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Demand Response Opportunities in PJM’s Markets
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PJM Interconnection, LLC
**PJMr Overview**

**KEY STATISTICS**

- PJM member companies: 600+
- Millions of people served: 51
- Peak load in megawatts: 144,644
- MWs of generating capacity: 167,367 KMs
- Of Transmission lines: 90,520
- GWh of annual energy: 729,000
- Generation sources: 1,310
- Square miles of territory: 164,260
- Area served: 13 states + DC
- Internal/external tie lines: 250

- 26% of generation in Eastern Interconnection
- 23% of load in Eastern Interconnection
- 19% of transmission assets in Eastern Interconnection
- 19% of U.S. GDP produced in PJM

United States

Eastern Interconnection
What is Demand Response?

- Customer ability to manage total electricity bill
  - Reducing or shifting consumption away from high price periods to low price periods
    - In a manner similar to the gasoline example
  - Committing to reductions during peak to maintain reliability in exchange for a payment that reduces the total electricity bill
    - Similar to reducing recurring expenses for “infrastructure needs” such as with homes and cars
From a PJM operational perspective it is:

- End-use customer ability to change consumption in response to wholesale energy market prices
- End-use customer ability to reduce consumption to meet system generation capacity adequacy needs during an emergency

For utilities or load serving entities it is:

- End-use customer’s ability to shift consumption to lower priced periods to reduce high price purchases or peaking generation
- End-use customer’s ability to reduce consumption at peak to reduce the need for new generating capacity
- Other end-use customers can also benefit from these actions
Demand Response Opportunities in PJM

- **PJM Energy Market**
  - End-use customers reduce consumption in response to wholesale market prices
  - Reductions are compensated at the prevailing wholesale market price less the retail rate
  - Participation is voluntary in that there is no requirement that reductions in consumption take place

- **PJM RPM Capacity Market**
  - End-use customers commit to reduce consumption during emergencies at extreme system peaks to maintain reliability
  - End-use customers receive payment for making this commitment
  - When called, reductions are mandatory
Incentives to Respond to Wholesale Prices in the Energy Market

An End-Use-Customer reduce consumption when wholesale prices are high

G&T part of Retail Rate

Wholesale Price (Hourly LMP)
Total Registered MWs in PJM's Economic Demand Response

*Data as of the first day of each month.*
*Data for last few months are subject to significant change due to the settlement window.*
Offers of Demand-Side Resources as Capacity in PJM by Delivery Year

Prior to RPM Implementation

RPM Implemented

- Energy Efficiency
- RPM and FRR DR
- Interruptible Load for Reliability
- Active Load Management

2005 2006 2007 2008 2009 2010 2011 2012 2013

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PJM Demand Side Response Estimated Revenue

*Capacity revenue prior RPM implementation on 6/1/07 estimated based on average daily ALM capacity credits and weighted average daily PJM capacity market clearing price.
Demand Response Opportunities in PJM

- **PJM Synchronized Reserve Markets**
  - As Synchronized Reserves end-use customers commit to reduce load in response to a contingency
  - End-use customers receive a payment for this commitment
  - If contingency occurs and PJM asks for reserve, reductions are mandatory

- **PJM Regulation Market**
  - End-use customers commit to follow PJM regulation and frequency response signal
  - End-use customers receive payment for this commitment
  - To date there has not been any demand response in regulation

60.00 Hz
• **CO₂ Emissions Rates of Marginal Units** - PJM has analyzed the CO₂ emissions rate information from the Generation Attribute Tracking System (GATS), which is administered by PJM Environmental Information Services (PJM EIS), for the specific marginal units for each five minute interval from January 2005 through December 2010. The five-minute marginal data was aggregated into hourly blocks and then sorted into on-peak and off-peak time periods and ultimately averaged for each month. The on-peak period is all non-holiday weekdays from 7 a.m. until 11 pm and the off-peak is comprised of all other hours. The annual numbers are also provided.

• **Average CO₂ Emissions Rates** - The average CO₂ emissions rate is calculated with the CO₂ emissions rate information from GATS. Each unit’s monthly generation numbers are coupled with the CO₂ rate to determine the total monthly emissions. The total CO₂ emissions values for all units are summed across the PJM region and divided by the total generation in the region to determine the average CO₂ emission rate in PJM for that month. The annual numbers are also provided.
## CO₂ Emissions Rates of Marginal Units
### Average CO₂ Emissions Rates

<table>
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<tr>
<th>Year</th>
<th>Marginal On-Peak</th>
<th>Marginal Off-Peak</th>
<th>PJM System Average</th>
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