PACIFICORP

Utah

2009 Analysis of System Losses

November 2011

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November 15, 2011

Mr. Kenneth Houston, PE
Vice President, Transmission Services
PacifiCorp
825 NE Multnomah, Suite 1600
Portland, OR 97232

RE: 2009 LOSS ANALYSES – Utah

Dear Mr. Houston:

Transmitted herewith are the results of the 2009 Analysis of System Losses for the Utah operations. These results consist of an Annual analysis which develops cumulative expansion factors (loss factors) for both demand (peak-kW) and energy (average-kWh) losses by discrete voltage levels applicable to metered sales data. The loss calculations were made using a preliminary system wide transmission loss factor which was then incorporated into the Utah loss model to derive the final results prescribed herein. Our analyses considered only technical losses in arriving at our final recommendations.

On behalf of MAC, we appreciate the opportunity to assist you in performing the loss analysis contained herein. The level of detail, multiple databases, and state jurisdictions coupled with power flow studies and updates are consistent with prior loss studies and reflect reasonable and representative power losses on the PacifiCorp system. Our review of these data and calculated loss results support the proposed loss factors as presented herein for your use in various cost of service, rate studies, and demand analyses.

Should you require any additional information, please let us know at your earliest convenience.

Sincerely,

Paul M. Normand
Principal

PACIFICORP - UTAH

2009 ANALYSIS OF SYSTEM LOSSES

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1.0 EXECUTIVE SUMMARY

This report presents PacifiCorp's 2009 Analysis of System Losses for Utah's power systems as performed by Management Applications Consulting, Inc. (MAC). Our analyses considered only technical losses and did not attempt to quantify non-technical factors such as theft and meter accuracy. The study developed separate demand (kW) and energy (kWh) loss factors for each voltage level of service in the power system. The cumulative loss factor results by voltage level, as presented herein, can be used to adjust metered sales data in Utah for losses in performing cost of service studies, determining voltage discounts, and other analyses which may require a loss adjustment.

The procedures used in the overall loss study were consistent with prior studies and emphasized the use of "in house" resources where possible. To this end, extensive use was made of the Company's peak hour power flow studies and transformer plant investments in the model. Using estimated load data provided a means of calculating reasonable estimates of losses by using a "top-down" and "bottom-up" procedure. In the "top-down" approach, losses from the high voltage system, through and including distribution substations, were calculated along with power flow data, conductor and transformer loss estimates, and metered sales.

At this point in the analysis, system loads and losses at the input into the distribution substation system are known with reasonable accuracy. However, it is the remaining loads and losses on the distribution substations, primary system, secondary circuits, and services which are generally difficult to estimate. Estimated load data provided the starting point for performing a "bottom-up" approach for calculating the remaining distribution losses. Basically, this "bottom-up" approach develops line loadings by first determining loads and losses at each level beginning at a customer's meter service entrance and then going through secondary lines, line transformers, primary lines and finally distribution substation. These distribution system loads and associated losses are then compared to the initial calculated input into Distribution Substation loadings for reasonableness prior to finalizing the loss factors. An overview of the loss study is shown on Figure 1 on page 4.

Appendix A identifies the PacifiCorp system-wide Transmission 2009 loss factors for the integrated PacifiCorp System for 500 kV through 46 kV. These preliminary loss factors will be finalized and approved as the Company's FERC OATT rate in 2012.

Appendix B incorporates Appendix A's loss factor and presents a total PacifiCorp Utah only loss calculation and derives specific loss factors by voltage applicable to metered sales. Table 1, below, provides the final results from Appendix A and B for the calendar year. The distribution system losses are calculated in Appendix B for all voltage levels except transmission which was obtained from Appendix A. These loss expansion factors are applicable only to metered sales at the point of receipt for adjustment to the power system's input level.

TABLE 1
Loss Factors at Sales Level
Utah

Voltage Level of Service	2009	Delivery System (Excludes Transmission)
Demand (kW)		
Transmission[1]	1.04259	1.00000
Primary	1.07377	1.02990
Secondary	1.10106	1.05609
Energy (kWh)		
Transmission[1]	1.04527	1.00000
Primary	1.06635	1.02016
Secondary	1.09322	1.04588

Losses – Net System Input[2]	7.23% MWh
	8.03% MW
Losses – Net System Output[3]	7.79% MWh
	8.73% MW

The loss factors presented in the Delivery Only column of Table 1 are the Total PacifiCorp loss factors divided by the transmission loss factor in order to remove the transmission losses from each service level loss factor. For example, the secondary distribution demand loss factor of 1.05609 includes the recovery of all non-transmission losses from distribution substation, primary lines, line transformers, secondary conductors and services. The additional transformation loss multipliers are appropriate as an adjustment for either additional transformation or additional primary loss recovery.

The net system input shown in Table 1 presents percent MWh losses of 7.23% for the total PacifiCorp load using calculated losses divided by the associated input energy to the system. The 8.03% represents the MW losses also using system input as a reference. The net system output reference shown in Table 1 represents MWh losses of 7.79% and MW losses of 8.73%. These results use the appropriate total losses for each but are divided by system output or sales. These calculations are all based on the results from Exhibits 1, 7, and 9 of Appendix B.

[1] Reflects preliminary loss factors from Appendix A for 500 kV through 46 kV.
[2] Net system input equals firm sales plus losses, Company use less non-requirement sales and related losses. See Appendix B, Exhibit 1, for their calculations.
[3] Net system output uses losses divided by output or sales data as a reference.

Due to the very nature of losses being primarily a function of equipment loadings, the loss factor derivations for any voltage level must consider both the load at that level plus the loads from lower voltages and their associated losses. As a result, cumulative losses on losses equates to additional load at higher levels along with future changes (+ or –) in loads throughout the power system. It is therefore important to recognize that losses are multiplicative in nature (future) and not additive (test year only) for all future years to ensure total recovery based on prospective fixed loss factors for each service voltage.

The derivation of the cumulative loss factors shown in Table 1 have been detailed for all electrical facilities in Exhibit 9, page 1 for demand and page 2 for energy. Beginning on line 1 of page 1 (demand) under the secondary column, metered sales are adjusted for service losses on lines 3 and 4. This new total load (with losses) becomes the load amount for the next higher facilities of secondary conductors and their loss calculations. This process is repeated for all the installed facilities until the secondary sales are at the input level (line 45). The final loss factor for all delivery voltages using this same process is shown on line 46 and Table 1 for demand. This procedure is repeated in Exhibit 9, page 2, for the energy loss factors.

The loss factor derivation for major voltage categories is simply the input required (line 45) divided by the metered sales (line 2).

An overview of the loss study is shown on Figure 1 on the next page. Figure 2 simply illustrates the major components that must be considered in a loss analysis.

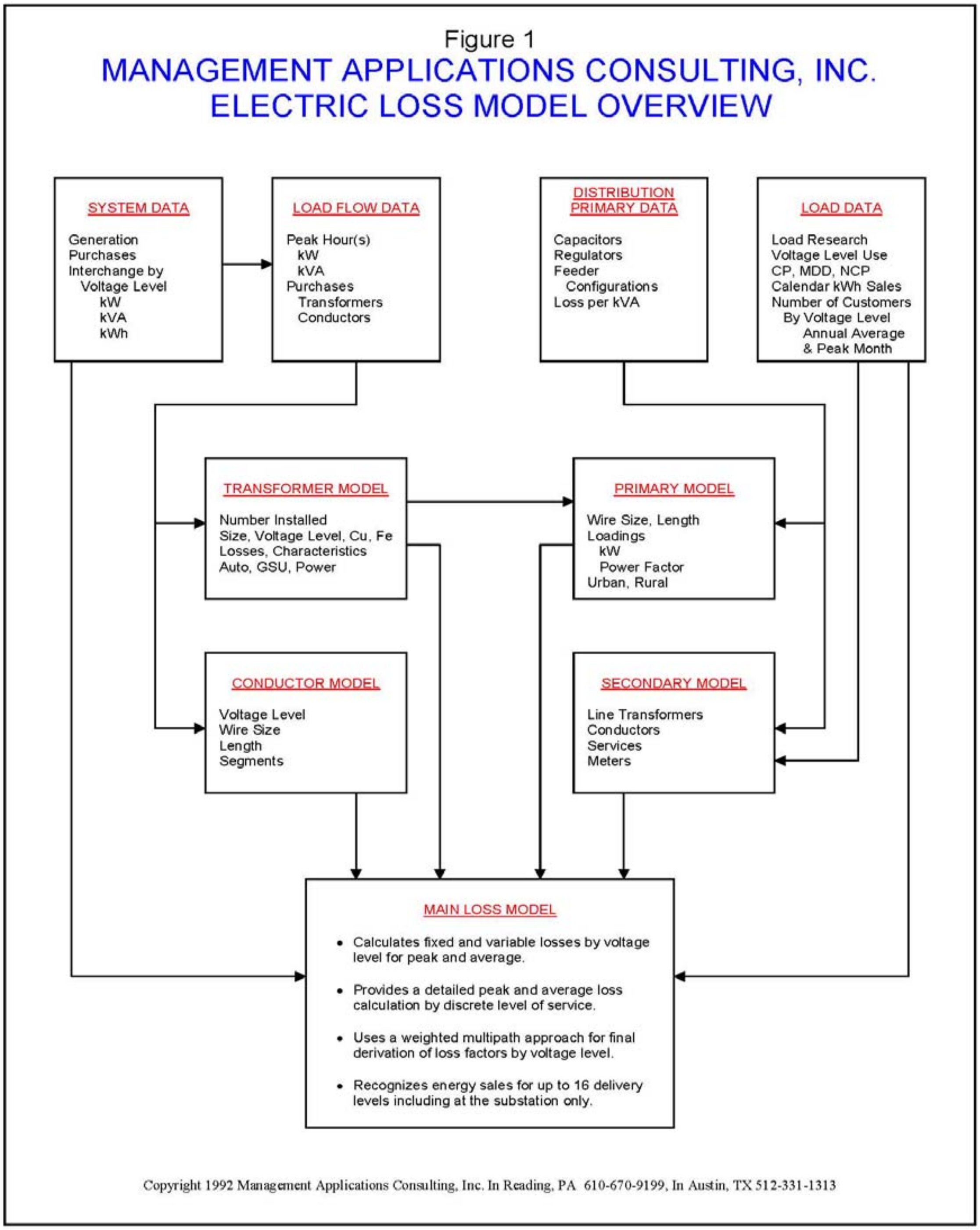
Figure 1
MANAGEMENT APPLICATIONS CONSULTING, INC.
ELECTRIC LOSS MODEL OVERVIEW
SYSTEM DATA
Generation
Purchases
Interchange by
Voltage Level
kW
kVA
kWh
LOAD FLOW DATA
Peak Hour(s)
kW
kVA
Purchases
Transformers
Conductors
DISTRIBUTION PRIMARY DATA
Capacitors
Regulators
Feeder
Configurations
Loss per kVA
LOAD DATA
Load Research
Voltage Level Use
CP, MDD, NCP
Calendar kWh Sales
Number of Customers
By Voltage Level
Annual Average
& Peak Month
TRANSFORMER MODEL
Number Installed
Size, Voltage Level, Cu, Fe
Losses, Characteristics
Auto, GSU, Power
PRIMARY MODEL
Wire Size, Length
Loadings
kW
Power Factor
Urban, Rural
CONDUCTOR MODEL
Voltage Level
Wire Size
Length
Segments
SECONDARY MODEL
Line Transformers
Conductors
Services
Meters
MAIN LOSS MODEL
• Calculates fixed and variable losses by voltage level for peak and average.
• Provides a detailed peak and average loss calculation by discrete level of service.
• Uses a weighted multipath approach for final derivation of loss factors by voltage level.
• Recognizes energy sales for up to 16 delivery levels including at the substation only.
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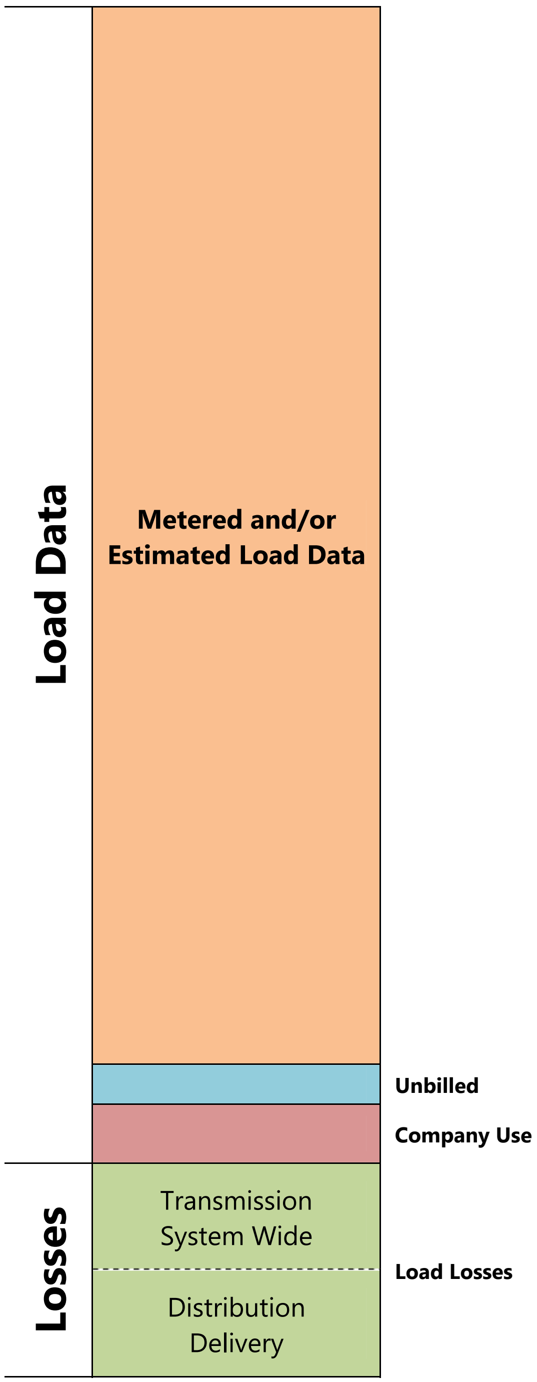
Figure 2
Generic Energy Loss Components



2.0 INTRODUCTION

This report of the 2009 Analysis of System Losses for Utah provides a summary of results, conceptual background or methodology, description of the analyses, and input information related to the study.

2.1 Conduct of Study

Typically, between five to ten percent of the total kWh requirements of an electric utility is lost or unaccounted for in the delivery of power to customers. Investments must be made in facilities which support the total load which includes losses or unaccounted for load. Revenue requirements associated with load losses are an important concern to utilities and regulators in that customers must equitably share in all of these cost responsibilities. Loss expansion factors are the mechanism by which customers' metered demand and energy data are mathematically adjusted to the generation or input level (point of reference) when performing cost and revenue calculations.

An acceptable accounting of losses can be determined for any given time period using available engineering, system, and customer data along with empirical relationships. This loss analysis for the delivery of demand and energy utilizes such an approach. A microcomputer loss model[4] is utilized as the vehicle to organize the available data, develop the relationships, calculate the losses, and provide an efficient and timely avenue for future updates and sensitivity analyses. Our procedures and calculations are consistent with prior loss studies and rely on numerous databases that include customer statistics and power system modeling results.

Company personnel performed most of the data gathering and data processing efforts. MAC analyzed the Company’s various databases and performed calculations to check the reasonableness of results. A review of the preliminary results provided for additions to the database and modifications to certain initial assumptions based on available data. Efforts in determining the data required to perform the loss analysis centered on information which was available from existing studies or reports within the Company.

[4]Copyright by Management Applications Consulting, Inc.

From an overall perspective, our efforts concentrated on five major areas:

1. System information by state jurisdiction concerning peak demand and metered annual sales data by voltage level,
2. High voltage power system power flow data and associated loss calculations (utilized preliminary system wide Transmission Loss Factors),
3. Distribution system primary and secondary loss calculations,
4. Derivation of fixed and variable losses by voltage level, and
5. Development of final cumulative expansion factors at each voltage level for peak demand (kW) and annual energy (kWh) requirements reconciled to system input.

2.2 Electric Power Losses

Losses in power systems consist of primarily technical losses with a much smaller level of non-technical losses.

Technical Losses

Electrical losses result from the transmission of energy over various electrical equipment. The largest component of these losses is power dissipation as a result of varying loading conditions and are oftentimes called load losses which are proportional to the square of the current (I^2R). These losses can be as high as 75% of all technical losses. The remaining losses are called no-load and represent essentially fixed (constant) energy losses throughout the year. These no-load losses represent energy required by a power system to energize various electrical equipment regardless of their loading levels. The major portion of no-load losses consists of core or magnetizing energy related to installed transformers throughout the power system.

Non-Technical Losses

These are unaccounted for energy losses that are related to energy theft, metering, non-payment by customers, and accounting errors. Losses related to these areas are generally very small and can be extremely difficult and subjective to quantify. Our efforts generally do not develop any meaningful level as appropriate because we assume that improving technology and utility practices have minimized these amounts.

2.3 Description of Model

The Loss Model is a customized applications model, constructed using the Excel software program. Documentation consists primarily of the model equations at each cell location. A significant advantage of such a model is that the actual formulas and their corresponding computed values at each cell of the model are immediately available to the analyst.

A brief description of the two appendices and their major categories of effort for the preparation of each loss model is as follows:

- Appendix A identifies the preliminary system wide transmission loss factors and supporting calculations. These transmission loss factors formed the basis and starting point with which to derive the final delivery loss factors for each remaining voltage level as presented in Appendix B and summarized on Table 1 of the Executive Summary.

- Appendix B which contains calculations for distribution-related conductors, transformers, and all primary and secondary losses as summarized in the output reports.

3.0 METHODOLOGY

3.1 Background

The objective of a Loss Study is to provide a reasonable set of energy (average) and demand (peak) loss expansion factors which account for system losses associated with the transmission and delivery of power to each voltage level over a designated period of time. The focus of this study is to identify the difference between total energy inputs and the associated sales with the difference being equitably allocated to all delivery levels. Several key elements are important in establishing the methodology for calculating and reporting the Company's losses. These elements are:

- Selection of voltage level of services,
- Recognition of losses associated with conductors, transformations, and other electrical equipment/components within voltage levels,
- Identification of customers and loads at various voltage levels of service,
- Review of generation or net power supply input at each level for the test period studied, and
- Analysis of kW and kWh sales by voltage levels within the test period.

The three major areas of data gathering and calculations in the loss analysis were as follows:

1. System Information (monthly and annual)
    - MWH generation and MWH sales.
    - Coincident peak estimates and net power supply input from all sources and voltage levels.
    - Customer load data estimates from available load research information, adjusted MWH sales, and number of customers in the customer groupings and voltage levels identified in the model.
    - System default values, such as power factor, loading factors, and load factors by voltage level.

2. High Voltage System (Appendix A)

   - Presents the detailed calculations and derivation of the preliminary system wide transmission loss factors used in the calculations developed in Appendix B.

3. Distribution System (Appendix B)

   - Distribution Substations – data was developed for modeling each substation as to its size and loading. Loss calculations were performed from this data to determine load and no load losses separately for each transformer.

   - Primary lines – Line loading and loss characteristics were obtained from distribution feeder analyses. These loss results developed kW loss per MW of load by Primary Voltage level. An average was calculated to derive the primary loss estimate after weighting the proper rural versus urban customer mix.

   - Line transformers – Losses in line transformers were based on each customer service group's size, as well as the number of customers per transformer. Accounting and load data provided the foundation with which to model the transformer loadings and calculate load and no load losses.

   - Secondary network – Typical secondary networks were estimated for conductor sizes, lengths, loadings, and customer penetration for residential and small general service customers.

   - Services – Typical services were estimated for each secondary service class of customers identified in the study with respect to type, length, and loading.

The loss analysis was thus performed by constructing the model in segments and subsequently calculating the composite until the constraints of peak demand and energy were met:

- Information as to the physical characteristics and loading of each transformer and conductor segment was modeled.

- Conductors, transformers, and distribution were grouped by voltage level, and unadjusted losses were calculated.

- The loss factors calculated at each voltage level were determined by "compounding" the per-unit losses. Equivalent sales at the supply point were obtained by dividing sales at a specific level by the compounded loss factor to determine losses by voltage level.

- The resulting demand and energy loss expansion factors were then used to adjust all sales to the generation or input level in order to estimate the difference.

- Reconciliation of kW and kWh sales by voltage level using the reported system kW and kWh was accomplished by adjusting the initial loss factor estimates until the mismatch or difference was eliminated.

3.2 Calculations and Analysis

This section provides a discussion of the input data, assumptions, and calculations performed in the loss analysis. Specific appendices have been included in order to provide documentation of the input data utilized in the model.

3.2.1 Bulk, Transmission and Subtransmission Lines

Appendix A provides the summary results of the hourly calculations of segments of the PacifiCorp power system on an hourly basis.

3.2.2 Transformers

Appendix A provides the summary results of the hourly calculations of segments of the PacifiCorp power system on an hourly basis.

3.2.3 Distribution System

The load data at the substation and customer level, coupled with primary and secondary network information, was sufficient to model the distribution system in adequate detail to calculate losses.

<u>Primary Lines</u>

Estimates were made by the Company of primary line losses by the different levels of distribution voltage and whether they were urban or rural. These estimates consider substations, feeders per substation, voltage levels, loadings, total circuit miles, wire size, and single- to three-phase investment estimates. Our recommended loss factors were determined by calculating all other factors, and the remaining unaccounted for MW and MWH were assigned to primary losses.

Line Transformers

Losses in line transformers were determined based on typical transformer sizes for each secondary customer service group and an estimated or calculated number of customers per transformer. Accounting records and estimates of load data provided the necessary database with which to model the loadings. These calculations also made it possible to determine separate copper and iron losses based on a table of representative losses for various transformer sizes.

Secondary Line Circuits

Calculations of secondary line circuit losses were performed for loads served through these secondary line investments. Estimates of typical conductor sizes, lengths, loadings and customer class penetrations were made to obtain total circuit miles and losses for the secondary network. Customer loads which do not have secondary line requirements were also identified so that a reasonable estimate of losses and circuit miles of the investments could be made.

Service Drops and Meters

Service drops were estimated for each secondary customer reflecting conductor size, length and loadings to obtain demand losses. A separate calculation was also performed using customer maximum demands to obtain kWh losses. Meter loss estimates were also made for each customer and incorporated into the calculations of kW and kWh losses included in the Summary Results.

4.0 DISCUSSION OF RESULTS

A brief description of each Exhibit provided in Appendix B as follows:

Exhibit 1 - Summary of Company Data

This exhibit reflects system information used to determine percent losses and a detailed summary of kW and kWh losses by voltage level. The loss factors developed in Exhibit 7 are also summarized by voltage level.

Exhibit 2 - Summary of Conductor Information

A summary of MW and MWH load and no load losses for conductors by voltage levels is presented. The sum of all calculated losses by voltage level is based on input data information provided in Appendix A. Percent losses are based on equipment loadings.

Exhibit 3 - Summary of Transformer Information

This exhibit summarizes transformer losses by various types and voltage levels throughout the system. Load losses reflect the copper portion of transformer losses while iron losses reflect the no load or constant losses. MWH losses are estimated using a calculated loss factor for copper and the test year hours times no load losses.

Exhibit 4 - Summary of Losses Diagram (2 Pages)

This loss diagram represents the inputs and output of power at system peak conditions. Page 1 details information from all points of the power system and what is provided to the distribution system for primary loads. This portion of the summary can be viewed as a "top down" summary into the distributor system.

Page 2 represents a summary of the development of primary line loads and distribution substations based on a "bottom up" approach. Basically, loadings are developed from the customer meter through the Company’s physical investments based on load research and other metered information by voltage level to arrive at MW and MVA requirements during peak load conditions by voltage levels.

Exhibit 5 - Summary of Sales and Calculated Losses

Summary of Calculated Losses represents a tabular summary of MW and MWH load and no load losses by discrete areas of delivery within each voltage level. Losses have been identified and are derived based on summaries obtained from Exhibits 2 and 3 and losses associated with meters, capacitors and regulators.

Exhibit 6 - Development of Loss Factors, Unadjusted

This exhibit calculates demand and energy losses and loss factors by specific voltage levels based on sales level requirements. The actual results reflect loads by level and summary totals of losses at that level, or up to that level, based on the results as shown in Exhibit 5. Finally, the estimated values at generation are developed and compared to actual generation to obtain any difference or mismatch.

Exhibit 7 - Development of Loss Factors, Adjusted

The adjusted loss factors are the results of adjusting Exhibit 6 for any difference. All differences between estimated and actual are prorated to each level based on the ratio of each level's total load plus losses to the system total as shown on Exhibit 8. These new loss factors reflect an adjustment in losses due only to kW and kWh mismatch.

Exhibit 8 – Adjusted Losses and Loss Factors by Facility

These calculations present an expanded summary detail of Exhibit 7 for each segment of the power system with respect to the flow of power and associated losses from the receipt of energy at the meter to the generation for the Company's power system.

Exhibit 9 – Appendix B Only – Summary of Losses by Delivery Voltage

These calculations present a reformatted summary of the losses presented in Exhibits 7 and 8 by power system delivery segment as calculated by voltage level of service based on sales.

Appendix A

PacifiCorp
System Wide Transmission
Loss Factors (Preliminary)

PacifiCorp

2009 State Jurisdictional Transmission Loss Analysis With GSU

Pages 1	Index
Schedule 1, Page 2	Presents the summary loss results of the calculated hourly losses for the Company's PACE and PACW control areas at the annual peak hour and for the annual average losses for all hours of the year. Calculated loss factors are applicable to the metered (output) sales level. All data is from Schedule 2.
Schedule 2, Page 3	Summary of the summer and winter peak hour MW and annual MWH losses for PACE and PACW and the total system. Results are detailed by segment and season: Summer (June, July, August, and September), Winter (all months excluding Summer months). Loss data is from Schedule 3.
Schedule 3, Page 4	Summary of MW and MWH loss results for each control area by season and voltage level.
Schedule 4, Page 5	Summary of seasonal peak hour MW and average MWH loss results for PACE by voltage level from Appendices A (winter) and B (summer) hourly loss calculations.
Schedule 5, Page 6	Summary of seasonal peak hour MW and average MWH loss results for PACW by voltage level from Appendices C (winter) and D (summer) hourly loss calculations.

PACIFICORP 2009 TRANSMISSION LOSS ANALYSIS

		LOSSES	PERCENT OF TOTAL TRANSMISSION	INPUT	OUTPUT	LOSS FACTOR (Input/Output)
A.	**TRANSMISSION DEMAND**		**Peak (MW) Summer**			
1	East	325.0	73.4%	7,443	7,118	1.04566
2	West	117.9	26.6%	3,647	3,529	1.03340
3	Total Demand	442.8	100.0%	11,090	10,647	1.04159
4	Unmetered Station Use Adjustment					0.00100
5	Demand Loss Factor					1.04259
B.	**ENERGY**		**Annual MWH**			
6	East	2,002,285	70.8%	45,369,000	43,366,715	1.04617
7	West	826,451	29.2%	21,361,106	20,534,655	1.04025
8	Total Energy	2,828,736	100.0%	66,730,106	63,901,370	1.04427
9	Unmetered Station Use Adjustment					0.00100
10	Energy Loss Factor					1.04527

NOTES:
(1) Results include Bridger losses from Schedule 4,
(2) Results include Corona loss estimates from Schedule 3.
(3) Loss calculations include adjusted (reduced) for Company ownership.
(4) Loss calculations include GSU and Wind Plant.
(5) Loss calculations excludes third party facilities.

PACIFICORP POWER FLOW RESULTS - SUMMARY OF LOSSES

		PEAK (SUMMER)			PEAK (WINTER)			ANNUAL		
		Total (MW)	% of Total Area	% of Total System	Total (MW)	% of Total Area	% of Total System	Total Annual (MWH)	% of Total Area	% of Total System
	EAST									
1	Load (Peak MW, Annual MWH)	7,443			6,946			45,369,000		
	Transmission									
2	Transformers	25.0	7.7%	5.6%	23.9	7.7%	5.4%	145,704	7.3%	5.2%
3	Transmission Lines	300.0	92.3%	67.8%	286.7	92.3%	65.0%	1,856,581	92.7%	65.6%
4	Total Transmission	325.0	100.0%	73.4%	310.6	100.0%	70.4%	2,002,285	100.0%	70.8%
5	Subtotal - EAST	325.0	100.0%	73.4%	310.6	100.0%	70.4%	2,002,285	100.0%	70.8%
6	Losses % of Input (Line 6/Line 1)	4.4%			4.5%			4.4%		
7	Losses % of Output (Line 6/(Line 1/Line 6))	4.6%			4.7%			4.6%		
	WEST									
8	Load (Peak MW, Annual MWH)	3,647			4,009			21,361,106		
	Transmission									
9	Transformers	11.9	10.1%	2.7%	12.5	9.5%	2.8%	98,188	11.9%	3.5%
10	Transmission Lines	106.0	89.9%	23.9%	118.3	90.5%	26.8%	728,263	88.1%	25.7%
11	Total Transmission	117.9	100.0%	26.6%	130.7	100.0%	29.6%	826,451	100.0%	29.2%
12	Subtotal - WEST	117.9	100.0%	26.6%	130.7	100.0%	29.6%	826,451	100.0%	29.2%
14	Losses % of Input (Line 14/Line 9)	3.2%			3.3%			3.9%		
15	Losses % of Output (Line 14/(Line 9/Line 14))	3.3%			3.4%			4.0%		
	TOTAL PACIFICORP									
16	Load (Peak MW, Annual MWH)	11,090			10,955			66,730,106		
	Transmission									
17	Transformers	36.9		8.3%	36.3		8.2%	243,893		8.6%
18	Transmission Lines	406.0		91.7%	405.0		91.8%	2,584,843		91.4%
19	Total Transmission	442.8		100.0%	441.3		100.0%	2,828,736		100.0%
20	Total System	442.8		100.0%	441.3		100.0%	2,828,736		100.0%
22	Losses % of Input (Line 22/Line 17)	4.0%			4.0%			4.2%		
23	Losses % of Output (Line 22/(Line 17/Line 22))	4.2%			4.2%			4.4%		

PACIFICORP POWER FLOW RESULTS - TOTAL TRANSMISSION

TIME	MW INPUT	TRANSFORMER LOSSES MW: 345 kV to 500 kV (1)	161 kV to 345 kV Includes Bridger	115 kV to 161 kV	46 kV to 115 kV	GSU	SVC	Subtotal Transformers	TRANSMISSION LINE LOSSES MW: 345 kV to 500 kV (2)	161 kV to 345 kV Includes Bridger	115 kV to 161 kV	Corona 500 kV to 138 kV	46 kV to 115 kV	Below 46 kV	Subtotal Transm Lines	Total Transmission Losses
WINTER - EAST																
1 PEAK - MW	6,946		7.160	3.450	0.182	12.569	0.504	23.864		177.157	51.324	9.313	45.029	3.889	286.712	310.576
2 LOSS % TO INPUT			0.103%	0.050%	0.003%	0.181%	0.007%	0.344%		2.550%	0.739%	0.134%	0.648%	0.056%	4.128%	
3 LOSS % TO TOTAL LOSSES								7.684%							92.316%	100.000%
4																
5 WINTER MWH	29,694,446		33,163	9,480	812	53,402	2,612	99,470		753,679	206,587	70,607	136,393	18,450	1,185,716	1,285,186
6 LOSS % TO INPUT			0.112%	0.032%	0.003%	0.180%	0.009%	0.335%		2.538%	0.696%	0.238%	0.459%	0.062%	3.993%	
7 LOSS % TO TOTAL LOSSES								7.740%							92.260%	100.000%
SUMMER - EAST																
8 PEAK - MW	7,443		7.211	4.461	0.190	12.566	0.534	24.962		175.235	67.436	9.313	45.430	2.607	300.021	324.982
9 LOSS % TO INPUT			0.097%	0.060%	0.003%	0.169%	0.007%	0.335%		2.354%	0.906%	0.125%	0.610%	0.035%	4.031%	
10 LOSS % TO TOTAL LOSSES								7.681%							92.319%	100.000%
11																
12 SUMMER MWH	15,674,554		16,316	6,444	415	22,316	744	46,234		410,374	146,442	35,449	72,178	6,422	670,864	717,099
13 LOSS % TO INPUT			0.104%	0.041%	0.003%	0.142%	0.005%	0.295%		2.618%	0.934%	0.226%	0.460%	0.041%	4.280%	
14 LOSS % TO TOTAL LOSSES								6.447%							93.553%	100.000%
TOTAL ANNUAL - EAST																
15 PEAK - MW	7,443		7.211	4.461	0.190	12.566	0.534	24.962		175.235	67.436	9.313	45.430	2.607	300.021	324.982
16 ANNUAL MWH	45,369,000		49,479	15,924	1,228	75,718	3,356	145,704		1,164,053	353,028	106,055	208,572	24,872	1,856,581	2,002,285
17 LOSS % TO INPUT			0.109%	0.035%	0.003%	0.167%	0.007%	0.321%		2.566%	0.778%	0.234%	0.460%	0.055%	4.092%	
18 LOSS % TO TOTAL ANNUAL INPUT								7.277%							92.723%	100.000%
19 LOSS % TO TOTAL ANNUAL OUTPUT																43,366,715
20 (Input - Losses)																4.617%
LOSS FACTORS - EAST																
21 Demand																1.04566
22 Energy																1.04617
WINTER - WEST																
23 PEAK - MW	4,009	0.465	6.843		2.042	3.109		12.459	11.433	30.143		4.691	70.768	1.237	118.271	130.730
24 LOSS % TO INPUT		0.012%	0.171%		0.051%	0.078%		0.311%	0.285%	0.752%		0.117%	1.765%	0.031%	2.950%	
25 LOSS % TO TOTAL								9.530%							90.470%	100.000%
26																
27 WINTER MWH	14,464,624	1,165	36,257		11,417	17,590		66,430	64,387	114,122		35,565	279,221	1,616	494,911	561,341
28 LOSS % TO INPUT		0.008%	0.251%		0.079%	0.122%		0.459%	0.445%	0.789%		0.246%	1.930%	0.011%	3.422%	
29 LOSS % TO TOTAL LOSSES								11.834%							88.166%	100.000%
SUMMER - WEST																
30 PEAK - MW	3,647	0.390	6.604		1.834	3.065		11.892	10.025	27.421		4.691	62.660	1.161	105.958	117.851
31 LOSS % TO INPUT		0.011%	0.181%		0.050%	0.084%		0.326%	0.275%	0.752%		0.129%	1.718%	0.032%	2.906%	
32 LOSS % TO TOTAL								10.091%							89.909%	100.000%
33																
34 SUMMER MWH	6,896,481	536	19,636		4,442	7,144		31,759	30,516	51,775		17,856	132,623	581	233,351	265,110
35 LOSS % TO INPUT		0.008%	0.285%		0.064%	0.104%		0.461%	0.442%	0.751%		0.259%	1.923%	0.008%	3.384%	
36 LOSS % TO TOTAL LOSSES								11.979%							88.021%	100.000%
TOTAL ANNUAL - WEST																
37 PEAK - MW	3,647	0.390	6.604		1.834	3.065		11.892	10.025	27.421		4.691	62.660	1.161	105.958	117.851
38 ANNUAL MWH	21,361,106	1,702	55,893		15,859	24,735		98,188	94,903	165,897		53,421	411,844	2,197	728,263	826,451
39 LOSS % TO INPUT		0.008%	0.262%		0.074%	0.116%		0.460%	0.444%	0.777%		0.250%	1.928%	0.010%	3.409%	
40 LOSS % TO TOTAL ANNUAL INPUT								11.881%							88.119%	100.000%
39 LOSS % TO TOTAL ANNUAL OUTPUT																20,534,655
40 (Input - Losses)																4.025%
LOSS FACTORS - WEST																
41 Demand																1.03340
42 Energy																1.04025
TOTAL ANNUAL - PACIFICORP																
43 PEAK SUMMER - MW	11,090	0.390	13.814	4.461	2.023	15.632	0.534	36.854	10.025	202.657	67.436	14.004	108.091	3.767	405.979	442.833
44 ANNUAL MWH	66,730,106	1,702	105,372	15,924	17,087	100,453	3,356	243,893	94,903	1,329,951	353,028	159,476	620,416	27,069	2,584,843	2,828,736
45 PEAK WINTER MW	10,955	0.465	14.003	3.450	2.224	15.678	0.504	36.323	11.433	207.299	51.324	14.004	115.797	5.125	404.983	441.306

PACIFICORP POWER FLOW RESULTS - EAST

		TRANSFORMER LOSSES MW							TRANSMISSION LINE LOSSES MW							
TIME	MW-EAST INPUT	161 kV to 345 kV	Bridger 345 kV	115 kV to 161 kV	46 kV to 115 kV	GSU	SVC	Subtotal Transformers	161 kV to 345 kV	Bridger 345 kV	115 kV to 161 kV	Corona 500 kV to 138 kV	46 kV to 115 kV	Below 46 kV	Subtotal Transm Lines	Total Transmission Losses
WINTER - EAST																
1 PEAK - MW	6,946	4.226	2.934	3.450	0.182	12.569	0.504	23.864	118.027	59.130	51.324	9.313	45.029	3.889	286.712	310.576
2 LOSS % TO INPUT		0.061%	0.042%	0.050%	0.003%	0.181%	0.007%	0.344%	1.699%	0.851%	0.739%	0.134%	0.648%	0.056%	4.128%	
3 LOSS % TO TOTAL LOSSES								7.684%							92.316%	100.000%
4																
5 WINTER MWH	29,694,446	15,751	17,413	9,480	812	53,402	2,612	99,470	440,073	313,606	206,587	70,607	136,393	18,450	1,185,716	1,285,186
6 LOSS % TO INPUT		0.053%	0.059%	0.032%	0.003%	0.180%	0.009%	0.335%	1.482%	1.056%	0.696%	0.238%	0.459%	0.062%	3.993%	
7 LOSS % TO TOTAL LOSSES								7.740%							92.260%	100.000%
SUMMER - EAST																
8 PEAK - MW	7,443	4.278	2.933	4.461	0.190	12.566	0.534	24.962	118.015	57.220	67.436	9.313	45.430	2.607	300.021	324.982
9 LOSS % TO INPUT		0.057%	0.039%	0.060%	0.003%	0.169%	0.007%	0.335%	1.586%	0.769%	0.906%	0.125%	0.610%	0.035%	4.031%	
10 LOSS % TO TOTAL LOSSES								7.681%							92.319%	100.000%
11																
12 SUMMER MWH	15,674,554	7,729	8,587	6,444	415	22,316	744	46,234	243,369	167,005	146,442	35,449	72,178	6,422	670,864	717,099
13 LOSS % TO INPUT		0.049%	0.055%	0.041%	0.003%	0.142%	0.005%	0.295%	1.553%	1.065%	0.934%	0.226%	0.460%	0.041%	4.280%	
14 LOSS % TO TOTAL LOSSES								6.447%							93.553%	100.000%
TOTAL ANNUAL - EAST																
15 PEAK - MW	7,443	4.278	2.933	4.461	0.190	12.566	0.534	24.962	118.015	57.220	67.436	9.313	45.430	2.607	300.021	324.982
16 ANNUAL MWH	45,369,000	23,480	26,000	15,924	1,228	75,718	3,356	145,704	683,442	480,611	353,028	106,055	208,572	24,872	1,856,581	2,002,285
17 LOSS % TO INPUT		0.052%	0.057%	0.035%	0.003%	0.167%	0.007%	0.321%	1.506%	1.059%	0.778%	0.234%	0.460%	0.055%	4.092%	
18 LOSS % TO TOTAL ANNUAL INPUT								7.277%							92.723%	100.000%
19 LOSS % TO TOTAL ANNUAL OUTPUT																43,366,715
20 (Input - Losses)																4.617%
LOSS FACTORS - EAST																
21 Demand																1.04566
22 Energy																1.04617

	Winter Hours	Summer Hours	Total Hours	Percent of Total Hours
PERCENT RANGE - EAST				
22 91-100	169	109	278	3.17%
23 76-90	970	905	1,875	21.40%
24 51-75	4,596	1,875	6,471	73.87%
25 1-50	97	39	136	1.55%
26 Total Hours	5,832	2,928	8,760	100.00%

NOTES:

(1) Bridger losses shown at 66.7% - reference Work paper 1.
(2) Summer Period includes June, July, August, and September.
(3) Winter Period includes all non Summer months.

PACIFICORP POWER FLOW RESULTS - WEST

		TRANSFORMER LOSSES MW					TRANSMISSION LINE LOSSES MW						
TIME	**MW-WEST INPUT**	**345 kV to 500 kV (1)**	**161 kV to 345 kV**	**46 kV to 115 kV**	**GSU**	**Subtotal Transformers**	**345 kV to 500 kV (2)**	**161 kV to 345 kV**	**Corona 500 kV to 138 kV**	**46 kV to 115 kV**	**Below 46 kV**	**Subtotal Transm Lines**	**Total Transmission Losses**
WINTER - WEST													
1 PEAK - MW	4,009	0.465	6.843	2.042	3.109	12.459	11.433	30.143	4.691	70.768	1.237	118.271	130.730
2 LOSS % TO INPUT		0.012%	0.171%	0.051%	0.078%	0.311%	0.285%	0.752%	0.117%	1.765%	0.031%	2.950%	
3 LOSS % TO TOTAL LOSSES						9.530%						90.470%	100.000%
4													
5 WINTER MWH	14,464,624	1,165	36,257	11,417	17,590	66,430	64,387	114,122	35,565	279,221	1,616	494,911	561,341
6 LOSS % TO INPUT		0.008%	0.251%	0.079%	0.122%	0.459%	0.445%	0.789%	0.246%	1.930%	0.011%	3.422%	
7 LOSS % TO TOTAL LOSSES						11.834%						88.166%	100.000%
SUMMER - WEST													
8 PEAK - MW	3,647	0.390	6.604	1.834	3.065	11.892	10.025	27.421	4.691	62.660	1.161	105.958	117.851
9 LOSS % TO INPUT		0.011%	0.181%	0.050%	0.084%	0.326%	0.275%	0.752%	0.129%	1.718%	0.032%	2.906%	
10 LOSS % TO TOTAL LOSSES						10.091%						89.909%	100.000%
11													
12 SUMMER MWH	6,896,481	536	19,636	4,442	7,144	31,759	30,516	51,775	17,856	132,623	581	233,351	265,110
13 LOSS % TO INPUT		0.008%	0.285%	0.064%	0.104%	0.461%	0.442%	0.751%	0.259%	1.923%	0.008%	3.384%	
14 LOSS % TO TOTAL LOSSES						11.979%						88.021%	100.000%
TOTAL ANNUAL - WEST													
PEAK - MW	3,647	0.390	6.604	1.834	3.065	11.892	10.025	27.421	4.691	62.660	1.161	105.958	117.851
15 ANNUAL MWH	21,361,106	1,702	55,893	15,859	24,735	98,188	94,903	165,897	53,421	411,844	2,197	728,263	826,451
16 LOSS % TO INPUT		0.008%	0.262%	0.074%	0.116%	0.460%	0.444%	0.777%	0.250%	1.928%	0.010%	3.409%	
17 LOSS % TO TOTAL ANNUAL INPUT						11.881%						88.119%	100.000%
18 LOSS % TO TOTAL ANNUAL OUTPUT													20,534,655
19 (Input - Losses)													4.025%
LOSS FACTORS - WEST													
20 Demand													1.03340
21 Energy													1.04025

	Winter Hours	**Summer Hours**	**Total Hours**	**Percent of Total Hours**
PERCENT RANGE - WEST				
22 91-100	49	287	336	3.84%
23 76-90	2,039	512	2,551	29.12%
24 51-75	3,663	1,981	5,644	64.43%
25 1-50	81	148	229	2.61%
26 Total Hours	5,832	2,928	8,760	100.00%

NOTES:

(1) Summer Period includes June, July, August, and September.

(2) Winter Period includes all non Summer months.

Appendix B

Results of PacifiCorp Utah 2009 Loss Analysis

PACIFICORP UTAH

EXHIBIT 1

SUMMARY OF COMPANY DATA

ANNUAL PEAK		4,365	MW
GENERATION & PURCHASES-INPUT		24,087,011	MWH
ANNUAL SALES	-OUTPUT	22,346,337	MWH
SYSTEM LOSSES	INPUT	1,740,674	or 7.23%
	OUTPUT		or 7.79%
SYSTEM LOAD FACTOR		63.0%	

SUMMARY OF LOSSES - OUTPUT RESULTS

SERVICE	KV	MW	% TOTAL	MWH	% TOTAL
TRANS	500,345,161	178.3	50.87%	1,043,194	59.93%
	115,69,46	4.09%		4.33%	
PRIMARY	34,12,1	96.4	27.50%	325,617	18.71%
		2.21%		1.35%	
SECONDARY	< 1	75.8	21.63%	371,864	21.36%
		1.74%		1.54%	
TOTAL		350.5	100.00%	1,740,674	100.00%
		8.03%		7.23%	

SUMMARY OF LOSS FACTORS

SERVICE	KV	CUMMULATIVE SALES EXPANSION FACTORS DEMAND d	DEMAND 1/d	ENERGY e	ENERGY 1/e
TRANS	500,345,161	1.04259	0.95915	1.04527	0.95669
	115,69,46				
PRIM SUBS		0.00000	0.00000	0.00000	0.00000
PRIMARY	34,12,1	1.07377	0.93130	1.06635	0.93778
SECONDARY	< 1	1.10106	0.90821	1.09322	0.91473

SUMMARY OF CONDUCTOR INFORMATION

EXHIBIT 2

DESCRIPTION			CIRCUIT MILES	LOADING % RATING	MW LOSSES LOAD	MW LOSSES NO LOAD	MW LOSSES TOTAL	MWH LOSSES LOAD	MWH LOSSES NO LOAD	MWH LOSSES TOTAL
--- BULK -----------	345 KV	OR GREATER								
TIE LINES			0.0	0.00%	0.000	0.000	0.000	0	0	0
BULK TRANS			0.0	0.00%	0.000	0.000	0.000	0	0	0
SUBTOT			0.0		0.000	0.000	0.000	0	0	0
--- TRANS ---------	115 KV	TO	345.00 KV							
TIE LINES			0	0.00%	0.000	0.000	0.000	0	0	0
TRANS1	161 KV		0.0	0.00%	0.000	0.000	0.000	0	0	0
TRANS2	115 KV		0.0	0.00%	0.000	0.010	0.010	0	89	89
SUBTOT			0.0		0.000	0.010	0.010	0	89	89
--- SUBTRANS ------	35 KV	TO	115 KV							
TIE LINES			0	0.00%	0.000	0.000	0.000	0	0	0
SUBTRANS1	69 KV		0.0	0.00%	0.000	0.000	0.000	0	0	0
SUBTRANS2	46 KV		0.0	0.00%	0.000	0.000	0.000	0	0	0
SUBTRANS3	35 KV		0.0	0.00%	0.000	0.000	0.000	0	0	0
SUBTOT			0.0		0.000	0.000	0.000	0	0	0
PRIMARY LINES			21,095		60.786	2.991	63.778	180,170	28,300	208,470
SECONDARY LINES			8,443		6.193	0.000	6.193	20,045	0	20,045
SERVICES			17,859		15.153	2.214	17.367	52,055	19,391	71,446
TOTAL			47,397		82.133	5.215	87.348	252,271	47,780	300,050

SUMMARY OF TRANSFORMER INFORMATION EXHIBIT 3

DESCRIPTION		KV VOLTAGE	CAPACITY MVA	NUMBER TRANSFMR	AVERAGE SIZE	LOADING %	MVA LOAD	MW LOSSES LOAD	MW LOSSES NO LOAD	MW LOSSES TOTAL	MWH LOSSES LOAD	MWH LOSSES NO LOAD	MWH LOSSES TOTAL
BULK STEP-UP		345	0.0	0	0.0	0.00%	0	0.000	0.000	0.000	0	0	0
BULK - BULK			0.0	0	0.0	0.00%	0	0	0.000	0.000	0	0	0
BULK - TRANS1		161	0.0	0	0.0	0.00%	0	0.000	0.000	0.000	0	0	0
BULK - TRANS2		115	0.0	0	0.0	0.00%	0	0.000	0.000	0.000	0	0	0
TRANS1 STEP-UP		161	0.0	0	0.0	0.00%	0	0.000	0.000	0.000	0	0	0
TRANS1 - TRANS2		115	0.0	0	0.0	0.00%	0	0.000	0.000	0.000	0	0	0
TRANS1-SUBTRANS1		69	0.0	0	0.0	0.00%	0	0.000	0.000	0.000	0	0	0
TRANS1-SUBTRANS2		46	0.0	0	0.0	0.00%	0	0.000	0.000	0.000	0	0	0
TRANS1-SUBTRANS3		35	0.0	0	0.0	0.00%	0	0.000	0.000	0.000	0	0	0
TRANS2 STEP-UP		115	0.0	0	0.0	0.00%	0	0.000	0.000	0.000	0	0	0
TRANS2-SUBTRANS1		69	0.0	0	0.0	0.00%	0	0.000	0.000	0.000	0	0	0
TRANS2-SUBTRANS2		46	0.0	0	0.0	0.00%	0	0.000	0.000	0.000	0	0	0
TRANS2-SUBTRANS3		35	0.0	0	0.0	0.00%	0	0.000	0.000	0.000	0	0	0
SUBTRAN1 STEP-UP		69	0.0	0	0.0	0.00%	0	0.000	0.000	0.000	0	0	0
SUBTRAN2 STEP-UP		46	0.0	0	0.0	0.00%	0	0.000	0.000	0.000	0	0	0
SUBTRAN3 STEP-UP		35	0.0	0	0.0	0.00%	0	0.000	0.000	0.000	0	0	0
SUBTRAN1-SUBTRAN2		46	0.0	0	0.0	0.00%	0	0.000	0.000	0.000	0	0	0
SUBTRAN1-SUBTRAN3		35	0.0	0	0.0	0.00%	0	0.000	0.000	0.000	0	0	0
SUBTRAN2-SUBTRAN3		35	0.0	0	0.0	0.00%	0	0.000	0.000	0.000	0	0	0
DISTRIBUTION SUBSTATIONS													
TRANS1 -	161	34	0.0	0	0.0	0.00%	0	0.000	0.000	0.000	0	0	0
TRANS1 -	161	12	0.0	0	0.0	0.00%	0	0.000	0.000	0.000	0	0	0
TRANS1 -	161	1	0.0	0	0.0	0.00%	0	0.000	0.000	0.000	0	0	0
TRANS2 -	115	34	0.0	0	0.0	0.00%	0	0.000	0.000	0.000	0	0	0
TRANS2 -	115	12	3,198.7	113	28.3	53.50%	1,711	3.274	4.502	7.775	9,989	39,433	49,422
TRANS2 -	115	1	14.0	1	14.0	53.50%	7	0.018	0.022	0.040	55	193	248
SUBTRAN1-	69	34	32.5	2	16.3	59.80%	19	0.048	0.050	0.098	145	439	584
SUBTRAN1-	69	12	291.2	47	6.2	53.50%	156	0.434	0.509	0.943	1,323	4,459	5,782
SUBTRAN1-	69	1	7.5	2	3.8	53.50%	4	0.014	0.016	0.029	43	136	179
SUBTRAN2-	46	34	0.0	0	0.0	0.00%	0	0.000	0.000	0.000	0	0	0
SUBTRAN2-	46	12	2,562.9	228	11.2	53.50%	1,371	3.193	4.022	7.215	9,742	35,231	44,973
SUBTRAN2-	46	1	173.9	33	5.3	53.50%	93	0.238	0.290	0.528	726	2,538	3,264
SUBTRAN3-	35	34	0.0	0	0.0	0.00%	0	0.000	0.000	0.000	0	0	0
SUBTRAN3-	35	12	9.0	1	9.0	53.50%	5	0.014	0.015	0.030	43	135	178
SUBTRAN3-	35	1	0.0	0	0.0	0.00%	0	0.000	0.000	0.000	0	0	0
PRIMARY - PRIMARY			154.8	31	5.0	53.50%	83	0.217	0.219	0.436	661	1,920	2,581
LINE TRANSFRMR			10,569.5	187,457	56.4	31.56%	3,335	11.947	28.122	40.069	19,529	246,351	265,880
			==========	==========	==========	==========		==========	==========	==========	==========	==========	==========
TOTAL			17,014	187,915				19.396	37.767	57.163	42,255	330,836	373,091

SUMMARY OF LOSSES DIAGRAM - DEMAND MODEL - SYSTEM PEAK 4365.025565 MW

BULK TIE LINES	
LOAD	0.00% MW
LOAD LOSS	0.000 MW
NOLD LOSS	0.000 MW

BULK LINES	
LOADING	0.00%
LOAD LOSS	0.000 MW
NOLD LOSS	0.000 MW

BULK STEP UP	
LOADING	0.00%
NO LOAD	0.000 MW
LOAD	0.000 MW
AVG SIZE	0 MVA
NUMBER	0

BULK-BULK	
LOADING	0.00%
NO LOAD	0 MW
LOAD	0 MW
AVG SIZE	0 MVA
NUMBER	0

TRANS TIE LINES	
LOAD	0.00% MW
LOAD LOSS	0.000 MW
NOLD LOSS	0.000 MW

BULK-TRANS1 STEP DOWN	
LOADING	0.00%
NO LOAD	0.000 MW
LOAD	0.000 MW
AVG SIZE	0 MVA
NUMBER	0

TRAN1-TRAN2 STEP DOWN	
LOADING	0.00%
NO LOAD	0.000 MW
LOAD	0.000 MW
AVG SIZE	0 MVA
NUMBER	0

BULK-TRANS2 STEP DOWN	
LOADING	0.00%
NO LOAD	0.000 MW
LOAD	0.000 MW
AVG SIZE	0 MVA
NUMBER	0

TRANS 1&2 STEP UPS	
LDNG TR1SU	0.00%
NOLOAD1&2	0.000 MW
LOAD 1&2	0.000 MW
AVSIZ TR1SU	0.0 MVA
NUMBER	0

TRANS1	161.0 KV
LOADING	0.00%
LOAD LOSS	0.000 MW
NOLD LOSS	0.000 MW

TRANS2	115.0 KV
LOADING	0.00%
LOAD LOSS	0.000 MW
NOLD LOSS	0.010 MW

TRANS CUST	
SUBS	0.000 MW
	0.000 MVA
LINES	MW
	MVA

SUBTRANS TIE LINES	
LOAD	0.00% MW
LOAD LOSS	0.000 MW
NOLD LOSS	0.000 MW

TRANS1&2-SUBTRANS1	
LDNG TR2-ST	0.00%
NO LOAD	0.000 MW
LOAD	0.000 MW
AVSIZ TR2	0 MVA
NUMBER	0

SUBTR1&2-SUBTRANS2&3	
LOADING	0.00%
NO LOAD	0.000 MW
LOAD	0.000 MW
AVG SIZE	0 MVA
NUMBER	0

TRANS1&2- SUBTRANS2	
LDNG TR2-ST	0.00%
NO LOAD	0.000 MW
LOAD	0.000 MW
AVSIZ TR2-ST	0.00 MVA
NUMBER	0

TRANS1&2-SUBTRANS3	
LDNG TR2-ST2	0.00%
NO LOAD	0.00
LOAD	0.00
AVSIZ TR2-ST2	0.00
NUMBER	0

SUBTRANS1,2,&3 STEP UPS	
LDNG ST1SU	0.00%
NO LOAD	0.000 MW
LOAD	0.000 MW
AVSIZ ST2	0.0 MVA
NUMBER	0

SUBTRANS1	69 KV
LOADING	0.00%
LOAD LOSS	0.000 MW
NOLD LOSS	0.000 MW

SUBTRANS2	46 KV
LOADING	0.00%
LOAD LOSS	0.000 MW
NOLD LOSS	0.000 MW

SUBTRANS2	35 KV
LOADING	0.00%
LOAD LOSS	0.000 MW
NOLD LOSS	0.000 MW

SUBTRANS CUST	
SUBS - MW	0.000
MVA	0.000
LINES- MW	
MVA	

TO DISTRIBUTION SYSTEM
195033.1 MVA 191132.4 MW

TRANS1	0.0 MVA
	0.00%
161 KV	

TRANS2	193,384.9 MVA
	99.15%
115 KV	

SUBTRANS1	179.2 MVA
	0.09%
69 KV	

SUBTRANS2	1,464.2 MVA
	0.75%
46 KV	

SUBTRANS3	4.8 MVA
	0.00%
35 KV	

FROM HIGH VOLTAGE SYSTEM

TOTAL 195,033 MVA 191,132 MW

TRANS1 0.0 MVA 0.00% 161 KV	TRANS2 193,384.9 MVA 99.15% 115 KV	SUBTRANS1 179.2 MVA 0.09% 69 KV	SUBTRANS2 1,464.2 MVA 0.75% 46 KV	SUBTRANS3 4.8 MVA 0.00% 35 KV

DISTRIBUTION SYSTEM LOAD

	PRIM1	PRIM2	PRIM3	PRIM1	PRIM2	PRIM3	PRIM1	PRIM2	PRIM3	PRIM1	PRIM2	PRIM3	PRIM1	PRIM2	PRIM3
VOLTAGE	34	12	1	34	12	1	34	12	1	34	12	1	34	12	1
LOAD MVA	0	0	0	0	193,377	7	19	156	4	0	1,371	93	0	5	0
% SYS TOT	0.00%	0.00%	0.00%	0.00%	99.15%	0.00%	0.01%	0.08%	0.00%	0.00%	0.70%	0.05%	0.00%	0.00%	0.00%
NOLD LOSS	0.000	0.000	0.000	0.000	4.502	0.022	0.050	0.509	0.016	0.000	4.022	0.290	0.000	0.015	0.000
LOAD LOSS	0.000	0.000	0.000	0.000	3.274	0.018	0.048	0.434	0.014	0.000	3.193	0.238	0.000	0.014	0.000
AVG SIZE	0.0	0.0	0.0	0.0	28.3	14.0	16.3	6.2	3.8	0.0	11.2	5.3	0.0	9.0	0.0
NUMBER	0	0	0	0	113	1	2	47	2	0	228	33	0	1	0
DIVERSITY RATIO	0.000	0.000	0.000	0.000	1.000	1.000	1.000	1.000	1.000	0.000	1.000	1.000	0.000	1.000	0.000

PRIMARY LINES		
LOADING	3274.881	MW
@ SYS PF	3341.715	MVA
LOAD LOSS	60.786	MW
NOLD LOSS	2.991	MW
TOT LOSS	63.778	MW

PRIM/PRIM TRANSF		
LOADING	82.791	MW
NOLD LOSS	0.219	MW
LOAD LOSS	0.217	MW
AVG SIZE	4.99	
NUMBER	31	

PRIM CUST	LOADS	
NO LINES	0.000	MW
CUST SUB	0.000	MVA
NO LINES	0.000	MW
CO. SUB	0.000	MVA
PRIM WITH	163.932	MW
LINES	172.560	MVA

LINE TRANSFORMERS				
LOADING	3046.736	MW	MVA	3375.288
NOLD LOSS	28.122	MW		
LOAD LOSS	11.947	MW		
AVG SIZE	56.4	KVA		
NUMBER	187457			

SECONDARY LINES		
LOAD	1164.154	MW
LOAD LOSS	6.193	MW
NOLD LOSS	0.000	MW
TOT LOSS	6.193	MW

NO SECONDARY LINES		
LOAD	1842.512	MW

SERVICES		
LOAD	3000.473	MW
LOAD LOSS	15.153	MW
NOLD LOSS	2.214	MW
TOT LOSS	17.367	MW

CUSTOMER SECONDARY LOAD

2983.106 MW

SUMMARY of SALES and CALCULATED LOSSES EXHIBIT 5

LOSS # AND LEVEL	MW LOAD	NO LOAD +	LOAD =	TOT LOSS	EXP FACTOR	CUM EXP FAC	MWH LOAD	NO LOAD +	LOAD =	TOT LOSS	EXP FACTOR	CUM EXP FAC
1 BULK XFMMR	0.0	0.00	0.00	0.00	0.000000	0.000000	0	0	0	0	0	0
2 BULK LINES	0.0	0.00	0.00	0.00	0.000000	0.000000	0	0	0	0	0.0000000	0.0000000
3 TRANS1 XFMR	0.0	0.00	0.00	0.00	0.000000	0.000000	0	0	0	0	0.0000000	0.0000000
4 TRANS1 LINES	0.0	0.00	0.00	0.00	0.000000	0.000000	0	0	0	0	0.0000000	0.0000000
5 TRANS2TR1 SD	0.0	0.00	0.00	0.00	0.000000	0.000000	0	0	0	0	0.0000000	0.0000000
6 TRANS2BLK SD	0.0	0.00	0.00	0.00	0.000000	0.000000	0	0	0	0	0.0000000	0.0000000
7 TRANS2 LINES	0.0	0.01	0.00	0.01	0.000000	0.000000	0	89	0	89	0.0000000	0.0000000
TOTAL TRAN	0.0	0.01	0.00	0.01	0.000000	0.000000	0	89	0	89	0.0000000	0.0000000
8 STR1BLK SD												
9 STR1T1 SD	0.0	0.00	0.00	0.00	0.000000	0.000000	0	0	0	0	0.0000000	0.0000000
10 SRT1T2 SD	0.0	0.00	0.00	0.00	0.000000	0.000000	0	0	0	0	0.0000000	0.0000000
11 SUBTRANS1 LINES	0.0	0.00	0.00	0.00	0.000000	0.000000	0	0	0	0	0.0000000	0.0000000
12 STR2T1 SD	0.0	0.00	0.00	0.00	0.000000	0.000000	0	0	0	0	0.0000000	0.0000000
13 STR2T2 SD	0.0	0.00	0.00	0.00	0.000000	0.000000	0	0	0	0	0.0000000	0.0000000
14 STR2S1 SD	0.0	0.00	0.00	0.00	0.000000	0.000000	0	0	0	0	0.0000000	0.0000000
15 SUBTRANS2 LINES	0.0	0.00	0.00	0.00	0.000000	0.000000	0	0	0	0	0.0000000	0.0000000
16 STR3T1 SD	0.0	0.00	0.00	0.00	0.000000	0.000000	0	0	0	0	0.0000000	0.0000000
17 STR3T2 SD	0.0	0.00	0.00	0.00	0.000000	0.000000	0	0	0	0	0.0000000	0.0000000
18 STR3S1 SD	0.0	0.00	0.00	0.00	0.000000	0.000000	0	0	0	0	0.0000000	0.0000000
19 STR3S2 SD	0.0	0.00	0.00	0.00	0.000000	0.000000	0	0	0	0	0.0000000	0.0000000
20 SUBTRANS3 LINES	0.0	0.00	0.00	0.00	0.000000	0.000000	0	0	0	0	0.0000000	0.0000000
21 SUBTRANS TOTAL	0.0	0.00	0.00	0.00	0.000000		0	0	0	0	0.0000000	
22 TRANSMSN LOSS FAC	4,365.0	17.83	160.48	178.31	1.042590	1.042590	24,087,011	312,958	730,236	1,043,194	1.0452700	1.0452700
DISTRIBUTION SUBST												
TRANS1	0.0	0.00	0.00	0.00	0.000000	0.000000	0	0	0	0	0.0000000	0.0000000
TRANS2	1,677.1	4.52	3.29	7.82	1.004682	0.000000	8,395,883	39,627	10,044	49,670	1.0059512	0.0000000
SUBTR1	175.6	0.57	0.50	1.07	1.006129	0.000000	875,410	5,034	1,511	6,545	1.0075330	0.0000000
SUBTR2	1,434.9	4.31	3.43	7.74	1.005425	0.000000	7,152,181	37,769	10,468	48,237	1.0067902	0.0000000
SUBTR3	4.7	0.02	0.01	0.03	1.006293	0.000000	23,520	135	43	178	1.0076157	0.0000000
WEIGHTED AVERAGE	3,292.3	9.4	7.2	16.66	1.005085	1.047892	16,446,994	82,565	22,065	104,630	1.0064024	1.0519622
PRIMARY INTRCHNGE	0.0				0.000000		0				0.0000000	
PRIMARY LINES	3,274.9	3.21	61.00	64.21	1.020000	1.068850	16,342,015	28,125	180,170	208,296	1.0129106	1.0655437
LINE TRANSF	3,046.7	28.12	11.95	40.07	1.013327	1.083094	15,110,866	246,351	19,529	265,880	1.0179104	1.0846280
SECONDARY	3,006.7	0.00	6.19	6.19	1.002064	1.085330	14,844,986	0	20,045	20,045	1.0013521	1.0860946
SERVICES	3,000.5	2.21	15.15	17.37	1.005822	1.091648	14,824,941	19,391	52,055	71,446	1.0048426	1.0913541
		==========	==========	==========				==========	==========	==========		
TOTAL SYSTEM		60.82	262.01	322.83				689,568	1,024,100	1,713,668		

DEVELOPMENT of LOSS FACTORS EXHIBIT 6
UNADJUSTED
DEMAND

LOSS FACTOR LEVEL	CUSTOMER SALES MW	CALC LOSS TO LEVEL	SALES MW @ GEN	CUM EXPANSION FACTORS	
	a	b	c	d	1/d
BULK LINES	0.0	0.0	0.0	0.00000	0.00000
TRANS SUBS	0.0	0.0	0.0	0.00000	0.00000
TRANS LINES	867.5	36.9	904.4	1.04259	0.95915
SUBTRANS SUBS	0.0	0.0	0.0	0.00000	0.00000
SUBTRANS LINES	0.0	0.0	0.0	0.00000	0.00000
PRIM SUBS	0.0	0.0	0.0	0.00000	0.00000
PRIM LINES	163.9	11.3	175.2	1.06885	0.93559
SECONDARY	2,983.1	273.4	3,256.5	1.09165	0.91605
TOTALS	4,014.5	321.6	4,336.1		

DEVELOPMENT of LOSS FACTORS
UNADJUSTED
ENERGY

LOSS FACTOR LEVEL	CUSTOMER SALES MWH	CALC LOSS TO LEVEL	SALES MWH @ GEN	CUM EXPANSION FACTORS	
	a	b	c	d	1/d
BULK LINES	0	0	0	0.00000	0.00000
TRANS SUBS	0	0	0	0.00000	0.00000
TRANS LINES	6,569,989	297,423	6,867,412	1.04527	0.95669
SUBTRANS SUBS	0	0	0	0.00000	0.00000
SUBTRANS LINES	0	0	0	0.00000	0.00000
PRIM SUBS	0	0	0	0.00000	0.00000
PRIM LINES	1,022,853	67,042	1,089,895	1.06554	0.93849
SECONDARY	14,753,495	1,347,793	16,101,288	1.09135	0.91629
TOTALS	22,346,337	1,712,258	24,058,595		

ESTIMATED VALUES AT GENERATION

LOSS FACTOR AT VOLTAGE LEVEL	MW	MWH
BULK LINES	0.00	0
TRANS SUBS	0.00	0
TRANS LINES	904.41	6,867,412
SUBTRANS SUBS	0.00	0
SUBTRANS LINES	0.00	0
PRIM SUBS	0.00	0
PRIM LINES	175.22	1,089,895
SECONDARY	3,256.50	16,101,288
SUBTOTAL	4,336.13	24,058,595
ACTUAL ENERGY LESS THI	4,365.03	24,087,011
MISMATCH	(28.89)	(28,417)
% MISMATCH	-0.66%	-0.12%

DEVELOPMENT of LOSS FACTORS EXHIBIT 7
ADJUSTED
DEMAND

LOSS FACTOR LEVEL	CUSTOMER SALES MW a	SALES ADJUST b	CALC LOSS TO LEVEL c	SALES MW @ GEN d	CUM EXPANSION FACTORS e	f=1/e
BULK LINES	0.0	0.0	0.0	0.0	0.00000	0.00000
TRANS SUBS	0.0	0.0	0.0	0.0	0.00000	0.00000
TRANS LINES	867.5	0.0	36.9	904.4	1.04259	0.95915
SUBTRANS SUBS	0.0	0.0	0.0	0.0	0.00000	0.00000
SUBTRANS LINES	0.0	0.0	0.0	0.0	0.00000	0.00000
PRIM SUBS	0.0	0.0	0.0	0.0	0.00000	0.00000
PRIM LINES	163.9	0.0	12.1	176.0	1.07377	0.93130
SECONDARY	2,983.1	0.0	301.5	3,284.6	1.10106	0.90821
TOTALS	4,014.5	0.0	350.5	4,365.0		

DEVELOPMENT of LOSS FACTORS
ADJUSTED
ENERGY

LOSS FACTOR LEVEL	CUSTOMER SALES MWH a	SALES ADJUST b	CALC LOSS TO LEVEL c	SALES MWH @ GEN d	CUM EXPANSION FACTORS e	f=1/e
BULK LINES	0	0	0	0	0.00000	0.00000
TRANS SUBS	0	0	0	0	0.00000	0.00000
TRANS LINES	6,569,989	0	297,423	6,867,412	1.04527	0.95669
SUBTRANS SUBS	0	0	0	0	0.00000	0.00000
SUBTRANS LINES	0	0	0	0	0.00000	0.00000
PRIM SUBS	0	0	0	0	0.00000	0.00000
PRIM LINES	1,022,853	0	67,863	1,090,716	1.06635	0.93778
SECONDARY	14,753,495	0	1,375,387	16,128,882	1.09322	0.91473
TOTALS	22,346,337	0	1,740,674	24,087,011		
			0			

ESTIMATED VALUES AT GENERATION

LOSS FACTOR AT VOLTAGE LEVEL	MW	MWH
BULK LINES	0.00	0
TRANS SUBS	0.00	0
TRANS LINES	904.41	6,867,412
SUBTRANS SUBS	0.00	0
SUBTRANS LINES	0.00	0
PRIM SUBS	0.00	0
PRIM LINES	176.02	1,090,716
SECONDARY	3,284.59	16,128,882
	4,365.03	24,087,011
ACTUAL ENERGY LESS THIR	4,365.03	24,087,011
MISMATCH	0.00	0
% MISMATCH	0.00%	0.00%

Adjusted Losses and Loss Factors by Facitliy EXHIBIT 8

Unadjusted Losses by Segment

	MW	MWH
Service Drop Losses	17.22	71,314
Secondary Losses	6.14	20,009
Line Transformer Losses	39.74	265,391
Primary Line Losses	63.69	207,913
Distribution Substation Losses	16.52	104,438
Transmission System Losses	178.31	1,043,194
Total	321.63	1,712,258

Mismatch Allocation by Segment

	MW	MWH
Service Drop Losses	-3.47	(3,029)
Secondary Losses	-1.24	(850)
Line Transformer Losses	-8.01	(11,272)
Primary Line Losses	-12.84	(8,830)
Distribution Substation Losses	-3.33	(4,436)
Transmission System Losses	0.00	0
Total	-28.89	(28,417)

Adjusted Losses by Segment

	MW	MWH
Service Drop Losses	20.70	74,343
Secondary Losses	7.38	20,858
Line Transformer Losses	47.75	276,662
Primary Line Losses	76.53	216,743
Distribution Substation Losses	19.85	108,873
Transmission System Losses	178.31	1,043,194
Total	350.52	1,740,674

Loss Factors by Segment

Retail Sales from Service Drops	2,983.11	14,753,495
Adjusted Service Drop Losses	20.70	74,343
Input to Service Drops	3,003.80	14,827,838
Service Drop Loss Factor	**1.00694**	**1.00504**
Output from Secondary	3,003.80	14,827,838
Adjusted Secondary Losses	7.38	20,858
Input to Secondary	3,011.18	14,848,696
Secondary Loss Factor	**1.00246**	**1.00141**
Output from Line Transformers	3,011.18	14,848,696
Adjusted Line Transformer Losses	47.75	276,662
Input to Line Transformers	3,058.94	15,125,359
Line Transformer Loss Factor	**1.01586**	**1.01863**
Retail Sales from Primary	162.19	1,011,334
Req. Whls Sales from Primary	1.74	11,519
Input to Line Transformers	3,058.94	15,125,359
Output from Primary Lines	3,222.87	16,148,212
Adjusted Primary Line Losses	76.53	216,743
Input to Primary Lines	3,299.40	16,364,955
Primary Line Loss Factor	**1.02375**	**1.01342**
Output from Distribution Substations	3,299.40	16,364,955
Adjusted Distribution Substation Losses	19.85	108,873
Input to Distribution Substations	3,319.25	16,473,828
Distribution Substation Loss Factor	**1.00602**	**1.00665**
Retail Sales at from Transmission	826.11	6,388,101
Req. Whls Sales from Transmission	41.36	181,888
Non-Req. Whls Sales from Transmission	0.00	0
Third Party Wheeling Losses	0.000	0
Input to Distribution Substations	3,319.25	16,473,828
Output from Transmission	4,186.71	23,043,817
Adjusted Transmission System Losses	178.31	1,043,194
Input to Transmission	4,365.03	24,087,011
Transmission System Loss Factor	**1.04259**	**1.04527**

DEMAND MW

SUMMARY OF LOSSES AND LOSS FACTORS BY DELIVERY VOLTAGE

EXHIBIT 9

	SERVICE LEVEL		**SALES MW**	**LOSSES**	**SECONDARY**	**PRIMARY**	**SUBSTATION**	**SUBTRANS**	**TRANSMISSION**
1	**SERVICES**								
2	SALES		2,983.1		2,983.1				
3	LOSSES			20.7	20.7				
4	INPUT				3,003.8				
5	**EXPANSION FACTOR**	**1.00694**							
6	**SECONDARY**								
7	SALES								
8	LOSSES			7.4	7.4				
9	INPUT				3,011.2				
10	**EXPANSION FACTOR**	**1.00246**							
11	**LINE TRANSFORMER**								
12	SALES								
13	LOSSES			47.8	47.8				
14	INPUT				3,058.9				
15	**EXPANSION FACTOR**	**1.01586**							
16	**PRIMARY**								
17	SECONDARY				3,058.9				
18	SALES		163.9			163.9			
19	LOSSES			76.5	72.6	3.9			
20	INPUT								
21	**EXPANSION FACTOR**	**1.02375**							
22	**SUBSTATION**								
23	PRIMARY				3,131.6	167.8			
24	SALES		0.0				0.0		
25	LOSSES			19.9	18.8	1.0	0.0		
26	INPUT				3,150.4	168.8	0.0		
27	**EXPANSION FACTOR**	**1.00602**							
28	**SUB-TRANSMISSION**								
29	DISTRIBUTION SUBS								
30	SALES								
31	LOSSES								
32	INPUT								
33	**EXPANSION FACTOR**								
34	**TRANSMISSION**								
35	SUBTRANSMISSION								
36	DISTRIBUTION SUBS				3,150.4	168.8	0.0		
37	SALES		867.5						867.5
38	LOSSES			178.3	134.2	7.2	0.0		36.9
39	INPUT				3,284.6	176.0	0.0		904.4
40	**EXPANSION FACTOR**	**1.04259**							
41	**TOTALS** LOSSES			350.5	301.5	12.1	0.0		36.9
42	% OF TOTAL			100%	86.01%	3.45%	0.00%		10.54%
43	SALES		4,014.5		2,983.1	163.9	0.0		867.5
44	% OF TOTAL		100.00%		74.31%	4.08%	0.00%		21.61%
45	INPUT		4,365.0		3,284.6	176.0	0.0		904.4
46	**CUMMULATIVE EXPANSION LOSS FACTORS** (from meter to system input)				**1.10106**	**1.07377**	**NA**		**1.04259**

ENERGY MWH **SUMMARY OF LOSSES AND LOSS FACTORS BY DELIVERY VOLTAGE** **EXHIBIT 9**

	SERVICE LEVEL		SALES	LOSSES	SECONDARY	PRIMARY	SUBSTATION	SUBTRANS	TRANSMISSION
1	**SERVICES**								
2	SALES		14,753,495		14,753,495				
3	LOSSES			74,343	74,343				
4	INPUT				14,827,838				
5	**EXPANSION FACTOR**	**1.00504**							
6	**SECONDARY**								
7	SALES								
8	LOSSES			20,858	20,858				
9	INPUT				14,848,696				
10	**EXPANSION FACTOR**	**1.00141**							
11	**LINE TRANSFORMER**								
12	SALES								
13	LOSSES			276,662	276,662				
14	INPUT				15,125,359				
15	**EXPANSION FACTOR**	**1.01863**							
16	**PRIMARY**								
17	SECONDARY				15,125,359				
18	SALES		1,022,853.000			1,022,853			
19	LOSSES			216,743	203,014	13,729			
20	INPUT								
21	**EXPANSION FACTOR**	**1.01342**							
22	**SUBSTATION**								
23	PRIMARY				15,328,373	1,036,582			
24	SALES		0				0		
25	LOSSES			108,873	101,977	6,896	0		
26	INPUT				15,430,350	1,043,478	0		
27	**EXPANSION FACTOR**	**1.00665**							
28	**SUB-TRANSMISSION**								
29	DISTRIBUTION SUBS								
30	SALES								
31	LOSSES								
32	INPUT								
33	**EXPANSION FACTOR**								
34	**TRANSMISSION**								
35	SUBTRANSMISSION								
36	DISTRIBUTION SUBS				15,430,350	1,043,478	0		
37	SALES		6,569,989						6,569,989
38	LOSSES			1,043,194	698,532	47,238	0		297,423
39	INPUT				16,128,882	1,090,716	0		6,867,412
40	**EXPANSION FACTOR**	**1.04527**							
41	**TOTALS** LOSSES			1,740,674	1,375,387	67,863	0		297,423
42	% OF TOTAL			100%	79.01%	3.90%	0.00%		17.09%
43	SALES		22,346,337		14,753,495	1,022,853	0		6,569,989
44	% OF TOTAL		100.00%		66.02%	4.58%	0.00%		29.40%
45	INPUT		24,087,011		16,128,882	1,090,716	0		6,867,412
46	**CUMMULATIVE EXPANSION LOSS FACTORS** (from meter to system input)				**1.09322**	**1.06635**	**NA**		**1.04527**

Appendix C

Discussion of Hoebel Coefficient

COMMENTS ON HOEBEL COEFFICIENTS

The Hoebel constant represents an established industry standard relationship between peak losses and average losses and is used in a loss study to estimate energy losses from peak demand losses. H. F. Hoebel described this relationship in his article, "Cost of Electric Distribution Losses," Electric Light and Power, March 15, 1959. A copy of this article is attached.

Within any loss evaluation study, peak demand losses can readily be calculated given equipment resistance and approximate loading. Energy losses, however, are much more difficult to determine given their time-varying nature. This difficulty can be reduced by the use of an equation which relates peak load losses (demand) to average losses (energy). Once the relationship between peak and average losses is known, average losses can be estimated from the known peak load losses.

Within the electric utility industry, the relationship between peak and average losses is known as the loss factor. For definitional purposes, loss factor is the ratio of the average power loss to the peak load power loss, during a specified period of time. This relationship is expressed mathematically as follows:

(1) $F_{LS}\ .\ A_{LS}\ )\ P_{LS}$

where: F_{LS} = Loss Factor
A_{LS} = Average Losses
P_{LS} = Peak Losses

The loss factor provides an estimate of the degree to which the load loss is maintained throughout the period in which the loss is being considered. In other words, loss factor is the ratio of the actual kWh losses incurred to the kWh losses which would have occurred if full load had continued throughout the period under study.

Examining the loss factor expression in light of a similar expression for load factor indicates a high degree of similarity. The mathematical expression for load factor is as follows:

(2) $F_{LD}\ .\ A_{LD}\ )\ P_{LD}$

where: F_{LD} = Load Factor
A_{LD} = Average Load
P_{LD} = Peak Load

This load factor result provides an estimate of the degree to which the load loss is maintained throughout the period in which the load is being considered. Because of the similarities in definition, the loss factor is sometimes called the "load factor of losses." While the definitions are similar, a strict equating of the two factors cannot be made. There does exist, however, a relationship between these two factors which is dependent upon the shape of the load duration curve. Since resistive losses vary as the square of the load, it can be shown mathematically that the loss factor can vary between the extreme limits of load factor and load factor squared. The relationship between load factor and loss factor has become an industry standard and is as follows:

$$(3)\quad F_{LS}\ .\ H*F_{LD}^2 + (1-H)*F_{LD}$$

where:
F_{LS} = Loss Factor
F_{LD} = Load Factor
H = Hoebel Coefficient

As noted in the attached article, the suggested value for H (the Hoebel coefficient) is 0.7. The exact value of H will vary as a function of the shape of the utility's load duration curve. In recent years, values of H have been computed directly for a number of utilities based on EEI load data. It appears on this basis, the suggested value of 0.7 should be considered a lower bound and that values approaching unity may be considered a reasonable upper bound. Based on experience, values of H have ranged from approximately 0.85 to 0.95. The standard default value of 0.9 is generally used.

Inserting the Hoebel coefficient estimate gives the following loss factor relationship using Equation (3):

$$(4)\quad F_{LS}\ .\ 0.90*F_{LD}^2 + 0.10*F_{LD}$$

Once the Hoebel constant has been estimated and the load factor and peak losses associated with a piece of equipment have been estimated, one can calculate the average, or energy losses as follows:

$$(5)\quad A_{LS}\ .\ P_{LS} * [H*F_{LD}^2 + (1-H)*F_{LD}]$$

where:
A_{LS} = Average Losses
P_{LS} = Peak Losses
H = Hoebel Coefficient
F_{LD} = Load Factor

Loss studies use this equation to calculate energy losses at each major voltage level in the analysis.