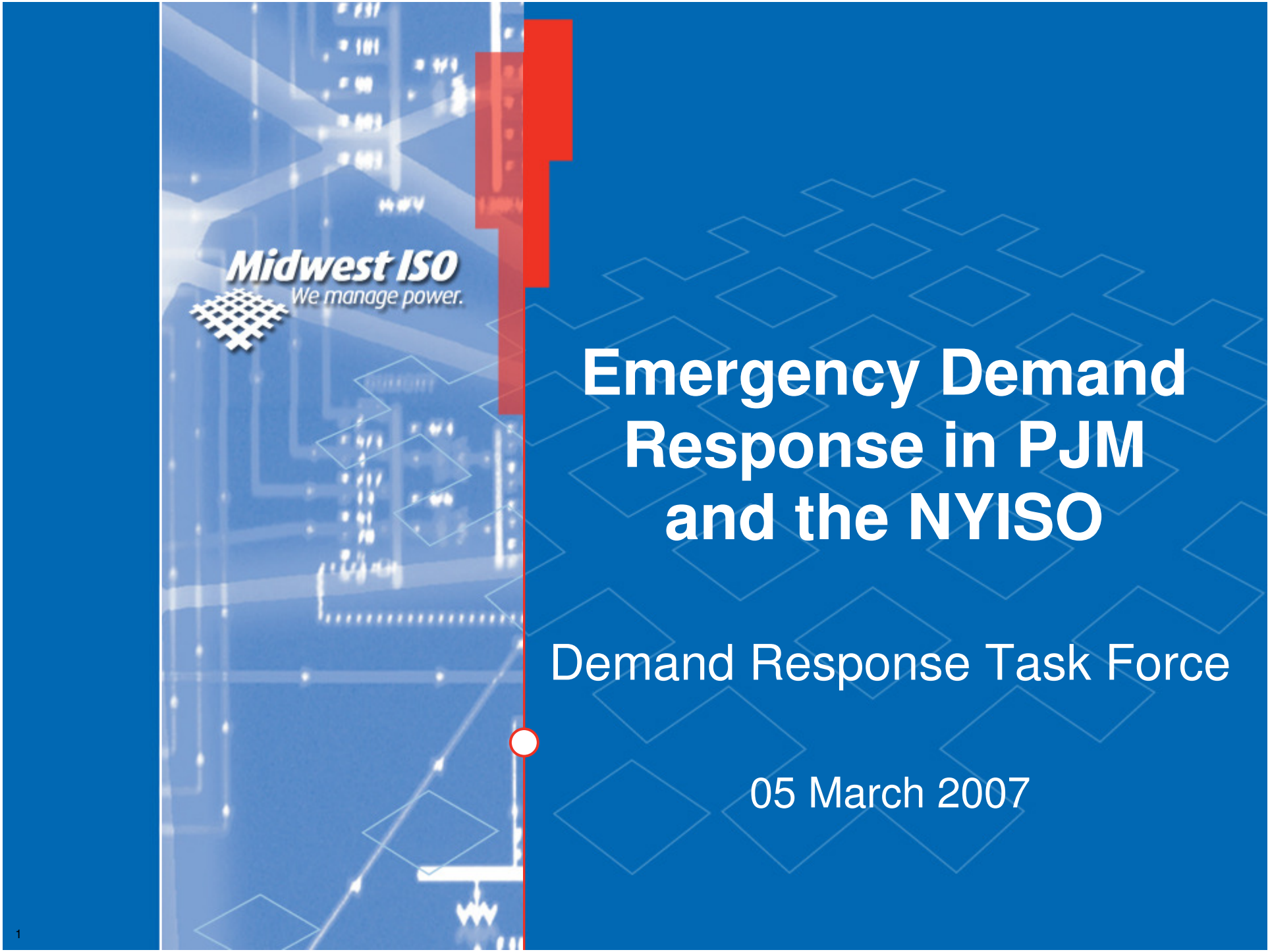


Emergency Demand Response in PJM and the NYISO

Demand Response Task Force

05 March 2007

Introduction

Overview

- This presentation describes the emergency demand response programs adopted by PJM and the New York ISO (NYISO).
- Our objective is to learn from their experiences to better design an emergency demand response program for the Midwest ISO footprint.

PJM Programs

Emergency Programs

- PJM has two emergency DR programs:
  - Energy-only
  - Full Emergency.
- Both programs are open to:
  - Customers with on-site generation
  - Customers that can reduce their loads.
- The Energy-Only program pays participants the hourly zonal LMPs for load reductions, or net generation, during an emergency event.
- In addition, the Full Emergency program pays participants capacity credits.

PJM Programs

Emergency Programs

- Only PJM members can interact with PJM as Curtailment Service Providers (CSPs) acting on behalf of load-reducing customers.
  - CSPs must register their customers with PJM.
  - PJM sends all event notifications to CSPs who then must notify their customers.
  - PJM makes all payments to CSPs who then pay their customers under contract.
- Minimum offer size for both on-site generation and load reductions is 100 KW.
- PJM minimum load reduction request - 2 hrs.

PJM Programs

Energy-Only Program

- Participation in the Energy-Only program is voluntary; the participant is free to reduce its net load by less (or more) than its maximum registered amount without penalty.
- The participant is only paid for its actual load reduction or net generation.
- Load reductions (or net generation) during an emergency event are measured against the participant's metered load (or net generation) in the hour preceding the event.

PJM Programs

Full Emergency Program

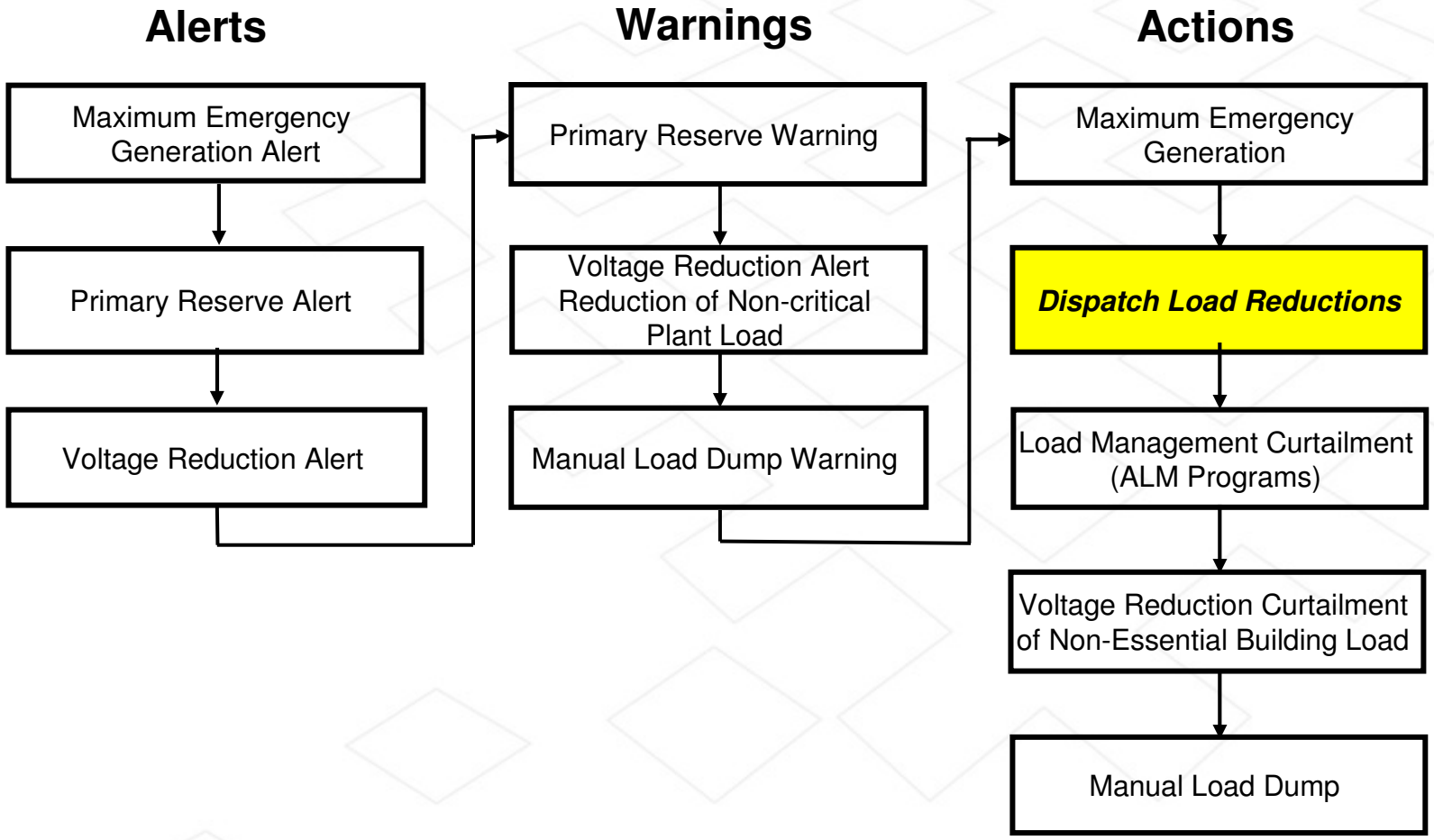
- Because participants' CSPs receive capacity credits in the Full Emergency program, their participation is mandatory.
- Thus, a participant that is called during an emergency event must reduce demand by its full registered amount or its CSP will pay a capacity deficiency charge.
- Load reductions (or net generation) during an emergency event are measured against the customer's metered load (or net generation) in the hour preceding the event.

PJM Programs

Dispatching Load Reductions

- PJM Notifies the CSPs of an impending emergency event; the CSPs then notify their customers of actions to be taken.
- PJM “dispatches” its load reduction requests, in ascending order of the participants’ energy offer prices, until the desired total system load reduction is achieved.
- Unclear whether participants’ shutdown cost and minimum down time are accounted for.
- PJM cancels load reductions in reverse order.

PJM Programs



PJM Programs

Payment for Energy Reduction

- If a participant's energy offer price is less than its hourly zonal LMP it is paid the LMP for each MWh of energy foregone (or generated) during the event.
- If a participant's offer price is higher than its hourly zonal LMP it is paid its offer price for each MWh of energy foregone (generated).
- If the total payment does not fully cover the participant's shutdown cost it receives an additional "make whole" payment.
- PJM recovers these payments from all LSEs serving the participant's pricing zone.

PJM Programs

Emergency Programs Can Set LMPs

- In either program a participant's offer price can set the real time LMP if its load reduction is needed to maintain system reliability.
- But to do so customer's in the Energy-Only program must meet PJM's telemetry requirements for measuring their loads in real time. Most do not qualify.
- Customers in the Full Emergency program must meet those telemetry requirements as a precondition to participation.

PJM Programs

Observations

- The Full Emergency Load Response program appropriately rewards customers that can reduce their loads as instructed by PJM.
- These load reductions directly compete with generating capacity in providing for resource adequacy.
- As demand response capacity replaces generating capacity, capacity prices will decline and the system will move towards an energy-only market.

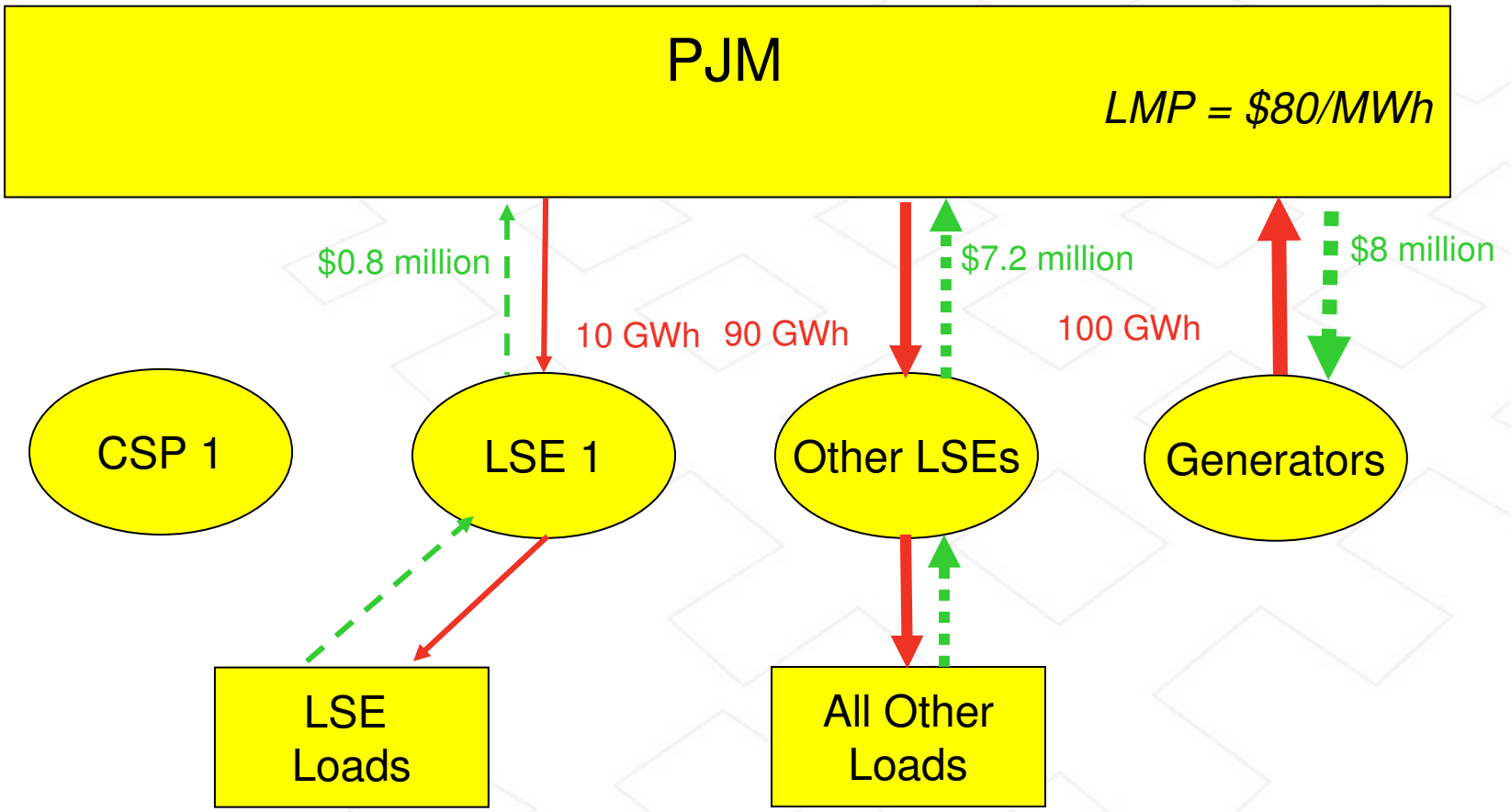
PJM Programs

Observations

- The payments for energy savings may overcompensate for their load reductions.
  - The CSP is directly paid LMP (or more) for its foregone energy consumption.
  - The participant also avoids paying the retail rate for that same energy!
- PJM recovers payments from all LSEs in the pricing zone.

PJM Programs

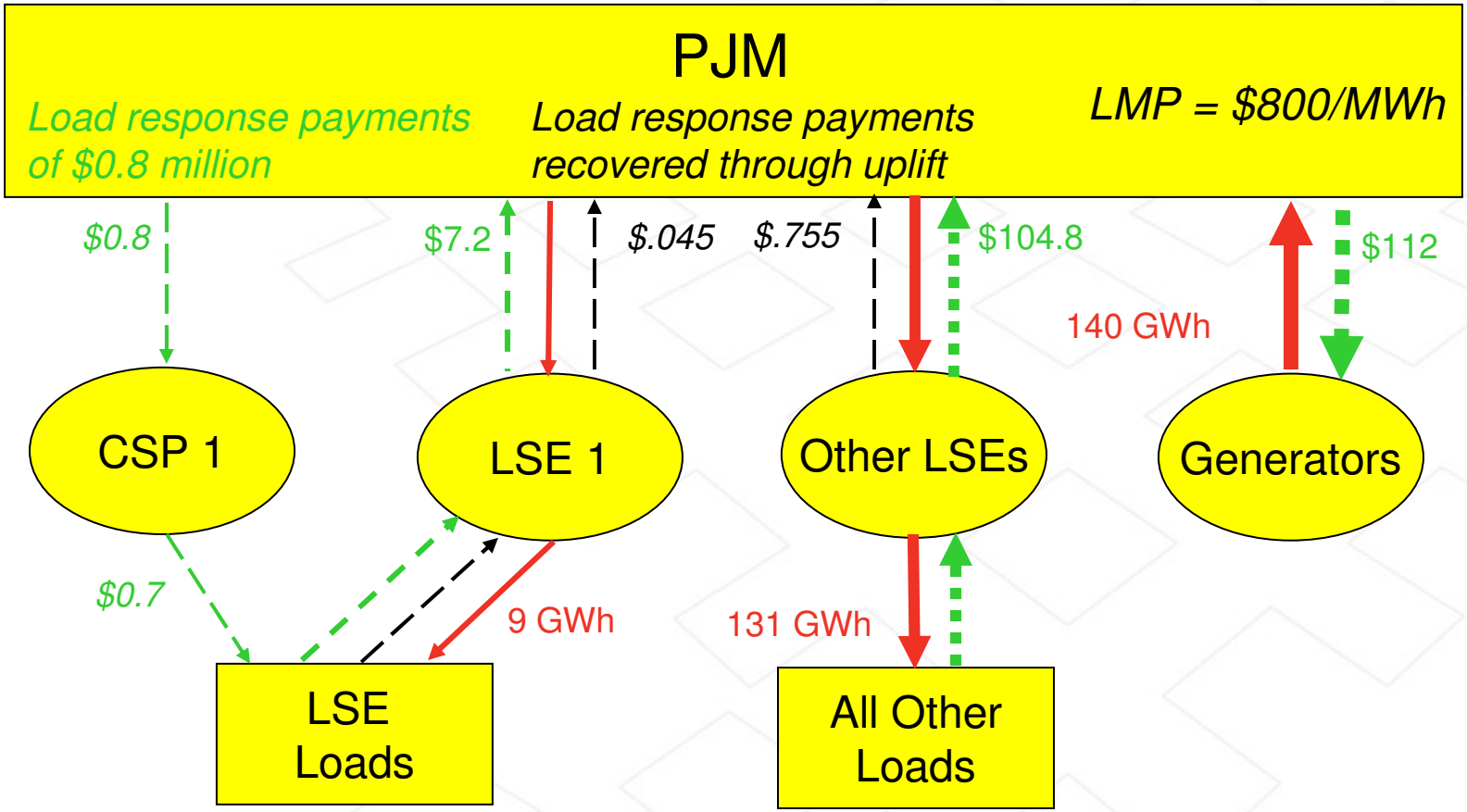
Power &Money Flows – No Load Response



Total hourly load = 100 GWh

PJM Programs

Power &Money Flows – With Load Response



Total hourly load without load response = 140 GWh

NYISO Programs

Emergency Programs

- NYISO has two emergency DR programs:
  - Emergency Demand Response Program (EDRP)
  - Installed Capacity/Special Case Resources (ICAP-SCR).
- As with PJM, both programs are open to load reductions and on-site generation.
- Both programs pay participants for foregone energy usage (or energy generated) during an emergency event.
- In addition, the ICAP-SCR program provides for customers to sell capacity credits.

NYISO Programs

Emergency Programs

- As in PJM, end-use customers in both programs must participate through a Curtailment Service Provider (CSP).
- Minimum offer size in both programs is 100 KW.

NYISO Programs

EDRP

- EDRP participants have the option, but not the obligation, to sell their forgone energy to the ISO during an emergency event.
- A participant's response is measured by comparing its metered, hourly consumption during an event with its Baseline (CBL).
  - The CBL is a statistical forecast of what the participant's consumption would be during the event hours absent any reduction.
- For its foregone energy the participant is paid the hourly zonal LBMP or $500/MWh, whichever is higher.

NYISO Programs

ICAP-SCR

- ICAP-SCR participants sell both load reduction capacity and forgone energy.
- These participants are obligated to respond as instructed during an emergency event.
- As with EDRP, a participant's response is measured by comparing its metered, hourly consumption during an emergency event with its Baseline (CBL).
- For its foregone energy the participant is paid the hourly zonal LBMP or $500/MWh, whichever is higher.

NYISO Programs

ICAP-SCR

- Initially the participant's declared load reduction capability is converted into an "unforced capacity equivalent" (UCAP), then updated based on actual performance.
- The participant can contractually sell its UCAP to an LSE or into the capacity auctions.
- Failure to respond as dispatched results in a UCAP derate which gets reversed only gradually over time.
- A participant's obligation to fulfill its capacity contract continues despite being derated.

NYISO Programs

Dispatching Load Reductions

- NYISO notifies CSPs of an impending emergency event; the CSPs then notify their customers of actions to be taken.
- NYISO “dispatches” the load reduction requests in ascending order of participants’ energy offer prices until the desired total system load reduction is achieved.
- The dispatch process does not account for a participant’s per-event shutdown cost or minimum down time.
- Load reductions cancelled in reverse order.

NYISO Programs

Emergency Programs Can Set LBMPs

- A participant's offer price in either program can set the real time LBMP if its load reduction is needed to maintain system operating reserves at acceptable levels.
- This need is determined through estimation; participants do not have telemetry installed.

Summary

Observations

- The NYISO and PJM emergency demand response programs are substantively similar:
  - Both pay participants for load reduction capacity that can be demonstrated and penalize them for noncompliance.
  - Both pay for foregone energy usage at the hourly zonal LMPs.
  - Both make participants whole for their offer prices, shutdown costs and minimum down times.
  - Both allow participant offer prices to set the zonal LMPs if needed to maintain reliability.
  - Both may over-compensate participants for energy reductions.

Summary

Observations

- The programs also have their differences.
- Participant response measurement:
  - PJM measures response through comparisons with actual metered load in the hour immediately preceding the emergency event.
  - NYISO measures response through comparisons with a participant's CBL.
- Price paid for foregone energy:
  - PJM pays the larger of a participant's energy offer price or its hourly zonal LMP.
  - NYISO does also but it limits participant's energy offer prices to $500/MWh.

Summary

Comparison of Programs

PROGRAM	PJM		NEW YORK ISO	
	Energy-Only	Full Emergency	EDRP	ICAP-SCR
Minimum Reduction	100 KW	100 KW	100 KW	100 KW
Required Response Time	None		None	
Advance Notification	2 hours	2 hours		
Triggered by	Low Op Reserves	Low Op Reserves	Low Op Reserves	Low Op Reserves
Min/Max Interruption Duration	2 hrs/?	2hrs/?		
Response Measure	Compare loads with the load in hour preceding start of the event.	Compare loads with the load in hour preceding start of the event.	Compare loads with participant's CBL for the event hours.	Compare loads with participant's CBL for the event hours.
Energy Payment	Higher of LMP or offer price.	Higher of LMP or offer price.	Higher of LBMP or $500/MWh.	Higher of LBMP or $500/MWh.
Capacity Payment	No	Yes	No	Yes; UCAP credits which participant's can sell into the market.
"Make Whole" Payments	Yes, if needed to cover shutdown cost and/or minimum down time.	Yes	Yes, if needed to cover shutdown cost and/or minimum down time.	Yes
Noncompliance Penalty	No	Yes; Assessed Capacity Deficiency Charge.	No	Yes; UCAP is derated.
Set Market Price	Yes, if ISO needs the load reduction and load is telemetered.	Yes, if ISO needs the load reduction.	Yes, if ISO needs the load reduction.	Yes, if ISO needs the load reduction.
Telemetry Requirements	Must telemeter real time loads to PJM.	Must telemeter real time loads to PJM.	No; real time loads are estimated.	No; real time loads are estimated.

Summary

Some Questions

- Is overcompensating participants bad?
  - On first impression economic theory says yes.
  - But given the current price caps on energy offers a "second-best" argument may apply.
- Overcompensation clearly encourages participation in the load response programs.
  - It allows participants to reduce loads at LMPs equal to half their intrinsic values.
  - Thus loads valued up to $2000/MWh can be dispatched when LMP is $1000/MWh.
- The alternative is to involuntary interrupt loads valued in excess of $2000/MWh.

Summary

That's all folks!