

DESCRIPTION OF
AREA CONTROL ERROR (ACE) CALCULATION
(Automatic Time Error control)

The equation used to calculate Area Control Error is given as follows:

$$ACE = (NI_A - NI_S) + \left(\prod_{\text{primary}}^{\text{on/off peak}} / (1-Y)*H \right) - 10\beta (F_A - F_S) - T_{\text{ob}} + I_{\text{ME}}$$

Where,

ACE is the Area Control Error in MW. Negative values denote a condition of undergeneration and positive values denote overgeneration.

NI_A is net actual interchange in MW. It is defined as the algebraic sum of the energy on the area tie lines. Positive net interchange results from delivering excess generation out of the area.

NI_S is scheduled net interchange in MW. It includes dynamic schedules. It is defined as the mutually prearranged intended net energy on the area tie lines. Bilateral schedules to correct inadvertent interchange accumulations are not included in this term. Positive scheduled net interchange is due to more energy intended to be delivered from the area than received by the area.

H Correction Time period in Hours. (initially $H \geq 2.0$ hours). This term is to be used for AGC control only and is not to be included in the ACE equation used for performance reporting.

β is the control area's frequency bias setting in MW/0.1 Hz. It is considered to have a negative sign.

B_S is the WECC frequency bias setting in MW/0.1 Hz. It is considered to have a negative sign.

Y is β / B_S . This term is to be used for AGC control only and is not to be included in the ACE equation used for performance reporting.

$\prod_{\text{primary}}^{\text{on/off peak}}$ is the Control Area's accumulated primary inadvertent interchange in MWh. An On-Peak and Off-Peak accumulation accounting is required.

Where:

$$\prod_{\text{primary}}^{\text{on/off peak}} = \text{last period's } \prod_{\text{primary}}^{\text{on/off peak}} + (1-Y) * (\prod_{\text{actual}} - \beta * \Delta TE / 6)$$

and

$$\left| \prod_{\text{primary}}^{\text{on/off peak}} / (1-Y)*H \right| \leq L_{10}$$

This term is to be used for AGC control only and is not to be included in the ACE equation used for performance reporting.

I_{actual} is the hourly inadvertent interchange for the last hour.

ΔTE is the hourly change in system time error adjusted for any manual time error corrections and time error adjustments.

Where:

$$\Delta\text{TE} = \text{TE}_{\text{end hour}} - \text{TE}_{\text{begin hour}} - \text{TD}_{\text{adj}} - (t) * (\text{TE offset})$$

TD_{adj} is any operator adjustment to the control center time error to correct for differences with the WECC time monitor.

t is the number of minutes of manual time correction that occurred during the hour.

TE offset is either +0.020 Hz or -0.020 Hz

FA is the actual system frequency in Hz.

F_S is the scheduled system frequency in Hz, normally 60.00 Hz.

T_{ob} is scheduled interchange energy (in MW) used to bilaterally correct inadvertent accumulations. Refer to the Bilateral Inadvertent Payback Scheduling Procedure in the Operating Committee Handbook.

I_{ME} is a manually entered value (in MW) to compensate for known equipment error, whether control or measurement. Examples are as follows:

- Calibration errors in telemetry
- Calibration errors in AGC algorithm
- Calibration errors in analog load frequency control system
- Non-scheduled losses
- Absence of telemetry (when not used in another part of the equation)

An attempt should be made to keep this term at zero by correcting the errors.

References:

- “Effect of Coordinated Correction of Tie-Line Bias Control in Interconnected Power System Operation”, AAFouad, SHKwan, IEEE PAS, Vol. PAS-101, No. 5, May 1982.
- “Decomposition of Time Deviation and Inadvertent Interchange on Interconnected System, Parts I & II.” NCohn, IEEE PAS, Vol. PAS-101, No. 5, May 1982.
- “Generation Control for Deregulated Electric Power Systems”, RPSchulte, IEEE Summer Power Meeting 2000, Seattle, WA.
- “Two-Area Analysis of System Time Error and Inadvertent Interchange Energy in Interconnected Power Systems”, AAFouad, SHKwan, IEEE PAS, Vol. 11, No. 4, November 1996.
- “Modified Automatic Time Error Control and Inadvertent Interchange Reduction for the WECC Interconnected Power Systems”, RPSchulte, WLMcReynolds, DEBadley, III PAS, Vol. 6, No. 3, August 1991.

Approved by Compliance Monitoring and Operating
Practices Subcommittee: January 10, 2002

Approved by Operations Committee: February 28, 2002

Approved by Board of Directors: October 4, 2002