R162-08

Electric System Loss Study of the KCP&L GMOC System for the Year 2008

Prepared for

Kansas City Power & Light Greater Missouri Operations Company

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Executive Summary

This report documents the results of the Electric System Loss study performed for the Kansas City Power & Light Greater Missouri Operations Company (KCP&L GMOC) electric utility company that serves about 380,000 retail customers in Missouri. There are two electric properties that make up KCP&L GMOC, Saint Joseph Light and Power (SJLP) and Missouri Public Service (MPS).

The KCP&L GMOC power system losses are a consequence of doing business for a full service electric utility. The electric system is dynamic and decisions are made every day that affect the losses and the efficiency of the system. The losses that result from the operation of the electric system must be properly charged to the customers that are responsible for those losses. In order to enhance the operational decision making process and make a fair allocation for the losses to the customers, it is necessary to understand the electric losses in detail as a function of where they occur in the system.

The test year of 2008 was selected for this study. Demand and energy losses were calculated for both MPS and SJLP systems. The losses for each of the systems have been separated in this report.

For this study, Siemens Energy, Inc., Power Technologies International (Siemens PTI) used several techniques to perform both the system loss study and the calculation of service level loss factors. Using Siemens PTI software and a representative sample of circuits, both transmission and distribution systems were modeled in detail to determine the technical losses.

Load research and FERC Form 1 data were not available for the test year of 2008; however, load research data did cover the peak month. To obtain the energy and loss values for the year 2008, the 2007 FERC Form 1 data were escalated by one percent to account for system growth.

Technical and Non-Technical Losses

The technical losses were calculated for the following sub-systems: Transmission lines, corona, transmission and generator step-up transformers, distribution transformers, distribution lines, distribution secondary transformers, secondary lines and service drops, and customer meters. Transformers have two loss components: Load losses and no-load losses. Load losses are a function of electric currents (load) and voltage. No-load losses are a function of voltage.

Load losses are also referred to as copper losses. Load and copper losses are the normal terms used to describe the current-related losses. The no-load losses are due to the excitation losses in transformers, meters, and reactors, and are also called iron or excitation losses. Corona losses are also considered no-load losses. Corona losses are significant in high voltage transmission lines. Corona losses depend on the voltage level and the length of the transmission circuits. It was found in this study that the corona losses are not very significant in the KCP&L GMOC system. Generator step up (GSU) transformers, depending on the meter location, can contribute to the load and no-load losses of the system.

Tables A-1 through A-8 in the Appendix summarize the results and provide the demand and energy loss multipliers. There are eight major energy loss categories, as indicated above, with transformers having load loss and no-load loss components. Table A-1 and Table A-2 show the calculated demand and energy losses for the MPS and the SJLP systems, respectively. Tables A-1 and A-2 also show the FERC Form 1 losses, escalated for year 2008.

The FERC Form 1 reported losses are determined from the system outputs, obtained from the customer meters and tie line flow readings, and the system inputs, obtained from the tie line flows and internal generation records. The reported FERC Form 1 total system losses are considered the electric loss bench mark values.

The sum of the calculated losses for the eight sub-systems listed above should give a reasonable approximation of the FERC Form 1 reported losses. The procedures used in this study include assumptions that provide good approximations of the losses. However, when the calculated losses and the reported FERC Form 1 losses are compared, there is usually a difference. As shown in Tables A-1 and A-2, the sum of the calculated losses determined in this study, does not match the FERC Form 1 losses; therefore, the difference was allocated by applying adjustments to the calculated losses to make them match with the FERC Form 1 losses. The allocation procedure is discussed in Section 5. Tables A-3 and A-4 show the adjustments that were made and the categories where the adjustments were applied. The calculation procedure resulted in excess losses on the MPS system and insufficient losses on the SJLP system. Adjustments were made to the losses in both systems in order to match the calculated losses with the escalated FERC Form 1 losses.

Tables A-5 and A-6 show the demand and energy loss multipliers, respectively, for the MPS system. Similarly, tables A-7 and A-8 show the demand and energy loss multipliers, respectively, for the SJLP system. Loss multipliers are used to allocate losses to customers as a function of their voltage level of service.

In addition to the technical losses, the non-technical losses associated with unmetered company use and energy diversion (theft) were also identified in the study.

Section

1

Introduction

Kansas City Power & Light Greater Missouri Operations Company (KCP&L GMOC) is comprised by Saint Joseph Light and Power (SJLP) and Missouri Public Service (MPS). In 2007 SJLP and MPS filed separate FERC Form 1 reports.

MPS is the larger of the two properties and had about 242,180 customers in 2007. MPS 2007 system peak demand was 1,525 MW and the corresponding energy requirement was 7,424,748 MWH. Through the electric system there were requirement and non-requirement sales to the ultimate consumer. The total sales amounted to 7,424,748 MWH. Requirement sales are generally sales to organizations such as municipals. Non-requirement sales are energy sales from excess generation to other utilities. Sales result in losses mostly on the transmission system. The energy loss for the MPS system was about 6.1% of the total system energy requirements.

SJLP had, approximately, 66,070 customers in 2007. SJLP 2007 system peak demand was 437 MW and the corresponding system energy requirement was 2,590,839 MWH. SJLP had sales to the ultimate customer and non-requirement sales. The energy loss for SJLP was about 6.5%.

The MPS system has a lower load factor and thus a lower loss factor for the transmission system, primary system and secondary system. Table 1.1 shows the load factors and loss factors for each system used in this report.

Table 1.1 GMOC Load and Loss Factors

System	Transmission System	Primary System	Primary Customers	Secondary Customers
MPS Load Factor	0.567	0.502	0.689	0.479
SJLP Load Factor	0.665	0.610	0.703	0.587
MPS Loss Factor	0.338	0.267	0498	0.245
SJLP Loss Factor	0.459	0.388	0.509	0.350

Demand and energy losses were calculated separately for the SJLP and MPS systems. The losses from the customer meter to the generator set-up transformers are included. The study was performed for the year 2008 but data was only available through the month of October of 2008. In order to have a complete year of data to use in the analysis, the 2007 energy value was escalated by one percent. The peak values were captured from the load research data available. Year 2008 is a leap year; therefore, 8,784 hours (366 days) were used in the calculations.

Section

2

Transmission System Losses

The transmission system is comprised by lines with voltages between 34.5 KV and 345 kV, and transformers with high and low-side voltages within the same range. The methodology used to calculate the losses in the transmission lines and transformers depend on their voltage level. The methodology used for voltages 69 kV and above is described in this section. Since that the KCP&L GMOC 34.5 kV transmission system is generally radial, its losses were calculated separately using the load factor/loss methodology. The losses in the generation step-up transformers were included as part of the transmission system in those cases where the meter is located on the transformer low voltage side. In this report the total transmission losses are broken down into transmission line losses and transformer losses.

The operation of the transmission lines results in a resistive loss which is a function of the current squared (copper or load loss), and corona losses which are a function of the voltage squared (no-load loss). Similarly, transmission transformer losses have a resistive component which is a function of the current squared (copper or load loss), and an excitation component which is a function of the voltage squared (no-load loss). Corona losses and excitation losses produce a reasonably constant loss because the voltages remain relatively constant. There is a demand component and an energy component for all load losses and no-load losses.

PSS/E revision 30 software was used to calculate the KCP&L GMOC transmission losses for 2008.

The losses in the transmission system of KCP&L GMOC system are the losses calculated for the MPS and SJLP systems.

2.1 Transmission System Load Losses for Voltages 69 KV and Above

KCP&L GMOC operates its own control area. The losses in the transmission system of the KCP&L GMOC system are the losses calculated for the MPS and SJLP systems or zones. Separate transmission losses were calculated for each of these two zones.

The resistive losses (current squared times resistance) for the transmission lines and transformers are a function of the load of each zone, the internal generation, power purchases, power sales, wheeling, and inadvertent power flows through the zones. In looped systems, the flows related to sources and loads do not follow a set pattern. For example, at one point in time and at specific locations, the direction of the flows may be, for example, from North to South and at other times from South to North in certain parts of the system. Null points during the transition periods (times when flow is zero or near zero within the zones on any specific line) result in zero or near zero losses. The unpredictability of these flows and

the duration of null points complicate the calculation of losses on the transmission system and all but eliminate the ability to use a load factor/loss factor methodology.

KCP&L GMOC provided five (5) 2008 power flow cases for the loss study (summer peak, winter peak, fall peak, April minimum, and summer shoulder). The cases represent different system conditions for the Southwestern Power Pool (SPP) electric system, which includes the KCP&L GMOC control area. The resistance of the transformers was added to the power flow cases so that both the line losses and transformer load losses could be determined during the power flow simulation.

From load research and SCADA data, load, generation and tie line information for 20 hours were selected. The data were modeled into the provided power flow cases and a total of 20 power flow cases were developed for use in the transmission loss calculation. The generation and load in the MPS and SJLP zones was varied to match the selected SCADA generation and load research data. The power flow cases developed this way modeled load from the minimum to maximum levels for each of the two zones.

The losses in the MPS and SJLP transmission system for voltages 69 kV and above were calculated by solving the series of 20 power flows. The losses were plotted against each zone's total system loads as shown in Figures 2.1 and 2.2. A logarithmic regression analysis was performed for each zone and a curve was fitted to the 20 sets of data using standard regression analysis methods. The calculated losses determined using the regression function are also shown in Figures 2.1 and 2.2 for MPS and SJLP zones respectively along with the losses calculated using the 20 power flow cases.

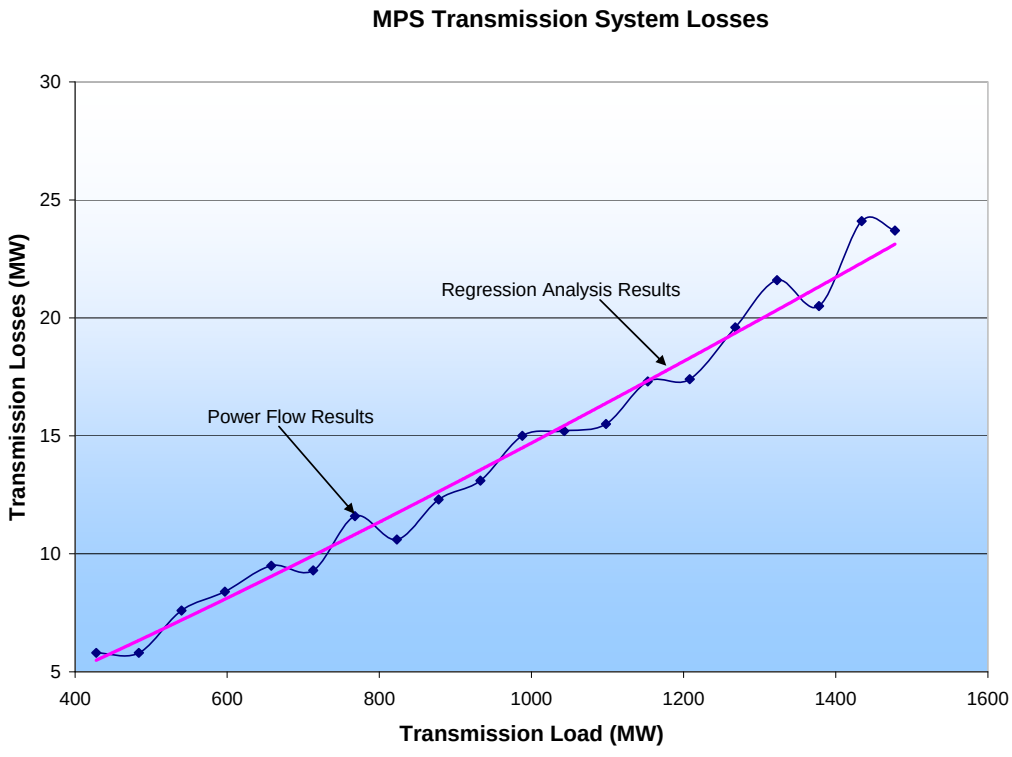

Figure 2.1. MPS Transmission System Losses for Voltages 69 KV and Above

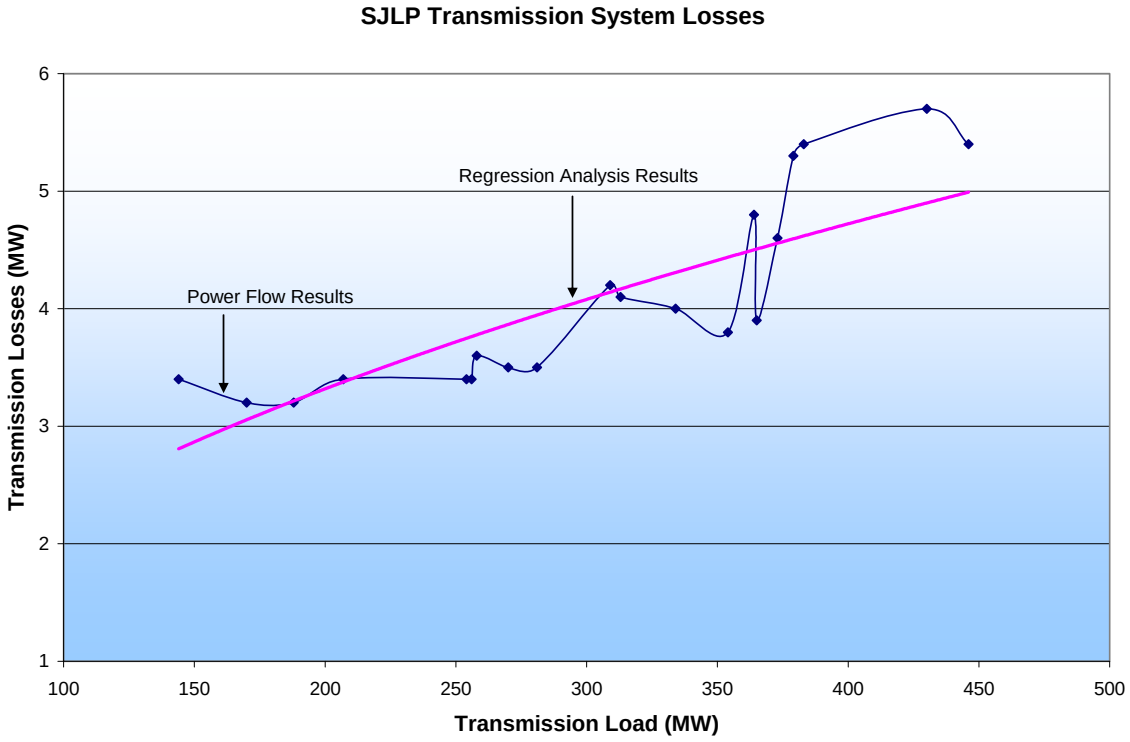

Figure 2.2. SJLP Transmission System Losses for Voltages 69 KV and Above

The regression analysis results for the MPS and SJLP zones obtained from the solution of the 20 power flow cases that were studied, illustrated in Figures 2.1 and 2.2 above, show that a mathematical relationship exists between the calculated loss and the load. However, it should also be considered that the transmission losses do not only depend on the load but also they depend on the amount of generation dispatched and the inter-tie flow levels. For instance, the case with the peak load MW (1478 MW), from Figure 2.1 above, has a lower percentage loss than the case with the second largest load because its generation and load are about 100 MW less and only 44 MW larger than the case with second highest load, respectively.

As explained above, mathematical relationships were used to find the transmission losses for the transmission lines with voltages of 69 kV and above. However, it is not possible to integrate these results directly between the minimum and maximum load because there may be multiple load data points with the same value between the minimum and the maximum load. Therefore, load duration curves were developed for the MPS and SJLP zones to perform the integration. The load duration curves are shown in Figures 2.3 and 2.4

The load duration curves show the relatively smooth transition of increasing loadings from the knee of the curve to the peak load. A frequency function of the MPS zone loads, not shown, indicates that the most frequent load occurs 748 times and lies between 625 and 650 MW, with a range of 25 MW, so there is an average of about 30 occurrences at each one megawatt increment in this range. Whereas the frequency function of the SJLP zone loads indicates that the most frequent load occurs 862 times and lies between 240 and 250 MW,

with a range of 10 MW, so there is an average of about 86 occurrences at each one megawatt increment in this range.

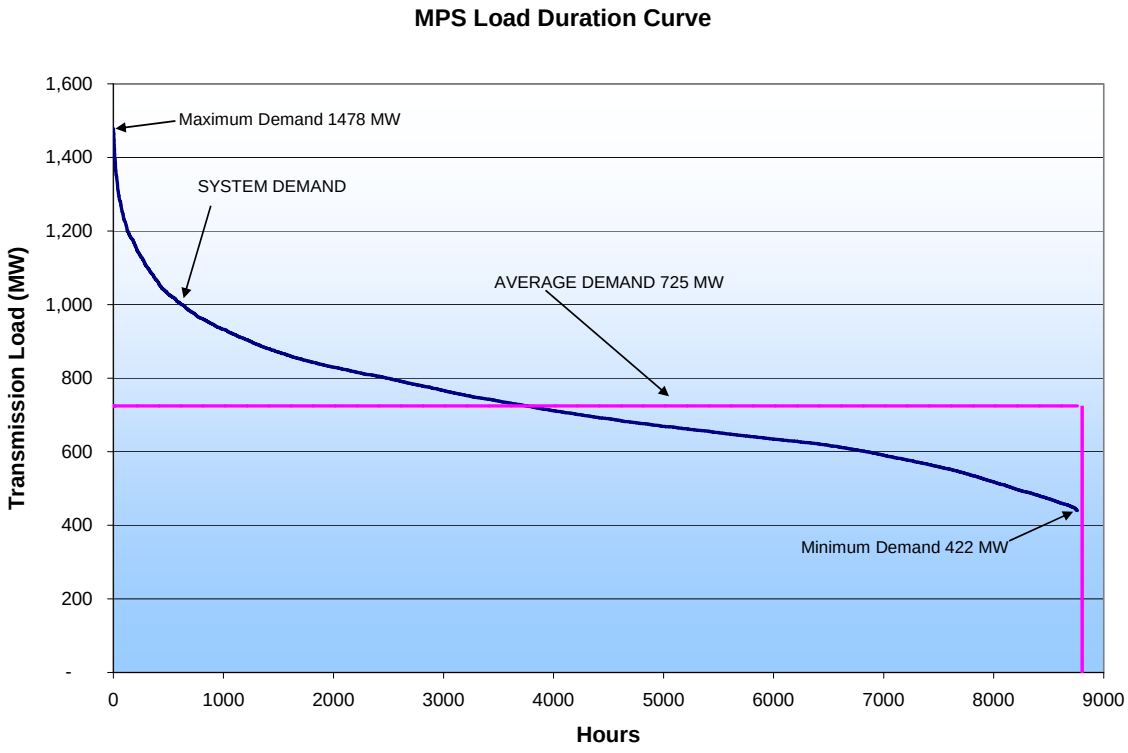

Figure 2.3. MPS Transmission System Load Duration Curve

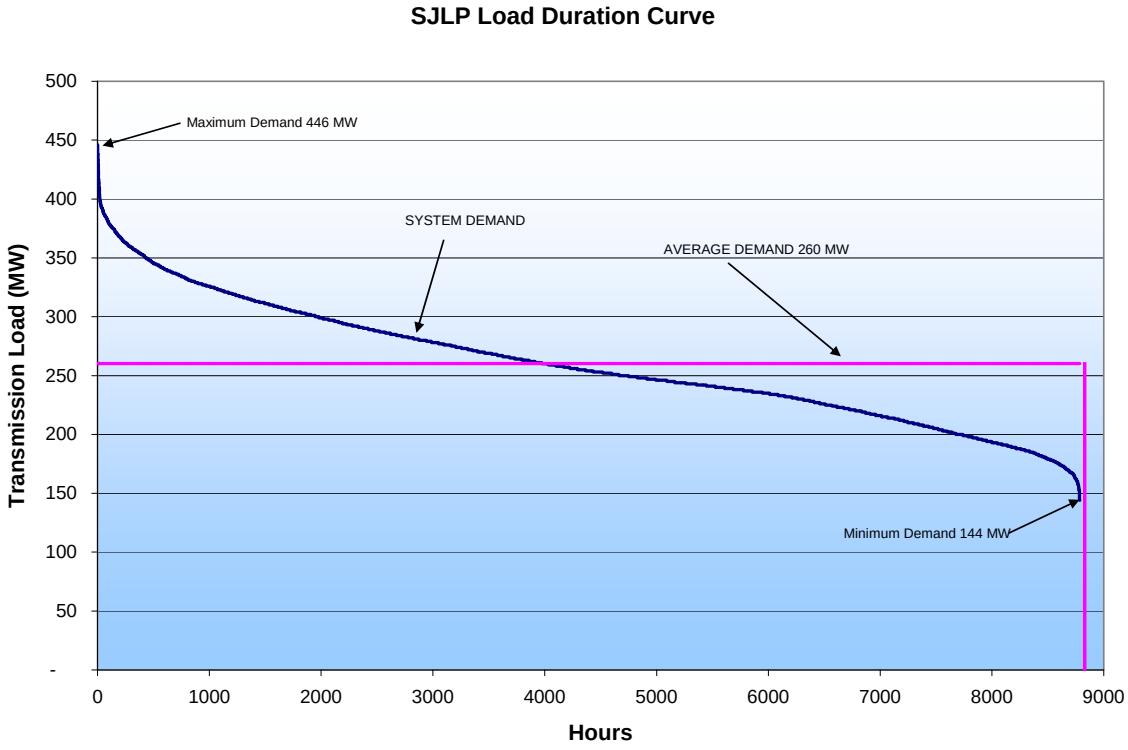

Figure 2.4 SJLP Transmission System Load Duration Curve

The regression analysis produced an equation or function that was based on the total system load. The KCP&L GMOC control area's 8,784-hourly loads for the year 2008, provided by the SCADA system, represent the loads plus losses within the control area. The regression functions were used to calculate the corresponding losses for the 8,784 hourly data for the MPS and SJLP zones. The sum of the transmission line and transformer losses for each hour of the entire year was found to be 89,942,150 kWh for the MPS zone and 33,176,835 KWh for the SJLP zone. The control area peak demand for the MPS zone was 1,478 MW (including losses) and occurred on August 4th, 2008 at 16:00 hours while that of SJLP zone was 446 MW and also occurred on August 4th, 2008 at 16:00 hours. The MPS zone total transmission loss at its peak was calculated as 23.3 MW or 1.58 percent of its total system load while that of SJLP zone was calculated at 4.9 MW or 1.1 percent of the its total system load.

Figures 2.5 and 2.6 show the load and losses for the MPS and SJLP zones on their peak day, respectively. As it would be expected, their losses are greater at their peak time than at their minimum load time. The area between the two curves in Figures 2.5 and 2.6 represent the energy losses for the peak load day for MPS and SJLP, respectively.

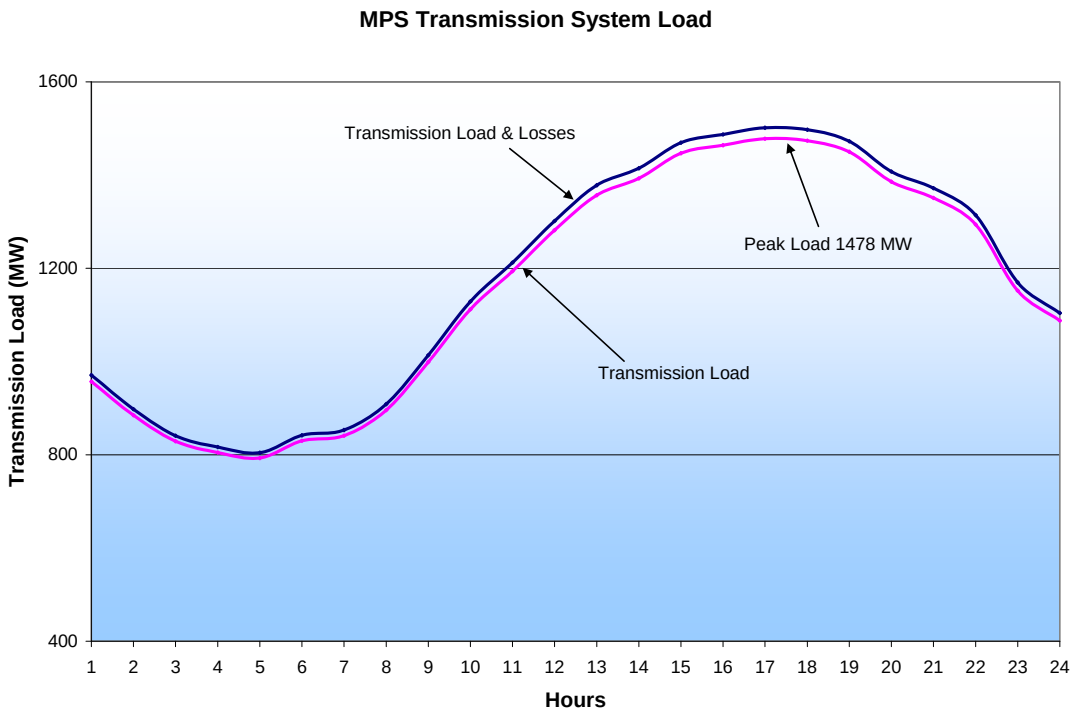

Figure 2.5 MPS Transmission System Peak Day Load and Losses

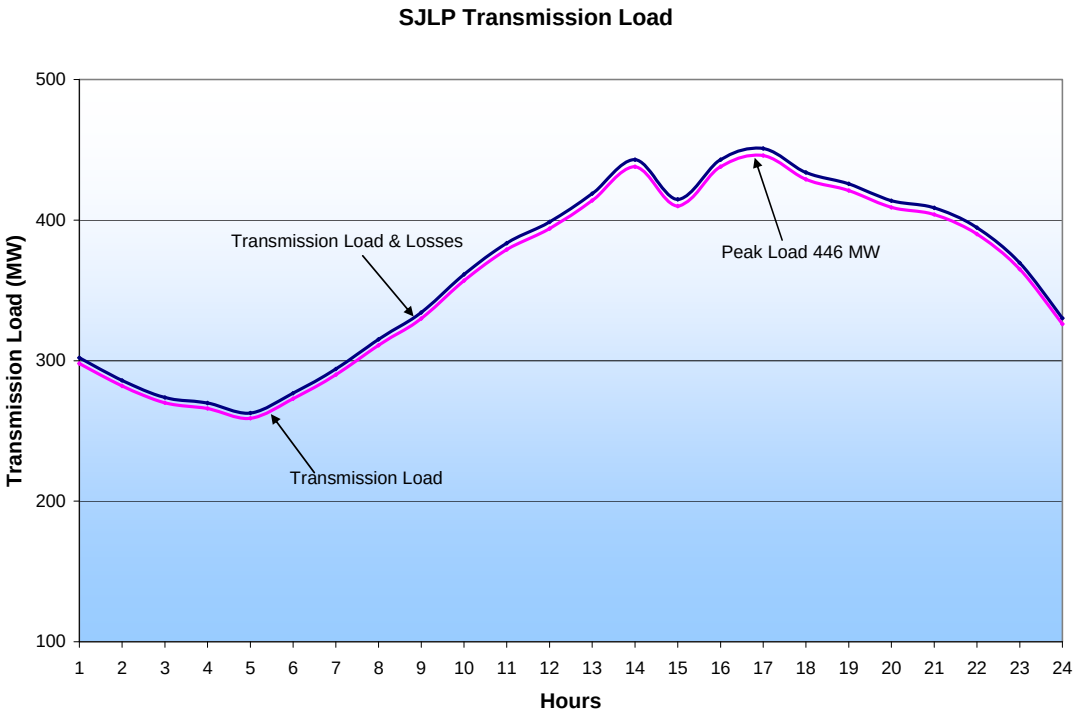

Figure 2.6 SJLP Transmission System Peak Day Load and Losses

2.2 Transmission Transformer No-Load Losses

The calculations of the no-load losses of transformers for the MPS and SJLP zones with voltages 69 kV and above are described in this sub-section.

Transformers have two distinctive characteristics that result in losses. The first one is called iron loss or excitation loss and is caused by the excitation current or magnetizing current of the transformer core. This loss is always present as long as the transformer is energized, and is a function of the voltage squared. Sometimes the iron or excitation loss is called no-load loss because it is nearly constant over the year and does not vary as a function of the load. These losses are mostly in the form of heat and noise. In this report, the term no-load loss is used to describe the iron or excitation loss.

The no-load losses are calculated by taking the capacity of each transformer and multiplying it by the per unit no-load loss. The per-unit no-load loss is usually provided by the transformer manufacturer. When manufacturer data is not available, typical per unit no-load loss data is used. Transmission transformers where typical data was used for the no-load loss calculation are indicated in Table A-9 of Appendix A. The same table shows the results of this analysis, providing the demand loss portion of the no-load loss. The energy loss is calculated by multiplying the demand loss by the number of hours in the period which, in this case, is 8,784 hours. The no-load coincident and non-coincident demand losses for the transmission transformers are identical. They are 1,362.4 kW and 306.1 KW for MPS and SJLP zones, respectively. The corresponding annual no-load energy loss is 11,967,023 kWh and 2,688,782 KWh for MPS and SJLP zones, respectively.

2.3 Generator Step-up Transformer No-Load Losses

The no-load losses for MPS and SJLP zones in the generator step-up (GSU) transformers were calculated separately and the results are shown in Table A-10 in Appendix A. The no-load coincident and non-coincident demand losses are the same. They are 1, 361.4 kW and 102.0 KW for the MPS and SJLP zones, respectively. The corresponding annual 2008 no-load energy loss is 11,958,116 kWh and 895,968 KWh for the MPS and SJLP zones respectively. The second characteristic is the load losses. The resistance of the transmission transformers and generator step-up transformers were included in the power flow transformer data. Therefore, the load losses were determined during the power flow calculating process and have already been included in the results discussed in sub-section 2.1 above.

2.4 Corona Losses in Transmission Lines

Corona loss is an electric discharge to the air surrounding an energized conductor. The amount of discharge is mainly a function of the voltage level and the diameter of the conductor during fair weather conditions. Other factors influencing the corona discharge are: adverse weather conditions, elevation, conductor spacing, and presence of a shield wire. Also, rain increases the corona loss substantially.

Corona demand losses were calculated separately for the 345-kV, 161-kV, and 69-kV transmission lines, using the Bonneville Power Administration computer program, CORONAII, Corona and Field Effects. Corona loss is negligible for voltages of 69-kV and

below in fair weather conditions. Table A-11 in the Appendix lists the number of miles of KCP&L GMOC transmission lines by zone and voltage with the corona losses.

The corona losses are based on normal conditions for most of the hours in the year. According to publicly available sources, there was an average of 0.33 inches of rain for about 115 hours in the geographical area where the KCP&L GMOC transmission lines are located. The total demand loss due to corona effects was calculated assuming normal conditions. The coincident demand loss is 53.4 kW and 29.9 KW for MPS and SJLP zones respectively. The energy loss for MPS and SJLP zones are 1,006,765 kWh and 571,267 KWh respectively.

2.5 34.5 KV System Transmission Load Losses

The 34.5 kV KCP&L GMOC transmission system is, generally, a radial system. System data were supplied in PSS/E format. On a radial system it is only necessary to calculate the peak loss in each 34.5 kV system line. The non-coincident peak load losses for these 34.5 kV lines were separated into the MPS and SJLP zones. The energy losses were calculated using the load factor/loss factor methodology from the non-coincident demands. The calculated losses include the load losses in all 34.5 kV lines including the load losses of the transmission transformers.

The non-coincident and the coincident peak demand loss for the MPS 34.5 kV system is 2,400 kW and the corresponding annual energy loss is 7,125,581 kWh. The corresponding losses for the SJLP system are 3,200 kW and 12,901,939 kWh. The losses are higher in the SJLP 34.5 kV system because it has more lines and higher loads.

As with the transmission system with voltages above 34.5-kV, the transformer no-load losses were calculated separately. Table A-12 in the Appendix shows these losses for the MPS and SJLP systems. The demand no-load loss for these transformers is 116.2 kW and 102.5 kW for MPS and SJLP respectively. The corresponding energy losses are 1,017,649 kWh and 897,900 kWh for MPS and SJLP, respectively.

Section

3

Primary Distribution System Losses

Electric system demand and energy losses have been calculated for the distribution primary system. Included in this category are the load and no-load losses in the distribution primary transformers, and the load losses in the distribution primary lines. Distribution primary transformers have low side voltages that are considered in the distribution voltage class such as, 24-kV, 12-kV, and 4-kV. The non-coincident peak demand losses were calculated for transformer load losses and primary line losses. Energy losses were calculated from the peak losses using the load factor/loss factor methodology. The no-load transformer losses were determined from manufacturer's data or typical data. The transformer no-load losses are nearly constant over time so the coincident peak loss is the same as the non-coincident losses. The no-load energy loss is simply the demand loss times the number of hours in the year.

The load and loss factors were calculated from the load research data. The results are shown in Table 1.1 of Section 1 of this report. Loss factors were used in the calculation of the energy losses of the transformers. The loss calculation procedure used for the distribution primary transformers is the same as the one used for other transformers and has been described in previous sections.

The transformer load and no-load loss values have a comparatively small variance when they are expressed in per unit of the OA (Oil to Air) transformer rating. For this reason, typical values were used for those transformers for which manufacturer's test values were not available. The tables in the Appendix indicate those transformers where typical values were used in the calculations.

Distribution line losses were calculated using the procedure described below.

3.1 Distribution Primary Transformer Load Losses

Transformers load losses are associated with the current through the transformer that is a function of load. The peak load losses are a function of the square of the load current through the transformer at the time of the no-coincident peak. The SCADA system (System Control and Data Acquisition) and meter reading sources provided the peak load for many of these transformers. The average loading for those transformers having recorded load information was first determined. The average loading was then used as the peak load for those transformers with no historical loading information. These peak loads were used to calculate the load losses using the transformer resistance. The calculation of transformer losses is performed in per unit using the square of the load multiplied by the resistance. The result is the non-coincident peak loss.

The non-coincident peak loss is used with the loss factor and 8,784 hours in year to determine the annual energy loss Table A-13 in the Appendix shows the non-coincident load losses for each transformer for both the MPS and SJLP systems. Energy losses are calculated using the total hours in the year and the loss factor with results shown on the same table. The transformers in both systems are loaded on the average above the base OA rating.

The coincidence factor at this level was assumed to be 0.98. The coincidence factor is used to calculate the coincident peak demand from the non-coincident peak demand. The coincident peak demand is the ratio of the peak demand of the area being reviewed, to the sum of the individual peak demands of the component loads in that area. The coincident peak demand is shown on Tables A-1 and A-2 for the MPS and SJLP systems, respectively.

The total non-coincident peak load losses are 12,013 kW and 4,087 kW for the MPS and SJLP systems, respectively. The total energy load losses are 28,175,581 kWh and 13,929,960 kWh for the MPS and SJLP systems, respectively.

3.2 Distribution Primary Transformer No-Load Losses

The no-load losses are a function of the square of the applied voltage. Voltages are assumed to be relatively constant on the average. Therefore, the losses are also relatively constant. To calculate the no-load energy losses the peak loss is multiplied by the hours in the period, or 8,784 hours for year 2008. Table A-13 in the Appendix contains the no-load demand and energy losses.

The total non-coincident peak no-load losses are 2,368 kW and 779 kW for the MPS and SJLP systems, respectively. The total energy load losses are 20,805,287 kWh and 6,845,310 kWh for the MPS and SJLP systems, respectively.

3.3 Distribution Primary Line Losses

The procedure used to calculate the primary distribution lines is described below. Typical circuits from each of the two systems, MPS and SJLP, were selected as representative circuits. Forty (40) 12-kV circuits were selected for detailed study using the Siemens PTI computer model PSS/E Adept using data from the KCP&L GMOC distribution model SynerGee Electric. The data for these circuits were taken from previously modeled circuits but only 23 ported over with only minor modifications. The other circuits would have required major work to achieve a satisfactory model in the Adept format. The data included conductor length and type, phasing (A, B, C, AB, BC, AC, and ABC), loads by phase, and capacitors. Total circuit load was scaled for each circuit to match the SCADA system recorded non-coincident peak loads on that circuit, or the estimated load from the substation transformers that the circuits were connected to. Non-coincident demand losses were calculated by the PSS/E Adept computer program. The results from these 23 circuits are shown in Table A-14 in the Appendix.

A regression analysis was performed to determine a mathematical relationship for the primary line losses as a function of the circuit load. The resulting graph and regression equation are shown in Figure 3.1 below. Other equation types such as linear, exponential and logarithmic, were tested but had lower correlation coefficients (R squared values). Although there are values above and below the calculated curve, this is normal for a utility's

distribution circuits because of the length, load density, capacitors, and conductor variations on each circuit.

The resulting equation was used to estimate the losses of the remaining circuits on the system including the 4-kV and 24-kV. The equation was applied to all circuits in their class to determine the non-coincident demand loss for each circuit. Energy losses were calculated from the non-coincident demand using the loss factor. The coincident demand was determined using the calculated loss at the system peak hour. Using the modeled circuits a square relationship was used to estimate the losses on the 4-kV a 24-kV circuits.

The results for the three voltage class distribution circuits are shown on Tables A-15 and A-16 in the Appendix for the MPS and SJLP systems respectively.

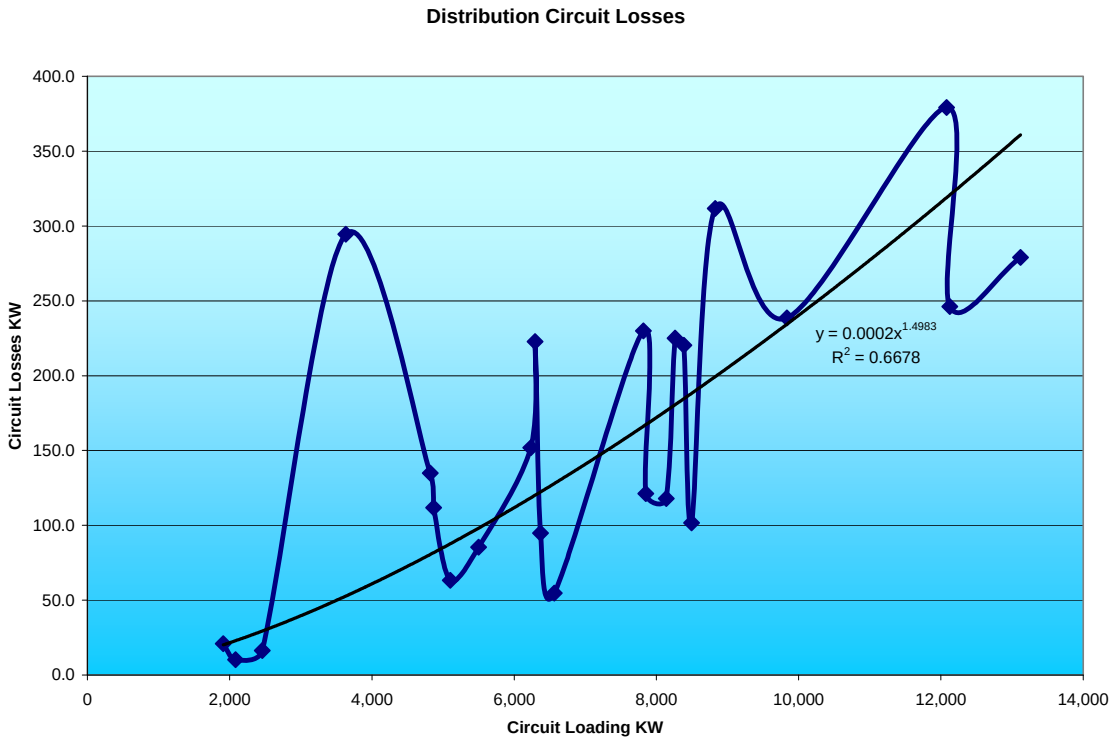

Figure 3.1 Distribution Primary Line Losses

The non-coincident peak losses are 36,319 kW and 8,192 kW for the MPS and SJLP systems, respectively. The energy losses are 85,179,101 kWh and 27,921,269 kWh for the MPS and SJLP systems, respectively.

Section

4

Secondary Distribution System Losses

Distribution secondary transformers, distribution secondary lines, distribution service drops, and customer meters, comprise the distribution secondary system. Distribution secondary transformers have a load and a no-load loss component. The meter losses are considered excitation related and are quantified as no-load losses. Demand losses are calculated for each of these component systems and the energy losses are determined from the demand loss.

4.1 Distribution Secondary Transformers

Distribution secondary transformers on the KCP&L GMOC system range in size from 5 kVA to 1,750 kVA. In 2007 there were reported 94,243 installed units on the MPS system with a total capacity of 4,477,685 kVA. The SJLP system had 27,033 units with a capacity of 1,435,159.5 kVA. The losses in the distribution secondary transformers, like all transformers, have load loss and no-load loss components.

No-load losses were developed using typical loss characteristics for each size of transformer. The no-load demand was calculated using the typical no-load per unit value for each transformer size and multiplying it by the number of transformers in that size category. The resulting total coincident and non-coincident no-load demand loss is 9,310 kW for the MPS system. The energy losses were calculated by multiplying the no-load demand loss by the number of hours in a year resulting in energy loss of 81,777,933 kWh for the MPS system. In the SJLP system the calculated demand no-loss is 2,624 kW and the energy loss is 23,053,406 kWh. The losses are shown in Tables A-16 and A-17 for the MPS and SJLP systems, respectively.

The coincident demand load loss is a function of the square of the current at the time the system peak occurs, but this is not necessarily the maximum demand on the transformer. Based on the peak demand from the load research data at the secondary service level, it was found that the average distribution secondary transformer is loaded to 33 percent. This is the loading for which the demand loss was calculated. This is an average loading and because the calculation of loss is a square function, it is not correct to simply take the 33 percent loading to calculate the losses. The proper method is to calculate each transformer's demand using the loading of each transformer but this individual loading was not known. Therefore, an approximate method was used in this study to create a frequency distribution function that resulted in a 33 percent average loading for each transformer size, while capturing the various loadings above and below the average loading.

Table A-17 and A-18 shows the load losses for the secondary transformers. The non-coincident demand loss is 8,455 kW for the MPS system. Energy losses were calculated based on the transformer non-coincident peak by using a loss factor of 0.224 and 8,784

hours. The resulting energy load losses for the MPS system are 80,923,671 kWh. The demand load losses for SJLP are 2,001 kW and the energy load losses are 19,142,339 kWh.

4.2 Distribution Secondary Lines and Service Drops

Losses that occur on the secondary lines and service drops are the most difficult to calculate because of the lack of data. Information such as the configuration, conductor size, and length of each of the services to the customers, is not kept on engineering drawings because a large number of drawings would be required. Each customer's electric service installation is customized, to a certain degree, making it slightly different than the distribution standard. Based on the KCP&L GMOC distribution standards, 12 different secondary and service drop configurations were used with the average secondary customer load. The customer load was assumed to be un-balanced for the 240/120 volt configurations with 50 percent of the load on one leg, 40 percent on the other leg and 10 percent on the neutral. The non-coincident demand losses were calculated based on these 12 different loads and configurations. It was assumed that the coincident factor was 85 percent. Energy losses were determined using a loss factor of 0.245 and 8,784 hours.

For the MPS system the peak losses are 16,264.6 kW, and the energy losses are 35,002,785 KWh.

For the SJLP system the peak losses are 5,434.1 kW, and the energy losses are 16,706,597 KWh.

4.3 Meters

Losses can be attributed to each meter on the electric system. The standard residential meter takes just under one watt of energy for each hour of operation. The demand loss for electric meters is calculated by taking the number of meters times the hourly losses of each meter type, as shown on Table A-19 in the Appendix. The coincident and non-coincident demand is the same and is 207.8 kW for MPS and 56.6 kW for SJLP. The energy losses are calculated by multiplying the demand loss by 8,784 hours in a year. The resulting electric meter energy losses are 1,824,981 kWh for MPS and 496,902 kWh for SJLP.

4.4 Unaccounted Demand and Energy Use

There are two main components that make up energy that is unaccounted. These two components are energy diversion and Company unmetered use. Energy diversion is the term used to describe energy that is stolen by customers by tampering with the meter or bypassing the meter. Energy diversion in the United States is very small. In discussions with KCP&L GMOC, it was determined that energy diversion was not a problem in their service territory. It is assumed that energy diversion is 0.002 percent of sales to the ultimate customer. For the MPS system, the non-coincident demand loss from energy diversion is 29.0 kW, and for energy losses is 120,125 kWh. For the SJLP system, the non-coincident demand loss from energy diversion is 8.0 kW, and for energy losses is 42,458 kWh.

4.5 Unaccounted Substation Station Power and Light

The only losses from unmetered company use that are believed not to be accounted for in the reported losses are the losses from the substation light and power. An estimate of the non-coincident demand for this use is based on a 25 kVA transformer with a 15 kW demand. There are 158 substations on the MPS system and 78 on SJLP. This yields a non-coincident peak loss of 2,370 kW for MPS and 1,170 for SJLP. The coincident peak loss was estimated at 90 percent of the non-coincident value. Energy losses were calculated using a 60 percent utilization factor yielding 12,490,848 kWh for MPS and 6,166,368 kWh for SJLP.

Section

5

Loss Allocation Procedure

Technical losses were calculated using KCP&L GMOC data for eight categories including, transmission lines, transmission corona, transmission transformers, distribution substation transformers, distribution lines, distribution secondary transformers, service drops, and meters.

Summing the losses on these eight independently calculated systems should give a reasonable approximation of the total losses determined by taking the difference between the inputs to the system and the sales. The procedures used in this study include assumptions that provide good approximations of the losses of these eight systems. When the calculated losses and the reported losses are compared, there is usually a difference. The loss difference is due to the assumptions and approximation methods used in the study. Therefore, the loss difference is allocated back to the calculated values so that the total calculated loss of the eight categories is equal to the recorded loss.

The allocation is performed according to the degree of confidence in the calculated loss results, arising from the calculation methodology, availability of data, completeness of the data used in the study. For example, the procedure used to calculate the losses is most accurate with the transformer no-load losses because there is no need for customer load to be a part of the calculation.

The calculation procedure resulted in excess losses on the MPS system and insufficient losses on the SJLP system. The results of the allocation process are presented in Tables A-3 and A-4 for the MPS and SJLP systems respectively.

Appendix

A

Results

Table A-1

MPS CALCULATED LOSSES

	NON-COINCIDENT PEAK LOSSES KW	COINCIDENT PEAK LOSSES KW	ENERGY LOSSES KWH
TRANSMISSION SYSTEM			
Transmission Lines	23,298.9	23,298.9	89,942,150
Line Corona	4,725.5	53.4	1,006,765
Transformer No-Load	1,362.4	1,362.4	11,967,023
34.5 kV System	2,400.0	2,400.0	7,125,581
34.5 kV Transformer No-Load	116.2	116.2	1,017,649
Generator Step-Up No-Load	1,361.4	1,361.4	11,958,116
Sum	33,264.3	28,592.2	123,017,284
DISTRIBUTION PRIMARY SYSTEM			
Primary Distribution Transformer Load	12,013.5	11,773.2	28,175,581
Primary Distribution Transformer No-Load	2,368.5	2,368.5	20,805,287
Primary Lines	36,318.6	35,592.2	85,179,101
Sum	50,700.6	49,733.9	134,159,969
DISTRIBUTION SECONDARY SYSTEM			
Transformer Load	8,455.0	8,455.0	80,923,671
Transformer No-Load	9,309.9	9,309.9	81,777,933
Lines and Service Drops	16,264.6	16,264.6	35,002,785
Customer Meters	207.8	207.8	1,824,981
Sum	34,237.3	34,237.3	199,529,370
NON-TECHNICAL LOSSES			
Substation Station Light & Power	2,370.0	2,133.0	12,490,848
Energy Diversion	29.0	26.1	120,125
Sum	2,399.0	2,159.1	12,610,973
Total	120,601.2	114,722.5	469,317,597
TOTAL SYSTEM LOSSES CALCULATED	120,601.2	114,722.5	469,317,597
TOTAL ESCALATED FERC FORM 1 LOSSES			452,101,001
LOSSES ADJUSTMENT NECESSARY			-17,216,596

Table A-2

SJLP CALCULATED LOSSES

	NON-COINCIDENT PEAK LOSSES KW	COINCIDENT PEAK LOSSES KW	ENERGY LOSSES KWH
TRANSMISSION SYSTEM			
Transmission Line	4,991.7	4,991.7	33,176,835
Line Corona	2,712.9	29.9	571,267
Transformer No-Load	306.1	306.1	2,688,782
34.5 kV System	3,200.0	3,200.0	12,901,939
34.5 kV Transformer No-Load	102.5	102.5	897,900
Generator Step-Up No-Load	102.0	102.0	895,968
Sum	11,415.2	8,732.2	51,132,691
DISTRIBUTION PRIMARY SYSTEM			
Primary Distribution Transformer Load	4,087.2	4,005.5	13,929,960
Primary Distribution Transformer No-Load	779.3	779.3	6,845,310
Primary Lines	8,192.4	8,028.6	27,921,269
Sum	13,058.9	12,813.4	48,696,539
DISTRIBUTION SECONDARY SYSTEM			
Transformer Load	2,001.0	2,001.0	19,142,339
Transformer No-Load	2,624.5	2,624.5	23,053,406
Lines and Service Drops	5,434.1	5,434.1	16,706,597
Customer Meters	56.6	56.6	496,902
Sum	10,116.2	10,116.2	59,399,244
NON-TECHNICAL LOSSES			
Substation Station Light & Power	1,170.0	1,053.0	6,166,368
Energy Diversion	8.0	7.0	42,458
Sum	1,178.0	1,060.0	6,208,826
Total	35,768.3	32,721.8	165,437,300
TOTAL SYSTEM LOSSES CALCULATED	35,768	32,722	165,437,300
TOTAL ESCALATED FERC FORM 1 LOSSES			169,796,150
LOSSES ADJUSTMENT NECESSARY			4,358,850

Table A-3

MPS ALLOCATED LOSSES

	NON-COINCIDENT PEAK LOSSES KW	COINCIDENT PEAK LOSSES KW	ENERGY LOSSES KWH
TRANSMISSION SYSTEM			
Transmission Lines	22,069.8	22,069.8	85,197,235
Line Corona	4,725.5	53.4	1,006,765
Transformer No-Load	1,362.4	1,362.4	11,967,023
34.5 kV System	2,273.4	2,273.4	6,749,670
34.5 kV Transformer No-Load	116.2	116.2	1,017,649
Generator Step-Up No-Load	1,361.4	1,361.4	11,958,116
Sum	31,908.7	27,236.6	117,896,458
Distribution PRIMARY SYSTEM			
Primary Distribution Transformer Load	11,379.7	11,152.1	26,689,173
Primary Distribution Transformer No-Load	2,368.5	2,368.5	20,805,287
Primary Lines	34,402.6	33,714.5	80,685,462
Sum	48,150.8	47,235.1	128,179,922
DISTRIBUTION SECONDARY SYSTEM			
Transformer Load	8,009.0	8,009.0	76,654,528
Transformer No-Load	9,309.9	9,309.9	81,777,933
Lines and Service Drops	15,406.6	15,406.6	33,156,207
Customer Meters	207.8	207.8	1,824,981
Sum	32,933.3	32,933.3	193,413,649
NON-TECHNICAL LOSSES			
Substation Station Light & Power	2,370.0	2,133.0	12,490,848
Energy Diversion	29.0	26.1	120,125
Sum	2,399.0	2,159.1	12,610,973
Total	115,391.8	109,564.1	452,101,001
TOTAL SYSTEM LOSSES CALCULATED	115,391.8	109,564.1	452,101,001
TOTAL ESCALATED FERC FORM 1 LOSSES			452,101,001
LOSSES ADJUSTMENT NECESSARY			0
TOTAL SYSTEM LOSSES ALLOCATED			452,101,001
		Allocated Losses	

Table A-4

SJLP ALLOCATED LOSSES

	NON-COINCIDENT PEAK LOSSES KW	COINCIDENT PEAK LOSSES KW	ENERGY LOSSES KWH
TRANSMISSION SYSTEM			
Transmission Lines	5,167.5	5,167.5	34,345,150
Line Corona	2,712.9	29.9	571,267
Transformer No-Load	306.1	306.1	2,688,782
34.5 kV System	3,312.7	3,312.7	13,356,278
34.5 kV Transformer No-Load	102.5	102.5	897,900
Generator Step-Up No-Load	102.0	102.0	895,968
Sum	11,703.7	9,020.7	52,755,345
DISTRIBUTION PRIMARY SYSTEM			
Primary Distribution Transformer Load	4,231.1	4,146.6	14,420,501
Primary Distribution Transformer No-Load	779.3	779.3	6,845,310
Primary Lines	8,481	8,311.3	28,904,511
Sum	13,491.3	13,237.2	50,170,322
DISTRIBUTION SECONDARY SYSTEM			
Transformer Load	2,071.5	2,071.5	19,816,433
Transformer No-Load	2,624.5	2,624.5	23,053,406
Lines and Service Drops	5,625.5	5,625.5	17,294,916
Customer Meters	56.6	56.6	496,902
Sum	10,378.1	10,378.1	60,661,657
NON-TECHNICAL LOSSES			
Substation Station Light & Power	1,170.0	1,053.0	6,166,368
Energy Diversion	8.0	7.0	42,458
Sum	1,178.0	1,060.0	6,208,826
Total	36,751.1	33,696.0	169,796,150
TOTAL SYSTEM LOSSES ALLOCATED	36,751.1	33,696.0	169,796,150
TOTAL ESCALATED FERC FORM 1 LOSSES			169,796,150
LOSSES ADJUSTMENT NECESSARY			0
TOTAL SYSTEM LOSSES ALLOCATED			169,796,150
		Allocated Losses	

Table A-5

MPS COINCIDENT DEMAND LOSS MULTIPLIERS

SERVICE LEVEL	Total System kW	Multiplier	Secondary Service kW	Secondary Service Cumulative Multiplier	Primary Service kW	Primary Service Cumulative Multiplier	Transmission Service kW	Transmission Service Cumulative Multiplier
Secondary		1.028087						
Sales	1,252,022		1,252,022					
Losses + Diversion	35,165		35,165					
Input to Primary	1,287,187		1,287,187	1.028087				
Primary		1.033652	1,287,187					
Primary Sales	120,574				120,574			
Primary Losses	47,375		43,317		4,058			
Input to Substation	1,455,136		1,330,504	1.062684	124,632	1.033652		
Transmission		1.018689	1,330,504		124,632			
Transmission Sales	6,295						6,295	
Losses	27,312		24,865		2,329		118	
System Input	1,488,742		1,355,369	1.082545	126,961	1.052970	6,412	1.018689
Losses + Diversion	109,852		103,348		6,387		118	

Table A-6

MPS ENERGY LOSS MULTIPLIERS

SERVICE LEVEL	Total System kWh	Multiplier	Secondary Service kWh	Secondary Service Cumulative Multiplier	Primary Service kWh	Primary Service Cumulative Multiplier	Transmission Service kWh	Transmission Service Cumulative Multiplier
Secondary		1.039022						
Sales	5,288,458,350		5,288,458,350					
Losses + Diversion	206,365,949		206,365,949					
Input to Primary	5,494,824,299		5,494,824,299	1.039022				
Primary		1.020478	5,494,824,299					
Primary Sales	780,764,324				780,764,324			
Primary Losses	128,513,677		112,524,915		15,988,762			
Input to Substation	6,404,102,300		5,607,349,214	1.060299	796,753,086	1.020478		
Transmission		1.018235	5,607,349,214		796,753,086			
Transmission Sales	24,398,885						24,398,885	
Losses	117,221,374		102,247,968		14,528,502		444,905	
System Input	6,545,722,560		5,709,597,182	1.079634	811,281,588	1.039086	24,843,790	1.018235
Losses + Diversion	452,101,001		421,138,832		30,517,264		444,905	

Table A-7

SJLP COINCIDENT DEMAND LOSS MULTIPLIERS

SERVICE LEVEL	Total System kW	Multiplier	Secondary Service kW	Secondary Service Cumulative Multiplier	Primary Service kW	Primary Service Cumulative Multiplier	Transmission Service kW	Transmission Service Cumulative Multiplier
Secondary		1.031726						
Sales	361,972		361,972					
Losses + Diversion	11,484		11,484					
Input to Primary	373,455		373,455	1.031726				
Primary		1.032490	373,455					
Primary Sales	36,247				36,247			
Primary Losses	13,311		12,134		1,178			
Input to Substation	423,014		385,589	1.065247	37,425	1.032490		
Transmission		1.020987	385,589		37,425			
Transmission Sales	9,220						9,220	
Losses	9,071		8,092		785		194	
System Input	441,305		393,681	1.087603	38,210	1.054159	9,414	1.020987
Losses + Diversion	33,866		31,710		1,963		194	

Table A-8

SJLP ENERGY LOSS MULTIPLIERS

SERVICE LEVEL	Total System kWh	Multiplier	Secondary Service kWh	Secondary Service Cumulative Multiplier	Primary Service kWh	Primary Service Cumulative Multiplier	Transmission Service kWh	Transmission Service Cumulative Multiplier
Secondary		1.036259						
Sales	1,850,354,563		1,850,354,563					
Losses + Unaccounted	67,091,209		67,091,209					
Input to Primary	1,917,445,772		1,917,445,772	1.036259				
Primary		1.024323	1,917,445,772					
Primary Sales	155,803,005				155,803,005			
Primary Losses	50,428,004		46,638,379		3,789,625			
Input to Transmission	2,123,676,782		1,964,084,152	1.061464	159,592,630	1.024323		
Transmission		1.024108	1,964,084,152		159,592,630			
Transmission Sales	44,745,595						44,745,595	
Losses	52,276,938		47,350,695		3,847,504		1,078,739	
System Input	2,220,699,314		2,011,434,846	1.087054	163,440,134	1.049018	45,824,334	1.024108
Losses + Unaccounted	169,796,151		161,080,283		7,637,129		1,078,739	

Table A-9

TRANSMISSION TRANSFORMERS NO-LOAD LOSSES

Substation	High Side Voltage KV	Low Side Voltage KV	Rating OA/FA/FA/FOA MVA	No-Load Demand Loss KW	No-Load Energy Loss KWH
MPS Transmission Transformers					
Nevada 161-69	161	69	30/40/50	44.9	394,226
Nevada 161-69	161	69	30/40/50	45.0	395,280
South Harper	161	69	30/40/50	28.4	249,466
North Warsaw	161	69	30/40/50	44.9	394,402
Belton South	161	69	60/80/100	31.3	274,939
Liberty South	161	69	60	60.6	532,574
Clinton	161	69	50	69.3	608,731
Clinton	161	69	50	38.2	335,549
Harrisonville	161	69	30/40/50	44.9	394,226
Lexington	161	69	30/50	20.2	176,998
Roanridge	161	69	30/40/50	46.8	410,916
Odessa	161	69	20/27/33	40.0	351,360
Warrensburg East	161	69	50	78.8	692,179
Pleasant Hill 345	345	161	240/320/400	87.5	768,512
Pleasant Hill 345	161	69	60/80/100	78.8	692,179
Longview	161	69	60/80/100	71.8	630,691
Martin City	161	69	30/40/50	39.8	349,603
Sedalia West	161	69	100	58.8	516,763
Sedalia West	161	69	100	44.9	394,753
Sibley	161	69	100	106.5	935,724
Sibley	161	345	400	85.9	754,106
Peculiar 345	161	345	400	85.9	754,546
Stranger Creek	345	161	214/285/357/400	109.2	959,301
			Subtotal	1,362.4	11,967,023
SJLP Transmission Transformers					
Lake road	161	35	67	44.8	393,435
Lake road	161	35	67	44.8	393,435
Maryville	161	69	30/40/50	32.4	284,602
Maryville	161	69	30/40/50	32.9	288,994
Midway	161	69	30/40/50/56	14.47	127,104
St Joseph	345	161	336	67.5	592,920
St Joseph	345	161	336	69.3	608,292
			Subtotal	306.1	2,688,782
KCP&L GMOC Total				1,668.5	14,655,805
Note:		Values are estimated			

Table A-10

GSU TRANSFORMERS NO-LOAD LOSSES

Plant	High Side Voltage KV	Low Side Voltage KV	Rating OA/FA/FA/FOA MVA	No-Load Demand Losses KW	No-Load Energy Losses KWH
MPS GSU Transformers					
S.HARP#1	161	18	270	88.6	778,262
S.HARP#2	161	18	270	88.6	778,262
S.HARP#3	161	18	270	88.6	778,262
ARIESCT2	161	18	200	96.1	844,415
ARIESCT1	161	18	200	99.7	875,484
ARIESSTG	161	18	300	158.7	1,394,258
TWA 1	161	13	25	66.1	580,543
TWA 2	161	13	25	65.7	577,082
NEVADA#1	69	13.2	25	21.0	184,025
GRNWD#3&#4	161	13.2	70	108.2	950,429
GRDWD#1&#2	161	13.2	70	82.2	722,045
RGREEN#3	69	13.2	100	65.7	577,109
SIBLEY#1	69	13.2	45/60	46.9	411,970
SIBLEY#2	69	13.2	45/60	65.2	572,717
SIBLEY#3	161	22	450	220.1	1,933,253
			Sub Total	1,361.4	11,958,116
SJLP GSU Transformers					
LAKE RD 4	161	13.8	60/80/100/112	20.6	180,950
LAKE RD 1	34.5	13.2	18/24/30	12.3	108,043
LAKE RD 2	34.4	13.2	33	15.9	139,666
LAKE RD 3	34.5	13.2	12/16/20	10.4	91,354
LAKE RD 5	34.5	13.2	45/60/75/84	18.2	159,869
LAKE RD 6	34.5	13.8	18/24/30	12.3	108,043
LAKE RD 7	34.5	13.8	18/24/30	12.3	108,043
			Sub Total	102.0	895,968
KCP&L GMOC Total				1,286.2	12,854,084
		Values are estimated			
Note:		Values are from PSS/E Ratings			

Table A-11

CORONA LOSSES

MPS Corona Losses

		LOSSES			DEMAND LOSSES		ENERGY LOSSES		TOTAL LOSSES	
VOLTAGE	LENGTH OF CIRCUITS	NO RAIN	WITH RAIN	HOURS OF RAIN	NO RAIN	WITH RAIN	NO RAIN	WITH RAIN	DEMAND	ENERGY
KV	MILES	KW/MILE	KW/MILE	HOURS	KW	KW	KWH	KWH	KW	KWH
69	419.61	0	0.008	115	0.0	3.4	0	386	0.0	386
161	544.66	0.01	0.837	115	5.4	455.9	47,217	52,426	5.4	99,643
345	151.82	0.314	28.101	115	48.0	4,266.3	416,112	490,624	48.0	906,736
				SUBTOTAL	53.4	4,725.5	463,329	543,436	53.4	1,006,765

SJLP Corona Losses

		LOSSES			DEMAND LOSSES		ENERGY LOSSES		TOTAL LOSSES	
VOLTAGE	LENGTH OF CIRCUITS	NO RAIN	WITH RAIN	HOURS OF RAIN	NO RAIN	WITH RAIN	NO RAIN	WITH RAIN	DEMAND	ENERGY
KV	MILES	KW/MILE	KW/MILE	HOURS	KW	KW	KWH	KWH	KW	KWH
69	128.11	0	0.008	115	0.0	1.0	0	118	0.0	118
161	90.86	0.01	0.837	115	0.9	76.0	7,877	8,746	0.9	16,622
345	93.8	0.314	28.101	115	29.0	2,635.9	251,401	303,125	29.0	554,526
				SUBTOTAL	29.9	2,712.9	259,278	311,989	29.9	571,267
KCP&L GMOC TOTAL									83.4	1,578,031

Table A-12

69-34 KV TRANSFORMER NO LOAD LOSSES

Location	Rating OA/FA/FOA MVA	No-Load Demand Losses KW	No-Load Energy Losses KWH
MPS 69-34 KV Transformers			
Post Oak	10/12.5	10.1	88,476
Appleton City	3	6.5	56,765
Cole Camp Jct	10/12.5	10.8	94,608
Dedrick Jct	11.2/14	7.9	68,854
Garden City	7.5	15.5	135,780
Metz	10	8.6	75,686
Clinton Plt	10	10.8	94,608
Lexington	10	10.2	89,702
Ridgeway	5.0/6.25	6.8	59,918
Trenton	7.5/9.375	10.8	94,871
Concordia	6/8	11.6	101,616
Lamar	3	6.5	56,765
	Subtotal	116.2	1,017,649
SJLP 69-34 KV Transformers			
Edmond St	15/20/25	25.0	219,000
Browns Curve	7.5/9.3/8.4/10.5	15.5	135,780
Kellog	7.5/9.3/8.4/10.5	15.5	135,780
Maryville	7.5/8.4/9.4/10.5	15.5	135,780
Oregon	7.5	15.5	135,780
Maryville	7.5/8.4/9.4/10.5	15.5	135,780
	Subtotal	102.5	897,900
KCP&L GMOC Total		218.7	1,915,549
Note:		Values are Estimates	

Table A-13

Primary Distribution Transformers

Substation	High Side Voltage KV	Low Side Voltage KV	OA Rating MVA	Demand No-Load Losses Watts	Energy No-Load Losses KWH	Load Losses Watts	Transformer Peak Load KVA	Demand Load Losses KW	Energy Load Losses KWH
MPS Distribution Transformers									
13 & 40 Jct	69	12.5	1.5	3,025	26,572	10,320	1,454	9.7	22,750
Adrian	161	25	18	15,900	139,666	76,900	10,370	25.5	59,806
Anaconda	69	4.16	3.75	6,536	57,412	31,704	1,617	5.9	13,837
Appleton City	69	12.5	7.5	6,460	56,745	27,650	3,600	6.4	15,010
Arrowhead Manufact.	69	12.5	3.75	5,256	46,169	15,305	3,634	14.4	33,773
Belton City	69	4.16	3.75	6,536	57,412	31,704	3,000	20.3	47,610
Belton South	69	12.5	15	15,340	134,747	53,218	8,687	17.8	41,747
Belton South	69	12.5	15	15,500	136,152	53,111	9,861	23.0	53,943
Belton South	161	12.5	18	13,300	116,827	85,300	22,852	137.5	322,483
Blairstown	34.5	12.5	3.75	6,218	54,619	21,641	1,304	2.6	6,098
Blue Ridge Mall	69	12.5	7.5	12,060	105,935	38,906	2,075	3.0	7,036
Blue Springs East	161	12.5	15	19,260	169,180	70,695	14,609	67.1	157,372
Blue Springs East	161	12.5	15	19,340	169,883	70,323	19,252	115.8	271,589
Blue Springs East	161	12.5	15	20,083	176,409	61,772	14,118	54.7	128,289
Blue Springs South	161	12.5	18	13,776	121,008	62,387	22,696	99.2	232,657
Blue Springs South	161	12.5	18	17,400	152,842	67,390	18,543	71.5	167,691
Blue Springs West	161	12.5	15	17,615	154,730	55,143	19,565	93.8	219,992
Blue Springs West	161	12.5	15	18,000	158,112	52,366	20,652	99.3	232,891
Blythedale - Eagleville	34.5	12.5	2.5	6,218	54,619	21,641	1,904	12.6	29,551
Brownington	34.5	12.5	1	3,600	31,622	11,500	365	1.5	3,518
Cainsville	34.5	12.5	1	3,600	31,622	11,500	661	5.0	11,727
Calhoun	34.5	12.5	2.5	6,218	54,619	21,641	1,565	8.5	19,935
Clinton Green St.	69	12.5	15	10,166	89,298	78,183	16,957	99.9	234,298
Clinton Green St.	69	12.5	5	9,120	80,110	34,140	4,846	32.1	75,285
Clinton Plant	69	12.5	5	10,009	87,919	33,474	4,846	31.4	73,643
Clinton Plant	69	12.5	15	10,182	89,439	57,429	16,957	73.4	172,147
Cole Camp	34.5	4.16	5	10,009	87,919	33,474	3,139	13.2	30,958
Concordia	34.5	4.16	1.5	3,025	26,572	10,320	975	4.4	10,319
Concordia	69	12.5	15	12,799	112,426	48,073	7,435	11.8	27,675
Concordia	34.5	4.16	3.75	6,536	57,412	31,704	3,043	20.9	49,017
Deepwater	34.5	12.5	1.5	3,025	26,572	10,320	965	4.3	10,085
Duncan Road	161	12.5	18	15,385	135,142	65,759	18,543	69.8	163,704
East Lynne	34.5	12.5	3	6,536	57,412	31,704	1,852	12.1	28,378
Ferrelview	161	25	30	36,779	323,067	104,123	43,696	220.9	518,083
Ferrelview	161	25	30	38,031	334,064	105,233	37,421	163.7	383,930
Freeman Pipe-Line	69	12.5	5	11,000	96,624	35,000	1,272	2.3	5,394
Freeman Pipe-Line	69	12.5	5	11,000	96,624	35,000	4,846	32.9	77,161
Freeman	69	7.2	1.5	3,025	26,572	10,320	1,467	9.9	23,219
Frost road	161	12.5	25	29,100	255,614	107,600	17,174	50.8	119,143
Frost road	161	12.5	25	29,100	255,614	107,600	23,696	96.7	226,793
Garden City	34.5	12.5	5	6,400	56,218	50,629	3,809	29.4	68,953
Grain Valley	161	12.5	18	13,600	119,462	83,000	20,609	108.8	255,172
Grandview City	69	8.32	7.5	11,899	104,521	50,974	7,112	45.8	107,416
Grandview City	69	8.32	7.5	11,899	104,521	50,974	7,049	45.0	105,540
Grandview East	161	12.5	15	23,571	207,048	76,080	17,290	101.1	237,113
Grandview East	161	12.5	18	15,196	133,482	65,594	15,041	45.8	107,416
Grandview West	69	8.32	12	15,350	134,834	65,630	6,243	17.8	41,747
Grandview West	69	8.32	12	18,400	161,626	89,445	9,111	51.6	121,019
Greenridge	34.5	12.5	1.5	3,025	26,572	10,320	1,396	8.9	20,873
Hallmark	161	12.5	15	27,950	245,513	64,173	15,453	68.1	159,717
Hallmark	161	12.5	15	28,200	247,709	62,444	15,453	66.3	155,495
Harris Road	161	12.5	15	12,900	113,314	69,700	15,453	74.0	173,554
Harrisonville Lake	34.5	12.5	2.5	2,430	21,345	9,004	1,539	3.4	7,974
Harrisonville West	69	12.5	7.5	12,098	106,269	38,153	2,370	3.8	8,912
Harwood	34.5	12.5	0.45	5,070	44,535	14,233	165	1.9	4,456
Holden	69	4.16	7.5	7,648	67,180	37,142	6,522	28.1	65,904
Hook Road	161	12.5	15	13,900	122,098	86,900	20,060	155.4	364,464
Hook Road	161	12.5	15	14,192	124,663	52,627	14,609	49.9	117,032
Iantha	34.5	4.16	0.5	4,846	42,567	13,838	85	0.4	938
Jamesport	69	12.5	5	1,805	15,855	7,483	4,846	7.0	16,486
KC South	161	12.5	18	13,700	120,341	85,400	11,896	37.3	87,481
KC South	161	12.5	25	13,080	114,895	60,362	5,092	2.5	5,863

Table A-13

Primary Distribution Transformers

Substation	High Side Voltage KV	Low Side Voltage KV	OA Rating MVA	Demand No-Load Losses Watts	Energy No-Load Losses KWH	Load Losses Watts	Transformer Peak Load KVA	Demand Load Losses KW	Energy Load Losses KWH
KCI Airport	161	12.5	15	29,431	258,522	66,091	5,652	9.4	22,046
KCI Airport	161	12.5	15	29,545	259,523	65,697	7,283	15.5	36,353
Kelsey Hayes	69	4.16	3.75	6,536	57,412	31,704	1,141	2.9	6,801
Kelsey Hayes	69	4.16	3.75	6,536	57,412	31,704	1,946	8.5	19,935
Kelsey Hayes	69	4.16	3.75	6,536	57,412	31,704	4,348	42.6	99,911
Kelsey Hayes	69	4.16	3.75	6,536	57,412	31,704	2,663	16.0	37,525
Kelsey Hayes	69	4.16	7.5	9,286	81,568	46,647	2,609	5.6	13,134
Kingsville	69	12.5	7.5	12,098	106,269	38,153	9,913	66.7	156,433
Knob Noster	69	12.5	9	10,888	95,640	49,736	8,722	46.7	109,527
Lake Winnebago	161	12.5	15	14,311	125,708	61,350	7,487	15.3	35,884
Lake Winnebago	161	12.5	15	24,240	212,924	61,540	9,771	26.1	61,213
Lakeland School	34.5	12.5	0.75	4,073	35,777	12,418	326	2.3	5,394
Lakewood	161	12.5	15	26,325	231,239	66,351	15,574	71.5	167,691
Lakewood	161	12.5	15	27,750	243,756	87,466	19,722	151.2	354,614
Larmar	34.5	12.5	0.75	4,073	35,777	12,418	326	2.3	5,394
Lamonte	69	12.5	5	10,009	87,919	33,474	1,976	5.2	12,196
Laredo	69	12.5	5	6,186	54,338	27,076	2,139	5.0	11,727
Lee's Summit East	161	12.5	18	13,597	119,436	65,687	10,057	20.5	48,079
Lee's Summit East	161	12.5	18	13,800	121,219	87,200	20,348	111.4	261,270
Lee's Summit East	161	12.5	18	13,300	116,827	85,300	25,241	167.7	393,312
Leeton	34.5	12.5	2	6,218	54,619	21,641	1,617	14.1	33,069
Lexington	69	4.16	3.75	6,218	54,619	21,641	326	0.2	384
Lexington	69	12.5	12	16,550	145,375	63,640	18,183	146.1	342,652
Liberal	34.5	4.16	2.5	6,218	54,619	21,641	2,383	19.7	46,203
Liberty Moss St	69	12.5	12	21,038	184,798	59,160	11,629	55.6	130,400
Liberty Moss St	69	12.5	12	22,805	200,319	54,265	11,629	51.0	119,612
Liberty Moss St	69	12.5	12	23,192	203,719	58,532	11,629	55.0	128,993
Liberty South	161	12.5	18	13,670	120,077	78,486	11,801	33.7	79,038
Liberty South	161	12.5	25	12,940	113,665	59,123	25,755	62.7	147,052
Liberty West	161	12.5	15	14,533	127,658	58,490	15,913	65.8	154,323
Liberty West	161	12.5	18	14,100	123,854	81,700	18,543	86.7	203,340
Lincoln	34.5	12.5	5	13,020	114,368	32,220	3,391	14.8	34,711
Longview	161	12.5	15	16,040	140,895	57,614	18,478	87.4	204,982
Longview	161	12.5	15	18,309	160,826	54,827	15,417	57.9	135,794
Lowry City	34.5	12.5	2.5	3,929	34,512	13,567	1,200	3.1	7,271
Montrose	34.5	12.5	1.5	3,025	26,572	10,320	1,304	7.8	18,294
Mt Moriah	34.5	4.16	0.3	1,000	8,784	3,000	196	1.3	3,049
Nevada 3M	69	12.5	12	15,175	133,297	61,258	14,847	93.8	219,992
Nevada 3M	69	12.5	12	16,780	147,396	63,260	14,018	86.3	202,402
Nevada Plant	69	12.5	12	19,870	174,538	46,190	19,215	118.4	277,687
Nevada Plant	69	12.5	15	10,114	88,841	60,227	14,537	56.6	132,746
Norborne	34.5	12.5	2.5	3,929	34,512	13,567	2,113	9.7	22,750
Oak Grove	161	12.5	15	16,685	146,561	59,379	19,596	101.3	237,582
Oak Grove	161	12.5	15	25,010	219,688	77,796	21,087	153.7	360,477
Orrick	161	12.5	7.5	8,761	76,957	42,731	5,110	19.8	46,437
Osceola	34.5	12.5	7.5	7,925	69,613	30,410	4,539	11.1	26,033
Peculiar	69	12.5	7.5	12,098	106,269	38,153	2,370	3.8	8,912
Pittsburgh Corning	69	12.5	5	11,700	102,773	37,047	4,735	33.2	77,865
Platte City	161	25	18	14,300	125,611	80,900	28,261	199.4	467,658
Platte City	161	25	18	16,680	146,517	66,950	22,453	104.2	244,383
Pope Lane	161	25	30	21,800	191,491	115,600	37,421	179.9	421,925
Post Oak	34.5	12.5	0.75	4,073	35,777	12,418	516	5.9	13,837
Post Oak	161	12.5	12	22,880	200,978	55,762	15,677	95.2	223,275
Prairie Lee	161	12.5	15	23,800	209,059	76,900	17,843	108.8	255,172
Prairie Lee	151	12.5	15	23,800	209,059	76,900	17,843	108.8	255,172
Ralph Green Plant	69	12.5	12	20,495	180,028	58,445	11,234	51.2	120,081
Ralph Green Plant	69	12.5	15	10,030	88,104	55,470	14,042	48.6	113,983
Raymore	69	12.5	15	12,600	110,678	53,949	16,278	63.5	148,928
Raymore	69	12.5	15	12,842	112,804	47,438	12,835	34.7	81,383
Raymore North	161	12.5	18	14,300	125,611	83,000	23,515	141.7	332,333
Raytown	161	12.5	21	14,024	123,187	85,944	20,000	78.0	182,936
Raytown	161	12.5	21	14,034	123,275	85,627	22,609	99.3	232,891
Richards Gebaur	69	4.16	3.75	6,532	57,377	31,501	4,330	42.0	98,504
Richards Gebaur	69	4.16	3.75	6,540	57,447	31,906	4,330	42.5	99,676

Table A-13

Primary Distribution Transformers

Substation	High Side Voltage KV	Low Side Voltage KV	OA Rating MVA	Demand No-Load Losses Watts	Energy No-Load Losses KWH	Load Losses Watts	Transformer Peak Load KVA	Demand Load Losses KW	Energy Load Losses KWH
Richmond	161	12.5	15	26,900	236,290	64,080	13,492	51.8	121,488
Richmond	161	12.5	15	27,500	241,560	66,580	10,957	35.5	83,259
Ridgeway	34.5	4.16	1.5	3,480	30,568	11,166	652	2.1	4,925
Rockville	34.5	4.16	1.5	3,480	30,568	11,166	670	2.2	5,160
Sedalia East	161	12.5	15	24,000	210,816	60,770	19,891	106.9	250,716
Sedalia East	161	12.5	15	29,600	260,006	66,685	17,500	90.8	212,956
Sedalia Ingram St	69	12.5	12	24,080	211,519	57,700	17,220	118.8	278,625
Sedalia West	161	12.5	15	13,500	118,584	81,800	94,470	3,244.6	7,609,651
Sedalia West	161	12.5	15	24,000	210,816	72,900	19,060	117.7	276,045
Sedalia West	161	12.5	18	29,584	259,866	70,836	19,596	84.0	197,008
Shell City	34.5	4.16	0.75	4,073	35,777	12,418	488	5.3	12,430
Sibley Plant	69	12.5	12	15,175	133,297	61,258	11,583	57.1	133,918
Smithville	161	13.8	12	22,500	197,640	55,212	2,374	2.2	5,160
Smithville	161	13.8	12	22,880	200,978	55,762	15,677	95.2	223,275
Spickard	34.5	4.16	1.5	3,025	26,572	10,320	591	1.6	3,753
Staley	69	12.5	15	26,920	236,465	64,870	19,252	106.9	250,716
Staley	69	12.5	15	26,920	236,465	64,870	10,957	34.6	81,148
Strasburg	34.5	12.5	3.75	3,929	34,512	13,567	2,687	7.0	16,417
Strother Rd	161	12.5	25	13,090	114,983	60,165	17,061	28.0	65,669
Trenton	69	4.16	3.75	6,864	60,293	21,931	2,393	8.9	20,873
Trenton	69	4.16	3.75	6,864	60,293	21,931	2,393	8.9	20,873
Turner	161	12.5	18	13,600	119,462	84,900	18,626	90.9	213,190
Turner	161	12.5	18	13,784	121,079	78,088	18,543	82.9	194,428
TWA	161	12.5	15	25,889	227,409	76,165	5,204	9.2	21,577
TWA	161	12.5	15	25,970	228,120	64,720	6,457	12.0	28,144
Urich	69	12.5	3.75	6,535	57,403	27,687	3,170	19.8	46,437
Walker	34.5	12.5	1	3,600	31,622	11,500	809	7.5	17,590
Warrensburg East	69	12.5	12	24,080	211,519	57,700	17,220	118.8	278,625
Warrensburg East	161	12.5	18	14,230	124,996	65,486	18,172	66.7	156,433
Warrensburg Pine St	69	4.16	3.75	6,536	57,412	31,704	1,809	7.4	17,355
Warrensburg Pine St	69	12.5	12	17,240	151,436	59,970	16,904	119.0	279,094
Warrensburg Pine St	69	12.5	12	19,360	170,058	59,790	9,300	35.9	84,197
Warsaw	69	12.5	7.5	12,173	106,928	36,648	6,391	26.6	62,386
Warsaw	69	12.5	7.5	12,173	106,928	36,648	6,391	26.6	62,386
Western Electric	161	12.5	18	15,136	132,955	55,293	14,870	37.7	88,419
Western Electric	161	12.5	18	15,211	133,613	65,482	20,652	86.2	202,167
Western Electric	161	12.5	25	31,500	276,696	117,640	33,261	208.2	488,297
Western Electric	161	12.5	25	31,600	277,574	115,920	33,261	205.2	481,261
Whiteman AFB East	161	12.5	15	26,475	232,556	96,733	14,348	88.5	207,562
Whiteman AFB West	161	12.5	15	26,475	232,556	96,733	10,174	44.5	104,367
Windsor	161	12.5	10	10,748	94,410	38,154	8,614	28.3	66,373
Total		MW	1,870	2,368,544	20,805,287		1,893,849	11,976.6	28,089,039
Total				2,368.5	KW				

Table A-13

Primary Distribution Transformers

Substation	High Side Voltage KV	Low Side Voltage KV	OA Rating MVA	Demand No-Load Losses Watts	Energy No-Load Losses KWH	Load Losses Watts	Transformer Peak Load KVA	Demand Load Losses KW	Energy Load Losses KWH
SJLP Distribution Transformers									
Ajax	34.5	12.5	5	10,009	87,919	33,474	5,395	39.0	132,919
Ajax	34.5	12.5	7.5	10,220	89,772	49,524	8,093	57.7	196,653
Ajax	34.5	12.5	7.5	10,220	89,772	49,524	8,093	57.7	196,653
Alabama St	161	12.5	18	14,000	122,976	83,900	27,346	193.6	659,826
Belt Junction	34.5	12.5	3.75	6,218	54,619	21,641	4,047	25.2	85,886
Belt Junction	34.5	12.5	3.75	6,218	54,619	21,641	4,047	25.2	85,886
Belt Junction	34.5	12.5	7.5	12,098	106,269	38,153	8,093	44.4	151,324
Belt Junction	34.5	12.5	7.5	12,098	106,269	38,153	8,093	44.4	151,324
Belt Junction	34.5	12.5	7.5	12,098	106,269	38,153	8,093	44.4	151,324
Brown's Curve	69	12.5	1.5	4,126	36,243	11,912	1,114	6.6	22,494
Burlington Jct	69	12.5	2.5	5,070	44,535	21,222	3,068	32.0	109,062
Cook	161	12.5	18	25,780	226,452	74,869	28,660	189.8	646,875
Cook	161	12.5	18	25,940	227,857	70,631	29,682	192.1	654,714
Craig	69	12.5	1.5	4,126	36,243	11,912	1,841	17.9	61,007
East Side	161	12.5	18	13,300	116,827	85,300	25,334	169.0	575,984
East Side	161	12.5	18	13,301	116,836	85,301	18,534	90.4	308,101
East Side	161	34.5	36	54,600	479,606	96,500	54,553	221.6	755,255
East Side	161	34.5	36	54,600	479,606	96,500	57,133	243.1	828,531
Edmond St.	34.5	12.5	9	20,800	182,707	14,350	5,764	5.9	20,108
Edmond St.	34.5	12.5	12	13,620	119,638	54,940	7,492	21.4	72,935
Edmond St.	34.5	12.5	12	13,620	119,638	54,940	10,669	43.4	147,916
Edmond St.	69	34.5	12	13,620	119,638	54,940	11,128	47.2	160,867
Fairfax	69	12.5	2.5	2,430	21,345	9,004	3,068	13.6	46,351
Filmore St.	69	12.5	5	1,805	15,855	7,483	1,332	0.5	1,704
Filmore St.	69	12.5	7.5	12,098	106,269	38,153	15,255	157.8	537,813
Filmore St.	69	12.5	7.5	12,098	106,269	38,153	8,313	46.9	159,844
Filmore St.	69	12.5	7.5	12,098	106,269	38,153	14,086	134.6	458,743
Gower	34.5	12.5	3.75	6,218	54,619	21,641	4,047	25.2	85,886
Grant City	34.5	12.5	2.5	2,430	21,345	9,004	2,698	10.5	35,786
Highway 48	34.5	12.5	1.5	4,126	36,243	11,912	1,619	13.9	47,374
Iatan	34.5	12.5	2.5	2,430	21,345	9,004	2,698	10.5	35,786
Industrial Park	34.5	12.5	5	10,009	87,919	33,474	12,177	198.5	676,526
Industrial Park	34.5	12.5	7.5	12,098	106,269	38,153	14,980	152.2	518,727
Industrial Park	161	34.5	19	1,019	8,951	5,239	24,939	9.0	30,674
Industrial Park	161	34.5	20	39,622	348,040	83,109	23,935	119.0	405,575
King City	34.5	12.5	3	6,218	54,619	21,641	3,237	25.2	85,886
Kraus Mill	34.5	4.16	2.5	2,430	21,345	9,004	1,875	5.1	17,382
Lake Road	161	34.5	40	740	6,500	4,295	55,569	8.3	28,288
Lake Road	161	34.5	40	740	6,500	4,295	52,926	7.5	25,561
Maitland	34.5	12.5	2.5	5,070	44,535	21,222	2,698	24.7	84,182
Maryville	69	12.5	7.5	12,098	106,269	38,153	9,203	57.4	195,630
Maryville	69	12.5	7.5	12,098	106,269	38,153	9,203	57.4	195,630
Messanie St	34.5	12.5	5	10,009	87,919	33,474	8,814	104.0	354,452
Messanie St	34.5	12.5	5	10,009	87,919	33,474	9,320	116.3	396,373
Messanie St	34.5	12.5	5	10,009	87,919	33,474	6,770	61.4	209,263
Messanie St	34.5	12.5	5	10,009	87,919	33,474	8,414	94.8	323,097
Mound City	69	12.5	3.75	7,800	68,515	18,963	3,893	20.4	69,527
Mound City	69	12.5	3.75	7,800	68,515	18,963	3,016	12.3	41,921
Muddy Creek	34.5	12.5	1	3,600	31,622	11,500	1,079	13.4	45,670
Muddy Creek	34.5	12.5	3.75	6,218	54,619	21,641	4,047	25.2	85,886
Nodaway	69	12.5	5	10,009	87,919	33,474	8,924	106.6	363,313
Nodaway	69	12.5	5	10,009	87,919	33,474	6,136	50.4	171,773
Nodaway	69	12.5	7.5	6,460	56,745	27,650	12,163	72.7	247,776
Oak Street	34.5	12.5	3.75	6,218	54,619	21,641	5,448	45.7	155,754
Oak Street	34.5	12.5	3.75	6,218	54,619	21,641	2,543	10.0	34,082
Oak Street	34.5	12.5	5	10,009	87,919	33,474	6,544	57.3	195,289
Oak Street	34.5	12.5	7.5	6,460	56,745	27,850	6,741	22.5	76,684
Oregon	34.5	12.5	3.75	6,218	54,619	21,641	4,047	25.2	85,886
Parnell	34.5	12.5	1	3,600	31,622	11,500	1,079	13.4	45,670
Pickering	69	12.5	1.5	4,309	37,850	12,076	1,841	18.2	62,029
Quaker Oats	34.5	12.5	7.5	12,098	106,269	38,153	8,961	54.5	185,746
Quaker Oats	34.5	12.5	7.5	12,098	106,269	38,153	4,440	13.4	45,670
Ravenwood	34.5	12.5	1.5	4,126	36,243	11,912	1,619	13.9	47,374
Rochester	34.5	12.5	1.5	4,126	36,243	11,912	1,619	13.9	47,374

Table A-13

Primary Distribution Transformers

Substation	High Side Voltage KV	Low Side Voltage KV	OA Rating MVA	Demand No-Load Losses Watts	Energy No-Load Losses KWH	Load Losses Watts	Transformer Peak Load KVA	Demand Load Losses KW	Energy Load Losses KWH
Rosecrans	34.5	12.5	3.75	6,218	54,619	21,641	1,951	5.9	20,108
Rosecrans	34.5	12.5	3.75	6,218	54,619	21,641	2,398	8.8	29,992
Rushville	34.5	12.5	3.7	6,218	54,619	21,641	3,993	25.2	85,886
Savannah	69	12.5	7.5	6,430	56,481	28,240	13,134	86.6	295,149
Savannah	69	12.5	7.5	6,430	56,481	28,240	6,639	22.1	75,321
Savannah	69	12.5	7.5	6,430	56,481	28,240	7,134	25.6	87,250
Tarkio	69	12.5	3.75	6,218	54,619	21,641	3	0.0	0.0
Tarkio	69	12.5	5	10,009	87,919	33,474	3,470	16.1	54,872
Water Works	34.5	4.16	3.75	6,218	54,619	21,641	2,813	12.2	41,580
Water Works	34.5	4.16	3.75	6,218	54,619	21,641	2,813	12.2	41,580
Wire Rope	34.5	4.16	3.75	6,218	54,619	21,641	2,102	6.8	23,176
Wire Rope	34.5	4.16	5	10,009	87,919	33,474	2,005	5.4	18,404
Woodbine	161	12.5	18	15,490	136,064	5,315	17,389	5.0	17,041
Total			627.95	779,293	6,845,310		783,432	4,087.2	13,929,960
Total				779.3	KW				

Table A-14

Primary Distribution Circuit Loss Results

Circuit Name	System	Circuit Loading KW	Circuit Losses KW	Percent Loss
18-503	MPS	1,910	21.0	1.11
FM-11	MPS	2,082	10.3	0.50
OK-23	SJLP	2,459	16.3	0.67
550-501	MPS	3,633	294.6	8.82
553-505	MPS	4,819	134.9	2.88
FM-15	SJLP	4,869	111.8	2.35
553-506	MPS	5,102	63.2	1.25
OK-21	SJLP	5,501	85.4	1.58
OK-24	SJLP	6,235	151.9	2.50
MA-48	SJLP	6,293	222.8	3.67
ES-112	MPS	6,372	94.7	1.51
OK-22	SJLP	6,565	54.8	0.84
ES-115	MPS	7,816	230.0	3.03
ES-111	MPS	7,850	121.3	1.57
MA-49	SJLP	8,137	117.9	1.47
ND-121	SJLP	8,264	225.1	2.80
MA-46	SJLP	8,387	220.4	2.70
ES-114	MPS	8,493	101.7	1.21
MA-47	SJLP	8,826	311.7	3.66
553-504	MPS	9,835	238.6	2.49
426-5510	MPS	12,080	379.2	3.24
FM-14	SJLP	12,125	246.2	2.07
FM-12	SJLP	13,118	279.0	2.17
	Total	160,771	3,732.8	2.38

Table A-15

MPS Primary Distribution Circuit Losses

Substation Name	Circuit Number	Circuit Votage kV	Circuit Demand Loading KVA	Circuit Demand Losses KW	Circuit Energy Loss KWH
Dearborn Sub @658		2.4	304	26.2	61,448
Dearborn 2.4	501	2.4	304	26.2	61,448
Edgerton	501	2.4	304	26.2	61,448
Edgerton Sub. @658		2.4	304	26.2	61,448
Modena	501	2.4	304	26.2	61,448
Ridgeway	501	2.4	304	26.2	61,448
Ridgeway	502	2.4	304	26.2	61,448
Tindall	501	2.4	304	26.2	61,448
10th & Porter East	407	4	918	49.5	116,094
10th & Porter Sub @ 766	502	4	2016	160.8	377,129
10th & Porter West	408	4	918	49.5	116,094
11th & Grand North	502	4	918	49.5	116,094
11th & Grand South	501	4	492	19.4	45,499
2nd & Mass.	401	4	528	21.6	50,659
2nd & Mass.	402	4	1632	117.2	274,872
2nd & Mass.	403	4	1620	115.9	271,824
6th & Kentucky North	502	4	918	49.5	116,094
6th & Kentucky West	501	4	918	49.5	116,094
Belton City	501	4	840	43.3	101,553
Belton City	502	4	918	49.5	116,094
Belton City	503	4	1920	149.5	350,627
Cainsville	501	4	918	49.5	116,094
Cainsville	502	4	918	49.5	116,094
Cole Camp City	501	4	918	49.5	116,094
Cole Camp City	502	4	918	49.5	116,094
Cole Camp Jct.	501	4	120	2.3	5,394
Concordia	501	4	918	49.5	116,094
Concordia	502	4	918	49.5	116,094
Concordia	503	4	918	49.5	116,094
Galt -	501	4	531	21.8	51,128
Holden	501	4	918	49.5	116,094
Holden	502	4	918	49.5	116,094
Holden	503	4	918	49.5	116,094
Hume	501	4	918	49.5	116,094
Iantha	501	4	918	49.5	116,094
Kelsey Hayes	513	4	560	23.6	55,350
Kelsey Hayes	514	4	918	49.5	116,094
Kelsey Hayes	515	4	1360	89.2	209,203
Kelsey Hayes	516	4	680	31.6	74,112
Kelsey Hayes	517	4	1000	56.3	132,042
Kelsey Hayes	519	4	680	31.6	74,112

Table A-15

MPS Primary Distribution Circuit Losses

Substation Name	Circuit Number	Circuit Votage kV	Circuit Demand Loading KVA	Circuit Demand Losses KW	Circuit Energy Loss KWH
Kelsey Hayes	520	4	600	26.2	61,448
Kelsey Hayes	521	4	910	48.8	114,452
Kelsey Hayes	522	4	918	49.5	116,094
Kelsey Hayes	523	4	918	49.5	116,094
Lexington	508	4	300	9.3	21,812
Lexington	509	4	250	7	16,417
Liberal Burgess	503	4	918	49.5	116,094
Liberal Moundville	504	4	918	49.5	116,094
Liberal Rural	501	4	918	49.5	116,094
Mt. Moriah	478	4	180	4.3	10,085
Ohio St. 12/4 Sub. @ 140	503	4	720	34.4	80,679
Raytown	501	4	1552	108.7	254,937
Raytown	502	4	918	49.5	116,094
Richard Gebaur S.	503	4	918	49.5	116,094
Richard Gebaur S.	504	4	918	49.5	116,094
Richard Gebaur S.	505	4	918	49.5	116,094
Richard Gebaur S.	506	4	918	49.5	116,094
Richard Gebaur S.	507	4	918	49.5	116,094
Schell City	501	4	918	49.5	116,094
Schell City	502	4	918	49.5	116,094
Schell City	503	4	918	49.5	116,094
Smithville	503	4	496	19.7	46,203
Trenton	501	4	2202	183.6	430,602
Trenton	502	4	918	49.5	116,094
Trenton	502	4	918	49.5	116,094
Trenton	503	4	848	43.9	102,960
Warrensbg	502	4	918	49.5	116,094
Warrensbg	503	4	918	49.5	116,094
Chula -	501	7.2	3083	93.8	219,992
Freeman	501	7.2	3083	93.8	219,992
Freeman	502	7.2	3083	93.8	219,992
Milgrove	501	7.2	3083	93.8	219,992
Grandview City	501	8	1792	33.7	79,038
Grandview City	502	8	3456	90.2	211,549
Grandview City	503	8	3968	110.9	260,097
Grandview City	504	8	2432	53.3	125,006
Grandview City	505	8	1760	32.8	76,927
Grandview West	503	8	4400	129.5	303,720
Grandview West	504	8	1344	21.9	51,363
Grandview West	506	8	5504	181.1	424,739
Grandview West	507	8	3083	76	178,245

Table A-15

MPS Primary Distribution Circuit Losses

Substation Name	Circuit Number	Circuit Votage kV	Circuit Demand Loading KVA	Circuit Demand Losses KW	Circuit Energy Loss KWH
13/40 Junction	501	12	5349	77.1	180,825
13/40 Junction	502	12	5349	77.1	180,825
92 Hwy.	501	12	1116	7.4	17,355
92 Hwy. Sub@ 658		12	1116	7.4	17,355
9th & Ingr Riv	549	12	5349	77.1	180,825
9th & Ingram	522	12	7300	122.9	288,241
9th & Ingram Rival	531	12	9800	191	447,958
Adrian	524	12	4680	63.1	147,990
Appleton City 12KV	502	12	5349	77.1	180,825
Appleton City 12KV N.	503	12	5349	77.1	180,825
Appleton City 12KV S.	501	12	5349	77.1	180,825
Arrowhead.	501	12	5349	77.1	180,825
Belton South	5511	12	6768	109.7	257,282
Belton South	5522	12	5040	70.5	165,346
Belton South	5533	12	5976	91	213,425
Belton South	5544	12	2016	17.9	41,981
Belton South	5555	12	9216	174.2	408,556
Belton South		12	5349	77.1	180,825
Belton South		12	5349	77.1	180,825
Belton South		12	9072	170.2	399,175
Blairstown Blairstown	502	12	5349	77.1	180,825
Blairstown Chilhowee	501	12	5349	77.1	180,825
Blue Ridge	502	12	1674	13.5	31,662
Blue Ridge	503	12	251	0.8	1,876
Blue S. S.	504	12	5349	77.1	180,825
Blue Sp. E.	5501	12	5349	77.1	180,825
Blue Sp. E.	5566	12	5349	77.1	180,825
Blue Sp. East	5578	12	3283.2	37.1	87,012
Blue Sp. South	502	12	7920	138.8	325,532
Blue Sp. South	503	12	5760	86.2	202,167
Blue Sp. South	505	12	7416	125.8	295,042
Blue Sp. W.	504	12	5349	77.1	180,825
Blue Springs East	502	12	9072	170.2	399,175
Blue Springs East	503	12	2880	30.5	71,533
Blue Springs East	504	12	1728	14.2	33,304
Blue Springs East	5519	12	8006.4	141.1	330,926
Blue Springs East	5528	12	5126.4	72.4	169,802
Blue Springs East	5553	12	9705.6	188.3	441,625
Blue Springs East	5577	12	4579.2	61.1	143,300
Blue Springs West	502	12	9300	176.6	414,185
Blue Springs West	503	12	9000	168.1	394,250

Table A-15

MPS Primary Distribution Circuit Losses

Substation Name	Circuit Number	Circuit Votage kV	Circuit Demand Loading KVA	Circuit Demand Losses KW	Circuit Energy Loss KWH
Blue Springs West	506	12	5000	69.7	163,469
Blue Springs West	507	12	5600	82.6	193,724
Blue Springs West	508	12	6400	100.9	236,644
Blythedale/Eaglevil	501	12	5349	77.1	180,825
Blythedale/Eaglevil	502	12	5349	77.1	180,825
Brownington	500	12	336	1.2	2,814
Calhoun	501	12	5349	77.1	180,825
Centerview	501	12	5349	77.1	180,825
Centerview	502	12	5349	77.1	180,825
Clinton Plant Rival	504	12	5364	77.4	181,528
Clinton Plant Seventh	502	12	5544	81.4	190,910
Clinton Plant Water	503	12	5148	72.8	170,740
Concordia	502	12	4200	53.7	125,944
Concordia	503	12	2500	24.7	57,930
Deepwater East	501	12	5349	77.1	180,825
Deepwater West	502	12	5349	77.1	180,825
Dun. Rd	504	12	5349	77.1	180,825
Dun. Rd	505	12	5349	77.1	180,825
Dun. Rd	516	12	5349	77.1	180,825
Duncan Rd	514	12	5349	77.1	180,825
Duncan Rd	515	12	5349	77.1	180,825
Duncan Road	502	12	7900	138.3	324,359
Duncan Road	503	12	8100	143.6	336,789
East Feeder	502	12	5349	77.1	180,825
East Lynn	501	12	5349	77.1	180,825
East Lynn	502	12	5349	77.1	180,825
East Lynn	503	12	5349	77.1	180,825
Faucett 25/12 KV @658		12	816	4.6	10,789
Ferrelview 291 Hwy.	503	12	3000	32.4	75,989
Frost Rd Noland Rd	502	12	4608	61.7	144,707
Frost Road 50 Hwy.	504	12	6480	102.8	241,100
Frost Road 75th St. 506	506	12	8640	158.2	371,031
Frost Road 83rd St.	503	12	5349	77.1	180,825
Frost Road Norfleet508	508	12	7776	135.1	316,854
Frost Road Spare	507	12	5349	77.1	180,825
Frost Road Tie	505	12	5349	77.1	180,825
Garden City	501	12	5349	77.1	180,825
Garden City	502	12	5349	77.1	180,825
Grain Valley	502	12	8064	142.6	334,444
Grain Valley	503	12	8784	162.1	380,178
Grain Valley	504	12	2304	21.8	51,128

Table A-15

MPS Primary Distribution Circuit Losses

Substation Name	Circuit Number	Circuit Votage kV	Circuit Demand Loading KVA	Circuit Demand Losses KW	Circuit Energy Loss KWH
Grandview East	501	12	5349	77.1	180,825
Grandview East	501	12	5349	77.1	180,825
Grandview East	502	12	5349	77.1	180,825
Grandview East	503	12	5349	77.1	180,825
Grandview East	506	12	5349	77.1	180,825
Grandview East	507	12	5856	88.3	207,092
Grandview East	508	12	5349	77.1	180,825
Green Ridge	501	12	5349	77.1	180,825
Green St. Eighth St.	505	12	6672	107.4	251,888
Green St. Franklin	504	12	6696	108	253,295
Green St. Green St.	503	12	6500	103.3	242,272
Hallmark	504	12	5349	77.1	180,825
Hallmark	505	12	5349	77.1	180,825
Hallmark	506	12	5349	77.1	180,825
Hallmark	508	12	5349	77.1	180,825
Hallmark	509	12	5349	77.1	180,825
Hallmark	510	12	5349	77.1	180,825
Hallmark	510	12	5349	77.1	180,825
Harris Rd	502	12	5349	77.1	180,825
Harris Rd	502	12	5349	77.1	180,825
Harris Rd	502	12	5349	77.1	180,825
Harris Rd	503	12	5349	77.1	180,825
Harris Rd	503	12	5349	77.1	180,825
Harris Rd		12	5349	77.1	180,825
Harris Rd		12	5349	77.1	180,825
Harrisonville	501	12	5349	77.1	180,825
Harrisonville E. 58	502	12	5349	77.1	180,825
Harrisonville W. 58	503	12	5349	77.1	180,825
Harrisonville West	501	12	5349	77.1	180,825
Harrisonville West	502	12	5349	77.1	180,825
Harrisonville West	503	12	5349	77.1	180,825
Harwood	501	12	5349	77.1	180,825
Harwood	502	12	5349	77.1	180,825
Harwood	503	12	5349	77.1	180,825
Hook Rd.	502	12	7488	127.6	299,264
Hook Rd.	503	12	6768	109.7	257,282
Hook Rd.	504	12	5349	77.1	180,825
Hook Rd.	507	12	8784	162.1	380,178
Hook Rd.	508	12	5349	77.1	180,825
Hook Rd.	509	12	5349	77.1	180,825
Jamesport S.	502	12	5349	77.1	180,825

Table A-15

MPS Primary Distribution Circuit Losses

Substation Name	Circuit Number	Circuit Votage kV	Circuit Demand Loading KVA	Circuit Demand Losses KW	Circuit Energy Loss KWH
KC South	502	12	4520	59.9	140,485
KC South	503	12	5349	77.1	180,825
KC South	504	12	6400	100.9	236,644
KC South	507	12	5349	77.1	180,825
KC South	508	12	5349	77.1	180,825
KC South	509	12	4608	61.7	144,707
KCI Air Cargo		12	5349	77.1	180,825
KCI Air Cargo		12	600	2.9	6,801
KCI Central Left		12	3500	40.8	95,689
KCI Central Right		12	4000	49.9	117,032
KCI Gen. Aviation		12	1200	8.2	19,232
KCI Gen. Aviation		12	2600	26.2	61,448
KCP&L	501	12	1040	6.6	15,479
Kelsey Hayes	502	12	420	1.7	3,987
Kelsey Hayes	503	12	700	3.7	8,678
Kelsey Hayes	504	12	440	1.8	4,222
Kelsey Hayes	505	12	5349	77.1	180,825
Kelsey Hayes	507	12	1560	12.2	28,613
Kelsey Hayes	508	12	800	4.5	10,554
Kelsey Hayes	509	12	1440	10.8	25,330
Kelsey Hayes	510	12	1400	10.3	24,157
Kingsville	501	12	6732	108.8	255,172
Kingsville	502	12	5349	77.1	180,825
Kingsville	503	12	5349	77.1	180,825
Kingsville	504	12	5349	77.1	180,825
Kingsville	505	12	5349	77.1	180,825
Knob Noster	501	12	5349	77.1	180,825
Knob Noster	502	12	5349	77.1	180,825
Lake Winnebago	502	12	5349	77.1	180,825
Lake Winnebago	505	12	1908	16.5	38,698
Lake Winnebago N.	502	12	4100	51.8	121,488
Lake Winnebago S.	504	12	4980	69.3	162,531
Lake Winnebago W.	503	12	4824	66.1	155,026
Lakeland Brownington	501	12	5349	77.1	180,825
Lakeland School	502	12	5349	77.1	180,825
Lakewd	506	12	5349	77.1	180,825
Lakewood	501	12	6624	106.2	249,074
Lakewood	502	12	5349	77.1	180,825
Lakewood	503	12	5349	77.1	180,825
Lakewood	507	12	5270.4	75.4	176,838
Lakewood	508	12	5349	77.1	180,825

Table A-15

MPS Primary Distribution Circuit Losses

Substation Name	Circuit Number	Circuit Votage kV	Circuit Demand Loading KVA	Circuit Demand Losses KW	Circuit Energy Loss KWH
Lakewood	508	12	9259.2	175.4	411,371
Lakewood 40 Hwy (RT)	503	12	5349	77.1	180,825
Lakewood Hospital	502	12	5349	77.1	180,825
Lamar Heights	501	12	5349	77.1	180,825
LaMonte	501	12	5349	77.1	180,825
Lee's S. E	513	12	5952	90.5	212,252
Lee's S. E	514	12	3151	34.9	81,852
Lee's S. E (open) 515	515	12	5349	77.1	180,825
Lee's S. E 504 (open)	504	12	5349	77.1	180,825
Lee's S. E 508 (open)	508	12	5349	77.1	180,825
Lee's S. E Frd 509 (open)	509	12	5349	77.1	180,825
Lee's Summit E.	502	12	5349	77.1	180,825
Lee's Summit East502	502	12	6300	98.5	231,015
Lee's Summit East503	503	12	5349	77.1	180,825
Lee's Summit East505	505	12	6500	103.3	242,272
Lee's Summit East507	507	12	8832	163.5	383,461
Lee's Summit East510	510	12	5349	77.1	180,825
Leeton	501	12	5349	77.1	180,825
Leeton	502	12	5349	77.1	180,825
Leeton	503	12	5349	77.1	180,825
Lexington	502	12	4800	65.6	153,854
Lexington	503	12	6600	105.6	247,667
Lexington	504	12	5328	76.7	179,887
Liberal (Wholesale)+A104	502	12	5349	77.1	180,825
Liberty South	507	12	5349	77.1	180,825
Liberty South	508	12	5349	77.1	180,825
Liberty South	509	12	5349	77.1	180,825
Liberty South	510	12	5349	77.1	180,825
Liberty South Frd.	502	12	7806	135.8	318,496
Liberty South Frd.	503	12	3061	33.4	78,334
Liberty South Frd.	504	12	5349	77.1	180,825
Liberty W	502	12	5349	77.1	180,825
Liberty W	503	12	6480	102.8	241,100
Liberty W	504	12	8352	150.3	352,503
Liberty W	508	12	5349	77.1	180,825
Liberty W	509	12	5349	77.1	180,825
Liberty W	510	12	5349	77.1	180,825
Liberty West	507	12	5349	77.1	180,825
Liberty West	513	12	5349	77.1	180,825
Liberty West	514	12	5349	77.1	180,825
Liberty West	515	12	5349	77.1	180,825

Table A-15

MPS Primary Distribution Circuit Losses

Substation Name	Circuit Number	Circuit Votage kV	Circuit Demand Loading KVA	Circuit Demand Losses KW	Circuit Energy Loss KWH
Liberty West	516	12	5349	77.1	180,825
Lincoln	501	12	5349	77.1	180,825
Lincoln	502	12	5349	77.1	180,825
Lone Jack	502	12	5349	77.1	180,825
Lone Jack	503	12	5349	77.1	180,825
Lone Jack	504	12	5349	77.1	180,825
Longview	502	12	5349	77.1	180,825
Longview East	503	12	6200	96.2	225,621
Longview East	504	12	7800	135.7	318,261
Longview East	5510	12	6120	94.3	221,164
Longview South	502	12	7400	125.4	294,104
Longview West	5505	12	8064	142.6	334,444
Lowry City East	502	12	5349	77.1	180,825
Lowry City West	501	12	5349	77.1	180,825
Mont. Germantown	501	12	5349	77.1	180,825
Mont. South Rural	503	12	5349	77.1	180,825
Montrose Montrose	502	12	5349	77.1	180,825
Moss St.	503	12	9216	174.2	408,556
Moss St. E. Circuit	553	12	3300	37.4	87,715
Moss St. Indust Park	502	12	2400	23.2	54,412
Moss St. Morse Ave.	510	12	7800	135.7	318,261
Moss St. West	584	12	7344	124	290,821
Moss St. Wilshire	592	12	9675	187.4	439,514
Nev 3 M Cross Town	506	12	9130	171.8	402,927
Nev 3M CampClark	504	12	8784	162.1	380,178
Nev 3M RichHill	505	12	5112	72	168,864
Nevada 3 M	503	12	8784	162.1	380,178
Nevada Deerfield	501	12	3360	38.4	90,061
Nevada Mid Town	503	12	6100	93.9	220,226
Nevada North	502	12	5400	78.2	183,405
Nevada Plant 506	506	12	5349	77.1	180,825
Nevada Plant 507	507	12	5349	77.1	180,825
Nevada Plant 508	508	12	5349	77.1	180,825
Nevada South	504	12	3816	46.5	109,058
New Market Sub @658		12	2027.68	18	42,216
New Market Transf.	501	12	2027.68	18	42,216
Norborne	501	12	5349	77.1	180,825
Norborne	502	12	5349	77.1	180,825
Oak Grove	502	12	5349	77.1	180,825
Oak Grove	503	12	5349	77.1	180,825
Oak Grove	504	12	5349	77.1	180,825

Table A-15

MPS Primary Distribution Circuit Losses

Substation Name	Circuit Number	Circuit Votage kV	Circuit Demand Loading KVA	Circuit Demand Losses KW	Circuit Energy Loss KWH
Oak Grove	5506	12	5349	77.1	180,825
Oak Grove	5523	12	200	0.6	1,407
Oak Grove	5531	12	7000	115.4	270,651
Odessa City Sub	573	12	5349	77.1	180,825
Ohio Street East	501	12	5349	77.1	180,825
Ohio Street West	502	12	5349	77.1	180,825
Orrick	502	12	2908.8	31	72,705
Orrick	503	12	1792.8	15	35,180
Osceola Boy Scout	502	12	5349	77.1	180,825
Osceola North	503	12	5349	77.1	180,825
Osceola Roscoe	501	12	5349	77.1	180,825
P Corning (Fdr to main plant)		12	5349	77.1	180,825
P Corning (Fdr. To smelter	41	12	4356	56.7	132,980
Peculiar	501	12	8976	167.5	392,842
Peculiar	502	12	5349	77.1	180,825
Platte C. 24.9 Sw Sub @ 6		12	5349	77.1	180,825
Pleasant Hill	503	12	5349	77.1	180,825
Pleasant Hill		12	5349	77.1	180,825
Pleasant Hill		12	7200	120.4	282,377
Pleasant Hill City	502	12	1542	12	28,144
Pleasant Hill Rural	503	12	5349	77.1	180,825
Post Oak	501	12	5349	77.1	180,825
Post Oak	502	12	5349	77.1	180,825
Post Oak	503	12	5349	77.1	180,825
Pr. Lee	502	12	2400	23.2	54,412
Pr. Lee	503	12	5349	77.1	180,825
Pr. Lee	504	12	5800	87.1	204,278
Pr. Lee	507	12	5349	77.1	180,825
Pr. Lee	508	12	7488	127.6	299,264
Pr. Lee	509	12	8928	166.1	389,559
Prairie Lee	508	12	5349	77.1	180,825
Prairie Lee	509	12	5349	77.1	180,825
Prairie Lee 504	504	12	5349	77.1	180,825
Raymore	502	12	5349	77.1	180,825
Raymore	502	12	7872	137.6	322,717
Raymore	503	12	5349	77.1	180,825
Raymore	503	12	7104	118	276,749
Raymore	506	12	5349	77.1	180,825
Raymore	507	12	5349	77.1	180,825
Raymore	508	12	5349	77.1	180,825
Rayn	503	12	8000	140.9	330,457

Table A-15

MPS Primary Distribution Circuit Losses

Substation Name	Circuit Number	Circuit Votage kV	Circuit Demand Loading KVA	Circuit Demand Losses KW	Circuit Energy Loss KWH
Rayn	504	12	6200	96.2	225,621
Rayn	506	12	7900	138.3	324,359
Rayn	507	12	4900	67.6	158,544
Rayn	508	12	6000	91.6	214,832
Raytown	502	12	6600	105.6	247,667
Rich Hill	502	12	5349	77.1	180,825
Rich Hill City	503	12	5349	77.1	180,825
Richmond	503	12	2880	30.5	71,533
Richmond	504	12	7200	120.4	282,377
Richmond	509	12	7852	137	321,310
Richmond	510	12	4815	65.9	154,557
Rockvil Missile Site	502	12	5349	77.1	180,825
Rville Fed Housing	501	12	5349	77.1	180,825
Sedalia E.	507	12	5349	77.1	180,825
Sedalia E.	508	12	3264	36.8	86,308
Sedalia E.	509	12	3072	33.6	78,803
Sedalia E. South	502	12	4600	61.5	144,238
Sedalia E. SW	504	12	5349	77.1	180,825
Sedalia E. West	503	12	8200	146.3	343,121
Sedalia W.	506	12	5349	77.1	180,825
Sedalia W.	507	12	5349	77.1	180,825
Sedalia W.	508	12	5349	77.1	180,825
Sedalia W.	509	12	5349	77.1	180,825
Sedalia W. 11th St.521	521	12	9216	174.2	408,556
Sedalia W. 16th St.554	554	12	8064	142.6	334,444
Sedalia W. Alcan	502	12	5349	77.1	180,825
Sedalia W. Main	503	12	6912	113.2	265,491
Sheldon	501	12	5349	77.1	180,825
Sheldon Milo	502	12	5349	77.1	180,825
Sibley	501	12	5349	77.1	180,825
Sibley	501	12	7200	120.4	282,377
Sibley	502	12	3456	40.1	94,048
Smithv 13.8/2.4 Sub @ 823		12	496	2.2	5,160
Smithville	503	12	5349	77.1	180,825
Smithville 169 Hwy.	501	12	8904	165.5	388,152
Smithville 92/C Hwy.	502	12	2352	22.5	52,770
Smithville Frd.	506	12	2184	20.1	47,141
Smithville Frd.	507	12	5349	77.1	180,825
Smithville Frd.	508	12	5349	77.1	180,825
Spickard	501	12	544	2.5	5,863
Staley Rd.		12	5349	77.1	180,825

Table A-15

MPS Primary Distribution Circuit Losses

Substation Name	Circuit Number	Circuit Votage kV	Circuit Demand Loading KVA	Circuit Demand Losses KW	Circuit Energy Loss KWH
Staley Rd.		12	2592	26	60,979
Staley Rd.		12	8064	142.6	334,444
Staley Rd. New Mark	501	12	5349	77.1	180,825
Staley Rd. Northland	502	12	9696	188	440,922
Staley Rd. Northland	506	12	7992	140.7	329,988
Strasburg	501	12	5349	77.1	180,825
Strasburg	501	12	5349	77.1	180,825
Strasburg	502	12	5349	77.1	180,825
Strasburg North	502	12	5349	77.1	180,825
Strasburg South	501	12	5349	77.1	180,825
Strother Rd	502	12	5349	77.1	180,825
Strother Rd	504	12	5349	77.1	180,825
Strother Rd Frd.	503	12	5184	73.6	172,616
Trenton	507	12	5349	77.1	180,825
Turner Rd.	502	12	6336	99.4	233,126
Turner Rd.	503	12	5349	77.1	180,825
Turner Rd.	504	12	5349	77.1	180,825
Turner Rd.		12	5349	77.1	180,825
Turner Rd.		12	5349	77.1	180,825
Turner Rd.		12	5349	77.1	180,825
TWA	508	12	5349	77.1	180,825
TWA Comp. Center	503	12	1764	14.6	34,242
TWA Comp. Center	504	12	5349	77.1	180,825
TWA Computer Center	507	12	1764	14.6	34,242
TWA Power Plant	502	12	3024	32.8	76,927
TWA Power Plant	506	12	4176	53.2	124,771
Urich	501	12	5349	77.1	180,825
W. Elec. Valle Vista	509	12	6408	101.1	237,113
Walker	501	12	5349	77.1	180,825
Walker	502	12	5349	77.1	180,825
Warrensbg E.	503	12	6732	108.8	255,172
Warrensbg East	504	12	8095	143.5	336,555
Warrensburg	501	12	240	0.7	1,642
Warrensburg	504	12	1380	10.1	23,688
Warrensburg 12 KV	573	12	4200	53.7	125,944
Warrensburg 12 KV	583	12	4356	56.7	132,980
Warrensburg E.	511	12	7638	131.5	308,411
Warrensburg East	502	12	5349	77.1	180,825
Warrensburg East	512	12	8175	145.6	341,480
Warrensburg East	513	12	8629	157.9	370,327
Warrensburg Plant	506	12	8640	158.2	371,031

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MPS Primary Distribution Circuit Losses

Substation Name	Circuit Number	Circuit Votage kV	Circuit Demand Loading KVA	Circuit Demand Losses KW	Circuit Energy Loss KWH
Warrensburg Plant	5546	12	6912	113.2	265,491
Warsaw	505	12	1920	16.6	38,932
Warsaw North	503	12	3960	49.1	115,156
Warsaw South	501	12	3600	42.6	99,911
West Feeder	501	12	5349	77.1	180,825
Western E Sprint	505	12	8736	160.8	377,129
Western Elec Unity	511	12	7776	135.1	316,854
Western Electric	501	12	5349	77.1	180,825
Western Electric	508	12	5349	77.1	180,825
Western Electric	510	12	5349	77.1	180,825
Western Electric	514	12	5349	77.1	180,825
Western Electric	514	12	5349	77.1	180,825
Western Electric	518	12	5349	77.1	180,825
Western Electric	519	12	5349	77.1	180,825
Western Electric	520	12	5349	77.1	180,825
Western Electric	521	12	2880	30.5	71,533
Western Electric	513	12	7800	135.7	318,261
Western Electric	515	12	5349	77.1	180,825
Western Electric "A"	507	12	5760	86.2	202,167
Western Electric "B"	506	12	5952	90.5	212,252
Western Electric "C"	504	12	5760	86.2	202,167
Windsor 12 KV	502	12	3700	44.4	104,133
Windsor 12 KV	503	12	4200	53.7	125,944
Adrian	507	24	4860	16.7	39,167
Ferrelview AWC North.	501	24	4565	15.2	35,649
Ferrelview Gateway/EHN.	502	24	4565	15.2	35,649
Ferrelview Har Dav	504	24	6800	27.6	64,731
Gilman - North	501	24	598	0.7	1,642
Platte City	502	24	6000	22.9	53,708
Platte City	503	24	4565	15.2	35,649
Platte City	505	24	4565	15.2	35,649
Platte City P.C.	503	24	4565	15.2	35,649
Platte City Weston	502	24	4565	15.2	35,649
Power Coal	7702	34	4565	7.6	17,824
Total			2,245,506.4	36,318.6	85,179,101

Estimated

Table A-16

SJLP Primary Distribution Circuit Losses

Substation Name	Circuit Number	Circuit Votage kV	Circuit Demand Loading KVA	Circuit Demand Losses KW	Circuit Energy Loss KWH
Ajax	67	12	4,430	58.1	198,016
Ajax	68	12	9,061	169.9	579,052
Ajax	69	12	3,208	35.8	122,013
Ajax	70	12	6,984	115.0	391,942
Alabama St	AS11	12	4,712	63.8	217,443
Alabama St	AS12	12	8,657	158.6	540,539
Alabama St	AS14	12	4,052	50.9	173,477
Alabama St	AS15	12	4,052	50.9	173,477
Belt Jct.	60	12	2,587	26.0	88,613
Belt Jct.	61	12	3,177	35.3	120,309
Belt Jct.	62	12	8,589	156.8	534,405
Belt Jct.	63	12	5,612	82.9	282,539
Belt Jct.	64	12	2,338	22.3	76,003
Browns C.	BC170	12	628	3.1	10,565
Browns C. to Maitland	3325	12	2,260	21.2	72,254
Browns C. to Oregon	3326	12	5,995	91.5	311,850
Burlington Jct.	BN145	12	1,386	10.2	34,764
Burlington Jct.	BN146	12	3,171	35.2	119,968
Cook	CK113	12	6,682	107.6	366,721
Cook	CK114	12	9,385	179.0	610,066
Cook	CK115	12	7,007	115.6	393,987
Cook	CK16	12	8,649	158.4	539,858
Cook	CK17	12	5,553	81.6	278,108
Cook	CK18	12	3,967	49.3	168,024
Cook	CK19	12	8,804	162.7	554,513
Craig	CR165	12	954	5.8	19,768
East Side	ES110	12	2,438	23.8	81,115
East Side	ES111	12	9,270	175.8	599,160
East Side	ES112	12	5,759	86.1	293,445
East Side	ES113	12	8,852	164.0	558,943
East Side	ES114	12	6,726	108.7	370,470
East Side	ES115	12	10,187	202.4	689,818
East Side	ES31	12	19,063	517.7	1,764,421
East Side	ES32	12	33,569	1,208.5	4,118,800
East Side	ES33	12	8,000	140.9	480,214
East Side	ES34	12	8,000	140.9	480,214
Edmond St.	2	12	6,187	95.9	326,846
Edmond St.	13	12	6,272	97.9	333,662
Edmond St.	14	12	4,652	62.6	213,353
Edmond St.	15	12	3,951	49.0	167,001
Edmond St.	16	12	628	3.1	10,565
Edmond St.	20	12	1,907	16.4	55,894

Table A-16

SJLP Primary Distribution Circuit Losses

Substation Name	Circuit Number	Circuit Votage kV	Circuit Demand Loading KVA	Circuit Demand Losses KW	Circuit Energy Loss KWH
Fairfax	FX160	12	2,230	20.8	70,890
Fillmore St.	FM11	12	2,554	25.5	86,909
Fillmore St.	FM12	12	6,253	97.4	331,958
Fillmore St.	FM13	12	769	4.2	14,314
Fillmore St.	FM14	12	4,800	65.6	223,577
Fillmore St.	FM15	12	3,847	47.1	160,526
Fillmore St.	FM16	12	4,004	50.0	170,410
Gower	65	12	3,229	36.2	123,377
Gower	66	12	2,416	23.4	79,752
Grant City	GC135	12	1,686	13.7	46,692
Grant City	GC136	12	1,437	10.8	36,808
Hwy 48	HW180	12	234	0.7	2,386
Hwy 48	HW181	12	1,568	12.3	41,921
Industrial Park	IP11	12	7,030	116.1	395,691
Industrial Park	IP12	12	8,595	156.9	534,745
Kellog	80	12	740	4.0	13,633
Kellog	81	12	1,646	13.2	44,988
King City	KC185	12	1,338	9.7	33,059
King City	KC186	12	1,636	13.1	44,647
Lake Road	30	12	4,052	50.9	173,477
Lake Road	31	12	5,757	86.1	293,445
Lake Road	32	12	4,052	50.9	173,477
Lake Road	50	12	1,428	10.7	36,468
Lake Road	52	12	4,052	50.9	173,477
Lake Road	56	12	3,746	45.2	154,050
Maitland	ML175	12	2,865	30.3	103,268
Maryville	MV17	12	4,052	50.9	173,477
Maryville	MV18	12	4,588	61.3	208,922
Maryville	MV19	12	7,643	131.6	448,518
Maryville	MV20	12	1,476	11.2	38,172
Messanie St.	46	12	5,089	71.6	244,027
Messanie St.	47	12	4,853	66.6	226,986
Messanie St.	48	12	3,909	48.2	164,275
Messanie St.	49	12	5,378	77.7	264,817
Mound City	MC200	12	2,247	21.0	71,572
Mound City	MC201	12	1,741	14.3	48,737
Muddy Creek	76	12	1,809	15.2	51,805
Muddy Creek	77	12	5,428	78.8	268,566
Nodaway	ND121	12	5,104	71.9	245,049
Nodaway	ND122	12	7,022	115.9	395,009
Oak St.	21	12	3,850	47.1	160,526
Oak St.	22	12	3,778	45.8	156,095

Table A-16

SJLP Primary Distribution Circuit Losses

Substation Name	Circuit Number	Circuit Votage kV	Circuit Demand Loading KVA	Circuit Demand Losses KW	Circuit Energy Loss KWH
Oak St.	23	12	837	4.8	16,359
Oak St.	25	12	3,145	34.8	118,605
Oregon	OR190	12	2,888	30.6	104,291
Oregon	OR191	12	2,943	31.5	107,358
Parnell	PL125	12	1,190	8.1	27,606
Phelps City	PC157	12	1,440	10.8	36,808
Phelps City	PC158	12	4,052	50.9	173,477
Pickering	PK140	12	2,248	21.0	71,572
Ravenwood	RW120	12	1,578	12.4	42,262
Ravenwood	RW121	12	1,457	11.0	37,490
Rochester	78	12	1,224	8.5	28,970
Rochester	79	12	1,042	6.6	22,494
Rosecrans	RS11	12	4,052	50.9	173,477
Rosecrans	RS13	12	4,052	50.9	173,477
Rushville	53	12	2,723	28.0	95,429
Rushville	54	12	3,760	45.5	155,073
Savannah	92	12	7,354	124.2	423,297
Savannah	93	12	3,624	43.0	146,552
Savannah	94	12	4,118	52.1	177,567
Tarkio	TK151	12	971	6.0	20,449
Tarkio	TK152	12	1,011	6.4	21,812
Tarkio	TK153	12	1,588	12.5	42,602
Tarkio	TK154	12	2,704	27.7	94,407
Woodbine	WB11	12	6,698	108.0	368,085
Woodbine	WB12	12	9,709	188.4	642,103
Worth	WH130	12	4,052	50.9	173,477
Worth	WH131	12	4,052	50.9	173,477
Total			501,804	8,192.4	27,921,269
		Estimated			

Table A-17

MPS Secondary Transformers

kVA	Number of Units	Total kVA	Unit No-Load Demand Losses Watt	No-Load Demand Losses kW	No-Load Energy Losses kWh	Unit Load Demand Losses Watt	Load Demand Losses kW	Load Energy Losses kWh
5	3,365	16,825	12	40.4	354,698	45	34.0	323,184
10	7,950	79,500	25	198.8	1,745,820	91	161.0	1,544,048
15	11,316	169,740	37	418.7	3,677,791	136	343.0	3,284,612
25	34,906	872,650	61	2,129.3	18,703,473	226	1,759.0	16,836,848
37.5	7,503	281,363	90	675.3	5,931,572	338	566.0	5,412,575
50	18,496	924,800	119	2,201.0	19,333,795	449	1,852.0	17,724,599
75	4,231	317,325	176	744.7	6,541,058	670	632.0	6,050,205
100	2,529	252,900	230	581.7	5,109,389	887	500.0	4,787,676
112.5	170	19,125	256	43.5	382,280	995	38.0	361,014
150	550	82,500	331	182.1	1,599,127	1,313	161.0	1,541,273
167	989	165,163	364	360.0	3,162,205	1,455	321.0	3,071,224
225	328	73,800	469	153.8	1,351,260	1,931	141.0	1,351,787
250	2	500	511	1.0	8,977	2,131	1.0	9,096
300	604	181,200	590	356.4	3,130,266	2,524	340.0	3,253,708
333	118	39,294	639	75.4	662,331	2,777	73.0	699,375
500	632	316,000	843	532.8	4,679,904	3,989	562.0	5,380,633
750	148	111,000	1,042	154.2	1,354,633	5,600	185.0	1,768,895
1000	167	167,000	1,144	191.0	1,678,166	6,988	260.0	2,490,701
1500	45	67,500	1,166	52.5	460,896	9,181	92.0	881,769
1750	194	339,500	1,121	217.5	1,910,292	10,024	434.0	4,150,449
Total	94,243	4,477,685		9,309.9	81,777,933		8,455.0	80,923,671

Table A-18

SJLP Secondary Transformers								
KVA	Number of Units	Total kVA	Unit No-Load Demand Losses Watt	No-Load Demand Losses kW	No-Load Energy Losses kWh	Unit Load Demand Losses Watt	Load Demand Losses kW	Load Energy Losses kWh
5	1,450	7,250.0	12	17	152,842	45	11	108,422
10	4,168	41,680.0	25	104	915,293	91	66	630,240
15	4,923	73,845.0	37	182	1,600,014	136	116	1,112,515
25	8,197	204,925.0	61	500	4,392,149	226	322	3,078,225
37.5	156	5,850.0	90	14	123,327	338	9	87,615
50	5,601	280,050.0	119	667	5,854,703	449	437	4,178,774
75	810	60,750.0	176	143	1,252,247	670	94	901,772
100	413	41,300.0	230	95	834,392	887	64	608,710
112.5	53	5,962.5	256	14	119,181	995	9	87,627
150	170	25,500.0	331	56	494,276	1,313	39	370,895
167	204	34,068.0	364	74	652,265	1,455	52	493,208
225	108	24,300.0	469	51	444,927	1,931	36	346,532
250	67	16,750.0	511	34	300,738	2,131	25	237,244
300	132	39,600.0	590	78	684,098	2,524	58	553,605
333	13	4,329.0	639	8	72,969	2,777	6	59,987
500	174	87,000.0	843	147	1,288,455	3,989	121	1,153,321
750	108	81,000.0	1,042	113	988,516	5,600	105	1,004,960
1000	92	92,000.0	1,144	105	924,498	6,988	112	1,068,262
1500	122	183,000.0	1,166	142	1,249,542	9,181	194	1,861,173
1750	72	126,000.0	1,121	81	708,974	10,024	125	1,199,252
Total	27,033	1,435,159.5		2,624	23,053,406		2,001	19,142,339

Table A-19

Meter Losses

MPS METER LOSSES

	Quantity	Loss/Meter (W/Hr)	Demand Losses (W)	Energy Losses (Wh)
Single Phase Mechanical	218,962	0.9	197,066	1,731,027,744
Three Phase Mechanical	1,705	3.5	5,968	52,422,912
Single Phase Electronic	16,922	0.2	3,384	29,725,056
Three Phase Electronic	4,481	0.3	1,344	11,805,696
Subtotal	242,070		207,762	1,824,981,408

SJLP METER LOSSES

	Quantity	Loss/Meter (W/Hr)	Demand Losses (W)	Energy Losses (Wh)
Single Phase Mechanical	59,836	0.9	53,852	473,035,968
Three Phase Mechanical	543	3.5	1,901	16,698,384
Single Phase Electronic	1,928	0.2	386	3,390,624
Three Phase Electronic	1,434	0.3	430	3,777,120
Subtotal	63,741		56,569	496,902,096
KCP&L GMOC Total	305,811		264,331	2,321,883,504