

# Demand Response in Wholesale Electricity Markets

## Alberta Electric System Operator (AESO) Demand Response Opportunities

	Alberta Electric System Operator		
	<u>Reliability based</u>		<u>Price based</u>
<b>Program name</b>	<b>Supplemental Reserves</b>	<b>Frequency Responsive Load Shed Service</b>	No active program at present; only real time market based price sensitive load response.
<b>Customer type</b>	Individual	Individual	
<b>Minimum Reduction</b>	5 MW	Any Amount	
<b>Trigger Event</b>	Loss of Resources	Frequency Change Below 59.5 Hz	
<b>Response Time</b>	10 minute	Automatic	
<b>Energy Payment</b>	Indexed to Pool Price		
<b>Notification</b>	Automated Dispatch System		
<b>Program Available</b>	Permanent	Permanent	
<b>Penalty For Non-performance</b>	Yes	Must be available 75% of time	

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## California Independent System Operator (CAISO) Demand Response Opportunities

	CAISO		
	Reliability Based	Price Based	
	Emergency	Day Ahead- A/S	Real Time
Program Name	Voluntary Load Reduction Program	Participating Load Program	Participating Load Program
Customer Type	Individual/Aggregate within zones	Individual/Aggregate within zones	Individual/Aggregate within zones
Service Type	Load Reduction	Non-spin	Imbalance Energy
Minimum Reduction	Any Amount	1 MW	1 MW
Trigger	Stage 1 Emergency	Price Based	Price Based
Notification	Pager	Automated Dispatch System	Automated Dispatch System
Response Time	Start and End Time Issued; no set lead time	10 min or less	60 min or less
Payment Rate and Terms	None	MCP	MCP
Duration of Demand Response Event		Up to 2 hours	Up to 2 hours
Resource Adequacy Resource	No	Yes	Yes
Program Available	Yes	Yes	Yes
Metering Requirements	No	Yes	Yes
Telemetry Requirements	No	Yes	No
Penalty for Non-performance	No	No; some market risk associated with buy back of A/S	No; some market risk associated with buy back of energy

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## ***Electric Reliability Council of Texas (ERCOT) Demand Response Opportunities***

	ERCOT					
	Reliability Based	Price Based				
	N/A					
<b>Program Name</b>	N/A	Load Acting as a Resource (LaaR) / Generation	Load Acting as a Resource (LaaR) / Generation	Load Acting as a Resource (LaaR) / Generation	Load Acting as a Resource (LaaR) / Generation / Balancing Up-Load (BUL)	Load Acting as a Resource (LaaR) / Generation
<b>Resource Type</b>		Responsive Reserve Service	Non Spinning Reserve Service	Replacement Reserve Service	UP - Balancing Energy Service	DOWN - Balancing Energy Service
<b>Customer Type I- Individual, A- Aggregate</b>		I or A, Registered w/ Qualified Scheduling Entity (QSE) or Retail Electric Provider (REP)	I or A, Registered w/ Qualified Scheduling Entity (QSE) or Retail Electric Provider (REP)	I or A, Registered w/ Qualified Scheduling Entity (QSE) or Retail Electric Provider (REP)	I or A, Registered w/ Qualified Scheduling Entity (QSE) or Retail Electric Provider (REP)	I or A, Registered w/ Qualified Scheduling Entity (QSE) or Retail Electric Provider (REP)
<b>Minimum Reduction</b>		1 MW	1 MW	1 MW	1 MW	1 MW
<b>Event for Notification</b>		Frequency change	Loss of resource	To provide additional Balancing Energy Service	Decrease in frequency	Increase in frequency
<b>Response Time</b>		Immediate w/ Relay action, 10 minutes w/ manual	30 minutes	10 minute, Response as bid	10 minutes for full payment, 70 minutes for partial payment	10 minutes
<b>Energy Payment</b>					Market clearing price in Balancing Energy Market	
<b>Minimum Payment Rate (\$/MWh)</b>						
<b>Minimum Duration of Event</b>		15 Minutes	15 Minutes	15 Minutes	15 Minutes	15 Minutes
<b>Maximum Duration of Event</b>		Larger of (customer availability or system need)	Larger of (customer availability or system need)	Larger of (customer availability or system need)	Larger of (customer availability or system need)	Larger of (customer availability or system need)
<b>Specific Event Limits</b>						
<b>Bid Limits</b>						
<b>Capacity Payment (Y/N)</b>		Yes	Yes	Yes	May receive based on Non-Spinning Reserves -- BUL receives only if responds	
<b>Program Start Date</b>					September 1, 2003	
<b>Program End Date</b>						
<b>Minimum Term (Yrs)</b>						
<b>Penalty for Non-performance</b>		No			3 or more under-performance, will need to requalify	
<b>Generation Allowed for Load</b>		Yes, with permit	Yes, with permit	Yes, with permit	Yes, with permit	Yes, with permit

# Demand Response in Wholesale Electricity Markets

## Independent Electric System Operator of Ontario (IESO) Demand Response Opportunities

	IESO					
	Reliability Based		Price Based			
	Emergency		Day Ahead	Real Time		
Program Name	Emergency Load Reduction Program (ELRP)	Emergency Demand Response Program (EDRP)	N/A	Dispatchable Loads	Transitional Demand Response Program (TDRP)	Hour Ahead Dispatchable Load (HADL)
Customer Type	Individual/Aggregate	Individual		Individual	Individual/Aggregate	Individual/Aggregate
Minimum Reduction	1 MW	1 MW		1MW	250 KW	1 MW
Notification	IESO Request- Operating Reserve and/or Energy Deficiency	IESO Request - Operating Reserve and/or Energy Deficiency		Dispatch Instructions	Predispatch price exceeds \$120	Customer submits bids for 3 hour ahead predispatch run
Response Time	1 hour	5 minutes		5 minutes	2 hours	30 minutes
Payment Rate and Terms	\$400/MW per hr - 2 hr reduction \$500/MW per hr - 3 hr reduction \$600/MW per hr - 4 hr reduction	Contracted Value		No payment for energy reductions. Dispatch based on bid price to avoid consumption when price is higher. Ability to offer into and be paid in the Operating Reserve markets.	Higher of \$120 or MCP	Bid Guarantee - Pays difference btwn MCP and bid price if MCP is below bid price
Duration of Demand Response Event	Min 2 hours/ Max 4 hours	Min 2.5 hours		5 minutes	Min 1 hour	Min 1 hour
Installed Capacity Credit (ICAP)	None	None		None	None	None
Program Available	Permanent	May 02- Mar 07		Permanent	May 05 - Apr 07	Permanent
Penalty for Non-performance	Compliance Process	None		Compliance Process	None	Compliance Process

# Demand Response in Wholesale Electricity Markets

## *Independent System Operators New England (ISO-NE) Demand Response Opportunities*

	ISO-NE		
	Reliability Based	Price Based	
	EMERGENCY/ INSTALLED CAPACITY	DAY AHEAD	REAL TIME
<b>Program Name</b>	<i>Real Time Demand Response</i>	<i>Day Ahead Load Response</i>	<i>Real Time Price Response</i>
<b>Customer Type</b>	Individual	Individual	Individual/Aggregated Customers
<b>Minimum Reduction</b>	100 KW	100 KW	100 KW
<b>Notification</b>	ISO NE Request - Grid Stability	Customer submits bids into DA Market. (Min bid \$0.05/KWh - Max bid \$1.00/KWh)	ISO NE Request - Wholesale price to exceed \$0.10/KWh
<b>Response Time</b>	30 Minutes or 2 Hours	Next Day	Customer Decides
<b>Payment Rate and Terms</b>	Minimum of \$0.50/KWh 30 Min 2 Hour \$0.35/KWh	Greater of Bid Price or DA Clearing Price	Minimum of \$0.10/KWh
<b>Duration of Demand Response Event</b>	Min of 2 Hours up to 11 Hours	Based on accepted schedule (1 to 11 Hours)	"Window" open at 7am and closes at 6 pm
<b>Installed Capacity Credit (ICAP)</b>	Yes	No	No
<b>Program Available</b>	August 1, 2003 - February 29, 2008	June 1, 2005 - February 29, 2008	August 1, 2003 - February 29, 2008
<b>Penalty for Non-performance</b>	Reduced Adjusted Capability up to 100% + loss of capacity for the month	No, Settlement with RT price	No

# Demand Response in Wholesale Electricity Markets

## ***Midwest Independent System Operators (Midwest ISO) Demand Response Opportunities***

	Midwest Independent System Operator	
	<u>Current Markets</u>	<u>Markets under discussion, moving forward</u>
<b>Energy Markets: Day-Ahead</b>	PRD and DRRs can & do participate. Voluntary load zone definition.	PRD and DRRs can participate. Voluntary load zone definition.
<b>Energy Markets: Real-Time</b>	DRRs can & do participate. PRD not allowed. Voluntary load zone definition.	PRD and DRRs can participate. Voluntary load zone definition.
<b>Ancillary Services Markets</b>	None currently.	DRRs can participate, if qualified to provide the reliability service.
<b>Resource Adequacy Construct</b>	Demand response can be used in fulfillment of resource adequacy requirements, if allowed by existing RROs and state arrangements	Demand response can be used in fulfillment of resource adequacy requirements.
<b>Planning Process</b>	Incorporating demand response into transmission expansion planning process is in development	Complete integration of demand response into transmission expansion planning process.
<b>Emergency Procedures</b>	Voluntary programs under MPs' control.	Establish clearly defined emergency protocols for calling on & pricing emergency demand response programs.

# Demand Response in Wholesale Electricity Markets

## *New York Independent System Operators (NYISO) Demand Response Opportunities*

	NYISO			
	Reliability Based		Price Based	
	EMERGENCY	INSTALLED CAPACITY	DAY AHEAD	ANCILLARY SERVICES
Program Name	<i>Emergency Demand Response Program (EDRP)</i>	<i>ICAP Special Case Resource Program (SCR)</i>	<i>Day-Ahead Demand Response Program (DADRP)</i>	<i>Program under consideration</i>
Customer Type	Individual/Aggregate within zones	Individual/Aggregate within zones	Individual/Aggregate within zones	
Minimum Reduction	100 KW	100 KW	1 MW	
Notification	NYISO Request - Reserve Deficiency	NYISO Request - Reserve Deficiency	Customer submits bids into DA Market	
Response Time	2 Hours	2 Hours	per Day-Ahead schedule	
Payment Rate and Terms	Minimum of \$0.50/KWh	Minimum of \$0.50/KWh	Greater of Bid Price or Marginal Price	
Duration of Demand Response Event	Min of 4 Hours	Min of 4 Hours	Based on accepted schedule	
Installed Capacity Credit (ICAP)	No	Yes	No	
Program Available	Permanent	Permanent	Permanent	
Penalty for Non-performance	No	Yes	Greater of DA or RT LBMP*Shortfall	

# Demand Response in Wholesale Electricity Markets

## ***PJM Demand Response Opportunities***

	PJM					
	Reliability Based		Price Based			
	EMERGENCY	INSTALLED CAPACITY	DAY AHEAD	REAL TIME	Market Based Reliability Services	
<b>Program Name</b>	<i>Emergency Load Response (ELRP)</i>	<i>Active Load Management (ALM)</i>	<i>Economic Load Response Program - Day Ahead</i>	<i>Economic Load Response Program - Real Time</i>	<i>Synchronized Reserve</i>	<i>Regulation</i>
<b>Customer Type</b>	Individual/Aggregate	Individual	Individual/Aggregate	Individual/Aggregate	Individual/Aggregate	Individual
<b>Minimum Reduction</b>	.1 MW	.1 MW	.1 MW	.1 MW	1 MW	1 MW
<b>Notification</b>	PJM Calls Event	PJM Calls Event	Customer submits bids into DA Market	Customer or PJM Calls Event	PJM calls event	PJM assigns Demand Resource
<b>Response Time</b>	1 Hour	1 Hour or 2 Hour	Next Day	1 Hour	10 minutes or 0.16666 hr	5 minutes or 0.08333 hr
<b>Payment Rate and Terms</b>	Minimum of \$0.50/KWh	ALM Credit based on type of ALM, (DLC, FSL or GLD)	DA Zonal, Aggregate, or Nodal LMP	If LMP<\$75/MWh, LMP-(Gen+Trans) If LMP>\$75/MWh, LMP	Energy payment based on Economic Load Response Minimum payment of \$50/MWh for Tier 1 and \$7.50/MWh for Tier 2	Market Clearing Price except AEP zone. AEP zone = cost + \$7.50 MWh
<b>Duration of Demand Response Event</b>	Min 2 Hours	up to 6 Hours	"window" open all day	"window" open all day	1 min to 30 min	1 hr
<b>Installed Capacity Credit (ICAP)</b>	No	Yes	No	No	No	No
<b>Program Available</b>	June 1, 2002 - December 31, 2007	Permanent since 1991	June 1, 2002 - December 31, 2007	June 1, 2002 - December 31, 2007	May 1, 2006 - no end date	May 1, 2006 - no end date
<b>Penalty for Non-performance</b>	No	ALMCredit*Shortfall*Daily Capacity Deficiency Rate(schedule 11)*365/10	RT LMP*Shortfall	No	Tier 2 obligated to provide shortfall for 3 consecutive same-peak days	Loose certification

# Demand Response in Wholesale Electricity Markets

***SPP***