Public Service Company of Colorado Transmission Loss Filing
Docket No. ER15-266-000

Holy Cross Energy, Intermountain Rural Electric Association and Tri-State Generation & Transmission Association, Inc.
First Set
Served December 4, 2014

DISCOVERY REQUEST COOP 1-2.a

The Xcel Energy OATT now has a single transmission loss value of 2.56%. What was the origin of this single loss value (i.e., does it represent average energy losses over a year, the capacity losses during a single peak hour, etc.)?

RESPONSE:

The single transmission loss value of 2.56% is from the Electric System Loss Analysis dated March 29, 2006. The Executive Summary of the 2006 analysis was included as Attachment 5 to Xcel Energy Services Inc.'s October 31, 2008 filing in Docket No. ER09-195-000. The loss factor (termed the loss multiplier) is set out at page x of the Executive Summary. The multiplier was calculated using the total energy losses of the test year of the 2006 analysis.

Sponsor: Jim Jordan
Xcel Energy Services Inc.

Response Date: December 15, 2014

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Docket No. ER15-266-000

Holy Cross Energy, Intermountain Rural Electric Association and Tri-State Generation & Transmission Association, Inc.
First Set
Served December 4, 2014

DISCOVERY REQUEST COOP 1-2.c

The Loss Study states at page 2-1 that "[t]he procedure that was used to calculate transmission losses was to simulate a number of different power flow cases that are representative of the system operation, from maximum to minimum load, taking into account the variation of generation and inter-tie flows."

i. Did this procedure have the effect of capturing power flows associated with third party transmission, such as reported in PSCo's 2012 FERC Form 1 at page 400?
ii. Did this procedure involve the use of actual transmission peak load data as reported at page 400 of PSCo's FERC Form 1 for 2012 or for any other year?
iii. What was the source of the data relied upon by Siemens for its power flow cases?

RESPONSE:

The power flow cases used by Siemens are derived from the latest base cases available on the Western Electricity Coordinating Council (WECC) website for the selected study year and season, which include modeling of all transmission facilities, loads, generation and inter-tie flows for the entire WECC region. PSCo provided modeling data for these cases during the WECC case creation process; these cases were again reviewed by PSCo and Siemens before the loss study to include major transmission and generation updates.

PSCo's 2012 FERC Form 1, at page 400, reports Monthly Peak Load Total, Firm Network Transmission Service for Self, Firm Network Transmission Service for Others, Long Term Firm Point-to-Point Reservations, Other Long Term Firm Transmission Service, and Short-Term Firm Point-to-Point Reservations. As explained above, WECC base cases include modeling of all transmission facilities, loads, generation and inter-tie flows for the entire WECC region, so third party transmission transactions for the entire WECC region are already accounted for in the WECC power flow base cases by the corresponding entities. PSCo did not have actual third party load, generation and inter-tie flows for 2012, so third party transactions reflecting the transactions reported in FERC Form 1 could not be modeled in the power flow case.

On the other hand, the PSCo load data modeled in the summer peak cases is the "Firm Network Service for Self" load reported in the 2012 FERC Form 1. Also, Siemens prepared a series of power flow cases representing different load levels for year 2012, from the annual peak load to minimum load. PSCo generation dispatch was accordingly changed to achieve load-generation balance in each of the power flow cases.

The PSCo loads in the three WECC starting power flow base cases for peak periods were scaled to meet actual peak loads for the respective seasons.

Sponsor: Robert Zeles, Siemens
Octavio Gutierrez, Siemens
Sirisha Tanneeru, Xcel Energy Services Inc.

Response Date: December 15, 2014

Public Service Company of Colorado Transmission Loss Filing
Docket No. ER15-266-000

Holy Cross Energy, Intermountain Rural Electric Association and Tri-State Generation & Transmission Association, Inc.
First Set
Served December 4, 2014

DISCOVERY REQUEST COOP 1-2.d

The Loss Study states at page 2-4 that "[t]he sum of hourly losses for 2012 was 578,760,270 kWh. The PSCO peak demand was 6,927 MW (excluding losses) at 17:00 hours on June 25th. The loss at this peak was 169.9 MW or 2.45 percent of the load."

i. According to the PSCo 2012 FERC Form 1, Page 400, the annual transmission peak demand for "Firm Network Service for Self" was 6,939 MW at 17:00 hours on June 25th, 2012. During the same hour the "Monthly Peak MW – Total" was 7,797 MW. In view of the fact that the purpose of the Loss Study is to identify transmission system losses, and the additional fact that under its OATT PSCo charges all transmission customers for losses, why is it not appropriate to include the Transmission Monthly Peak Total in the denominator, which makes the 169.9 MW of peak demand transmission losses only 2.178 percent of the transmission peak load?

RESPONSE:

The demand loss of 169.9 MW applies only when the demand is 6,927 MW. It does not apply at a higher demand level, for example, at 7,797 MW. At 7,797 MW the demand loss is expected to be higher depending on the generation dispatch.

The MW/MWh losses reflect all losses on PSCo transmission lines and transformers. The denominator that has been used is based on native load, but can be modified with appropriate demand and energy units.

Sponsor: Octavio Gutierrez
Siemens

Response Date: December 15, 2014

Public Service Company of Colorado Transmission Loss Filing
Docket No. ER15-266-000

Holy Cross Energy, Intermountain Rural Electric Association and Tri-State Generation & Transmission Association, Inc.
First Set
Served December 4, 2014

DISCOVERY REQUEST COOP 1-2.e

Under the Transmission Formula Rate, cost responsibility is allocated on a 12 CP basis. The Loss Study states at page 2-4 that Siemens calculated summer peak demand losses as high as 2.27 percent, but that calculated winter peak demand losses were as low as 1.54 percent. Why is PSCo proposing to use the single summer peak hour demand loss percentage when calculating demand cost responsibility during each month of the 12 months of the year rather than using a demand loss percentage that is an average of the demand losses during each of the 12 monthly peak hours?

RESPONSE:

First, it must be noted that the 1.54 percent loss value does not correspond to any monthly peak losses. This value was observed for a winter light load case, where the load was much lower than the monthly peak load levels.

The percent demand loss changes with the level of demand. In the study, Siemens calculated the demand loss for every hour in 2012, including the monthly peak loads, and the percent loss may be different for every hour as the load, generation dispatch, and the network configuration may change. The numbers cited in the question represent two load levels out of the 8,784 load levels considered in the study.

PSCo resource capacity needs are planned based on the annual peak demand and losses.

Sponsor: Octavio Gutierrez
Robert Zeles
Siemens

Response Date: December 15, 2014

Public Service Company of Colorado Transmission Loss Filing
Docket No. ER15-266-000

Holy Cross Energy, Intermountain Rural Electric Association and Tri-State Generation & Transmission Association, Inc.
First Set
Served December 4, 2014

DISCOVERY REQUEST COOP 1-2.h

Table 5-2 places transmission level energy losses at 59,845 MWH, or 1.8337 percent of transmission level input of 31,971,761 MWH. Table 1-2 identifies actual transmission level energy input of 34,530,183 MWH and Page 401a of PSCo's 2012 FERC Form 1 shows total losses of 1,592,864 MWH based on total transmission input of 34,993,011 MWH.

i. If the purpose of the Loss Study is to determine losses on the transmission and distribution systems, and if the Siemens study modeled typical system operations, including generation for pumping energy and wheeling transactions, should the 34,993,011 value be increased to recognize the energy flows associated with pumping energy, wheeling transactions and interchange transactions, bringing the total number to 39,370,153?

ii. What factors caused the Loss Study to derive a total transmission MWH input value that is 18.79% lower than the 2012 actual transmission energy transfers as reported in PSCo's FERC Form 1?

iii. What factors caused the Loss Study to derive losses that are 6.94% higher than actual losses reported in the 2012 PSCo FERC Form 1?

RESPONSE:

i. For the loss study, the thermal, pumped storage, and renewable generation was reflected in the 56 power flow cases based upon the typical generation patterns of those resources, with coal generation operating as base load capacity, pumped storage reducing system load during peak periods and increasing system load during early morning hours, and wind resources providing more electric energy during lighter load hours than during peak periods. The Cabin Creek facility was modeled as generating power during daytime hours and as negative generation (pumping) for a sufficient number of hours. The actual operating data for Cabin Creek was used to develop an appropriate modeling representation for Cabin Creek. If other transactions (wheeling and interchange) were to be included, it would increase the percentage of losses on the transmission system so there would be a higher loss factor. However, it is not feasible to model every hour with the non-typical load patterns that are generally associated with these types of transactions. Another factor to consider is that both the source and the delivery point for each individual transaction would need to be known and modeled.

ii./iii. The significant number of system elements involved does not allow the individual calculation of losses in each element. Additionally, losses vary as the flow of electric current changes every second throughout the year. Therefore, Siemens uses statistical methods to support the engineering calculations to estimate the losses, and the calculation results may under- or over-estimate the losses. The methods used try to minimize the loss difference, taking into account the time and costs to perform the loss study.

Sponsor: Octavio Gutierrez
Robert Zeles
Siemens

Response Date: December 15, 2014

Public Service Company of Colorado Transmission Loss Filing
Docket No. ER15-266-000

Holy Cross Energy, Intermountain Rural Electric Association and Tri-State Generation & Transmission Association, Inc.
First Set
Served December 4, 2014

DISCOVERY REQUEST COOP 1-2.j

Table 2-1, the Power Flow Case Summary sets out values for certain periods, such as Heavy Summer 2011/2013. Are the values shown the calculated peak values during the identified periods or the average monthly peak values for those periods?

RESPONSE:

The values shown in Table 2-1 represent the values in the six power flow cases used to perform the study. The three "Heavy" cases reflect the actual system peak load for the indicated period, with the generation column indicating the level of generation to meet that load.

Sponsor: Robert Zeles
Octavio Gutierrez
Siemens

Response Date: December 15, 2014

Public Service Company of Colorado Transmission Loss Filing
Docket No. ER15-266-000

Holy Cross Energy, Intermountain Rural Electric Association and Tri-State Generation & Transmission Association, Inc.
First Set
Served December 4, 2014

DISCOVERY REQUEST COOP 1-2.k

Was the PSCo detailed system model updated for power flow cases associated with later periods (e.g., Heavy Summer 2012/2013) or was it held static?

RESPONSE:

The PSCo transmission model in the six power flow cases reflects the transmission system configuration for each of the described seasonal periods. The 2012/2013 Heavy Winter case reflects the addition of a 345-kV line between Pawnee, Missile Site, Smoky Hill, and new generation at Missile Site. This change in system topology was also reflected in the 2012/13 light winter power flow case. The power flow case was not held static but updated to reflect the system characteristics for the appropriate study year and season.

Sponsor: Robert Zeles
Siemens

Response Date: December 15, 2014

Public Service Company of Colorado Transmission Loss Filing
Docket No. ER15-266-000

Holy Cross Energy, Intermountain Rural Electric Association and Tri-State Generation & Transmission Association, Inc.
First Set
Served December 4, 2014

DISCOVERY REQUEST COOP 1-2.l

Does the term "Load" as used in Table 2-1 refer to peak hour load on the PSCo transmission system? If not, what does it refer to?

RESPONSE:

The data presented in Table 2-1 is a summary of PSCo system data included in the six power flow cases used for the analysis. The values in the "load" column represent the total identified PSCo load that is in each of the power flow cases. The light load periods that correspond to the power flow studies are representative of the typical lighter load periods and do not refer to specific dates.

Sponsor: Robert Zeles
Siemens

Response Date: December 15, 2014

Public Service Company of Colorado Transmission Loss Filing
Docket No. ER15-266-000

Holy Cross Energy, Intermountain Rural Electric Association and Tri-State Generation & Transmission Association, Inc.
First Set
Served December 4, 2014

DISCOVERY REQUEST COOP 1-2.m

Were the transmission level energy and capacity loss calculations performed by Siemens based on hypothetical, rather than actual operations?

RESPONSE:

With respect to the term "actual operations," it is assumed that this is referring to generation dispatch for the resources available to PSCo. While the actual generation data for most resource types is available for the 8,784 hours in the study year, only 56 power flow cases were run. The generation scheduled in these cases reflected the typical generation patterns for base load units, pumped storage generation and pumping cycles, and general wind resource patterns.

Sponsor: Robert Zeles
Siemens

Response Date: December 15, 2014

Public Service Company of Colorado Transmission Loss Filing
Docket No. ER15-266-000

Holy Cross Energy, Intermountain Rural Electric Association and Tri-State Generation & Transmission Association, Inc.
First Set
Served December 4, 2014

DISCOVERY REQUEST COOP 1-2.n

Did Siemens make any calculations of transmission level energy losses or capacity losses based on actual 2012 PSCo system operations?

RESPONSE:

No. Additional information would be required to allocate or distribute load values to all of the substations in the PSCo system. Since a complete set of this data (needed for all 8,784 hours) is not available, no attempt has been made to use actual hourly generation and purchased power values.

The relationship that was developed for system transmission losses and system loads was based on a load duration curve process where the three seasonal power flow models were scaled from maximum levels to lower levels. In this process, the resource dispatch was simulated for the seasonal power flow cases based upon generation information that was provided. The load duration curve approach coupled with the three seasonal power flow cases results in the loss of monthly time-based information.

Sponsor: Robert Zeles
Siemens

Response Date: December 15, 2014

Public Service Company of Colorado Transmission Loss Filing
Docket No. ER15-266-000

Holy Cross Energy, Intermountain Rural Electric Association and Tri-State Generation & Transmission Association, Inc.
First Set
Served December 4, 2014

DISCOVERY REQUEST COOP 1-2.o

The Loss Study states at page vii that calculated losses exceed 2012 FERC Form 1 reported losses by 6.9%. If the calculated losses were based on hypothetical operating conditions, is it reasonable to assume that the calculated values would not match actual reported losses?

RESPONSE:

The term "hypothetical" is somewhat misleading. The thermal, pumped storage, and renewable generation was reflected in the 56 power flow cases based upon the basic characteristics of those resources, with coal generation operating as base load capacity, pumped storage reducing system load during peak periods and increasing system load during early morning hours, and wind resources providing more electric energy during lighter load hours than during peak periods.

The power flow cases developed by Siemens reflect these considerations and thus represent a reasonable simulation of actual operations.

Since the entire transmission system is represented, there are no portions of the transmission system where losses can occur and not be accounted for.

Sponsor: Robert Zeles
Siemens

Response Date: December 15, 2014

Public Service Company of Colorado Transmission Loss Filing
Docket No. ER15-266-000

Holy Cross Energy, Intermountain Rural Electric Association and Tri-State Generation & Transmission Association, Inc.
First Set
Served December 4, 2014

DISCOVERY REQUEST COOP 1-2.p

The Loss Study concludes that it is necessary to allocate the discrepancy as a reduction in losses, such that the factors generate losses that match 2012 reported losses; however it does so by allocating the entire discrepancy as a reduction of distribution losses, with no reduction in transmission losses. The table below shows the effect of allocation of these loss credits as a reduction in distribution losses.

Distribution Primary	Calculated		Allocated		Reduction	Percent
Primary Lines 4.16 kV	723,604		615,157		108,447	0.1763
Primary Lines 12.48 kV	12,053,861		10,247,334		1,806,527	0.1763
Primary lines 13.2 KV	320,815,951		272,735,057		48,080,894	0.1763
Primary Lines 24.9 kV	16,939,332		14,400,613		2,538,719	0.1763
Total	350,532,748		297,998,161		52,534,587	0.1763
Distribution Secondary						
Transformer Load	46,015,146		39,118,799		6,896,347	0.1763
Transformer no-load	143,335,599		143,335,599		0	0.0000
Lines in Service Drops	341,126,640		290,001,570		51,125,070	0.1763
Customer Meters	9,177,585		9,177,585		0	0.0000
Total	539,654,970		481,633,553		58,021,417	0.1205

i. Is it standard industry practice when conducting loss studies to allocate the difference between FERC Form 1 reported losses and calculated losses entirely as a reduction to or increase in distribution losses, with no allocation of such amounts to transmission losses?
ii. Was the decision to apply a 17.63 percent credit of losses to each primary line voltage level supported by an engineering or analytical assessment?
iii. If there is engineering or analytical support for this allocation please provided copies of that support.
iv. If the overall calculated transmission losses are the result of modeling hypothetical operating conditions rather than calculated based on actual 2012 operating conditions, why is it reasonable to assume that the calculated transmission losses are not overstated and only distribution losses are overstated?

RESPONSE:

i. The decision to adjust or not to adjust the transmission losses depends on Siemens' perception of the level of accuracy obtained in the transmission loss analysis, including the reliability of the data provided. Siemens believes that the transmission models provided by PSCo are accurate and complete with respect to the PSCo system. The rationale for not adjusting transmission demand and energy losses is that the transmission losses can be calculated with great accuracy, because the transmission model used in the calculations is accurate and the resource dispatch reflects actual operations patterns. Therefore, no allocation was considered necessary for transmission losses.

The distribution losses occur in many components that cannot be evaluated individually due to their sheer number, such as primary and secondary distribution circuits, service drops, and secondary transformer load-related losses; therefore, the distribution losses can only be approximated by evaluating the losses of a sample of distribution circuits that is used to project their losses to the entire population using statistical methods. The no-load losses in transformers and the losses in customer meters are not allocated because these losses can be calculated with precision. The allocation process assumes that the loss number reported in FERC Form 1 is correct.

ii. With respect to the 17.63 percent adjustment to the primary line voltage level, the allocation percentage changes from year to year for the same company and from company to company. The amount to allocate depends on the difference between the total calculated losses and the FERC reported losses. If both numbers are equal, the allocation percent would be zero. In the PSCo case, the difference was -110,556,192 kWh and the percent was calculated as this amount divided by the total calculated losses

on those elements that were not evaluated individually (such as distribution circuits, service drops, and others) to obtain the percent reduction that was applied to each of the calculated losses of these elements.

iii. The allocation procedure is supported by the rationale discussed in the first two paragraphs of this response. As the number of elements that are evaluated increases, the percent allocation should be lower. It is expected that the allocation percentage would be zero or close to zero if the loss in each and every element were to be measured at infinitesimal intervals. Again, this procedure assumes that the FERC reported loss is 100% correct.

iv. With respect to not adjusting the calculated transmission losses, in theory, there is probably some error in the calculation of transmission losses. However, that error is expected to be much lower than the degree of uncertainty associated with a small sample of the distribution feeder circuits representing the entire system of primary circuits and possible error in the calculated value of the distribution losses.

Sponsor: Octavio Gutierrez
Siemens

Response Date: December 15, 2014

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Docket No. ER15-266-000

Holy Cross Energy, Intermountain Rural Electric Association and Tri-State Generation & Transmission Association, Inc.
First Set
Served December 4, 2014

DISCOVERY REQUEST COOP 1-2.q

Does PSCo have meters at each of the inputs to its transmission system (e.g., generator interconnections, transmission interconnections with other utilities) and at each of its transmission substations such that it has the capability to calculate transmission level losses as the difference between energy input over a given interval of time and concurrent energy outputs? If so, does PSCo make use of this capability and did Siemens request and review this data?

RESPONSE:

No. PSCo has meters installed at the generator interconnections, which are inputs to the transmission system. PSCo has Balancing Authority Area (BAA) metering on transmission lines and transformers at BAA boundaries; these meters sum up the energy transfers between the adjacent BAAs for energy accounting and load accounting purposes. PSCo substations also have revenue meters for transmission level customers, but other facilities in the substation (transmission lines and transformers that do not form balancing area boundaries, distribution banks serving load, etc.) are not metered and no data is available. Because this data does not exist, calculating the transmission losses as the difference between all transmission system energy inputs and outputs over a given interval of time is not feasible. As such, there were no transmission level loss calculation outputs for Siemens to request or review.

Sponsor: Betty Mirzayi
Xcel Energy Services Inc.

Response Date: December 15, 2014

Public Service Company of Colorado Transmission Loss Filing
Docket No. ER15-266-000

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First Set
Served December 4, 2014

DISCOVERY REQUEST COOP 1-2.r

If such data does exist, please provide the transmission losses for the system peak hour of each month of 2012, and the total energy losses at the transmission level for 2012.

RESPONSE:

As explained in response to question 1-2.q, the data mentioned in the question does not exist.

Sponsor: Betty Mirzayi
Xcel Energy Services Inc.

Response Date: December 15, 2014

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First Set
Served December 4, 2014

DISCOVERY REQUEST COOP 1-2.s

The Loss Study states at page 2-4 that Siemens' 56 case load flow analysis showed a correlation between PSCo load and losses, with a summer system maximum of 2.27% and a light winter load maximum of 1.54%. However, the Loss Study then concludes that the peak loss is 2.46%. Please provide copies of the analyses the support a system peak loss based on load of 2.46% rather than 2.27%.

RESPONSE:

Regression analysis was performed relating the power flow losses versus the PSCo loads shown in the 56 power flow runs. The data used for the analysis is shown graphically on Page 2-4 in Figure 2-1 of the loss report.

The data used for this analysis is shown on the attached file.

Using the regression equation and the peak demand of 6,927 MW, the resulting demand loss is 169.9 MW, which is 2.45% of peak demand. Figure 2-1 shows that the regression equation produces slightly higher losses at high load levels than were observed for the few data points for peak load hours.

Attachment:

ER15-266_ Attachment COOP1-2.s.A1.pdf

Sponsor: Robert Zeles
Siemens

Response Date: December 15, 2014