

**NERC**

NORTH AMERICAN ELECTRIC  
RELIABILITY CORPORATION

# BAL-002-2 – Contingency Reserve for Recovery from a Balancing Contingency Event Standard Background Document

February 2013

**RELIABILITY | ACCOUNTABILITY**



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# Table of Contents

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Contents

Table of Contents ..... 2

Introduction ..... 3

Background ..... 3

Rationale by Requirement ..... 4

    Requirement 1 ..... 4

    Requirement 2 ..... 4

## Introduction

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The revision to NERC Policy Standards in 1996 created a Disturbance Control Standard (DCS). They replaced B1 (Area Control Error (ACE) to zero in 10 minutes following a disturbance) and B2 (ACE must start to return to zero in 1 minute following a disturbance) with a standard that states: ACE must return to either zero or a pre-disturbance value of ACE within 15-minutes following a reportable disturbance. Balancing Authorities are required to report all disturbances equal to or greater than 80% of the Balancing Authority's most severe single contingency.

BAL-002 was created to replace portions of Policy .It measures the ability of an applicable entity to recover from a reportable event with the deployment of reserve. The reliable operation of the interconnected power system requires that adequate generating capacity be available at all times to maintain scheduled frequency and avoid loss of firm load following loss of transmission or generation contingencies. This generating capacity is necessary to replace generating capacity and energy lost due to forced outages of generation or transmission equipment.

This document provides background on the development and implementation of BAL-002-2 - Contingency Reserve for Recovery from a Balancing Contingency Event. This document explains the rationale and considerations for the requirements and their associated compliance information. BAL-002-2 was developed to fulfill the NERC Balancing Authority Controls (Project 2007-05) Standard Authorization Request (SAR), which includes the incorporation of the FERC Order 693 directives. The original SAR, approved by the industry, presumes there is presently sufficient contingency reserve in all the North American Interconnections. The underlying goal of the SAR was to update the standard to make the measurement process more objective and to provide information to the Balancing Authority or Reserve Sharing Group, such that the parties would better understand the use of Contingency Reserve to balance resources and demand following a Reportable Contingency Event. Currently, the existing BAL-002-1 standard contains Requirements specific to a Reserve Sharing Group which the drafting team believes are commercial in nature and is a contractual arrangement between the reserve sharing group parties. BAL-002-2 is intended to measure the successful deployment of contingency reserve by responsible entities. Relationships between the entities should not be part of the performance requirements, but left up to a commercial transaction.

Clarity and specifics are provided with several new definitions. Additionally, the BAL-002-2 eliminates any question on who is the applicable entity and assures the applicable entity is held responsible for the performance requirement. The drafting team's goal was to have BAL-002-2 solely a performance standard. The primary objective of BAL-002-2 is to assure the applicable entity balances resources and demand and returns its Area Control Error to defined values (subject to applicable limits) following a Reportable Balancing Contingency Event.

## Background

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This section discusses the new definitions associated with BAL-002-2.

### **Balancing Contingency Event**

The purpose of BAL-002-2 is to ensure the Balancing Authority or Reserve Sharing Group balance resources and demand by returning its Area Control Error to defined values following a Reportable Balancing Contingency Event.

The drafting team included a specific definition for a Balancing Contingency Event to eliminate any confusion and ambiguity. The prior version of BAL-002 was broad and could be interpreted in various manners leaving the ability to measure compliance up to the eye of the beholder. By including the specific definition, it allows the Responsible Entity to fully understand how to perform and meet compliance. Also, FERC Order 693 (at P355) directed entities to include a Requirement that measures response for any event or contingency that causes a frequency deviation. By developing a specific definition that depicts the events causing an unexpected change to the Responsible Entity's ACE, and the necessary requirements assures FERC's requirement is met.

### **Most Severe Single Contingency**

The Most Severe Single Contingency (MSSC) term has been widely used within the industry, however, it has never been defined. In order to eliminate a wide range of definitions, the drafting team has included a specific definition designed to fulfill the needs of the standard. In addition, in order to meet FERC Order No. 693 (at P356), to develop a continent-wide contingency reserve policy, it was necessary to establish a definition for MSSC.

### **Contingency Reserve**

Most system operators generally have a good understanding of the need to balance resources and demand and return its Area Control Error to defined values following a Reportable Balancing Contingency Event. However, the existing contingency reserve definitions primarily focused on generation and not demand side management. In order to meet FERC Order No. 693 (at P 356) to include a Requirement that explicitly allows demand-side management (DSM) to be used as a resource for contingency reserve, the drafting team elected to expand the definition of Contingency Reserve to explicitly include capacity associated with demand side management.

Additionally, conflict existed between BAL-002 and EOP-002 as to when an entity could deploy its contingency reserve. To eliminate the conflict and to assure BAL-002 and EOP-002 work together and complimented each other, the drafting team clarified the existing definition of Contingency Reserve.

### **Reserve Sharing Group Reporting ACE**

The drafting team elected to include this definition to provide clarity for measurement of compliance for the appropriate Responsible Entity.

### **Other Definitions**

Other definitions have been added or modified to assure clarification within the standard and requirements.

## **Rationale by Requirement**

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### **Requirement 1**

Except when an Energy Emergency Alert Level 2 or Level 3 is in effect, the Responsible Entity experiencing a Reportable Balancing Contingency Event shall demonstrate that within the Contingency Event Recovery Period the Responsible Entity returned its ACE to:

- Zero, (if its Pre-Reportable Contingency Event ACE was positive or equal to zero),
  - less the sum of the magnitudes of all subsequent Balancing Contingency Events that occur within the Contingency Event Recovery Period, and
  - further reduced by the magnitude of the difference between (i) the Responsible Entity's Most Severe Single Contingency (MSSC) and (ii) the sum of the magnitudes of the Reportable Balancing Contingency Event and all previous Balancing Contingency Events that have not completed their Contingency Reserve Restoration Period when the sum referenced in clause (ii) of this bullet is greater than MSSC,
- , or
- Its Pre-Reportable Contingency Event ACE Value, (if its Pre-Reportable Contingency Event ACE was negative),
  - less the sum of the magnitudes of all subsequent Balancing Contingency Events that occur within the Contingency Event Recovery Period, and

further reduced by the magnitude of the difference between (i) the Responsible Entity's Most Severe Single Contingency (MSSC) and (ii) the sum of the magnitudes of the Reportable Balancing Contingency Event and all previous Balancing Contingency Events that have not completed their Contingency Reserve Restoration Period when the sum referenced in clause (ii) of this bullet is greater than MSSC

### ***Background and Rationale***

Requirement R1 reflects the operating principles first established by NERC Policy 1. Its objective is to assure the Responsible Entity balances resources and demand and returns its Area Control Error (ACE) to defined values (subject to applicable limits) following a Reportable

Balancing Contingency Event. It requires the Responsible Entity to recover from events that would be less than or equal to the Responsible Entity's MSSC. It establishes a ceiling for the amount of Contingency Reserve and timeframe the Responsible Entity must demonstrate in a compliance evaluation. It is intended to eliminate the ambiguities and questions associated with the existing standard. In addition, it allows Responsible Entity(s) to have a clear way to demonstrate compliance and support the Interconnection to the full extent of MSSC.

By including new definitions, and modifying existing definitions, and the above R1, the drafting team believes it has successfully fulfilled the requirements of FERC Order No. 693 (at P 356) to include a Requirement that explicitly allows DSM to be used as a resource for contingency reserve. It also recognizes that the loss of transmission as well as generation may require the deployment of contingency reserve.

Additionally, R 1 is designed to assure the applicable entity must use reserve to cover a Balancing Contingency Event or the combination of any previous Balancing Contingency Events that have occurred within the specified period, to address the Order's concern that the applicable entity is responding to events and performance is measured. The Reportable Balancing Contingency Event definition, along with R1 allows for measurement of performance.

The drafting team used data supplied by Consortium for Electric Reliability Technology Solutions (CERTS) to help determine all events that have an impact on frequency. Data that was compiled by CERTS to provide information on measured frequency events is presented in Attachment 1. Analyzing the data, one could demonstrate events of 100 MW or greater would capture all frequency events for all interconnections. However, at a 100 MW reporting threshold, the number of events reported would significantly increase with no reliability gain since 100 MW is more reflective of the outlying events, especially on larger interconnections.

The goal of the drafting team was to design a continent-wide standard to capture the majority of the events that impact frequency. Reviewing the data, the drafting team concluded, based on the median, to establish a single continent-wide standard. Thus, some interconnections may report more events and some would report less. To assure the requirements of the FERC Order No. 693 were met, the drafting team decided to capture the majority of the events having a significant impact on frequency; the reportable threshold was selected as the lesser of 80% of the applicable entity(s) Most Severe Single Contingency or 500 MW.

### **Violation Severity Levels**

In the Violation Severity Levels for Requirement R1, the impact of the Responsible Entity recovering from a Reportable Balancing Contingency Event depends on the amount of its Contingency Reserve available and does it have sufficient response. The VSL takes these factors into account.

### **Compliance Calculation**

To determine compliance with R1, the required contingency reserve response and measured contingency reserve response are computed and compared as follows (assuming all resource loss values, i.e. Balancing Contingency Events, are positive):

- The required contingency reserve response equals the lesser of the megawatt loss of the Reportable Balancing Contingency Event, and, the Most Severe Single Contingency minus the sum of the megawatt losses of any previous Balancing Contingency Events whose start preceded the start of the Reportable Balancing Contingency Event by less than the sum of the Contingency Event Recovery Period and Contingency Reserve Restoration Period.
- The measured contingency reserve response is equal to one of the following:
  - If the Pre-Reportable Contingency Event ACE Value is greater than or equal to zero, then the measured contingency reserve response equals (a) the megawatt value of the Reportable Balancing Contingency Event plus (b) the most positive ACE value within its Contingency Event Recovery Period (and following the occurrence of the last subsequent event, if any) plus (c) the sum of the megawatt losses of subsequent Balancing Contingency Events occurring within the Contingency Event Recovery Period of the Reportable Balancing Contingency Event.
  - If the Pre-Reportable Contingency Event ACE Value is less than zero, then the measured contingency reserve response equals (a) the megawatt value of the Reportable Balancing Contingency Event plus (b) the most positive ACE value within its Contingency Event Recovery Period (and following the occurrence of the last subsequent event, if any) plus (c) the sum of the megawatt losses of subsequent Balancing Contingency Events occurring within the Contingency Event Recovery Period of the Reportable Balancing Contingency Event, minus (d) the Pre-Reportable Contingency Event ACE Value.
- Compliance is computed as follows on CR Form 1 in order to document all Balancing Contingency Events used in compliance determination:
  - If the required contingency reserve response is less than or equal to zero, then the Reportable Balancing Contingency Event Compliance equals 100 percent.
  - If the required contingency reserve response is greater than zero,
    - and the measured contingency reserve response is greater than or equal to the required contingency reserve response, then the Reportable Balancing Contingency Event Compliance equals 100 percent.
    - and the measured contingency reserve response is less than or equal to zero, then the Reportable Balancing Contingency Event Compliance equals 0 percent.
    - and the measured contingency reserve response is less than the required contingency reserve response but greater than zero, then

## Contingency Reserve for Recovery From a Balancing Contingency Event Standard Background Document

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the Reportable Balancing Contingency Event Compliance equals 100% \* (1 - ((required contingency reserve response - measured contingency reserve response) / required contingency reserve response)).

The above computations can be expressed mathematically in the following 7 sequential steps, labeled as [1-7], where:

ACE\_BEST – most positive ACE during the Contingency Event Recovery Period occurring after the last subsequent event, if any (MW)

ACE\_PRE - Pre-Reportable Contingency Event ACE Value (MW)

COMPLIANCE - Reportable Balancing Contingency Event Compliance percentage (0 - 100%)

MEAS\_CR\_RESP - measured contingency reserve response for the Reportable Balancing Contingency Event (MW)

MSSC – Most Severe Single Contingency (MW)

MW\_LOST - megawatt loss of the Reportable Balancing Contingency Event (MW)

REQ\_CR\_RESP – required contingency reserve response for the Reportable Balancing Contingency Event (MW)

SUM\_PREV - sum of the megawatt losses of any previous Balancing Contingency Events whose start precedes the start of the Reportable Balancing Contingency Event by less than the sum of the Contingency Event Recovery Period and Contingency Reserve Restoration Period (MW)

SUM\_SUBSQ - sum of the megawatt losses of subsequent Balancing Contingency Events occurring within the Contingency Event Recovery Period of the Reportable Balancing Contingency Event (MW)

REQ\_CR\_RESP = minimum of MW\_LOST, and, (MSSC - SUM\_PREV) [1]

If ACE\_PRE is greater than or equal to 0, then

MEAS\_CR\_RESP = MW\_LOST + ACE\_BEST + SUM\_SUBSQ [2]

If ACE\_PRE is less than 0, then

MEAS\_CR\_RESP = MW\_LOST + ACE\_BEST + SUM\_SUBSQ - ACE\_PRE [3]

If REQ\_CR\_RESP is less than or equal to 0, then COMPLIANCE = 100 [4]



If REQ\_CR\_RESP is greater than 0, and,

MEAS\_CR\_RESP is greater than or equal to REQ\_CR\_RESP, then

COMPLIANCE = 100 [5]

If REQ\_CR\_RESP is greater than 0, and, MEAS\_CR\_RESP is less than or equal to 0, then

COMPLIANCE = 0 [6]

If REQ\_CR\_RESP is greater than 0, and, MEAS\_CR\_RESP is greater than 0, and,

MEAS\_CR\_RESP is less than REQ\_CR\_RESP, then

COMPLIANCE =  $100 * (1 - ((REQ\_CR\_RESP - MEAS\_CR\_RESP) / REQ\_CR\_RESP))$  [7]

## Requirement 2

- R2.** Except during the Disturbance Recovery Period and Contingency Reserve Recovery Period, or during an Energy Emergency Alert Level 2 or 3, each Responsible Entity shall maintain an amount of Contingency Reserve at least equal to its Most Severe Single Contingency.

### ***Background and Rationale***

R2 establishes a uniform continent-wide contingency reserve requirement. R2 establishes a requirement that contingency reserve be at least equal to its Most Severe Single Contingency. By including a definition of Most Severe Single Contingency and R2, a consistent uniform continent-wide contingency reserve requirement has been established. Its goal is to assure that the Responsible Entity will have sufficient contingency reserve that can be deployed to meet R1.

FERC Order 693 (at P356) directed BAL-002 be developed as a continent-wide contingency reserve policy. R2 fulfills the requirement associated with the required amount of contingency reserve a Responsible Entity must have available to respond to a Reportable Balancing Contingency Event. Within FERC Order 693 (at P336) the Commission noted that the appropriate mix of operating reserve, spinning reserve and non-spinning reserve should be addressed. However, the Order predated the approval of the new BAL-003, which addresses frequency responsive reserve and the amount of frequency response obligation. With the development of BAL-003, and the associated reliability performance requirement, the drafting team believes that, with R2 of BAL-002 and the approval of BAL-003, the Commission's goals of a continent-wide contingency reserves policy is met. The suites of BAL standards (BAL-001, BAL-002, and BAL-003) are all performance-based. With the suite of standards and the specific

requirements within each respective standard, a continent-wide contingency policy is established.

In the Violation Severity Levels for Requirement R1, the impact of the Responsible Entity recovering from a Reportable Balancing Contingency Event depends on the amount of its Contingency Reserve available and does it have sufficient response. The VSL takes these factors into account.

# **Attachment 1**

## **NERC Interconnections 2009-2012**

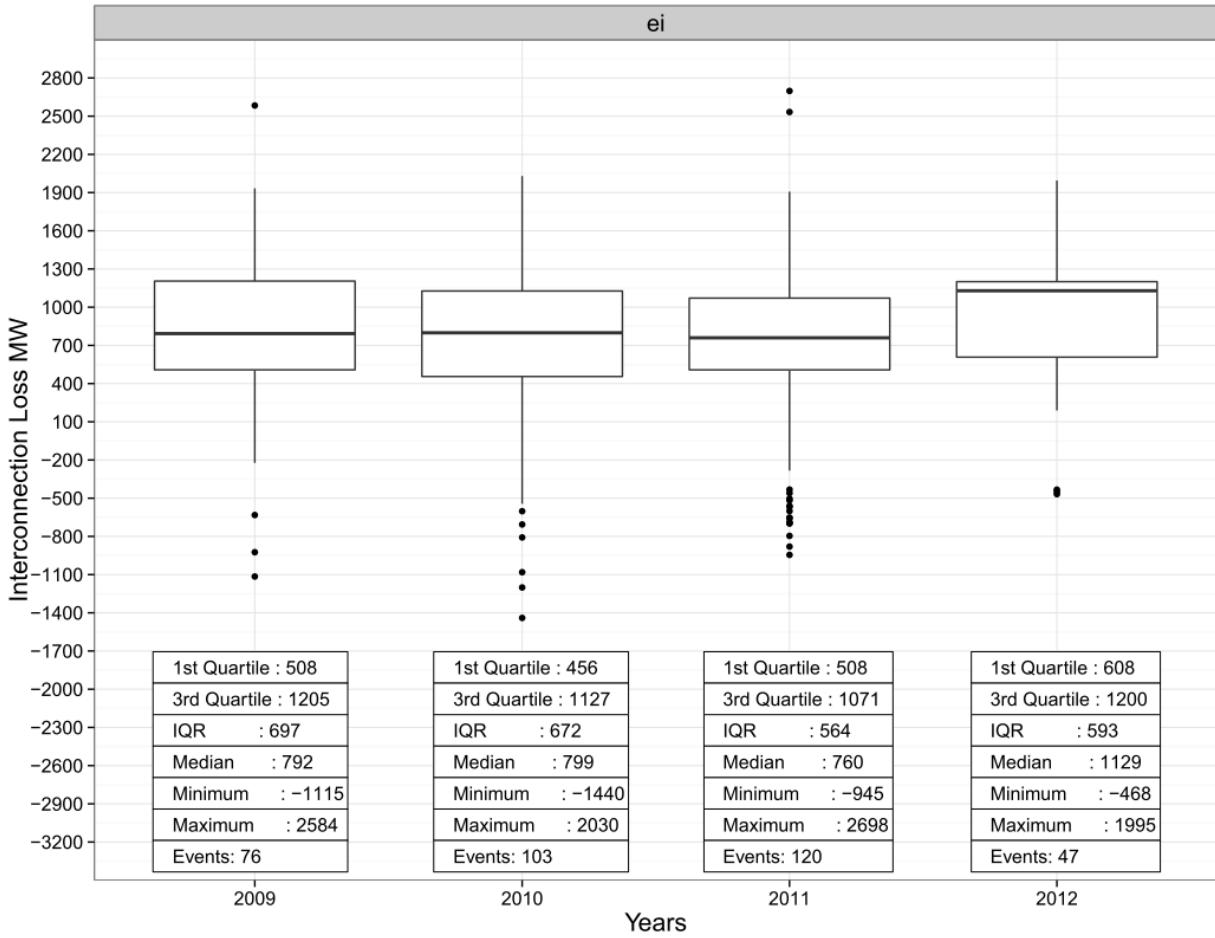
### **Frequency Events Loss MW Statistics**

For: NERC BARC Standard Drafting Team

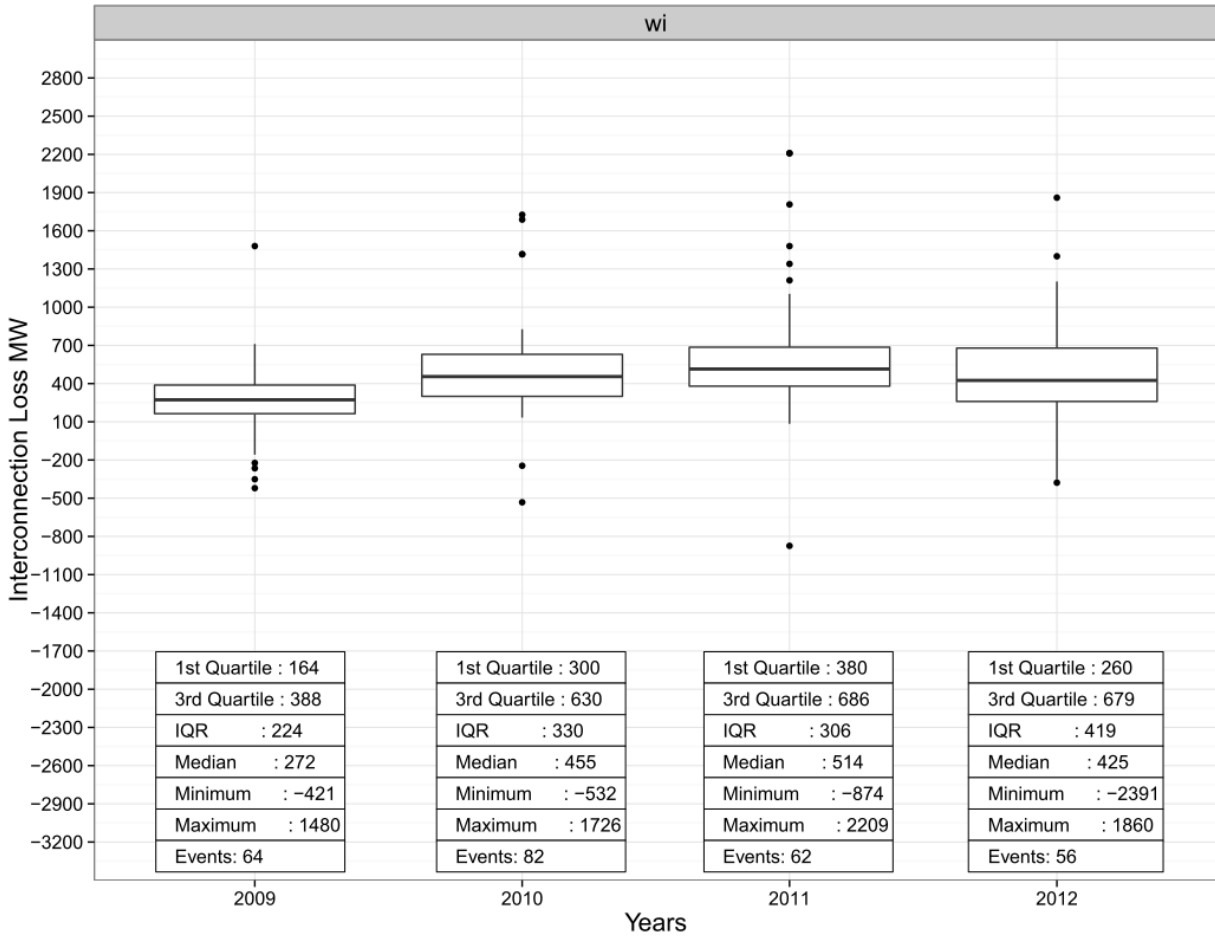
Prepared by: CERTS

Date: November 2, 2012

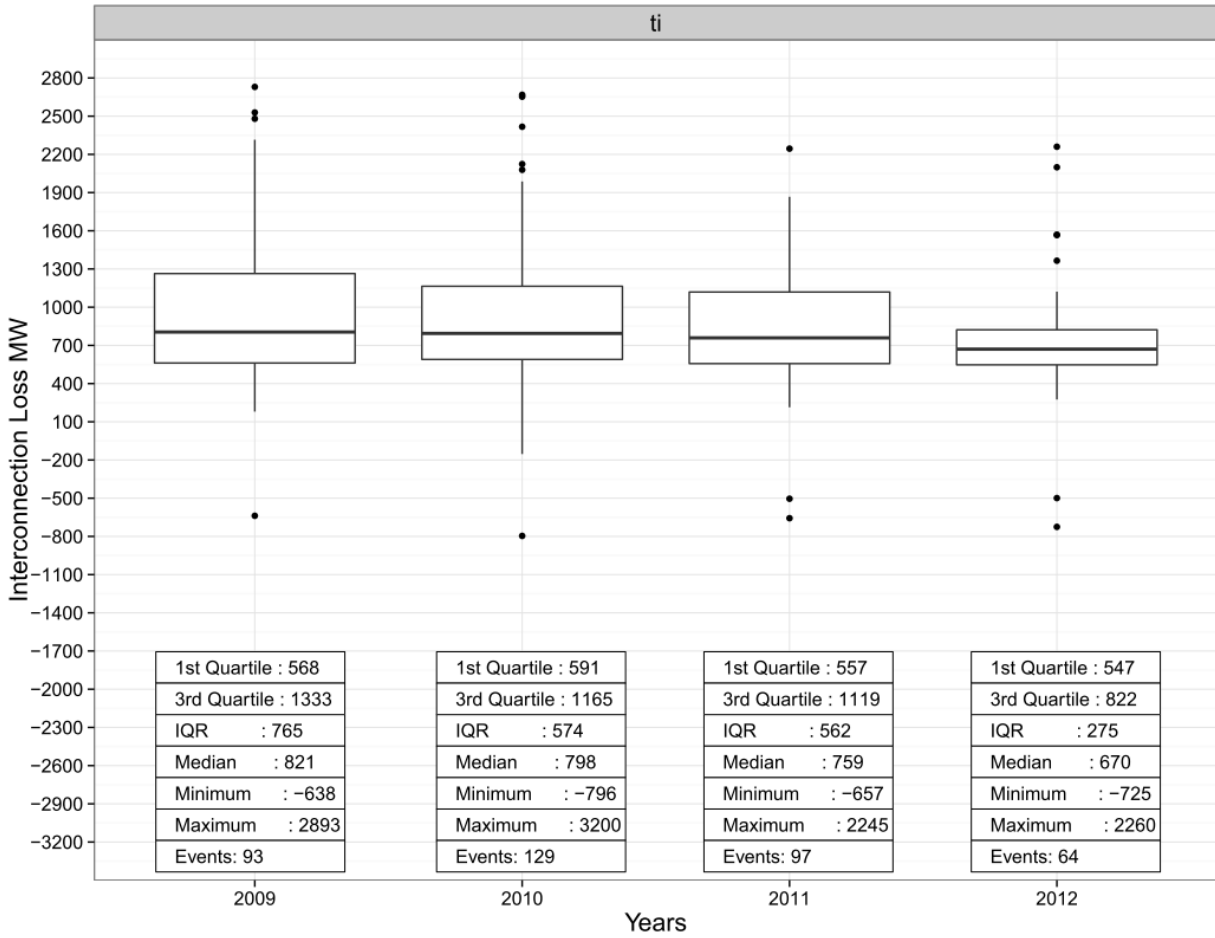
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