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NORTH AMERICAN ELECTRIC
RELIABILITY CORPORATION

BAL-001-1 – Real Power Balancing Control Performance Standard Background Document

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RELIABILITY | ACCOUNTABILITY



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Introduction

This document provides background on the development, testing, and implementation of BAL-001-1 - Real Power Balancing Control Standard. The intent is to explain the rationale and considerations for the requirements and their associated compliance information.

The original work for this standard was done by the Balancing Authority Controls standard drafting team, which later joined with the Reliability-based Control Standard drafting team. These combined teams were renamed Balance Authority Reliability-based Control standard drafting team (BARC SDT).

The purpose of proposed Standard BAL-001-1 is to maintain Interconnection frequency within predefined frequency limits. This draft standard defines Balancing Authority ACE Limit (BAAL), and required the Balancing Authority (BA) to balance its resources and demand in Real-time so that its clock-minute average of its Area Control Error (ACE) does not exceed its BAAL for more than 30 consecutive clock-minutes.

As a proof of concept for the proposed BAAL standard, a BAAL field trial was approved by the NERC Standards Committee and the Operating Committee. Currently participating in the field trial are 13 Balancing Authorities in the Eastern Interconnection, 26 Balancing Authorities in the Western Interconnection, the ERCOT Balancing Authority, and Quebec. Reliability Coordinators for all Interconnections continue to monitor the performance of those participating Balancing Authorities and provide information to support monthly analysis of the BAAL field trial. As of the end of September 2011, no reliability issues with the BAAL field trial have been identified by any Reliability Coordinator.

Historical Significance

A1-A2 Control Performance Policy was implemented in 1973 as:

- A1 required the Balancing Authority's ACE to return to zero within 10 minutes of previous zero.
- A2 required that the Balancing Authority's averaged ACE for each 10-minute period must be within limits.
- A1-A2 had three main short comings:
 - Lack of theoretical justification
 - Large ACE treated the same as a small ACE, regardless of direction
 - Independent of Interconnection frequency

In 1996, a new NERC policy was approved which used CPS1, CPS2, and DCS.

CPS1 is a:

- Statistical measure of ACE variability
- Measure of ACE in combination with the Interconnection's frequency error

- Based on an equation derived from frequency-based statistical theory

CPS2 is:

- Designed to limit a Control Area's (now known as a Balancing Authority) unscheduled power flows
- Similar to the old A2 criteria

The proposed BAL-001-1 retains CPS1, but proposes a new measure BAAL. Currently CPS2:

- Does not have a frequency component.
- CPS2 many times give the Balancing Authority the indication to move their ACE opposite to what will help frequency.
- Requires Balancing Authorities to comply 90 percent of the time as a minimum.

Background and Rationale by Requirement

Requirement 1

R1. Each Balancing Authority shall operate such that the Balancing Authority's Control Performance Standard 1 (CPS1) (as calculated in Attachment 1) is greater than or equal to 100 percent for the applicable Interconnection in which it operates for each 12-month period, evaluated monthly, to support Interconnection frequency.

Background and Rationale

Requirement R1 is not a new requirement. It is a restatement of the current BAL-001-0.1a Requirement R1 with its equation and explanation of its individual components moved to an attachment, Attachment 1 - Equations Supporting Requirement R1 and Measure M1. This requirement is commonly referred to as Compliance Performance Standard 1 (CPS1). R1 is intended to measure how well a Balancing Authority is able to control its generation and load management programs, as measured by its Area Control Error (ACE), to support its Interconnection's frequency over a rolling one-year period.

CPS1 is a measure of a Balancing Authority's control performance as it relates to its generation, Load management, and Interconnection frequency when measured in one-minute averages over a rolling one-year period. If all Balancing Authorities on an Interconnection are compliant with the CPS1 measure, then the Interconnection will have a root mean square (RMS) frequency error less than the Interconnection's Epsilon 1.

A Balancing Authority reports its CPS1 value to its regional entity each month. This monthly value provides trending data to the Balancing Authority, NERC resources subcommittee, and others as needed to detect changes that may indicate poor control on behalf of the Balancing

Authority. Requirement R1 remains unchanged, although the wording of the requirement was modified to provide clarity.

Requirement 2

R2. Each Balancing Authority shall operate such that its clock-minute average of reporting ACE does not exceed for more than 30 consecutive clock-minutes its clock-minute Balancing Authority ACE Limit (BAAL) (as calculated in Attachment 2) for the applicable Interconnection in which it operates to support Interconnection frequency.

Background and Rationale

Requirement R2 is a new requirement intended to replace existing BAL-001-0.1a Requirement R2, commonly referred to as Control Performance 2 (CPS2). The proposed Requirement R2 is intended to enhance the reliability of each Interconnection by maintaining frequency within predefined limits under all conditions.

The Balancing Authority ACE Limits (BAAL) are unique for each Balancing Authority and provide dynamic limits for its Area Control Error (ACE) value limit as a function of its Interconnection frequency. BAAL was derived based on reliability studies and analysis which defined a Frequency Trigger Limit (FTL) bound measured in Hz. The FTL is equal to 60 Hz, plus or minus three times an Interconnection's Epsilon 1 value. Epsilon 1 is the root mean square (RMS) targeted frequency error for each Interconnection, as recommended by the NERC Resources Subcommittee and approved by the NERC Operating Committee. Epsilon 1 values for each Interconnection are unique. When a Balancing Authority exceeds its BAAL, it is providing more than its share of risk that the Interconnection will exceed its FTL. When all Balancing Authorities are within their BAAL (high and low), the Interconnection frequency will be within its FTL limits.

BAAL is defined by two equations; BAAL low and BAAL high. BAAL low is for Interconnection frequency values less than 60 Hz, and BAAL high is for Interconnection frequency values greater than 60 Hz. BAAL values for each Balancing Authority are dynamic and change as Interconnection frequency changes. For example, as Interconnection frequency moves from 60 Hz, the ACE limit for each Balancing Authority becomes more restrictive. The BAAL provides each Balancing Authority a dynamic ACE limit that is a function of Interconnection frequency.

CPS2 was not designed to address Interconnection frequency. Currently, it measures the ability of a Balancing Authority to maintain its average ACE within a fixed limit of plus or minus a MW value called L_{10} . To be compliant, a Balancing Authority must demonstrate its average ACE value during a consecutive 10-minute period was within the L_{10} bound 90 percent of all 10-minute periods over a one-month period. While this standard does require the Balancing

Authority to correct its ACE to not exceed specific bounds, it fails to recognize Interconnection frequency. For example, the Balancing Authority may be increasing or decreasing generation to meet its CPS2 bounds, even if this is a direction that reduces reliability by moving Interconnection frequency farther from its scheduled value. CPS2 allows a Balancing Authority to be outside its ACE bounds 10 percent of the time. There are 72 hours per month that a Balancing Authority's ACE can be outside its L₁₀ limits and be compliant with CPS2.

In summary, the proposed BAAL requirement will provide dynamic limits that are Balancing Authority and Interconnection specific. These ACE values are based on identified Interconnection frequency limits to ensure the Interconnection returns to a reliable state when an individual Balancing Authority's ACE or Interconnection frequency deviates into a region that contributes too much risk to the Interconnection. This requirement replaces and improves upon CPS2, which is not dynamic, is not based on Interconnection frequency, and allows significant hours when a Balancing Authority's ACE values are unbounded.