Generation Initial Training Program

Capacity Excess Emergencies
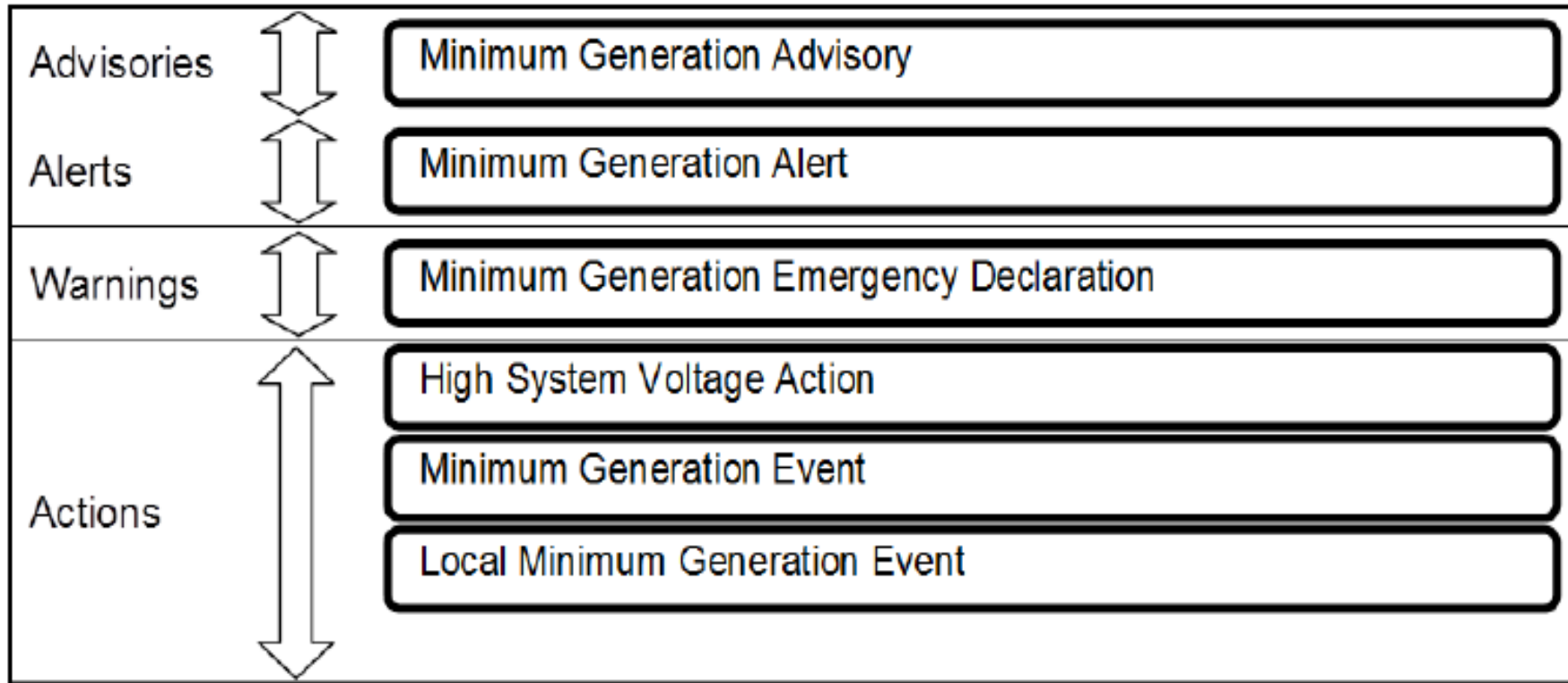
PJM State & Member Training Dept.

Students will be able to:

- Identify the reporting guidelines and process for:
  - Operating during capacity excess conditions

Capacity Excess Conditions

- When do we have capacity excess?

  - Valley Load

    - If the RTO valley load is projected to be at or below 70,000MWs (Summer/Winter) or 65,000MWs (Spring/Fall)

- Where will the declarations get posted?

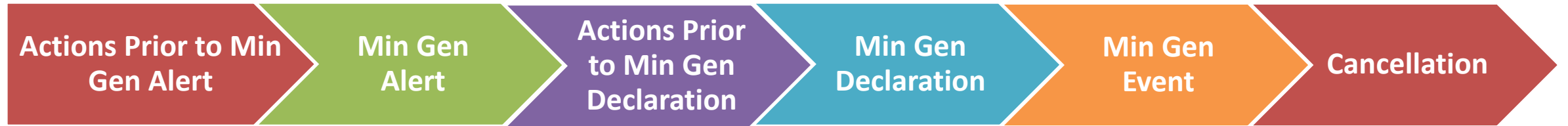 - selected PJM web-sites and the NERC RCIS

Capacity Excess Conditions

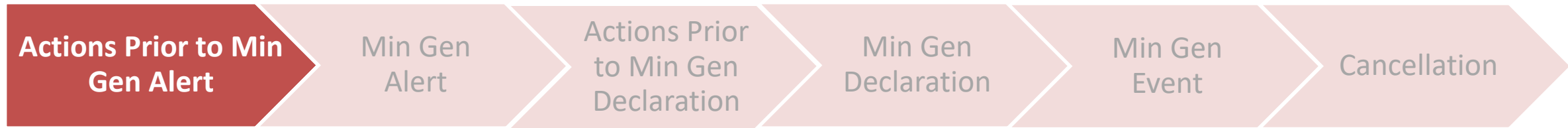| Advisories | ↕ | Minimum Generation Advisory |
Alerts	↕	Minimum Generation Alert
Warnings	↕	Minimum Generation Emergency Declaration
Actions	↕	High System Voltage Action
		Minimum Generation Event
		Local Minimum Generation Event

Capacity Excess Conditions

- Light Load Procedures

  - Failure of a Control Area to provide adequate generation control can result in:

    - Deviations in frequency

    - Inadvertent power flow

    - Stability issues

    - Transmission constraints

- For the RTO to meet its control requirements, it may be necessary to deviate from normal operating procedures during light load periods

Potential Phases of a Minimum Generation Event

| Actions Prior to Min Gen Alert | Min Gen Alert | Actions Prior to Min Gen Declaration | Min Gen Declaration | Min Gen Event | Cancellation |

Capacity Excess Conditions

| Actions Prior to Min Gen Alert | Min Gen Alert | Actions Prior to Min Gen Declaration | Min Gen Declaration | Min Gen Event | Cancellation |

Minimum Generation Advisory (Actions *Prior to* Minimum Generation Alert)

Purpose

- To provide an early notification that system conditions may require the use of the PJM Emergency Procedures

- Advisory is issued when PJM is aware two or more days in advance of the event

PJM Actions:

- Reviews the valley load forecasts over the next several days

  - If the RTO load is projected to be at or below 70,000MWs (Summer/Winter) or 65,000MWs (Spring/Fall), PJM Issues a **Minimum Generation Advisory** message to the Emergency Procedures site 1-2 days ahead of time to provide an informational only notice that a Min Gen Alert/Action is likely

Capacity Excess Conditions

| Actions Prior to Min Gen Alert | Min Gen Alert | Actions Prior to Min Gen Declaration | Min Gen Declaration | Min Gen Event | Cancellation |
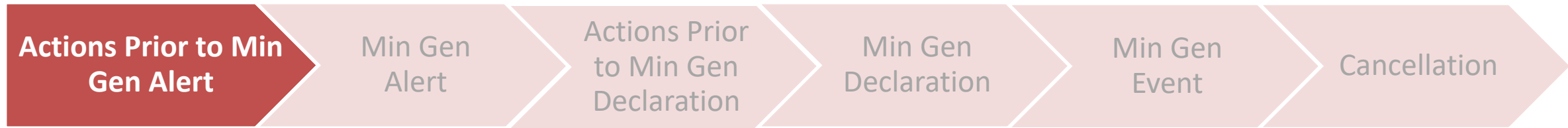
Actions *Prior to* Minimum Generation Alert

PJM Actions:

– Prepares a Minimum Generation Worksheet
   • Determine if Minimum Generation Alert criteria is met
   • Determine if Light Load Procedures are required for the upcoming scheduling period
– Formulate a scheduling strategy for the light load period
– Hydro plant schedules are reviewed to ensure:
   • Pumping at pump storage facilities is maximized
   • Generation at run-of-river facilities is minimized

Capacity Excess Conditions

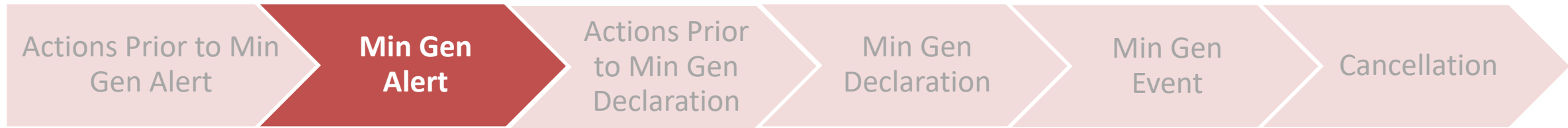| Actions Prior to Min Gen Alert	Min Gen Alert	Actions Prior to Min Gen Declaration	Min Gen Declaration	Min Gen Event	Cancellation
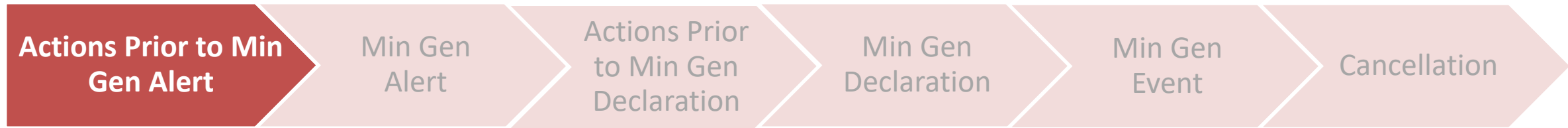
Actions *Prior to* Minimum Generation Alert

Member Actions:

- Generation dispatchers should utilize the advanced notification provided by an Advisory in order to prepare for any action associated with a Minimum Generation Alert

Capacity Excess Conditions

Actions Prior to Min Gen Alert	**Min Gen Alert**	Actions Prior to Min Gen Declaration	Min Gen Declaration	Min Gen Event	Cancellation

Minimum Generation Alert

- Purpose: To provide an early alert that PJM Emergency Procedures may be required

- Trigger: When the expected generation level is within 2,500 MW of normal minimum energy limits

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Capacity Excess Conditions

Minimum Generation Alert

PJM Actions:

- Issues alert for specified light load period when conditions necessitate
  - Issued via ALL-CALL and posts on selected PJM websites and the NERC RCIS

- Provides information to members:
  - Adjusted Minimum generation
  - Valley load estimate
  - Margin values

Capacity Excess Conditions

Minimum Generation Alert

Member Actions:

- Review unit normal maximum and minimum energy limits, as well as emergency minimum limits with station operating personnel

- Generation Dispatchers compile emergency reducible information and report via eDART

- The amount reported to the Reducible on Declaration Column is, by region, the Emergency Reducible Generation (ERG) that will be started down when PJM makes the Minimum Generation Emergency Declaration, before the actual Minimum Generation Event

- The amount reported in the Total Reducible Generation is the total reducible generation available for both the Declaration and Event. Joint-owned generation is reported by the operating company

Capacity Excess Conditions

Minimum Generation Alert

Member Actions:

- Schedule additional unit maintenance, as appropriate, during light load periods

- Renew and update resource data in PJM's computer systems
  - Resource availability
  - Energy limits

- Contact PJM dispatch if ramp limits are prohibiting the ability to export energy from the PJM system during the projected period
  - To assist in system control, exports should coincide with load drop-out periods

Reporting Reducibles

- eDART ERG Reporting Form

Reporting Reducibles

Reporting Reducibles

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When to calculate Emergency Reducible Generation

- Minimum Generation Alert is the trigger for Generation Dispatchers to compile their emergency reducible information
  - Reported to PJM Dispatchers via eDART ERG Reporting Tool

PJM Manual 13 Section 2.4.2 Minimum Generation Alert Notes

Note:1: In order to ensure resources do not force emergency procedures they must be dispatchable (Dispatchable Generation) in the range between the greater of the resource's physical minimum operating level or Capacity Interconnection Rights (CIR) and Maximum Facility Output (MFO) (i.e. fixed gen flag must not be selected).

Note 2: Resources may not submit an economic minimum that exceeds the greater of the resource's physical minimum operating level or the level of their CIR in the real-time energy market. This restriction does not apply to the day-ahead market.

Note 3: An intermittent resource's Economic Minimum shall not exceed the level of its CIR.

Note 4: An intermittent resource's Emergency Minimum should be set to 0.

Calculating Reducibles

- **Min Gen** - difference between EcoMin and EmergMin

  - Why is this important

- **What might happen if your emergency reducibles aren't entered correctly?**

  - If eco min=emerg min, the unit cannot reduce its output during a min gen

  - If not correct, does not reflect the actual ability of the unit

Capacity Excess Conditions

You have the following Unit in your portfolio....

> **Example**
>
> - Economic Maximum = 250 MW
>
> - Current Output = 200 MW
>
> - Economic Minimum = 125 MW
>
> - Emergency Minimum= 100 MW

25 MW

How much ERG do you report for this unit ?

Capacity Excess Conditions

| Actions Prior to Min Gen Alert | Min Gen Alert | **Actions Prior to Min Gen Declaration** | Min Gen Declaration | Min Gen Event | Cancellation |
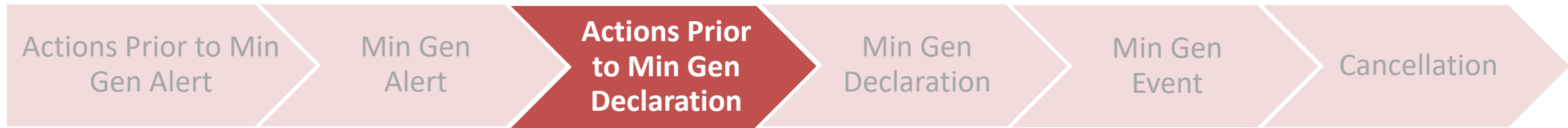
Actions *Prior* to Minimum Generation Declaration

PJM Actions:

- Re-evaluate valley load estimate and amount of Spot-in transactions

- PJM dispatcher updates the amount of emergency reducible generation available to determine the final strategy
    - The final strategy includes the amount and time frames for the reducible generation to be reduced

- Reduce units to normal minimum generation, review units assigned to regulate, then relieve units that are unable to regulate at or near normal minimum levels

- Reduce System LMP to "0" and reduce Spot-In contracts as required

Capacity Excess Conditions

Actions Prior to Min Gen Alert	Min Gen Alert	Actions Prior to Min Gen Declaration	**Min Gen Declaration**	Min Gen Event	Cancellation
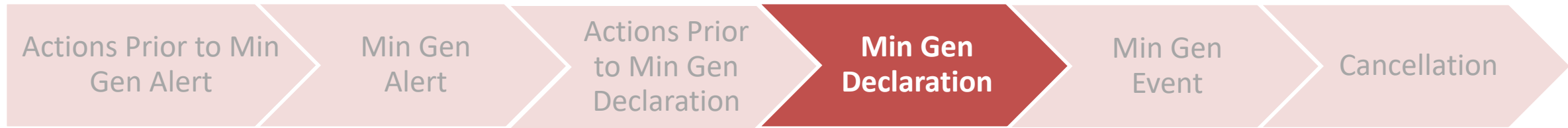
Minimum Generation Emergency Declaration

Purpose:

- Notify members of Min Gen survey results and strategy, including:
  - Anticipated amount of reducible generation, and
  - Forecasted time of the reduction

Capacity Excess Conditions

Actions Prior to Min Gen Alert	Min Gen Alert	Actions Prior to Min Gen Declaration	**Min Gen Declaration**	Min Gen Event	Cancellation
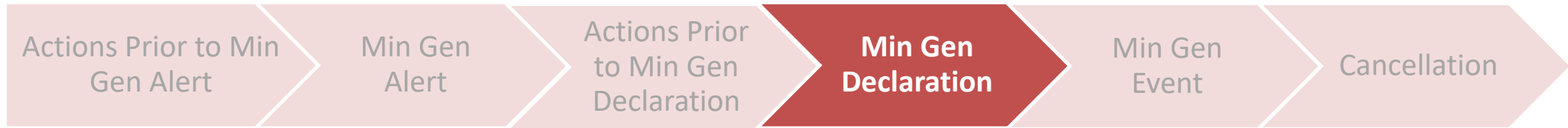
Minimum Generation Emergency Declaration

PJM Actions:

- PJM dispatcher will issue via the ALL-CALL a Minimum Generation Emergency Declaration

- Notify members of the survey results and strategy to include the amount of reducible generation (%) to be reduced and the forecast time

- Posts the Declaration on selected PJM web-sites and the NERC RCIS

Capacity Excess Conditions

Minimum Generation Emergency Declaration

Member Actions:

- Generation Dispatchers ensure their units are following PJM economic base points to Economic Minimum output

- Wind Generation Operators will adjust Wind Turbine Control systems or manually adjust turbine output to achieve the desired SCED base point

- Generation dispatchers reduce generation as reported via eDART on the minimum Generation Form in the Reducible on Declaration column

Capacity Excess Conditions
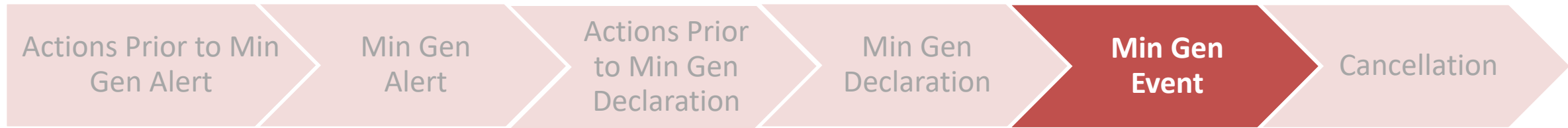
Minimum Generation Emergency Declaration

Member Actions:

- Generation dispatchers determine the specific units that will be reduced and the sequence and timing of reductions based on the direction given by PJM

- Generation dispatchers contact PJM Master Coordinator and report additional Reducible Generation that is reduced beyond what is reported on the Minimum Generation form

Capacity Excess Conditions

Actions Prior to Min Gen Alert	Min Gen Alert	Actions Prior to Min Gen Declaration	Min Gen Declaration	**Min Gen Event**	Cancellation

Minimum Generation Event

Trigger:

- A Minimum Generation Emergency Event is implemented when PJM dispatch can no longer match the decreasing load and utilization of emergency reducible generation as necessary

- All resources are expected to reduce proportionally based on the percentage Emergency Reducible Generation declared

Capacity Excess Conditions

Minimum Generation Event

PJM Actions:

- PJM dispatcher issues via the ALL-CALL a Minimum Generation Emergency Event and requests Local Generation dispatchers to reduce Emergency Reducible Generation (ERG)

  - In proportion to the total amount of ERG reported minus what was reported as being reducible on declaration

- If the system is transmission constrained, follow the Guidelines for Constrained Operations

- Posts the Declaration on Selected PJM web-sites and the NERC RCIS

- Attempt to sell Emergency Energy to external systems

Capacity Excess Conditions

Minimum Generation Emergency Event

PJM Actions:

- Reduce Network External Designated purchases as required to maintain system control after all internal PJM resources are reduced to Emergency Minimum Levels (100% reducibles implemented)

- Recommend the shutdown of specific units that are not required for area protection during the current load period or the subsequent on-peak period

Example: If Member reported 200MW as total ERG with 100MW reported as Reducible on Declaration, 100MW would have been started down when PJM issued the Minimum Generation Emergency Declaration. If when issuing the Minimum Generation Event, PJM requests 20% reducibles, Member would reduce 20MW from the 100MW that was reported as targeted for reduction on the Event

# Capacity Excess Conditions

Minimum Generation Emergency Event

Member Action:

- Generation Dispatchers follow the direction of PJM dispatcher

- Implementation of Emergency Reducible Generation Curtailments should be achieved within 15 minutes or within a timeframe that the technology permits

  - PJM should be notified if curtailment is expected to exceed 15 minutes

Capacity Excess Conditions

05/21/2005 20:02
PJM issued a Minimum Generation Alert for the midnight period of Sunday May 22, 2005
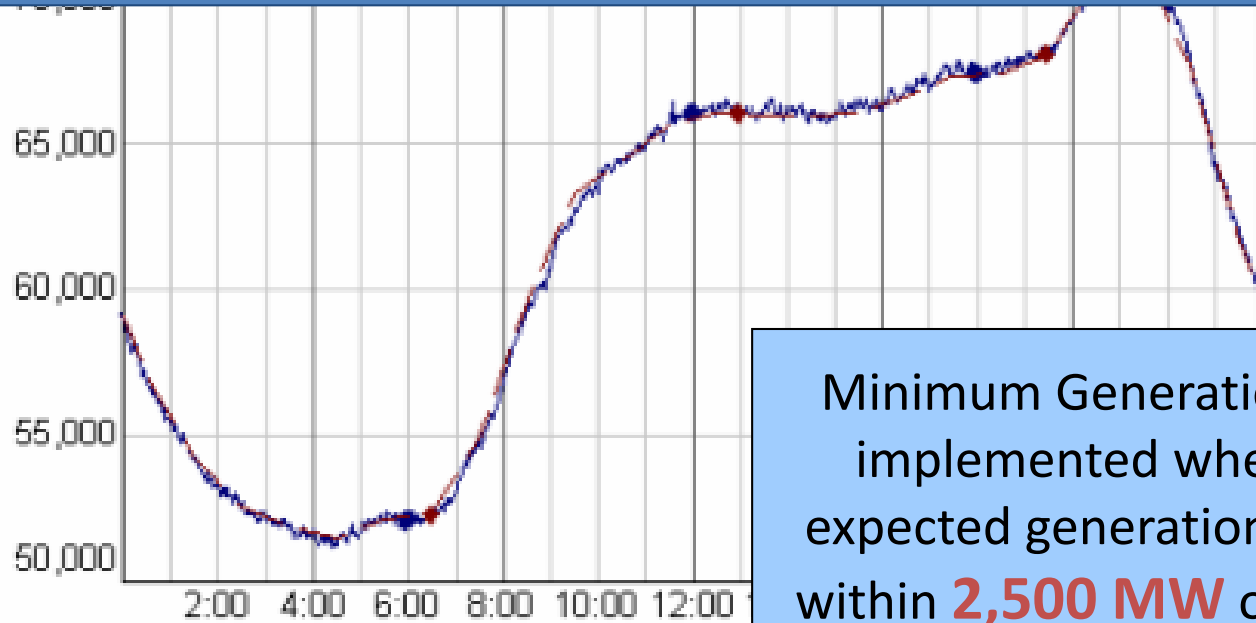
Minimum Generation Alert implemented when the expected generation level is within **2,500 MW** of normal minimum energy limits

Minimum Generation Alert

Request ID: 31682   Timestamp: 05/21/2005 21:56

Period: MIDNIGHT   Date: 05/22/2005

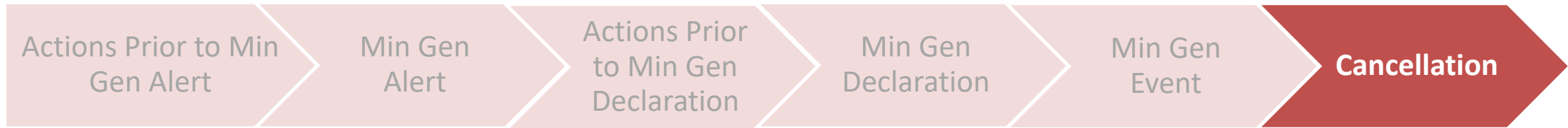Notes: NY Spots - 1840 Mw Other Spots 1374 Mw Total Spots - 3214 Mw.

PJM Control Area

Normal Minimum Generation:	56287
Bath County Pumps (-):	-1810
Generation Adjustment (+):	1500
Yard Creek Pumps (-):	-400
Muddy Run Pumps (-):	-960
Conowingo (+):	270
Safe Harbor / Holtwood (+):	93
Net Interchange (+/-):	1488
Spot Market (-):	-3214
RECS's (+):	45
Smith Mountain Pumps (-):	-80
Adjusted MinGen Override Calc:	
Misc Hydro (+/-):	383
Seneca Pumps (-):	-445
Wind Forecast (+/-):	
Adjusted Minimum Generation:	53157
Valley Load Estimate:	55370
Margin:	-2213

Min Gen Event from May 22, 2005

Operations Log: Sunday, May 22, 2005	
Thru 05/22/2005	**Minimum Generation Alert in effect for the midnight period**
05/22/2005 01:15	System cost at 0, curtailing total 860 MWs of spot in contracts by 2000
05/22/2005 01:20	Min Generation Emergency Declaration issued – expected 40% emergency reducibles by 0300
05/22/2005 02:15	Curtailing 225 MWs of Dispatchable Transaction
05/22/2005 05:45	Restoring 225 MWs of Dispatchable Transaction
05/22/2005 06:25	Issued Minimum Generation Event, Requested 30% reducible generation
05/22/2005 06:45	Curtailed Dispatchable Transaction 225 MWs
05/22/2005 07:15	Cancelled Minimum Generation Event, Requested restoration of 30% reducible generation
05/22/2005 07:45	Cancelled Minimum Generation Alert and Declaration

Capacity Excess Conditions

| Actions Prior to Min Gen Alert | Min Gen Alert | Actions Prior to Min Gen Declaration | Min Gen Declaration | Min Gen Event | **Cancellation** |

Cancellation

PJM Actions:

- A PJM dispatcher will cancel a Minimum Generation Emergency when actions taken under these procedures are no longer necessary

Member Actions:

- Generation dispatchers report actual generation that was reduced to the PJM dispatcher

Capacity Excess Conditions

Local Minimum Generation Events

- Implemented when there is an excess generation situation in a localized area or set of areas

    - Which has the potential to result in stability issues or constrained operations

Capacity Excess Conditions

Local Minimum Generation Events

PJM Actions:

- Request local Generation dispatchers to reduce Emergency Reducible Generation

- Curtail dispatchable contracts and Spot Market imports

- Attempt to sell Emergency Energy to external systems

- After 100% Reducible Generation, reduce Network External Designated purchases

- Direct shutdown of effective units not required for area protection

Capacity Excess Conditions

Local Minimum Generation Events

Member Actions:

- Generation dispatchers follow the direction of PJM dispatcher via eDART

  *(see eDART ERG Reporting Form in Manual 13 Attachment H)

Questions?

**PJM Client Management & Services
Telephone: (610) 666-8980
Toll Free Telephone: (866) 400-8980
Website: www.pjm.com**

The Member Community is PJM's self-service portal for members to search
for answers to their questions or to track and/or open cases with
Client Management & Services