Overview of the DR Programs of the Organized Markets

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Introduction

Overview

- This presentation describes the demand response programs of ISOs/RTOs in the US:
  - products traded
  - the trading process
  - program parameters.
- It then compares the three most fully developed programs: PJM, NYISO and ISO-NE.
- Finally, it raises the issue of whether the ISOs/RTOs should be involved in DR programs.

Products Traded

Demand Response Products Traded

- Three distinct types of demand response (DR) are traded through ISO/RTO programs:
  - economic demand response
  - emergency demand response
  - ancillary services demand response
- DR can be provided through reductions in end use loads or through on-site (behind-the-meter) generation.

Products Traded

Economic Demand Response

- These are load reductions that customers make when the wholesale market price exceeds the value the customers place on those loads.
- In effect, the customers “resell” their energy entitlements into the wholesale market to earn a profit.

*Profit = MWhs * (Price – Value of load)*

Products Traded

Emergency Demand Response

- These are interruptible loads that the ISO calls on when its operating reserves are below acceptable levels and it has exhausted all supply resources.
- The alternative is to involuntarily interrupt other loads, imposing very high costs on customers.
  - Studies indicate that residential customers value uninterrupted service at $2000 to $4000 per MWh.
  - Those studies also indicate that C&I customers place much higher values on uninterrupted service.

Products Traded

Ancillary Services Demand Response

- These are load reductions that can respond very quickly to ISO instructions or system frequency changes (e.g., near-instantaneous to 10 minutes).
- Their quick responsive allows then to provide:
  - Frequency regulation service (seconds)
  - Synchronous operating reserve (10 min)
  - Nonsynchronous operating reserve (10 min)
  - Standby/replacement/supplemental reserve (30 min).

Products Traded

Existing ISO Programs

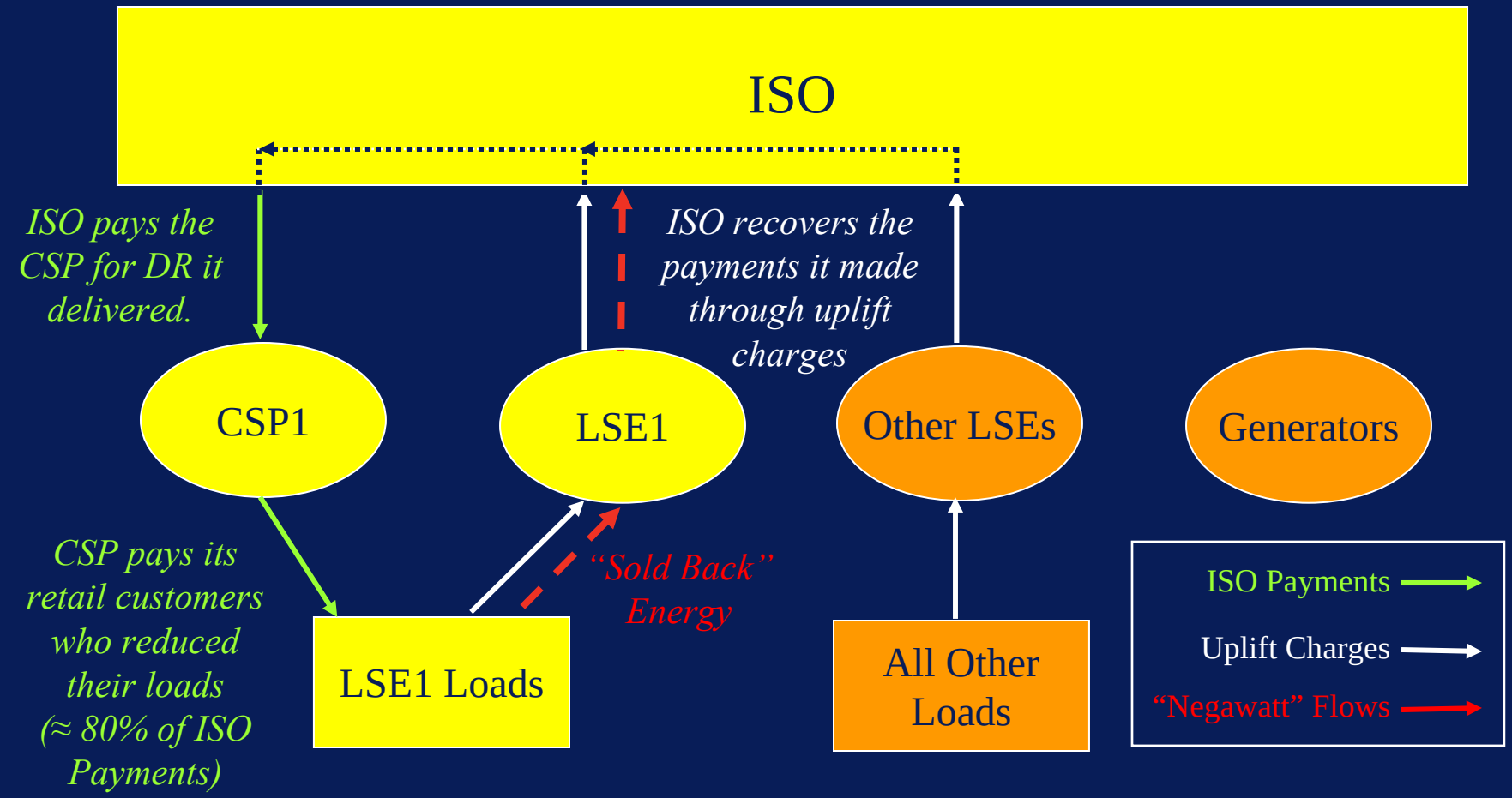
Type of DR Program	ISO/RTO					
	ISO-NE	NYISO	PJM	MISO	ERCOT	CAISO
Economic						
Day Ahead Price-Based	●	●	●	●		
Real Time Price-Based	●	●	●			
Emergency (Reliability)						
Interruptible Load	●	●	●	●	*	
Voluntary Public Appeal						●
Ancillary Service						
Synchronized Operating Reserve			●		●	
Nonsynchronized Operating Reserve	*	*	●		●	●
Replacement/Supplemental Reserve	*	*	●		●	●
Regulation			●		●	
Forward Capacity Market	●		●			

Implemented: ●

Under development: *

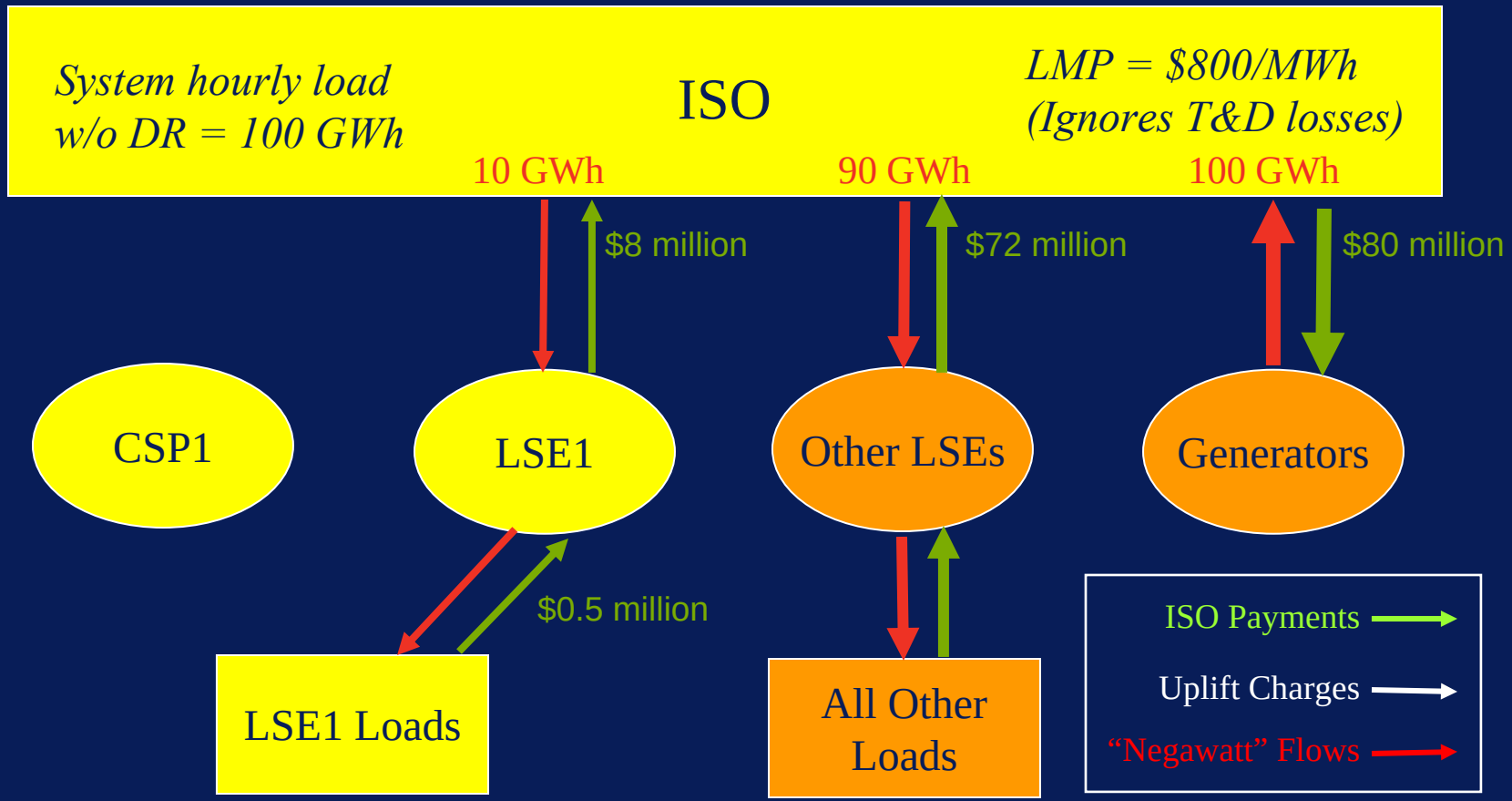
The Trading Process

DR Power &Money Flows



The Trading Process

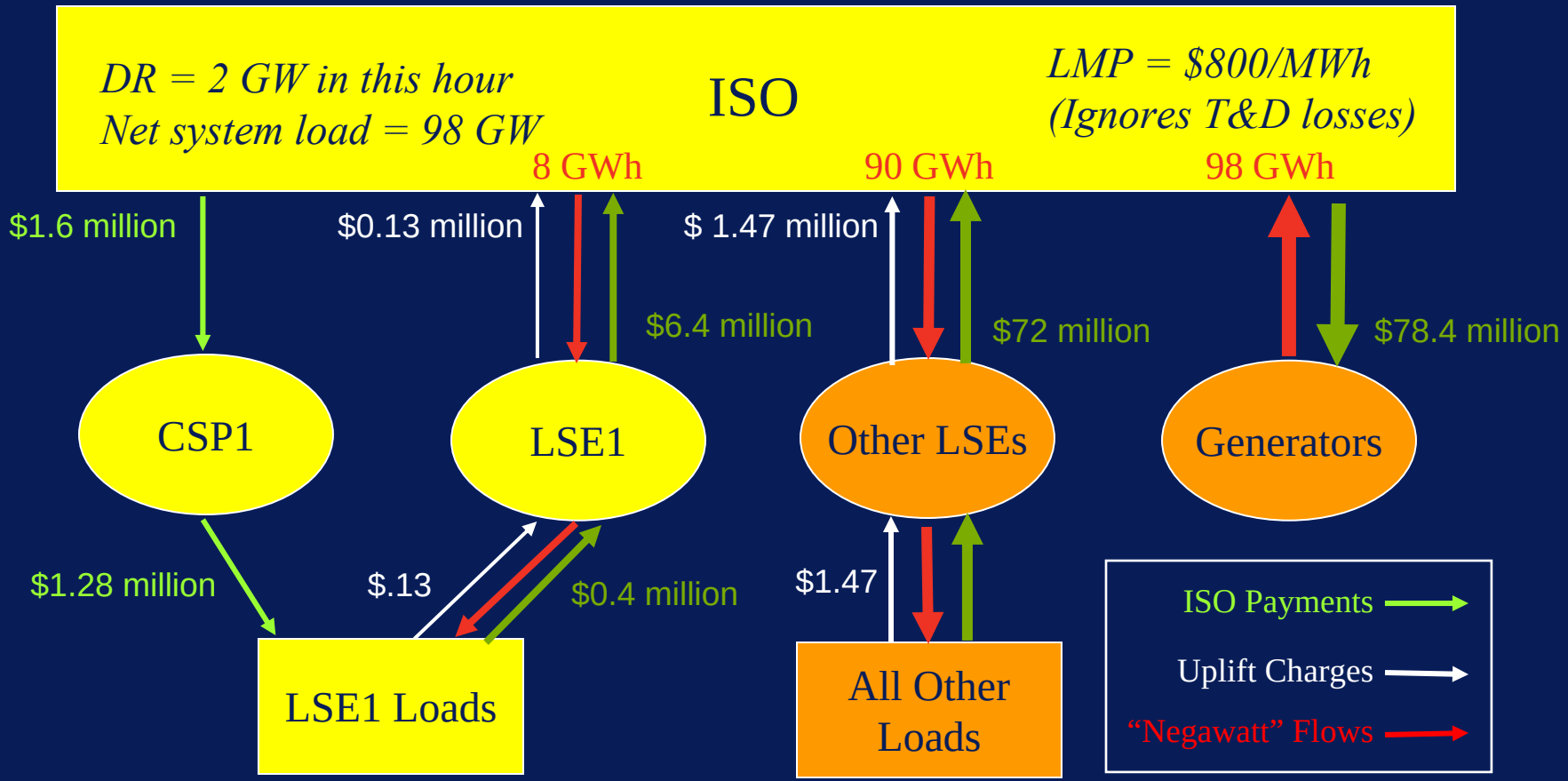
Total System Power &Money Flows w/o DR



LSE1 Retail Energy Rate = $50/MWh

The Trading Process

Total System Power &Money Flows With DR



LSE1 Retail Energy Rate = $50/MWh

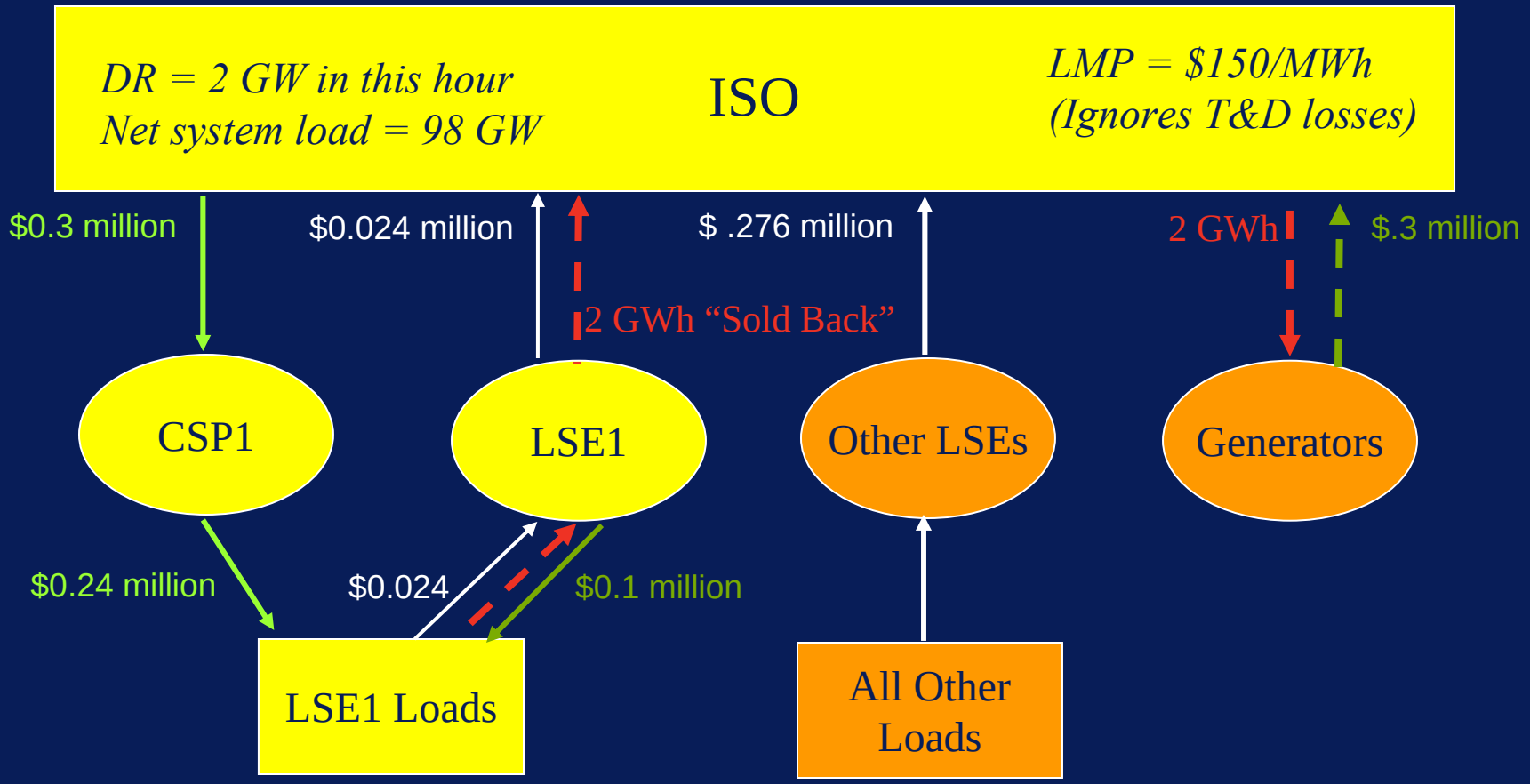
The Trading Process

Incremental Power &Money Flows With DR

In effect, the DR loads receive an energy price of $690/MWh

The Trading Process

Incremental Power &Money Flows With DR



In effect, the DR loads receive an energy price of $170/MWh

Program Parameters

Program-Specific Parameters

- Each ISO program can be described by the values assigned to the following set of parameters:
  - Minimum Load Reduction
  - Advance Notification
  - Minimum Outage Duration
  - Maximum Outage Duration
  - Response Time
  - Response Metric
  - Response Obligation
  - Noncompliance Penalty
  - Capacity Payment/Credit
  - Energy Offer Price
  - Energy Payment
  - Offer Prices Set LMPs
  - “Make Whole” Payment
  - Telemetry Requirements
  - ISO Cost Recovery.

Program Parameters

Parameters Defining Physical Constraints

- Minimum Load Reduction
- Advance Notification
- Minimum Outage Duration
- Maximum Outage Duration
- Response Time
- Response Metric
- Response Obligation
- Noncompliance Penalty
- Capacity Payment/Credit
- Energy Offer Price
- Energy Payment
- Offer Prices Set LMPs
- "Make Whole" Payment
- Telemetry Requirements
- ISO Cost Recovery.

Products Traded

Physical Constraints

- Minimum load reduction offers are generally 100 KW; exceptions: ERCOT, NYISO, CAISO.
- Advance notification varies: 30 min – 4 hours.
- Min/Max duration varies: 2 hrs. to no max.
- Response time is generally 30 minutes.
- Obligated to respond if capacity is RA resource.
- Real-time telemetry required if price offer can set the real-time energy price; exception is NYISO.

Program Parameters

Parameters Measuring Performance

- Minimum Load Reduction
- Advance Notification
- Minimum Outage Duration
- Maximum Outage Duration
- Response Time
- Response Metric
- Response Obligation
- Noncompliance Penalty
- Capacity Payment/Credit
- Energy Offer Price
- Energy Payment
- Offer Prices Set LMPs
- “Make Whole” Payment
- Telemetry Requirements
- ISO Cost Recovery.

Program Parameters

Performance Measurement

- DR providers are paid for their deemed load reductions.
- A provider's deemed load reduction is the difference between its actual metered load and its consumption baseline (CBL).
  - The CBL is an estimate of what the provider would have consumed "but for" the program incentive.
  - The CBL is statistically derived from historical data
  - CBL methodologies vary and are controversial.

Program Parameters

Parameters Determining Compensation

- Minimum Load Reduction
- Advance Notification
- Minimum Outage Duration
- Maximum Outage Duration
- Response Time
- Response Metric
- Response Obligation
- Noncompliance Penalty
- Capacity Payment/Credit
- Energy Offer Price
- Energy Payment
- Offer Prices Set LMPs
- "Make Whole" Payment
- Telemetry Requirements
- ISO Cost Recovery.

Program Parameters

Compensation

- Most ISO programs pay DR providers for the energy they "resell" to the market.
  - The price paid is typically the higher of the provider's offer price or LMP.
  - But in ISO-NE providers don't submit energy offers and are paid LMP plus a fixed premium based on how quickly they can reduce their loads (30 min or 2 hrs.).
- Providers of emergency DR or ancillary services are also compensated for their available capacity.

Specific Programs

PJM Emergency Programs

Program Parameter	PJM Emergency Programs	
	Energy-Only	Full Emergency
Min Load Reduction	100 KW	
Advance Notification	Day ahead advisory; 1 or 2 hour notice.	
Triggered by	Low Operating Reserves.	
Min/Max Duration	Guaranteed 2 hr minimum. Limited to 6 hour maximum.	
Response Measure	Compare response with the load in hour before the start of the event.	
Energy Payment	Higher of LMP or offer price.	
Sets Market Price	Yes, if load reduction is needed for reliability and load is telemetered.	
"Make Whole" Payments	Yes, if needed to cover shutdown cost and/or minimum down time.	
Response Required	No	Yes
Capacity Payment	No	Yes; capacity credits which CSP can sell into capacity markets.
Noncompliance Penalty	No	Yes; Assessed Capacity Deficiency Charge.
Telemetry Requirements	Optional. Real time response must be telemetered to PJM at 5 minute intervals if load is to set the LMP.	

Specific Programs

NYISO Emergency Programs

Program Parameter	PJM Emergency Programs	
	Energy-Only	Full Emergency
Min Load Reduction	100 KW	
Advance Notification	Day ahead advisory; 1 or 2 hour notice.	
Triggered by	Low Operating Reserves.	
Min/Max Duration	Guaranteed 2 hr minimum. Limited to 6 hour maximum.	
Response Measure	Compare response with the load in hour before the start of the event.	
Energy Payment	Higher of LMP or offer price.	
Sets Market Price	Yes, if load reduction is needed for reliability and load is telemetered.	
"Make Whole" Payments	Yes, if needed to cover shutdown cost and/or minimum down time.	
Response Required	No	Yes
Capacity Payment	No	Yes; capacity credits which CSP can sell into capacity markets.
Noncompliance Penalty	No	Yes; Assessed Capacity Deficiency Charge.
Telemetry Requirements	Optional. Real time response must be telemetered to PJM at 5 minute intervals if load is to set the LMP.	

Specific Programs

ISO-NE Emergency Programs

Program Parameter	ISO NE Emergency Programs		
	RT Demand Response - 30 Min	RT Demand Response - 2 Hr	RT Profiled Demand Response
Min Load Reduction	100 KW		
Advance Notification	Variable. There can be virtually no advance notice.		
Triggered by	Low operating reserves		
Min/Max Duration	Guaranteed 2 hr minimum. Limited to 11 hour maximum.		
Response Measure	Compare response during event hours with participant's CBL. CBL is based on a rolling average of actual hourly consumption in the previous 5 non-event days. In addition, the CBL is adjusted upward if actual demand in the 2 hours before the event exceeds the CBL.		
Energy Payment	Higher of LMP or $500/MWh.	Higher of LMP or $350/MWh.	Higher of LMP or $100/MWh.
"Make Whole" Payments	No. Participants do not submit minimum curtailment prices in the emergency programs.		
Set Market Price	No. Participants do not submit offer prices in the emergency programs.		
Capacity Payment	Yes. Receive credit for capacity which can be traded in the capacity market.		
Noncompliance Penalty	Yes. Forfeiture of one month's capacity credit and suffer an indefinite capacity derate.		
Max Response Time	Within 30 minutes of event start.	Within 30 minutes of event start.	
Telemetry Requirements	Must transmit real time loads to ISO at 5 minute intervals via Internet Based Communication System (IBCS).		A Monitoring & Verification Plan is required and can substitute for interval metering.

Specific Programs

PJM Economic Programs

Program Parameter	PJM Economic Programs	
	Day Ahead	Real Time
Min Load Reduction	100 KW	
Advance Notification	By 1600 of Day Before.	Up to 1 hour.
Triggered by	Energy Prices.	
Min/Max Duration	Customer specifies.	
Response Measure	Customer has choice of CBL with or without Weather Sensitivity Adjustment (WSA).	
Energy Payment	LMP< $75/MWh: DAM LMP less retail G&T tariff.	LMP< $75/MWh: DAM LMP less retail G&T tariff.
	LMP≥ $75/MWh: DAM LMP.	LMP≥ $75/MWh: DAM LMP.
Sets Market Price	Yes.	Yes, if metered by PJM.
"Make Whole" Payments	Yes.	Yes, if dispatched by PJM.
Response Required	No.	
Capacity Payment	No.	
Telemetry Requirements	None.	

Specific Programs

NYISO Economic Programs

Program Parameter	NYISO Economic Programs
	Day-Ahead Option
Min Load Reduction	1 MW (Available to loads; behind the meter generation excluded)
Advance Notification	Notified by 1100 day before RT operations
Triggered by	Participant's offer is accepted or rejected based on cleared prices in the Day-Ahead Market.
Min/Max Duration	Customer specifies both the minimum and maximum.
Response Measure	Compare day ahead offer quantity with participant's CBL. See Table describing NYISO Energency Programs.
Energy Payment	Payment based on Day Ahead LMPs. Minimum offer price is $75 per MWh
Sets Market Price	Yes.
"Make Whole" Payments	No.
Response Required	No but deviations from DAM quantities are settled at RT LMPs. If an event occurs and participant fails to fully curtail its registered load it is penalized as described in the Table on NYISO Emergency Programs.
Capacity Payment	No. Compensation for capacity only applies to DR offered as an ICAP SCR resource.
Telemetry Requirements	No; real time response is estimated.

Specific Programs

ISO-NE Economic Programs

Program Parameter	ISO-NE Economic Programs
	Day-Ahead Option
Min Load Reduction	100 KW. Can offer up to the capacity registered in an Emergency Demand Response program.
Advance Notification	By 1600 of Day Before.
Triggered by	Participant's offer is accepted or rejected based on cleared prices in the Day-Ahead Market.
Min/Max Duration	Minimum duration is the higher of 2 hours or the minimum downtime offered. Maximum duration is that offered by participant.
Response Measure	Compare day ahead offer quantity with participant's CBL. See Table describing ISO-NE Energency Programs.
Energy Payment	The higher of the participant's Curtailment Initiation Price or the Day-Ahead LMP. Participant can offer a minimum payment along with a minimum downtime (up to 4 hours) which, when combined with its energy offer price ($50/MWh to $1000/MWh), determines its Curtailment Initiation Price.
Sets Market Price	No. Offer prices clear after the Day-Ahead Market has closed.
"Make Whole" Payments	Yes, indirectly through the Curtailment Initiation Price offered by the participant.
Response Required	No but deviations from DAM quantities are settled at RT LMPs. If an event occurs and participant fails to fully curtail its registered load it is penalized as described in the Table on ISO-NE Emergency Programs.
Capacity Payment	No. Compensation for capacity only applies to DR offered as an ICAP SCR resource.
Telemetry Requirements	Must telemeter real time loads to ISO at 5 minute intervals via Internet-Based Communication System (IBCS) except for Profiled Response Program, which can telemeter hourly data.

Food for Thought

Should ISOs/RTOs Be In The DR Business?

- All DR is produced by *retail* customers who reduce *retail* loads.
- ISOs/RTOs have responsibility for running *wholesale* markets.
- So how did the ‘twain’ meet?

Food for Thought

Should ISOs/RTOs Be In The DR Business?

- While attempting to mitigate high prices during the 2000-01California meltdown the FERC issued an order containing the following statement:

  > These transactions are considered wholesale when they involve the sale for resale of energy that would ordinarily be consumed by the reseller.

- This is a brilliant, audacious assertion! But is it legal?

Food for Thought

Should ISOs/RTOs Be In The DR Business?

- Furthermore, can a "sale for resale" be legitimate if the seller doesn't own what it is selling?
  - Generally the retail customer does not pay its LSE for the energy it is reselling to the wholesale market.
- To correct this the responding customer should receive the difference between the LMP and its retail energy rate.
  - PJM requires such treatment when LMP is below $75/MWh but waives it when prices are higher.

Food for Thought

Should ISOs/RTOs Be In The DR Business?

- The case for ISO/RTO involvement in emergency and ancillary services DR programs is more clear because the deployment of these resources require central coordination.
- In contrast, economic DR resources are coordinated by market prices.
- Retail tariffs that expose customers to the real time spot energy prices would deliver economic DR more efficiently and at lower cost.

That's all Folks!