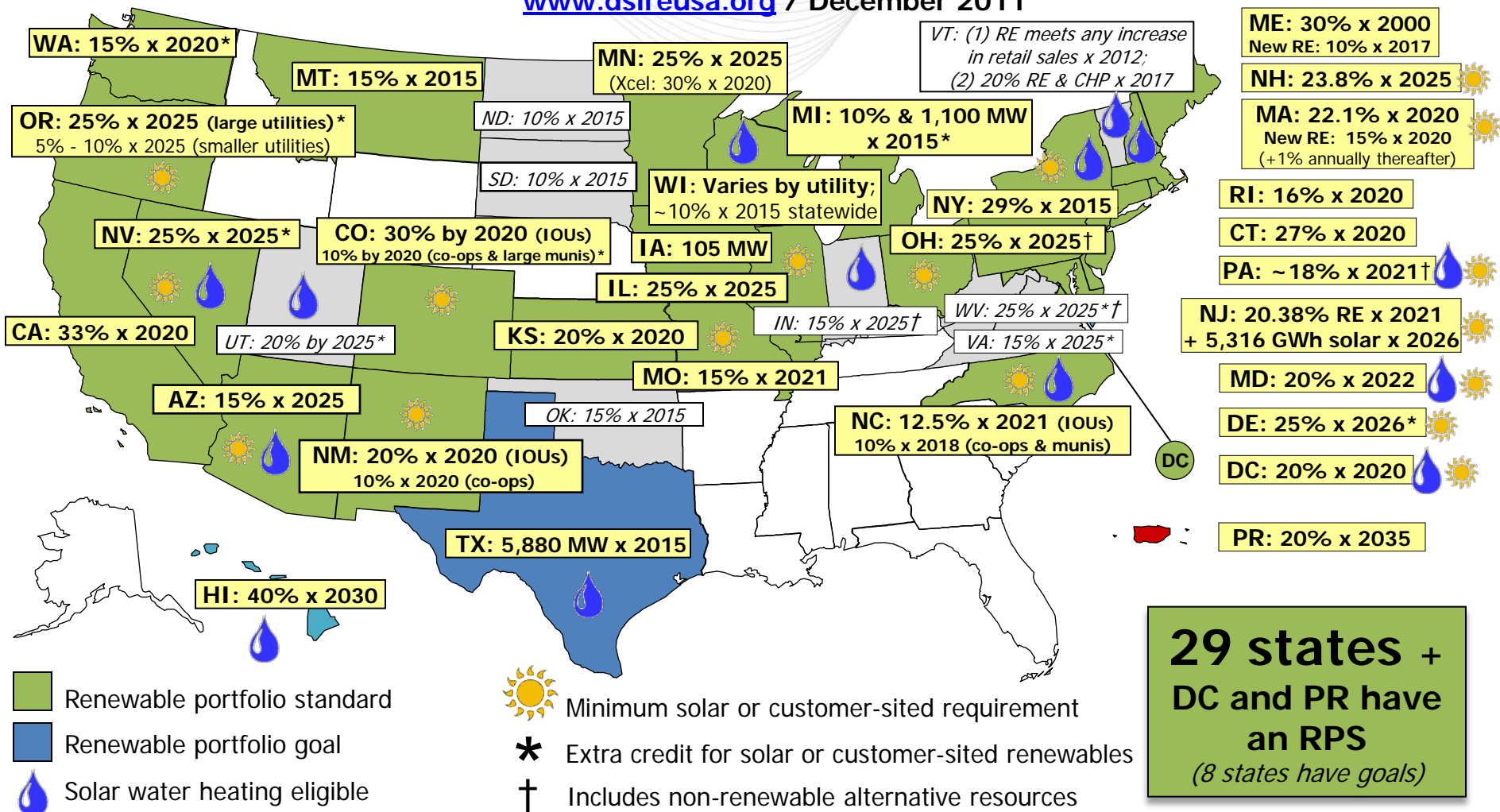
January 2012

☀ Minimum solar requirement

** Includes non-renewable "alternative" energy resources

- **North Carolina** (April 2011)
 - ↓ SB 75: Added demand reductions as a qualify resource
- **Maryland** (May 2011)
 - ↓ SB 690: In-state trash-to energy changed to Tier 1 resource
 - ↓ SB 717: Solar water heating systems can qualify as solar resource starting in 2012
 - ↑ SB 791: (April 2012): will accelerate solar target (2% by 2022) by 2 years
- **Indiana** (May 2011)
 - ↑ SB 251: Established voluntary Clean Energy Standard starting in 2013
- **Delaware** (July 2011)
 - ↓ SB 124: Qualified fuel cells can count for up to 30% of the SREC requirement
- **District of Columbia** (August 2011)
 - ↑ Solar resource eligibility limited to solar facilities located in the District (after 1/31/2011)
 - ↑ Solar target increased from 0.4% to 2.5% by 2023
- **Illinois** (October 2011)
 - ↑ SB 1672: Added a requirement for distributed renewable resources (<2 MW)
- **Virginia** (April 2012)
 - ↓ HB 1102: Utilities can meet up to 20% of the state voluntary RPS through R&D investment
 - ↓ HB 232: Land fill gas and CHP powered by renewable fuel added as qualifying resources

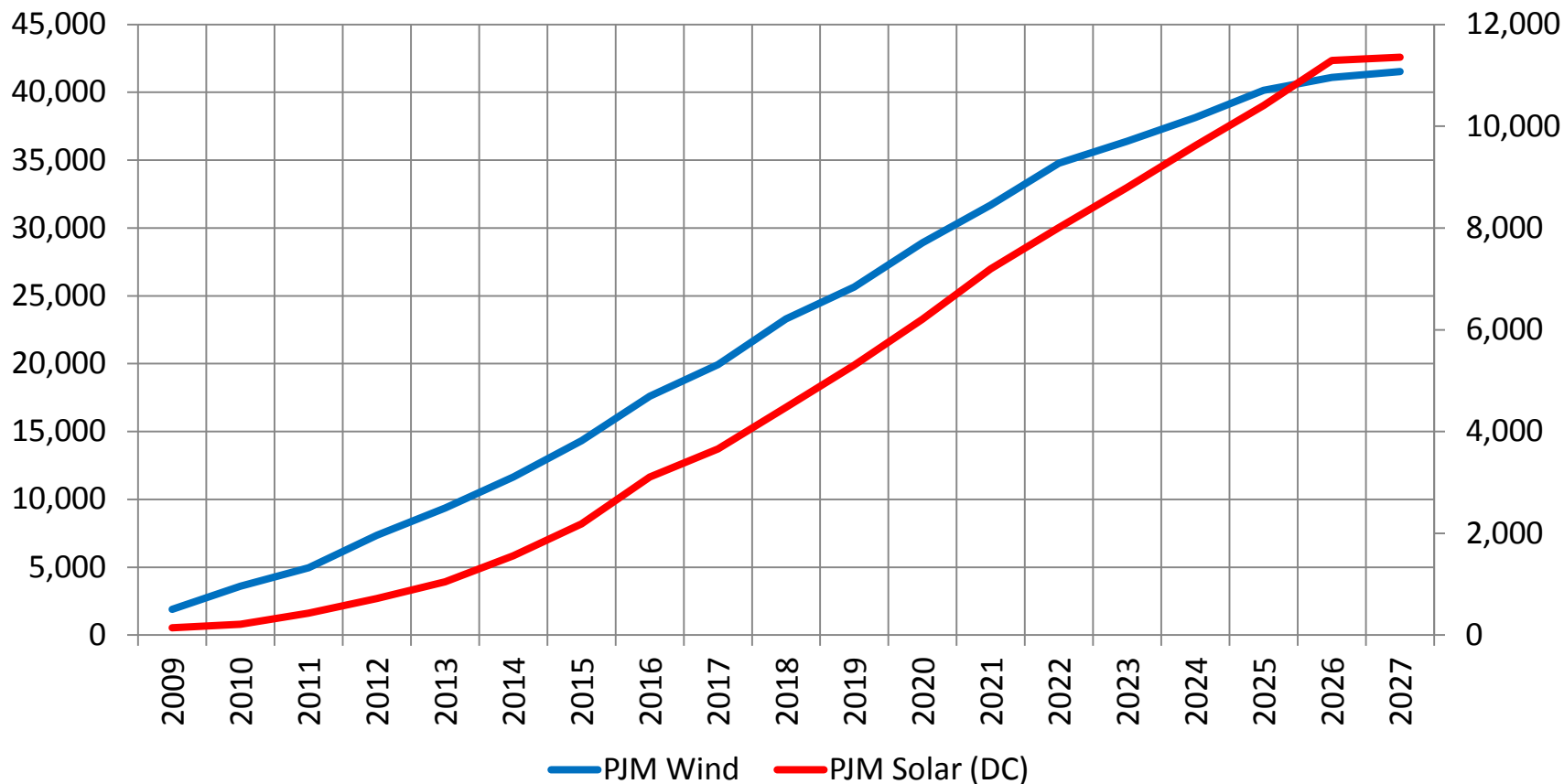
www.dsireusa.org / December 2011

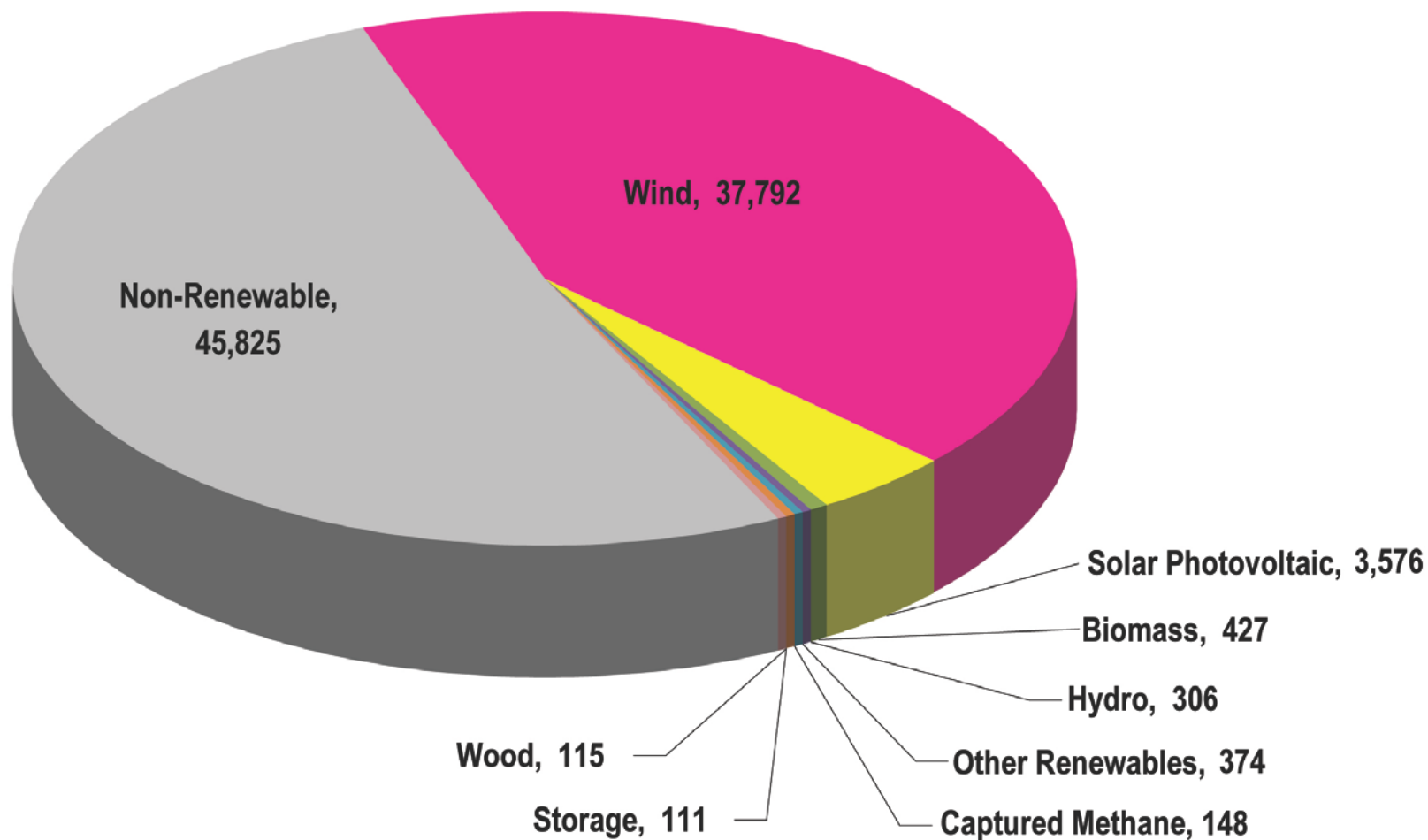


Projected Renewable Energy Requirements in PJM

**By 2026: 133,000 GWh of renewable energy, 13.5% of PJM annual net energy
(41 GW of wind and 11 GW of solar)**

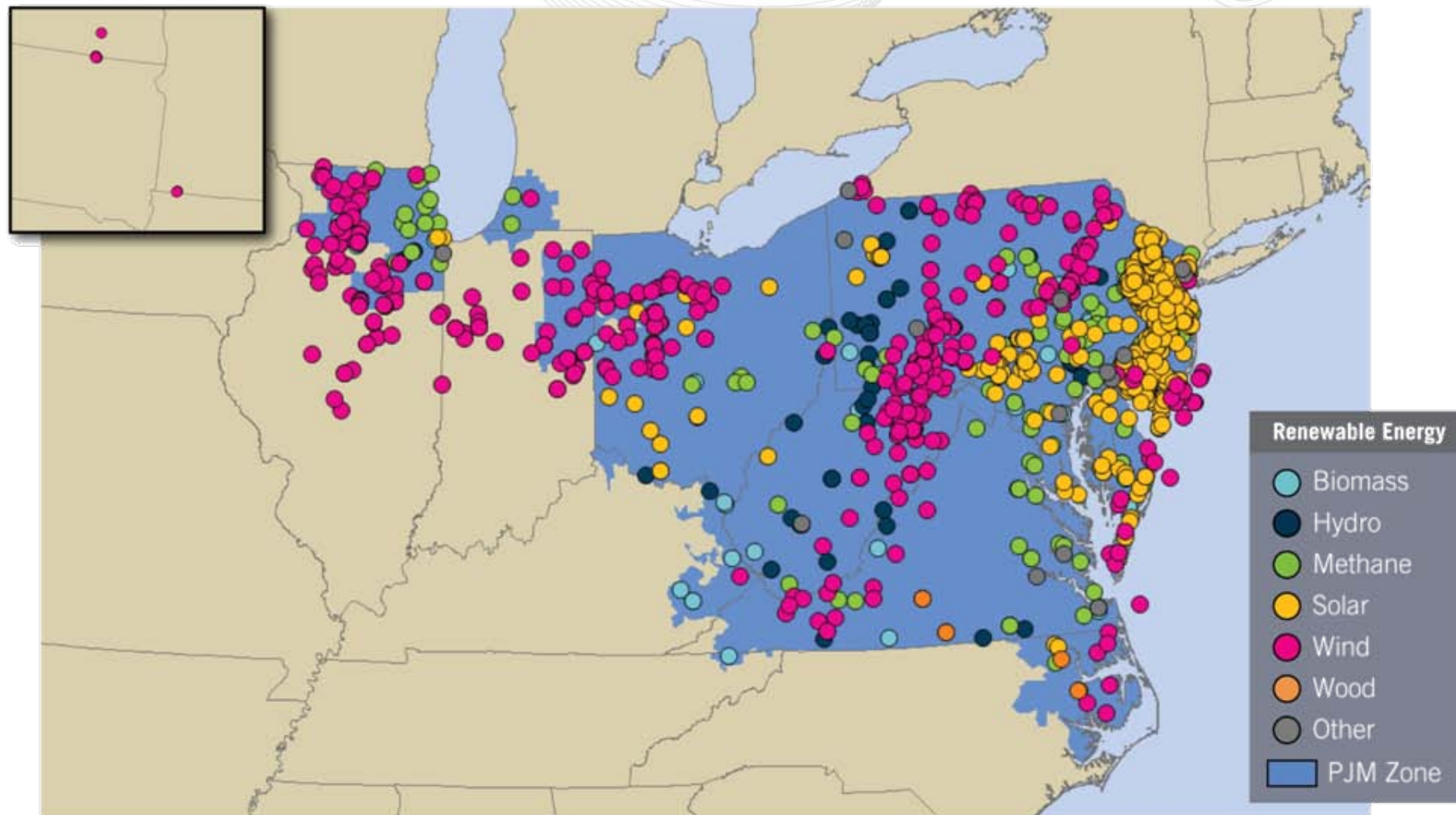
Wind and **Solar** Requirements in PJM (MW)





As of January 4, 2012

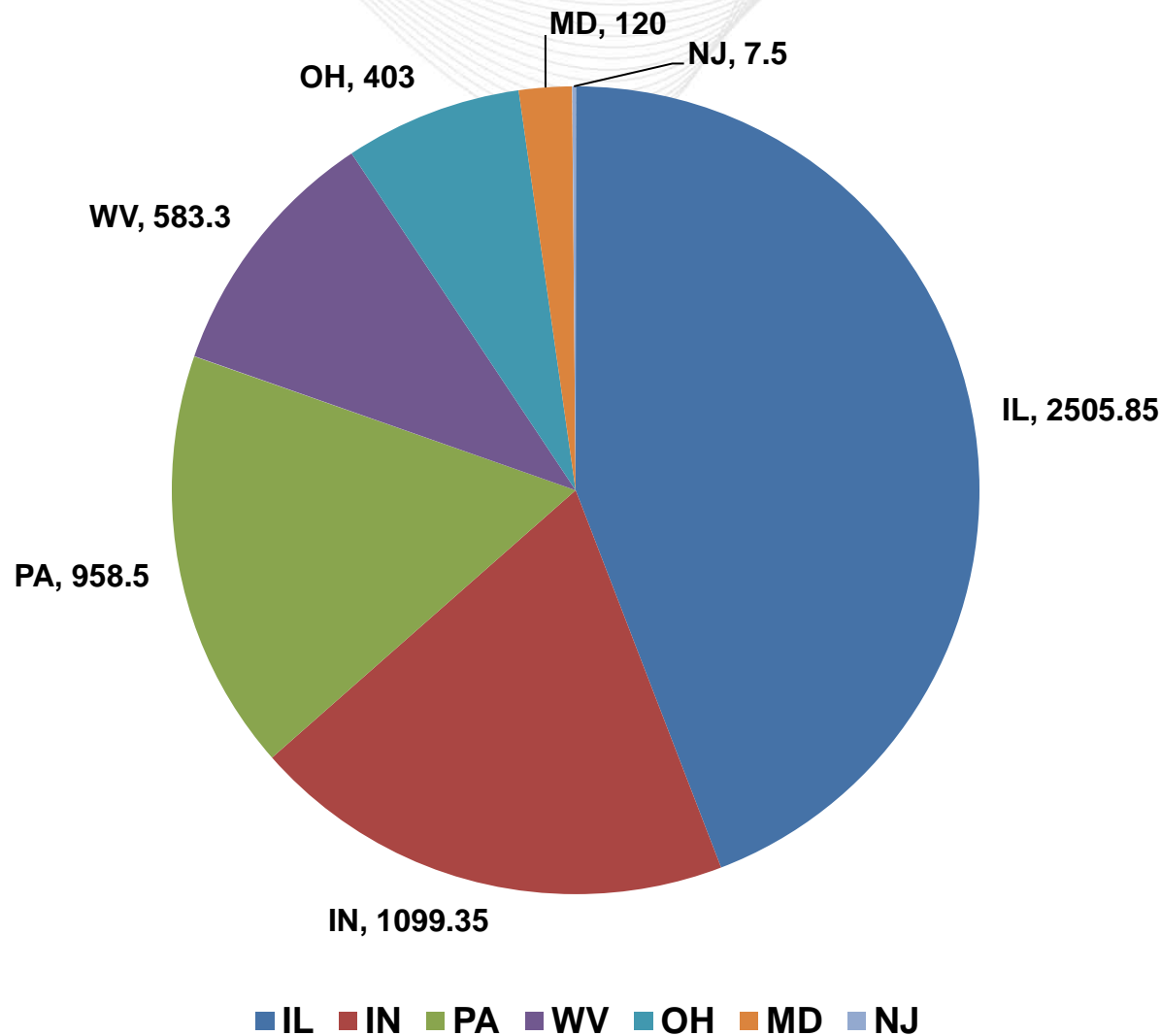
Proposed Renewable Generation in PJM



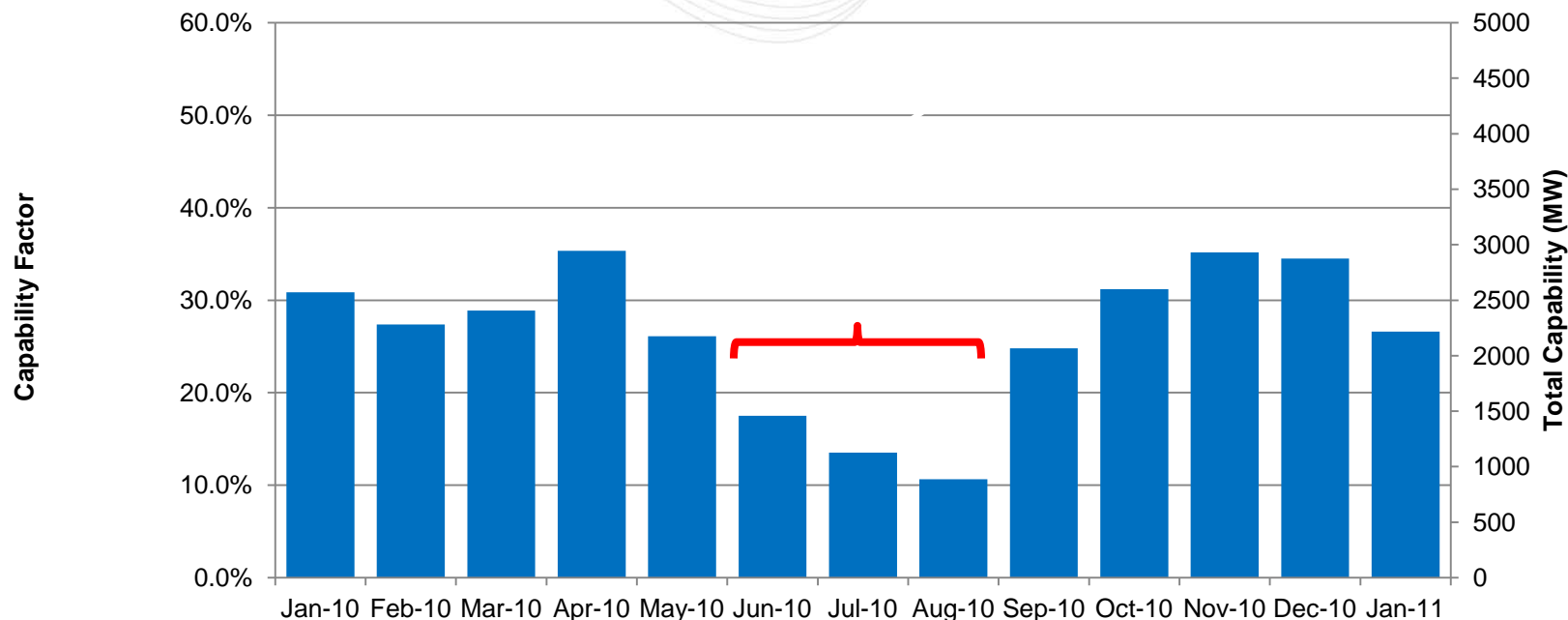
As of January 4, 2012

Existing PJM Wind Installed (MW), by State

June 2012 – 5,677.5 MW



Mean Wind Capability Factor in 2010



	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10	Jan-11
■ Capability Factor	30.9%	27.4%	28.9%	35.3%	26.1%	17.5%	13.5%	10.6%	24.8%	31.2%	35.2%	34.5%	26.6%
Total Capacity (MW)	3639.4	3639.4	3741.4	3741.4	3741.4	3840.4	3840.4	4381.8	4381.8	4550.5	4550.5	4550.5	4600.5
RTO Load (MW)**	88900	87539	74637	68286	74022	89232	96767	92343	78348	68811	73659	89509	89778

$$\text{Capability Wind Factor} = \frac{\text{Average Wind Generation}}{\text{Total Wind Capability}^*}$$

* Does not incorporate turbine outages

** Includes 350 MW dynamically scheduled units

- Formed the Intermittent Resource Working Group (IRWG) to address market, operational, and reliability issues specific to variable resources.
- Implemented a centralized wind power forecasting service in April 2009 for use in PJM reliability assessments:
 - Day Ahead (Medium-Term Wind Power Forecast)
 1. predict day-ahead congestion and mitigating strategies
 2. ensure sufficient generation resources are scheduled to meet reserve requirements
 - Real-Time (Short-Term Wind Power Forecast)
 1. evaluate current day congestion
 2. ensure that sufficient generation resources are available to respond to real-time or projected fluctuations in Wind Power Output.
- Implemented changes to improve wind resource management in June 2009.
 - Generating resources are now able to submit negative price offers, enabling wind resources to submit flexible offers that better reflect the price at which they will reduce output.

- Implemented tariff changes to allow Energy Storage Resources to participate in PJM ancillary services markets
- Implemented changes to:
 - Improve communication/coordination when a wind farm has multiple owners/operators
 - Improve dispatch and control by ensuring that economic minimums are not set too high.
- Initiated a PJM Renewable Integration Study (PRIS) to assess impacts to planning, markets, and operations

- Flexible resources will be needed to offset the impacts of variable generating resources
- New market players:
 - Price Responsive Demand
 - Smart Grid Technologies
 - Energy Storage Resources
 - battery arrays
 - flywheels
 - compressed air energy storage
 - plug-in hybrid electric vehicles (PHEVs)
- Potential market changes:
 - Market for load following service from existing generators?
 - New tools to co-optimize energy and ancillary service markets, and improve forecasting and scheduling capabilities

- For more information about PJM's initiatives:
 - Exploring Tomorrow's Grid: New developments and technologies to advance the grid:
<http://pjm.com/about-pjm/exploring-tomorrows-grid/smart-grid.aspx>
 - Renewable Energy Dashboard: See how PJM is working to bring renewable energy to the grid:
<http://pjm.com/about-pjm/renewable-dashboard.aspx>