Emergency Procedures: Capacity Emergencies

Capacity Shortage & Capacity Excess

Student Guide

Prepared by:
State & Member Training

Table of Contents

Objectives

- Identify the process and requirements for operating during:
  - Capacity Shortage emergencies
  - Capacity Excess emergencies

Capacity Emergencies Overview

Capacity Emergencies

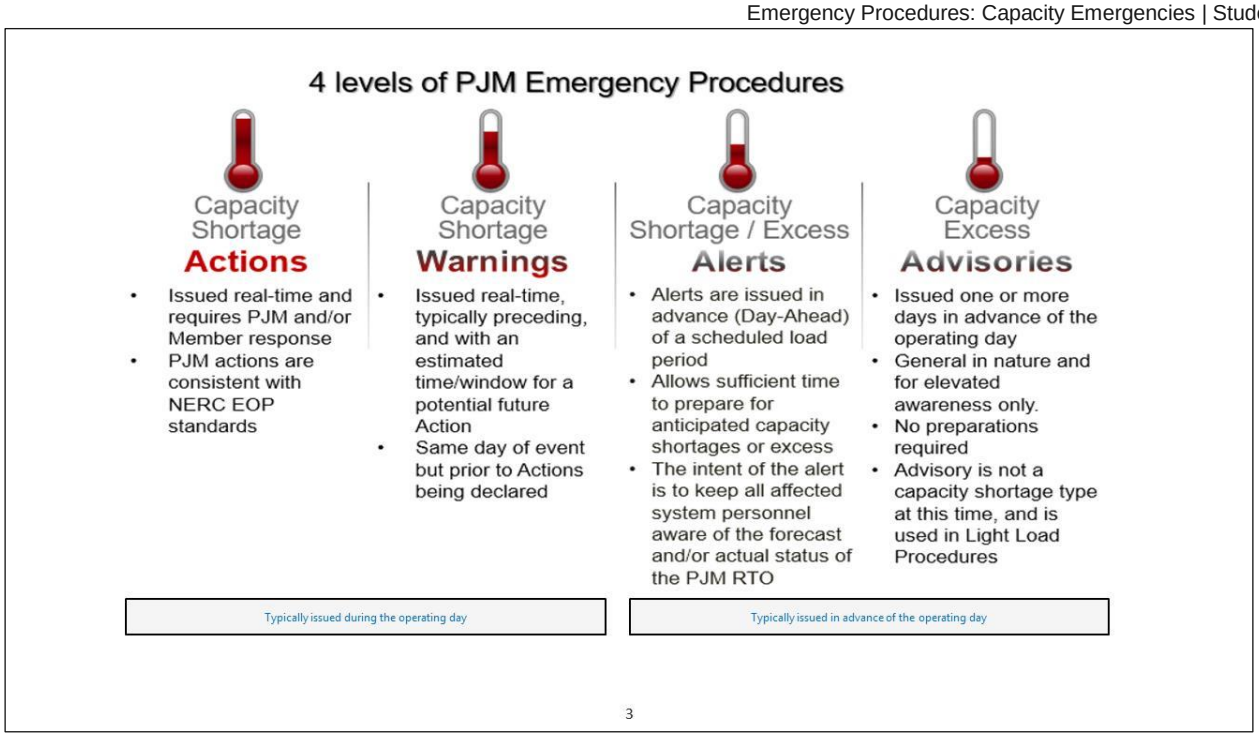
Capacity Emergencies

Capacity Emergency:

- *Capacity Shortage*: capacity deficiency, often triggered by reserve capability
- *Capacity Excess*: light load conditions

	Reserve Service		
	Synchronized Reserve (SR)	Primary Reserve (PR)	30-Minute Reserve (30 Min)
Reliability Requirement	Largest Single Contingency	150% of Synchronzied Reserve Reliability Requirement	Markets Requirement Greater of Primary reserve requirement, 3,000 MW, or largest active gas contingency
			Operations Day Ahead Scheduling Reserve Requirement = Underforecasted LFE + FOR

2

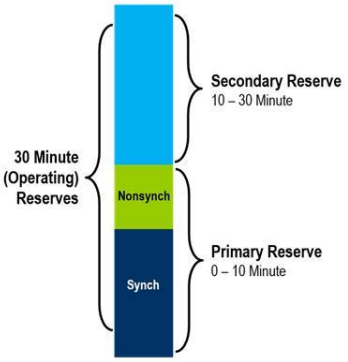

4 levels of PJM Emergency Procedures
Capacity Shortage
Actions
Issued real-time and requires PJM and/or Member response
PJM actions are consistent with NERC EOP standards
Capacity Shortage
Warnings
Issued real-time, typically preceding, and with an estimated time/window for a potential future Action
Same day of event but prior to Actions being declared
Capacity Shortage / Excess
Alerts
Alerts are issued in advance (Day-Ahead) of a scheduled load period
Allows sufficient time to prepare for anticipated capacity shortages or excess
The intent of the alert is to keep all affected system personnel aware of the forecast and/or actual status of the PJM RTO
Capacity Excess
Advisories
Issued one or more days in advance of the operating day
General in nature and for elevated awareness only.
No preparations required
Advisory is not a capacity shortage type at this time, and is used in Light Load Procedures
Typically issued during the operating day
Typically issued in advance of the operating day
3

Overview

Capacity Shortage

Capacity Shortage

	Reserve Service		
	Synchronized Reserve (SR)	Primary Reserve (PR)	30-Minute Reserve (30 Min)
Reliability Requirement	Largest Single Contingency	150% of Synchronzied Reserve Reliability Requirement	Markets Requirement Greater of Primary reserve requirement, 3,000 MW, or largest active gas contingency
			Operations Day Ahead Scheduling Reserve Requirement = Underforecasted LFE + FOR



5

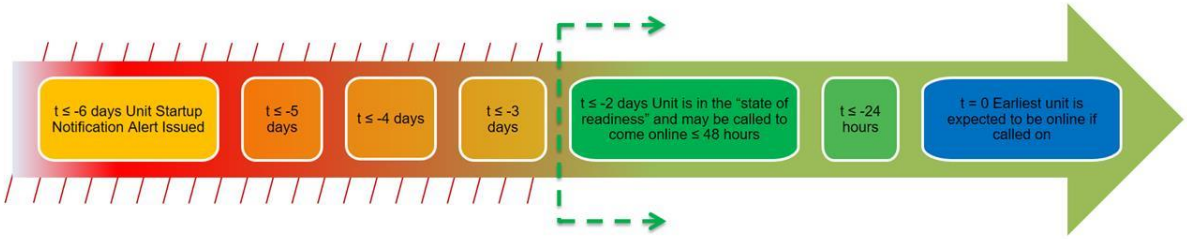
Alerts

Alerts

Unit Startup Notification Alert

Purpose: Alert members to place units in state of readiness so they can be brought online within 48 hours for an anticipated shortage of operating capacity, stability issues or constrained operations for future periods

Trigger: Implemented when a reliability assessment determines that long lead time generation is needed for future periods and can be issued for the RTO, specific Control Zone(s) or on an individual unit basis



7

PJM Actions - Unit Startup Notification Alert

Notifications

- Notify members and PJM management
- *Issue* alert, stating the alert period(s) and the affected areas; *Cancel* when appropriate
  - If the Alert is issued for the RTO or a control zone, it will be issued via the ALL-CALL system; otherwise individual unit owners will be called

Operations

- Schedule an amount of long lead time generation anticipated to be needed for the operating day(s) in economic order respecting unit operating parameters
  - Once a generator is scheduled its offer price is locked for the operating day
- Evaluate system conditions daily to determine whether to release units, keep the units in the state of readiness, or to call the units online

8

Member Actions - Unit Startup Notification Alert

Notifications

- Notify management, all stations, and key personnel
- GDs report to PJM Dispatch any and all resource limited facilities as they occur via Markets Gateway and update PJM Dispatch as appropriate

Operations

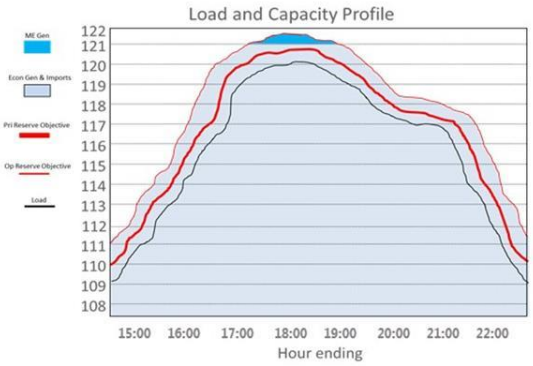
- GDs orders unit(s) to be in the *state of readiness* (able to be online within **48 hours**) in the ***lesser of:***
  - (Submitted Notification Time + Start-up Time) - 48 hours, **OR**
  - 6 days - 48 hours

9

Maximum Generation/Load Management Alert

Purpose: Early alert that system conditions may require the use of PJM Emergency Procedures

Trigger: When Maximum Emergency Generation is called into the operating capacity or if Demand Response is projected to be implemented



Operating Reserve Requirement is greater than scheduled Operating Reserve

10

PJM Actions - Maximum Generation/Load Management Alert

Notifications

- Notify PJM management
- *Issue* alert to members, stating the amount of estimated operating reserve capacity and the requirement; *Cancel* when appropriate
- Report significant changes in the estimated operating reserve capacity
- Issue a NERC Energy Emergency Alert Level 1 via the Reliability Coordinator Information System (RCIS)

Operations

- Perform a situation analysis and prepare capacity, load, interchange, and reserve projections
- Review the level of dependency on External Transactions

11

Member Actions - Maximum Generation/Load Management Alert

Notifications

- Notify management, all stations, key personnel
- GDs report to PJM Dispatch any and all resource limited facilities as they occur via Markets Gateway, updating PJM Dispatch as appropriate
- GDs update the "early return time" for any planned generator outages

Operations

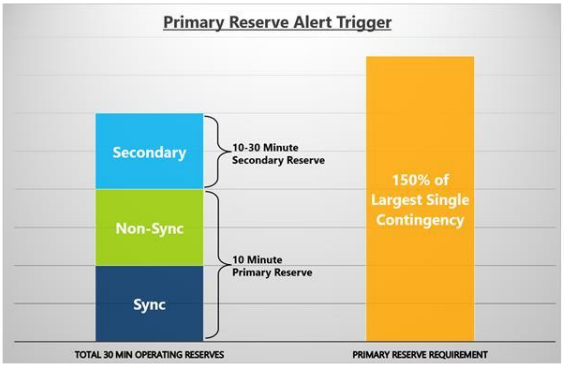
- Review plans to determine if any maintenance or testing on any monitoring, control, or system equipment can be deferred or cancelled
- Suspend any high risk testing of generating or transmission equipment

12

Primary Reserve Alert

Purpose: Alert members of the anticipated shortage of operating reserve capacity for a future critical period

Trigger: When **estimated** operating reserve capacity is *less than* the **forecasted** primary reserve requirement



13

PJM Actions - Primary Reserve Alert

Notifications

- Notify PJM management
- *Issue* alert to members, stating the amount of estimated operating reserve capacity and the requirement; *Cancel* when appropriate
- Report significant changes in the estimated operating reserve capacity

14

Member Actions - Primary Reserve Alert

Notifications

- Notify management, all stations, and key personnel
- GDs report to PJM Dispatch any and all resource limited facilities as they occur via Markets Gateway
- GDs inform PJM of any environmentally restricted units and may consider the need to obtain a temporary variance

Operations

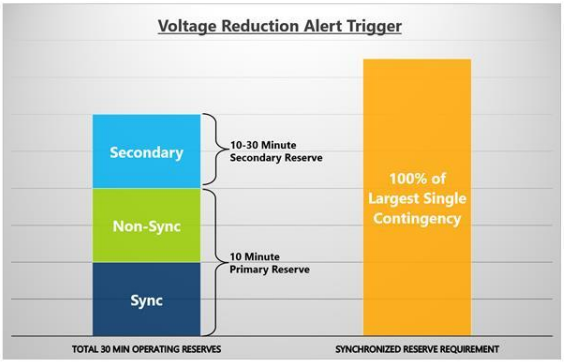
- Review plans to determine if any maintenance or testing on any monitoring, control, or system equipment can be deferred or cancelled

15

Voltage Reduction Alert

Purpose: Alert members that a voltage reduction may be required during a future critical period

Trigger: When the **estimated** Operating Reserve capacity is *less than* the **forecasted** Synchronized Reserve Requirement



16

PJM Actions - Voltage Reduction Alert

Notifications

- Notify PJM management
- *Issue* alert to members, stating the amount of estimated operating reserve capacity and the requirement; *Cancel* when appropriate
- Advise members that a possibility exists that a Voltage Reduction Action will be issued, including the estimated hour of implementation

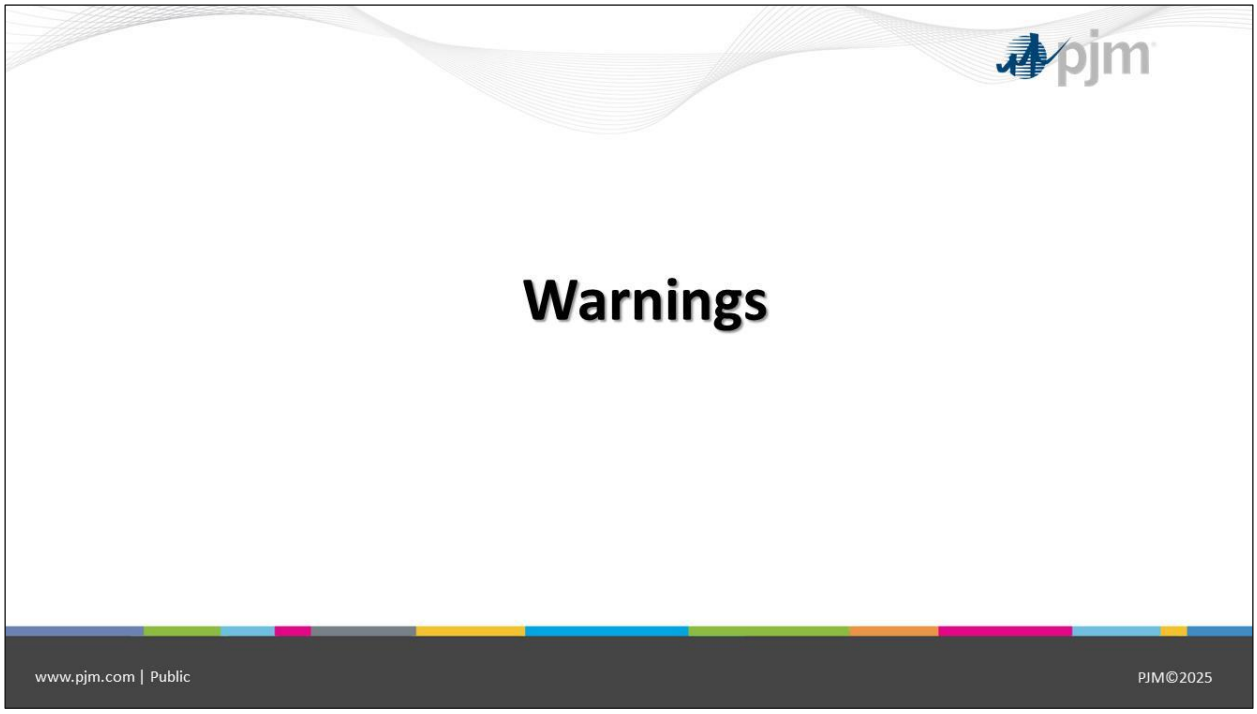
17

Member Actions - Voltage Reduction Alert

- **Notifications**
  - Notify management, all stations, and key personnel
  - SOS members / PJM Management consider issuing system-wide or Control Zone-specific Public/Media Notification Message
- **Operations**
  - Proceed on the basis that a Voltage Reduction Warning will be issued during this future period and take steps that could expedite implementation of a Voltage Reduction Action, should one become necessary
  - Substations without SCADA control will be expected to be staffed in order to implement a Voltage Reduction Action if needed
  - PJM marketers remain on heightened awareness regarding PJM system conditions and the potential need for Emergency Energy Purchases

18

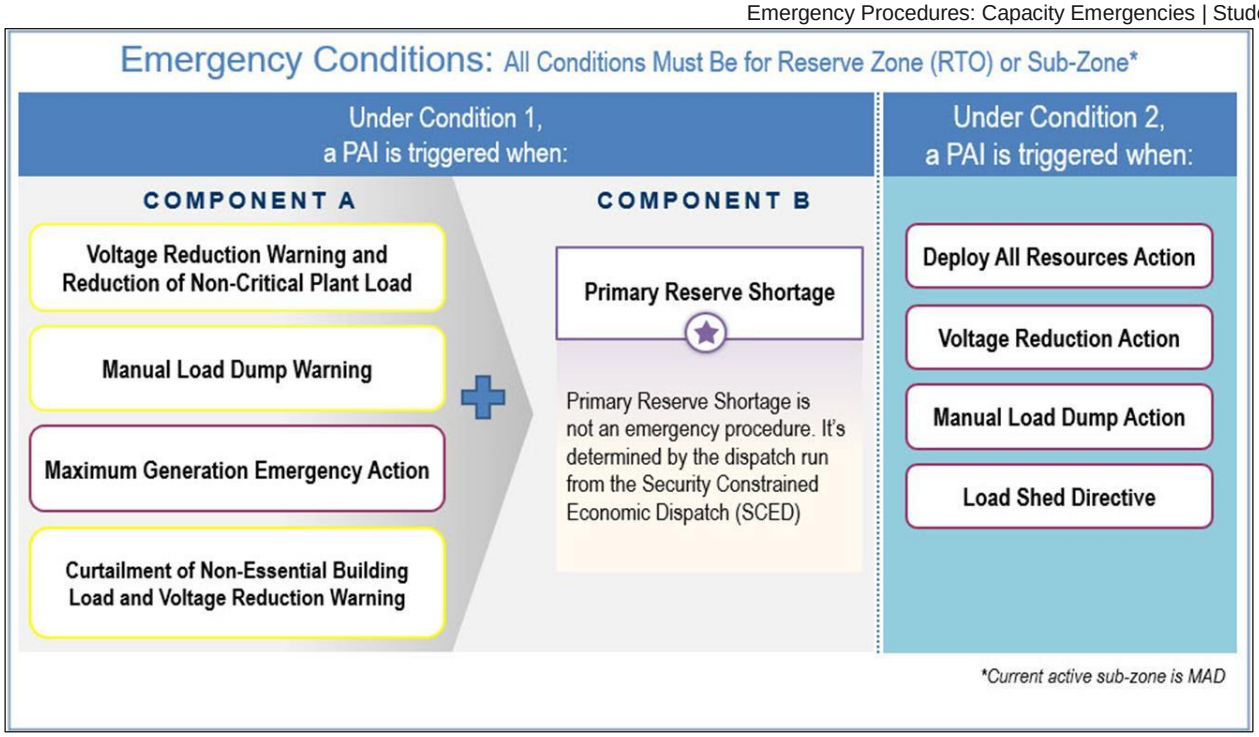
Warnings



Performance Assessment Interval (PAIs)

- Some Warnings and Actions trigger a Performance Assessment Interval (PAI) as Condition 1 or 2 elements
  - PJM calculates (after-the-fact) the actual performance of capacity resources, evaluating real-time production vs. their UCAP position
    - How well are you doing compared to what you've committed to being able to do?
  - Results in potential bonus payments or penalty charges
  - The interval means this assessment occurs every 5 minutes during the assessment period

20



Capacity Shortages - Warnings

- During periods of reserve deficiencies, other measures must be taken to maintain system reliability including:
  - Loading generation that is restricted for reasons other than cost
  - Recalling non-capacity backed off-system sales
  - Purchasing emergency energy from participants / surrounding pools
  - Load relief measures
- Due to system conditions and the time required to obtain results, PJM dispatchers may find it necessary to vary the order of application to achieve the best overall system reliability
- Warnings can be issued for the entire PJM RTO or for specific Control Zone(s)

22

Capacity Shortages - Warnings

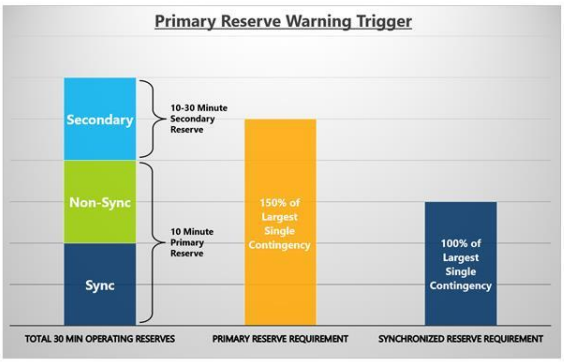
- Actions taken prior to entering into capacity related Emergency Procedures
  - Review weather projections, load forecasts, reserve projections, and generation performance
  - Ensure LMPs are reflective of system conditions
  - Curtail all non-firm exports (issue EEA1)
  - Dispatch may elect to implement an interchange cap to stabilize the amount of interchange during peak hours to protect against volatility

23

Primary Reserve Warning

Purpose: Warning that available Primary Reserves are less than the Primary Reserve Requirement and present operations are becoming critical

Trigger: Available **Primary Reserve** capacity is *less than* the **Primary Reserve Requirement**, but greater than the Synchronized Reserve Requirement



24

PJM Actions - Primary Reserve Warning

Notifications

- *Issue* warning to members and PJM management, stating the amount of adjusted primary reserve capacity and the requirement; *Cancel* when appropriate
- Notify PJM public information personnel

Operations

- Coordinate with members to ensure all available equipment is scheduled and that requested secondary reserve is brought to primary reserve status
- Ensure all deferrable maintenance or testing on the control and communications systems has halted at PJM Control Center

25

Member Actions - Primary Reserve Warning

Notifications

- Notify management, all stations, and key personnel
- GDs report to PJM Dispatch any and all resource limited facilities as they occur via Markets Gateway
- GDs inform PJM of any environmentally restricted units and may consider the need to obtain a temporary variance

Operations

- Ensure all deferrable maintenance or testing affecting capacity, critical transmission, or impactful control/monitoring systems is halted
- GDs prepare to load all available primary reserve, if requested.
- PJM Marketers remain on heightened awareness regarding PJM system conditions and the potential need for Emergency Energy Purchases

26

Voltage Reduction Warning & Reduction of Non-Critical Plant Load

Purpose: Warning that the available Synch Reserve is less than the Synch Reserve Requirement and that present operations have deteriorated such that a voltage reduction may be required

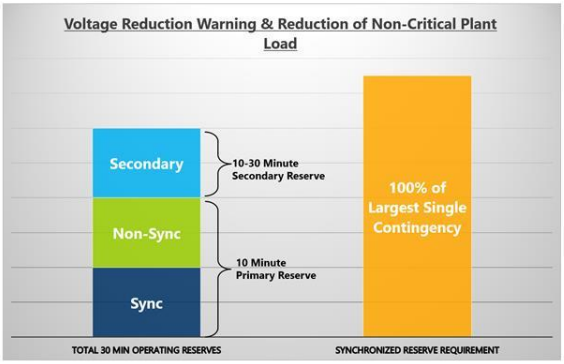
PAI
Condition 1

27

Voltage Reduction Warning & Reduction of Non-Critical Plant Load

Trigger: Available **Synchronized Reserve** capacity is *less than* the **Synchronized Reserve Requirement**, after all available secondary and primary reserve capacity is brought to a synchronized reserve status and emergency operating capacity is scheduled from adjacent systems

- Excludes restricted Maximum Emergency capacity



28

PJM Actions - Voltage Reduction Warning

Notifications

- *Issue* warning to members and PJM management, stating the amount of adjusted synchronized reserve capacity and the requirement; *Cancel* when appropriate
- Notify the Department of Energy (DOE)
- Notify PJM public information personnel

29

Member Actions - Voltage Reduction Warning

Notifications

- Notify management, all stations, and key personnel
- Notify governmental agencies, as applicable
- TOs/DPs and Curtailment Service Providers (CSPs) notify appropriate personnel that there is a potential need to implement load management programs

Operations

- GDs order all generating stations to curtail non-critical station light and power
- TOs/DPs prepare to reduce voltage, if requested
- PJM Marketers remain on heightened awareness regarding PJM system conditions and the potential need for Emergency Energy Purchases

30

Manual Load Dump Warning

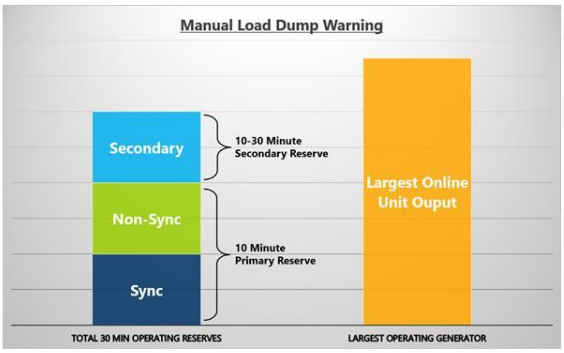
Purpose: Warning of the increasingly critical system conditions that may require manually shedding load

PAI
Condition 1

31

Manual Load Dump Warning

Trigger: Available **Primary Reserve** capacity is *less than* the **largest operating generator**, or the **loss of a transmission facility jeopardizes reliable operations** after all other possible measures are taken to increase reserves



32

PJM Actions - Manual Load Dump Warning

Notifications

- *Issue* warning to members and PJM management, stating the estimated amount of load relief that is required (if applicable); *Cancel* when appropriate
- Notify FERC Division of Reliability
- Issue a NERC Energy Emergency Alert Level 3 (EEA3 = ALERT LEVEL 3) via the RCIS
- Notify PJM public information personnel

Operations

- Establish mutual awareness with the appropriate TOs of the need to address the occurrence of a serious contingency with minimum delay
- Examine bulk power bus voltages and alert the appropriate member dispatchers of the situation

33

Member Actions - Manual Load Dump Warning

Notifications

- Notify management, all stations, key personnel, and governmental agencies, as applicable

Operations

- TOs/DPs review local procedures and prepare to shed load in the amount requested
- TOs/DPs reinforce internal communications so that load shed can occur with minimum delay
- PJM Marketers remain on heightened awareness regarding PJM system conditions and the potential need for Emergency Energy Purchases
- TOs *may* coordinate with behind-the-meter generation (BtMG)

34

Curtailment of Non-Essential Building Load

Purpose: Provide additional load relief

Trigger: Prior to, **but no later than**, the issuance of a *Voltage Reduction Action*

35

PJM Actions - Curtailment of Non-Essential Building Load

Notifications

- Notify members and PJM management, advising members to consider the use of public appeals to conserve electricity usage; cancel when appropriate
- Notify outside systems through the RCIS
- Notify PJM public information personnel

Operations

- Issues a request to curtail non-essential building load

36

Member Actions - Curtailment of Non-Essential Building Load

Notifications

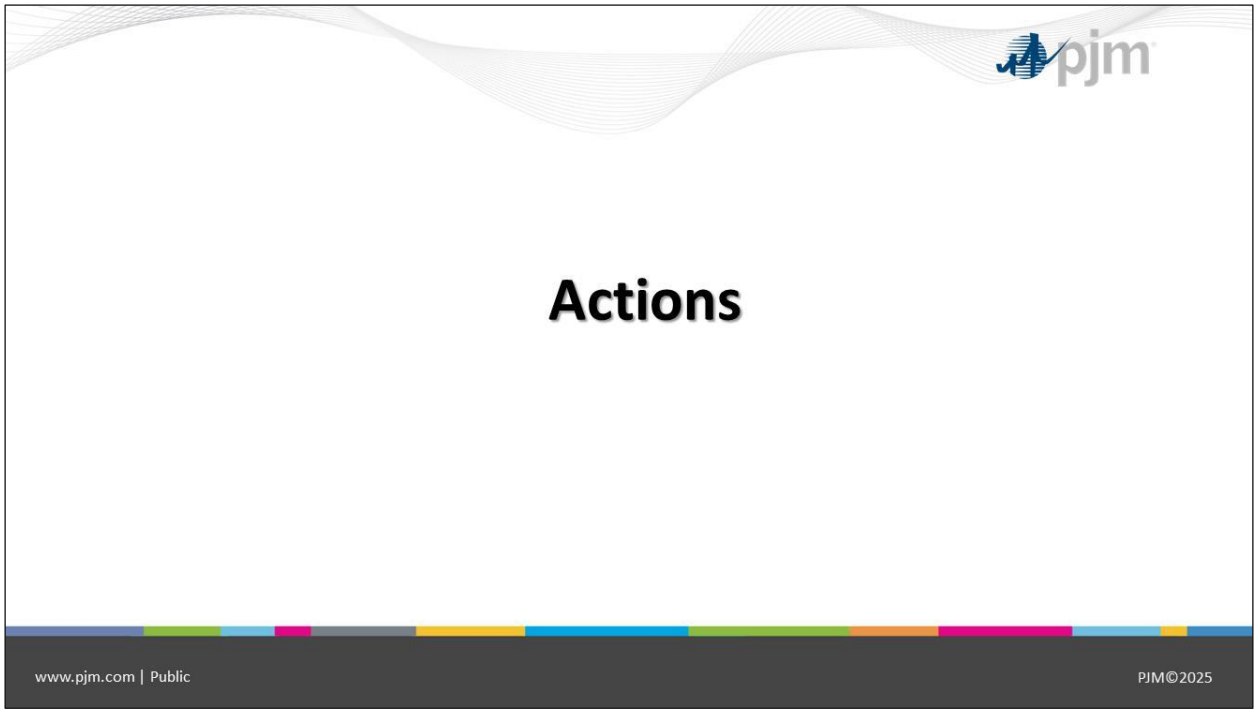
- Notify management, all stations, key personnel, and governmental agencies, as applicable

Operations

- Switch off all non-essential light and power in commercial, operations, and administration offices

37

Actions



Pre-Emergency Load Management Reduction Action

Purpose: Provide additional load relief by using PJM controllable load management programs

Applicability: Any site registered in the PJM Demand Response (DR) Program as a DR type that needs 30, 60, or 120-minute lead time to make reductions

- Reductions are mandatory when dispatched during the product availability window
- Minimum dispatch duration is 1 hour

39

PJM Actions - Pre-Emergency LM Reduction Action

Notifications

- Notify members, PJM management, and PJM public information personnel
- Advise members to consider the use of public appeals to conserve electricity usage
- Notify other Control Areas through the RCIS
- *Issue* detailed instructions to CSPs to dispatch 30, 60 and/or 120 minute Pre-Emergency Load Management Reductions via the DR Hub System and Emergency Procedures website (also referenced via ALL-CALL); *Cancel* when appropriate

40

Member Actions - Pre-Emergency LM Reduction Action

Operations

- CSPs implement load management reductions as requested by PJM Dispatch

41

Emergency Load Management Reduction Action

Purpose: Provide additional load relief by using PJM controllable load management programs. Load relief is expected to be required after initiating Maximum Emergency Generation.

Applicability: Any site registered in the PJM Demand Response (DR) Program as a DR type that needs 30, 60, or 120-minute lead time to make reductions

- Reductions are mandatory when dispatched during the product availability window
- Minimum dispatch duration is 1 hour

42

PJM Actions - Emergency LM Reduction Action

Notifications

- Notify members, PJM management, and PJM public information personnel
- Advise members to consider the use of public appeals to conserve electricity usage
- Notify other Control Areas through the RCIS
- *Issue* detailed instructions to CSPs to dispatch 30, 60 and/or 120 minute Pre-Emergency Load Management Reductions via the DR Hub System and Emergency Procedures website (also referenced via ALL-CALL); *Cancel* when appropriate
- Issue a NERC Energy Emergency Alert Level 2 (EEA2 = ALERT LEVEL 2) via the RCIS

43

Member Actions - Emergency LM Reduction Action

Notifications

- Notify management of the emergency procedure, consider the use of public appeals to conserve electricity usage
- Notify governmental agencies, as applicable

Operations

- CSPs implement load management reductions as requested by PJM Dispatch

44

Maximum Generation Emergency Action

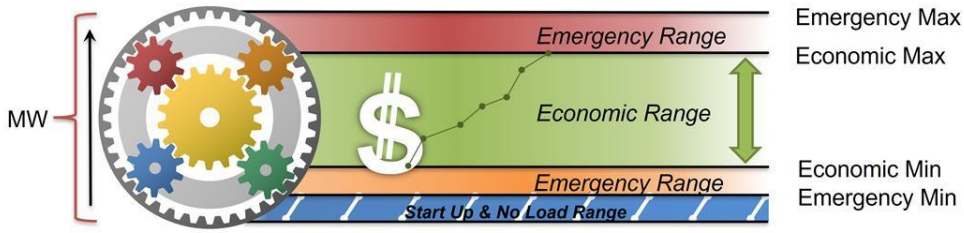
Purpose: To increase generation above the maximum economic level

45

Maximum Generation Emergency Action

Trigger: Real-time generation is needed to meet the load demand that is greater than the highest incremental cost level

- Maximum Emergency Generation can only be included in the daily operating capacity when requested by PJM Dispatch



Example Generator Economic vs Emergency Ranging

46

PJM Actions - Maximum Generation Emergency Action

Notifications

- Notify members, PJM management, and PJM public information personnel
- *Issue* Maximum Generation Emergency Action; *Cancel* when appropriate
- Instruct members to suspend Regulation on all resources, except hydro generation

Emergency Bid Process

- Implement the Emergency Bid Process, requesting emergency bids by posting messages to selected PJM websites, RCIS, and contacting neighboring control areas
  - PJM Member is responsible for delivering (i.e. securing all transmission service) the energy to one of PJM's borders with a neighboring control area

47

PJM Actions - Maximum Generation Emergency Action

Recalling Off-System Capacity Sales

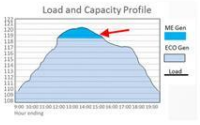
- Determine the feasibility of recalling off-system capacity sales that are recallable
  - PJM will not curtail transactions if the net result would:
    - Put the sink BA into load shed, unless it would prevent load shed within PJM
    - Put PJM in a more severe capacity emergency due to reciprocal transaction curtailments

48

PJM Actions - Maximum Generation Emergency Action

Maximum Generation Emergency Action

- Begin to load Maximum Emergency Generation or purchase available emergency energy from PJM Members (Emergency Bid Process) and neighboring Control Areas based on economics and availability
  - Load Maximum Emergency generation incrementally, as required
  - Max Emergency CTs are typically loaded prior to Max Emergency Steam in order to preserve synchronized reserve



49

Member Actions - Maximum Generation Emergency Action

Notifications

- Notify management, all stations, and key personnel
- GDs report to PJM Dispatch any and all resource limited facilities as they occur via Markets Gateway
- GDs notify PJM dispatching of any Maximum Emergency generation loaded prior to PJM requesting Maximum Emergency generation is loaded

Operations

- PJM Marketers recall off-system capacity sales that are recallable as directed by PJM dispatchers
- GDs suspend regulation, as requested, and load all units to the Maximum Emergency generation level, as required
- Maximum Generation Emergency Action is identified as a trigger to load Non-Retail Behind the Meter Generation

50

Emergency Voluntary Energy-Only DR Reduction Action

Purpose: To request end-use customers who participate in the Emergency Voluntary Energy Only Demand Response Program to reduce load during emergency conditions when additional load relief is still needed

Applicability: Any site registered in the PJM Demand Response program as an emergency energy only resource. ***These reductions are voluntary***.

51

PJM Actions - Emergency Voluntary Energy-Only DR Reduction Action

Notifications

- *Issue* Action via the PJM ALL-CALL and post message to selected PJM websites; *Cancel* when appropriate
- Notify members, PJM management, PJM Markets and public information personnel

52

Member Actions - Emergency Voluntary Energy-Only DR Reduction Action

Notifications

- Notify management

Operations

- CSPs with Demand Resource(s) registered in the Energy Only Option of Emergency Load Response reduce load

53

Deploy All Resources Action

Purpose: To instruct PJM Members that the following is required **immediately:**

- All generation resources are needed *online*
- All Load Management resources dispatched need to *reduce load*

Trigger: When unplanned events such as the loss of a transmission or generating facility(s) have resulted in reliable operations being jeopardized such that a Voltage Reduction Action or a Manual Load Dump Action may be required

PAI
Condition 2

54

PJM Actions - Deploy All Resources Action

Notifications

- *Issue* the Deploy All Resources Action; *Cancel* when appropriate
- Issue a NERC Energy Emergency Alert Level 2 (EEA2 = ALERT LEVEL 2) via the RCIS
- Notify members, PJM management, and PJM public information personnel

Operations

- Suspend all reserve assignments and regulation assignments
- Dispatch Load Management via DR Hub
- Recall any external capacity

55

Member Actions - Deploy All Resources Action

Transmission Owners

- **Notifications**
  - Notify management of the emergency procedure, consider the use of public appeals to conserve electricity usage
  - Notify applicable government entities

Curtailment Service Providers (CSPs)

- **Operations**
  - CSPs with Load Management (Pre-Emergency and/or Emergency) reduce load **immediately** when dispatched

56

Member Actions - Deploy All Resources Action

Generation Dispatchers

- **Notifications**
  - Notify management of the emergency procedure, consider the use of public appeals to conserve electricity usage
  - Notify applicable government entities

57

Member Actions - Deploy All Resources Action

- **Operations**
  - Raise all available online generating units to full output (Emergency Max)
  - Start up all offline generation and ramp to full output (Emergency Max)
  - Upon cancellation of this action:
    - Units that have not started should abort start, if possible
    - Online units should return to following SCED basepoints and any regulation/reserve assignments

Generation Able To...	Start/Synch < 30	Start/Synch > 30
	Start & Inform PJM	Call PJM Prior
Member CSPs with dispatched registrations for load management reduce load immediately when dispatched		

58

Voltage Reduction Action

Purpose: To reduce voltage on the distribution system in order to reduce demand and therefore provide a sufficient amount of reserve to maintain tie flow schedules and preserve limited energy sources

- Voltage reductions can also be implemented to increase transmission system voltages

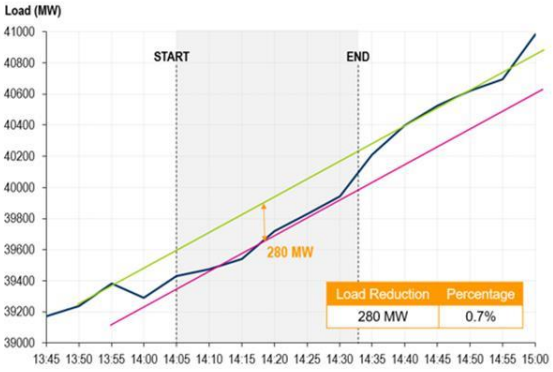
Trigger: When load relief is still needed to maintain tie schedules

PAI
Condition 2

59

Voltage Reduction Action

- Voltage Reduction
  - Voltage is reduced at distribution levels by 2.5%-5% of nominal values depending on the area
  - Produces a 2%-3% decrease in system load, increasing transmission voltages
  - Generally, limited impact to end-use customers (dimmer lights, slower heating)



Summer & Winter Testing is performed to ensure voltage reduction capabilities

60

PJM Actions - Voltage Reduction Action

- **Notifications**
  - *Issue* the order for a 5% Voltage Reduction (see M13 for exceptions); *Cancel* when appropriate
  - Notify members, PJM management, and PJM public information personnel, with potential for system-wide public/media notification
  - Advise members to consider the use of public appeals to conserve electricity usage
  - Notify other Control Areas through the RCIS
  - Notify the Department of Energy (DOE)
  - Issue the applicable NERC Energy Emergency Alert Level via the RCIS (Level 2 or Level 3)
- **Operations**
  - Investigate loading of shared reserves with neighboring systems prior to implementation of a voltage reduction, recognizing the impact on transmission limits
  - Initiate Shortage Pricing, if the voltage reduction region corresponds with an entire Synchronized Reserve Zone/Sub-Zone

61

Member Actions - Voltage Reduction Action

Notifications

- Notify management of the emergency procedure, consider the use of public appeals to conserve electricity usage
- TOs notify governmental agencies, as applicable

Operations

- TOs take steps to implement the voltage reduction

62

Manual Load Dump Action

Purpose & Trigger: An Operating Instruction from PJM to shed firm load when the PJM RTO cannot provide adequate capacity to meet its load and tie schedules, or critically overloaded transmission lines/equipment cannot be relieved in any other way

PAI
Condition 2

63

PJM Actions - Manual Load Dump Action

Analysis

- Verify separations have not occurred and that load shed will help, not aggravate the condition
- Instruct members to suspend all remaining regulation, if not already suspended
- Determine which Control Zone(s) are capacity deficient and the relative proportion of deficiency
  - Estimate the total amount of load to be dumped and utilize the PJM EMS to determine deficient Control Zones and their share of load shed required

64

PJM Actions - Manual Load Dump Action

Notifications

- *Order* the appropriate members to shed load according to PJM EMS calculations; *Cancel* when appropriate
  - PJM will implement load shedding, while minimizing overlap with automatic load shedding, in controlled step sizes to minimize system impact and further uncontrolled separation
- Notify members, PJM management, and PJM public information personnel, with potential for system-wide public/media notification
- Advise members to consider the use of public appeals to conserve electricity usage
- Notify other Control Areas through the RCIS
- Notify FERC, DOE, FEMA, and NERC offices using established procedures
- Issue a NERC Energy Emergency Alert Level 3 (EEA3 = ALERT LEVEL 3) via the RCIS

65

PJM Actions - Manual Load Dump Action

Operations

- Initiate Shortage Pricing, if the manual load shed region corresponds with an entire Synchronized Reserve Zone/Sub-Zone
- Load shed considerations:
  - If partial restoration of the load shed is requested by PJM, confirmation of the load restored by each member must be made prior to further restoration requests by PJM
  - If under-frequency load shed is insufficient to return frequency to acceptable ranges, PJM will shed sufficient load to restore system frequency

66

Member Actions - Manual Load Dump Action

Notifications

- Notify management of the emergency procedure, consider the use of public appeals to conserve electricity usage
- TOs notify governmental agencies, as applicable
- TOs report the amount of load curtailed/restored upon implementation to the PJM Power Dispatcher

67

Member Actions - Manual Load Dump Action

Operations

- GDs suspend remaining regulation, when directed by PJM prior to shedding load
- TOs/DPs shed an amount of load equal to or in excess of the amount requested by PJM **within 5 minutes of the issued directive**
  - Mid-Atlantic Region operators refer to M13: Attachment E for specific allocation
  - Load Shed Plan must consider/recognize priority/critical load
- TOs/DPs maintain the requested amount of load relief until the order is cancelled
- TOs may coordinate with BtMG

68

Member Actions - Manual Load Dump Action

- Considerations for Load Shed Plan:
  - Must recognize priority and critical load, including:
    - Health & public safety facilities
    - Facilities electric service to BES facilities (i.e., off-site power to generating stations)
    - Critical gas or telecommunications infrastructure
  - Must include provisions to minimize overlap of circuits designated for load shed and circuits associated with critical loads, UFLS, or UVLS
  - Load that is shed should be rotated, when feasible, to reduce impact to end-use customers
  - Plans should be reviewed and updated at least annually

69

Manual Load Dump Action

Winter/Summer Required Manual Load Dump PJM Mid-Atlantic Region																
			PPL Zone				PEPCO ZONE		AE		DPL Zone					
MW	PS	PE	PPL	UGI	BC	FE-East	PEPCO	SMECO	AECO	Vineland	DPL	ODEC	DEMEC	Dover	Easton	Rockland
%	17.38%	14.81%	12.63%	0.34%	11.44%	20.95%	9.29%	1.42%	4.01%	0.25%	4.55%	1.37%	0.50%	0.23%	0.09%	0.72%
500	87	74	63	2	57	105	46	7	20	1	23	7	3	1	0	4
1000	174	148	126	3	114	210	93	14	40	3	45	14	5	2	1	7
1500	261	222	190	5	172	314	139	21	60	4	68	21	8	3	1	11
2000	348	296	253	7	229	419	186	28	80	5	91	27	10	5	2	14
3000	521	444	379	10	343	629	279	43	120	8	136	41	15	7	3	22
4000	695	592	505	14	457	838	372	57	160	10	182	55	20	9	4	29
5000	869	741	632	17	572	1048	465	71	201	13	227	69	25	12	5	36

Manual Load Dump Allocation - PJM Mid-Atlantic Region

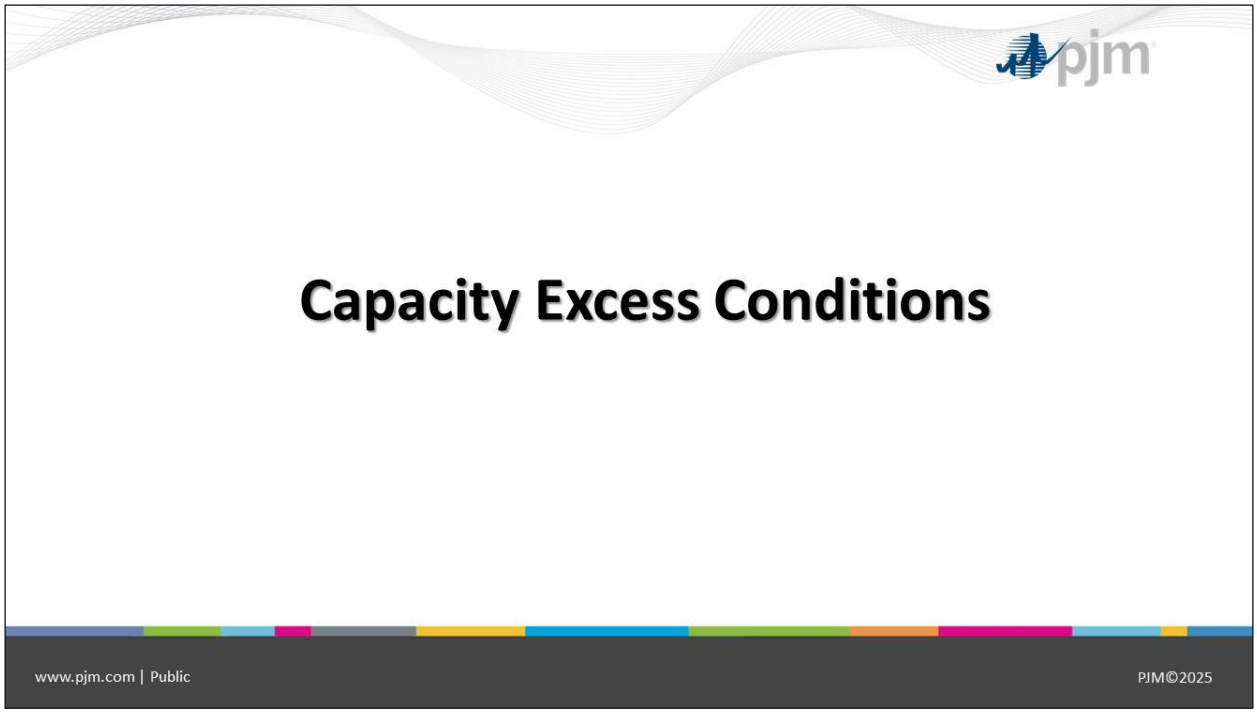
When issuing a manual Load Dump via All Call, the PJM Dispatcher will include the following information in the message:

- (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 2024 summer but applicable to both 2024 summer and 2024/2025 Winter Load conditions

70

Overview



Capacity Excess Conditions

- What is Capacity Excess?
  - When Valley Load level is at or below:
    - 70,000 MWs in Summer/Winter
    - 65,000 MWs in Spring/Fall

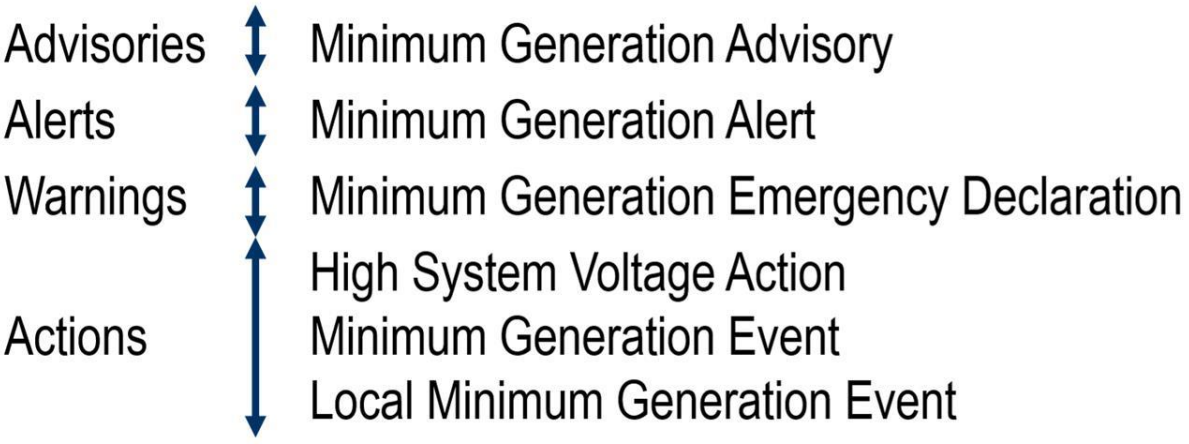
72

Capacity Excess Conditions

- Light Load Procedures:
  - Failure to provide adequate generation control can result in:
    - Deviations in frequency
    - Inadvertent power flow
    - Stability issues
    - Transmission contraints
  - For the RTO to meet its control requirements, it may be necessary to deviate from normal operating procedures during light load periods

73

Capacity Excess Conditions

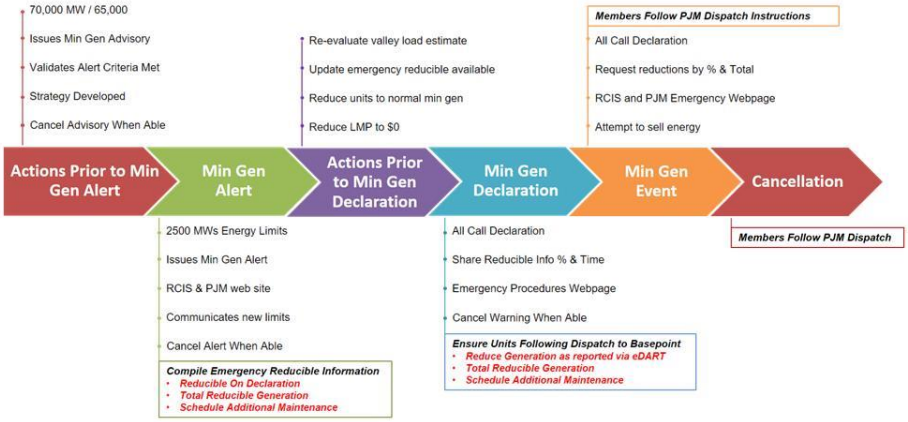


74

Phases of a Minimum Generation Event

Potential Phases of a Min Gen Event

Potential Phases of a Minimum Generation Event



75

Minimum Generation Advisory

Purpose: Provide an early notification that system conditions may require the use of the PJM Emergency Procedures

Trigger: RTO load is projected to be at or below the 70,000MW/65,000MW level

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

76

PJM Actions - Minimum Generation Advisory

Notifications

- *Issue* the Minimum Generation Advisory, providing an informational-only notice that a Min Gen Alert is likely; *Cancel* when appropriate

Operations

- Review valley load forecasts for the upcoming several days
  - Prepare the Minimum Generation Worksheet to determine it the Minimum Generation Alert criteria are met
    - Minimum Generation Alert criteria = Expected generation level is within 2500 MW of normal minimum energy limits
- Formulate a scheduling strategy for the light load period
  - Review hydro schedules to ensure the following are maximized:
    - Pumping at pump-storage facilities
    - Generation at run-of-river facilities

77

Member Actions - Minimum Generation Advisory

Operations

- GDs should utilize the advanced notification to prepare for any action associated with a Minimum Generation Alert

78

Minimum Generation Alert

Purpose: Provide an early alert that PJM Emergency Procedures may be required

Trigger: When the expected generation level is within 2500 MW of normal minimum energy limits

79

PJM Actions - Minimum Generation Alert

Notifications

- *Issue* the Minimum Generation Alert; *Cancel* when appropriate
- Provide the following information to members:
  - Adjusted Minimum Generation
  - Valley Load Estimates
  - Margin Values

80

Member Actions - Minimum Generation Alert

Generation Dispatchers

- **Notifications**
  - Contact PJM if ramp limits are prohibiting the ability to export energy from the PJM system
- **Operations**
  - Review unit normal maximum and minimum energy limits, as well as emergency minimum energy limits
  - Compile emergency reducible information and report via eDART
  - Schedule additional unit maintenance for the expected light load periods, notifying PJM as required
  - Renew and update resource data, paying particular attention to:
    - Resource availability
    - Energy limits (normal max, normal min, emergency min)

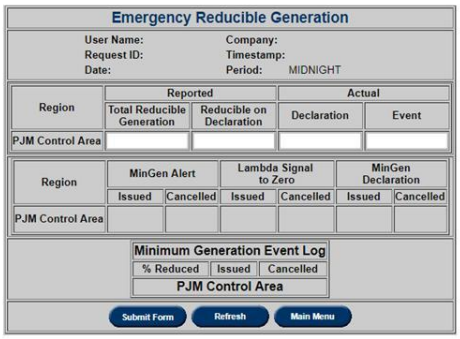
81

Reporting Emergency Reducible Generation (ERG)

- Minimum Generation Alert is the trigger for Generation Dispatchers to compile their emergency reducible generation (ERG) information
  - Reported to PJM via eDART ERG Reporting Tool
    - Minimum Gen Report menu option

82

Reporting Emergency Reducible Generation (ERG)



Emergency Reducible Generation

User Name: Company:
Request ID: Timestamp:
Date: Period: MIDNIGHT

Region	Reported		Actual	
	Total Reducible Generation	Reducible on Declaration	Declaration	Event
PJM Control Area				

Region	MinGen Alert		Lambda Signal to Zero		MinGen Declaration	
	Issued	Cancelled	Issued	Cancelled	Issued	Cancelled
PJM Control Area						

Minimum Generation Event Log

% Reduced	Issued	Cancelled
PJM Control Area		

Submit Form Refresh Main Menu

Reducible on Declaration	• The amount of ERG that will be started down when PJM makes the Declaration, before the actual Minimum Generation Event
Total Reducible Generation	• The total ERG available for both the Declaration and the Event • Joint-owned generation is reported by the operating company

83

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 EcoMin = EmergMin, the unit cannot reduce its output during a Min Gen Event
  - If not correct, does not reflect the actual ability of the unit

84

Calculating Reducibles

You have the following Unit in your portfolio:

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

How much ERG do you report for this unit?

85

PJM Actions Prior to Min Gen Declaration

Operations

- Re-evaluate valley load estimate and the amount of spot-in transactions
- Update the amount of emergency reducible generation available
- Reduce units to normal minimum generation
- Review regulation assignments; 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 to maintain system control

86

Min Gen Emergency Declaration

Purpose: Notify members of Min Gen survey results and strategy, including:

- Anticipated amount of reducible generation, and
- Forecasted time of the reduction

87

PJM Actions - Min Gen Emergency Declaration

Notifications

- *Issue* the Minimum Generation Declaration; *Cancel* when appropriate
- Posts information to RCIS

88

Member Actions - Min Gen Emergency Declaration

Notifications

- Report additional Reducible Generation that is reduced beyond what is reported on the Min Gen Form upon the Declaration

Operations

- Ensure units are following economic basepoints to EcoMin output
  - Wind/Solar operators adjust Control Systems or manually adjust resource output to achieve desired SCED basepoint
- Reduce generation as reported via eDART on the *Min Gen Form* in the **Reducible on Declaration** column
- Determine the specific units that will be reduced and the sequence/timing of reductions based on direction given by PJM

89

Min Gen Event

Trigger: PJM can no longer match the decreasing load and utilization of emergency reducible generation is required

- ALL resources are expected to reduce proportionally based on the percentage ERG declared

90

PJM Actions - Min Gen Event

Notifications

- *Issue* the Minimum Generation Event, requesting GDs to reduce Emergency Reducible Generation; *Cancel* when appropriate
- Posts information to RCIS

Operations

- Emergency Reducible Generation is reduced in proportion to the total amount of ERG reported, less the amount reducible on declaration
- Attempt to sell Emergency Energy to external systems
- Reduce Network External Designated purchases, as required to maintain system control, after all internal PJM resources are reduced to EmergMin levels
- Recommend shutdown of specific units not required for protection or subsequent on-peak period; recommend return times

91

Member Actions - Min Gen Event

Notifications

- Notify PJM if curtailments are expected to exceed 15 minutes
- Upon cancellation, report actual generation that was reduced to PJM

Operations

- Follow direction of PJM Dispatch
- Implementation of reductions should be **achieved within 15 minutes** or within timeframe that technology permits

92

Local Min Gen Events

Trigger: There is an excess of generation in a localized area or set of areas with the potential to result in stability issues or constrained operations

93

PJM Actions - *Local* Min Gen Events

Notifications

- *Issue* the Local Minimum Generation Event, requesting local GDs to reduce ERG in proportion to the total amount of ERG reported; *Cancel* when appropriate

Operations

- Reduce effective local generation to their EcoMin levels, curtail dispatchable contracts and Spot Market Imports, as applicable
- Attempt to sell Emergency Energy to external systems
- Reduce Network External Designated purchases, after all effective PJM resources are reduced to EmergMin levels
- Direct shutdown of effective units not required for protection or subsequent on-peak period; recommend return times

94

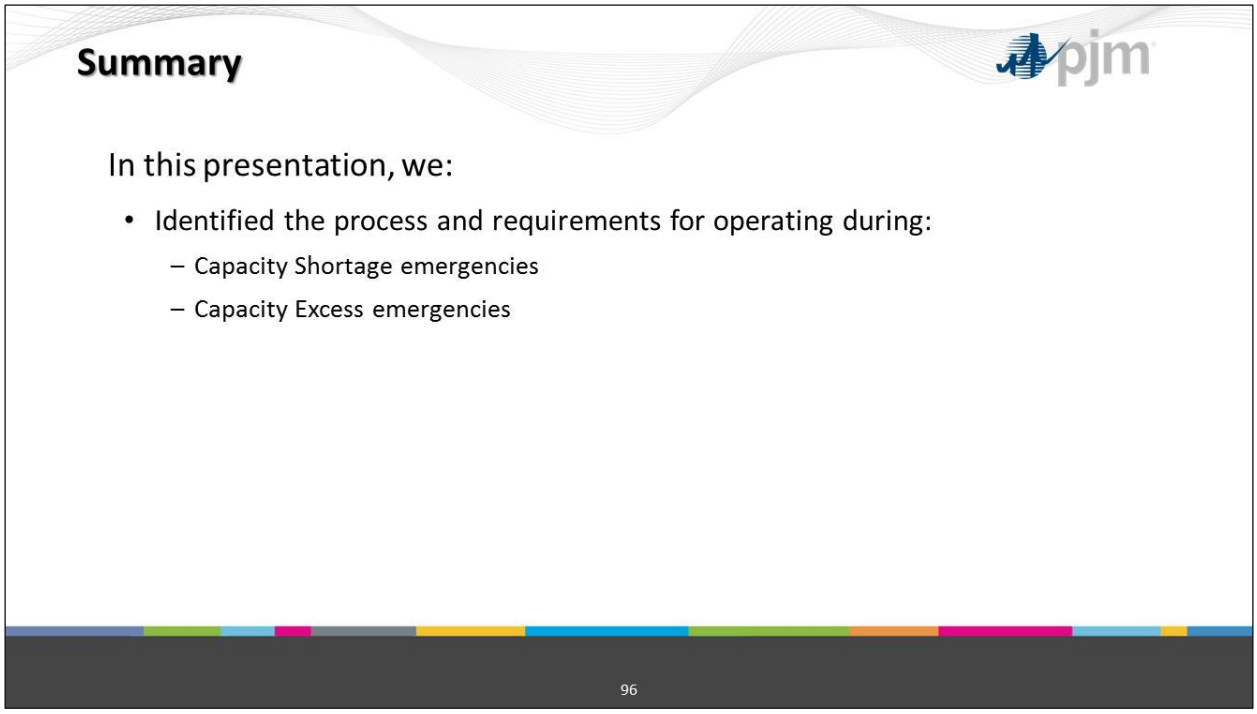
Member Actions - *Local* Min Gen Events

Operations

- Follow the direction of PJM Dispatch via eDART
  - eDART ERG Reporting Form - Manual 13, Attachment H

95

Summary



Questions?

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

Member Community

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