Exhibit No.:
Issue: Energy Studies; Customer Contacts

Witness/Type of Exhibits: Graham Direct

Sponsoring Party: KCPL
Case No.: HO-86-139

DIRECT TESTIMONY OF

Robert H. Graham

ON BEHALF OF

KANSAS CITY POWER & LIGHT COMPANY

CASE NO. HO-86-139

DIRECT TESTIMONY

OF

ROBERT H. GRAHAM

Director, District Commercial Operations

KANSAS CITY POWER & LIGHT COMPANY

Case No. HO-86-139
(September 1986)

Q. PLEASE STATE YOUR NAME AND ADDRESS.

A. Robert H. Graham. My business address is 1330 Baltimore, Kansas City, Missouri.

Q. BY WHOM ARE YOU EMPLOYED AND IN WHAT CAPACITY?

A. I am employed by Kansas City Power & Light Company ("KCPL" or "Company") as the Director of District Commercial Operations.

Q. PLEASE REVIEW YOUR EDUCATIONAL BACKGROUND AND PROFESSIONAL EXPERIENCE.

A. I graduated from Finley Engineering College in 1958 with a Bachelor of Science in Electrical Engineering. In April of that year I joined Massaglia-Neustrom-Middleton, a consulting firm in Kansas City, Missouri, as a design engineer. I worked on the design of the electrical and mechanical systems for commercial and industrial buildings throughout the Midwest, but principally in Kansas and Missouri. I reviewed these projects, in the field, to insure that the plans and specifications were followed and to resolve any conflicts between trades or operational problems. Some of these projects were buildings taking steam from KCPL, such as the Federal Office Building at 601 East 12th Street. I have professional engineering licenses in the states of Missouri and Kansas.

I left the consulting firm in 1967 to join Kansas City Power & Light Company. My initial position was a sales engineer calling on architects, engineers, and commercial and industrial customers. Subsequently, I was supervisor and then Manager of Commercial and Industrial Sales and Manager of District Commercial Operations, and I am presently the Director of District Commercial Operations. In my present position I am responsible for the five Commercial Operations Offices. These offices are responsible for the coordination of all new business between the customer and the Company and the account maintenance on all large commercial and industrial accounts. Included in these accounts are all steam customers.

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY?

A. I will review the communications we have had with our customers regarding the steam conversion plan and this case. I will summarize the procedures used in the customer energy studies and the results to date, and also review the customer reaction to the conversion plan and the energy audits. Finally, I will explain the reasons for KCPL offering to its steam customers electric heating equipment other than electric boilers as a replacement heating source.

Q. WHEN WERE THE STEAM CUSTOMERS FIRST ADVISED THAT STEAM SERVICE FROM THE GRAND AVENUE PLANT WOULD EVENTUALLY BE PHASED OUT?

A. At the request of our steam customers, an informational meeting was held during June 1985. The history of the steam business in Kansas City was reviewed at the meeting. Steam customers were informed that, for economic reasons, the Company was seeking alternatives to central station steam service. It was explained that any such plan would be subject to review and approval by the Missouri Public Service

Commission (Commission) before it became effective. A commitment was made to audit the premises of each steam heat customer. The audit would review the customer's billings and present steam heating system, provide preliminary design and cost as to how the system could be converted, and list conservation measures that would improve the buildings energy systems. The audits would focus on the heating system itself and any improved energy management systems that might be implemented.

Q. WHAT COMMUNICATIONS FOLLOWED THIS MEETING?

A. Following the June 1985 meeting, KCPL sent a letter to steam customers advising them that by early 1986 the Company would develop a tentative five-year conversion plan. The plan would eliminate the low pressure distribution system through the use of on-site electric boilers. The plan would also study ways to minimize the high pressure steam distribution system. A tentative meeting date of March 1986 was set for presenting this plan to steam customers.

Q. WHEN WAS THE MEETING SCHEDULED TENTATIVELY FOR MARCH 1986 HELD?

A. Every customer on the Downtown Steam System was invited to a meeting on March 13, 1986, when the plan was presented to them.

Q. HOW MANY ATTENDED THIS MEETING?

A. Registration cards from persons representing or associated with 62 customers were collected at the meeting.

Q. WHAT WAS PRESENTED AT THIS MEETING?

A. KCPL confirmed that its study indicated it is not economically feasible for the Company to continue central station steam service in Downtown Kansas City; thus, we would continue our pursuit to discontinue central station steam service. We stated that the Company planned to propose to the Commission that we be allowed to install on-site electric boilers for steam production. Under the proposal the customer would continue to be billed on the steam rate. KCPL would own and operate the boilers through 1995 at which time the customer would assume ownership of the boiler and become an electric heat customer. We would also propose that the customer be given the option of buying the boiler at any time prior to December 31, 1995, at depreciated original cost. Upon purchase of the boiler, the customer would become an electric heat customer.

Q. WERE ANY OTHER CUSTOMER OPTIONS PRESENTED AT THIS MEETING?

A. Yes. We stated that in some instances a form of electric heat other than an on-site boiler might better suit the customer's needs. To provide for such an event, KCPL would seek approval from the Commission to own and install an electric space heating system, and to bill the customer under the applicable electric rate schedules. If the capital cost of this option is greater than the cost of the on-site boiler option, the customer would be required to reimburse KCPL for the difference.

KCPL is proposing to offer these equipment options to alleviate to some extent the financial burden of our steam customers in converting from central station steam service. As I discuss later, the offering of on-site electric boilers and other electrical heating equipment also has benefits to KCPL and its electric customers.

Q. WHAT OTHER INFORMATION WAS PRESENTED AT THIS MEETING?

A. Two other major items were also covered. First, KCPL presented a systematic conversion plan. Under this plan, a customer's location determines which one of eleven conversion phases the customer is in. During each year, from the time permission is received to begin the plan, to 1990, several phases would be disconnected from the central station steam system.

Also, in response to questions, the future projected price of steam and electricity used for space heating was discussed. KCPL stated that the Company would require substantial increases in steam rates and that the customer should expect to start seeing these increases in 1987. It was anticipated that electric heating rates should remain around current levels or possibly decrease, as the Company had requested a decrease in the electric heating rate in its pending rate case.

Q. WHAT WAS THE RESPONSE TO THIS MEETING?

A. During the two week period following the meeting, telephone contact was made with each meeting attendee who submitted a registration card. In general, these people indicated that they were receptive to KCPL's plan. They were pleased with KCPL's willingness to pay the upfront cost of converting from district steam to on-site produced steam. The uncertainty of the future prices of all fuels was of concern to the majority of people contacted. Virtually all customers expressed an interest in seeing the results of their energy study before making detailed comments on the plan.

Q. WHAT OTHER COMMUNICATIONS HAVE YOU HAD, IN REFERENCE TO THE PLAN AND RATE CASE, WITH YOUR STEAM CUSTOMERS?

A. The Notice of Filings and Hearings on KCPL Downtown Steam Service Plan and Proposed Rate Increases were mailed to all steam customers on September 4, 1986. This Notice informed the customers that KCPL had filed with the Commission a steam rate case and our plan. The Notice also contained the schedule for all proceedings associated with this case.

There was one other written communication with the steam customers which was a letter dated September 9, 1986, informing them of the meeting to be held on September 16, 1986, to answer any questions concerning the procedures associated with the Commission hearings, the schedule of these proceedings, and to explain participation requirements.

Q. WHAT TRANSPIRED AT THE SEPTEMBER 16, 1986, MEETING WITH THE STEAM CUSTOMERS?

A. The schedule and the procedures associated with the steam case were reviewed. It was pointed out, to intervene in the case, that it was necessary to file an application with the Commission by September 24, 1986.

A brief review of the electric boiler test project, the condition of the steam plant and distribution system, and the conversion plan was presented. At the conclusion of the meeting one of the customers indicated that his company intended to intervene in behalf of the steam conversion plan and invited others to join in this intervention. Approximately 30 steam customers were represented at the meeting.

Q. HOW DID KCPL CARRY OUT THE OFFERED ENERGY AUDITS?

A. The Company hired Energy Masters Corporation, a local consulting firm that specializes in energy audits and retrofit work, to make these

audits. This firm has many years of experience in this type of work and enjoys a fine reputation in the Kansas City area. The studies consist of: (1) a survey of the building, (2) an analysis of the steam and electrical consumption over the past three years, (3) a calculation of the building heating and cooling requirements, (4) an analysis of each energy consuming system in the building, (5) a correlation of calculated steam requirements with the actual steam usage, (6) a determination of size of replacement electric steam boiler or other electric heating equipment, (7) a schematic of the electric boiler design and a detailed cost estimate for the recommended conversion. A typical energy audit is attached as KCPL Exhibit No. _____ (RHG), Schedule 1.

Q. WHAT PROGRESS HAS BEEN MADE IN PERFORMING THESE AUDITS?

A. To date we have completed 83 audits on just over 11.9 million square feet of space. Audits are in progress on an additional 10 buildings containing .6 million square feet. Twenty-eight buildings totaling 2.1 million square feet are unscheduled at this time.

Q. WHEN DO YOU ANTICIPATE THE REST OF THE AUDITS WILL BE COMPLETED?

A. The consulting firm has enough staff committed to these audits to complete the balance in 1986. Work can begin on any requested audit within two weeks of the request.

Q. WHAT HAVE THESE AUDITS SHOWN TO DATE?

A. These audits have shown that the condition of the buildings and heating systems vary considerably. Some of the audits have covered buildings which have only been in service a couple of years; others have been in service fifty years. In the older buildings the consultant has come up

with several recommendations to conserve energy, such as a better control system, improving the shell of the building, and suggestions on how to shutdown the steam system during the summer months. In the newer buildings there are naturally fewer energy conservation recommendations. In all cases, the consultant has been able to find space and a method to install electric boilers or other electric space heating equipment.

Q. HOW IS THE INFORMATION IN THE AUDIT CONVEYED TO THE CUSTOMERS AND WHAT HAS BEEN THEIR REACTION?

A. An appointment is made with each customer to review the audit. A copy of the audit is given to and reviewed with the customer by our engineering staff. All points are explained and almost all customers' questions are answered. The one question that we have not been able to answer is, "What will KCPL be allowed to do for the customer and when can we find out?"

In many cases the customers are very pleased with the energy conservation recommendations. Many of these recommendations are very low cost or no cost recommendations. The customers have also been very pleased that the consultant has been able to complete the audit of their building without disrupting their business.

Q. HAS THE CONSULTANT RECOMMENDED HEATING EQUIPMENT OTHER THAN A STEAM BOILER IN ANY OF THESE AUDITS?

A. Yes, the consultant has recommended equipment other than a steam boiler. In many cases it has been recommended a combination of an electric resistance heating system and a steam boiler be utilized. In some cases the customer's system uses steam to heat hot water which is then piped throughout the building for heating. By using an electric

hot water boiler rather than a steam boiler, one heat exchange is eliminated which increases the efficiency of the system. In other cases, the customer's steam piping is in poor condition and rather than replace the interior steam piping, the customer prefers to use a different heating system. In some instances the customer has an air system for air conditioning and could do the heating by simply installing resistance heat coils in the duct work. Electric resistance heating is also recommended for remote areas which are difficult to reach with steam piping.

The consultant has recommended that some of the central domestic hot water systems now using steam be converted to decentralized electric hot water systems. This eliminates most of the hot water piping and completely eliminates the recirculation hot water piping. This is done by placing small electric hot water heaters throughout the building adjacent to restrooms and other facilities requiring hot water. More heat is lost in the domestic hot water piping and recirculation than in the hot water actually used by occupants of the building.

The results of these audits thus indicated that for many of our steam customers, the offering of only on-site steam boilers is not the most efficient or desirable method of meeting their heating needs. In response to this customer need, KCPL broadened its option offering to include electric space heating equipment.

Q. WHY DOES THE CONVERSION PLAN CALL FOR THE EVENTUAL CONVERSION OF ALL THESE STEAM HEAT CUSTOMERS TO ELECTRIC HEAT CUSTOMERS?

A. A comparison of the projected steam rate to the electric heat rate on equivalent steam units indicates that the conversion from steam to electric heat would be to the long term benefit of the customer as the

steam rate exceeds $12/M lbs. If these customers eventually become electric heat customers, our electric heating rates are such that the customers will have a lower operating cost on our heat rates than they will on the proposed and projected steam rates. This winter load is off peak load, and it will improve the overall Company electric load factor which, in turn, tends to reduce per unit costs. KCPL Exhibit No. ____ (BJB) Schedule 1, pages 9.6 - 9.7, indicates that addition of this load would improve KCPL's load factor by .77 percentage points. When all central station steam customers have been converted, the Company can then eliminate the Steam Operating Department and all other associated overheads, such as steam rate case processing and separate accounting and billing functions.

Q. DOES THIS COMPLETE YOUR TESTIMONY?

A. Yes.

AFFIDAVIT

STATE OF MISSOURI)
) ss.
COUNTY OF JACKSON)

Robert H. Graham, being first duly sworn, on his oath states: that he has participated in the preparation of the foregoing written testimony, in question and answer form, consisting of 10 pages, to be presented to the Public Service Commission of the State of Missouri in Case No. HO-86-139; that the answers therein contained were given by him; that he has knowledge of the matters set forth in said answers; and that such answers are true to the best of his knowledge and belief.

Robert H. Graham

Subscribed and sworn to before me this 19th day of September, 1986.

Carol Giles
Notary Public

My Commission Expires:

CAROL GILES
Notary Public, State of Missouri
Commissioned in Platte County
My Commission Expires June 15, 1987

KCPL EXHIBIT NO. _____ (RHG)
SCHEDULE 1
SPONSOR: GRAHAM

Subject: STUDY OF ENERGY REQUIREMENTS FOR
THE HOME SAVINGS BUILDING
1000-1006 GRAND AVENUE
KANSAS CITY, MISSOURI

Client: KANSAS CITY POWER AND LIGHT COMPANY

Consultant: ENERGY MASTERS CORPORATION
11880 COLLEGE BOULEVARD
OVERLAND PARK, KANSAS 66210
(913) 469-5454

Date: AUGUST 28, 1985

HOME SAVINGS BUILDING
KANSAS CITY, MISSOURI

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The following pertinent data has been extracted from our Study of Energy Requirements for the Home Savings Building:

187,994	Gross Square Feet (see Section 2.1)
3,144,600 kwh	1984 Metered Electrical Consumption
$219,770	1984 Metered Electrical Cost
1,020 kw	Historical Peak Electrical Demand
3,458 Mlb	1984 Metered Steam Consumption
$37,419	1984 Metered Steam Cost
6557 Mlb	1984 Estimated Actual Consumption (34,879 Btu/Gross Square Feet/Yr.)
75,484	Btu/Gross Sq.Ft./Year (metered Steam & Electrical)
91,971	Btu/Gross Sq.Ft./Year (Estimated Actual Consumption)
$1.37	Dollars/Gross Sq.Ft./Year

HEATING LOAD:

6,623 MBH	Peak Block Heating Load (35 Btus/Sq.Ft.)
795 MBH	Warm-up and Piping Losses (12%)
7,418 MBH	Total Heating Plant
222 HP	Boiler Horsepower Required
2,521 kw	Projected Heating Plant Demand
$184,900	Boiler Plant Installed Construction Cost (Two - 1,110 kw boilers)

COOLING LOAD:

489	Tons
	(2.6 Tons/1,000 Sq.Ft.)

1.0 INTRODUCTION

1.1 Objective

The purpose of this study is to assist Kansas City Power and Light Company (KCPL) in its commitment to provide the energy needs of all of its steam heat customers, in particular: the Owners of the Home Savings Building.

This study identifies the energy requirements for the building, and provides specific recommendations to meet these needs. A detailed estimate of the cost associated with implementing the recommendations is included.

1.2 Methodology

The accomplishment of the Objective requires a thorough understanding of the major building systems. The following is Energy Masters Corporation's approach in addressing the immediate and long-term requirements for the Home Savings Building:

A. Survey the building and confer with operating personnel to ascertain type and capacity of the mechanical and electrical systems and operating procedures.

B. Analyze the steam and electric consumption for the last three years.

C. Calculate the building load and ventilation requirements.

D. Prepare an energy analysis by system, i.e., heating, water heating, fans, lighting, and miscellaneous equipment. Identify areas of excess energy use.

E. Identify steam usages, i.e., domestic water heating, entrance heating, or humidification, which might be converted to resistance heating or heat pump, thus eliminating or reducing the requirement for on-site steam generation.

F. Determine the required capacity of an on-site electric steam boiler or other electric equipment.

G. Provide a schematic design in sufficient detail for accurate pricing, for any modifications recommended to reduce steam usage and for installation of an on-site electric boiler.

H. Provide a detailed cost estimate for the recommended modifications and for the electric boiler installation.

2.0 BUILDING SYSTEMS AND SITE IDENTIFICATION

2.1 Physical Data

The building is seventeen stories of reinforced concrete and brick construction, with wooden, double-hung windows of single glass. The first seven floors are rectangular in shape, while the last ten floors are U-shaped. The approximately dimensions and areas for the building are as follows:

Floors Basement thru Seventh

115.5' x 95.66 = 11,049 Sq.Ft./Floor

11,049 Sq.Ft./Flr. x 8 Floors = 88,392 Sq.Ft.

Floors Eighth thru Seventeenth

(115.5' x 95.66) - (48.75' x 26.33')

= 9,765 Sq.Ft./Floor

9,765 Sq.Ft./Flr./ x 10 Floors = 97,650 Sq.Ft.

Penthouse

25.5' x 76.5' = 1,952 Sq.Ft.

TOTAL: 187,994 Sq.Ft.

2.2 Mechanical Systems

Plumbing: The domestic hot water is generated by one electric water heater.

Air Handling and Ventilation: Ducted, single-zone, self-contained package units serve the tenant spaces and the lobby. A large, single-zone heating and ventilating unit serves the lobby in the wintertime. The units utilize 100 percent return air. One toilet exhaust fan, located in the Penthouse, provides

ventilation for rest rooms on all floors.

Cooling: Refrigeration for air conditioning is provided by direct expansion, water-cooled compressors located in the individual, self-contained package units. A roof-mounted cooling tower cools the condenser water for the water-cooled compressors. Two condenser water pumps are located in a penthouse adjacent to the cooling tower.

Heating: The primary source of heating is steam. Steam enters the building from Tenth Street in the northeast corner of the Basement. Steam is fed up to the Penthouse, where it is separated into two major zones and distributed down throughout the building, serving the perimeter radiators and steam coils located in the air handling units. Each radiator is equipped with a manual valve on the supply and a thermostatic steam trap on the return. Steam condensate is pumped through a coil in the heating and ventilating unit to heat the Lobby. The steam main is manually valved off in the cooling season, as steam is used only for heating.

2.3 Electrical System

The electrical service is 208/120 volt, 3-phase, 4-wire, and 1,020 kw is the largest measured demand in the last thirty-six months. The service entrance is from Grand Avenue and enters the building in the southeast corner.

The largest user of electrical energy is lighting, with air handling units, air conditioning, and miscellaneous equipment making up the remainder.

The following is a tabulation of the peak demand for each system, but does not necessariliy indicate the magnitude of energy use (See Energy Consumption section):

Load	KW
Refrigeration	479
Air Handling Unit Fans	78
Lighting	404
Miscellaneous	59
Total	1,020

2.4 Operations and Maintenance

Operations:

A. The supply fans operate continously.

B. The toilet exhaust fan operates from a timer operating thirty minutes an hour, every hour.

C. Refrigeration compressors are manually cycled "OFF" between 10 P.M. and 7 A.M.

Maintenance:

D. It is understood from the Mechanical Service Contractor that a significant problem exists with the building steam traps. A new, large steam trap has been installed in the condensate return, prior to the condensate meters, in order for the steam system to build the necessary

pressure required for proper steam distribution. Additionally, the trap reduces the amount of steam passing through the meter and filling the Basement and First Floor areas. If the traps on the individual radiators were functioning properly, the new trap in the condensate return main would not have been needed.

2.5 Heating and Cooling Loads

HOME SAVINGS BUILDING
08-13-1985

KANSAS CITYMISSOURI LAT = 39 ALT = 742
CONST= 130W/80R/130B ID= 78/50 : 70
WALL COLOR: MEDIUM ROOF COLOR: DARK
-
60515841.6

		D.B.TEMP	TOTAL TONS	RSH TONS	C.F.M.
1.	JUL AT 6 P.M.	96.0	465.76	302.42	183,286
2.	FEB AT 4 P.M.	57.0	93.78	95.10	57,637
3.	MAR AT 4 P.M.	69.0	210.36	166.49	100,906
4.	APR AT 4 P.M.	79.0	299.80	221.27	134,104
5.	MAY AT 4 P.M.	88.0	384.12	265.39	160,841
6.	JUL AT 4 P.M.	98.0	488.97	315.68	191,321
7.	DEC AT 4 P.M.	59.0	88.32	86.71	52,552

ZONE HEATING--> =4,513,889 W/INFIL=6,623,181 C.F.M = 150,527

INPUTS

	CEILING	PARTITION	FLOOR	SKYLIGHT
TRANSMISSION FACT.	0.00	0.00	0.00	0.00
TEMP DIFF HEATING	0	0	0	68
TEMP DIFF COOLING	0	0	0	20

FLOURESCENT LIGHTS - N SOLAR FACTOR SKYLIGHT = 0.00

EFFECTIVE AVERAGES FOR ZONE LOADS OR OP-COST:

EXPOSURE:	N.	NE	E.	SE	S.	SW	W.	NW
WALL TRANS. FACTORS	0.36	0.00	0.35	0.00	0.35	0.00	0.35	0.00
GLASS TRANS FACTORS	1.13	0.00	1.13	0.00	1.13	0.00	1.13	0.00
GLASS SOLAR FACTORS	0.56	0.00	0.56	0.00	0.56	0.00	0.56	0.00

ROOF TRANS. FACTOR = 0.43 SKYLIGHT TRANS. FACTOR = 0.00

OUTPUTS

NUMBER OF PEOPLE	= 1,880	SENSIBLE PEOPLE LOAD	= 460,585
TOTAL LIGHTS	= 375,988	LIGHTING LOAD	=1,283,247
OTHER ELECTRICAL	= 93,997	OTHER ELECTRICAL	= 320,812
N. TYPE 1 GLASS AREA=	10,323	N. TYPE 1 GLASS SOLAR	= 89,924
E. TYPE 1 GLASS AREA=	11,387	E. TYPE 1 GLASS SOLAR	= 206,031
S. TYPE 1 GLASS AREA=	2,084	S. TYPE 1 GLASS SOLAR	= 38,952
W. TYPE 1 GLASS AREA=	8,835	W. TYPE 1 GLASS SOLAR	= 618,239
TOTAL GLASS AREA =	32,629	TOTAL GLASS SOLAR	= 953,146
TOTAL GLASS AREA =	32,629	TOTAL GLASS TRANS.	= 737,415
SKYLIGHT AREA =	0	TOTAL SKYLIGHT SOLAR	= 0
SKYLIGHT AREA =	0	TOTAL SKYLIGHT TRANS	= 0

N. TYPE 1 WALL AREA =	13,696	N. TYPE 1 WALL LOAD =	40,746
N. TYPE 2 WALL AREA =	1,104	N. TYPE 2 WALL LOAD =	4,598
E. TYPE 1 WALL AREA =	13,744	E. TYPE 1 WALL LOAD =	99,046
E. TYPE 2 WALL AREA =	207	E. TYPE 2 WALL LOAD =	2,088
S. TYPE 1 WALL AREA =	23,698	S. TYPE 1 WALL LOAD =	125,437
W. TYPE 1 WALL AREA =	17,765	W. TYPE 1 WALL LOAD =	91,650
TOTAL WALL AREA =	70,214	TOTAL WALL TRANS. =	363,565
PARTITION AREA =	0	TOTAL PART. TRANS =	0
CEILING AREA =	0	TOTAL CEILING TRANS =	0
FLOOR AREA =	0	TOTAL FLOOR TRANS =	0
AREA OF ROOF =	11,050	ROOF LOAD =	181,193
SAFETY FACTOR =	0%	SAFETY B.T.U.S =	0
EVAP FAN H.P. =	82.17	FAN HEAT GAIN - DT =	251,957
MISC SENSIBLE =	0	MISC. SENSIBLE =	0
VENTILATION CFM =	28,199	O. A. SENSIBLE LOAD =	620,380
MISC. LATENT =	0	MISC. LATENT =	0
NUMBER OF PEOPLE =	1,880	PEOPLE LATENT LOAD =	385,388
VENTILATION CFM =	28,199	O.A. LATENT LOAD =	385,428
TOTAL CFM-STDAIR =	191,321	TOTAL LATENT LOAD =	770,815
ROOM SENSIBLE =	3,788,154	ROOM LAT. LOAD =	385,388

****

PLENUM RETURN EXHAUST CREDIT -75,436

--> GRAND TOTAL LOAD = 5,867,680 BTU'S OR 488.97 TONS <--

LOAD RUN FOR # 6. JUL AT 4 P.M.

AREA (SQ FT) =	187,994	SQ. FT PER TON =	384
TOTAL CFM-STD AIR =	191,321	CFM PER SQ FT =	1.02

HEATING LOAD

PARTITION LOAD =	0	CEILING LOAD =	0
VENTILATION LOAD =	2,109,293	ROOF HEATING LOAD =	323,102
FLOOR HEATING LOAD=	0	SKYLIGHT LOAD =	0
GLASS HEATING LOAD=	2,507,213	WALL HEATING LOAD =	1,683,574
SLAB HEATING LOAD =	0	INFIL HEAT LOAD =	2,109,293
WARM UP LOAD =	0	H LOAD WITH VENT =	6,623,181

COIL SELECTION PARAMETERS

DB TEMP ENT/LVG =	83.0 / 58.8	TOT SENSIBLE LOAD =	5,096,865
WB TEMP ENT/LVG =	67.7 / 58.1	TOTAL COIL LOAD =	5,867,680
SPECIFIED ROOM RH =	50%	RESULTING ROOM RH =	51%
TERM AIR TEMP =	60.00 / 110	DEGREES ROTATED = 0	
T. ST. EVAP FAN =	1.50	CEILING RETURN !!!	
BLDG. 'U' FACTOR=	0.58	CARRIER DEFAULTS	

3.0 ENERGY CONSUMPTION

3.1 Energy Profile

The utility data was obtained for the last thirty-six months. We used Calendar Year 1984 for the Base Consumption Year. The steam utility data is suspect.

The total electrical energy consumption for the Base Year was 10,732.5 million Btus/Year, or 57,089 Btus/sq.ft./Year. The metered steam consumption was 3,458 million Btus/Year, or 18,394 Btus/Gross Sq.Ft./Year. Because of defective steam traps, and possibly inaccurate condensate meters, all of the steam consumption was not metered. A more realistic, conservative estimate of the actual steam consumption would be 34,878 Btus/Gross Sq.Ft./Yr. (Htg.), or 6,557 Mlb/Year, based on similar buildings for the Kansas City Area. This data, combined with the field measurements and the actual operating procedures, was used to establish the building's energy base consumption profile.

3.2 Areas of Excessive Consumption

Analysis of the annual consumption, as detailed in Table 1, indicates that heating is the highest user of energy. The second energy user is lighting, followed by air moving equipment, air conditioning, and miscellaneous.

TABLE 1

ESTIMATED ANNUAL ENERGY USAGE BY SYSTEM

		BTUS x 10^6
Heating	6,557 MLB	6,557
Domestic Hot Water	149,120 KWH	509
Lighting	1,446,950 KWH	4,938
Air Conditioning	586,800 KWH	2,003
Supply Fans	678,520 KWH	2,316
Miscellaneous	283,210 KWH	967
Total:		17,290

91,971 Btus/Sq.Ft./Year

TABLE 2
UTILITY DATA
ELECTRICITY

	BILLING DATE	DEMAND	KWH	DOLLARS
1982	May	840	224,400	14,157.47
	June	870	253,200	15,527.00
	July	960	299,400	17,928.09
	August	960	350,400	20,731.66
	September	900	341,400	20,161.16
	October	870	377,400	21,155.42
	November	780	126,000	10,065.73
	December	768	148,800	11,173.07
			2,121,000	$130,899.06
1983	January	768	191,400	13,139.44
	February	768	207,600	13,850.51
	March	768	204,600	13,718.83
	April	768	191,400	13,139.44
	May	780	224,400	14,652.74
	June	990	290,400	18,684.20
	July	990	381,000	22,495.87
	August	1,020	373,800	24,732.62
	September	990	388,200	24,586.84
	October	900	288,600	19,586.50
	November	840	229,800	16,448.49
	December	816	190,200	14,431.17
			3,161,400	$209,466.65
1984	January	816	220,200	15,920.92
	February	816	194,400	14,624.21
	March	816	210,600	15,395.30
	April	816	180,600	13,967.35
	May	816	229,200	16,280.61
	June	990	301,800	20,745.95
	July	1,020	372,000	24,261.42
	August	990	360,000	23,516.14
	September	1,020	343,800	22,919.15
	October	1,020	282,600	20,006.17
	November	816	225,600	16,109.25
	December	816	223,800	16,023.57
			3,144,600	$219,770.04
1985	January	816	230,400	16,337.71
	February	816	208,200	15,281.05
	March	816	234,600	16,537.63
	April	816	205,800	15,166.81
	May	816	411,000	27,082.35
	June	870	313,200	20,592.19
	July	900	227,400	14,670.87
			1,830,600	$125,668.61

TABLE 3

UTILITY DATA

STEAM

	MONTH	MLB		DOLLARS	
1983	January	1,056		11,980.66	
	February	664		7,660.22	
	March	468		5,761.67	
	April	355		4,720.13	
	May	54		744.07	
	June	53		680.94	
	July	----		----	
	August	----		----	
	September	----		----	
	October	31		692.11	
	November	266		3,775.04	
	December	1,448		18,041.16	
	5003 Htg.Degree Days:		4,395		$54,056.00
1984	January	1,183		12,636.42	
	February	389		4,158.42	
	March	689		7,733.14	
	April	174		1,988.87	
	May	27		378.87	
	June	----		----	
	July	----		----	
	August	----		----	
	September	----		----	
	October	1		13.04	
	November	340		3,876.61	
	December	655		6,634.30	
	4798 Htg. Degree Days:		3,458		$37,419.67
1985	January	1,321		13,078.29	
	February	1,010		10,232.82	
	March	298		3,034.21	
	April	132		1,449.98	

4.0 ENERGY CONSERVATION RECOMMENDATIONS

4.1 Air Handling Units

1. Cycle supply fans "OFF" in the unoccupied mode. Presently the fans operate continuously twenty-four hours a day.

   Cost: $0

2. Cycle the toilet exhaust fan "OFF" in the unoccupied mode from a new time clock. Presently the exhaust fan operates thirty minutes "OFF" every hour by a cycle timer.

   Estimated Cost: $250.00

4.2 Heating

1. Repair bad steam traps. As previously mentioned in the Operations and Maintenance section of this report, there appears to be a significant problem with the thermostatic traps located in perimeter radiators. For any steam system to work properly, it is imperative the traps are well maintained.

   Estimated Cost: $34,212

2. Single-glazed, wood, double-hung windows are presently installed. Recommend installing interior storm sashes on approximately 872 windows to reduce conductive and convective heat losses.

   Estimated Cost: $182,295

3. Twelve windows are installed in the elevator shafts. Recommend blocking up these windows to improve the building envelope. Price is estimated with the assumption that work may be performed on top of an elevator.

   Estimated Cost: $3,600

5.0 PRELIMINARY DESIGN RECOMMENDATIONS FOR ON-SITE STEAM GENERATION

5.1 Description

The planned electric utility system substation will be 13.2 kv - 480/277 volt. A 480 volt,3Ø, 3 wire,secondary service will serve the new electric boilers and accessories.

Install two Lattner horizontal electrical boilers (1,110 kw each), and connect to existing steam supply and condensate return systems to provide the necessary heating energy for the Home Savings Building.

5.2 Scope of Work

A. Provide new, 480 volt, 3 phase, 3 wire electrical service with CT cabinet, meter conduit, and two 2,000 amp main switches for new electric resistance heat boilers. Main switches shall be provided to meet the National Electrical Code. Ground fault protection will be required for both switches, because they are rated at more than 1,000 amps each.

B. Provide feeders from switchgear to boilers.

C. Provide feeder and transformer for boiler accessories.

D. Provide 30 footcandles of lighting and two receptacles for maintenance purposes for boiler room. Connect lighting and receptacles to existing building electrical system.

E. Boiler and Accessories:

Install two Lattner Model 1110BFP, 125 psig ASME approved steam boilers trimmed for 15 psig to provide 36,297#/Hr. steam at 10 psig steam when using 170° feedwater. Current draw at 480/60/3 is 1336.5 amps, not including controls and boiler feed pumps.

Options Included with Boiler:

1. Linear sequence controller.
2. Alarm for high water.
3. Alarm for low water.
4. Auxiliary low water cutoff.
5. Alternate feedwater supply system with controls to supply boiler water in the event of boiler feed pump failure.
6. Automatic boiler drum blowdown system with motorized valve (slow opening) and control system.
7. High water level protective interlock for high level trip.
8. Automatic blowdown water tempering system to allow for discharge into city sewer.
9. Lattner Model #1425, ASME Coded blowdown receiver.
10. Boiler water deaeration system with controls mounted in condensate receiver makeup tank.
11. Lattner boiler feed pumps and 36"diameter x 96"long condensate receiver with automatic water makeup constructed as a prepiped unit including feedwater strainers and sight glass. Pump isolation valves and thermometers are included.

12. Provisions for chemical treatment in condensate receiver. (Manual chemical addition).

E. Disconnect and cap the 8" district steam service located at the service entrance, and at the 4" riser feeding the Mezzanine as well as the 8" riser feeding the Penthouse. Abandon in place all existing steam main piping located in the Basement floor.

F. Provide the necessary insulated steam supply and condensate return piping to connect to the existing building heating system. Steam supply shall be 8" connecting to the 8" riser (above grade) feeding the Penthouse and the 4" riser feeding the Mezzanine area. Relocate ductwork as required.

G. Install a new condensate receiver and pump with all necessary valves and controls located in the condensate pit beneath the stairwell. Connect to existing condensate return piping from the Mezzanine.

H. Reuse the two abandoned "Differential Vacuum" systems, including tanks and pumps, and modify piping as necessary.

I. Remove the four existing condensate meters and return to Owner. Install new condensate meters (supplied by the Utility Company) in the main condensate return line.

J. Provide one-hour fire rating of the boiler room with the required numbers of egress.

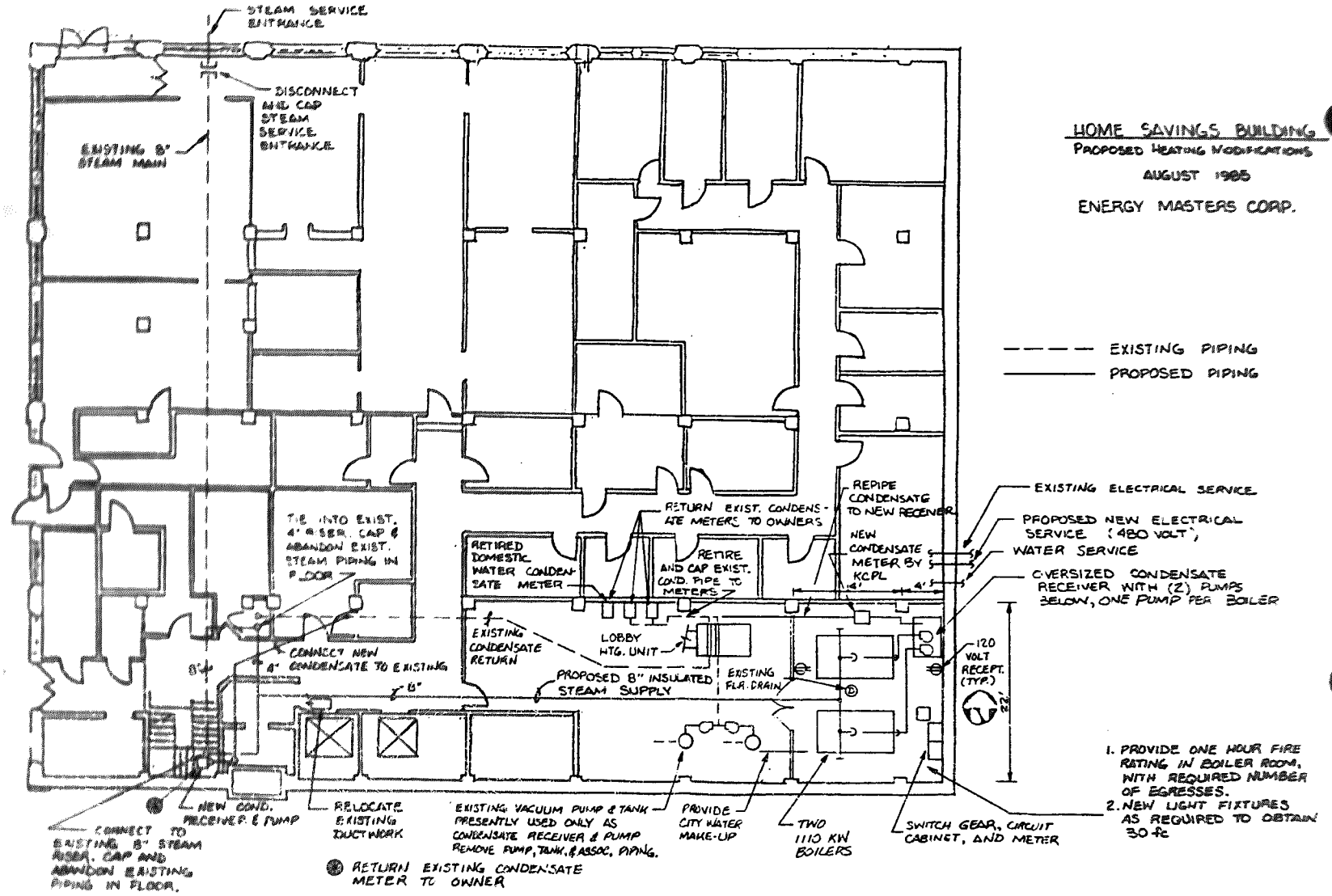
5.3 Cost Estimate

A.	Electrical	$ 46,580
B.	Boilers, Deaerating Feedwater System and Accessories	51,796
	Sales Tax @ 6.225%	3,224
	Contractor Boiler Markup for Warranty	3,108
	Field Labor to Remove and Reinstall Electrical Panels and Heating Elements for Access to Boiler Room	3,000
C.	Install Boiler System (2 men x 1 Mth. x 173 Hrs./Mth. x $40/Hr.)	13,840
D.	Remote Condensate Receiver, Valves, and Controls	738
	Sales Tax @ 6.225%	46
E.	Piping and Insulation	
	Supply 90 Ft. - 8" @ $102/L.F.	9,180
	Supply 20 Ft. - 4" @ $ 60/L.F.	1,200
	Return 30 Ft. - 1" @ $ 50/L.F.	1,500
	Return 30 Ft. - 3" @ $ 60/L.F.	1,800
F.	Cap Existing Steam Service at Three Locations	
	Two 8-inch	80
	One 4-inch	40

G.	Reuse Existing Vacuum Pumps and Tanks, and Modify Piping.	$ 240
H.	Remove Existing Four Condensate Meters and Install New Meters.	500
I.	Fire-rate Boiler Room:	
	(One-Hour) Install Two Doors and Repair Wall.	
	Install Fire-rated Double Doors	2,600
	Repair and Extend Brick Wall	1,800
J.	Ventilate Boiler Room as required by Kansas City, Missouri, Building Code.	1,850

Subtotal:	$143,622
Contractor's Overhead and Profit:	21,468
Subtotal:	$165,090
Project Management 6%	9,905
Engineering 6%	9,905
Total:	$184,900

NOTE: The Owner must repair or replace all defective steam traps for this system to operate properly.



HOME SAVINGS BUILDING

PROPOSED HEATING MODIFICATIONS

AUGUST 1985

ENERGY MASTERS CORP.

——— EXISTING PIPING

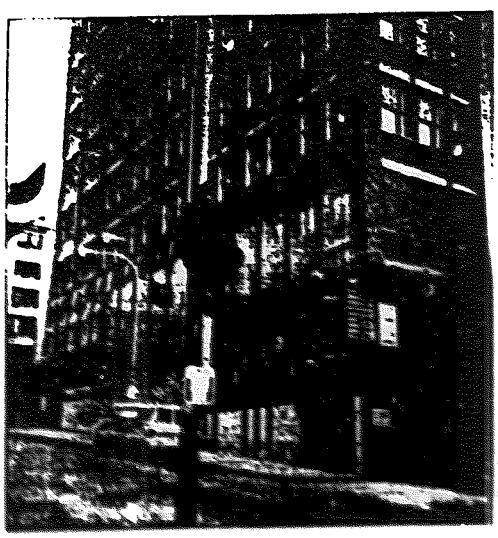
——— PROPOSED PIPING

1. PROVIDE ONE HOUR FIRE RATING IN BOILER ROOM, WITH REQUIRED NUMBER OF EGRESSES.
2. NEW LIGHT FIXTURES AS REQUIRED TO OBTAIN 30 fc

APPENDIX

Upper floors

East side to left
North side to right
(Light court set-
back toward center.)



Lower floors

North side

Lower floors

East side

Upper floors

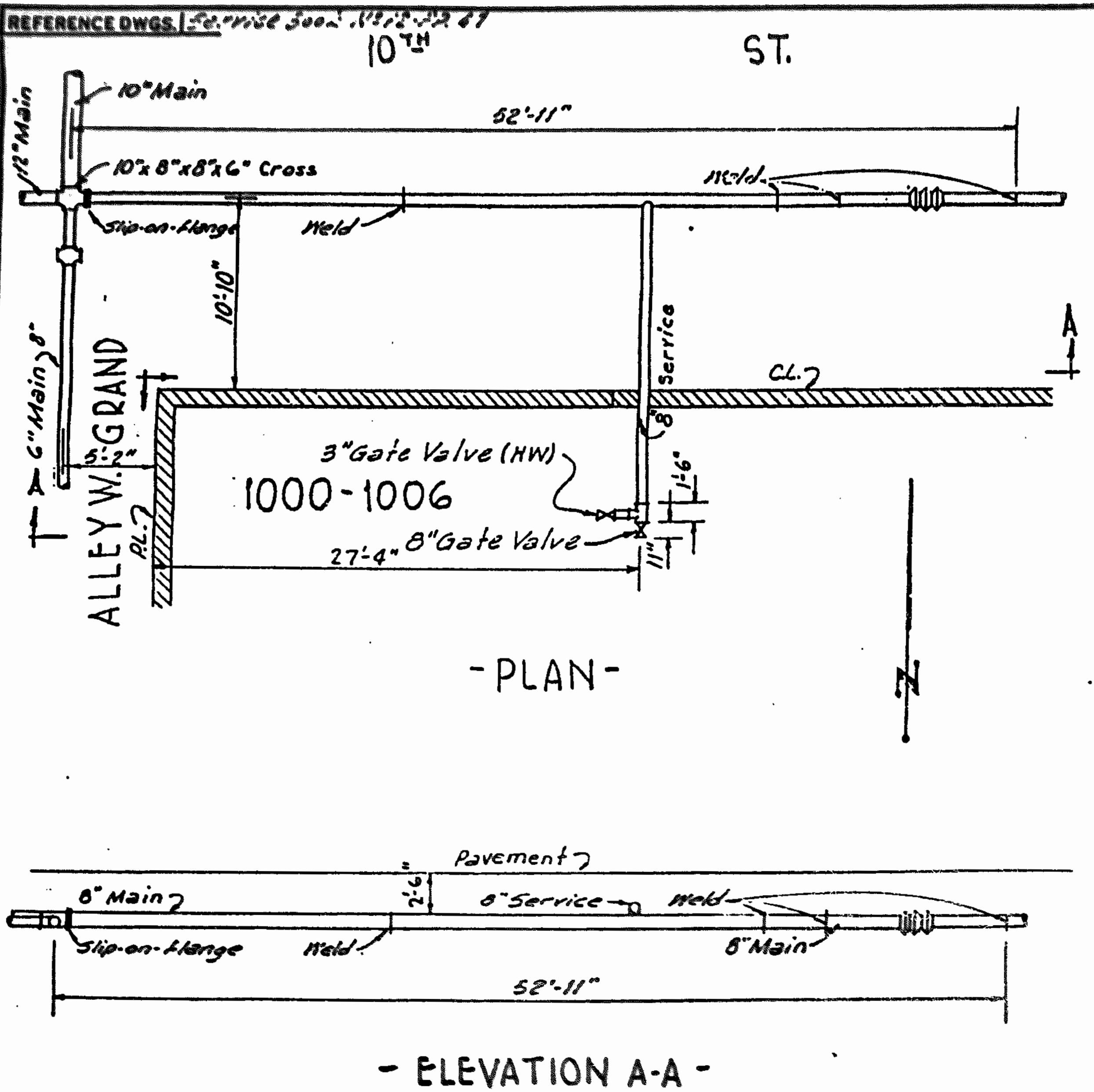
South side to left
East side to right

Lower floors

West side

Lower floors

West side
(Entering alley)



This service installed 8-26-30.

REV.	DATE	BY	CKD.	APPR.	JOB NO.
3		LC			G-9381
2		E.H.			
1		C.A.			

APPROVED	DATE		
[illegible]	[illegible]	8" STEAM SERVICE 1000-1006 GRAND	K.C. POWER & LIGHT CO. ENGINEERING DEPT.
DRAWN J.B.R. 7-31-51	CHECKED	SCALE 1/8"=1'-0" JOB NO.	DWG. NO. 19-318-A170

ANALYSIS FORM

3

Tenant - Home Savings Bldg.

Acct # - 00-008-02340.0

Address - 1000 Grand Rm 1354

Month	Mlbs	$
January	1056	11980.66
February	664	7660.22
March	468	5761.67
April	355	4220.13
May	54	744.07
June	53	680.94
July	—	—
Aug	—	—
Sept	—	—
Oct	31	692.11
Nov	246	3725.04
Dec	1448	18,041.16
Total	4395	54,056.00

Customer -

Acct # -

Address -

Month	Mlbs	$
January		
February		
March		
April		
May		
June		
July		
Aug		
Sept		
Oct		
Nov		
Dec		
Total		

1983 Total - 4395 — $54,056.

1982 Total - 4767 — $45,579

NAME Home Savings Bldg ADDRESS 1000 Grand Rm 1354 ACCT. 00-008-02360.0

YEAR 1985 RATE 10213 METER CONSTANT(s) _____

BILLING INFORMATION

Month	Meter Reading(s)	Total Mlbs.	Revenue
Jan.		1321	13078.89
Feb.		1010	10232.82
March		298	3034.21
April		132	1449.98
May		-	-
June		-	-
July			
August			
Sept.			
Oct.			
Nov.			
Dec.			

Last Year - High Usage _____ Low _____ Rev. _____ $/Mlb. _____

Month _____ Month _____

NAME Home Savings Bldg. ADDRESS 1000 Grand ACCT. 8-02340.0

YEAR 1984 RATE _____ METER CONSTANT(s) _____

BILLING INFORMATION

Month	Meter Reading(s)	Total Mlbs.	Revenue
Jan.		1183	12,636.42
Feb.		389	4158.42
March		689	7733.14
April		174	1988.87
May		27	378.87
June		—	—
July		—	—
August		—	—
Sept.		—	—
Oct.		1	13.04
Nov.		340	3876.61
Dec.		655	6634.30
[redacted]			

Last Year - High Usage _____ Low _____ Rev. _____ $/Mlb. _____

Month _____ Month _____

KANSAS CITY POWER & LIGHT COMPANY
KCPL FORM NO. 87-11 14/791

ANALYSIS FORM

Bob Hruba

Home Savings — 1000 Grand — 11-304-06768.1

29581 - 249a3218 c600

as billed on 16LAE

Date	Dem	Kwh	money
7/16/85	900	227400	14670.87
6/26/85	870	313200	20592.19
5/28/85	816	411,000	27082.35
4/16/85	816	205800	15166.81
3/18/85	816	234600	16537.63
2/13/85	816	208200	15281.05
1/16/85	816	230400	16337.71
		1,824,600	$125,668.61
12/14/84	816	223800	16123.57
11/14/84	816	225600	16169.25
10/15/84	1020	282600	20006.17
9/13/84	1020	343800	22919.15
8/14/84	990	360000	23516.14
7/17/84	1020	372000	24261.42

as billed on 16LAE

Date	Dem	Kwh	money
6/14/84	990	301800	20745.95
5/14/84	816	229200	16280.61
4/12/84	816	180600	13967.35
3/16/84	816	210600	15395.30
2/15/84	816	194400	14624.21
1/17/84	816	220200	15920.92
		3,144,600	$219,770.04
12/15/83	816	190200	14431.17
11/16/83	840	229800	16448.49
10/14/83	900	288600	19586.50
9/14/83	990	388200	24586.84
8/15/83	1020	373800	24732.62
7/18/83	990	381000	22495.87
6/15/83	990	290400	18689.20

as billed on 16LAE

Date	Dem	Kwh	money
5/16/83	780	224400	14452.74
4/15/83	768	191400	13139.44
3/17/83	768	204600	13718.83
2/15/83	768	207600	13850.51
1/14/83	768	191400	13139.84
		3,161,400	$209,466.25
12/14/82	768	148800	11173.87
11/15/82	780	126000	8815.73
10/14/82	870	327400	21155.42
9/16/82	900	344400	20666.16
8/13/82	960	350400	20731.66
7/15/82	960	299400	17928.89
6/16/82	870	253200	15527.00
5/17/82	840	224400	14157.47
		2,121,000	$130,299.6