

## 2.3 Capacity Shortages

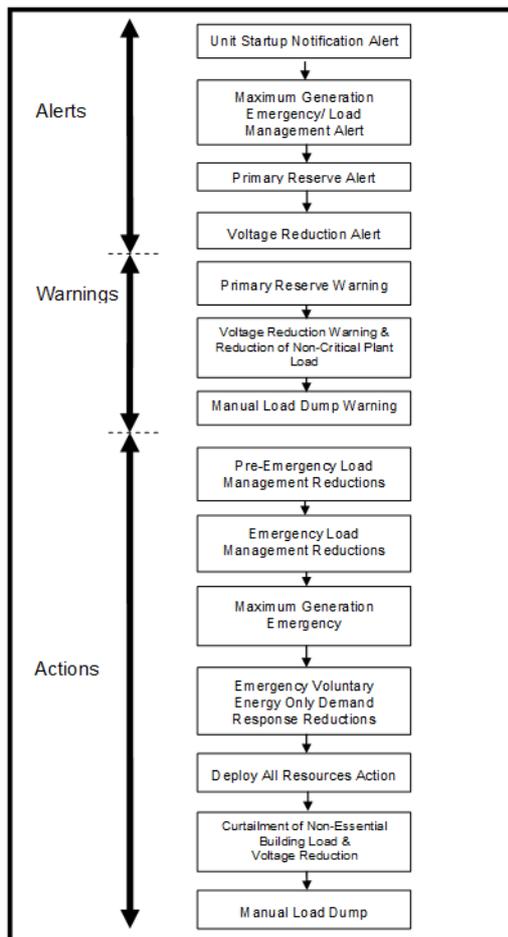
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PJM is responsible for declaring the existence of an Emergency, and for directing the operations of the PJM Members as necessary to manage, alleviate, or end an Emergency. PJM also is responsible for transferring energy on the PJM Members' behalf to resolve an Emergency. PJM is also responsible for executing agreements with other Control Areas interconnected with the PJM RTO for the mutual provision of service to meet an Emergency. In addition, in accordance with EOP-011 R5, if PJM receives an Emergency notification from a Transmission Operator within the RTO, PJM will notify within 30-minutes other Transmission Operators within the RTO and neighboring Reliability Coordinators via All-Call and RCIS postings.

Exhibit 1 illustrates that there are three general levels of emergency actions for capacity shortages, as well as an Advisory level.

Emergency Procedure level types are identified below:

- **Advisory** – 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.]
- **Alerts** – issued one or more days in advance of the operating day for elevated awareness and to give time for advanced preparations.
- **Warnings** – issued real-time, typically preceding, and with an estimated time/window for a potential future Action
- **Actions** – issued real-time and requires PJM and/or Member response
  - PJM actions are consistent with NERC EOP standards.



### Emergency Levels

Exiting emergency procedures are achieved in a controlled, deliberate manner so as to not adversely affect system reliability, while minimizing the impact of these emergency actions on the DP's customers. PJM members are expected to implement all emergency procedures immediately to achieve the desired relief within 30 minutes unless otherwise directed. PJM dispatchers have the flexibility of implementing the emergency procedures in whatever order is required to ensure overall system reliability. PJM dispatchers have the flexibility to exit the emergency procedures in a different order than they are implemented when conditions necessitate.

PJM strives to meet customer energy demands either through the use of available generating resources, power purchases from PJM Members, or through the use of planned load management programs. If customer demand cannot be met, Emergency actions, such as voltage reductions, and as a last resort, manual load shedding that minimizes overlap with automatic load shedding, are used.

During unconstrained operations, PJM Control Zones will jointly implement Emergency Procedures up to the point of a Manual Load Dump Action. Prior to the implementation of a Manual Load Dump Action, PJM Dispatch will review each PJM Control Zone energy / reserves calculation to determine their relative level of capacity deficiency (reserves evaluated via PJM EMS system). If all PJM Control Zones are capacity deficient, Manual Load Dump Actions will be

implemented proportionally, based on the level of shortage, otherwise only the deficient Control Zones will be required to shed load.

Transmission constraints may result in PJM Dispatch implementing emergency procedures, including load shed, on a Control Zone specific basis or a subset of a Control Zone.

Unless otherwise noted, all capacity related Alerts / Warnings / Actions are to be communicated via ALL-CALL to local Transmission / Generation owners/ Curtailment Service Providers. Regardless of communication methodology, Emergency Procedures are posted to selected PJM web-sites.

### **Unit Startup Notification Alert**

The purpose of the Unit Startup Notification Alert is to 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. It is 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 individual unit basis. The Unit Startup Notification Alert is issued so that units can be ready to come online in 48 hours or less, based on the lesser of submitted notification time + startup time or 6 days. After reaching the state of readiness, if a unit fails to come online within 48 hours when called by PJM, the unit will be considered as forced outage until it can be online or PJM cancels the unit.

### **PJM Actions**

- PJM Dispatch notifies PJM management and members.
- PJM Dispatch issues the Alert to members, stating the Alert period(s) and the affected areas. An Alert can be issued for the RTO, specific Control Zone(s) or individual unit basis on the projected location of transmission constraints and should be issued as soon as practicable (typically 6 days or less) prior to the anticipated need for long lead time generation to come online.

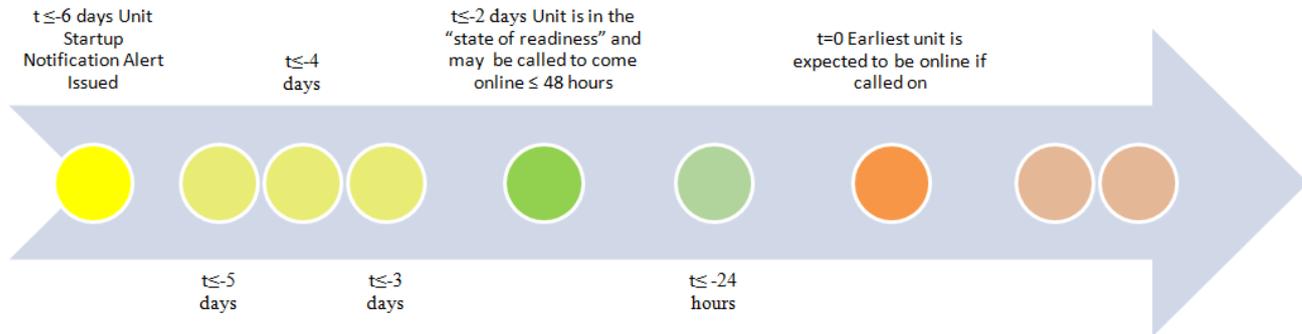
If the Alert is issued for the RTO or a control zone, it will be issued via the ALL-CALL system. Otherwise individual unit owners will be called.

- PJM will 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.
- PJM Dispatch will evaluate system conditions daily to determine whether to release units from the Alert, to keep the units in the state of readiness or to call the units online.
- PJM Dispatch cancels the Alert, when appropriate.

### **PJM Member Actions**

- Transmission / Generation dispatchers notify management of the Alert.
- Transmission / Generation dispatchers advise all stations and key personnel.

- Generation dispatchers orders unit(s) to be in the state of readiness (i.e. able to be online within 48 hours) in the lesser of (submitted notification time + startup time or 6 days) minus 48 hours.



### 2.3.1 Advanced Notice Emergency Procedures: Alerts

The intent of the alert(s) is to keep all affected system personnel aware of the forecasted and/or actual status of the PJM RTO. All alerts and cancellation thereof are broadcast on the ALL-CALL system and posted to selected PJM web-sites to assure that all members receive the same information.

Alerts are issued in advance of a scheduled load period to allow sufficient time for members to prepare for anticipated initial capacity shortages.

#### Maximum Generation Emergency / Load Management Alert

The purpose of the Maximum Generation Emergency/ Load Management Alert is to provide an early alert that system conditions may require the use of the PJM emergency procedures. It is implemented when Maximum Emergency generation is called into the operating capacity or if Demand Response is projected to be implemented.

#### PJM Actions

- PJM Dispatch notifies PJM management.
- PJM dispatchers perform a situation analysis and prepare capacity/load/ interchange/reserve projections for that day and appropriate future operating periods considering potential bottled generation based on location of transmission constraints.
- PJM Dispatch issues an alert to members, stating the amount of estimated operating reserve capacity and the requirement. Alert can be issued for entire PJM RTO or for specific Control Zones and should be issued 1 or more days prior to the operating day.
- PJM Dispatch reports significant changes in the estimated operating reserve capacity.
- PJM Dispatch issues a NERC Energy Emergency Alert Level 1 (EEA1 = ALERT LEVEL 1 / THREAT LEVEL = ELEVATED / THREAT COLOR = YELLOW) via the Reliability Coordinator Information System (RCIS) to ensure all Reliability Authorities clearly understand potential and actual PJM system energy emergencies. EEA1 signals that PJM foresees or is

experiencing conditions where all available resources are scheduled to meet firm load, firm transactions, and reserve commitments, and is concerned about sustaining its required Contingency Reserves.

- PJM Dispatch reviews the level of dependency on External Transactions to serve PJM load and contacts PJM support staff if the need to implement Capacity Benefit Margin (CBM) is required (refer to PJM Manual for [Transmission Service Request](#), (M-02), Section 2 for additional details regarding Capacity Benefit Margin). PJM Dispatch shall log occurrences where CBM is implemented base on the results of support staff analysis. PJM shall notify external systems via RCIS and PJM members via the PJM website and issue appropriate NERC alert levels consistent with NERC EOP-011, Attachment 1.
- PJM Dispatch determines whether a Supplemental Status Report (SSR) is required and notifies PJM Members via the ALL-CALL. PJM Dispatch may elect not to request an SSR until the operating day for which the Alert is in effect.
- PJM Dispatch cancels the Alert, when appropriate.

#### **PJM Member Actions**

- Transmission / Generation dispatchers notify management of the alert.
- Transmission / Generation dispatchers advise all stations and key personnel.
- Transmission / Generation dispatchers review plans to determine if any maintenance or testing, scheduled or being performed, on any monitoring, control, transmission, or generating equipment can be deferred or cancelled.
- Generation dispatchers report to PJM Dispatch any and all fuel / environmental limited facilities as they occur and update PJM Dispatch as appropriate.
- Transmission / Generation dispatchers suspend any high risk testing of generating or transmission equipment.
- Generation dispatchers will update the “early return time” for any Planned generator outages as indicated in PJM’s Manual for [Pre-Scheduling Operations](#) (M-10), Section 2.2.

#### **Primary Reserve Alert**

The purpose of the Primary Reserve Alert is to alert members of the anticipated shortage of operating reserve capacity for a future critical period. It is implemented when estimated operating reserve capacity is less than the forecasted primary reserve requirement.

#### **PJM Actions**

- PJM Dispatch notifies PJM management and members.
- PJM Dispatch issues alert to members, stating the amount of estimated operating reserve capacity and the requirement. An Alert can be issued for the entire PJM RTO or for specific Control Zone(s) based on the projected location of transmission constraints and should be issued 1 or more days prior to the operating day.
- PJM Dispatch reports significant changes in the estimated operating reserve capacity.
- PJM Dispatch cancels the Alert, when appropriate.

### **PJM Member Actions**

- Transmission / Generation dispatchers notify management of the alert.
- Transmission / Generation dispatchers advise all stations and key personnel.
- Transmission / Generation dispatchers review plans to determine if any maintenance or testing, scheduled or being performed, on any generating equipment or critical monitoring, control, or bulk power transmission facility can be deferred or cancelled.
- Generation Dispatchers are to inform PJM of any environmentally restricted units and may consider the need to obtain a temporary variance from environmental regulators for specific generators in accordance with [Attachment M](#) to assist in preventing load shed. PJM is not responsible for obtaining a temporary variance from environmental regulations but will assist the member company if requested.

### **Voltage Reduction Alert**

The purpose of the Voltage Reduction Alert is to alert members that a voltage reduction may be required during a future critical period. It is implemented when the estimated operating reserve capacity is less than the forecasted synchronized reserve requirement. A summary table below lists the estimated times to implement and approximate load relief.

### **PJM Actions**

- PJM Dispatch notifies PJM management.
- PJM Dispatch issues an alert to members, stating the amount of estimated operating reserve capacity and the requirement. An Alert can be issued for the entire PJM RTO or for specific Control Zone(s) based on the projected location of transmission constraints and should be issued 1 or more days prior to the operating day.
- PJM Dispatch advises members that a possibility exists that a Voltage Reduction Action will be issued and the estimated hour of implementation.
- PJM dispatcher cancels the Alert, when appropriate.

### **PJM Member Actions**

- Transmission / Generation dispatchers notify management of the alert.
- Transmission / Generation dispatchers advise all stations and key personnel.
- Transmission dispatchers / DPs 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.
- SOS members / PJM Management consider issuing the appropriate system-wide or Control Zone-specific Public/Media Notification Message See [Attachment A](#).
- PJM marketers remain on heightened awareness regarding PJM system conditions and the potential need for Emergency Energy Purchases.

Substations without SCADA control will be expected to be staffed in order to implement a Voltage Reduction Action if needed.

**Voltage Reduction Summary Table:**

PJM MID-ATLANTIC							
	TIME (m)	Voltage Reduction %	Load Reduction %	Est. PEAK LOAD	Est. Load Reduction	SCADA	COMMENTS
PPL	2	5%	2%	7,193	107.90	Y	
PSEG	5	5%	2%	10,090	201.80	Y	
DPL	5	5%	2%	3,991	79.82	Y	
ACE	5	5%	2%	2,750	55.00	Y	
PECO	2	5%	1%	8,547	85.47	Y	
RECO	5	5%	2%	407	8.14	Y	
UGI	2	5%	1%	188	1.88	Y	Implemented at the Mountain station.
PEPCO	5	5%	2%	6,563	131.26	Y	
BGE	2	5%	3%	6,945	173.63	Y	Initially distribution voltages are lowered automatically. Additional adjustments are made to push voltage change up the transmission system through manual tap changes through SCADA. These additional operation steps take up to 15 min.
FE East - JCPL	10	5%	1%	5,968	59.68	Y	The Distribution Operator implements 5% voltages reduction via SCADA to distribution transformers with automatic ULTC. There are 17 control points in EMS and each control point sends the reduction

							signal to multiple stations.
<b>FE East – MAIT (PENLC ZONE)</b>	10	5%	1%	2,890	28.90	Y	The Distribution Operator implements a 5% voltage reduction by operating individual ULTC from SCADA. out
<b>FE East – MAIT (METED ZONE)</b>	10	5%	1%	2,940	29.40	Y	The TSO implements a 5% voltage reduction on the 69 kV sub-transmission system by operating individual ULTC from SCADA and the Distribution Operator implements a 5% voltage reduction via SCADA to distribution transformers with automatic ULTC. The Distribution Operator has 14 control points in EMS and each control point sends the reduction signal to multiple stations.
<b>TOTAL</b>			1.65%	58,472	962.87		
<b>PJM SOUTH AND WEST REGIONS</b>							
	<b>TIME (m)</b>	<b>Voltage Reduction %</b>	<b>Load Reduction %</b>	<b>Est. PEAK LOAD</b>	<b>Est. Load Reduction</b>	<b>SCADA</b>	<b>COMMENTS</b>
<b>DUQU</b>	60	5.0%	2%	2,893	57.86	Y	
<b>DOM</b>	2	5%	2%	19,531	292.97	Y	3% Voltage Reduction with a 1% Est. Load Reduction in the Winter. In the summer could reach a 5% Voltage Reduction with a 1.5%-2% Est. Load Reduction.
<b>AEP</b>	N/A	N/A	N/A	23,006	N/A	N	AEP does not have a Voltage Reduction Program
<b>FE</b>	10	5%	1.7%	8,817	149.89	Y	FE South's voltage

<b>South</b>							reduction program implements a 5% voltage reduction, in accordance with PJM procedures. The SCADA implemented program is capable of a 2.5% voltage reduction, however this would not be used during the PJM Voltage Reduction Action.
<b>COMED</b>	30	2.5%5%	3%	22,001	682.03	Y	COMED can achieve 1.3% Load reduction in 15 minutes, then another 1.8% in the next 15 minutes. 2.5% voltage reduction inside Chicago. 5% voltage reduction outside Chicago.
<b>DAYTON</b>	10	5%	1.00%	3,403	34.03	Y	20 Sub-Stations can be manually controlled with a 5% Voltage Reduction with a 1% Est. Load Reduction. DAYTON will required 2 hour minimum notification to man stations.
<b>FE West - ATSI</b>	N/A	N/A	N/A	12,921	N/A	N	FE West does not have a voltage reduction program.
<b>DEOK</b>	N/A	N/A	N/A	5,436	N/A	N	DEOK does not have a voltage reduction program.
<b>EKPC</b>	N/A	N/A	N/A	1,924	N/A	N	EKPC does not have a voltage reduction program.
<b>GridForce/RMU</b>	N/A	N/A	N/A	39	N/A	N	GridForce/RMU does not have a voltage reduction program.
<b>TOTAL</b>			1.2%	99,971	1,216.78		
<b>RTO TOTAL</b>			1.4%	158,443	2,179.65		

### 2.3.2 Real-Time Emergency Procedures (Warnings and Actions)

All warning and actions are issued in real-time. Warnings are issued during present operations to inform members of actual capacity shortages or contingencies that may jeopardize the reliable operation of the PJM RTO. Disturbance control actions per NERC standard BAL-002 are described in PJM Manual 12, “Balancing Operations” (M-12), Section 4, “Providing Ancillary Services”. Generally, a warning precedes an associated action. The intent of warnings is to keep all affected system personnel aware of the forecast and/or actual status of the PJM RTO.

All Warnings and Actions listed in Steps 1 to 10 below will trigger a capacity **Performance Assessment Internal (PAI)** as detailed in *PJM Manual 18, PJM Capacity Market*.

The PJM RTO is normally loaded according to bid prices; however, during periods of reserve deficiencies, other measures must be taken to maintain system reliability. These measures involve:

- 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. Issuance and cancellation of emergency procedures are broadcast over the ALL-CALL and posted to selected PJM web-sites. Only affected systems take action. PJM dispatchers broadcast the current and projected PJM RTO status periodically using the ALL-CALL during the extent of the implementation of the emergency procedures. Upon receipt of the ALL-CALL, impacted members are expected to begin implementing the PJM Member Actions listed as soon as possible/indicated to help ensure the emergency conditions are mitigated.

The Real-Time Emergency Procedures section combines Warnings and Actions in their most probable sequence based on notification requirements during extreme peak conditions. Depending on the severity of the capacity deficiency, it is unlikely that some Steps would be implemented.

**Actions taken prior to entering into capacity related Emergency Procedures:**

1. Review weather projections, load forecasts, reserve projections and generation performance.
2. Ensure LMPs are reflective of system conditions
3. Curtail all non-Firm exports and issue an EEA1, as required by EOP-011 Attachment 1, via the RCIS and Emergency Procedures webpage.
4. Dispatch may elect to implement an interchange cap to stabilize the amount of interchange during peak hours to protect against volatility.

**Step 1:**

**Pre-Emergency Load Management Reduction Action (30, 60 or 120-minute)**

Issuance of this procedure will trigger a capacity **Performance Assessment Interval (PAI)** as detailed in *PJM Manual 18, PJM Capacity Market*.

Applicability: Any site registered in the PJM Demand Response program as a demand resource (a.k.a. DR) type that needs 30, 60 or 120 minute lead time to make its reductions. These reductions are mandatory when dispatched during the product availability window.

The minimum dispatch duration is 1 hour.

### **PJM Actions**

- PJM Dispatch notifies PJM management, PJM public information personnel, and members. PJM dispatcher advises members to consider the use of public appeals to conserve electricity usage. PJM dispatcher notifies other Control Areas through the RCIS.
- PJM Dispatch, via the DR Hub System and Emergency Procedures website, will post detailed instructions to the Curtailment Service Providers (CSP) to dispatch 30, 60 and/or 120 minute Pre-Emergency Load Management Reductions. An Action can be issued for the entire PJM RTO, specific Transmission Zone(s) or a Transmission Sub-zone(s) if transmission limitations exist. PJM dispatcher will also issue an ALL-CALL informing the Members and CSPs to check the DR Hub and Emergency Procedures postings for the detailed information pertaining to the Pre-Emergency Load Management that has been called.
- PJM Dispatch cancels the Action, when appropriate.

### **PJM Member Actions**

- Member Curtailment Service Providers implement load management reductions as requested by PJM dispatchers.

### **Step 2:**

#### **Emergency Load Management Reduction Action (30, 60 or 120-minute)**

Issuance of this procedure will trigger a capacity **Performance Assessment Interval (PAI)** as detailed in *PJM Manual 18, PJM Capacity Market*.

Applicability: Any site registered in the PJM Demand Response program as a demand resource (a.k.a. DR) type that needs 30, 60 or 120 minute lead time to make its reductions. These reductions are mandatory when dispatched during the product availability window.

The minimum dispatch duration is 1 hour.

The purpose of the Load Management Reduction is to provide additional load relief by using PJM controllable load management programs. Load relief is expected to be required after initiating Maximum Emergency generation.

### **PJM Actions**

- PJM Dispatch notifies PJM management, PJM public information personnel, and members. PJM Dispatch advises members to consider the use of public appeals to conserve electricity usage. PJM Dispatch notifies other Control Areas through the RCIS.
- PJM Dispatch, via DR Hub System and Emergency Procedures website, will post detailed instructions to the Curtailment Service Providers (CSP) to implement dispatch 30, 60 and/or 120 minute Emergency Load Management Reductions (Long Lead Time). An Action can be issued for the entire PJM RTO, specific Transmission Zone(s) or a subset of a Transmission Sub-zone(s) if transmission limitations exist. PJM Dispatch will also issue an ALL-CALL informing the Members and CSPs to check the DR Hub and Emergency Procedures postings for the detailed information pertaining to the Emergency Load Management that has been called.
- PJM Dispatch issues a NERC Energy Emergency Alert Level 2 (EEA2 = ALERT LEVEL 2) via the RCIS to ensure all Reliability Authorities clearly understand potential and actual PJM system emergencies if one has not already been issued concurrent with the issuance of Emergency Load Management Reductions. NERC EEA2 is issued when the following has occurred: Public appeals to reduce demand, voltage reduction, and interruption of non-firm load in accordance with applicable contracts, demand side management, or utility load conservation measures.
- PJM Dispatch cancels the Action, when appropriate.

### **PJM Member Actions**

- Member Curtailment Service Providers implement load management reductions as requested by PJM dispatchers.
- Member dispatchers notify management of the emergency procedure and that they should consider the use of public appeals to conserve electricity usage.
- Member dispatchers notify governmental agencies, as applicable.

**1**, Load management programs, whether under PJM control and directed by PJM Dispatch or solely under the Local Control Center's direction, have various names including, but not limited to Active Load Management, interruptibles, curtailables, or load management. To simplify operations during these emergency situations, all PJM issued reductions are referred to as Pre-Emergency or Emergency Load Management Reductions.

**Note 2:** PJM RTO Load Management Reductions are not to be used to provide assistance to adjacent Control Areas beyond PJM. Restoration of Load Management Reductions is undertaken in a stepped approach, as necessary. PJM Control Zones implement Emergency Procedures concurrently until a Manual Load Dump Action, which will only occur in the deficient Control Area.

**Note 3:** Pre-Emergency and Emergency Load Management Reductions are available for Limited, Extended Summer and Annual Demand Resources as defined in the Reliability Assurance Agreement (RAA).

**Note 4, EEA Levels:** PJM dispatcher issue a NERC Energy Emergency Alert Level 2 (EEA2 = ALERT LEVEL 2) via the Reliability Coordinator Information System (RCIS) to ensure all Reliability Authorities clearly understand potential and actual PJM system emergencies if one has not already been issued concurrent with the issuance of Emergency Load Management Reductions. A NERC EEA2 may be issued when the following has occurred: Public appeals to reduce demand, voltage reduction, interruption of non-firm load in accordance with applicable contracts, demand side management/active load management, or utility load conservation measures.

**Note 5, Demand Resource Curtailment:** If PJM needs to dispatch Demand Resources (DR) during the Limited DR availability Period then PJM will dispatch all DR products simultaneously unless all products have been dispatched frequently during the current delivery year. Frequent dispatch of DR during the delivery year is defined as:

- 2 times prior to July 1<sup>st</sup>,
- 4 times prior to August 1<sup>st</sup>, or,
- 7 times prior to September 1<sup>st</sup>.

Should PJM frequently dispatch DR during a delivery based on the criteria above PJM may elect to dispatch only the Extended Summer and Annual DR, to preserve Limited DR for the remainder of the delivery year.

**Note 6, Capacity Benefit Margin (CBM):** Under NERC Energy Emergency Alert Level 2, the PJM dispatcher may request import energy over firm transfer capability set aside as CBM. If so, dispatch will waive any real-time operating timing and ramp requirements and document such actions in compliance with MOD-004-1.

### **Step 3 (Real-time):**

#### **Primary Reserve Warning**

Issuance of this procedure will trigger a capacity **Performance Assessment Interval (PAI)** as detailed in *PJM Manual 18, PJM Capacity Market*.

The purpose of the Primary Reserve Warning is to warn members that the available primary reserve is less than required and present operations are becoming critical. It is implemented when available primary reserve capacity is less than the primary reserve requirement, but greater than the synchronized reserve requirement.

#### **PJM Actions**

- PJM Dispatch issues a warning to members and PJM management stating the amount of adjusted primary reserve capacity and the requirement. A Warning can be issued for the entire PJM RTO or for specific Control Zone(s) based on the projected location of transmission constraints.
- PJM Dispatch notifies PJM public information personnel.
- PJM Dispatch rechecks with members to assure that all available equipment is scheduled and that requested secondary reserve is brought to primary reserve status.
- PJM Dispatch ensures that all deferrable maintenance or testing on the control and communications systems has halted at PJM Control Center. PJM dispatcher should provide as much advance notification as possible to ensure maintenance/testing does not

impact operations. This notification may occur prior to declaration of Primary Reserve Warning.

- PJM Dispatch cancels the Warning, when appropriate.

#### **PJM Member Actions**

- Transmission / Generation dispatchers notify management of the warning.
- Transmission / Generation dispatchers advise all stations and key personnel.
- Generation dispatchers prepare to load all available primary reserve, if requested.
- Transmission / Generation dispatchers ensure that all deferrable maintenance or testing affecting capacity or critical transmission is halted. Any monitoring or control maintenance work that may impact operation of the system is halted.
- Generation Dispatchers are to inform PJM of any environmentally restricted units and may consider the need to obtain a temporary variance from environmental regulators for specific generators in accordance with [Attachment M](#) to assist in preventing load shed. PJM is not responsible for obtaining a temporary variance from environmental regulations but will assist the member company if requested.
- PJM marketers remain on heightened awareness regarding PJM system conditions and the potential need for Emergency Energy Purchases.

#### **Step 4 A (Real-time):**

##### **Maximum Generation Emergency Action**

Issuance of this procedure will trigger a capacity **Performance Assessment Interval (PAI)** as detailed in *PJM Manual 18, PJM Capacity Market*.

The purpose of the Maximum Generation Emergency Action is to increase the PJM RTO generation above the maximum economic level. It is implemented whenever generation is needed 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.

##### **PJM Actions**

- PJM Dispatch issues a Maximum Generation Emergency Action. An Action can be issued for the entire PJM RTO, specific Control Zone(s) or a subset of a Control Zone if transmission limitations exist.
- PJM Dispatch notifies PJM management, PJM public information personnel, and member dispatchers.

- PJM Dispatch implements the Emergency Bid-Process, requesting Emergency bids by posting messages to selected PJM web-sites, RCIS, and contacting the neighboring control areas.
- PJM Dispatch instructs members to suspend Regulation on all resources, except hydro generation.
- PJM Dispatch determines the feasibility recalling off-system capacity sales that are recallable (network resources).
  - PJM Dispatch will determine any limiting transmission constraints internal to PJM that would impact the ability to cut transactions to a specific interface.
  - PJM Dispatch will identify off-system capacity sales associated with the identified interfaces.
  - PJM Dispatch will contact the sink Balancing Authority to determine the impact of transaction curtailment.
- If the net result of cutting off-system capacity sales would put the sink Balancing Authority into load shed then PJM will not curtail the transactions unless it would prevent load shedding within PJM.
- If the net result of cutting off-system capacity sales would put PJM in a more severe capacity emergency than it is in currently in due to reciprocal transaction curtailments from the sink Balancing Authority, PJM will not initiate curtailing the transactions.
- PJM Dispatch declares a Maximum Generation Emergency Action and begins to load Maximum Emergency generation or purchase available emergency energy from PJM Members (Emergency Bid Process) and from neighboring Control Areas based on economics and availability.
- PJM Dispatch loads Maximum Emergency generation incrementally as required, if the entire amount of Maximum Emergency generation is not needed. PJM dispatchers generally load Maximum Emergency CTs prior to loading Maximum Emergency Steam in order to preserve synchronized reserve.

Emergency Bid-Process: Following issuance of a Maximum Generation Emergency Action, PJM may purchase available energy from any PJM Member (as emergency) that is available up to the amount required or until there is no more available, recognizing the impact on transmission constraints. The following rules are used to provide an orderly operation.

PJM should consider loading of shared reserves with neighboring systems prior to implementing voltage reduction, while recognizing the impact on transmission limits.

- The PJM Member is responsible for delivering (i.e., securing all transmission service) of the energy to one of PJM's borders with a neighboring control area. To ensure deliverability, firm transmission service may be required if external Reliability Authorities have issued TLRs.
- PJM attempts to provide 60-minutes notice before the energy is required by posting on selected PJM web-sites an emergency procedure message stating that PJM anticipates requiring emergency energy purchases beginning at a specific time.
- Once PJM posts the request for emergency purchases all PJM Members can submit "bids" to make emergency energy sales to PJM. PJM Members should use email as primary means of submitting bids with fax as a secondary means if email is unavailable and call

PJM to confirm receipt. The Emergency Bid form is found in [Attachment D](#) along with the rules for submitting. Bids may also be called into a pre-assigned, recorded voice line. They should be structured as follows:

- time – of energy available
- amount – of energy available
- price of energy
- duration (hours) energy is available and limits on minimum time required to take
- notification time to cancel/accept
- PJM Member identification
- interface and contract path
- PJM accepts the offers and schedules the energy using the following guidelines:
  - Energy is accepted based on economics (least cost offers will be accepted first based on energy price and minimum hours) if more energy is offered than required.
  - Energy is accepted as required based on economics from the available bids (i.e., if PJM requires 500 MW immediately it takes the cheapest 500 MW bid at the time). PJM adjusts current schedules to correct economics if time permits (i.e., if a cheaper scheduled is bid after a more expensive schedule is loaded PJM only cancels the first if reasonable time exists to cancel one and load the other).
  - Similarly priced offers are selected based on timestamps (i.e., first in first selected).

Bids accepted by PJM are Emergency Purchases by PJM and will set the Locational Marginal Price. The energy received is accounted for according to the current Emergency Energy accounting procedures. See the PJM Manual for [Operating Agreement Accounting](#) (M-28) for more details.

PJM reserves the right to load Maximum Emergency generation as required to control the system regardless of whether any bids were/were not accepted (i.e., sudden unit loss may not allow time to accept bids).

PJM implements and curtails emergency purchase transactions with as much notice as practical to allow for a reliable transition into and out of emergency conditions.

PJM requests emergency energy from neighboring Control Areas (under current Control Area agreements) after all energy offered by the PJM Members is accepted, unless there is an immediate need for the energy.

PJM can deviate from or change the order of the above actions as/if necessary.

- PJM Dispatch cancels the Action, when appropriate.

#### **PJM Member Actions**

- Transmission / Generation dispatchers notify management of the emergency procedure.
- PJM Marketers recall off-system capacity sales that are recallable as directed by PJM dispatchers.

- Generation dispatchers suspend regulation, as requested, and load all units to the Maximum Emergency generation level, as required.
- Generation dispatchers notify PJM dispatching of any Maximum Emergency generation loaded prior to PJM requesting Maximum Emergency generation is loaded.

**Step 4 B (Real-time):**

**Emergency Voluntary Energy Only Demand Response Reduction Action**

Issuance of this procedure will trigger a capacity **Performance Assessment Interval (PAI)** as detailed in *PJM Manual 18, PJM Capacity Market*.

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

The purpose of this Load Reduction Action is to request end-use customers, who participate in the Emergency Voluntary Energy Only Demand Response Program, to reduce load during emergency conditions.

**PJM Actions**

- PJM Dispatch issues Action via the PJM ALL-CALL and post message to selected PJM Websites. An Action can be issued for the entire PJM RTO, specific Control Zone(s) or a subset of a Control Zone if transmission limitations exist.
- PJM Dispatch notifies PJM management, PJM public information personnel, and PJM Markets personnel.
- PJM Dispatch cancels the Action, when appropriate.

**PJM Member Actions**

- Curtailment Service Providers with Demand Resource(s) registered in the Energy Only Option of Emergency Load Response reduce load.
- Transmission / Generation dispatchers notify management of the emergency procedure.

**Step 5 (Real-time):**

**Voltage Reduction Warning & Reduction of Non-Critical Plant Load**

Issuance of this procedure will trigger a capacity **Performance Assessment Interval (PAI)** as detailed in *PJM Manual 18, PJM Capacity Market*.

The purpose of the Voltage Reduction Warning & Reduction of Non-Critical Plant Load is to warn members that the available synchronized reserve is less than the Synchronized Reserve

Requirement and that present operations have deteriorated such that a voltage reduction may be required. It is implemented when the available synchronized reserve capacity is less than the synchronized reserve requirement, after all available secondary and primary reserve capacity (except restricted Maximum Emergency capacity) is brought to a synchronized reserve status and emergency operating capacity is scheduled from adjacent systems.

#### **PJM Actions**

- PJM Dispatch issues a warning to members and PJM management, stating the amount of adjusted synchronized reserve capacity and the requirement. A Warning can be issued for the entire PJM RTO or for specific Control Zone(s) based on the projected location of transmission constraints.
- PJM Dispatch notifies PJM public information personnel.
- PJM notifies the Department of Energy (DOE).
- PJM Dispatch cancels the Warning, when appropriate.

#### **PJM Member Actions**

- Transmission / Generation dispatchers notify management of the warning.
- Transmission / Generation dispatchers notify governmental agencies, as applicable.
- Transmission / Generation dispatchers advise all stations and key personnel.
- Generation dispatchers order all generating stations to curtail non-critical station light and power.
- Transmission dispatchers / DPs prepare to reduce voltage, if requested.
- Transmission dispatchers / DPs and Curtailment Service Providers notify appropriate personnel that there is a potential need to implement load management programs, in addition to interrupting their interruptible/curtailable customers in the manner prescribed by each policy, if it has not already been implemented previously. PJM marketers remain on heightened awareness regarding PJM system conditions and the potential need for Emergency Energy Purchases.

#### **Step 6 (Real-time):**

##### **Curtailment of Non-Essential Building Load**

Issuance of this procedure will trigger a capacity **Performance Assessment Interval (PAI)** as detailed in *PJM Manual 18, PJM Capacity Market*.

The purpose of the Curtailment of Non-Essential Building Load is to provide additional load relief, to be expedited prior to, but no later than, the issuance of a Voltage Reduction Action.

#### **PJM Actions**

- PJM Dispatch notifies PJM management, PJM public information personnel, and members. PJM dispatcher advises members to consider the use of public appeals to conserve electricity usage. PJM dispatcher notifies outside systems through the RCIS.

- PJM Dispatch issues a request to curtail non-essential building load. An Action can be issued for the entire PJM RTO, specific Control Zone(s) or a subset of a Control Zone if transmission limitations exist.
- PJM Dispatch cancels the Action, when appropriate.

### **PJM Member Actions**

- Transmission / Generation dispatchers notify management of the emergency procedure and to consider the use of public appeals to conserve electricity usage.
- Transmission dispatchers notify governmental agencies, as applicable.
- Transmission / Generation dispatchers / DPs switch off all non-essential light and power in DP-owned commercial, operations, and administration offices.

### **Step 7 (Real-time):**

#### **Deploy All Resources Action**

Issuance of this procedure will trigger a capacity **Performance Assessment Interval (PAI)** as detailed in *PJM Manual 18, PJM Capacity Market*.

For emergency events that evolve over time, PJM will dispatch generation and Load Management resources via the normal mechanisms of SCED, DR Hub and direct phone calls. However, for emergency events that develop rapidly and without prior warning, PJM may need to dispatch all resources in a large area very quickly. The purpose of the Deploy All Resources Action, during such emergency conditions, is to instruct PJM Members that all generation resources are needed online immediately and that all Load Management resources dispatched need to reduce load immediately. This step is issued 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.

#### **PJM Actions**

- PJM Dispatch issues the Deploy All Resources Action. This Action can be issued for the entire PJM RTO, specific Control Zone(s) or a subset of a Control Zone if transmission limitations exist and the sub-zone was previously defined.
- PJM Dispatch will suspend all reserve assignments and regulation assignments.
- PJM dispatches Load Management via DR Hub.
- PJM recalls any external capacity.
- PJM Dispatch issues a NERC Energy Emergency Alert Level 2 (EEA2 = ALERT LEVEL 2) via the RCIS to ensure all Reliability Authorities clearly understand potential and actual PJM system emergencies if one has not already been issued concurrent with the issuance of Emergency Load Management Reductions.
  - NERC EEA2 is issued when the following has occurred: Public appeals to reduce demand, voltage reduction, and interruption of non-firm load in accordance with applicable contracts, demand side management, or utility load conservation measures.

- PJM Dispatch notifies PJM management, PJM public information personnel, and member dispatchers.
- PJM Dispatch cancels the Action, when appropriate.

### **PJM Member Actions**

- Member Generation Dispatchers raise all available online generating units to full output (Emergency Maximum).
- Member Generation Dispatchers start up all offline generation and ramp to full output (Emergency Maximum), utilizing the communication methods below:
  - Generators that can be online in less than 30-minutes should start immediately upon receipt of the ALL-CALL and then notify PJM Dispatch when they are on-line.
  - Generators that require more than 30-minutes to be on-line should call the PJM dispatcher prior to initiating the start sequence.
- Member Curtailment Service Providers with Load Management (Pre-Emergency and/or Emergency) reduce load immediately when dispatched.
- Transmission/Generation Dispatchers notify management of the emergency procedure and that they should consider the use of public appeals to conserve electricity usage.
- Member dispatchers notify governmental agencies, as applicable.
- Upon cancellation of this procedure:
  - Units that have not started should abort their start if possible.
  - Online units should return to following SCED basepoints as well as any regulation or reserve assignments.

### **Step 8 (Real-time):**

#### **Manual Load Dump Warning**

Issuance of this procedure will trigger a capacity **Performance Assessment Interval (PAI)** as detailed in *PJM Manual 18, PJM Capacity Market*.

The purpose of the Manual Load Dump Warning is to warn members of the increasingly critical condition of present operations that may require manually shedding load.. It is issued when 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 reserve. The amount of load and the location of areas(s) are specified.

#### **PJM Actions**

- PJM Dispatch issues the warning to members and PJM management, stating the estimated amount of load relief that is required (if applicable). A Warning can be issued for the entire PJM RTO or for specific Control Zone(s) based on the projected location of transmission constraints.
- PJM Dispatch notifies PJM public information personnel.
- PJM Dispatch notifies FERC via the FERC Division of Reliability's email [emergency@FERC.gov](mailto:emergency@FERC.gov), consistent with FERC Order No. 659.

- PJM Dispatch issues a NERC Energy Emergency Alert Level 3 (EEA3 = ALERT LEVEL 3) via the RCIS to ensure all Reliability Authorities clearly understand potential and actual level of PJM System Emergencies. An EEA 3 is issued when the BA is unable to meet minimum Contingency Reserve Requirements.
- PJM Dispatch establishes a mutual awareness with the appropriate member dispatchers of the need to address the occurrence of a serious contingency with minimum delay.
- PJM Dispatch examines bulk power bus voltages and alerts the appropriate member dispatchers of the situation.
- PJM dispatcher cancels the Warning, when appropriate.

### **PJM Member Actions**

- Transmission / Generation dispatchers notify management of the warning.
- Transmission dispatchers notify governmental agencies, as applicable.
- Transmission / Generation dispatchers advise all station and key personnel.
- Transmission dispatchers / DPs review local procedures and prepare to shed load in the amount requested.
- Transmission dispatchers / 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.
- Transmission Owner may coordinate with BtMG facility interconnected to the transmission system, or through the relevant electric distribution utility, during expected prolonged emergency load dump/shed or as otherwise necessary to help mitigate a grid emergency. As BtMG facilities do not participate in the wholesale energy market, any request to operate for the purpose of helping to mitigate a wholesale market issue is on a voluntary basis at the discretion of the BtMG owner. Any request to operate to mitigate a wholesale market issue will be communicated to the BtMG as a voluntary request at the discretion of the BtMG owner. Refer to Manual 14D Appendix A for more information regarding BtMG.

### **Step 9 (Real-time):**

#### **Voltage Reduction Action**

Issuance of this procedure will trigger a capacity **Performance Assessment Interval (PAI)** as detailed in *PJM Manual 18, PJM Capacity Market*.

The purpose of Voltage Reduction during capacity deficient conditions is 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. It is implemented when load relief is still needed to maintain tie schedules. The lead times needed to implement the voltage reduction vary by TO and are listed in the [Voltage Reduction Summary Table](#).

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

## **PJM Actions**

- PJM Dispatch notifies PJM management, PJM public information personnel, and members. PJM dispatcher advises members to consider the use of public appeals to conserve electricity usage. PJM dispatcher notifies outside systems through the RCIS. PJM Dispatch notifies DOE. An Action can be issued for the entire PJM RTO, specific Control Zone(s) or a subset of a Control Zone if transmission limitations exist.
- PJM Management may issue system-wide or Control Zone-specific Public/Media Notification Message W2. See [Attachment A](#).
- PJM Dispatch investigates loading of shared reserves with neighboring systems prior to implementation of a voltage reduction, recognizing the impact on transmission limits.
- PJM Dispatch issues the order for a 5% Voltage Reduction Action.

See [Voltage Reduction Summary Table](#) above for known exceptions to 5% Voltage Reduction Action.

- PJM Dispatch issues a NERC Energy Emergency Alert Level 2 or Level 3 via the RCIS to ensure all Reliability Authorities clearly understand potential and actual PJM system emergencies if one has not already been issued concurrent with the issuance of Active Load Management Curtailables / Full Emergency Load Response (formerly known as ALM).
  - NERC EEA2 is issued when the following has occurred: Public appeals to reduce demand, voltage reduction, and interruption of non-firm load in accordance with applicable contracts, demand side management/active load management, or utility load conservation measures.
  - NERC EEA3 is issued when the BA is unable to meet minimum Contingency Reserve Requirements.
- If it has not already begun, the PJM Dispatch will initiate Shortage Pricing if the region where the voltage reduction action has been initiated corresponds with an entire Synchronized Reserve Zone or Sub-Zone.
- PJM dispatcher cancels the Action, when appropriate.

## **PJM Member Actions**

- Transmission / Generation dispatchers notify management of the emergency procedure and to consider the use of public appeals to conserve electricity usage.
- Member Transmission dispatchers notify governmental agencies, as applicable.
- Member Transmission dispatchers / DPs take steps to implement the voltage reduction.

## **Step 10 (Real-time):**

### **Manual Load Dump Action**

Issuance of this procedure will trigger a capacity **Performance Assessment Interval (PAI)** as detailed in *PJM Manual 18, PJM Capacity Market*.

The Manual Load Dump Action is an Operating Instruction from PJM to shed firm load when the PJM RTO cannot provide adequate capacity to meet the PJM RTO's load and tie schedules, or

critically overloaded transmission lines or equipment cannot be relieved in any other way. Under capacity deficient conditions, the PJM EMS load dump allocation calculator was modified to institute changes to the [Operating Agreement](#) set forth in Schedule 1, Section 1.7.11 that states that “...the Office of Interconnection may not order a manual load dump in a Control Zone solely to address capacity deficiencies in another Control Zone.”

The load shed calculation determines which Control Zone(s) is short based on real-time load and energy values from EMS and capacity values received daily from the Capacity Adequacy Planning Department. Real-time energy values are used as a surrogate for available capacity, because in a capacity shortage situation all available generation should be loaded to full capacity. Since most of the values used in the load shed calculation are real-time dynamic numbers, the calculation is performed in the PJM EMS. Load Serving Entities will be able to designate within eCapacity that capacity resources are being used to serve load in a specific Control Zone. Similarly ExSchedule users will be able to specify that an external energy schedule is designated for a specific Control Zone. Resources that are not designated for a specific Control Zone will be considered an RTO resource for load shed calculation purposes and allocated across all Control Zones according to load ratio share. Only Control Zones that are determined to be deficient will be assigned a share of a load shed request initiated due to RTO capacity deficiencies. If the PJM Mid-Atlantic Region is determined to be deficient, its share will be further allocated according to [Attachment E](#).

#### **PJM Actions**

- PJM Dispatch verifies separations have not occurred and load shed is desirable on the system being controlled (i.e., make sure load shed will help, not aggravate the condition).
- PJM Dispatch instructs members to suspend all remaining regulation, if not already suspended previously.
- PJM Dispatch determines which Control Zone (s) are capacity deficient and the relative proportion of deficiency. PJM Dispatch estimates the total amount of load to be dumped and utilizes the PJM EMS to determine deficient Control Zones and their share of load shed required.
- PJM Dispatch orders the appropriate member dispatchers to shed load according to PJM EMS calculations. The PJM Mid-Atlantic Region share will be further allocated according to [Attachment E](#). PJM Dispatch will implement load shedding, while minimizing overlap with automatic load shedding, in controlled step sizes to minimize system impact and further uncontrolled separation.
- PJM Dispatch notifies PJM management, PJM public information personnel, and members. PJM Dispatch advises members to consider the use of public appeals to conserve electricity usage and public announcements of the emergency. PJM Dispatch notifies other Control Areas through the RCIS, and notifies DOE, FEMA, and NERC offices, using established procedures.
- PJM Dispatch notifies FERC via the FERC Division of Reliability’s email [emergency@FERC.gov](mailto:emergency@FERC.gov), consistent with FERC Order No. 659.

- PJM Dispatch issues a NERC Energy Emergency Alert Level 3 (EEA3 = ALERT LEVEL 3) via the RCIS to ensure all Reliability Authorities clearly understand potential and actual level of PJM System Emergencies.
- PJM Management issues a system-wide or Control Zone specific Public/Media Notification Message W3. Typically, this would be issued prior to a Manual Load Dump. See [Attachment A](#).
- If it has not already begun, the PJM Dispatch will initiate Shortage Pricing if the region where the manual load shed action has been initiated corresponds with an entire Synchronized Reserve Zone or Sub-Zone.
- PJM Dispatch cancels the Action, when appropriate.

If partial restoration of the load shed is requested by PJM dispatcher, confirmation of the load restored by each member must be made prior to further restoration requests by PJM dispatcher. If step 1 of UFLS is insufficient to return frequency to acceptable ranges and if emergency procedures cannot be implemented in a timely fashion then PJM Dispatch shall shed sufficient load to restore system frequency.

#### **PJM Member Actions**

- Generation dispatchers suspend remaining regulation, when directed by PJM prior to shedding load.
- Transmission dispatchers / DPs shed an amount of load equal to or in excess of the amount requested by PJM dispatcher (Mid-Atlantic Region operators refer to [Attachment E](#) for specific allocation) within 5 minutes of the issued directive. The load shed plan should consider/recognize priority/critical load.
- Transmission / Generation dispatchers notify management of the emergency procedure.
- Transmission dispatchers / DPs consider the use (or continued use) of public appeals to conserve electricity usage and consider the use of public announcements of the emergency.
- Transmission dispatchers notify governmental agencies, as applicable.
- Transmission dispatchers / DPs maintain the requested amount of load relief until the load shed order is cancelled by PJM dispatcher.
- Transmission Owner may coordinate with BtMG facility interconnected to the transmission system, or through the relevant electric distribution utility, during expected prolonged emergency load dump/shed or as otherwise necessary to help mitigate a grid emergency. As BtMG facilities do not participate in the wholesale energy market, any request to operate for the purpose of helping to mitigate a wholesale market issue is on a voluntary basis at the discretion of the BtMG owner. Any request to operate to mitigate a wholesale market issue will be communicated to the BtMG as a voluntary request at the discretion of the BtMG owner. Refer to Manual 14D Appendix A for more information regarding BtMG.

Transmission dispatchers report the amount of load curtailed / restored upon implementation to the PJM Power Dispatcher.

PJM Dispatch should take necessary actions to support system frequency, consistent with good utility practices. These actions may include emergency procedures to arrest frequency decline, but PJM will not violate BAAL (Balancing Authority ACE Limit) limits by over-generating to correct for a low frequency. PJM shall only use the assistance provided by the Interconnection's frequency bias for the time needed to implement corrective actions. PJM will not unilaterally adjust generation in an attempt to return Interconnection frequency to normal beyond that supplied through frequency bias action and Interchange Schedule changes. In general, emergency procedures are preserved to ensure PJM net tie deviation is not adversely impacting system frequency after all economic options have been exhausted. However, Emergency Procedures should be exhausted, including Manual Load Dump, to arrest frequency decline once Under Frequency Load Shedding Schemes (UFLS) have triggered but prior to generating stations tripping off-line (57.5 Hz). Under-frequency Load Shedding Plan settings are defined in [Attachment F](#), "PJM Manual Load Dump Capacity."