NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Proposed Resource Loss Protection Criteria

Background and Current Methodologies

The Resource Loss Protection Criteria (RLPC) is the respective Interconnection design resource loss in MW which is used to determine the Interconnection Frequency Response Obligation (IFRO).
An "N-2 Event" is defined as a single initiating event that leads to multiple (two or more) electrical facilities being removed from service. Examples of this are breaker failure events, bus faults, or double circuit tower outages.

Previously, the RLPC has been calculated from the largest N-2 event identified in each Interconnection, except for the Eastern Interconnection. In the Eastern Interconnection, the RLPC has been calculated using the largest single event in the previous ten years.

The RLPC value should be set for each Interconnection such that the underfrequency load shedding safety net is not activated for the largest N-2 Event. Previous BAL-003 IFRO methodology determined that the largest N-2 Event should not precipitate an underfrequency load shedding event. Ideally, the RLPC value should always equal or exceed the largest N-2 Event. If the RLPC is set to a larger value than the largest N-2 Event, the probability of an underfrequency load shedding event decreases. If the RLPC value is set to a value less than the largest N-2 Event, the probability of an underfrequency load shedding event increases. A quantitative approach to selecting the RLPC can be implemented that minimizes the need for detailed system analysis to be performed annually.

Currently, each Balancing Authority (BA) or Reserve Sharing Group (RSG) determines its Most Severe Single Contingency (MSSC) with respect to resource loss as required by BAL-002-2(i), Requirement R2. The MSSC calculation is done in Real-time operations based on actual system configuration.

Relevant Definitions

For convenience, the definitions of the following terms defined in the Glossary of Terms used in NERC Reliability Standards are provided below. Where a conflict exists between the definition provided here and the definition in the Glossary, the definition in the Glossary shall control.

Most Severe Single Contingency:
The Balancing Contingency Event, due to a single contingency identified using system models maintained within the RSG or a BA's area that is not part of a RSG, that would result in the greatest loss (measured in Megawatt (MW) of resource output used by the RSG or a BA that is not participating as a member of a RSG at the time of the event to meet Firm Demand and export obligation (excluding export obligation for which Contingency Reserve obligations are being met by the Sink Balancing Authority).

Balancing Contingency Event:
Any single event described in Subsections (A), (B), or (C) below, or any series of such otherwise single events, with each separated from the next by one minute or less.

A. Sudden loss of generation:
   a. Due to:
      i. unit tripping, or
      ii. loss of generator Facility resulting in isolation of the generator from the Bulk Electric System or from the responsible entity's System, or
      iii. sudden unplanned outage of transmission Facility.
   b. And that causes an unexpected change to the responsible entity's Area Control Area (ACE).

B. Sudden loss of an Import, due to forced outage of transmission equipment that causes an unexpected imbalance between generation and Demand on the Interconnection.

C. Sudden restoration of a Demand that was used as a resource that causes an unexpected change to the responsible entity's ACE.

Interconnection:
A geographic area in which the operation of Bulk Power System components is synchronized such that the failure of one or more of such components may adversely affect the ability of the operators of other components within the system to maintain Reliable Operation of the Facilities within their control. When capitalized, any one of the four major electric system networks in North America: Eastern, Western, ERCOT and Quebec.

Proposal

The Interconnection RLPC is calculated based on a resource loss in accordance with the following process:

- Each BA shall annually determine its two largest MSSC values in a normal system configuration (N-0). (An abnormal system configuration is not used to determine the RLPC.)
- Remedial Action Scheme (RAS) resource loss which is initiated by a single (N-1) contingency event needs to be included in this determination.
- RAS resource loss which is initiated by a multiple (N-2) contingency event needs to be included in this evaluation (RLPC cannot be lower than this value).
- Each BA then submits its two largest resource losses (MSSC1, MSSC2) used to determine its MSSC for a normal (N-0) system configuration using its FRS Form 1. The data is to include:
  - Initiating event, and
  - Megawatt (MW) loss.
- FRS Form 1 data is compiled by NERC for each Interconnection.

- For each Interconnection, the two largest single contingency (N-1) MSSC values are summed to become the Interconnection RLPC.
- If N-2 RAS resource loss for the Interconnection exceeds the RLPC calculated above, then the N-2 RAS resource loss becomes the Interconnection RLPC.

The calculated RLPC should meet or exceed any credible N-2 resource loss event.

For a hypothetical four-BA Interconnection, Plant 1, in BA1, has two generators rated at 1200 MW each. Plant 2, in BA2 has a generator rated at 1400 MW. BA2's next largest contingency is 1000 MW. The two largest resource losses for BA3 and BA4 are listed below.

BA1	MSSC1 = 1200 MW	MSSC2 = 1200 MW	Both MSSCs at Plant 1
BA2	MSSC1 = 1400 MW	MSSC2 = 1000 MW	Electrically separate MSSCs
BA3	MSSC1 = 1000 MW	MSSC2 = 800 MW	Electrically separate MSSCs
BA4	MSSC1 = 1500 MW (DC TIE)	MSSC2 = 500 MW	Electrically separate MSSCs

The ERO would apply the RLPC selection methodology described above to determine the RLPC for the Interconnection. Using this methodology, results in the following:

Interconnection MSSC1 = 1500 MW	Largest MSSC of the four BA's
Interconnection MSSC2 = 1400 MW	Largest remaining MSSC of the four BA's
Interconnection RLPC = 2900 MW	Summation of two largest resource losses
Interconnection Largest N-2 event	2400 MW at BA1's Plant 1

If an N-2 Event was applied, the RLPC for the Interconnection would be 2400 MW. The summation of MSSCs will exceed, but never fall short of, the N-2 Event scenario.

In order to evaluate RAS resource loss, single (N-1) and multiple (N-2) contingency events should be evaluated. Hypothetically, in an Interconnection:

BA1 RAS = 2850 MW N-2 RAS event
BA1 MSSC1 = 1150 MW
BA1 MSSC2 = 800 MW
BA2 MSSC1 = 1380 MW
BA2 MSSC2 = 1380 MW
BA3 RAS = 1000 MW N-1 RAS event
BA3 MSSC1 = 800 MW
BA3 MSSC2 = 700 MW

In this case, the summation of the two largest MSSCs are 2760 MW. However, the N-2 RAS event results in an RAS resource loss of 2850 MW. In this case, the N-2 event exceeds the summation of the two largest single contingency events. Therefore, the RLPC is the N-2 RAS event, or 2850 MW.

North American Interconnection RPLC Values

Based on initial review, the numbers below are believed to be representative of the RLPC for each Interconnection.

Eastern Interconnection:
Present RLPC = 4500 MW Load Credit = 0 MW
MSSC1 = 1732 MW
MSSC2 = 1477 MW
Proposed RLPC = 3209 MW

Western Interconnection:
Present RLPC = 2626 MW Load Credit = 120 MW
MSSC1 = 1505 MW
MSSC2 = 1344 MW
N-2 RAS = 2850 MW
Proposed RLPC = 2850 MW

ERCOT:
Present RLPC = 2750 MW Load Credit = 1209 MW
MSSC1 = 1375 MW
MSSC2 = 1375 MW
Proposed RLPC = 2750 MW

Quebec Interconnection:
Present RLPC = 1700 MW Load Credit = 0 MW
MSSC1 = 1000 MW
MSSC2 = 1000 MW
Proposed RLPC = 2000 MW