

Implementation Plan

Reliability Standard BAL-005-1

Project 2010-14.2.1 Balancing Authority Reliability-based Controls

Requested Approval

- BAL-005-1 – Balancing Authority Controls

Requested Retirement

- BAL-005-0.2b – Automatic Generation Control

Prerequisite Approval

- FAC-001-3 – Facility Interconnection Requirements

Revisions to Glossary Terms

The following definitions shall become effective when BAL-005-1 becomes effective:

Actual Frequency (F_A): The Interconnection frequency measured in Hertz (Hz).

Actual Net Interchange (NI_A): The algebraic sum of actual megawatt transfers across all Tie Lines, including Pseudo-Ties, to and from all Adjacent Balancing Authority areas within the same Interconnection. Actual megawatt transfers on asynchronous DC tie lines that are directly connected to another Interconnection are excluded from Actual Net Interchange.

Scheduled Net Interchange (NI_s): The algebraic sum of all scheduled megawatt transfers, including Dynamic Schedules, to and from all Adjacent Balancing Authority areas within the same Interconnection, including the effect of scheduled ramps. Scheduled megawatt transfers on asynchronous DC tie lines directly connected to another Interconnection are excluded from Scheduled Net Interchange.

Interchange Meter Error (I_{ME}): A term used in the Reporting ACE calculation to compensate for data or equipment errors affecting any other components of the Reporting ACE calculation.

Automatic Time Error Correction (I_{ATEC}): The addition of a component to the ACE equation for the Western Interconnection that modifies the control point for the purpose of continuously paying back Primary Inadvertent Interchange to correct accumulated time error. Automatic Time Error Correction is only applicable in the Western Interconnection.

$$I_{ATEC} = \frac{PII_{accum}^{on/off\ peak}}{(1-Y)*H} \text{ when operating in Automatic Time Error Correction Mode.}$$

The absolute value of I_{ATEC} shall not exceed L_{max} .

I_{ATEC} shall be zero when operating in any other AGC mode.

- L_{max} is the maximum value allowed for I_{ATEC} set by each BA between $0.2*|B_i|$ and L_{10} , $0.2*|B_i| \leq L_{max} \leq L_{10}$.
- $L_{10} = 1.65 * \epsilon_{10} \sqrt{(-10B_i)(-10B_S)}$.
- ϵ_{10} is a constant derived from the targeted frequency bound. It is the targeted root-mean-square (RMS) value of ten-minute average frequency error based on frequency performance over a given year. The bound, ϵ_{10} , is the same for every Balancing Authority Area within an Interconnection.
- $Y = B_i / B_S$.
- H = Number of hours used to payback primary inadvertent interchange energy. The value of H is set to 3.
- B_i = Frequency Bias Setting for the Balancing Authority Area (MW / 0.1 Hz).
- B_S = Sum of the minimum Frequency Bias Settings for the Interconnection (MW / 0.1 Hz).
- Primary Inadvertent Interchange (PII_{hourly}) is $(1-Y) * (II_{actual} - B_i * \Delta TE/6)$
- II_{actual} is the hourly Inadvertent Interchange for the last hour.
 ΔTE is the hourly change in system Time Error as distributed by the Interconnection time monitor, where: $\Delta TE = TE_{end\ hour} - TE_{begin\ hour} - TD_{adj} - (t)*(TE_{offset})$
- TD_{adj} is the Reliability Coordinator adjustment for differences with Interconnection time monitor control center clocks.
- t is the number of minutes of manual Time Error Correction that occurred during the hour.
- TE_{offset} is 0.000 or +0.020 or -0.020.
- PII_{accum} is the Balancing Authority Area's accumulated PII_{hourly} in MWh. An On-Peak and Off-Peak accumulation accounting is required,
where:

$$PII_{accum}^{on/offpeak} = \text{last period's } PII_{accum}^{on/offpeak} + PII_{hourly}$$

Reporting ACE: The scan rate values of a Balancing Authority Area's (BAA) Area Control Error (ACE) measured in MW includes the difference between the Balancing Authority Area's Actual Net Interchange and its Scheduled Net Interchange, plus its Frequency Bias Setting obligation, plus correction for any known meter error. In the Western Interconnection, Reporting ACE includes Automatic Time Error Correction (ATEC).

Reporting ACE is calculated as follows:

$$\text{Reporting ACE} = (NI_A - NI_S) - 10B(F_A - F_S) - I_{ME}$$

Reporting ACE is calculated in the Western Interconnection as follows:

$$\text{Reporting ACE} = (NI_A - NI_S) - 10B(F_A - F_S) - I_{ME} + I_{ATEC}$$

Where:

- NI_A = Actual Net Interchange.
- NI_S = Scheduled Net Interchange.
- B = Frequency Bias Setting.
- F_A = Actual Frequency.
- F_S = Scheduled Frequency.
- I_{ME} = Interchange Meter Error.
- I_{ATEC} = Automatic Time Error Correction.

All NERC Interconnections with multiple Balancing Authority Areas operate using the principles of Tie-line Bias (TLB) Control and require the use of an ACE equation similar to the Reporting ACE defined above. Any modification(s) to this specified Reporting ACE equation that is(are) implemented for all BAAs on an Interconnection and is(are) consistent with the following four principles of Tie Line Bias control will provide a valid alternative to this Reporting ACE equation:

1. All portions of the Interconnection are included in exactly one BAA so that the sum of all BAAs' generation, load, and loss is the same as total Interconnection generation, load, and loss;
2. The algebraic sum of all BAAs' Scheduled Net Interchange is equal to zero at all times and the sum of all BAAs' Actual Net Interchange values is equal to zero at all times;
3. The use of a common Scheduled Frequency F_S for all BAAs at all times; and,

4. Excludes metering or computational errors. (The inclusion and use of the I_{ME} term corrects for known metering or computational errors.)

Automatic Generation Control (AGC): Centrally located equipment ~~Equipment~~ that automatically adjusts ~~resources generation~~ in a Balancing Authority Area ~~from a central location~~ to help maintain the Reporting ACE of a Balancing Authority's Area within the bounds required under the NERC Reliability Standards ~~interchange schedule plus Frequency Bias. AGC may also accommodate automatic inadvertent payback and time error correction.~~ Resources utilized under AGC may include, but not be limited to, conventional generation, variable energy resources, storage devices and loads acting as resources, such as Demand Response.

Applicable Entities

- Balancing Authority

Applicable Facilities

- N/A

Background

Reliability Standard BAL-005-1 addresses Balancing Authority Reliability-based Controls and establishes requirements for acquiring data necessary to calculate Reporting Area Control Error (Reporting ACE). Reliability Standard BAL-005-1 (Balancing Authority Controls) and associated Implementation Plan was developed in conjunction with FAC-001-3 to ensure that entities with facilities and Load operating in an Interconnection are within a Balancing Authority Area's metered boundaries. This coordination will allow for the collection of data necessary to calculate Reporting Area Control Error (Reporting ACE) to achieve the best results under BAL-005-1.

General Considerations

To guarantee proper coordination as intended by the standard drafting team for Project 2010-14.2.1, BAL-005-1 **will implemented concurrently with FAC-001-3**, as reflected in the "Prerequisite Approvals" section above.

Effective Dates

BAL-005-1 and associated definitions shall become effective on the first day of the first calendar quarter that is twelve months after the date that this standard is approved by applicable

regulatory authorities or as otherwise provided for in a jurisdiction where approval by an applicable governmental authority is required for a standard to go into effect. Where approval by an applicable governmental authority is not required, the standard shall become effective on the first day of the first calendar quarter that is twelve months after the date the standard is adopted by the NERC Board of Trustees', or as otherwise provided for in that jurisdiction.

Retirements

BAL-005-0.2b (Automatic Generation Control) shall be retired immediately prior to the Effective Date of BAL-005-1 (Balancing Authority Controls) in the particular jurisdiction in which the revised standard is becoming effective.

BAL-006-2 (Inadvertent Interchange) Requirement R3 shall be retired immediately prior to the Effective Date of BAL-005-1 (Balancing Authority Controls) in the particular jurisdiction in which the revised standard is becoming effective.

The existing definitions of Reporting ACE and Automatic Generation Control should be retired at midnight of the day immediately prior to the effective date of BAL-005-1, in the jurisdiction in which the new standard is becoming effective.