Lesson Learned

Preventing Energy Emergency Alerts

Primary Interest Groups

Balancing Authorities (BAs)
Generator Owners (GOs)
Generator Operators (GOPs)
Reliability Coordinators (RCs)
Reserve Sharing Groups (RSGs)

Problem Statement

As several energy emergency alerts (EEAs) were issued over the course of several months, key items were identified that could have prevented the EEAs from being issued and, in some cases, prevented the BAs from unnecessarily shedding firm load to maintain system reliability.

Details[1]

Case 1

When temperatures were hotter than forecast and photovoltaic renewable resources were declining during the evening time frame, the RC declared an EEA-1 for BA 1 upon BA 1's request (see Figure 1). Around the same time, two generating units tripped off-line, totaling about 530 MW of generation.[2] This caused the RC to place BA 1 and another BA (BA 2) within the same RSG in an EEA-3. Since both BAs were a part of an RSG, they requested contingency reserve assistance from the other RSG members.

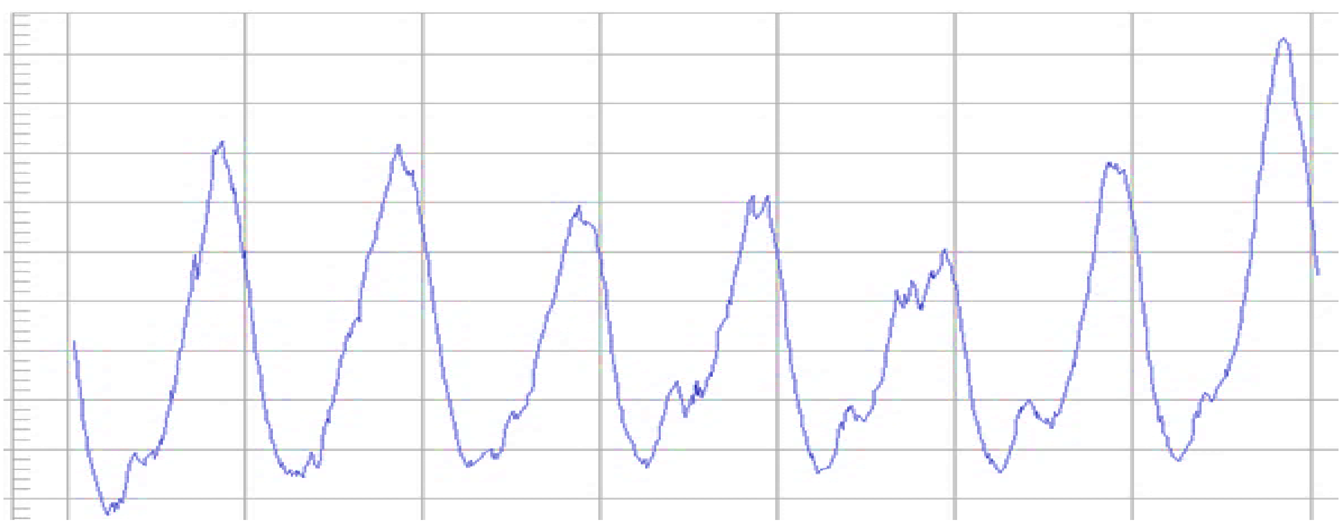

Figure 1: BA seven-day loading trend showing the demand on this day was higher than normal

[1] While reviewing the details, a review of BAL-002 EOP-011 Attachment 1 is recommended to understand the requirements of recovering Reporting ACE and the interactions with BAL-001 requirements.
[2] The two units together were less than the most severe single contingency (MSSC).

Issue 1:

While initiating the process for requesting contingency reserve assistance through the RSG automated computer program, the program's computer interface requires the system operator to use a pop-up display, fill out the information within the pop-up, and then submit the request before contingency reserve assistance is provided. As BA 1 submitted their request first, the program required BA 2 to acknowledge the request from BA 1 before they could finish submitting their request into the program. What was unknown at the time was that the program had an error, so when BA 2 submitted their request, the program did not credit BA 2 with the assistance they were already providing to BA 1. This was due to the pop-up display being filled out by BA 2 before they acknowledged the request from BA 1. As a result, the software glitch required BA 2 to provide approximately 200 MW of generation more than was needed for recovery of the RSG reporting area control error (ACE).

Issue 2:

As BA 2 was delivering contingency reserve due to the activation of the RSG program, about 60 MW of contingency reserve was not deployed due to a resource failure to start. Due to this issue, combined with the additional generation required, the ACE for BA 2 was not on track to recover to their required reporting ACE within 15 minutes. The BA 2 system operator on shift made the determination and informed the RC of his plan to shed 150 MW of firm load to help recover reporting ACE. As a result, the RC placed BA 2 into an EEA-3.

What was not known to the system operator at the time was that the two units tripped one minute and six seconds apart, so the resource loss was outside the one-minute threshold of a reportable balancing contingency event[3], making the requirement to recover the reporting ACE within 15 minutes not applicable per BAL-002[4].

Case 2

During the evening time frame when solar resources were declining, a 300 MW resource was lost. To meet the increasing load demand and recover from the loss of generation, the BA used generation from their contingency reserve obligation, causing the BA to go below their required levels by around 50% and placing them into an EEA-3.

Case 3

A wildland fire was threatening a major transmission corridor, and reduced available transfer capability (ATC) was imposed on the impacted transmission facilities. As the reduced ATC affected an RSG's ability to deliver contingency reserves to some of their member BAs, these BAs had to increase their required internal contingency reserves, causing one of them to request their RC to put them into an EEA. However, since this BA and others around them were still participating in the RSG, the contingency reserves from this zone was adequate to recover from the largest most severe single contingency (MSSC) within the affected zone. After the fact review per the RSG and the BA indicated the BA did not need to request an EEA.

[3] https://www.nerc.com/pa/Stand/Glossary%20of%20Terms/Glossary_of_Terms.pdf
[4] https://www.nerc.com/pa/Stand/Reliability%20Standards%20Complete%20Set/RSCompleteSet.pdf

Case 4
While load was increasing, a BA became deficient in meeting their required contingency reserves obligations and the RC declared an EEA-3 for the BA. As the BA was able to bring on additional generation to meet the demand, they investigated why they became deficient. It was discovered the BA always had enough generation; however, the BA's tool was not reporting all available generation reported to the system operators. (This condition was similar to Case 1, Issue 1)

Case 5
When a BA lost generation, they called on reserves from their RSG while dispatching their required generation. As the RSG members provided their requirement, the BA was unable to fulfill their required generation because some units that were requested to provide contingency reserve failed to startup. To recover the BA's reporting ACE to required levels within 15 minutes, the system operator shed approximately 100 MW of load. After investigating the event it was determined that since the BA was actively participating in an RSG and the amount of generation lost was less than the required amount to be a reportable balancing contingency event for the RSG, the system operator was not required to shed load per BAL-002 as the BA did not have to recover their reporting ACE within 15 minutes.

Corrective Actions

Case 1
BA 2 identified 73 corrective actions based on 29 findings from the event. These corrective actions included improvements to processes and tools, enhanced training, and improved communications and collaboration. Some of the more impactful corrective actions include the following:

- Improved Processes and tools
  - Units that are relied on for replacement reserves are now started on a weekly basis. As a result, starting performance has improved.
  - A new approach to determine generation replacement reserves is under development that will factor in a variety of factors, including increased outages, market dynamics, and variable generation.
  - Load forecasting improvements were identified, including a new load forecasting tool that is being used on a trial basis.
- Training Improvements
  - System operator training was updated enhancing a variety of topics including; three-part communication, implementing interruptible loads, responding to data integrity issues, timely classification of NERC reportable disturbances, and optimizing adjustments to the generation resource plan.
- Improved Communication and Collaboration
  - At the beginning of every shift, a daily status tailboard meeting has been implemented between System Operations and Supply & Trading to discuss electric system conditions, outages, resource risks and support system issues.

The vendor for the RSG automated computer program stated they were not aware of the issue with two simultaneous disturbances submitted by different participants. There was a temporary work-around quickly implemented that corrects this issue while the permanent enhancement is being developed. This permanent fix involves changing the way the calculation engine runs. (Software change also addressed **Case 4**)

Case 2

The corrective actions for this event were focused on the evening solar ramps. These were addressed in two phases:

- **Day ahead capacity assessment:** The entity creates a load forecast along with a high confidence band (load will come in somewhere between the high and low forecast). The capacity commitment was adjusted based on several criteria to ensure adequate resources to manage the evening solar ramp as well as recover from a system contingency.
- **Real Time Resource Management:** The entity is now coordinating with their thermal fleet to ensure units are positioned in the fastest ramp rate ranges before the start of the evening solar ramp. This ensures the resources committed in the day ahead process is fully available to help manage the evening ramp.

Case 3

The BA updated its energy management system displays and operating procedures to account for the available contingency reserve of all BAs in its RSG zone as the first condition of meeting contingency reserve obligation when there is no sufficient ATC for contingency reserve delivery from other RSG zones. Refresher training was also provided to the system operators.

Case 5

As a result of this event, the BA implemented improvements to procedures and business practices, new real-time situational awareness tools were developed and implemented, classroom and simulator training on EEA events was enhanced and implemented, and all system operators were reverified on tasks related to the event.

- Two new EMS real-time situational awareness tools were developed and implemented:
  - A single real-time EMS screen was developed to provide system operators with enhanced situational awareness during EEA event, including ACE, contingency reserves status (started, on-line, breaker open/closed, locked out, failed to start, etc.), load shed status (amount of load currently interrupted), RSG assistance (amount of assistance requested, ACE offset, temporary schedule), and N-1 import line schedules in vs contingency reserves.
  - A single trend display for N-1 import line schedules verses contingency reserves was developed and implemented.
- All system operators were retrained on potential capacity and energy management situations, RSG procedures, event reporting, DCS events, and events that are not DCS events. Retraining included joint practice sessions with the real-time energy procurement section.

Lesson Learned

- BAs that participate in an RSG need to understand when they are acting as a member of the RSG or as an independent BA. BAs in Case 1 and Case 5 dropped load per their individual limits but not per their RSG obligations. They were focusing on recovering their individual ACE. BAs that are a part of a RSG should provide periodic refresher training to their system operators to include the following:
  - The applicability of BAL-002, especially delineating when BAs are part of an RSG and when a BA acts as stand-alone BA
  - Using RSG procedures to determine when they are and are not considered an active member of the RSG
- RSGs should validate their programs for multiple contingency reserve activations at once to ensure the application being used does not miss prior contingency reserve activations. Any limitations of submitting multiple contingency reserve activations should be communicated to members and be included in training of the application.
- When a BA generates their load forecast, the capacity commitment should be adjusted based on several criteria to ensure they have adequate resources to manage the evening ramp of renewable resources as well as to recover from a reportable balancing contingency event.
- Forecast renewables so resources can be on-line and available to compensate for the ramp down of inverter-based resources and distributed energy resources[5]. See the *Essential Reliability Services Task Force Measures Framework Report*[6], Measure 6: Net Demand Ramping Variability. BAs should consider positioning their other generation and storage resources in the fastest ramp rate ranges before the start of the evening ramp for renewable resources. This ensures the resources committed in the day ahead process are fully available to help manage the evening ramp.
- BAs should have a process to validate that all available reserves are accounted for and properly displayed for the BA system operators to be aware of in case they need to be called upon.
- GOs/GOPs should consider testing their units that are not synchronized to the grid to ensure they can start up when called upon by their BA.

For additional resources, please see the *Capacity Awareness during an Energy Emergency Event* lessons learned[7].

Click here for: Lesson Learned Comment Form

For more Information please contact:

NERC – Lessons Learned (via email)	WECC Event Analysis
Source of Lesson Learned:	Western Electric Coordinating Council

[5] https://www.nerc.com/comm/PC/Documents/Summary_of_Activities_BPS-Connected_IBR_and_DER.pdf
[6] https://www.nerc.com/comm/Other/essntlrlbltysrvcstskfrcDL/ERSTF%20Framework%20Report%20-%20Final.pdf
[7] http://www.nerc.com/pa/rrm/ea/Lessons Learned Document Library/LL20120904_Capacity_Awareness_during_an_Energy_Emergency_Event.pdf

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