Inadvertent Interchange Accounting Training Document

Training Document Subsections

A. Introduction

[Appendix 1F – Inadvertent Interchange Energy Accounting Practices]

The purpose of this document is to explain inadvertent interchange (inadvertent) accounting. Included within this document are accounting practices that every control area within the North American Electric Reliability Council shall follow. These practices provide a method for isolating and eliminating the source(s) of accounting errors. They may also be used as an aid in identifying the poor control performance that contributes to inadvertent accumulations.

Additional information concerning inadvertent may be found in the NERC Operating Manual under Operating Policy 1F., Inadvertent Interchange.

Simple accounting errors (value or sign) made while recording actual net interchange or scheduled net interchange become operating problems as soon as they become a part of hourly accounting. This occurs because the system dispatcher may be influenced to bilaterally or unilaterally pay back inadvertent or offset a schedule setter to correct a perceived metering error. Viewed from a total interconnected network (Interconnection) perspective, when inadvertent no longer sums to zero due to accounting errors subsequent unilateral pay backs to correct for the "perceived" inadvertent will cause a generation surplus or deficiency on the interconnection. Ultimately this shows up in the form of a continuously recurring time error.

B. Definitions

Adjacent Control Areas: Any control areas within an Interconnection sharing a common tie line or metering point.

Hourly MWh Metered Values: MWh data accumulated (whether by telemetry, telephone, direct meter readings, etc.) on an hourly basis.

Adjustments For Error: Either meter errors, absence of metering data due to communication failure or missing data for whatever cause. The important point is that such adjustments are made between control areas involved in the same manner and at the same times in opposite directions.

C. Interchange Accounting

1. Accounting For Interchange. Accounting for energy between control areas residing within the same Interconnection is both simple and complicated. In theory, and in accordance to NERC Guides, inadvertent interchange is the difference between actual net interchange and scheduled net interchange over a given period, usually an hour. Mathematically it is the time integral of the deviation of a control area's actual net interchange from its scheduled net interchange:

$$= NI_{\cdot} - NI_{\cdot}$$

Where,

NI_I is inadvertent interchange. In accordance with NERC convention, negative values of inadvertent interchange denote a condition of undergeneration and positive values denote overgeneration.

NI_A is actual net interchange. It is the algebraic sum of the hourly integrated energy on a control area's tie lines including pseudo-ties for any jointly owned generating units. Actual net interchange is positive for power leaving the system and negative for power entering.

NI_S is scheduled net interchange. It is defined as the mutually prearranged net energy on a control area s tie lines including dynamic schedules or fixed schedules for any jointly owned generating units. Scheduled net interchange is positive for power scheduled to be delivered from the system and negative for power scheduled to be received into the system.

2. Actual Net Interchange Energy Accounting. Actual net interchange (metered interchange) between two adjacent control areas over a common tie line is accounted for at a specific point in the line. Furthermore, both control areas shall agree on the amount of energy flow through this point, including any pseudo-tie flows for jointly owned generating units that may exist between the two control areas. Therefore, the sum of metered energy accounted by both control areas over this tie line nets to zero. Since this is true for all control areas within the same Interconnection, the algebraic sum of all metered energy within the same Interconnection is also zero.

3. Scheduled Net Interchange Energy Accounting. All scheduled net interchange (and schedule changes) shall be agreed upon between the control areas involved prior to implementation in regard to magnitude, rate of change, and common starting time. Dynamic schedules and fixed schedules for jointly owned generating units between control areas should be agreed to on an hour-by-hour basis, and included as scheduled interchange. Since every interchange schedule is agreed to by all delivering and receiving control areas within an Interconnection, the algebraic sum of all scheduled net interchange is also zero.

4. Inadvertent Interchange Energy Accounting. As stated previously, inadvertent interchange is the difference between actual net interchange and scheduled net interchange over a given period. Since the algebraic sum of all actual net interchange and the algebraic sum of all scheduled net interchange for any given period is zero within an Interconnection, the sum of all inadvertent interchange is also zero.

D. Inadvertent Interchange Energy Accounting Practices

The practices set forth in this section outline the methods and procedures required to reconcile energy accounting and inadvertent interchange balances.

In order for a control area to properly monitor and account for inadvertent interchange, it shall adhere to the NERC Operating Policies.

1. Accounting Procedures

1.1. On-Peak and Off-Peak Accounting Periods. Each control area is obligated to maintain its inadvertent interchange accounting within two periods, namely, on-peak and off-peak (refer to Appendix A).

1.2. Schedules. All hourly schedules and schedule changes shall be agreed upon between the control areas involved prior to implementation in regard to magnitude, rate of change, and common starting time.

1.3. Dynamic Schedules. Dynamic schedules integrated on an hourly basis shall be agreed upon by the control areas involved subsequent to the hour, but in such a manner as not to impact inadvertent accounts. This is accomplished by ensuring that the hourly actual and scheduled interchange quantities agree between all delivering and receiving parties.

1.4. Daily Accounting. Each control area shall agree with adjacent control areas on the actual net interchange (MWh) and scheduled net interchange (MWh) at least once each day for on-peak and off-peak periods.

1.5. Monthly Accounting. Having agreed to the on-peak and off-peak period accumulations on a daily basis, adjacent control areas shall verify that the accumulated values for the month balance.

1.6. Adjustments for Error. Adjustments shall be made at least once each month to correct for differences between hourly MWh meter totals and the totals derived from register readings at the tie line meters.

1.6.1 Differences. Adjacent control areas shall agree upon the difference determined above and assign this correction to the proper on-peak and off-peak period at the same times and in equal quantities in the opposite directions.

1.6.2 Adjustments. Any adjustments necessary due to known metering errors, franchised territories, transmission losses or other special circumstances shall be made in the same manner.

2. Accounting Periods For Control Areas *Not* Using Daylight Savings Time

Some control areas (and states) do not recognize Daylight Saving Time. Where this is the case, inadvertent interchange accounting periods must be shifted in order to remain coordinated with the rest of the control areas that do recognize Daylight Saving Time.

During the shift to Daylight Saving Time, control areas not recognizing Daylight Saving Time should change their accounting periods as follows:

2.1. For the Eastern and ERCOT Interconnections

2.1.1. Atlantic Time Zone. If the control area is in the Atlantic Time Zone, then the on-peak hours change from Hour Ending (HE) 0900 HE 2400 AST Monday through Saturday to HE 0800 HE 2300 AST Monday through Saturday. Similarly, the off-peak hours change from HE 0100 HE 0800 AST Monday through Saturday to HE 2400 HE 0700 AST Monday through Saturday.

2.1.2 Eastern Time Zone. If the control area is in the Eastern Time Zone, then the on-peak hours change from Hour Ending (HE) 0800 HE 2300 EST Monday through Saturday to HE 0700 HE 2200 EST Monday through Saturday. Similarly, the off-peak hours change from HE 2400 HE 0700 EST Monday through Saturday to HE 2300 HE 0600 EST Monday through Saturday.

2.1.3 Central Time Zone. If the control area is in the Central Time Zone, then the on-peak hours change from HE 0700 HE 2200 CST Monday through Saturday to HE 0600 HE 2100 CST Monday through Saturday. Similarly, the off-peak hours change from HE 2300 HE 0600 CST Monday through Saturday to HE 2200 HE 0500 CST Monday through Saturday.

2.2. For the Western Interconnection

2.1.1. Central Time Zone. If the control area is in the Central Time Zone, then the on-peak hours change from HE 0900 HE 2400 CST Monday through Saturday to HE 0800 HE 2300 CST Monday through Saturday. Similarly, the off-peak hours change from HE 0100 HE 0800 CST Monday through Saturday to HE 2400 HE 0700 CST Monday through Saturday.

2.1.2. Mountain Time Zone. If the control area is in the Mountain Time Zone, then the on-peak hours change from HE 0800 HE 2300 MST Monday through Saturday to HE 0700 HE 2200 MST Monday through Saturday. Similarly, the off-peak hours change from HE 2400 HE 0700 MST Monday through Saturday to HE 2300 HE 0600 MST Monday through Saturday.

2.1.3. Pacific Time Zone. If the control area is in the Pacific Time Zone, then the on-peak hours change from HE 0700 HE 2200 PST Monday through Saturday to HE 0600 HE 2100 PST Monday through Saturday. Similarly, the off-peak hours change from HE 2300 HE 0600 PST Monday through Saturday to HE 2200 HE 0500 PST Monday through Saturday.

3. Accounting for Inadvertent Interchange over DC Tie Lines between Separately Synchronous Interconnections

For the purpose of NERC inadvertent interchange accounting, there shall be no contribution to a control area's inadvertent accumulation due to a dc tie connecting adjacent control areas operating in separate Interconnections.

4. Summary Of Accounting Rules

4.1. Summation of scheduled net interchange. The summation of all scheduled net interchange within an Interconnection shall total zero for any period of time.

4.2. Summation of actual net interchange. The summation of all actual net interchange within an Interconnection shall total zero for any period of time.

4.3. Summation of inadvertent interchange for Interconnection. The summation of all inadvertent interchange within an Interconnection shall total zero for any period of time.

5. Accounting Examples

Daily, total all actual net interchange accumulated during the on-peak and off-peak periods. Do the same with the scheduled net interchange. By period, subtract the totaled scheduled net interchange from the totaled actual net interchange. This will yield on-peak and off-peak inadvertent accumulations for the day. The addition of these two accumulations is the control area s inadvertent interchange accumulation for the day. All control areas are required to keep an accurate, continuous record of their current balances of on-peak, off-peak, and (net) inadvertent for the day, month, and accumulative to date.

As an example, the Western Interconnection's month-end inadvertent interchange report for February 1995 is included on the following page. Every control area in the Interconnection is included. The sum of each period's inadvertent totals to zero.

An example of an individual control area's month-end data submittal to its Performance Subcommittee representative is also included.

E. Interchange Accounting Practices for Jointly Owned Generating Units

[Appendix 1A The Area Control Error Equation, Section B Jointly Owned Units]

1. Jointly Owned Generating Units. It is assumed that every jointly owned generating unit resides within a host control area. It is also assumed that every owner will treat its share of the unit as generation within its own control area. Recipients may account for their share of unit output by one of three methods. All participants in a jointly owned generating unit must agree with the host control area on which of these methods is to be used:

1.1 Scheduled interchange. The host control area and the recipient control area agree on a pre-determined, fixed schedule. Generally, these schedules are manually altered to adjust for unplanned operating conditions at the unit, e.g., if the unit unexpectedly trips out of service.

1.2 Dynamically scheduled interchange. The host control area and recipient control area share an electronic signal indicating the real-time power transfer from the unit to the recipient. The host control area and recipient control areas see this transfer as a continually changing schedule between the two control areas. It is recommended that after-the-fact adjustments for month-end accumulators or erroneous signals be corrected in future operating periods and not be back-corrected.

1.3 As a pseudo-tie. The host control area and the recipient control area share an electronic signal indicating the real-time energy transfer from the unit to the recipient. The host control area and the recipient control area see this transfer as continually changing metered interchange between the two control areas. It is recommended that after-the-fact adjustments for month-end accumulators or erroneous signals be corrected in future operating periods and not be back-corrected.

F. Interchange Accounting Practices for Regulation Service

If a control area provides regulation service for another control area, it generally will occur in one of two ways:

1. **Supplemental Regulation.** The control area providing supplemental regulation service will receive a signal representing all or a portion of the other control area s ACE. Control areas participating in supplemental regulation are not required to make any changes to their accounting systems. Supplemental regulation can be implemented as a dynamic schedule or a pseudo-tie. Both control areas need to use the same method.

2. **Overlap Regulation.** The control area providing overlap regulation service will include all of the other control area s tie lines and schedules in its (the providing control area s) AGC equation. Entities participating in overlap regulation are required to notify the control area providing the regulation of all interchange schedules with other control areas before they are implemented. This is necessary to maintain the integrity of central coordinated control. Ultimate responsibility for energy accounting lies solely with the control area providing the overlap regulation service.

	ON-PEAK			OFF-PEAK			TOTAL		
	Previous Accum.	Net For Month	Carried Forward	Previous Accum.	Net For Month	Carried Forward	Previous Accum.	Net For Month	Carried Forward
B. C. Hydro & Power Authority	726	(1,191)	(465)	582	(1,114)	(532)	1,308	(2,305)	(997)
Bonneville Power Administration	(645)	926	281	1,504	(1,064)	440	859	(138)	721
Chelan County P.U.D. #1	72	(132)	(60)	11	(70)	(59)	83	(202)	(119)
Douglas County P.U.D. #1	3	2	5	0	6	6	3	8	11
Grant County P.U.D. #2	(4)	(54)	(58)	(25)	(29)	(54)	(29)	(83)	(112)
Idaho Power Company	691	(842)	(151)	(73)	87	14	618	(755)	(137)
Montana Power Company	6	43	49	(9)	7	(2)	(3)	50	47
Pacificorp – East	(221)	1,000	779	181	(64)	117	(40)	936	896
Pacificorp – West	(52)	(279)	(331)	(66)	50	(16)	(118)	(229)	(347)
Portland General Electric Company	(109)	108	(1)	35	(193)	(158)	(74)	(85)	(159)
Puget Sound Power & Light Company	45	(29)	16	(9)	(66)	(75)	36	(95)	(59)
Seattle City Light	8	(6)	2	(7)	11	4	1	5	6
Sierra Pacific Power Company	4	(13)	(9)	(72)	202	130	(68)	189	121
Tacoma City Light	(3)	(6)	(9)	(60)	(8)	(68)	(63)	(14)	(77)
TransAlta Utilities Corporation	(33)	(6)	(39)	(571)	(52)	(623)	(604)	(58)	(662)
Washington Water Power Company	1	69	70	(7)	21	14	(6)	90	84
Los Angeles Department of Water & Power	219	117	336	(419)	538	119	(200)	655	455
Pacific Gas & Electric Company	(2,374)	(621)	(2,995)	(1,974)	599	(1,375)	(4,348)	(22)	(4,370)
San Diego Gas & Electric Company	382	(369)	13	(96)	99	3	286	(270)	16
City of Pasadena	(539)	(26)	(565)	490	31	521	(49)	5	(44)
Nevada Power Company	562	(1,797)	(1,235)	161	(832)	(671)	723	(2,629)	(1,906)
Southern California Edison Company	3,084	1,420	4,504	1,670	(1,431)	239	4,754	(11)	4,743
Comision Federal de Electricidad	27	(5)	22	(3)	18	15	24	13	37
Arizona Public Service Company	(625)	891	266	(227)	855	628	(852)	1,746	894
El Paso Electric Company	27	5	32	(21)	42	21	6	47	53
Imperial Irrigation District	(287)	1,354	1,067	1,021	814	1,835	734	2,168	2,902
Public Service Company of New Mexico	108	68	176	255	236	491	363	304	667
Salt River Project	158	80	238	246	146	392	404	226	630
Tucson Electric Power Company	76	(73)	3	(55)	17	(38)	21	(56)	(35)
Western Area Power Administration – LC	(41)	111	70	(41)	114	73	(82)	225	143
Public Service Company of Colorado	659	1,282	1,941	(263)	257	(6)	396	1,539	1,935

Western Area Power Administration - UM	942	240	1,182	1,516	87	1,603	2,458	327	2,785
Western Area Power Administration - CM	(2,867)	(2,267)	(5,134)	(3,674)	686	(2,988)	(6,541)	(1,581)	(8,122)
TOTAL	0	0	0	0	0	0	0	0	0

PACIFICORP – EAST

INADVERTENT INTERCHANGE ACCOUNTING SUMMARY

FEBRUARY 1995 -- CENTRAL STANDARD TIME

	ON-PEAK INTERCHANGE			OFF-PEAK INTERCHANGE			TOTAL INTERCHANGE		
	Actual	Scheduled	Inadvertent	Actual	Scheduled	Inadvertent	Actual	Scheduled	Inadvertent
ADJACENT CONTROL AREA	MWh	MWh	MWh	MWh	MWh	MWh	MWh	MWh	MWh
Arizona Public Service Company	62,877	116,239	(53,362)	31,912	40,130	(8,218)	94,789	156,369	(61,580)
Idaho Power Company	138,439	(70,517)	208,956	163,561	3,796	159,765	302,000	(66,721)	368,721
Los Angeles Dept. of Water and Power	89,226	66,248	22,978	38,487	19,511	18,976	127,713	85,759	41,954
Montana Power Company	18,640	7,582	11,058	53,576	36,771	16,805	72,216	44,353	27,863
Nevada Power Company	64,464	32,490	31,974	49,430	24,660	24,770	113,894	57,150	56,744
PacifiCorp – West	(233,626)	(22,214)	(211,412)	(159,770)	36,224	(195,994)	(393,396)	14,010	(407,406)
Sierra Pacific Power Company	23,482	53,827	(30,345)	17,497	37,582	(20,085)	40,979	91,409	(50,430)
Western Area Power Admin. -- CM	(63,300)	(84,453)	21,153	(28,895)	(32,812)	3,917	(92,195)	(117,265)	25,070
TOTAL	100,202	99,202	1,000	165,798	165,862	(64)	266,000	265,064	936

	ON-PEAK	OFF-PEAK	NET
Previous Accumulation	-221	181	-40
Net for Month	1,000	(64)	936
Carried Forward	779	117	896