Capacity Emergencies & PJM Operational Requests

Capacity Shortage Actions

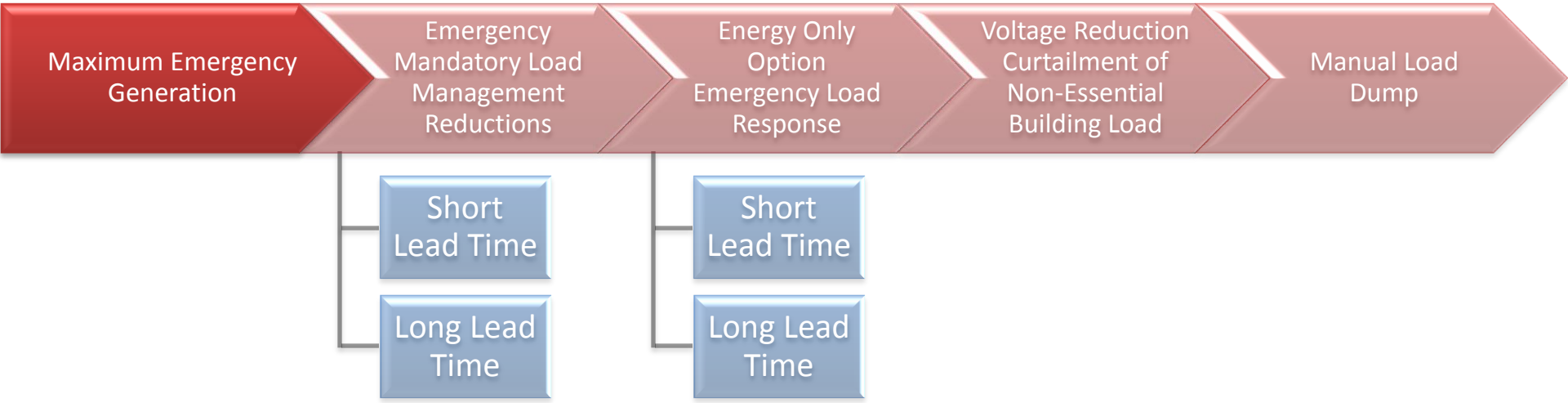
Capacity Excess Actions

PJM State & Member Training Dept.

Objectives

- Identify a PJM issued Action and the appropriate corresponding actions

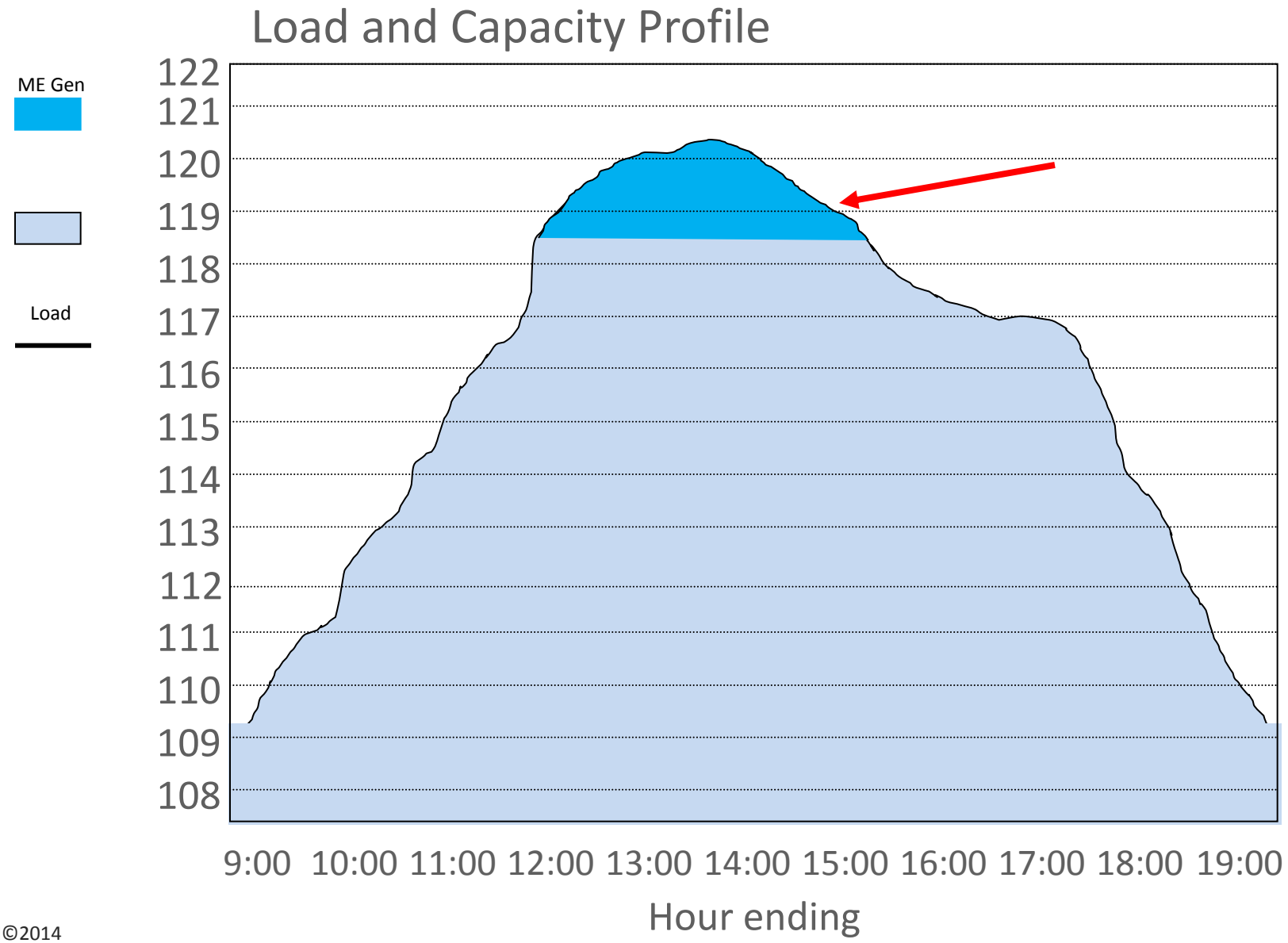
Capacity Shortage Actions



Maximum Emergency Generation

- Purpose
  - To increase generation above the maximum economic level
- Trigger
  - Real-time Generation is needed to meet the load demand that is greater than the highest incremental cost level

Load Exceeds Maximum Economic Generation Levels



Maximum Emergency Generation Action

PJM Actions:

- Issue the Maximum Emergency Generation Action
- Notify PJM management, PJM public information personnel, and member dispatchers
- Implements the Emergency Bid Process, requesting bids by posting messages to selected PJM web-sites, RCIS, and contacting neighboring Control Areas
- Suspend regulation on all resources except for hydroelectric
- Recalls off-system capacity sales from network resources

Maximum Emergency Generation Action

PJM Actions:

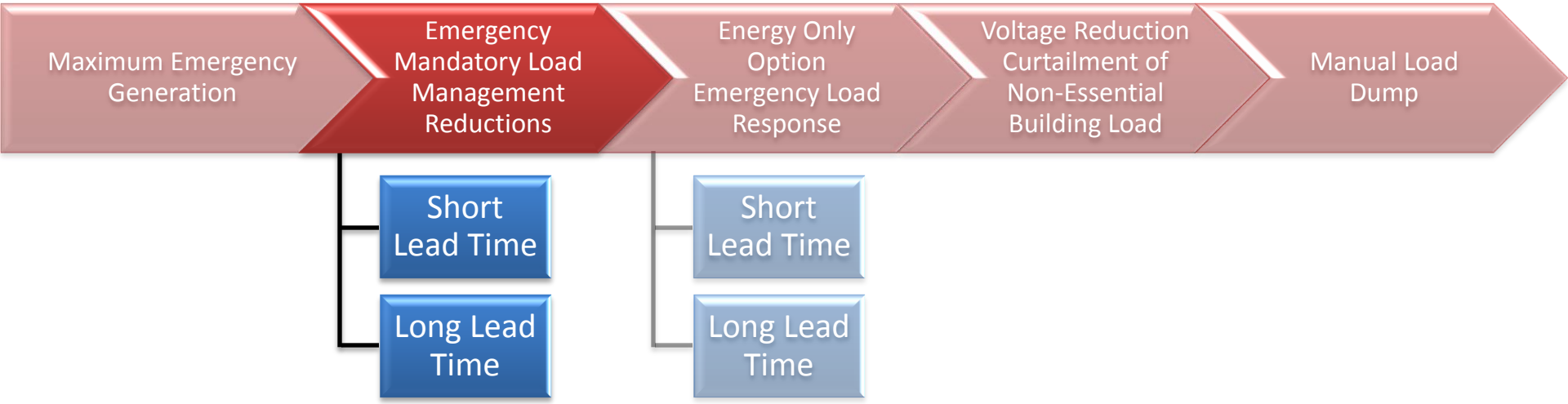
- Declares Maximum Emergency Generation Event and begin to load Maximum Emergency units or start purchases of Emergency Energy bids based on economics and availability
- Loading Maximum Emergency Generation units incrementally as required (Max Emergency CT's are loaded prior to Max Emergency Steam in order to preserve synchronized reserve

Maximum Emergency Generation Action

PJM Member Actions:

- Notify management
- Recall off-system capacity sales that are recallable
- Suspend regulation, as requested, and load all units to the Maximum Emergency Generation level, as required
- Notify PJM of any Maximum Emergency Generation loaded prior to PJM requesting Maximum Emergency Generation be loaded

Capacity Shortage Actions



Emergency Mandatory Load Management Reductions

- Applies to any site registered in the PJM Demand Response Program as a:
  - Capacity resource of interruptible load for reliability
  - Demand resource of interruptible load for reliability
- Issued to provide additional load relief using controllable load management programs (Load relief is expected to be issued after initiating Maximum Emergency Generation
- Participating customers receive capacity credits and/or reduced retail rates for reducing load during emergencies
- PJM and/or Transmission Operator controlled and directed

Emergency Mandatory Load Management Reductions - Types

PJM recognizes three types of Load Management:

- Direct Load Control (DLC) – Load management which is initiated directly by the LSE's market operations center, employing a communication signal to cycle equipment
- Firm Service Level (FSL) – Load management achieved by a customer reducing its load to a pre-determined level (the Firm Service Level), upon notification from the LSE's market operations center
- Guaranteed Load Drop (GLD) - Load management achieved by a customer reducing its load by a pre-determined amount (the guaranteed load drop), upon notification from the LSE's market operations center

Emergency Mandatory Load Management Reductions

PJM Actions:

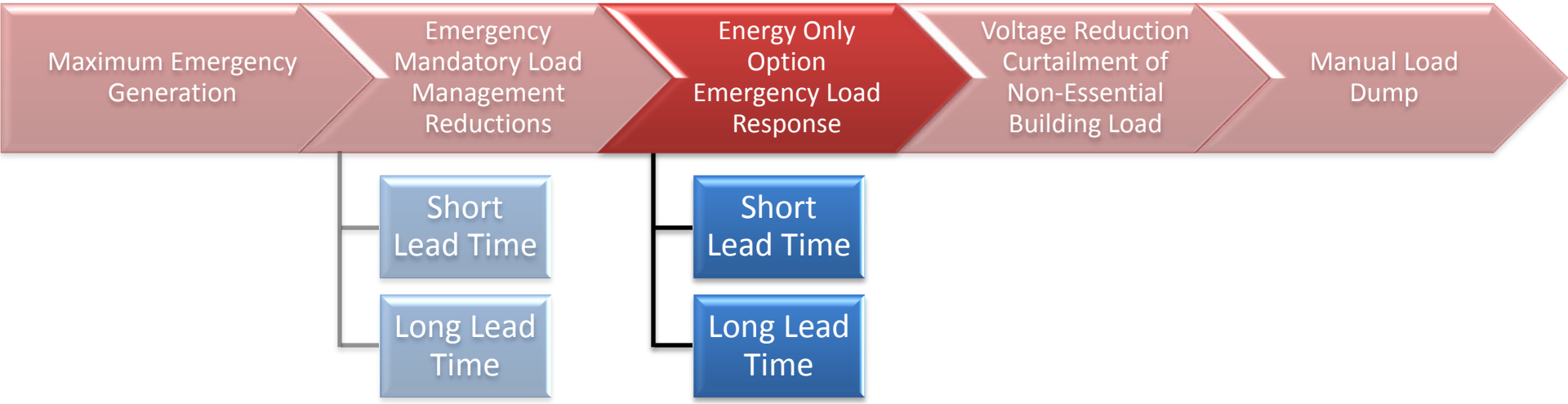
- Notifications to PJM management, public information personnel, and member companies
- Use of public appeals to conserve electricity usage
- Via the PJM All-Call, PJM requests Curtailment Service Providers to implement curtailment procedures
- Via the RCIS, PJM issues a NERC Energy Emergency Alert Level 2

Emergency Mandatory Load Management Reductions

PJM Member Actions:

- Member Curtailment Service Providers implement load reductions as requested by PJM
- Notify member company management and consider the use of public appeals
- Notify government agencies
- Long Lead Time: curtailment achieved in 1-2 hours
- Short Lead Time: curtailment achieved in 1 hour or less

Capacity Shortage Actions



Energy Only Option Emergency Load Response

- Purpose
  - To request end-use customers who participate in the Energy Only Option Emergency Load Response reduce load during emergency conditions
- Trigger
  - Additional load relief is still needed
- Program criteria:
  - Any site registered in the PJM Demand Response Program as an emergency energy only resource
  - Reductions are strictly voluntary

Energy Only Option Emergency Load Response

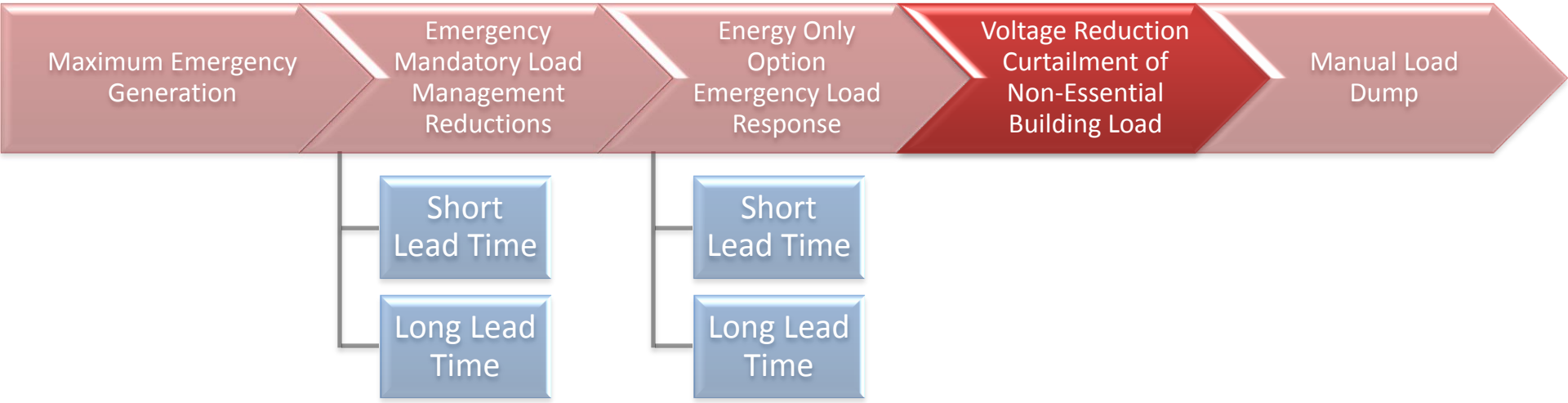
PJM Actions:

- Issues action via the All-Call and posts message on website
- Notifies PJM management, PJM public information personnel, and PJM Markets personnel
- Have Curtailment Service Providers with Demand Resources reduce load

PJM Member Actions:

- Notify management of the emergency procedure

Capacity Shortage Actions



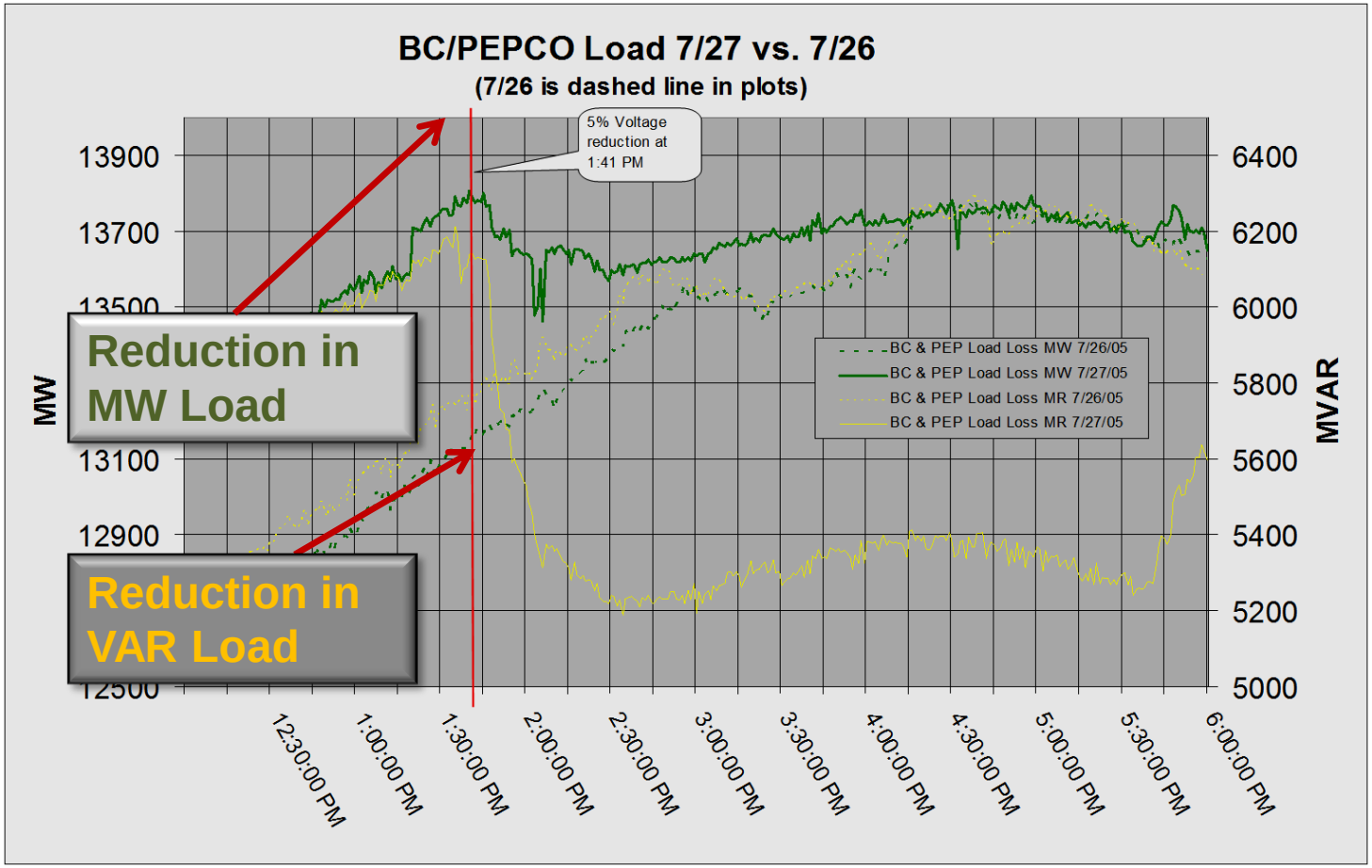
Voltage Reduction Action

- Purpose
  - To reduce load to provide a sufficient amount of reserve to maintain tie flow schedules and preserve limited energy resources OR to increase transmission system voltages
- Trigger
  - Load relief still needed to maintain ties
  - Curtailment of non-essential building load may be implemented prior to, but no later than the voltage reduction.

Voltage Reduction Action

- Voltage is reduced at distribution levels by 2.5% to 5% of nominal values depending on the area
  - Increases transmission voltages
- Produces a 2-3% decrease in system load
- Generally not noticed by customers
  - Lights dimmer, slower heating
  - City of Chicago limited to 2.5% voltage reduction

Effects of Voltage Reduction in BC/PEPCO in 2005



Voltage Reduction Action

PJM Actions:

- Notification to PJM Management, PJM public information personnel, and member companies
- Advise members to use public appeals for conservation of energy
- Notification to the Department of Energy
- Issue a system-wide or Control Zone-specific Public Media Message H-3
- Investigates loading of shared reserves with neighboring systems prior to a voltage reduction

Voltage Reduction Action

PJM Actions:

- Issues the order for a 2.5% to 5% voltage reduction
- Issues a NERC Energy Emergency Alert Level 2 via the RCIS
- Initiates Shortage Pricing if the region where the voltage reduction action has been initiated corresponds with an entire Synchronized Reserve Zone or Sub-Zone
- Cancels the reduction, when appropriate

Voltage Reduction Action

PJM Member Actions:

- Notification of member company management
- Notification of government agencies
- Consider the use of public appeals to conserve energy
- Take steps to implement a voltage reduction

Curtailment of Non-Essential Building Load

- Purpose:
  - The purpose is to provide additional relief, to be expedited prior to, but no later than the same time as the voltage reduction

Curtailment of Non-Essential Building Load

PJM Actions:

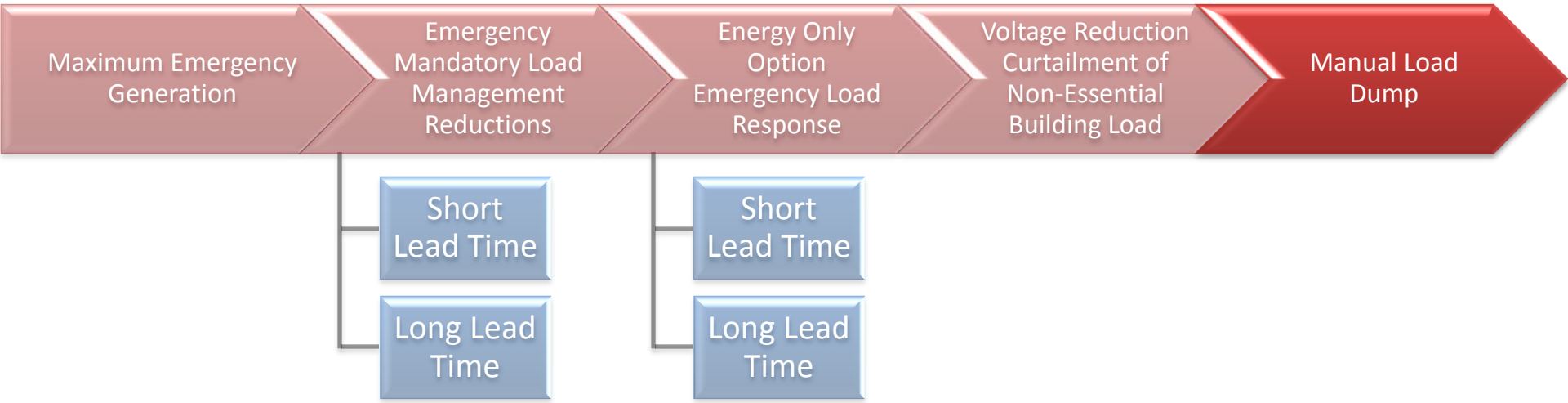
- Notification to PJM Management, PJM public information personnel, and member companies
- Advise members to utilize public appeals to conserve energy
- Issue the request to curtail non-essential building load
- Cancel the request, when appropriate

Curtailment of Non-Essential Building Load

PJM Member Actions:

- Notification of member company management
- Notification of government agencies
- Consider the use of public appeals to conserve energy
- Switch off all non-essential light and power in company-owned commercial, operations, and administration offices

Capacity Shortage Actions



Manual Load Dump Action

- Issued to provide relief when all other possible means of supplying internal load have been exhausted to prevent a catastrophe within PJM or to maintain tie schedules so as not to jeopardize the reliability of other interconnected regions
- Implemented when PJM cannot provide adequate capacity to meet load or critically overloaded transmission lines or equipment cannot be relieved in any other way and/or low frequency operation occurs within a part(s) of the RTO

Manual Load Dump Action

PJM Actions:

- Verify that separations have not occurred and that load dumping is desirable on the system being controlled
- Instruct members to suspend all remaining regulation
- Determine which Control Zone(s) are capacity deficient and the relative proportion of deficiency
- Estimate the total amount of load to be dumped
- Order appropriate members to dump load
- Notification to PJM Management, PJM public information personnel, and member companies

Manual Load Dump Action

PJM Actions:

- Advise members to consider the use of public appeals to conserve energy
- Notification to other Control Areas through the RCIS
- Notifications to DOE, FEMA, and NERC offices
- Notification to FERC via the FERC Division of Reliability's electronic pager system
- Issue a NERC Energy Emergency Alert Level 3
- PJM Management issues a system-wide or Control Zone specific Public/Media Notification Message H-4 (Should be issued prior to Manual Load Dump Action)

Manual Load Dump Action

PJM Actions:

- Initiates Shortage Pricing if the region where the manual load dump action has been initiated corresponds with an entire Synchronized Reserve Zone or Sub-Zone
- Cancels the action and restores required regulation, when appropriate
- If a partial restoration of the load dumped is requested by PJM, confirmation of restored load by each member must be made prior to any further load restoration
- If UFLS is insufficient to return frequency to acceptable ranges, PJM will dump sufficient load to restore system frequency

Manual Load Dump Action

PJM Member Actions:

- Suspend regulation, as required, prior to load dump
- Notification member company management of the procedure
- Notification of government agencies
- Consider the use of public appeals to conserve energy
- Promptly dump load equal to or in excess of the company's allotment of load dump
- Maintain the requested amount of load relief until the load dump order is cancelled by PJM
- Load dump plan should consider/recognize priority/critical load
- Report amount of load curtailed/restored upon implementation

Manual Load Dump Action

- Process described here pertains only to capacity deficient situations
  - For transmission constraints or voltage problems, load dump will be ordered in areas where it is most effective
- If Mid-Atlantic region is deemed deficient, total load shed must be further broken down by Manual Load Dump Allocation Tables
  - Manual M-13 – Attachment E
- Manual Load Dump last utilized in PJM on January 19, 1994

Manual 13 – Attachment E

Attachment E: Manual Load Dump Allocation Tables

Winter/Summer
Required Manual Load Dump
PJM Mid-Atlantic Region

			PPL Zone				PEPCO ZONE		AE		DPL Zone					
MW	PS	PE	PPL	UGI	BC	GPU	PEPCO	SMECO	AECO	Vineland	DPL	ODEC	DEMEC	Dover	Easton	Rockland
%	17.66%	14.57%	11.97%	0.32%	12.11%	19.98%	10.14%	1.35%	4.13%	0.26%	4.84%	1.19%	0.41%	0.27%	0.11%	0.70%
500	88	73	60	2	61	100	51	7	21	1	24	6	2	1	1	3
1000	177	146	120	3	121	200	101	13	41	3	48	12	4	3	1	7
1500	265	218	180	5	182	300	152	20	62	4	73	18	6	4	2	10
2000	353	291	239	6	242	400	203	27	83	5	97	24	8	5	2	14
3000	530	437	359	10	363	599	304	40	124	8	145	36	12	8	3	21
4000	707	583	479	13	484	799	406	54	165	10	194	48	16	11	4	28
5000	883	728	599	16	606	999	507	67	206	13	242	60	21	14	5	35

Manual Load Dump Allocation - PJM Mid-Atlantic Region

Winter/Summer
Required Manual Load Dump
Eastern Portion of PJM Mid-Atlantic Region Only

						AE		DPL Zone					
MW	PS	PE	PL East	JC	ME East	AE	Vineland	DPL	ODEC	DEMEC	Dover	Easton	Rockland
%	30.97%	25.54%	3.15%	18.19%	1.28%	7.24%	0.45%	8.48%	2.09%	0.72%	0.47%	0.19%	1.22%
500	155	128	16	91	6	36	2	42	10	4	2	1	6
1000	310	255	31	182	13	72	4	85	21	7	5	2	12
1500	465	383	47	273	19	109	7	127	31	11	7	3	18
2000	619	511	63	364	26	145	9	170	42	14	9	4	24

Manual Load Dump Allocation - Eastern Portion of PJM Mid-Atlantic Region

When issuing a manual Load Dump via All Call, the PJM Dispatcher will include the following information in the message:

(1) Area (PJM Mid-Atlantic Region, Eastern Portion of PJM Mid-Atlantic Region, or a zone / company)
(2) Total megawatts (refer to appropriate tables for allocation)
(3) Allocation table to be used
(4) Transmission Zone allocations will be handled separately based on PJM EMS capacity calculations

Allocation percentages are based on 2012 summer but applicable to both 2012 summer and 2012/2013 Winter Load conditions

Exhibit 16: Manual Load Dump Allocation Tables

Capacity Excess Actions

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

Capacity Excess Actions

Minimum Generation Declaration Actions

PJM Actions:

- PJM dispatcher will issue via the ALL-CALL a Minimum Generation Emergency Declaration
- Notify members of the survey results and strategy
- Posts the Declaration on Selected PJM web-sites

Minimum Generation Declaration Actions

PJM 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

Minimum Generation Declaration Actions

PJM 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 Actions

Minimum Generation Event Actions

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 Transmission constrained, follow the Guidelines for Constrained Operations
- Posts the Declaration on Selected PJM web-sites
- Attempt to sell Emergency Energy to external systems

Minimum Generation Event Actions

PJM Actions:

- Reduce Network External Designated purchases as required to maintain system control after all internal PJM resources are reduced to Emergency Minimum Levels
- 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

Minimum Generation Declaration Actions

PJM Member Action:

- Generation Dispatchers follow the direction of PJM dispatcher

Capacity Excess Actions

Cancellation

- The previous steps are followed in reverse order as the PJM RTO‘s load begins to exceed the generation
- A PJM dispatcher will cancel a Minimum Generation Emergency when actions taken under these procedures are no longer necessary

PJM Member Actions:

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

Local Minimum Generation Event

Local Minimum Generation Event Actions

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

Note: If reduction of emergency reducible generation is requested, no update of the PJM dispatch lambda program is required

Local Minimum Generation Event Actions

PJM Member Actions:

- Generation dispatchers follow the direction of PJM dispatcher via eDART

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

Summary

- Discussed the Actions required during both Capacity Shortage and Capacity Excess
- Discussed the Actions required during a Minimum Generation Event

Questions?

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Resources and References

- PJM. (2012). *PJM Manual 13: Certification and Training Requirements (rev. 51)*. Retrieved from http://pjm.com/~/media/documents/manuals/m13.ashx