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**Energy Baseline and Energy
Efficiency Resource Opportunities
for the Forest Products Laboratory
Madison, Wisconsin**

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(a) SBW Consulting Company, Bellevue, Washington.

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Preface

One of the goals of the U.S. Department of Energy Federal Energy Management Program (FEMP) is to facilitate energy efficiency improvements at federal facilities. This is accomplished by a balanced program of technology development, facility assessment, and use of cost-sharing procurement mechanisms. Technology development focuses upon the tools, software and procedures used to identify and evaluate energy-efficiency technologies and improvements. For facility assessment, FEMP has developed a Federal Energy Decision Screening (FEDS) System and provides metering equipment and trained analysts to federal agencies exhibiting a commitment to improve energy use efficiency. To assist in procurement of energy-efficiency measures, FEMP helps federal agencies devise and implement performance contracting and utility demand-side management strategies.

Pacific Northwest Laboratory^(a) supports the FEMP mission of energy systems modernization. Under this charter, the Laboratory and its contractors work with federal facility energy managers to assess and implement energy efficiency improvements at federal facilities nationwide. This work at the Forest Products Laboratory was conducted in conjunction with SBW Consulting Inc. of Bellevue, Washington, under contract to Pacific Northwest Laboratory.

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Executive Summary

This report provides recommendations to improve the energy use efficiency at the Forest Products Laboratory in Madison, Wisconsin. The assessment focuses upon the four largest buildings and central heating plant at the facility comprising a total of approximately 287,000 square feet. The analysis is comprehensive in nature, intended primarily to determine what if any energy efficiency improvements are warranted based upon the potential for cost-effective energy savings. Because of this breadth, not all opportunities are developed in detail; however, baseline energy consumption data and energy savings concepts are described to provide a foundation for detailed investigation and project design where warranted.

FEDS Level-1 Analysis Results and Recommendations

A FEDS Level-1 analysis was undertaken for the facility. A description of the FEDS software and data from the analysis is given in Appendix A. The FEDS Level-1 analysis provides a top-level screen as a preliminary indication of what actions should be initiated. It can be used to target and prioritize the most promising building and end-use retrofit opportunities and to estimate capital investment requirements and potential energy and cost savings. Further analysis performed as part of this project, summarized below, gives a more accurate assessment of the actual projects that are recommended for implementation and/or further analysis.

Based on the FEDS analysis, the total minimum first year overall energy savings at the FPL is 2,539 million Btu (9%) and over \$89,000 dollars in the twelve largest FPL buildings. The majority of the estimated savings is in electricity savings of over 922,000 kWh (\$47,183) with the majority of the electricity savings in lighting (865,154 kWh). First year cooling savings are estimated at over 61,000 ton-hours and nearly \$2,000/year.

Because the FEDS Level-1 software is limited to utility rebate inputs as "percentage" of installed cost, the lighting energy and energy cost savings were based on an overall average utility rebate of 2% for all lighting technologies including those where no utility dollar rebates are specified (i.e., are "custom" rebates). This is one factor why the estimates are considered "minimums." In the detailed analysis in Section 5, the lighting retrofit potential was analyzed using the actual utility dollar rebate available for each retrofit technology.

The FEDS analysis results also recommends replacement of the central boiler system for heating with package natural gas units in individual buildings. Since FEDS Level-1 does not analyze the efficiency potential in central energy systems themselves (only in the buildings served by those systems), this recommendation does not take into account the

potential (and cost-effectiveness) of upgrading and retaining the central system and the needs for process steam. The recommendation we make based on the detailed baseline and analysis is to retain and upgrade the central system including the central boiler and central chiller plant.

Baseline Data Collection and Analysis Results

Four types of baseline measurements were made in the four largest energy-consuming buildings (1, 29, 33, 34) at the FPL in CY 1991 and 1992: 1) end-use electrical consumption and connected load inventory, 2) boiler combustion efficiency, 3) steam production and distribution, and 4) lighting system use. Portable energy use metering equipment was installed to measure 15-minute time series electrical use for circuits serving the four largest buildings at the site. These measurements were subsequently summed and compared to the whole facility electrical use profile data (provided by the utility) to quantify the balance of site electrical use.

Steam flow computers were installed at the central plant and main distribution feeders to quantify steam production and use. Combustion analyzers were used to determine the combustion efficiency of Boiler #2 and Boiler #3. Finally, lighting and occupancy loggers were used at five representative locations to determine the percentage of time the spaces were illuminated and/or occupied. Significant site assistance was provided during the baseline data collection to install, move and maintain instrumentation as well as record and transmit data to PNL for analysis.

Building Loads

Electric demand at the facility ranges from a low of approximately 450 kW to a high of over 1,600 kW during the afternoon on summer workdays. The peak electrical demand in fiscal year (FY) 1992 of 1,623 kW occurred at 2:45 p.m. on July 8, 1992. The four largest buildings in this study contributed over 1,000 kW to this peak. The bulk of the balance is due to the space cooling requirements of the equipment serving Buildings 33 and 34 that was not included in the individual building measurements. This includes large chillers, distribution pumps, and the cooling tower. The seasonal patterns of electrical use at the facility are very regular, with almost constant demands on weekends, holidays and during weekday evenings and early morning hours and match very closely the peak profile of the utility.

During non-summer workdays the average peak electrical demands increase from approximately 500 kW to 850 kW. During the summer working hours the average demands increase to over 1,200 kW. The air conditioning demands average about 150 kW in June, over 200 kW in July and August, and 100 kW in September with greatest demands during the hours of noon to 4 p.m.

Total power for *Building 1* ranges from a baseload of approximately 200 kW to a peak of over 600 kW during the period. A regression analysis of daily electrical usage in August 1992 was conducted to estimate the energy use that is correlated to working-days and outside temperature. From this analysis and the connected load inventory, we estimate that 54% of the buildings electrical use in August was due to lighting, 23% due to fans, 13% due to air conditioning, and 10% to plug loads.

The load in *Building 29* ranges from a baseload of approximately 20 kW to a peak of over 80 kW. Weekend and nighttime power levels are essentially constant at 21 kW providing emergency lighting, ventilation, and limited refrigeration equipment power.

Baseload power levels for *Building 33* exceed 200 kW, while peak loads seldom exceed 250 kW. On weekends, loads increase slightly during daytime hours by 5 to 20 kW.

Baseload power levels in *Building 34* are approximately 80 kW and increase sharply on working days to a level of 120 to 140 kW. On most but not all weekends load increase during the day by about 10 kW. The weekday and weekend load profiles for this building are distinct. Weekend loads are essentially flat, indicating insignificant use of the building lighting and process equipment during these periods. The bulk of this power is for ventilation fans, an incubator, and emergency lighting.

Boiler Combustion Efficiency

Combustion efficiency measurements were made for Boiler #2 and Boiler #3, both fired by natural gas. Boiler #2 was tested on May 22, 1992. The test was limited to evaluation at low-firing rates due to the small load at the time. This test indicated an efficiency of 79%. Boiler #3 was tested on January 29, 1993. Tests were made at low, typical, medium, and maximum firing rates. Efficiency ranged from a low of 55% to a high of 80% at typical firing rates. These values indicate the boilers are functioning efficiently at typical loads, however efficiency drops considerably at low firing rates. This is significant at FPL because the boilers are run at low firing rates much of the year to serve the domestic hot water and process steam needs.

Steam Production Measurements

Daily steam production ranged from a baseload of approximately 70,000 pounds per day, up to a maximum of 270,000 pounds per day. Daily natural gas use to produce this steam varies from a base of approximately 120,000 cubic feet, to a high of 416,000 cubic feet. In the summer months during the measurement period, efficiencies ranged from a low of 60% to over 80%. In the fall, efficiency generally lies in the range of 70 to 75%, and in the winter efficiency increases to the range of 75 to 85%.

Lighting Use

The lighting connected load inventory data were combined with monitoring and estimates of hours-of-use for each lighting type to calculate annual kWh consumption and energy cost for each lamp. Electricity for lighting at the four buildings examined constitutes approximately 30% of overall FPL electric use. Approximately 430 kW of lighting capacity consume nearly 1.5 million kWh annually. The electrical cost to provide this lighting is estimated to be \$91,500 annually.

Recommendations

Recommendations are developed in quantitative detail for lighting retrofits and qualitatively for other major energy-consuming devices and systems. Our recommendation is for the site to work with Madison Gas and Electric, the serving utility, to pursue a site-wide lighting retrofit through a comprehensive demand-side management (DSM) program. This program would include up-front financing, incentives and payback of the FPL share of the financing based on the anticipated energy savings. In addition, other retrofits for boiler controls and energy-efficient motors should be incorporated into the comprehensive DSM program with the utility. Once all cost-effective retrofits have been undertaken in the buildings, a cool-storage system (for building air conditioning) may be cost-effective to implement with utility DSM participation.

Lighting

Replacement of lamps and fixtures with life-cycle cost effective alternatives (considering standard utility rebates) would result in a minimum reduction of lighting capacity by 146.6 kW or 34% of present capacity. These retrofits would result in a minimum savings of approximately 561,00 kWh annually, or an estimated savings in excess of \$36,000 per year. The installed cost of the new lighting is estimated at \$330,617. The "standard" utility rebates applied to individual technologies total \$44,425, or about 15% of the total cost; however, a comprehensive DSM program may increase this incentive. Table S.1 summarizes the results of this analysis.

We also estimate that 50% of the lamps (after fixture retrofit) would benefit from motion sensors, resulting in a minimum annual savings of approximately 5% of lighting energy after retrofit. Assuming one sensor per 5 fixtures on average, will require 320 motion sensors at a cost of \$16,000 without rebates. Table S.2 summarizes the analysis, indicating a minimum savings of approximately 60,000 kWh, or \$3,600 per year.

Overall, we estimate that lighting energy costs can be cost-effectively reduced by over 40% in the buildings examined while maintaining present lighting levels and service.

Table S.1. Estimated Energy and Cost Savings for a Lighting Retrofit in Buildings 1, 29, 33 and 34

Building Number	1	29	33	34	Total
Total Fixture Count	1902	329	477	490	3198
Current Lighting KWH/year	828,052	226,019	184,038	170,880	1,408,989
Current Lighting KW	280	55	47	48	430
Current Annual Costs	\$53,358	\$14,564	\$11,859	\$11,011	\$90,792
Fixtures Affected	1651	137	472	490	2750
Installation Cost	\$192,193	\$34,713	\$49,261	\$54,450	\$330,617
Standard Utility Rebate	\$28,647	\$2,382	\$6,520	\$6,876	\$44,425
FPL Cost	\$163,546	\$32,331	\$42,741	\$47,574	\$286,192
Annual KWH Savings	335,456	90,033	74,371	61,121	560,981
Peak KW Savings	104.4	6.7	18.3	17.2	146.6
Annual Cost Savings	\$21,616	\$5,802	\$4,792	\$3,939	\$36,148
Percent of Current Costs	40.5%	39.8%	40.4%	35.8%	39.8%

Table S.2. Estimated Lighting Energy and Cost Savings from Installation of Motion Sensors

Building Number	1	29	33	34	Total
Number of Motion Sensors	190	33	48	49	320
Motion Sensor Cost	\$9,500	\$1,650	\$2,400	\$2,450	\$16,000
Annual KWH Savings	24,630	6,799	5,483	5,488	42,400
Annual Cost Savings	\$1,587	\$438	\$353	\$354	\$2,732
Percent of Current Costs	3.0%	3.0%	3.0%	3.2%	3.0%

Boilers

The controls and instrumentation of the boiler plant are insufficient to effectively manage or monitor efficient boiler operation. An upgrade of control and monitoring functions will result in a minimum 10-20% reduction in natural gas use at the facility. These controls will improve boiler efficiency with commensurate reductions in fuel consumption.

The steam demand during the summer months is approximately 3,000 pounds per hour, less than 25% of the capacity of the smaller boilers. Operating efficiency of the boilers at this part load is relatively low. The installation of a smaller boiler of approximately 5,000 pounds per hour would allow the boilers to be used at higher loads and efficiencies. An alternative is summer shutdown of the steam system and installation of hot water distribution of local boilers to meet service hot water needs.

Motors and Transformers

Our estimate of motor capacity based upon the analysis of electric use indicates a continuously operating motor capacity in the range of 250 to 350 kW. Most of the motors at the facility are old and of constant speed. As motors are replaced, efficient motors should be specified, and as appropriate variable speed drives should be employed.

Most of the transformers at the facility are more than 20 years old. Newer more energy efficient transformers are now available to reduce transformer losses by as much as 50% and therefore the transformers should be replaced on failure. This could result in overall electrical savings on the order of 2 to 5% (280,000 kWh/year, or \$18,200/year).

Cool Storage

Examination of the peak day load profiles from the baseline assessment reveals that the daytime loads are more than three times the nighttime loads. Cool storage provides a practical means of levelizing this profile, with attractive benefits to both the utility and customer. The recommended concept is to install a dedicated chiller to cool stored water during off-peak hours for subsequent use during the peak periods. This permits the chillers to be off during the on-peak hours, thereby reducing peak demands and time-of-use energy costs. Although this strategy would increase overall energy requirements it can significantly reduce electrical costs due to savings on peak demand charges. The sizing and cost-effectiveness of these systems are dependent upon the magnitude of the loads they serve, so it is imperative that other cost-effective efficiency improvements be completed in buildings, central plants and thermal loops before design is initiated.

Energy Management and Control System (EMCS)

An EMCS appears to be particularly appropriate for Buildings 33 and 34 where our baseline metering indicated high baseload (24-hour) cooling, heating, and ventilation loads. The EMCS should, at a minimum, control the exhaust fans, make-up air units, and the chillers. This would permit the chillers to be staged to ensure that unnecessary fume hoods are turned off at night, and modulate the make-up air as necessary to maintain slight negative pressure for the laboratory spaces. Another candidate for EMCS is Building 1 to control the window air conditioners and packaged units for peak demand control and to ensure that units are shut off during unoccupied periods.

Use of Emergency Generators

The FPL currently has 100 kW of electrical generating capacity available with the emergency back-up generators. These generators could be interlocked with particular loads during peak demand hours to offset peak electrical demands. At \$7.00 per kW this would result in \$700 savings per month if the generators are in use during the peak demand hour.

Project Funding and Implementation

If the Department of Agriculture can provide funding for further detailed assessment, the Forest Products Laboratory appears to be an excellent candidate for pursuing the projects identified. Madison Gas and Electric (MG&E), the utility that provides gas and electric service to the FPL, also has an aggressive DSM program for both gas and electric technologies, including lighting, motors, heating, ventilation and air conditioning (HVAC) technologies; boiler controls; EMCS; water heating technologies; and thermal energy storage. The utility has expressed a willingness to work with the FPL to develop a comprehensive program that may include up-front financing as well as incentives (rebates) to ensure project implementation. During meetings with the utility, the recommended lighting retrofit was targeted by the utility as an initial step in the development of a long-term comprehensive program. The staff and management of the FPL exhibit the interest, commitment, and skills necessary to ensure project success. In addition, those recommended projects not pursued with utility financing may be viable candidates for energy savings performance or other third-party financing.

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1.0 Project Description

This project was carried out in five stages: 1) review of available energy consumption and facility characteristics data, 2) a site inspection to obtain additional data and an interview of facility energy managers, 3) specification and collection of energy-use baseline information, 4) discussions with the servicing electric and natural gas utility to explore cost-sharing options and obtain additional data, and 5) data analysis and report preparation. Each of these tasks is further described below.

1.1 Project Stages

The facility energy manager provided the following material in advance of the site inspection: 1) copies of fuel and water bills for FY90 as well as some graphs of prior year records, 2) correspondence with Madison Gas and Electric Company regarding its demand-side management (DSM) and incentive/rebate programs, 3) a plot plan for the facility, 4) an energy audit report conducted in 1981, and 5) a listing of energy conservation measures instituted since 1980 and options remaining to be accomplished. The billing data were assembled into electronic spreadsheets for analysis and review during the site inspection.

A team of two engineers toured the facility and collected additional data on June 4-5, 1991. The facility energy manager and operators were interviewed to understand facility operation and their observations of potential energy improvement opportunities. Measurements of lighting levels were made and the facility was inspected during occupied and unoccupied periods to assess lighting and equipment usage. Construction documents were reviewed and additional information from the utility bills was obtained. Also, during the assessment, a survey of lighting fixtures (connected load) was undertaken.

Supplemental data needs were developed based upon a review of the information collected in the first two stages, and prior experiences with energy-use monitoring and analysis. Three types of measurements were proposed and subsequently initiated in the summer of 1992: 1) end-use electrical consumption and a confirmation of the lighting technology (connected load) inventory completed in 1991, 2) steam production and distribution, and 3) lighting system use patterns (i.e., duty cycles).

Portable energy-use metering equipment was installed to measure 15-minute time series electrical use for circuits serving the four largest buildings at the site including the end-use consumption levels and profiles. These measurements were subsequently summed and compared to the whole facility electrical use profile data (provided by the utility) to quantify the balance of site electrical use. Steam flow computers were installed at the central plant and main distribution feeders to quantify steam production and use.

Finally, lighting and occupancy loggers were used at five representative locations to determine the percentage of time the spaces were illuminated and/or occupied.

Meetings with representative of Madison Gas and Electric were arranged during the first and last site visits to discuss available DSM program offerings, the special needs of the Forest Products Laboratory, and the energy analysis results. The utility provides DSM incentives for both gas and electric technologies including lighting, motors, heating, ventilation and air conditioning (HVAC) technologies, boiler controls, EMCS, water heating technologies, and thermal energy storage under its "Power Plus" program.^(a) During the meetings, the utility expressed a willingness to work with the FPL to develop a comprehensive program that may include up-front financing as well as incentives (rebates) to ensure project implementation.

1.2 Analyses Strategy

Most of the data obtained above were entered into electronic spreadsheets for review, analysis, and presentation. The Lighting Technology Matrix Screening Matrix (LTSM)¹ developed for the Federal Energy Management Program was used to determine and identify the most life-cycle cost-effective lighting retrofits. An overall assessment of energy efficiency improvement was conducted for the major energy systems and particular technologies using, where appropriate, the empirical data collected for the site. These particular assessments included lighting controls, examination of motor and transformer upgrades, steam production and distribution alternatives, HVAC system and control improvements, and on-site use of emergency generator capacity.

The Federal Energy Decision Screening System (FEDS) Level-1 model was also applied for the entire site (all 12 major buildings) to estimate the minimum *overall* potential energy savings in the buildings (see Appendix A). The estimated savings (both energy and dollars) are identified by building type and end use (i.e., heating, cooling, ventilation, lighting, plug load and hot water).

(a) "Power Plus" is a registered trademark of the Madison Gas and Electric Company Madison, Wisconsin, DSM rebate program for businesses. The technologies in the report were part of the program as of February 1, 1992.

2.0 Facility Description

This section describes the physical characteristics of the Forest Products Laboratory and the five buildings selected for energy monitoring and efficiency assessment, and their salient operating characteristics.

2.1 Functional Description

The FPL was established in 1910 by the U.S. Department of Agriculture to serve as a centralized wood research laboratory. Its mission is to improve the use of wood through research that leads to improved management and use of the timber resource, thus meeting the needs of the United States and contributing to the international community. Research programs are accomplished through coordinated partnerships involving industry, university, and government. Current research and technology transfer is conducted in six broad areas: 1) wood products, 2) pulp, paper, and composites, 3) protection and market, 4) microbial and biochemical conversion, 5) energy from wood, and 6) international forest products.

Approximately 300 people, including more than 100 research scientists and scientific professionals such as botanists, pathologists, engineers, biologists, physicists, economists, foresters, and microbiologists, are investigating ways to improve conversion and use of wood and paper products at the facility. The laboratory houses several unique facilities such as an analytical laboratory, engineering mechanics laboratory, fire testing laboratory, and pulp and paper pilot plant. The on-site laboratory administrative organization includes Personnel, Procurement and Property, Information, Research Facilities Engineering, Instrumentation, Planning and Management Analysis, Systems and Automated Data Processing, Statistics, and Budget and Fiscal Units.

2.2 Site Plan and Layout

The facility is comprised of 18 buildings on a site adjacent to the University of Wisconsin. Two buildings (39 and 40) are leased to the University. Of the remaining buildings, the four largest buildings plus the central steam plant building were selected for evaluation in this study. These buildings are: Building 1 - Main Building; Building 5 - Central Steam Plant; Building 29 - Pilot Plant; Building 33 - Fiber Research Laboratory; and Building 34 - Chemistry Research Laboratory. Figure 2.1 is a plot plan depicting the location of these buildings on the site.

These buildings support a variety of functions as indicated in Table 2.1. Figure 2.2 shows the percentage distribution of space use within these buildings. The largest uses of

Table 2.1. Building Areas by Functional Use

Functional Use	Building Number					
	1 ft ²	5 ft ²	29 ft ²	33 ft ²	34 ft ²	All ft ²
Office	84,641	120	400	6,600	7,150	98,911
Laboratory	18,410		1,325	15,880	12,690	48,305
High Bay			39,942			39,942
Environmental Chamber	5,625		800			6,425
Library	6,310					6,310
Conference	5,049			400	300	5,749
Shop	17,560					17,560
Mechanical	5,950	3,033	4,085	4,320	2,000	19,388
Storage	7,420	120	4,039	1,020		12,599
Hallway	15,325		400	4,760	3,360	23,845
Other	7,080	120		1,560	1,800	10,560
Total	173,370	3,393	50,991	34,000	25,500	287,254
With Central AC	8,200			1,175	2,774	12,149

Figure 2.2. Functional Space Use Shares

office, laboratory, high bay, and hallway constitute approximately 75% of the total space. The category "other" includes such spaces as restrooms, lobby, computer center, and lunchroom.

2.2.1 Building 1 - Main Building

Building 1 is comprised of five levels totaling 173,370 square feet. The ground floor houses a saw mill, carpenter shop, electrical and mechanical shop, lunchroom, storage rooms, five humidity rooms, and a variety of office and lab spaces. The first level includes the engineering mechanics laboratory, kilns, preservation laboratory, lobby, conference rooms, and a variety of offices and labs. The second through fourth floors are principally offices with some conference rooms and libraries. The top floor is a large conference room and photo studio.

The ventilation system is comprised of numerous exhaust fans, two central supply fans, and a number of air-handling units serving individual areas. Space cooling is provided to 8,200 square feet of conference rooms and other selected areas by chillers with water cooled condensers. The majority of offices have window air conditioners with local controls. The majority of space heating is accomplished with steam radiators and steam coils in air-handling systems.

2.2.2 Building 5 - Central Steam Plant

Building 5 is 3,393 square feet and contains the boilers that provides high pressure steam to the facility. The output of a 22,000 pound per hour boiler, and/or two 12,000 pound per hour boilers at 400 psi is distributed at 300 psi to pressure reducing stations at each of the buildings. Most of this steam is used to supply hot water convertors for space heating and water heating. Relatively small amounts of high pressure steam are used for some of the process equipment at the pilot plant. Condensate is returned to the boilers, and a heat recovery unit in Building 1 uses condensate heat for service water heating. The boilers are fired with natural gas, except during test and curtailment periods when number fuel oil #2 is burned. An 85-kW diesel motor generator set is located at the steam plant for backup emergency electrical power.

2.2.3 Building 26 - Pilot Plant

Building 29 is 50,991 square feet and contains high bay areas. This building contains a variety of process equipment including grinders, refiners, digesters, presses, and a paper machine. The structure has a concrete foundation with laminated arches and an insulated plywood panel exterior. There is a large amount of glazing area with insulating glass. A second floor covers approximately half of the area. Air is exhausted by various room exhaust fans and large rooftop fans. Makeup air is supplied by two air-handling units with

hot water coils for heating. Space heating is also provided by perimeter radiation and unit heaters. Although the building is not cooled, a constant temperature room and cold room have separate air-handling units with cooling.

2.2.4 Building 33 - Fiber Laboratory

Building 33 is 34,000 square feet with four levels. The building houses a variety of laboratory and office spaces on the top three floors. The ground floor is principally occupied by mechanical equipment (air-handlers, chillers, water heaters, standby generator) and storage spaces. The structure is pre-cast concrete with a combination of face brick and redwood panel exterior. The walls are approximately 25% single pane glass. Ventilation is provided by constant volume single duct reheat systems. The central air-handling units are 100% outside air, and approximately 35 laboratory exhaust hoods operate continuously to contribute to an overall five air changes per hour. Space heating is accomplished with hot water convectors in labs and corridors, hot water coils in office induction units, and steam unit heaters in mechanical spaces. Space cooling is provided to the offices and 1,175 square feet of laboratories in this building from centrifugal compressors on the lower level.

2.2.5 Building 34 - Chemistry Laboratory

Building 34 is 25,500 square feet on three levels. The construction and use is similar to Building 33, except for the lack of a lower level with mechanical equipment and storage. This building houses some of the most energy-intensive laboratories for analysis equipment, electron microscopes, and laser equipment. Like Building 33, it has many fume hoods and high air exchange rates. Space cooling is provided to the offices and 1,800 square feet of labs in this building from the chillers in Building 33.

2.3 Operating Characteristics

The buildings are typically occupied from 7 a.m. to 5 p.m. during non-holiday workdays by most of the 300 staff members. Because most of the offices have large windows, many office lights are not turned on during the day - especially in the summer. Cleaning is conducted during the early evening hours and is generally complete by midnight. The cleaning crews turn lights on and off as they work. Security guards help ensure all non-essential lights are turned off at night. These practices are very effective, as we found only three non-essential spaces lit during a late night site inspection. The fume hoods in Buildings 33 and 34 are equipped with timers intended to shut fans off during unoccupied periods. However, local override toggle switches were almost universally on during the site inspection, defeating the purpose of the timers. The exhaust fans in Building 29 are also on interlocked timers with the make up air-handler, but apparently this function was

overridden as the exhaust fans were on during a late night site inspection. The chillers in Building 33 are manually operated and staged to meet seasonal cooling requirements.

The steam plant operates 24 hours per day for 50 weeks a year. Portable boilers are employed during the annual maintenance shutdown in June to maintain service for water heating. During the summer months the load of approximately 3,500 pounds per hour is met by one of the 12,000 pound per hour boilers operating at part load. The boilers are manually trimmed by visual inspection of the fire tubes; however, as they automatically modulate it is difficult to maintain proper trim. Steam meters at the central plant are not reliable, and the combustion gas analysis kit is not maintained. Hence the actual steam production and boiler efficiencies were not known at the outset of this project.

The site has completed a steam trap program, and the observed levels of make up water (not shown) indicate that it is very successful. Fuel oil #2 is used to fire the boilers on days of natural gas curtailment - typically one or two days per year - and during tests every week to ensure system operation. Emergency generators at the central plant and in Building 33 are typically used only during test periods to ensure system operation.

3.0 Electrical Consumption

This section summarizes the electrical energy use data for the facility and describes the analysis carried out to identify energy efficiency improvement opportunities. In fiscal year 1992 total electrical costs at the Forest Products Laboratory were \$306,319 at an average blended rate of 5.4 cents per kWh. The monthly average costs vary from 4.7 to 6.4 cents per kWh due to the impact of time-of-use rates and seasonal demand charges. In this section we first present the overall electrical billing components, and then describe the electric use measurements for the whole facility and each of the four largest buildings.

3.1 Billing Components

Madison Gas & Electric levies a Commercial Lighting and Power Time of Use (Cg-2) rate for the main electric meter. This rate features the following:

Monthly Customer Charge	\$50
Summer On-Peak Demand Charges	\$ 7.70/kW
Winter On-Peak Demand Charge	\$ 6.30/kW
Summer Off-Peak Demand Charge	\$ 1.30/kW
Winter Off-Peak Demand Charge	\$ 1.00/kW
Summer On-Peak Energy Charge	\$ 0.0463/kWh
Winter On-Peak Energy Charge	\$ 0.0392/kWh
Off-Peak Energy Charge	\$ 0.0284/kWh
13.6 kV Primary Discount	\$ 0.10/kW and \$ 0.0010/kWh

The on-peak hours are from 10 a.m. to 9 p.m. Monday through Friday, excluding holidays. The summer months begin with the first scheduled meter reading on or after June 16. It ends with the fourth scheduled meter reading thereafter. All other months are billed at the winter rates.

The basis and costs associated with each of these components for each month of FY 1992 are given in Table 3.1 and Table 3.2, respectively. Table 3.3 summarizes the average daily consumption and costs, and shows the monthly blended charges (\$/kWh) in FY 1992. Figure 3.1 shows the contribution of each billing component to the total bill for

Table 3.1. Electric Billing Amounts for FY 1992

MONTH AND YEAR	DAYS IN PERIOD	ON-PEAK ENERGY KWH	OFF-PEAK ENERGY KWH	TOTAL ENERGY KWH	ON-PEAK DEMAND KW	OFF-PEAK DEMAND KW
OCT91	29	169,272	235,328	404,600	1110.1	1110.1
NOV91	29	177,926	257,474	435,400	1091.2	1091.2
DEC91	34	179,493	309,107	488,600	1042	1042
JAN92	30	168,771	258,229	427,000	979	979
FEB92	29	175,557	251,443	427,000	1028.2	1028.2
MAR92	32	185,826	283,174	469,000	1069.7	1069.7
APR92	30	186,559	258,641	445,200	1098.7	1098.7
MAY92	32	193,239	295,361	488,600	1341.9	1341.9
JUN92	29	214,132	278,668	492,800	1610.3	1610.3
JUL92	30	229,090	300,110	529,200	1622.9	1622.9
AUG92	32	225,337	324,863	550,200	1682.1	1682.1
SEP92	30	201,802	292,398	494,200	1454	1454
FY92 TOTAL	366	2,307,004	3,344,796	5,651,800		
FY92 AVG					1,261	1,261

each month of the year. Electrical consumption levels vary from 404,600 kWh in October 1991 to a high of 550,200 kWh in August. The average electrical consumption per day ranged from 13,952 kWh in January to 17,640 kWh in July. The average cost per day ranged from \$672 in December to \$1,103 in July.

Electric consumption and demand are related to two principal determinants: 1) working-day versus non-working day, and 2) outdoor air temperature. The first determinant is related to the use of interior lights and electronic equipment, while the second determinant is related to the use of air conditioning equipment. Estimated end-use shares were estimated with a multivariate regression model using billing and temperature data for FY 1990. The estimated energy use shares are given in Table 3.4. Figure 3.2 shows the estimated electrical end-use quantities for the major components (lighting, cooling and plug loads) for FY 1990.

Table 3.2. Electric Billing Costs for FY 1992

MONTH AND YEAR	MONTHLY CUSTOMER CHARGE	ON-PEAK ENERGY CHARGE	OFF-PEAK ENERGY CHARGE	ON-PEAK DEMAND CHARGE	OFF-PEAK DEMAND CHARGE	DEMAND DISCOUNT CHARGE	ENERGY DISCOUNT CHARGE	TOTAL CHARGE
OCT91	\$50.00	\$6,635.46	\$6,683.32	\$6,993.63	\$1,110.10	(\$111.01)	(\$404.60)	\$20,956.90
NOV91	\$50.00	\$6,974.70	\$7,312.26	\$6,874.56	\$1,091.20	(\$109.12)	(\$435.40)	\$21,758.20
DEC91	\$50.00	\$7,036.13	\$8,778.64	\$6,564.60	\$1,042.00	(\$104.20)	(\$488.60)	\$22,878.56
JAN92	\$50.00	\$6,615.82	\$7,333.70	\$6,167.70	\$979.00	(\$97.90)	(\$427.00)	\$20,621.33
FEB92	\$50.00	\$6,881.83	\$7,140.98	\$6,477.66	\$1,028.20	(\$102.82)	(\$427.00)	\$21,048.86
MAR92	\$50.00	\$7,284.38	\$8,042.14	\$6,739.11	\$1,069.70	(\$106.97)	(\$469.00)	\$22,609.36
APR92	\$50.00	\$7,313.11	\$7,345.40	\$6,921.81	\$1,098.70	(\$109.87)	(\$445.20)	\$22,173.96
MAY92	\$50.00	\$7,574.97	\$8,388.25	\$8,453.97	\$1,341.90	(\$134.19)	(\$488.60)	\$25,186.30
JUN92	\$50.00	\$9,914.31	\$7,914.17	\$12,399.31	\$2,093.39	(\$161.03)	(\$492.80)	\$31,717.35
JUL92	\$50.00	\$10,606.87	\$8,523.12	\$12,496.33	\$2,109.77	(\$162.29)	(\$529.20)	\$33,094.60
AUG92	\$50.00	\$10,433.10	\$9,226.11	\$12,952.17	\$2,186.73	(\$168.21)	(\$550.20)	\$34,129.70
SEP92	\$50.00	\$9,343.43	\$8,304.10	\$11,195.80	\$1,890.20	(\$145.40)	(\$494.20)	\$30,143.94
FY92 TOTAL	\$600	\$96,614	\$94,992	\$104,237	\$17,041	(\$1,513)	(\$5,652)	\$306,319
FY92 AVG	\$50	\$8,051	\$7,916	\$8,686	\$1,420	(\$126)	(\$471)	\$25,527

Table 3.3. Monthly Blended Electricity Costs for FY 1992

MONTH AND YEAR _____	PER DAY ON-PEAK KWH _____	PER DAY OFF-PEAK KWH _____	PER DAY TOTAL KWH _____	PER DAY CHARGE _____	BURDENED KWH RATE \$ per Kwh
OCT91	5837	8115	13952	\$722.65	0.052
NOV91	6135	8878	15014	\$750.28	0.050
DEC91	5279	9091	14371	\$672.90	0.047
JAN92	5626	8608	14233	\$687.38	0.048
FEB92	6054	8670	14724	\$725.82	0.049
MAR92	5807	8849	14656	\$706.54	0.048
APR92	6219	8621	14840	\$739.13	0.050
MAY92	6039	9230	15269	\$787.07	0.052
JUN92	7384	9609	16993	\$1,093.70	0.064
JUL92	7636	10004	17640	\$1,103.15	0.063
AUG92	7042	10152	17194	\$1,066.55	0.062
SEP92	6727	9747	16473	\$1,004.80	0.061
FY92 TOTAL					
FY92 AVG	6,315	9,131	15,447	\$838.33	0.054

Figure 3.1. Electric Billing History by Component for FY 1992

Table 3.4. Estimated Electrical Consumption Shares by Month for FY 1990

Month FY 90	Metered Total kWh	Estimated kWh for:		
		Space Cooling	Motors & Plugs	Lights
Oct	449,407		297,600	151,807
Nov	452,197		297,600	154,597
Dec	408,813		278,400	130,413
Jan	450,784		307,200	143,584
Feb	418,586		278,400	140,186
Mar	442,395	26,523	278,400	137,472
Apr	487,200	28,307	307,200	151,693
May	476,005	31,453	297,600	146,952
Jun	481,603	65,731	278,400	137,472
Jul	554,400	95,507	307,200	151,693
Aug	501,207	85,335	278,400	137,472
Sep	477,390	47,178	288,000	142,212
All	5,599,987	380,035	3,494,400	1,725,552
Percent	100.0%	6.8%	62.4%	30.8%

Figure 3.2. Estimated End-Use Electric Consumption for FY 1990

3.2 Facility Load Profiles

Based on utility billing data for the entire facility, the electric load (demand) at the facility ranges from a low of approximately 450 kW to a high of over 1,600 kW during the afternoon on summer workdays. The peak electrical demand in FY 1992 of 1623 kW occurred at 2:45 p.m. on July 8, 1992. This was a Wednesday with a high temperature of 90°F following a morning low of 67°F measured at the steam plant.

Figure 3.3 shows the electrical demands for each of the four submetered buildings and the entire facility on July 8-9, 1992. This figure indicates that the four buildings contributed over 1,000 kW to this peak. The bulk of the balance is due to the space cooling requirements of the equipment serving Buildings 33 and 34 that were not included in the individual building metering measurements. These requirements (loads) include large chillers, distribution pumps, and the cooling tower. It appears that July 8, 1992, was a rare day when both chillers and pump sets were operating, causing the unusually high electrical demand evidenced from 11 a.m. until 4 p.m.

Appendix B includes graphics showing the average weekday and weekend/holiday electric demand profiles for each month of FY 1990 obtained from utility billing data. These graphics clearly indicate that seasonal patterns of electrical use at the facility are very regular, with almost constant demands on weekends, holidays and during weekday evenings and early morning hours. These patterns of electrical use match closely those for the utility.

During non-summer workdays the average peak electrical demands increase from approximately 500 kW to 850 kW. Since nearly all lights are turned off during the evening and early morning, the base load of 500 kW is comprised primarily of motor and emergency lighting loads. The additional 350 kW is comprised primarily of lighting and electronic equipment loads.

During the summer working hours the average demands increase to over 1,200 kW. This is principally due to the energy use of air conditioning equipment, as the peak demands are highest during the hottest months. The length of day does not appear to significantly affect the electrical demand profiles. Consequently, it appears that the air conditioning demands average about 150 kW in June, over 200 kW in July and August, and 100 kW in September, with greatest demands during the hours of noon till 4 p.m.

Forest Products Laboratory Electric Use July 8-9, 1992 Measurements

Figure 3.3. Electrical Demand Profile During July 8-9, 1992 for Entire Facility and Building 1, 29, 33 and 34

3.3 Individual Building Metering Results

Dranetz 808 Power Analyzers^(a) were used to measure true power levels of the electrical mains serving Buildings 1, 19, 33, and 34 in May, June, July and August of 1992. The measurements were recorded onto floppy diskettes and recovered and mailed by the FPL staff to PNL for analysis. These data were used in conjunction with the utility metered data to produce Figure 3.3 discussed above. Figure 3.4 shows the load profiles of each of the buildings during the period of June 26 through July 11, 1992 to provide relative indications of magnitude and shape for each building and for working and non-working days during the period. Average profiles for working days and non-working days for each building are described below and the end-use load profile distinctions of each building are discussed.

3.3.1 Building 1

Electric power is provided to Building 1 through four electrical risers. The power analyzers were installed to concurrently measure each riser. Figure 3.5 is a load profile and area plot showing the contribution that each of these risers makes to the total 15-minute interval power consumption for the period June 26 to July 12, 1992. Total power levels range from a baseload of approximately 200 kW to a peak of over 600 kW during the period.

The average weekday and weekend profiles during the period are shown in Figure 3.6. The weekend profile shows only a slight increase in power consumption during daylight hours. The weekday profile shows that power consumption begins to increase at 6 a.m. from a nighttime baseload of about 200 kW and reaches a plateau of about 500 kW by 10 a.m. This plateau continues until 3 p.m. and then drops to an evening plateau of about 250 kW by 6 p.m. This level continues until 11 p.m. when it drops to the nighttime baseload.

This building shows distinct working-day and non-working day patterns. July 3, 1992 was a holiday at FPL explaining the low power use. The evening plateau and slight increase at 9 p.m. and 10 p.m. is due to lights turned on by the cleaning crew. Their contract includes a provision to ensure that all but emergency lights are off when they are done; hence the early morning loads are a combination of three major constituents: 1) emergency lighting, 2) computer and photocopy equipment, and 3) incubator and refrigerator energy use.

(a) Dranetz Technologies Inc., Edison, NJ.

15-minute Interval Demand

Figure 3.4. Load Profiles for June-July 1992 in Buildings 1, 29, 33 and 34

15-minute Interval Demand

Figure 3.5. Building 1 Load Profiles, June-July 1992

Figure 3.6. Building 1 Average Daily Load Profiles, July 1992

A regression analysis of daily electrical usage in August 1992 was conducted to estimate the energy use that is correlated to working-days and outside temperature. Figure 3.7 shows the results of this analysis, indicating a base load of approximately 900 kWh/day, air conditioning loads ranging from 0 to 1,400 kWh/day, and lights and plug use associated with working days at about 4,000 kWh/day. The errors of the regression are generally less than 500 kWh/day. From this analysis and the results of the connected load inventory, we estimate that 54% of the buildings electrical use in August was due to lighting, 23% due to fans, 13% due to air conditioning, and 10% to plug loads. These shares are displayed graphically in Figure 3.8.

3.3.2 Building 29

Electric power is provided to this building through an electrical service entrance shared with Building 33. To isolate power supplied to this building it was necessary to monitor selected sub-circuits. Fifteen-minute power level measurements during the period June 23, 1992 to July 12, 1992 range from a baseload of approximately 20 kW to a peak of over 80 kW, as shown in Figure 3.9.

Figure 3.7. Building 1 Electric Use Determinant from Regression Analysis

The average weekday and weekend power profiles during the period are depicted in Figure 3.10. Weekend and nighttime power levels are essentially constant at 21 kW providing emergency lighting, ventilation, and limited refrigeration equipment power. On weekdays, power levels rise sharply at 7 a.m. as the lights are turned on, and plateau at about 60 kW until 3 p.m., at which time loads diminish sharply to baseload levels by 6 p.m.

The building shows distinct working-day and non-workday profiles. This stems from the fact that only two switches control over 90% of the lighting, and that process equipment is used only during work periods when the lights are on. The security guard ensures that the lights are turned off during rounds between 5 p.m. and 6 p.m.

3.3.3 Building 33

Power is supplied to this building from a service entrance shared with Building 29. Submetering of selected circuits was necessary to disaggregate power use for the building.

Figure 3.8. Building 1 Electric Use Shares, August 1992

Figure 3.11 shows 15-minute electrical demands during the period June 23, 1992 to July 12, 1992. Baseload power levels exceed 200 kW, while peak loads seldom exceed 250 kW. On weekends, loads increase slightly during daytime hours by 5 to 20 kW.

The average weekend and weekday power profiles are shown in Figure 3.12. This indicates that nighttime loads are about 220 kW, and on weekdays these loads increase starting at 6 a.m. to a plateau from 8 a.m. to 4 p.m. of nearly 250 kW. Loads diminish rather quickly at between 5 p.m. to 6 p.m. and then slowly decrease to the minimum loads at midnight. On weekends, load increase by about 10 kW from 7 a.m. until 4 p.m., when they return to baseload levels.

The weekday and weekend load profile differences in this building are not as striking as the other buildings, owing to the large (~220 kW) baseload power levels. This large baseload is due to continuously operating ventilation fans and hot water circulation pumps (candidates for controls). The 25 kW increase during working hours is due primarily to lighting, and to a smaller extent to use of laboratory and computer equipment. The drop-off of power from 5 p.m. to 6 p.m. is due to the security guard turning off lights in unoccupied rooms. The gradual decrease to baseload levels from 6 p.m. to midnight is due in part to cleaning crew electrical needs for lights and equipment.

15-MINUTE INTERVAL DEMAND

Figure 3.9. Building 29 Load Profile, June-July 1992

Figure 3.10. Building 29 Average Daily Load Profiles, July 1992

3.3.4 Building 34

Power is supplied to Building 34 from a dedicated service entrance with two risers. Figure 3.13 shows 15-minute electrical demands during the period June 26, 1992 through August 1, 1992. Baseload power levels of approximately 80 kW, increase sharply on working days to a level of 120 to 140 kW. On most but not all weekends loads increase during the day by about 10 kW.

The average weekend and weekday load profiles are shown in Figure 3.14. On working-days loads begin to increase from a nighttime minimum of 80 kW at 6 a.m., and reach a plateau of 125 kW from 9 a.m. until 3 p.m. Loads then gradually diminish to baseloads that occur from midnight through 5 a.m. Weekend loads are essentially flat, with very slight increase after 6 a.m.

The weekday and weekend load profiles for this building are distinct. Weekend loads are essentially flat, indicating insignificant use of the building lighting and process equipment during these periods. The bulk of this power is for ventilation fans, an

15-MINUTE INTERVAL DEMANDS

Figure 3.11. Building 33 Load Profile, June-July 1992

incubator, and emergency lighting. The gradual decrease in power use on working-day evenings may be due to some employees working late hours and continuation of experiments into the evening hours.

Figure 3.12. Building 33 Average Daily Load Profiles, July 1992

15-MINUTE INTERVAL DEMAND

Figure 3.13. Building 34 Load Profile, June-August 1992

Figure 3.14. Building 34 Average Daily Load Profiles, July 1992

4.0 Fossil Fuel Consumption

Natural gas at the Forest Products Laboratory is predominantly consumed at the steam plant as boiler fuel. Small amounts of gas are used for laboratory processes and food preparation. In FY 1990, 831,257 therms of natural gas were consumed, costing a total of \$245,982. Monthly consumption varied from a low of 22,959 therms in June, to a high of 110,207 therms in December.

The amount of gas used for service water heating is estimated to range from a low of 1,000 therms per day in the summer to a high of 1,500 therms per day in the winter when water supply temperatures are lowest. Assuming an average of 1,250 therms per day results in an annual natural gas requirement of 456,250 therms, or approximately 55% for service hot water, process equipment, and system losses. This leaves approximately 375,000 therms (45%) per year for space heating.

4.1 Billing Components

Natural gas is provided by Madison Gas and Electric Company under a Best Efforts Interruptible Commercial and Industrial Rate (Ci-4). This rate is as follows:

Monthly Customer Charge	\$850
Distribution Commodity Charge	\$0.0279 to \$0.0558/therm

The best efforts gas commodity charge is based upon the actual cost of gas to the utility. Table 4.1 (page 4.7) provides a summary of FY 1990 billing data, and Table 4.2 (page 4.8) summarizes gas rates, use and cost per day, and burdened costs per therm for FY 1990.

4.2 Boiler Combustion Efficiency Measurements

Boiler combustion efficiency measurements were conducted for Boiler #2 and Boiler #3. Boiler #2 was tested on May 22, 1992, using a Bacharach Fryizer Model 200 analyzer.^(a) Appendix C gives the boiler efficiency testing data and describes the testing procedures. The test was limited to evaluation at low-firing rates due to the small load at the time. This test indicated an average efficiency of 79%. Boiler #3 was tested on January 29, 1993, using a Neotronics portable combustion analyzer.^(b) Tests were made

(a) Bacharach Instruments, Pittsburgh, PA.

(b) Neotronics Limited, Great Britain.

at low, typical, medium, and maximum firing rates. Efficiency ranged from a low of 55% to a high of 80% at typical firing rates.

These values indicate the boilers are functioning efficiently at typical loads; however, efficiency drops considerably at low firing rates. This is significant at FPL because the boilers are run at low firing rates much of the year to serve the domestic hot water and process steam needs and are therefore run in an inefficient operating mode during this time.

4.3 Steam Production Measurements

Three EMCO EMS 3270/TMP-960 steam flow analyzers^(a) were installed in May 1992 to measure steam production at the central plant and at the high (300 psi) and low (15 psi) pressure steam distribution through Building 33. Meter readings of the central plant flow computer were made at the end of each 8-hour shift. The other flow computers were read once each working day by FPL staff. During the steam flow measurement period, the central plant records (boiler logs) were also provided to PNL to provide information on outside air temperature, natural gas consumption, and make-up water consumption.

These data were entered into a spreadsheet and the daily steam flows and overall steam system efficiencies were calculated. Table 4.3 (page 4.9) gives the steam plant readings and calculations from July 1, 1992, through January 2, 1993. Figure 4.1 (page 4.4) displays the pounds of steam per day produced at the steam plant and the daily average outdoor air temperatures. Daily steam production ranges from a baseload of approximately 70,000 pounds per day, up to a maximum of 270,000 pounds per day. Gas use to produce this steam varies from a base of approximately 120,000 cubic feet/day, to a high of 416,000 cubic feet/day. For comparison, a similar analysis from plant boiler logs (only) for FY 1990 can be found in Appendix B.

Overall steam system delivery efficiencies were calculated based upon natural gas consumption, steam production, and make-up water requirements. Figure 4.2 (page 4.5) shows the overall delivery efficiency, and steam production, for each day from July 1, 1992, through January 2, 1993. (Since all 365 days of the year are plotted on this figure, they overlap each other at points where efficiency is the same due to similar operating conditions.) As expected, this figure shows that efficiency generally increases with the magnitude of steam requirements (November—January dates) since the boilers operate more efficiently at high loads and distribution system losses are smaller on a percentage basis at high loads. In the summer months (June—August dates), efficiencies range from a low of 60% to over 80%. In the fall (September—October), efficiency generally lies in

(a) Energy Measurement Company, Longmont, CO.

the range of 70% to 75%, and in the winter efficiency increases to the range of 75% to 85%. Based on these data, we conclude that the steam generation and distribution system is in overall excellent physical condition without significant leaks, deterioration or steam trap failures.

4.4 Steam Distribution System Measurements

Steam is distributed to Buildings 29, 33, and 34 at high pressure (300 psi) and then stepped down to 15 psi. EMCO insertion turbines were installed to measure both the 300 psi and 15 psi lines in Building 33. Subtracting these measurements from the total steam produced by the central plant provides an estimate of steam delivered to the other buildings, most notably Building 1. (Near the end of the metering in January 1993, FPL installed a steam flow meter to measure steam provided to other buildings from Building 1; however, these data are not available for this report.)

Table 4.4 (page 4.11) gives the steam distribution readings and steam flow calculations for the period July 1, 1992, through November 30, 1992, for the low and high pressure steam. Figure 4.3 (page 4.6) shows the average pounds per hour for each day of the period distributed through Building 33, and the balance of steam loads to other buildings (obtained through subtraction from the central plant data) for July 1, 1992, through November 30, 1992.

Figure 4.1. Daily Steam Production vs. Minimum Outside Temperature, July 1992 to January 1993

Figure 4.2. Steam Production and Overall Production Efficiency, July 1992 to January 1993

Figure 4.3. Steam Flow Measurements in Building 33 and Balance, July-November 1992

Table 4.1. Natural Gas Billing Component Rates and Costs for FY 1990

MONTH AND YEAR	DAYS IN PERIOD	GAS ENERGY THERMS	MONTHLY CUSTOMER CHARGE	DIST. CHARGE	GAS CHARGE	ORDER 500 CHARGE	OTHER CHARGES	TOTAL CHARGE
OCT89	31	63,270	850	3,594	\$12,413.57	\$306.23		\$17,163.51
NOV89	31	91,142	850	5,177	\$19,695.79	\$137.62		\$25,860.28
DEC89	29	110,207	850	6,260	\$26,890.51	\$661.24		\$34,661.51
JAN90	32	100,628	850	5,716	\$26,938.12	\$478.99	(\$223.39)	\$33,759.39
FEB90	29	95,401	850	5,419	\$23,888.41	\$311.01		\$30,468.19
MAR90	29	88,843	850	5,046	\$19,092.36	\$44.42		\$25,033.06
APR90	32	83,754	850	4,757	\$17,219.82	\$293.98		\$23,121.03
MAY90	31	65,225	850	3,705	\$12,960.21	\$371.78		\$17,886.77
JUN90	2	22,929	850	1,293	\$4,654.59	\$116.94		\$6,914.72
JUL90	32	39,194	850	2,187	\$7,866.24	\$218.70		\$11,121.96
AUG90	29	34,523	850	1,926	\$6,780.32	\$245.11		\$9,801.81
SEP90	30	36,141	850	2,017	\$7,080.02	\$242.87		\$10,189.56
FY90	364	831,257	\$10,200.00	\$47,096.37	\$185,479.95	\$3,428.89	(\$223.39)	\$245,981.82

Table 4.2. Natural Gas Billing Component Rates FY 1990

MONTH AND YEAR	DIST. RATE	GAS RATE	ORDER 500 RATE	GAS USE PER DAY TIHERMS	GAS COST PER DAY	OTIHER RATE	BURDENED COST PER TIHERM
OCT89	0.05680	0.19620	0.00484	2040.97	\$553.66		0.27127
NOV89	0.05680	0.21610	0.00151	2940.06	\$834.20		0.28374
DEC89	0.05680	0.24400	0.00600	3800.24	\$1,195.22		0.31451
JAN90	0.05680	0.26770	0.00476	3144.63	\$1,054.98	0.00222	0.33549
FEB90	0.05630	0.25040	0.00326	3289.69	\$1,050.63		0.31937
MAR90	0.05680	0.21490	0.00050	3063.55	\$863.21		0.28177
APR90	0.05680	0.20560	0.00351	2617.31	\$722.53		0.27606
MAY90	0.05680	0.19870	0.00570	2104.03	\$576.99		0.27423
JUN90	0.05640	0.20300	0.00510	790.66	\$238.44		0.30157
JUL90	0.05580	0.20070	0.00558	1224.81	\$347.56		0.28377
AUG90	0.05580	0.19640	0.00710	1190.45	\$337.99		0.28392
SEP90	0.05580	0.19590	0.00672	1204.70	\$339.65		0.28194
FY90	0.05652	0.21580	0.00455	2284.26	\$676.26	0.00222	0.29230

Table 4.3. Steam Plant Readings and Calculations, July 1992 to January 1993

FPL Steam Plant Readings

FPL Steam Plant Calculations

DATE	OUTDOOR TEMP	STEAM TOTAL	NATURAL GAS	MAKE-UP #1	MAKE-UP #2	COMMENTS	STEAM USED (pounds)	GAS USED (cubic feet)	MAKE-UP (gallons)	STEAM RATE (lbs/hour)	HEAT RATE (btu/lb)	EFFICIENCY (percent)
06/30/92		521556	420387	1904079	2330035	Boiler #2 On						
07/01/92	60	529288	420508	1904489	2333919	Filled #3	77320.0	119000.0	4304.0	3221.7	1585.2	83.27%
07/02/92	69	537257	420826	1905660	2333919		79880.0	120000.0	1181.0	3320.4	1551.0	79.53%
07/03/92	62	544867	420745	1907118	2333919		78100.0	119000.0	1458.0	3170.8	1610.6	77.18%
07/04/92	60	552473	420863	1908198	2333919		76060.0	118000.0	1078.0	3169.2	1597.9	77.14%
07/05/92	52	559745	420984	1908303	2334615		72720.0	121000.0	803.0	3030.0	1713.8	71.54%
07/06/92	55	567177	421108	1908303	2336197		74320.0	122000.0	1582.0	3096.7	1690.8	73.79%
07/07/92	62	574286	421223	1908303	2337358		71090.0	117000.0	1159.0	2962.1	1695.2	72.98%
07/08/92	67	581121	421335	1908303	2338124		68350.0	112000.0	768.0	2847.9	1687.8	72.67%
07/09/92	70	588134	421454	1908517	2339148		70130.0	119000.0	1239.0	2922.1	1747.8	70.95%
07/10/92	65	594805	421571	1908438	2339148		67710.0	117000.0	921.0	2821.3	1779.8	69.19%
07/11/92	62	601318	421680	1910183	2339148	Fault	84110.0	109000.0	721.0	2871.3	1751.2	70.04%
07/12/92	67	606414	421794	1911036	2339148		70980.0	114000.0	873.0	2957.5	1654.3	74.27%
07/13/92	62	618138	421915	1912085	2339148		77220.0	121000.0	1059.0	3217.5	1614.0	76.31%
07/14/92	54	628115	422181	1912140	2340928	Fault						
07/15/92	64	635619	422263	1912140	2341849		75040.0	122000.0	921.0	3128.7	1674.6	73.37%
07/16/92	62	643160	422402	1912378	2342818		75410.0	119000.0	1005.0	3142.1	1625.4	75.73%
07/17/92	66	650139	422517	1913197	2342818		69790.0	115000.0	819.0	2907.9	1697.2	72.32%
07/18/92	61	656926	422634	1913772	2342818		67870.0	117000.0	575.0	2827.9	1775.6	68.75%
07/19/92	65	664025	422750	1915060	2342818		70980.0	116000.0	1288.0	2957.9	1683.1	73.74%
07/20/92	64	671852	422923	1916788	2342818	1500 hrs	73702.5	129750.0	1279.5	3070.9	1813.3	68.35%
07/21/92	57	678795	423013	1916784	2343380		74145.0	135000.0	1173.0	3089.4	1875.4	65.91%
07/22/92	56	686125	423148	1916784	2344892		73300.0	135000.0	1512.0	3054.2	1897.0	65.69%
07/23/92	58	693602	423274	1916784	2346782		74770.0	126000.0	1890.0	3115.4	1735.7	72.36%
07/24/92	63	701142	423393	1916959	2347437		75400.0	119000.0	830.0	3141.7	1625.6	75.42%
07/25/92	70	708211	423513	1918205	2347437		70890.0	120000.0	1248.0	2945.4	1748.5	70.91%
07/26/92	63	715858	423640	1919914	2347437		76470.0	127000.0	1709.0	3186.3	1710.6	73.27%
07/27/92	58	723365	423760	1921258	2347980	Fault	75070.0	120000.0	1887.0	3127.9	1646.5	75.27%
07/28/92	51	730875	423879	1921258	2350210		75100.0	119000.0	2230.0	3129.2	1632.1	77.53%
07/29/92	59	739247	424012	1921258	2351608		83720.0	133000.0	1398.0	3488.3	1536.3	75.56%
07/30/92	57	747052	424145	1924657	2353318		78050.0	133000.0	5107.0	3252.1	1755.2	75.58%
07/31/92	62	752064	424223	1925425	2353318	Filled #1						
08/01/92	67	759674	424342	1925970	2354485		76100.0	119000.0	1714.0	3170.8	1610.6	77.52%
08/02/92	61	767335	424474	1925970	2355500		76610.0	120000.0	1015.0	3192.1	1774.7	69.35%
08/03/92	53	774570	424599	1925970	2357428	Shift to #1	72350.0	125000.0	1926.0	3014.6	1779.5	70.74%
08/04/92	51	781837	424725	1926846	2358674		70670.0	126000.0	1924.0	2944.6	1836.4	68.62%
08/05/92	51	788656	424852	1926199	2358674		70190.0	127000.0	1553.0	2924.6	1863.7	67.04%
08/06/92	61	795443	424971	1929344	2358674		67870.0	119000.0	1145.0	2827.9	1806.0	68.57%
08/07/92	67	802487	425087	1929923	2359488		70240.0	116000.0	1393.0	2926.7	1791.0	73.12%
08/08/92	70	808662	425187	1929923	2360696		61950.0	100000.0	1208.0	2581.3	1662.6	74.81%
08/09/92	70	815285	425300	1929923	2361530		66230.0	113000.0	834.0	2759.6	1757.4	69.95%
08/10/92	52	819272	425380	1929923	2362425	reset	39870.0	80000.0	895.0	1661.3	2066.7	70.43%
08/11/92	55	825036	425493	1930048	2363625		57640.0	113000.0	1325.0	2401.7	2019.3	61.56%
08/12/92	51	832533	425628	1931358	2363625		74970.0	135000.0	1310.0	3123.8	1854.7	66.83%
08/13/92	57	839979	425764	1933009	2363625		74480.0	136000.0	1651.0	3102.5	1881.3	66.42%
08/14/92	49	847189	425896	1934457	2363625		72100.0	132000.0	1448.0	3004.2	1885.7	66.03%
08/15/92	49	854631	426028	1934736	2364755		74420.0	130000.0	1409.0	3100.8	1799.2	69.37%
08/16/92	53	861499	426155	1934736	2366220		66680.0	129000.0	1465.0	2861.7	1934.6	64.49%
08/17/92	59	868430	426280	1934736	2368444		68410.0	125000.0	2224.0	2850.4	1882.0	67.55%
08/18/92	53	875448	426408	1935487	2368624		71080.0	128000.0	911.0	2981.7	1854.8	66.30%
08/19/92	59	882392	426536	1936934	2368624		59440.0	128000.0	1467.0	2893.3	1998.6	65.69%
08/20/92	59	889339	426664	193705	2368624		69470.0	128000.0	1771.0	2894.6	1897.8	66.21%
08/21/92	57	895999	426787	1939239	2369882		66600.0	123000.0	1772.0	2775.0	1902.3	66.19%
08/22/92	64	902064	426900	1939239	2371222		60650.0	113000.0	1360.0	2527.1	1919.0	65.14%
08/23/92	70	908983	427027	1939239	2373022		69190.0	127000.0	1800.0	2882.9	1890.6	66.52%
08/24/92	69	916784	427166	1940358	2373558		78010.0	139000.0	1656.0	3250.4	1835.3	67.37%
08/25/92	58	924833	427222	1942473	2373558	Oil 660gal	81480.0	58000.0	2114.0	3395.4	1955.1	64.32%
08/26/92	55	932287	427229	1943909	2373578	Oil 1000gal	73340.0	7000.0	1456.0	3055.8	2198.1	56.62%
08/27/92	51	939834	427275	1943909	2375588	Oil 690gal	58752.5	34500.0	1507.5	2364.7	2498.5	50.38%
08/28/92	58	946540	427402	1943909	2376890		100590.0	190500.0	1953.0	4191.3	1950.6	63.76%
08/29/92	57	953422	427530	1943925	2378279		68820.0	128000.0	1405.0	2867.5	1915.7	65.03%
08/30/92	53	960791	427668	1945259	2378500	Shift to #2	73690.0	138000.0	1555.0	3070.4	1928.9	64.66%
08/31/92	50	967991	427799	1945259	2379945		72000.0	131000.0	1445.0	3000.0	1874.0	66.44%
09/01/92	63	975054	427926	1945259	2381357		70830.0	127000.0	1412.0	2942.9	1850.2	67.22%
09/02/92	60	982124	428053	1945259	2382865		70700.0	127000.0	1508.0	2945.8	1850.2	67.44%
09/03/92	54	989194	428183	1945259	2384233		70700.0	130000.0	1368.0	2945.8	1893.9	65.66%
09/04/92	58	996071	428307	1945259	2385327		68770.0	124000.0	1094.0	2865.4	1857.2	66.57%
09/05/92	64	2596.5	428427	1945259	2386547		55255.0	120000.0	1220.0	2719.0	1994.1	65.58%
09/06/92	62	9008	428547	1945259	2387767		64115.0	120000.0	1220.0	2671.5	1927.8	64.47%
09/07/92	52	41749	429215	1945259	2393914	Fault						
09/08/92	60	48757	429338	1945259	2395056		70080.0	123000.0	1142.0	2920.0	1807.8	68.43%
09/09/92	65	55778	429466	1945259	2396331		70210.0	128000.0	1275.0	2925.4	1877.8	66.09%
09/10/92	56	62255	429589	1945259	2397681		84770.0	123000.0	1550.0	2698.8	1956.0	64.07%
09/11/92	35	68771	429708	1945259	2398870		65180.0	119000.0	989.0	2715.0	1881.1	65.64%
09/12/92	58	75110	429832	1945259	2400046		63390.0	124000.0	1176.0	2841.3	2014.8	61.54%
09/13/92	50	82362	429963	1945259	2401171		72520.0	131000.0	1125.0	3021.7	1880.6	68.40%
09/14/92	45	90920	430111	1945259	2402540		85580.0	148000.0	1369.0	3565.8	1781.3	69.42%
09/15/92	54	100744	430403	1945259	2405414	Fault						
09/16/92	46	109930	430557	1945259	2407413		91860.0	154000.0	1999.0	3827.5	1725.8	72.31%
09/17/92	39	119741	430717	1945259	2409023		98110.0	160000.0	1610.0	4087.9	1679.7	73.66%
09/18/92	43	128719	430871	1945259	2410371	Shift to #1	89780.0	154000.0	1348.0	3740.8	1766.8	69.87%
09/19/92	44	137312	431018	1945259	2412238		95930.0	147000.0	1860.0	3580.4	1762.0	70.86%
09/20/92	54	144812	431137	1945259	2413787		75000.0	119000.0	1551.0	3125.0	1634.3	75.25%
09/21/92	47	153109	431291	1945259	2415496		42970.0	154000.0	1709.0	3457.1	1911.9	65.18%
09/22/92	43	163500	431452	1945259	2417257		103910.0	161000.0	1751.0	4329.5	1695.9	75.60%
09/23/92	36	173269	431621	1945259	2419136		57960.0	149000.0	1			

Table 4.3. (contd)

FPL Steam Plant Readings

FPL Steam Plant Calculations

DATE	OUTDOOR TEMP	STEAM TOTAL	NATURAL GAS	MAKE-UP #1	MAKE-UP #2	COMMENTS	STEAM USED (pounds)	GAS USED (cubic feet)	MAKE-UP (gallons)	STEAM RATE (lbs/hour)	HEAT RATE (btu/lb)	EFFICIENCY (percent)
10/08/92	46	245843	432881	1945255	2433088		87380 0	152000 0	1602 0	3640 8	1791 7	69 29%
10/09/92	54	256095	433054	1945259	2434798		101520 0	173000 0	1705 0	4230 0	1755 2	70 54%
10/10/92	50	265725	433220	1945259	2438198		98300 0	186000 0	1387 0	4012 5	1775 5	69 46%
10/11/92	51	275340	433384	1945259	2437844		98150 0	184000 0	1448 0	4008 3	1756 8	70 27%
10/12/92	42	284811	433545	1945259	2438138		94710 0	181000 0	1492 0	3948 3	1750 9	70 59%
10/15/92	42	321478	434158	1945259	2444014		122223 3	204886 7	4878 0	1897 5	1724 8	74 61%
10/16/92	33	336818	434414	1945259	2445838		153400 0	255000 0	1824 0	6391 7	1712 2	71 71%
10/17/92	40	350942	434848	1945259	2447884		141240 0	235000 0	2058 0	5885 0	1713 7	71 97%
10/18/92	31	368188	434886	1945259	2448923		152480 0	247000 0	2029 0	6352 5	1688 7	73 76%
10/19/92	32	384977	435195	1945259	2452257		187890 0	298000 0	2334 0	7828 8	1639 1	74 98%
10/20/92	37	402595	435480	1945259	2454273		178180 0	285000 0	2018 0	7340 8	1686 2	73 63%
10/21/92	41	419135	435745	1945259	2458324		185400 0	285000 0	2051 0	6891 7	1650 2	74 47%
10/22/92	47	431081	435838	1945259	2457985		119280 0	194000 0	1981 0	4988 2	1675 5	73 54%
10/25/92	64	480443	436433	1945259	2462114	Meter read err						
10/26/92	44	472001	436823	1945255	2463887		115580 0	190000 0	1549 0	4815 8	1693 2	72 70%
10/27/92	44	485859	436843	1945255	2465288		138580 0	220000 0	1821 0	5880 8	1659 1	74 00%
10/28/92	42	488841	437051	1945255	2468882		129820 0	208000 0	1804 0	5409 2	1650 3	74 46%
10/29/92	37	514257	437302	1945255	2468488		158180 0	251000 0	1598 0	6508 7	1655 5	73 95%
10/30/92	38	529554	437550	1945255	2469845		152970 0	248000 0	1357 0	6373 8	1669 9	73 15%
10/31/92	40	542564	437762	1945255	2471828		130100 0	212000 0	1901 0	5420 8	1678 4	73 57%
11/01/92	39	557194	437982	1945255	2474071		148300 0	230000 0	2245 0	6095 8	1619 3	75 28%
11/02/92	36	571930	438227	1945255	2475692		147380 0	235000 0	1621 0	6140 0	1642 6	74 64%
11/03/92	35	590308	438517	1945255	2478051		183780 0	290000 0	2359 0	7857 5	1625 3	75 67%
11/04/92	32	508584	438708	1945255	2481178	860 gal oil bu	192760 0	319582 5	3127 0	8031 7	1707 7	72 44%
11/05/92	32	528768	439019	1945255	2483934		192040 0	311000 0	2758 0	9001 7	1688 0	73 92%
11/06/92	29	548574	439345	1945255	2486883		197880 0	326000 0	2949 0	9244 2	1697 1	72 72%
11/09/92	48	657734	440169	1945259	2484780	Fault						
11/12/92	32	686118	440887	1945259	2502803	Fault						
11/17/92	34	765829	442480	1945259	2512538	Fault						
11/18/92	34	785576	442815	1945259	2514733		199470 0	325000 0	2195 0	8311 3	1678 2	73 05%
11/19/92	38	804837	443128	1945259	2518700		190810 0	311000 0	1987 0	7942 1	1680 6	72 86%
11/20/92	51	820504	443383	1945259	2518417		158670 0	257000 0	1717 0	6811 3	1688 3	73 46%
11/21/92	37	835326	443819	1945259	2519917		148220 0	236000 0	1500 0	6175 8	1640 0	74 64%
11/22/92	32	852109	443894	1945259	2521480		167830 0	275000 0	1543 0	6992 9	1687 7	72 41%
11/23/92	36	870211	444217	1945259	2523825	Shift to #1	181020 0	323000 0	2365 0	7542 5	1837 9	76 94%
11/24/92	36	888082	444514	1945259	2525914		178510 0	297000 0	2089 0	7437 9	1713 7	77 53%
11/25/92	29	905918	444812	1945259	2528918	Shift to #3	178560 0	298000 0	3004 0	7440 0	1719 0	72 03%
11/26/92	21	924772	445108	1945259	2531417		188540 0	294000 0	2489 0	7855 8	1606 1	76 63%
11/27/92	23	945897	445428	1945259	2534210		209250 0	320000 0	2793 0	8718 8	1575 1	78 15%
11/28/92	24	965581	445729	1945259	2537113		198840 0	303000 0	2903 0	8285 0	1569 6	78 59%
11/29/92	28	984175	446020	1945259	2539998		185940 0	291000 0	2883 0	7747 5	1612 0	76 64%
11/30/92	28	9918	446346	1945259	2543080		217410 0	328000 0	3084 0	9058 8	1544 5	79 81%
12/01/92	23	25432	446683	1945259	2544290		195160 0	337000 0	1210 0	9131 7	1778 6	78 36%
12/02/92	28	43086	446989	1945259	2548610		178540 0	308000 0	5520 0	7355 8	1785 3	77 06%
12/03/92	23	64188	447308	1945259	2552278		211000 0	320000 0	2468 0	8791 7	1562 1	78 58%
12/04/92	16	95459	447632	1945259	2555200		212730 0	323000 0	2922 0	8863 8	1563 9	78 76%
12/05/92	11	95632	447855	1945259	2556034	fault						
12/06/92	20	109108	448285	1945259	2558992	fault						
12/07/92	25	131392	448625	1945259	2561029		222840 0	340000 0	2037 0	9285 0	1571 5	77 76%
12/08/92	24	153587	448981	1945259	2563254		221950 0	336000 0	2225 0	9247 9	1559 3	78 49%
12/09/92	21	175419	449293	1945259	2566426		218320 0	332000 0	3172 0	9098 7	1586 3	78 74%
12/10/92	29	195715	449804	1945259	2567385		202980 0	311000 0	959 0	8456 7	1578 3	76 84%
12/11/92	27	215349	449879	1945259	2568254		198340 0	275000 0	1889 0	8180 8	1442 7	84 76%
12/12/92	30	233194	450171	1945259	2571632		178450 0	292000 0	2378 0	7435 4	1685 4	73 03%
12/13/92	33	250558	450438	1945259	2575109		173840 0	285000 0	3477 0	7235 0	1571 9	79 20%
12/14/92	32	270722	450742	1945259	2578714		201840 0	308000 0	1805 0	8401 7	1583 1	78 02%
12/15/92	38	289090	451020	1945259	2578195		183680 0	278000 0	1481 0	7853 3	1558 9	78 25%
12/16/92	29	308362	451309	1945259	2580079		192720 0	289000 0	1884 0	8030 0	1544 6	79 21%
12/17/92	24	329430	451625	1945259	2581842		210860 0	316000 0	1763 0	8778 3	1544 9	79 00%
12/18/92	23	351178	451954	1945259	2583887		217480 0	329000 0	1825 0	9081 7	1558 2	78 33%
12/19/92	13	369759	452237	1945259	2585332		185810 0	283000 0	1685 0	7742 1	1568 8	77 88%
12/20/92	7	392814	452577	1945259	2587127		230550 0	340000 0	1795 0	9606 3	1519 0	80 28%
12/21/92	22	414419	452909	1945259	2588885		216050 0	332000 0	1758 0	9002 1	1582 8	77 08%
12/22/92	21	434821	453220	1945259	2590580		204020 0	311000 0	1675 0	8500 8	1570 1	77 71%
12/23/92	3	458270	453575	1945259	2592353		234490 0	355000 0	1793 0	9770 4	1559 3	78 17%
12/24/92	4	485597	453991	1945259	2594258		273270 0	416000 0	1905 0	11386 3	1568 0	77 65%
12/25/92	5	509949	454357	1945259	2596025		243520 0	366000 0	1767 0	10148 7	1548 0	78 68%
12/26/92	5	536886	454746	1945259	2598023		269370 0	389000 0	1998 0	11223 8	1487 4	81 31%
12/27/92	15	559248	455089	1945259	2599836		223620 0	343000 0	1813 0	9317 5	1579 9	77 21%
12/28/92	11	574878	455418	1945259	2601510	fault						
12/29/92	37	593748	455708	1945259	2603504		188700 0	290000 0	1994 0	8862 5	1582 9	77 39%
12/30/92	34	613192	456002	1945259	2605530		194440 0	294000 0	2026 0	9101 7	1557 4	78 64%
12/31/92	3	638452	456382	1945259	2607499		252600 0	380000 0	1969 0	10525 0	1548 5	78 58%
1/01/93	0	665479	456778	1945259	2609520		270270 0	394000 0	2021 0	11281 3	1501 5	81 15%
1/02/93	6	687772	457109	1945259	2611817		222930 0	333000 0	2097 0	9288 8	1538 6	79 46%

Table 4.4. Steam Distribution Readings and Calculations, July through November 1992

FPL Steam Distribution Readings

FPL Steam Calculations

Average Pounds per Hour

DATE	STEAM	TIME OF READING	BLDG33	BLDG33	COMMENTS	TOTAL	300PSI	15PSI	OTHER
	TOTAL		300PSI	15PSI		STEAM	STEAM	STEAM	STEAM
07/01/92	521556	08:30	272027	15883		3221.7	1170.6	406.8	1644.3
07/02/92	529288	08:40	274856	16866		3172.5	1277.2	547.3	1348.0
07/06/92	559745	08:45	287128	22125		3096.7	1311.9	388.1	1396.7
07/07/92	567177	08:15	290211	23037		2962.1	1289.0	372.9	1300.2
07/08/92	574286	11:20	293702	24047		2847.9	1212.8	290.8	1344.4
07/09/92	581121	15:30	297118	24866		2843.0	1118.0	222.7	1502.3
07/13/92	608414	09:15	307152	26865		2736.3	1323.0	310.0	1103.3
07/16/92	628115	10:25	316832	29133		3001.1	1188.6	189.7	1622.9
07/20/92	656926	09:00	328074	30927		3037.4	1108.6	385.5	1543.3
07/23/92	678795	09:40	336130	33728		3064.2	1487.5	272.6	1304.1
07/27/92	708211	09:30	350385	36340		3186.3	1250.2	156.5	1779.6
07/28/92	715858	10:25	353500	38730		3127.9	1258.2	182.3	1687.5
07/29/92	723365	08:25	356268	37131		3129.2	1377.6	381.6	1390.0
07/30/92	730875	08:55	359643	38017		3488.3	1531.0	477.4	1479.9
07/31/92	739247	12:10	363815	39318		3178.8	1253.8	333.9	1591.1
08/03/92	762134	09:10	372466	41622		3240.8	1432.8	515.2	1292.8
08/04/92	769912	08:45	375845	42837		2925.0	1311.2	448.0	1165.8
08/05/92	776932	08:30	378959	43901		2997.1	1392.2	446.4	1158.6
08/06/92	784125	09:10	382393	45002		2835.8	1207.2	298.4	1330.2
08/07/92	790931	10:00	385391	45743		2764.3	1078.7	195.5	1490.1
08/10/92	810834	08:45	393023	47126		2149.2	1031.8	252.7	364.7
08/12/92	821150	08:55	397993	48343		2588.3	1595.7	532.5	460.2
08/13/92	827362	08:01	401679	49573		3264.6	1577.9	597.2	1089.5
08/14/92	835197	09:00	405621	51065		3036.1	1453.2	485.5	1097.4
08/17/92	857057	09:10	416108	54569		2812.1	1272.9	302.0	1237.2
08/18/92	863806	08:05	419025	55261		2892.1	1407.6	409.6	1074.9
08/19/92	870747	08:30	422462	56281		2884.6	1406.8	339.6	1138.2
08/20/92	877670	11:00	426190	57181		2755.4	1230.9	262.7	1261.8
08/24/92	904122	08:40	437719	59622		3026.7	1454.1	531.6	1040.9
08/25/92	911386	08:57	441250	60913		3368.3	1524.3	580.7	1263.4
08/26/92	919470	09:15	444954	62324		3275.0	1607.1	528.0	1139.9
08/27/92	927330	08:35	448704	63556		3065.8	1558.8	576.6	930.4
08/28/92	934688	10:15	452705	65036		2946.0	1297.7	413.1	1235.2
08/31/92	955899	08:30	461821	67938		3116.7	1488.7	482.9	1145.1
09/01/92	963379	08:20	465369	69089		2917.7	1300.4	181.8	1435.6
09/03/92	977384	08:45	471665	69969		3076.3	1425.5	4.0	1646.8
09/04/92	984767	15:00	475977	69981		2805.9	1278.1	4.3	1523.6
09/08/92	11704	08:15	487384	70019		2571.3	1633.2	50.6	987.4
09/09/92	17875	10:20	491644	70151		2893.3	1521.5	466.6	905.2
09/10/92	24819	11:00	495397	71302		2724.1	1476.4	391.8	855.9
09/14/92	50970	08:30	509201	74965		2948.3	1311.6	283.4	1353.4
09/15/92	58046	08:15	512316	75638		2606.7	1225.8	257.5	1123.3
09/16/92	64302	08:15	515258	76256		2712.1	1315.9	318.8	1077.4
09/17/92	70811	08:30	518449	77029		2653.3	1243.8	276.2	1133.3
09/18/92	77179	08:15	521403	77685					
09/21/92	95630	09:13	535245	82253		3323.8	1833.6	526.7	963.4
09/22/92	103607	08:25	539499	83475		4137.1	2475.2	860.0	801.9
09/23/92	113536	09:02	545592	85592		4038.3	2238.8	833.3	966.2
09/24/92	123228	09:02	550965	87592		3598.8	1977.0	610.7	1011.0
09/25/92	131865	08:25	555588	89020		3365.7	1692.3	496.6	1176.9
09/28/92	156098	08:15	567744	92587		4407.5	2645.4	1129.5	632.7
09/29/92	166676	08:30	574159	95326		4221.3	2415.1	994.8	811.3
09/30/92	176807	08:20	579915	97697		3718.3	1937.4	613.2	1167.7
10/01/92	185731	10:02	584894	99273		3028.5	1530.7	431.3	1066.6
10/05/92	214805	08:30	599354	103347		3614.2	1884.2	666.8	1063.2
10/06/92	223479	08:37	603898	104955		3483.8	1873.4	652.9	957.5
10/07/92	231840	10:55	608825	106672		3651.0	1930.2	770.7	950.1
10/09/92	249365	09:50	617881	110288		4134.4	2278.2	1010.2	846.0
10/13/92	289055	08:30	639448	119851		4726.7	2125.8	912.5	1688.3
10/14/92	300399	08:30	644550	122041		4899.6	2362.9	1080.0	1456.7
10/15/92	312158	08:30	650221	124633		5767.1	2713.3	1323.8	1730.0
10/16/92	325999	08:30	656733	127810		6434.2	3160.5	1759.5	1514.2
10/19/92	372325	08:40	679541	140508		7823.3	3599.6	1925.6	2298.2
10/20/92	391101	09:07	688342	145216		7150.8	3617.6	1785.7	1747.5
10/21/92	408263	08:55	696952	149466		6647.5	3252.3	1194.9	2200.3
10/22/92	424217	08:30	704622	152284		4143.5	1978.1	1002.3	1163.2
10/26/92	463995	08:35	723628	161914		5510.8	2881.3	1432.0	1197.5
10/27/92	477221	08:25	730495	165327		5426.0	2768.4	1283.2	1374.4
10/28/92	490244	08:20	737116	168396		5682.1	2998.0	1433.0	1250.9
10/29/92	505381	08:20	744362	171459		5471.1	2771.1	1307.5	1158.4
10/30/92	519427	08:25	752042	175192		5914.1	3021.1	1441.1	1451.9
10/31/92	535008	08:45	760246	178582		5501.1	2813.1	1346.1	1441.9
11/01/92	551111	09:45	769120	182094		5912.2	3068.9	1590.2	1211.1
11/04/92	56597	08:15	789415	186001					

Table 4.4. (contd)

FPL Steam Distribution Readings

FPL Steam Calculations

DATE	STEAM	TIME OF READING	BLDG33 300PSI	BLDG33 15PSI	COMMENTS	Average Pounds per Hour			
	TOTAL					TOTAL STEAM	300PSI STEAM	15PSI STEAM	OTHER STEAM
11/05/92	616281	09:00	798293	203558		8201.7	3587.1	2245.3	2369.3
11/06/92	635252	08:40	807018	209065		7904.6	3686.6	2326.9	1891.1
11/12/92	683798	10:20	854933	241846					
11/13/92	702373	08:30	862841	247427		7739.6	3567.5	2517.7	1654.3
11/16/92	740070	09:00	890454	265813					
11/17/92	752293	08:45	900211	270527					
11/18/92	772488	08:45	910933	275572		8414.6	4467.5	2102.1	1845.0
11/19/92	791925	09:00	921111	280745		8098.8	4197.1	2133.2	1768.4
11/20/92	810651	08:35	930542	285310		7802.5	3999.0	1935.7	1867.8
11/23/92	858263	10:40	943243	298908		6612.8	1714.4	1835.5	3062.9
11/24/92	875918	08:50	950864	303996		7356.3	3438.0	2295.3	1622.9
11/25/92	893847	08:15	958294	308952		7470.4	3173.0	2116.4	2181.0
11/30/92	990920	08:34	8984	329691		8069.4	4213.0	1723.7	2152.7
12/01/92									
12/02/92									
12/03/92									
12/04/92									
12/05/92									
12/06/92									
12/07/92									
12/08/92									
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12/28/92									
12/29/92									
12/30/92									
12/31/92									

5.0 Lighting Retrofit Technology Assessment

The potential for higher efficiency lighting and lighting controls in Buildings 1, 29, 33 and 34 at the Forest Products Laboratory was assessed. The assessment involved four principal efforts: 1) an inventory of existing lamps and fixtures, 2) development of lighting energy consumption estimates, 3) identification of life-cycle cost-effective² lighting retrofit technologies, and 4) assessment of lighting control opportunities. The results of this assessment and details on the analysis effort are provided below.

Figures 5.1 and 5.2 and Tables 5.1 through 5.4 are shown at the end of this section, so as not to interrupt the flow of text.

5.1 Connected Load Survey

An inventory of all lighting equipment in the four buildings (1, 29, 33, and 34) was undertaken in 1991 and confirmed in 1992 to determine existing lighting loads, lighting levels, and estimate efficiencies. We noted the fixture type, lamp type, ballast type, control type, count, and location of all lighting equipment. This inventory was entered into a computer spreadsheet so that the total load associated with each type item could be quantified. Figure 5.1 shows the estimated capacity of the most common lighting types identified. In addition, lighting levels (illuminance) were measured at selected locations using a Photo Research LiteMate III^(a) to ensure that federal minimum illumination requirements would be met with a lighting retrofit.

5.2 Development of Lighting Energy Consumption Estimates

The lighting load inventory data were combined with estimates of hours-of-use for each lighting type to calculate annual lighting kWh consumption and energy cost for each lamp. These data were summed to produce the lighting inventory given in Table 5.1. This table indicates the count, and estimated peak kW, annual kWh, and annual energy cost for the major lighting types.

Electricity for lighting at the four buildings examined constitutes approximately 30% of overall FPL electric use. Approximately 430 kW of lighting capacity consume nearly 1.5 million kWh annually. The electrical cost to provide this lighting is estimated to be over \$91,000/year. A blended rate of 6.5 cents per kWh was used in this calculation to reflect the fact that most of the lighting energy is consumed during the peak hours.

(a) Kollmorgen Instruments Corp., Chatsworth, California.

5.3 Identification of Life-Cycle Cost-Effective Retrofit Lighting Technologies

Two principal strategies to reduce lighting electrical consumption were investigated: 1) replacement of lamps and fixtures with high efficiency technologies and at the same time retain or increase current lighting levels, and 2) application of occupancy sensors to shut off lights when spaces are unoccupied for periods exceeding 15 minutes.

The FEMP Lighting Technology Screening Matrix (LTSM) was used to identify and quantify cost-effective lighting retrofits for the fluorescent and incandescent lamps and fixtures in the four buildings. The LTSM was used with a federal discount rate of 4.0%, a blended (demand + energy) electricity cost of 5.5 cents per kWh and operation hours based on the site survey and measurements. The analysis also incorporated the applicable standard utility rebates (other than "custom" rebates) for lamps, ballasts, reflectors and fixtures that were identified as cost-effective retrofit technologies. "Custom" rebates for recommended retrofit technologies (e.g., low-pressure sodium fixtures) were considered to be \$0 for this analysis since no dollar incentive amount was given by the utility.

Table 5.2 summarizes the results of the analysis. Appendix D gives a description of the LTSM, and a listing of the specific recommended retrofit fixtures and locations for the retrofit. Based on the analysis, replacement of lamps and fixtures with the most life-cycle cost-effective alternative would result in a minimum reduction of lighting capacity by 146.6 kW, or 34% of present capacity. The retrofit would result in a minimum savings of approximately 561,00 kWh annually, or an estimated savings in excess of \$36,000 per year. The installed cost (1992\$) of the new lighting is estimated at \$330,617. The "standard" utility rebates applied to individual technologies based on the utility's "Power Plus" program total \$44,425, or about 15% of the total cost; however, a comprehensive DSM program may increase this incentive. Table 5.3 gives a listing and count of the new lighting technologies identified as cost-effective.

5.4 Lighting Controls Assessment

Motion sensors could further reduce lighting electrical consumption in selected spaces by shutting off lights during unoccupied periods. Five candidate spaces were examined for this assessment, where we installed MyTech and PST motion and light sensors^(a) for several weeks to determine control effectiveness. Figure 5.2 shows the results of these measurements. The data indicate that lights were on with no apparent motion greater than 10% of the time in three of the five selected spaces. At an estimated cost of \$50

(a) MyTech Sensor - MyTech Corp., Austin, Texas; PST Logger - Pacific Sciences and Technology, Bend, Oregon.

per motion sensor, these devices are life-cycle cost-effective in those three applications. Only in the scientist offices is occupancy and present lighting control such that a motion sensor would not be cost effective.

We estimate that 50% of the lamps would benefit from motion sensors, resulting in an annual savings of approximately 5% of lighting energy after retrofit. Assuming one sensor per five fixtures on average results in a need for 320 motion sensors at a cost of \$16,000 without rebates.^(a) Table 5.4 summarizes the analysis, indicating a potential savings of approximately 60,000 kWh, or \$3,600 per year.

Overall, we estimate that lighting energy costs can be cost-effectively reduced by over 40% in the buildings examined while maintaining present lighting levels.

(a) Note that utility rebates for lighting controls are available under a "custom" rebate.

Figure 5.1. Estimated Lighting Capacity (kW) by Type for Buildings 1, 29, 33 and 34

Figure 5.2. Lighting System Use Measurements in Selected Locations

**Table 5.1. Lighting Inventory and Estimated Energy Consumption
for Buildings 1, 29, 33 and 34**

Type	Count	Peak kW	Annual kWh	Energy Cost
Fluorescent Fixtures	2605	322.54	1,046,827	\$68,044
Mercury	192	38.40	168,192	\$10,932
Incandescent Ceiling Fixtures	317	28.24	89,335	\$5,807
Metal Halide	26	26.00	79,716	\$5,182
Incandescent Pendants	11	2.20	2,943	\$191
Incandescent Spot	20	1.50	11,826	\$769
Incandescent Exit Light	12	0.56	4,905	\$319
Compact Fluorescent	12	0.22	679	\$44
Other	3	10.06	4,564	\$297
All	3198	429.72	1,408,987	\$91,584

**Table 5.2. Estimated Energy and Cost Savings for a Lighting Retrofit
in Buildings 1, 29, 33 and 34**

Building Number	1	29	33	34	Total
Total Fixture Count	1902	329	477	490	3198
Current Lighting KWH/year	828,052	226,019	184,038	170,880	1,408,989
Current Lighting KW	280	55	47	48	430
Current Annual Costs	\$53,358	\$14,564	\$11,859	\$11,011	\$90,792
Fixtures Affected	1651	137	472	490	2750
Installation Cost	\$192,193	\$34,713	\$49,261	\$54,450	\$330,617
Standard Utility Rebate	\$28,647	\$2,382	\$6,520	\$6,876	\$44,425
FPL Cost	\$163,546	\$32,331	\$42,741	\$47,574	\$286,192
Annual KWH Savings	335,456	90,033	74,371	61,121	560,981
Peak KW Savings	104.4	6.7	18.3	17.2	146.6
Annual Cost Savings	\$21,616	\$5,802	\$4,792	\$3,939	\$36,148
Percent of Current Costs	40.5%	39.8%	40.4%	35.8%	39.8%

**Table 5.3. Retrofit Lighting Technologies Recommended
for Buildings 1, 29, 33 and 34**

New Lighting Technologies	Building 1	Building 29	Building 33	Building 34	Total
Compact Fluorescent - 11 watt	41		30		71
Compact Fluorescent - 18 watt	25				25
Compact Fluorescent - 27 watt	153		18		171
LED Exit Light	12				12
FL 1X4 1-T8 ELC REF			5		5
FL 1X4 2-34 ELC REF	612	108	405	489	1614
FL 1X8 2-110 ELC REF	63				63
FL 2X2 2-UT8 ELC	51				51
FL 2X2 2UT8 ELC	16				16
FL 2X4 2-34 ELC REF	136				136
FL 2X4 2-40 STD REF	45				45
FL 2X4 3-T8 ELC REF	497	29	14	1	541
ALL Technologies	1651	137	472	490	2750

ELC: Electronic Ballast

REF: Specular Reflector

**Table 5.4. Estimated Lighting Energy and Cost Savings from
Installation of Motion Sensors**

Building Number	1	29	33	34	Total
Number of Motion Sensors	190	33	48	49	320
Motion Sensor Cost	\$9,500	\$1,650	\$2,400	\$2,450	\$16,000
Annual KWH Savings	24,630	6,799	5,483	5,488	42,400
Annual Cost Savings	\$1,587	\$438	\$353	\$354	\$2,732
Percent of Current Costs	3.0%	3.0%	3.0%	3.2%	3.0%

6.0 Other Efficiency Improvement Potential

This section identifies additional opportunities for cost-effective energy efficiency improvements at the Forest Products Laboratory based on the metered data, other information collected during the performance of the project, and PNL experience at over 30 federal facilities. Many of the measures identified qualify for rebates from MG&E under its existing "Power Plus" DSM program. Others may qualify under a customized DSM program developed specifically between the FPL and the utility to acquire cost-effective demand and energy reductions from federal facilities, pending approval by MG&E and the utility commission.

The analysis conducted for this assessment is preliminary and the savings (energy and/or dollars) are quantified where data were available. Rigorous life-cycle cost evaluation needs to be conducted when designs and feasibility analyses are undertaken during subsequent stages of project development. Except for the envelope improvements which affect both the heating and cooling loads in the buildings, these recommendations are in addition to those determined by the FEDS Level-1 software analysis. Therefore, the energy and cost savings (as well as the required investment) would be in addition to those estimated by the FEDS Level-1 analysis and in the lighting retrofit analysis.

6.1 Envelope Improvements

The thermal integrity of most of the building envelopes is quite good, with the exception of Buildings 33 and 34. These buildings have single-pane glazing that should be replaced or supplemented with double-pane glazing. If replacement is desired, we would recommend double-pane glazing with a selective film inside. This film will allow short-wave radiation to enter while reflecting long wave radiation back to the building interiors, thus reducing heating requirements.

If exterior siding is replaced we recommend that FPL install additional insulation as part of the retrofit. Adding insulation solely for energy savings is likely not to be cost-effective.

6.2 Boilers

The controls and instrumentation of the boiler plant are insufficient to optimally manage or monitor boiler operation. An upgrade of control and monitoring functions will result in a minimum 10-15% reduction in natural gas use at the facility and improve overall operations.

In addition, the steam demand during the summer months is approximately 3,000 pounds per hour, less than 25% of the capacity of the smaller boilers. Operating

efficiency of the boilers at this part load is relatively low. The installation of a smaller boiler of approximately 5,000 pounds per hour would allow the boilers to be used at higher loads and efficiencies.

The summertime steam plant loads are sufficiently small that consideration should be given to shutting the plant down during the summer and using local boilers closer to the loads to generate the required hot water and steam. This would offset costs for the portable boilers presently used during the annual shutdown, and also increase energy efficiency since normal steam production and distribution losses would be reduced.

6.3 Motors and Transformers

Our estimate of motor capacity based upon the analysis of electric use indicates a continuously operating motor capacity in the range of 250 to 350 kW. Most of the motors at the facility are old and of constant speed. As motors are replaced, efficient motors should be specified, and as appropriate, variable speed drives should be employed. In addition, the utility offers rebates for high efficiency motors ranging from \$15/hp for 1-10 hp motors to \$10/hp for 11-99 hp motors with a "custom" rebate for greater than 100-hp motors.

Most of the transformers at the facility are more than 20 years old. Newer more energy efficient transformers are now available to reduce transformer losses by as much as 50%. This could result in an estimated overall electrical savings on the order of 2 to 5% (280,000 kWh/year, or \$18,200/year).

6.4 Energy Management and Control System (EMCS)

An EMCS appears to be particularly appropriate for Buildings 33 and 34 where high baseline cooling, heating, and ventilation loads exist (see Figures 3.11 and 3.13). The EMCS should control the exhaust fans, make-up air units, and the chillers at a minimum. This would permit the chillers to be staged as necessary, ensure that unnecessary fume hoods are turned off at night, and modulate the make-up air as necessary to maintain slight negative pressure for the laboratory spaces.

Another candidate for EMCS is Building 1 (see Figures 3.5 and 3.8) to control the window air conditioners and packaged units for peak demand control and to ensure that units are shut off during unoccupied periods. Most of the window air conditioners are on dedicated circuits making them relatively easy to control as a group. Interlocks on some of the large process equipment motors (particularly the grinder and saws) could ensure that these devices do not contribute to the peak demand for the site. If nothing else this equipment should be marked to let operators know that it should not be operated when peak conditions exist (typically noon to 4 p.m. on hot days). The utility offers a "custom"

program for energy management controls as well as incentives for high-efficiency window air conditioners (\$35-\$45/unit), package units (\$35-\$95/unit) as well as chillers (under a "custom" program).

6.5 Use of Emergency Generators

The FPL currently has 100 KW of electrical generating capacity available with the emergency back-up generators. These generators could be interlocked with particular loads during peak demand hours to offset peak electrical demands. At \$7.0 per kW this could result in \$700 savings per month if the generators are in use during the peak demand hour. The fuel costs would be offset somewhat by the additional kWh savings that occur as the generators offset utility power.

6.6 Cool Storage

Space cooling requirements significantly affect electrical costs, due to their magnitude at FPL, and the fact that they occur when time-of-day energy and demand rates are at their highest. Examination of the peak day load profiles (Figure 3.4) reveals that the day-time loads are more than three times the nighttime loads. Cool storage provides a practical means of levelizing this profile, with attractive benefits to both the utility and customer.

The concept is to install a dedicated chiller to cool stored water during off-peak hours, for subsequent use during the peak periods. This permits the chillers to be off during the on-peak hours, thereby reducing peak demands and time-of-use energy costs. Although this strategy would increase overall energy requirements it can significantly reduce peak loads and electrical costs. The utility offers a "custom" rebate for cool storage technologies.

The sizing and cost-effectiveness of these systems is dependent upon the magnitude of the loads they serve, so it is imperative that other cost-effective efficiency improvements in the buildings, central plant and thermal loops be completed before design is initiated. Otherwise it is likely that energy savings and cost-effectiveness estimates will be greater than that actually achieved after the other measures are implemented.

6.7 Cogeneration

Existing conditions at the steam plant make consideration of various cogeneration options desirable. Perhaps the most effective method will be installation of a gas-fired electrical generator in the central plant sized to meet the summertime thermal requirements using rejected heat. This would permit the steam boilers to be shut down during the

summer months and supplanted by the thermal output of the generator motor, while the generator offsets electrical consumption and demand during the peak months.

Another option is installation of a steam-turbine-driven generator, allowing the existing boilers to be used at higher capacities and offset electrical energy and peak demands during the summer months when electrical cost are greatest. The determination of the optimal size and type of electrical generation equipment on-site is beyond the scope of this assessment, but should be examined in the future.

7.0 Financing and Contracting Strategy

The Forest Products Laboratory appears to offer sufficiently cost-effective energy saving opportunities to pursue the projects identified. Madison Gas and Electric has an aggressive demand-side management (DSM) program for both gas and electric technologies including lights, motors, HVAC, hot water, boiler controls, EMCS and cool energy storage as part of its standard rebates as well as under its "custom" rebates. The utility has expressed a willingness to work with the FPL to develop the comprehensive program that may include financing and incentives to ensure project implementation. FEMP has demonstrated with other utilities that a comprehensive program between a utility and its federal customer can be beneficial to both the utility and the federal customer.³ The recommended lighting retrofit was targeted by the utility as an initial step in the development of such a comprehensive program.

It would be most desirable to combine in-kind contributions of installation labor from the laboratory staff, with the federal funding, the utility DSM program, and perhaps other third party investment to achieve the energy savings goals at minimum cost to the government. However, this approach is relatively complex and will require careful analysis, oversight, contracting and management.

The Energy Policy Act (EPAAct) of 1992⁴ encourages federal agencies to make use of utility DSM program offerings to the extent they provide life-cycle cost-effective efficiency improvement, subject to availability of funding. If the Department of Agriculture can provide funding for further assessment and procurement of efficiency improvements, the Forest Products Laboratory appears to be an excellent candidate for such expenditures. The staff and management of the Laboratory exhibit the interest, commitment, and skills necessary to ensure project success.

8.0 References

1. Dirks, J. A., E. E. Richman, R. W. Schultz, and S. A. Shankle. *Lighting Technology Screening Matrix (LTSM)*. Software Developed by Pacific Northwest Laboratory for the Federal Energy Management Program, July 13, 1992. Copyright (c) 1992 Battelle Memorial Institute.
2. 10 CFR Part 436 *Federal Energy Management and Planning Programs*.
3. Currie, J. W., L. R. Harris, and G. B. Parker. *Designing and Implementing DSM Programs for Federal Customers*. PNL-SA-22045, Pacific Northwest Laboratory, Richland, Washington, February 1993.
4. *The Energy Policy Act of 1992*. Public Law. PL 102-486, Washington, D.C. (October 24, 1992).

Appendix A

FEDS Level-1 Assessment Data

Appendix A

FEDS Level-1 Assessment Data

Introduction

A FEDS Level-1 analysis was performed on the FPL using the Buildings Version Release 1.2. The output files from the analysis are included in this appendix. The objective of FEDS Level-1 is to provide a top-level screen as a preliminary indication of what actions should be initiated; further analysis is required before a project is implemented. FEDS Level-1 depends upon numerous assumptions about the "typical" federal facility, with only minimal energy price and installation configuration information provided as input. The model never requires the input of engineering parameters. Specific FEDS Level-1 capabilities include:

- Accepting both energy and demand components from utility rate structures.
- Accepting input data of a generic and/or aggregated nature. For instance, the percentage of a building type that uses a particular heating fuel is entered, but the individual heating technologies are not specified.
- Estimating current energy consumption for all energy systems under consideration.
- Determining the optimal retrofits to the current system (considering interactive effects) and estimating the post-retrofit energy consumption, initial installed cost of the retrofits, recurring costs of the retrofits, value of the change in energy consumption and operation and maintenance requirements, and net present value of the retrofit.

PNL is also currently developing FEDS Level-2 scheduled to be released in October 1993. The basic difference between FEDS Level-1 and FEDS Level-2 is that FEDS Level-2 allows a knowledgeable user to override the default building and energy-using equipment parameters that were set in Level-1. The user can choose to generate a Level-2 input file from Level-1 input data. The user may then edit the Level-2 input file to change the various default assumptions; this allows a user to input "better" information.

Comparing FEDS Results with the Site Assessment

The site assessment results detailed in the report just prepared for the FPL lies somewhere between a Level-1 and Level-2 analysis. For example, like a FEDS Level-1 analysis, we made recommendations for saving energy through improved site-wide ventilation control though we did not recommend specific technologies. Like a Level-2 analysis we developed lighting retrofit recommendations by specific technology (e.g., LED exit lights)--however we did not quantify the cooling load reductions (i.e., interactive effects) due to a lighting retrofit. This is performed by the FEDS Level-1 (and Level-2) analysis.

In addition, because we ran FEDS Level-1 with 12 buildings (the majority of the buildings at the site), the results cannot be directly compared to the site assessment which only examined the four largest buildings and the steam plant. Also, FEDS Level-1 contains a limited number of building choices, it does not easily predict energy use and efficiency savings in mixed-use buildings (e.g., lab/office) nor in buildings with significant (once-through) ventilation rates or high bays such as those at the FPL. This limitation will be corrected in the Level-2 version. FEDS Level-1 also assumes certain technologies and efficiencies for the buildings such as 2x4 four-tube fixtures with standard ballasts for all lighting fixtures. We know from the connected load survey that this is not the case at the FPL.

FEDS Level-1 Analysis Inputs and Results

The 12 largest buildings at the site were chosen for analysis. Fiscal year 1990 building and utility data were used as the input data. Other items to note for the input data include:

- All buildings were assumed to function as OFFICE spaces with the exception of the central boiler plant and a storage building since no laboratory or laboratory/office building type is available.
- The central chiller on site is modelled as "single building electric chiller" units.
- The consumption of oil per year was derived from the steam production data and the assertion that 5% (or less) is supplied by #2 fuel oil at 105 lbs steam per gallon.
- An estimate of chilled water ton-hours was derived based on the electric consumption associated with chilled water production, the capacity of the chillers (tonnage), and an assumed COP using FEDS Level-1 code defaults. This was considered reasonable as it was found to be below the ton-hour value derived by assuming full load for the hours of operation reported by the site. (A preliminary calculation of ton-hours based on

gallons delivered and assumed supply and return temperatures was found to be a magnitude of 10 below a reasonable value and therefore abandoned.)

- Since FEDS only accepts utility rebates as a "percentage" of installed cost, an overall 2% lighting rebate value was assumed. The 2% value is conservative and was derived from the difference between the "with" and "without" rebate analysis as a percentage of the total installed cost of ALL proposed retrofits. A higher percentage would be obtained if only retrofits with the standard rebate amounts (i.e., no "custom" rebate technologies) were used to calculate the percentage.

The following summarizes the input and output data by page:

Page A.6 - is the summary of the input energy consumption, price and use breakdown for both on-site (central plant) and purchased fuel.

Page A.7 - is a summary of the input electricity price and rate schedule from MG&E.

Page A.8 - is a summary of the input of building information including our selection of "building type" and best estimate of heating and cooling service supplied to each building *type*.

Page A.9 - is a summary of the input of water heating, indoor lighting and operating hours for each building *type*.

Page A.10 - are input cost data including utility rebates for technologies.

Page A.11 - are output data giving a summary of the retrofit resource potential (dollar and energy) based on the FEDS analysis.

Page A.12 - are output data giving detailed results of the annual savings by fuel type and by central system based on the FEDS analysis.

Page A.13 - are the output data giving detailed results of the estimated annual savings by end-use technology, by fuel type and by central system based on the FEDS analysis.

Pages A.14-A.16 - are the output data giving detailed annual estimated energy use and savings by fuel type and by central system based on the FEDS analysis.

Pages A.17-A.19 - are the output data giving detailed annual estimated energy use and savings by end use *technology* by building *type* based on the FEDS analysis.

Based on the output data, the following observations are made:

- The significant number of mixed use lab/office buildings and the significant ventilation component load in the majority of the buildings at the site do not allow the FEDS Level-1 software to accurately predict the overall facility energy use (pages A.11-A.13) nor accurately predict the building type energy use (pages A.14-A.16). Estimated electrical consumption (3,455,001 kWh) significantly underpredicts the actual consumption (5,600,000 kWh) and estimated natural gas use (152,558 therms) also significantly underpredicts the actual natural gas use (831,250 therms). However, the estimated chilled water use (324,110 tons) is very close to the actual use (323,089 tons).
- The overall facility annual energy savings is estimated at 9% (2,500 MBtu) and over \$89,000. The majority of the savings is in electricity (922,778 kWh and over \$47,000). First year cooling savings are estimated at over 61,000 ton-hours and nearly \$2,000. These are minimum savings based on an estimated overall facility energy use of 29,593 MBtu (compared to over 100,000 MBtu actual energy use). A greater percentage savings is achievable given the actual energy use at the site and based on the monitoring and assessment data acquired in this project.
- For lighting (page A.13), FEDS Level-1 estimates a 40% electrical energy savings from (from the modeled baseline energy use) with cost-effective lighting retrofits in the 12 buildings. The site assessment (for the four largest buildings) also estimates nearly a 40% savings from a lighting retrofit (from the actual baseline energy use) in the four buildings.
- The overall investment required to obtain the minimum estimated energy savings through retrofits is estimated by the FEDS analysis to be \$650,000. This investment will return a net present value of savings of \$916,000 with a first year energy dollar savings of \$89,000.

Recommendations

We recommend that the specific retrofit measures, technologies and actions identified in the detailed site assessment be implemented to begin a systematic process for reducing site energy use and cost. In addition, a Level-2 analysis should be conducted once the Level-2 software becomes available. With Level-2, a knowledgeable user will be able to override the default building and energy-using equipment parameters that were set in Level-1. FEDS Level-2 will allow:

- A user-defined building that has two distinct uses (termed "use areas") such as a laboratory and office.

- The user to select from a large number of lighting technology configurations.
- Specification of an unlimited number of building groupings including multiple groups of the same building type.
- Ability to attribute the loads from buildings to central plants by assigning building heating, cooling, and service hot water.
- Ability to indicate occupancy status on a monthly basis, as well as indicating the heating set point to be used during the unoccupied months.
- Ability to specify fuels to consider for fuel-switching retrofits for a particular building group.

FEDERAL ENERGY DECISION SCREENING MODEL (FEDS) SCREEN INPUT DATA
 FACILITY NON-TRANSPORTATION ENERGY CONSUMPTION AND GENERATION
 Screen File: C:\FEDS\FEDS2\FPL\FPL2X.inp Output File: C:\FEDS\FEDS2\FPL\FPL2X.out Run Date: Tue Feb 23 10:14:51 1993

Weather Station: Madison WI
 Facility Name: Forest Products Laboratory
 Facility Location: Madison, WI

Energy Data Start Date: 10/89 Energy Data End Date: 9/90

BREAKDOWN BY PERCENTAGE OF END USE									
ENERGY CONSUMPTION				Other					
Energy Type	Consumption	Units	Indust	Process	Central	Central	Cogen	Elect	Building
-----	-----	-----	Loads	Boilers	Chillers	Gener	-----	-----	-----
Electricity	5,600	MWh	30.00	0.00	7.00	0.00	0.00	0.00	63.00
Oil	27,700	gallons	0.00	100.00	0.00	0.00	0.00	0.00	0.00
Natural Gas	831,250	therms	5.00	95.00	0.00	0.00	0.00	0.00	0.00

ON-SITE ENERGY GENERATION/TRANSFORMATION

Energy Type	Amount	Units
-----	-----	-----
District Steam	65,078	MMBtu
District Hot Water	0	MMBtu
District Chilled Water	323,089	Ton-Hours
Electricity	0	MWh

ENERGY PRICE DATA NON-ELECTRIC ENERGY PRICE INFORMATION

Energy Type	Price	Units
-----	-----	-----
Oil	.70	\$/gallons
Natural Gas	.29	\$/therms
Coal	0.00	\$/ton
Purchased Steam	0.00	\$/MMBtu
Self-Gen Steam	4.07	\$/MMBtu
Purchased Hot Water	0.00	\$/MMBtu
Self-Gen Hot Water	0.00	\$/MMBtu
Other Fuels	0.00	\$/MMBtu

MARGINAL ELECTRICITY PRICE AND SCHEDULE INFORMATION
Start Date: 10/16 End Date: 6/15
Schedule: Time-of-day rates

WINTER MARGINAL ELECTRICITY PRICES AND SCHEDULE

Period	WEEKDAYS				Units
	Start Time	End Time	Energy Rate	Demand Rate	
1	1000	2100	3.82	6.20	\$/kW
2	2100	1000	2.74	0.90	\$/kW
Period	SATURDAYS				Units
	Start Time	End Time	Energy Rate	Demand Rate	
1	2400	2400	2.74	0.90	\$/kW
Period	SUNDAYS				Units
	Start Time	End Time	Energy Rate	Demand Rate	
1	2400	2400	2.74	0.90	\$/kW

SUMMER MARGINAL ELECTRICITY PRICES AND SCHEDULE

Period	WEEKDAYS				Units
	Start Time	End Time	Energy Rate	Demand Rate	
1	1000	2100	4.53	7.60	\$/kW
2	2100	1000	2.74	1.20	\$/kW
Period	SATURDAYS				Units
	Start Time	End Time	Energy Rate	Demand Rate	
1	2400	2400	2.74	1.20	\$/kW
Period	SUNDAYS				Units
	Start Time	End Time	Energy Rate	Demand Rate	
1	2400	2400	1.74	1.20	\$/kW

BUILDING INFORMATION

Building Type	Number of Buildings	Each Building Floor Area (sf)	Average Date Construction
Office	10.00	31,425	1940
Warehouse & Storage ...	1.00	6,293	1937
Other	1.00	3,393	1958

SPACE HEATING ENERGY TYPE/TECHNOLOGY (Percent of Heat Provided by Each Technology)

Building Type	Elect		Hot Water		Oil		Nat Gas		Coal		Other		Not Heated	
	Elect Resist	Heat Pump	Steam	Water	---	---	---	---	---	---	---	---	---	---
Office	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Warehouse & Storage ...	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

SPACE COOLING ENERGY TYPE/TECHNOLOGY (Percent of Cooling Provided by Each Technology)

Building Type	Evap Cooler		Pack Units		Elect Heat Pump		Single Building Chiller		Steam Absorp Chiller		Water Absorp Chiller		Nat Gas Absorp Chiller		Other District Chilled Water		Not Cooled	
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Office	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	75.00	25.00	0.00
Warehouse & Storage ...	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00	0.00
Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00	0.00

SERVICE WATER HEATING TECHNOLOGY
(Percent of Heating Provided by Each Technology)

Building Type	Elect		Hot		Nat		Not Heated
	Resist	Heat Pump	Steam	Water	Oil	Coal	
Office	0.00	0.00	100.00	0.00	0.00	0.00	0.00
Warehouse & Storage ...	0.00	0.00	100.00	0.00	0.00	0.00	0.00
Other	0.00	0.00	100.00	0.00	0.00	0.00	0.00

INDOOR LIGHTING TECHNOLOGIES
(Percent of Lighting Provided by Each Technology)

Building Type	Elect		High Eff		Mercury Vapor		Metal Halide		High Pres Sodium		Low Pres Sodium
	Incan	Incan	Fluor	Fluor	Fluor	Vapor	Halide	Sodium	Sodium	Sodium	
Office	5.00	0.00	72.00	0.00	0.00	23.00	0.00	0.00	0.00	0.00	0.00
Warehouse & Storage ...	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other	0.00	0.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00

BUILDING OPERATING HOURS

Building Type	Weekdays		Saturdays		Sundays	
	Start	End	Start	End	Start	End
Office	700	1700	700	1200	700	1200
Warehouse & Storage ...	700	1700	700	1200	0	0
Other	2400	2400	2400	2400	2400	2400

FINANCIAL PARAMETERS

Financial parameters default values Discount rate default values
 Energy escalation rates default values

UTILITY COST SHARING (Percent of Installed Cost of Retrofits)

	Electric Utility	Gas Utility
Heating.....	0.00	0.00
Cooling.....	0.00	0.00
Ventilation..	0.00	0.00
Lights.....	2.00	0.00
Water Heating	0.00	0.00
Envelope.....	0.00	0.00

FEDS ANALYTICAL RESULTS

Summary of Retrofit Resource Potentials	

First year energy dollar savings due to retrofits	89,039
Present value of savings due to retrofits	916,058
Total estimated investment required for retrofits	650,824
Estimated current facility energy use (MMBtu)	29,593
Estimated post-retrofit facility energy use (MMBtu)	27,054
Estimated facility annual energy savings (MMBtu)	2,539

Detailed Results of Retrofits

Fuel	Annual Facility Energy Use by Fuel Type Dollars (1991)	Annual Facility Energy Use by Fuel Type Dollars (1991)
Electricity (kw-hr)		
existing	3,455,001	176,658
post-retrofit	2,532,222	129,476
difference	922,778	47,183
% change	-27	-27
Natural Gas (therms)		
existing	0	0
post-retrofit	152,558	45,005
difference	-152,558	-45,005
% change	n/a	n/a
District Steam (MMBtu)		
existing	13,911	84,930
post-retrofit	4	23
difference	13,908	84,907
% change	-100	-100
Chilled Water (ton-hours)		
existing	324,110	10,304
post-retrofit	262,651	8,350
difference	61,460	1,954
% change	-19	-19
Total (MMBtu)		
existing	29,593	271,893
post-retrofit	27,054	182,854
difference	2,539	89,039
% change	-9	-33

Annual Facility Energy Use by Fuel Type and End Use Technology

Fuel	Heating	Cooling	Vent	Lights	Plugs	Hot Water
Electricity (kw-hr)						
existing	0	0	573,749	2,147,720	733,532	0
post-retrofit	0	0	516,125	1,282,566	733,532	0
difference	0	0	57,624	865,154	0	0
% change	0	0	-10	-40	0	0
Natural Gas (therms)						
existing	0	0	0	0	0	0
post-retrofit	150,858	0	0	0	0	1,700
difference	-150,858	0	0	0	0	-1,700
% change	n/a	0	0	0	0	n/a
District Steam (MMBtu)						
existing	13,698	0	0	0	0	214
post-retrofit	0	0	0	0	0	4
difference	13,698	0	0	0	0	210
% change	-100	0	0	0	0	-98
Chilled Water (ton-hours)						
existing	0	324,110	0	0	0	0
post-retrofit	0	262,651	0	0	0	0
difference	0	61,460	0	0	0	0
% change	0	-19	0	0	0	0
Total (MMBtu)						
existing	13,698	3,890	1,958	7,330	2,504	214
post-retrofit	15,086	3,152	1,762	4,377	2,504	174
difference	-1,388	738	197	2,953	0	40
% change	10	-19	-10	-40	0	-19

Annual Energy Use by Building Type and Fuel Type

Building Type ... Office			
Fuel	Energy	Dollars (1991)	
Electricity (kw-hr)			
existing	3,391,580		173,416
post-retrofit	2,501,714		127,916
difference	889,866		45,500
% change	-26		-26
Natural Gas (therms)			
existing	0		0
post-retrofit	147,427		43,491
difference	-147,427		-43,491
% change	n/a		n/a
District Steam (MMBtu)			
existing	13,123		80,118
post-retrofit	0		0
difference	13,123		80,118
% change	-100		-100
Chilled Water (ton-hours)			
existing	324,110		10,304
post-retrofit	262,651		8,350
difference	61,460		1,954
% change	-19		-19
Total (MMBtu)			
existing	28,588		263,838
post-retrofit	26,433		179,757
difference	2,155		84,081
% change	-8		-32

Building Type ... Warehouse & Storage

Fuel	Energy	Dollars (1991)
Electricity (kw-hr)		
existing	33,780	1,727
post-retrofit	16,230	830
difference	17,549	897
% change	-52	-52
Natural Gas (therms)		
existing	0	0
post-retrofit	2,629	776
difference	-2,629	-776
% change	n/a	n/a
District Steam (MMBtu)		
existing	436	2,663
post-retrofit	1	9
difference	435	2,655
% change	-100	-100
Total (MMBtu)		
existing	552	4,391
post-retrofit	320	1,614
difference	232	2,776
% change	-42	-63

Fuel	Building Type ... Other	
	Energy	Dollars (1991)
Electricity (kw-hr)		
existing	29,641	1,516
post-retrofit	14,279	730
difference	15,363	786
% change	-52	-52
Natural Gas (therms)		
existing	0	0
post-retrofit	2,502	738
difference	-2,502	-738
% change	n/a	n/a
District Steam (MMBtu)		
existing	352	2,148
post-retrofit	2	14
difference	350	2,134
% change	-99	-99
Total (MMBtu)		
existing	453	3,664
post-retrofit	301	1,482
difference	152	2,182
% change	-34	-60

Annual Energy Use by Building Type, Fuel Type, and End Use Technology

Building Type ... Office

Fuel	Heating	Cooling	Vent	Lights	Plugs	Hot Water
Electricity (kw-hr)						
existing	0	0	573,749	2,092,048	725,783	0
post-retrofit	0	0	516,125	1,259,806	725,783	0
difference	0	0	57,624	832,242	0	0
% change	0	0	-10	-40	0	0
Natural Gas (therms)						
existing	0	0	0	0	0	0
post-retrofit	145,727	0	0	0	0	1,700
difference	-145,727	0	0	0	0	-1,700
% change	n/a	0	0	0	0	n/a
District Steam (MMBtu)						
existing	12,913	0	0	0	0	210
post-retrofit	0	0	0	0	0	0
difference	12,913	0	0	0	0	210
% change	-100	0	0	0	0	-100
Chilled Water (ton-hours)						
existing	0	324,110	0	0	0	0
post-retrofit	0	262,651	0	0	0	0
difference	0	61,460	0	0	0	0
% change	0	-19	0	0	0	0
Total (MMBtu)						
existing	12,913	3,890	1,958	7,140	2,477	210
post-retrofit	14,573	3,152	1,762	4,300	2,477	170
difference	-1,659	738	197	2,840	0	40
% change	13	-19	-10	-40	0	-19

Building Type Warehouse & Storage

Fuel	Heating	Cooling	Vent	Lights	Plugs	Hot Water
Electricity (kw-hr)						
existing	0	0	0	30,468	3,312	0
post-retrofit	0	0	0	12,918	3,312	0
difference	0	0	0	17,549	0	0
% change	0	0	0	-58	0	0
Natural Gas (therms)						
existing	0	0	0	0	0	0
post-retrofit	2,629	0	0	0	0	0
difference	-2,629	0	0	0	0	0
% change	n/a	0	0	0	0	0
District Steam (MMBtu)						
existing	435	0	0	0	0	1
post-retrofit	0	0	0	0	0	1
difference	435	0	0	0	0	0
% change	-100	0	0	0	0	0
Total (MMBtu)						
existing	435	0	0	104	11	1
post-retrofit	263	0	0	44	11	1
difference	172	0	0	60	0	0
% change	-40	0	0	-58	0	0

Building Type ... Other

Fuel	Heating	Cooling	Vent	Lights	Plugs	Hot Water
Electricity (kw-hr)						
existing	0	0	0	25,204	4,437	0
post-retrofit	0	0	0	9,842	4,437	0
difference	0	0	0	15,363	0	0
% change	0	0	0	-61	0	0
Natural Gas (therms)						
existing	0	0	0	0	0	0
post-retrofit	2,502	0	0	0	0	0
difference	-2,502	0	0	0	0	0
% change	n/a	0	0	0	0	0
District Steam (MMBtu)						
existing	350	0	0	0	0	2
post-retrofit	0	0	0	0	0	2
difference	350	0	0	0	0	0
% change	-100	0	0	0	0	0
Total (MMBtu)						
existing	350	0	0	86	15	2
post-retrofit	250	0	0	34	15	2
difference	99	0	0	52	0	0
% change	-28	0	0	-61	0	0

Appendix B

Preliminary Site Assessment Data

FOREST PRODUCTS LABORATORY WEEKDAY ELECTRIC DEMAND PROFILES

FOREST PRODUCTS LABORATORY WEEKDAY ELECTRIC DEMAND PROFILES

FOREST PRODUCTS LABORATORY WEEKEND ELECTRIC DEMAND PROFILES

FOREST PRODUCTS LABORATORY

Appendix C

Steam Boiler Efficiency Test Reports

2 of 2

BOILER EFFICIENCY TEST REPORT

LOCATION: FOREST PRODUCTS LABORATORY
MADISON, WISCONSIN

APPLIANCE: BOILER #3, CENTRAL PLANT BUILDING 5
35,000 btuh capacity

DATE: JANUARY 29, 1993

CONDITIONS: Testing conducted from 8am until 11am on Friday January 29, 1993. Outdoor temperature ranged from 0 to 5 degrees F, wind speed from 5 - 15 MPH. Central plant steam delivery rates varied from 12 to 18 thousand pounds per hour at 300 psi.

TEST EQUIPMENT: Neotronics Portable Combustion Analyzer and printer. Thermocouple installed at intake air inlet and gas sampling probe inserted in center of south uptake. The Neotronics unit samples the percentage of Oxygen and Carbon Monoxide in the combustion air and the temperature of the air supply and exhaust. From these data, and information on the type of fuel used, the unit computes the % efficiency and displays the percent Oxygen, net temperature rise, percent efficiency, and carbon monoxide parts per million.

TEST PROCEDURE: The Neotronics was calibrated on site using its self calibration routine. The sampling lines were purged by cycling the unit three times before recording values. Three tests were made at the current firing rate (approx 50% fire). Then the boiler was set at low fire for two tests, typical fire (approx 35% fire) for three tests, and maximum fire for three tests. Test results were printed locally. (see attached)

TEST RESULTS: The test results are summarized in the table below for each firing rate and cycle.

Firing Rate	Time of Test	Oxygen (%)	CO (PPM)	Net Temp (F°)	Combustion Efficiency (%)
Low	0940	17.4	114	197	55.2
	0945	17.6	104	181	56.3
Typical	1030	5.3	003	230	79.7
	1036	5.2	001	222	80.2
	1121	5.3	000	218	80.3
Medium	0849	2.4	004	255	80.1
	0854	2.3	003	255	80.2
	0902	2.3	002	251	80.3
Maximum	0952	1.3	064	308	78.5
	0958	1.3	038	325	77.8
	1004	1.2	047	312	78.3

COMBUSTION EFFICIENCY TEST

Boiler #2

On Friday, May 22, 1992, a combustion efficiency test was performed on boiler #2 at the FPL steam plant. The test was done with a Bacharach Fyrizer Model 200. At 8:15 am the boiler was running at about the lowest rate due to the hot weather. A combustion test was run at the low firing rate (gas pressure of 0 PSIG) first and then the gas pressure was raised to 3.3 PSIG on manual control and held steady. The results are shown below.

GAS PRESSURE	%O ₂	NET STACK TEMP.	%EXCESS AIR	%EFFIC.	%CO ₂
0	10.4	394 DEG F	87	75.3	6.0
3.3	0.9	511 DEG F	4	78.8	11.2
3.3	0.9	515 DEG F	4	78.7	11.2

The data indicate that the boiler is operating in an efficient mode and no significant changes in operations are recommended.

Appendix D

Lighting Retrofit Assessment Data

Appendix D

Lighting Retrofit Assessment Data

The Lighting Technology Screening Matrix (LTSM) was applied to develop the lighting retrofit assessment for the FPL. The LTSM was developed in support of the Federal Relighting Initiative (FRI) to assist federal energy managers in their efforts to comply with mandated life-cycle costing for energy equipment investments. The LTSM is a DOS-based software tool that calculates the life-cycle cost of an existing lighting fixture and a large number of potential energy-efficient replacements, both for a one-to one (fixture-for-fixture) replacement and on a lumen-equivalent (equal light output) basis.

The LTSM can be used to evaluate retrofits for many common configurations of fluorescent, incandescent, and exit lighting systems for any level (hours) of operation, blended electricity rate, discount rate, and utility rebate program.

The inputs to the LTSM include the following:

Discount Rate	Average Electrical Rate
State/Census Region	Analysis Period
End-Use Sector	Retrofit or New Project
Labor and Materials	Cost Multipliers (Override Defaults)
Fixture to Analyze	Minimum Lumen Ratio
Annual Operating Hours	Rebate Type

The outputs that the LTSM provides for the existing lighting system and each retrofit alternative are as follows:

Fixture name	Value of 1st year savings
Fixture code	Annualized ballast cost
Activity type	Annualized lamp cost
Lumen ratio	Annualized O&M cost
Watts	Annualized capital cost
Ballast life (yrs)	Annualized energy cost
Lamp life (yrs)	Annualized total cost
Installed cost	Life-cycle cost
Rebate value	Net present value
Annual kWh savings	Levelized energy cost

This appendix provides a listing of the existing fixtures at the FPI where life-cycle-cost-effective retrofits exist. To develop the retrofit recommendations, we used conservative assumptions to ensure that we would not overestimate savings. These assumptions include:

- Lighting systems operating hours were based upon summer measurements -- we expect lighting use to be greater in the winter when the days are shorter.
- A blended rate of 5.5 cents per kWh was used in the analysis.
- Installed costs of the retrofit fixtures included standard regional labor costs/rates -- we expect that much of the installation labor could be provided by in-house (FPL) staff.
- Standard Madison Gas and Electric rebates were applied when the rebate amounts were listed for the technology -- we expect a greater rebate is likely through negotiations, both to acquire and apply rebates under the utility's "custom" rebate (e.g., occupancy sensors) and/or through an overall greater rebate/incentive amount in exchange for delivery of a significant (large) energy resource/peak reduction to the utility through a comprehensive program.
- Present lighting levels are assumed to be maintained or slightly increased -- we believe that lighting levels could be decreased in some locations and still maintain federal recommend levels without adverse impacts.
- Fixture replacement was considered on a one for one basis -- that is the existing fixtures would be retrofitted without rearranging existing fixture configuration.
- Interactions with heating and cooling are not included since the LTSM does not account for these interactive effects. We expect more efficient lighting to reduce (electrical) cooling costs more than they would increase (steam) heating expenses.

Using these assumptions, we identified 2,750 fixtures that can be cost-effectively replaced with more efficient fixtures. The analysis and results are tabulated in the attached spreadsheets.

The first set of pages list the existing equipment and life-cycle-cost (LCC) of this equipment. Each row represents a unique location and technology type. The second set of pages identify the new equipment characteristics and life-cycle-costs (by row number corresponding to the exiting equipment listing). The Levelized Energy Cost indicates the cost of electrical power in terms of dollars per kWh where the energy savings just offset the new technology capital and operating costs. The third set of pages provides estimates of installed costs, utility rebates, annual energy savings, annualized costs, life-cycle cost, and net present value (NPV-the difference between the LCC of the retrofit technology and the existing technology). The value index (VI) is the ratio of the NPV to the installed cost and gives an indication of which technology to install that will give the greatest return on investment.

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FPL LIGHTING WITH REBATES

Existing Equipment

ROW	Bldg	Equipment-type	Code	Location	Capacity	Units	Fuel	Duty Cycle	Annual		Kwh	Energy-cost	Per Unit	# Units	Condition/comments
									Hours	Kw					
1	1	EXIT - INC (2x15)	E2	HALL	30	2		1	8760	0.06	525.60	28.91	782.18	1584.36	PENDENT
2	1	EXIT - INC (2x25)	E7	PUB/STORAGE	50	1	E	1	8760	0.05	438.00	24.09	498.33	498.33	
3	1	EXIT - INC (2x25)	E7	500	50	3	E	1	8760	0.15	1314.00	72.27	498.33	1494.99	RECESSED
4	1	EXIT - INC (2x25)	E7	PHOTO LAB	50	1	E	1	8760	0.05	438.00	24.09	498.33	498.33	
5	1	EXIT - INC (2x25)W	E7	LOBBY	50	4	E	1	8760	0.20	1752.00	96.36	498.33	1993.32	
6	1	EXIT - INC (2x25)	E7	HALL	50	1	E	1	8760	0.05	438.00	24.09	498.33	498.33	
7	1	FL 2X4 4-40 STD	F1	MEN LOCKER	198	2	E	0.01	87.6	0.39	34.34	1.89	12.98	25.92	
8	1	FL 2X4 4-40 STD	F1	G25	198	4	E	0.02	175.2	0.78	137.38	7.55	26.08	104.32	RECESSED
9	1	FL 2X4 4-40 STD	F1	316	198	4	E	0.35	3066	0.78	2403.74	132.21	870.14	3480.56	
10	1	FL 2X4 4-40 STD	F1	203-207	198	4	E	0.35	3066	0.78	2403.74	132.21	870.14	3480.56	RECESSED
11	1	FL 2X4 4-40 STD	F1	422	198	1	E	0.35	3066	0.20	600.94	33.05	870.14	870.14	PENDENT
12	1	FL 2X4 4-40 STD	F1	310	198	1	E	0.35	3066	0.20	600.94	33.05	870.14	870.14	RECESSED
13	1	FL 2X4 4-40 STD	F1	420	198	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	
14	1	FL 2X4 4-40 STD	F1	PUBLISHING	198	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	RECESSED
15	1	FL 2X4 4-40 STD	F1	INSTR LAB	197	2	E	0.35	3066	0.39	1208.00	66.44	870.14	1740.28	20/37/56 1c day/1/2/11/11
16	1	FL 2X4 4-40 STD	F1	309	198	13	E	0.35	3066	2.55	7812.17	429.87	870.14	11311.82	RECESSED W LOUV.
17	1	FL 2X4 2-40 STD	F1	PHOTO LAB	198	4	E	0.35	3066	0.78	2403.74	132.21	870.14	3480.56	
18	1	FL 2X4 4-40 STD	F1	126	198	4	E	0.35	3066	0.78	2403.74	132.21	870.14	3480.56	
19	1	FL 2X4 4-40 STD	F1	130	198	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	RECESSED, LOUV.
20	1	FL 2X4 4-40 STD	F1	212	198	4	E	0.35	3066	0.78	2403.74	132.21	870.14	3480.56	PENDENT
21	1	FL 2X4 4-40 STD FL40	F1	216	198	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	PENDENT
22	1	FL 2X4 4-40 STD	F1	303	198	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	PENDENT
23	1	FL 2X4 4-40 STD	F1	504	198	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	PENDENT
24	1	FL 2X4 4-40 STD	F1	213	198	22	E	0.35	3066	4.31	13220.59	727.13	870.14	19143.08	CEILING PARABOLIC
25	1	FL 2X4 4-40 STD	F1	HUM. EXC.	198	4	E	0.35	3066	0.78	2403.74	132.21	870.14	3480.56	PENDENT
26	1	FL 2X4 4-40 STD	F1	450	198	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	PENDENT
27	1	FL 2X4 4-40 STD	F1	PUB/OFFICE	198	4	E	0.35	3066	0.78	2403.74	132.21	870.14	3480.56	RECESSED
28	1	FL 2X4 4-40 STD	F1	27	198	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	RECESSED
29	1	FL 2X4 4-40 STD	F1	444	198	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	PENDENT
30	1	FL 2X4 4-40 STD	F1	435	198	5	E	0.35	3066	0.96	3004.66	165.26	870.14	4350.7	RECESSED
31	1	FL 2X4 4-40 STD	F1	COPY	198	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	PENDENT
32	1	FL 2X4 4-40 STD	F1	433	198	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	PENDENT
33	1	FL 2X4 4-40 STD	F1	209	198	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	RECESSED
34	1	FL 2X4 4-40 STD	F1	431	198	4	E	0.35	3066	0.78	2403.74	132.21	870.14	3480.56	RECESSED, LOUV.
35	1	FL 2X4 4-40 STD	F1	500	198	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	PENDENT
36	1	FL 2X4 4-40 STD	F1	428	198	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	PENDENT
37	1	FL 2X4 4-40 STD	F1	116	198	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	PENDENT
38	1	FL 2X4 4-40 STD	F1	427	198	4	E	0.35	3066	0.78	2403.74	132.21	870.14	3480.56	RECESSED
39	1	FL 2X4 4-40 STD	F1	3 LUNCH	198	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	PENDENT
40	1	FL 2X4 4-40 STD	F1	426	198	4	E	0.35	3066	0.78	2403.74	132.21	870.14	3480.56	RECESSED
41	1	FL 2X4 4-40 STD	F1	204A	198	4	E	0.35	3066	0.78	2403.74	132.21	870.14	3480.56	PENDENT
42	1	FL 2X4 4-40 STD	F1	143 BB	198	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	RECESSED
43	1	FL 2X4 4-40 STD	F1	261	198	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	69 FC SHADES DOWN
44	1	FL 2X4 4-40 STD	F1	307	198	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	PENDENT

10/7/92
FPL LIGHTING WITH REBATES

ROW	Bldg	Equipment type	Code	Location	Capacity	Units	Fuel	Daily Cycle	Annual Hours	Kw	Kwh	Energy-cost	Per Unit	Life-Cycle Cost	Life Cycle	Condition/comments
45	1	FL 2X4 4-40 STD	F1	204	196	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	RECESSED, LOUV	
46	1	FL 2X4 4-40 STD	F1	210	196	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	PENDENT	
47	1	FL 2X4 4-40 STD	F1	257	196	3	E	0.35	3066	0.59	1802.81	99.15	870.14	2610.42	DIRECTORS OFFICE	
48	1	FL 2X4 4-40 STD	F1	418	196	4	E	0.35	3066	0.78	2403.74	132.21	870.14	3480.56	RECESSED	
49	1	FL 2X4 4-40 STD	F1	305	196	4	E	0.35	3066	0.78	2403.74	132.21	870.14	3480.56	PENDENT	
50	1	FL 2X4 4-40 STD	F1	414	196	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	PENDENT	
51	1	FL 2X4 4-40 STD	F1	256	196	25	E	0.35	3066	4.90	15023.40	826.29	870.14	21753.5		
52	1	FL 2X4 4-40 STD	F1	411	196	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28		
53	1	FL 2X4 4-40 STD	F1	324 LIBRARY	196	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	RECESSED	
54	1	FL 2X4 4-40 STD	F1	410	196	6	E	0.35	3066	1.18	3605.62	198.31	870.14	5220.84	PENDENT	
55	1	FL 2X4 4-40 STD	F1	254	196	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	PENDENT	
56	1	FL 2X4 4-40 STD	F1	407	196	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	RECESSED	
57	1	FL 2X4 4-40 STD	F1	333	196	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	RECESSED	
58	1	FL 2X4 4-40 STD	F1	406/448	196	10	E	0.35	3066	1.96	6009.36	330.51	870.14	8701.4	RECESSED	
59	1	FL 2X4 4-40 STD	F1	250	196	18	E	0.35	3066	3.53	10816.85	584.93	870.14	15862.52	PENDENT	
60	1	FL 2X4 4-40 STD	F1	405	196	4	E	0.35	3066	0.78	2403.74	132.21	870.14	3480.56	RECESSED	
61	1	FL 2X4 4-40 STD	F1	404A	196	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	RECESSED	
62	1	FL 2X4 4-40 STD	F1	325A	196	3	E	0.35	3066	0.59	1802.81	99.15	870.14	2610.42	RECESSED	
63	1	FL 2X4 4-40 STD	F1	25	196	3	E	0.35	3066	0.59	1802.81	99.15	870.14	2610.42	RECESSED	
64	1	FL 2X4 4-40 STD	F1	325	196	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28		
65	1	FL 2X4 4-40 STD	F1	427A	196	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	RECESSED, LOUV.	
66	1	FL 2X4 4-40 STD	F1	324 LIBRARY	196	4	E	0.35	3066	0.78	2403.74	132.21	870.14	3480.56	RECESSED W LOUV.	
67	1	FL 2X4 4-40 STD	F1	246	196	6	E	0.35	3066	1.18	3605.62	198.31	870.14	5220.84	RECESSED	
68	1	FL 2X4 4-40 STD	F1	320	196	4	E	0.35	3066	0.78	2403.74	132.21	870.14	3480.56	RECESSED	
69	1	FL 2X4 4-40 STD	F1	434	196	4	E	0.35	3066	0.78	2403.74	132.21	870.14	3480.56	RECESSED	
70	1	FL 2X4 4-40 STD	F1	319	196	8	E	0.35	3066	1.57	4807.49	264.41	870.14	6961.12		
71	1	FL 2X4 4-40 STD	F1	240	196	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	RECESSED	
72	1	FL 2X4 4-40 STD	F1	318	196	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	PENDENT	
73	1	FL 2X4 4-40 STD	F1	503	196	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	RECESSED, LOUV	
74	1	FL 2X4 4-40 STD	F1	317	196	4	E	0.35	3066	0.78	2403.74	132.21	870.14	3480.56	RECESSED	
75	1	FL 2X4 4-40 STD	F1	238	196	3	E	0.35	3066	0.59	1802.81	99.15	870.14	2610.42	F. NDENT	
76	1	FL 2X4 4-40 STD	F1	258	196	6	E	0.35	3066	1.57	4807.49	264.41	870.14	6961.12	RECESSED, LOUV.	
77	1	FL 2X4 4-40 STD	F1	OFFICES	196	3	E	0.35	3066	0.59	1802.81	99.15	870.14	2610.42	RECESSED	
78	1	FL 2X4 4-40 STD	F1	311	196	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	CEILING RECESSED	
79	1	FL 2X4 4-40 STD	F1	237	196	4	E	0.35	3066	0.78	2403.74	132.21	870.14	3480.56	PENDENT	
80	1	FL 2X4 4-40 STD	F1	310	196	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	PENDENT	
81	1	FL 2X4 4-40 STD	F1	KILN	196	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	PENDENT	
82	1	FL 2X4 4-40 STD	F1	PUBLISHING	196	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28		
83	1	FL 2X4 4-40 STD	F1	236	196	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	PENDENT	
84	1	FL 2X4 4-40 STD	F1	124	196	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28		
85	1	FL 2X4 4-40 STD FL40	F1	114	196	4	E	0.35	3066	0.78	2403.74	132.21	870.14	3480.56	PENDENT	
86	1	FL 2X4 4-40 STD	F1	108	196	4	E	0.35	3066	0.78	2403.74	132.21	870.14	3480.56	RECESSED	
87	1	FL 2X4 4-40 STD	F1	235	196	4	E	0.35	3066	0.78	2403.74	132.21	870.14	3480.56	(ESTIMATE)	
88	1	FL 2X4 4-40 STD	F1	208	196	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	RECESSED	

ROW	Bldg	Equipment type	Code	Location	Capacity	Units	Fuel	Duty Annual			Kwh	Energy-cost	Life Cycle		Condition/comments
								Cycle	Hours	Kw			Cost	Per Unit	
89	1	FL 2X4 4-40 STD	F1	122	196	6	E	0.35	3066	1.16	3605.62	198.31	870.14	5220.84	DIRECTORS OFFICE
90	1	FL 2X4 4-40 STD	F1	230	196	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	PENDENT
91	1	FL 2X4 4-40 STD	F1	233	196	3	E	0.35	3066	0.59	1802.81	99.15	870.14	2810.42	RECESSED
92	1	FL 2X4 4-40 STD	F1	315	196	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	RECESSED
93	1	FL 2X4 4-40 STD	F1	110	196	1	E	0.35	3066	0.20	600.94	33.05	870.14	870.14	RECESSED
94	1	FL 2X4 4-40 STD	F1	327	196	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	W LOUV.
95	1	FL 2X4 4-40 STD	F1	231	196	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	RECESSED
96	1	FL 2X4 4-40 STD	F1	401B	196	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	RECESSED
97	1	FL 2X4 4-40 STD	F1	321	196	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	PENDENT
98	1	FL 2X4 4-40 STD	F1	409	196	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	PENDENT
99	1	FL 2X4 4-40 STD	F1	228B	196	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	RECESSED
100	1	FL 2X4 4-40 STD	F1	428A	196	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	RECESSED, LOUV
101	1	FL 2X4 4-40 STD	F1	403	196	4	E	0.35	3066	0.78	2403.74	132.21	870.14	3480.56	PENDENT
102	1	FL 2X4 4-40 STD	F1	440	196	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	RECESSED
103	1	FL 2X4 4-40 STD	F1	228A	196	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	RECESSED
104	1	FL 2X4 4-40 STD	F1	537	196	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	RECESSED
105	1	FL 2X4 4-40 STD	F1	430	196	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	PENDENT
106	1	FL 2X4 4-40 STD	F1	OFFICES	196	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	RECESSED
107	1	FL 2X4 4-40 STD	F1	227A	196	4	E	0.35	3066	0.78	2403.74	132.21	870.14	3480.56	PENDENT
108	1	FL 2X4 4-40 STD	F1	211	196	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	RECESSED
109	1	FL 2X4 4-40 STD	F1	PHOTO LAB	196	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	RECESSED
110	1	FL 2X4 4-40 STD	F1	128	196	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	PENDENT
111	1	FL 2X4 4-40 STD	F1	227	196	3	E	0.35	3066	0.59	1802.81	99.15	870.14	2810.42	PENDENT
112	1	FL 2X4 4-40 STD	F1	104	196	4	E	0.35	3066	0.78	2403.74	132.21	870.14	3480.56	PENDENT
113	1	FL 2X4 4-40 STD	F1	202	196	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	PENDENT
114	1	FL 2X4 4-40 STD	F1	29	196	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	PENDENT
115	1	FL 2X4 4-40 STD	F1	226	196	12	E	0.35	3066	2.35	7211.23	396.62	870.14	10441.68	RECESSED
116	1	FL 2X4 4-40 STD	F1	331	196	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	W LOUV.
117	1	FL 2X4 4-40 STD	F1	108	196	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	PENDENT
118	1	FL 2X4 4-40 STD	F1	415	196	6	E	0.35	3066	1.18	3605.62	198.31	870.14	5220.84	20' PEND. CEILING
119	1	FL 2X4 4-40 STD	F1	225A	196	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	PENDENT
120	1	FL 2X4 4-40 STD	F1	MESSANGER	196	4	E	0.35	3066	0.78	2403.74	132.21	870.14	3480.56	PENDENT
121	1	FL 2X4 4-40 STD	F1	329	196	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	RECESSED
122	1	FL 2X4 4-40 STD	F1	MECH.	196	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	RECESSED
123	1	FL 2X4 4-40 STD	F1	224	196	3	E	0.35	3066	0.59	1802.81	99.15	870.14	2810.42	RECESSED
124	1	FL 2X4 4-40 STD	F1	119A	196	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	PENDENT
125	1	FL 2X4 4-40 STD	F1	448	196	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	48FC,DL, LOUV.
126	1	FL 2X4 4-40 STD	F1	323	196	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	DIRECTORS OFFICE
127	1	FL 2X4 4-40 STD	F1	221	196	4	E	0.35	3066	0.78	2403.74	132.21	870.14	3480.56	PENDENT
128	1	FL 2X4 4-40 STD	F1	432	196	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28	RECESSED
129	1	FL 2X4 4-40 STD	F1	PUB/OFFICE	196	7	E	0.35	3066	1.37	4206.55	231.36	870.14	6090.98	RECESSED
130	1	FL 2X4 4-40 STD	F1	425	196	4	E	0.35	3066	0.78	2403.74	132.21	870.14	3480.56	RECESSED
131	1	FL 2X4 4-40 STD	F1	215	196	4	E	0.35	3066	0.78	2403.74	132.21	870.14	3480.56	RECESSED
132	1	FL 2X4 4-40 STD	F1	404	196	4	E	0.35	3066	0.78	2403.74	132.21	870.14	3480.56	RECESSED

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ROW	Bldg	Equipment type	Code	Location	Capacity	Units	Fuel	Duty Cycle	Annual Hours	Kwh	Energy-cost	Life Cycle Cost Per Unit	Life Cycle Cost * # Units	Condition/comments
133		1 FL 2X4 4-40 STD	F1	112	196	2	E	0.35	3066	0.39	1201.87	66.10	870.14	1740.28 PENDENT
134		1 FL 2X4 4-40 STD	F1	PHOTO LAB	196	4	E	0.35	3066	0.78	2403.74	132.21	870.14	3480.58 RECESSED
135		1 FL 2X4 4-40 STD	F1	412	196	8	E	0.35	3066	1.57	4807.49	264.41	870.14	6981.12 PENDENT
136		1 FL 2X4 4-40 STD	F1	COPY RM	196	1	E	0.75	6570	0.20	1287.72	70.82	1192.68	1192.68 PENDENT
137		1 FL 2X4 4-40 STD	F1	4TH STOR	196	2	E	0.75	6570	0.39	2375.44	141.65	1192.68	2385.32
138		1 FL 2X4 4-40 STD	F1	SHOP	196	7	E	1	8760	1.37	12018.72	661.03	1595.51	11166.57
139		1 FL 1X8 4-110 STD REF	F158	446	514	6	E	0.35	3066	3.08	9455.54	520.05	1558.82	9352.92
140		1 FL 2X4 3-40 STD	F2	452	147	5	E	0.35	3066	0.74	2253.51	123.94	666.72	3333.6 PENDENT
141		1 FL 2X4 3-40 STD	F2	MENS RM	147	4	E	0.35	3066	0.59	1802.81	99.15	666.72	2666.88 PENDENT
142		1 FL 2X4 3-40 STD	F2	456	147	9	E	0.35	3066	1.32	4056.32	223.10	666.72	6000.48 PENDENT
143		1 FL 2X4 3-40 STD	F2	407	147	3	E	0.9	7884	0.44	3476.84	191.23	1101.21	3303.83 WALL
144		1 CFL 15 WALL FIXT	F215	258	20	1		0.35	3066	0.02	61.32	3.37		0
145		1 CFL 15 WALL FIXT	F215	423	20	2	E	0.35	3066	0.04	122.64	6.75		0 PENDENT
146		1 CLF 13 + BLST UNIT	F252	HALL	18	1	E	0.35	3066	0.02	55.19	3.04		0 PENDENT
147		1 CFL 13 + BLST UNIT	F252	STORAGE	18	8	E	0.35	3066	0.14	441.50	24.28		0 PENDENT
148		1 FL 2X4 2-40 STD	F3	PROCUREMENT	98	6	E	0.01	87.6	0.59	51.51	2.83	6.48	38.88 CEILING
149		1 FL 2X4 2-40 STD	F3	143 B	98	4	E	0.35	3066	0.39	1201.87	66.10	451.52	1806.08 PENDENT
150		1 FL 2X4 2-40 STD	F3	117	98	3	E	0.35	3066	0.29	901.40	49.58	451.52	1354.56
151		1 FL 2X4 2-40 STD	F3	115	98	6	E	0.35	3066	0.59	1802.81	99.15	451.52	2709.12 PENDENT
152		1 FL 2X4 2-40 STD	F3	111(LAB)	98	4	E	0.35	3066	0.38	1201.87	66.10	451.52	1806.08 RECESSED
153		1 FL 2X4 2-40 STD	F3	335	98	13	E	0.35	3066	1.27	3906.08	214.83	451.52	5869.76
154		1 FL 2X4 2-40 STD	F3	HALL	98	16	E	0.35	3066	1.57	4807.49	264.41	451.52	7224.32 132 lc
155		1 FL 2X4 2-40 STD	F3	113	98	4	E	0.35	3066	0.39	1201.87	66.10	451.52	1806.08 PENDENT
156		1 FL 2X4 2-40 STD	F3	324 LIBRARY	98	2	E	0.35	3066	0.20	600.94	33.05	451.52	903.04 PENDENT
157		1 FL 2X4 2-40 STD	F3	101B	98	12	E	0.35	3066	1.18	3605.62	198.31	451.52	5418.24 PENDENT
158		1 FL 2X4 2-40 STD	F3	35	98	3	E	0.35	3066	0.29	901.40	49.58	451.52	1354.56 PENDENT
159		1 FL 2X4 2-40 STD	F3	104	98	4	E	0.35	3066	0.39	1201.87	66.10	451.52	1806.08 PENDENT
160		1 FL 2X4 2-40 STD	F3	441	98	1	E	0.35	3066	0.10	300.47	16.53	451.52	451.52 PENDENT
161		1 FL 2X4 2-40 STD	F3	222	98	2	E	0.35	3066	0.20	600.94	33.05	451.52	903.04 PENDENT
162		1 FL 2X4 2-40 STD	F3	220	98	4	E	0.35	3066	0.39	1201.87	66.10	451.52	1806.08 RECESSED
163		1 FL 2X4 2-40 STD	F3	201	98	2	E	0.35	3066	0.20	600.94	33.05	451.52	903.04 RECESSED
164		1 FL 2X4 2-40 STD	F3	443	98	7	E	0.35	3066	0.69	2103.28	115.68	451.52	3160.64 RECESSED
165		1 FL 2X4 2-40 STD	F3	119C	98	4	E	0.35	3066	0.39	1201.87	66.10	451.52	1806.08 PENDENT
166		1 FL 2X4 2-40 STD	F3	401	98	6	E	0.35	3066	0.59	1802.81	99.15	451.52	2709.12 PENDENT
167		1 FL 2X4 2-40 STD	F3	102	98	2	E	0.35	3066	0.20	600.94	33.05	451.52	903.04 PENDENT
168		1 FL 2X4 2-40 STD	F3	424	98	4		0.35	3066	0.39	1201.87	66.10	451.52	1806.08 RECESSED
169		1 FL 2X4 2-40 STD	F3	31	98	5	E	0.35	3066	0.49	1502.34	82.63	451.52	2257.6 PENDENT
170		1 FL 2X4 2-40 STD	F3	420	98	25	E	0.35	3066	2.45	7511.70	413.14	451.52	11288 RECESSED
171		1 FL 2X4 2-40 STD	F3	4TH STOR	98	2	E	0.9	7884	0.20	1545.26	84.99	745.63	1491.26 PENDENT
172		1 FL 2X4 2-40 STD	F3	PUB/STORAGE	98	1	E		8760	0.10	858.48	47.22	829.6	829.6
173		1 FL 1X4 2-40 STD	F4	CHANGE/STO	98	25	E	0.01	87.6	2.45	214.62	11.80	6.48	162 PENDENT
174		1 FL 1X4 2-40 STD	F4	HUMID #9	98	12	E	0.01	87.6	1.18	103.02	5.67	6.48	77.76 PENDENT
175		1 FL 1X4 2-40 STD	F4	G24	98	40	E	0.2	1752	3.92	6867.84	377.73	155.63	6225.2
176		1 FL 1X4 2-40 STD	F4	240	98	20	E	0.35	3066	1.96	6009.36	330.51	451.52	9030.4 PENDENT

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ROW	Bldg	Equipment type	Code	Location	Capacity	Units	Fuel	Duty Cycle	Annual Hours	Kw	Kwh	Energy cost	Life Cycle Cost		Condition/comments
													Per Unit	# Units	
177	1	FL 1X4 2-40 STD	F4	114	98	80	E	0.35	3066	5.88	18028.08	991.54	451.52	27091.2	CEILING MOUNT
178	1	FL 1X4 2-40 STD	F4	SHOP	98	4	E	0.35	3066	0.39	1201.87	68.10	451.52	1806.08	PENDENT
179	1	FL 1X4 2-40 STD	F4	8	98	6	E	0.35	3066	0.59	1802.81	99.15	451.52	2708.12	PENDENT
180	1	FL 1X4 2-40 STD	F4	146	98	6	E	0.35	3066	0.59	1802.81	99.15	451.52	2708.12	PENDENT
181	1	FL 1X4 2-40 STD	F4	109	98	14	E	0.35	3066	1.37	4206.55	231.36	451.52	6321.26	RECESSED
182	1	FL 1X4 2-40 STD	F4	215	98	11	E	0.35	3066	1.08	3305.15	181.78	451.52	4986.72	RECESSED
183	1	FL 1X4 2-40 STD	F4	43/45	98	6	E	0.35	3066	0.59	1802.81	99.15	451.52	2709.12	PENDENT
184	1	FL 1X4 2-40 STD	F4	214	98	6	E	0.35	3066	0.59	1802.81	99.15	451.52	2708.12	RECESSED
185	1	FL 1X4 2-40 STD	F4	10	98	3	E	0.35	3066	0.29	901.40	48.58	451.52	1354.56	
186	1	FL 1X4 2-40 STD	F4	211	98	4	E	0.35	3066	0.39	1201.87	68.10	451.52	1806.08	PENDENT
187	1	FL 1X4 2-40 STD	F4	PUBLISHING	98	15	E	0.35	3066	0.78	2403.74	132.21	451.52	3612.16	PENDENT
188	1	FL 1X4 2-40 STD	F4	210	98	12	E	0.35	3066	1.47	4507.02	247.89	451.52	6772.6	SUSPENDED
189	1	FL 1X4 2-40 STD	F4	7	98	5	E	0.35	3066	1.16	3605.62	198.31	451.52	5418.24	RECESSED
190	1	FL 1X4 2-40 STD	F4	21	98	5	E	0.35	3066	0.49	1502.34	82.83	451.52	2257.6	RECESSED
191	1	FL 1X4 2-40 STD	F4	223	98	4	E	0.35	3066	0.39	1201.87	68.10	451.52	1806.08	50 55 lc
192	1	FL 1X4 2-40 STD	F4	209	98	5	E	0.35	3066	0.49	1502.34	82.83	451.52	2257.6	RECESSED
193	1	FL 1X4 2-40 STD	F4	WOOD SHOP	98	15	E	0.35	3066	1.47	4507.02	247.89	451.52	6772.6	RECESSED
194	1	FL 1X4 2-40 STD	F4	9	98	6	E	0.35	3066	0.59	1802.81	99.15	451.52	2709.12	PENDENT
195	1	FL 1X4 2-40 STD	F4	413	98	13	E	0.35	3066	1.27	3906.63	214.83	451.52	5889.76	RECESSED
196	1	FL 1X4 2-40 STD	F4	53	98	18	E	0.35	3066	1.76	5408.42	297.46	451.52	8127.36	RECESSED
197	1	FL 1X4 2-40 STD	F4	219	98	12	E	0.35	3066	1.16	3605.62	198.31	451.52	5418.24	PEND. 45 80 lc
198	1	FL 1X4 2-40 STD	F4	252	98	10	E	0.35	3066	0.98	3004.68	165.26	451.52	4515.2	RECESSED
199	1	FL 1X4 2-40 STD	F4	SHOP	98	59	E	0.35	3066	5.78	17727.61	975.02	451.52	26639.68	PENDENT
200	1	FL 1X4 2-40 STD	F4	39	98	4	E	0.35	3066	0.39	1201.87	68.10	451.52	1806.08	
201	1	FL 1X4 2-40 STD	F4	MECH.	98	16	E	0.35	3066	1.57	4807.49	264.41	451.52	7224.32	RECESSED
202	1	FL 1X4 2-40 STD	F4	310A	98	3	E	0.35	3066	0.29	901.40	48.58	451.52	1354.56	RECESSED
203	1	FL 1X4 2-40 STD	F4	48/49A,B	98	1	E	0.35	3066	0.10	300.47	16.53	451.52	451.52	PENDENT
204	1	FL 1X4 2-40 STD	F4	262	98	4	E	0.35	3066	0.39	1201.87	68.10	451.52	1806.08	RECESSED
205	1	FL 1X4 2-40 STD	F4	7	98	4	E	0.35	3066	0.39	1201.87	68.10	451.52	1806.08	RECESSED
206	1	FL 1X4 2-40 STD	F4	248	98	9	E	0.35	3066	0.88	2704.21	148.73	451.52	4063.68	RECESSED
207	1	FL 1X4 2-40 STD	F4	15	98	8	E	0.35	3066	0.78	2403.74	132.21	451.52	3812.16	4 near window, 1 switch
208	1	FL 1X4 2-40 STD	F4	240	98	9	E	0.35	3066	0.88	2704.21	148.73	451.52	4063.68	PENDENT
209	1	FL 1X4 2-40 STD	F4	417	98	16	E	0.35	3066	1.57	4807.49	264.41	451.52	7224.32	RECESSED
210	1	FL 1X4 2-40 STD	F4	217	98	2	E	0.35	3066	0.20	600.94	33.05	451.52	903.04	
211	1	FL 1X4 2-40 STD	F4	301B	98	16	E	0.35	3066	1.76	5408.42	297.46	451.52	8127.36	CEILING MOUNT
212	1	FL 1X4 2-40 STD	F4	140	98	2	E	0.35	3066	0.20	600.94	33.05	451.52	903.04	PENDENT
213	1	FL 1X4 2-40 STD	F4	11A	98	11	E	0.35	3066	1.08	3305.15	181.78	451.52	4986.72	PENDENT
214	1	FL 1X4 2-40 STD	F4	239	98	9	E	0.35	3066	0.88	2704.21	148.73	451.52	4063.68	PENDENT
215	1	FL 1X4 2-40 STD	F4	3 LUNCH	98	4	E	0.35	3066	0.39	1201.87	68.10	451.52	1806.08	RECESSED
216	1	FL 1X4 2-40 STD	F4	145	98	2	E	0.35	3066	0.20	600.94	33.05	451.52	903.04	RECESSED
217	1	FL 1X4 2-40 STD	F4	11	98	2	E	0.35	3066	0.20	600.94	33.05	451.52	903.04	55 lc SHADES SHUT
218	1	FL 1X4 2-40 STD	F4	142	98	9	E	0.35	3066	0.88	2704.21	148.73	451.52	4063.68	PENDENT
219	1	FL 1X4 2-40 STD	F4	212	98	20	E	0.35	3066	1.96	6009.36	330.51	451.52	9030.4	PENDENT
220	1	FL 1X4 2-40 STD	F4	13	98	4	E	0.35	3066	0.39	1201.87	68.10	451.52	1806.08	RECESSED

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ROW	Bldg	Equipment type	Code	Location	Capacity	Units	Fuel	Duty Annual		Kwh	Energy-cost	Life Cycle		Condition/comments
								Cycle	Hours Kw			Cost	Per Unit	
221		1 FL 1X4 2-40 STD.	F4	17	98	3	E	0.35	3066	0.29	49.58	451.52	1354.56	RECESSED
222		1 FL 1X4 2-40 STD	F4	148	98	6	E	0.35	3066	0.59	99.15	451.52	2709.12	PENDENT
223		1 FL 1X4 2-40 STD	F4	313	98	15	E	0.35	3066	1.47	247.89	451.52	8772.8	RECESSED
224		1 FL 1X4 2-40 STD	F4	143	98	3	E	0.35	3066	0.29	49.58	451.52	1354.56	RECESSED
225		1 FL 1X4 2-40 STD	F4	216	98	9	E	0.35	3066	0.88	148.73	451.52	4083.88	CEILING MOUNT
226		1 FL 1X4 2-40 STD	F4	214	98	10	E	0.35	3066	0.98	165.26	451.52	4515.2	RECESSED
227		1 FL 1X4 2-40 STD	F4	141	98	47	E	0.35	3066	4.61	776.71	451.52	21221.44	RECESSED
228		1 FL 1X4 2-40 STD	F4	147	98	10	E	0.35	3066	0.98	165.26	451.52	4515.2	PENDENT
229		1 FL 1X4 2-40 STD	F4	238	98	4	E	0.35	3066	0.39	66.10	451.52	1806.08	RECESSED
230		1 FL 1X4 2-40 STD	F4	HALL	98	17	E	0.35	3066	1.87	280.94	619.65	10534.05	PENDENT
231		1 FL 1X4 2-40 STD	F4	HALL	98	5	E	0.35	3066	0.49	82.63	619.65	3098.25	RECESSED
232		1 FL 1X4 2-40 STD	F4	456	98	4	E	0.35	3066	0.39	66.10	619.65	2478.6	12-20 lc
233		1 FL 1X4 1-40 STD	F5	STAIR	49	1	E	0.35	3066	0.05	8.26	248.08	248.08	TRACK SPOT
234		1 FL 1X4 1-40 STD	F5	HUM. EXC.	49	10	E	0.35	3066	0.49	82.63	248.09	2480.9	CEILING
235		1 FL 1X4 1-40 STD	F5	STAIR	49	1	E	0.35	3066	0.05	8.26	248.09	248.09	TRACK SPOT
236		1 FL 1X4 1-40 STD	F5	HUM. EXC.	49	10	E	0.35	3066	0.49	82.63	248.08	2480.8	CEILING
237		1 FL 1X4 1-40 STD	F5	324 LIBRARY	49	8	E	0.35	3066	0.39	66.10	248.09	1984.72	
238		1 FL 1X4 1-40 STD	F5	324 LIBRARY	49	8	E	0.35	3066	0.39	66.10	248.08	1984.64	
239		1 FL 2X2 2-U STD	F6	METAL SHOP	98	9		7884	0.00	0.00	0.00	886.88	0	
240		1 FL 1X8 4-96 STD	F61	G	350	30	E	0.35	3066	10.50	1770.82	1558.82	46764.6	PENDENT
241		1 FL 1X8 4-96 STD	F61	WOOD SHOP	350	27	E	0.35	3066	9.45	1593.35	1558.82	42088.14	100-120 lc
242		1 INC 60 TABLE LAMP	I12	PUB/STORAGE	60	1	E	0.35	3066	0.08	10.12	380.4	380.4	
243		1 INC 60 CEIL	I2	MECH.	60	2	E	0.01	87.6	0.12	0.56	6.44	12.86	PENDENT
244		1 INC 60 CEIL	I2	HALL	60	3	E	0.35	3066	0.18	30.35	380.4	1141.2	PENDENT
245		1 INC 60 CEIL	I2	LOBBY	60	7	E	0.75	6570	0.42	151.77	518.86	3632.02	PENDENT
246		1 INC 60 CEIL	I2	HALL	60	8	E	0.75	6570	0.48	173.45	518.86	4150.88	PENDENT
247		1 INC 60 CEIL	I2	HALL	60	6	E	0.75	6570	0.36	136.09	518.86	3113.16	PENDENT
248		1 INC 60 CEIL	I2	HALL	60	4	E	0.75	6570	0.24	86.72	518.86	2075.44	PENDENT
249		1 INC 60 CEIL	I2	HALL	60	6	E	0.75	6570	0.36	136.09	518.86	3113.16	SCOUNCES
250		1 INC 60 CEIL	I2	HALL	60	5	E	0.75	6570	0.30	108.41	518.86	2594.3	PENDENT
251		1 INC 60 CEIL	I2	ELEV/PNTHSE	60	1	E	0.9	7884	0.08	26.02	622.71	622.71	CEILING FIXTURE
252		1 INC 200 PEND	I24	STORAGE	200	2	E	0.01	87.6	0.40	1.93	14.1	28.2	PENDENT
253		1 INC 200 PEND	I24	PHOTO LAB	200	1	E	0.01	87.6	0.20	0.96	14.1	14.1	PENDENT
254		1 INC 200 PEND	I24	CLOSET	200	1	E	0.01	87.6	0.20	0.96	14.1	14.1	PENDENT
255		1 INC 200 PEND	I24	CLOSET	200	4	E	0.01	87.6	0.80	3.85	14.1	58.4	PENDENT
256		1 INC 200 PEND	I24	MENS RM	200	2	E	0.35	3066	0.40	67.45	808.73	1617.48	PENDENT
257		1 INC 200 PEND	I24	MAIN LOBBY	200	1	E	0.9	7884	0.20	86.72	1323.65	1323.65	
258		1 75W SPOT	I32	AUDIT.	75	20	E	0.9	7884	1.50	650.43	0	0	PENDENT
259		1 INC 75 CEIL	I5	PHOTO LAB	75	22	E	0.2	1752	1.85	158.99	177.59	3506.98	PENDENT
260		1 INC 75 CEIL	I5	258	75	2	E	0.35	3066	0.15	25.29	489.01	978.02	PENDENT
261		1 INC 75 CEIL	I5	STORAGE	75	1	E	0.35	3066	0.08	12.65	489.01	489.01	PENDENT
262		1 INC 100 CEIL	I8	STORAGE	100	25	E	0.01	87.6	2.50	12.05	10.07	251.75	PENDENT
263		1 INC 100 CEIL	I8	STORAGE	100	4	E	0.01	87.6	0.40	1.93	10.07	40.28	PENDENT
264		1 INC 100 CEIL	I8	CHANGE/STO	100	20	E	0.01	87.6	2.00	9.84	10.07	201.4	PENDENT

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ROW	Bldg	Equipment type	Code	Location	Capacity	Units	Fuel	Duty Cycle	Annual Hours	Kwh	Energy-cost	Life-Cycle Cost Per Unit	Life Cycle Cost	# Units	Condition/comments
265	1	INC 100 CEIL	18	OFFICE	100	30	E	0.2	1752	3.00	5256.00	289.08	210.89	6326.7	PENDENT
266	1	INC 100 CEIL	18	120	100	20	E	0.35	3066	2.00	6132.00	337.26	580.56	11611.6	PENDENT
267	1	INC 100 CEIL	18	SHOP	100	8	E	0.35	3066	0.80	2452.80	134.30	580.56	4644.94	
268	1	INC 100 CEIL	18	HALL	100	2	E	0.35	3066	0.20	613.20	33.73	580.56	1161.16	PENDENT
269	1	INC 100 CEIL	18	MECH.	100	34	E	0.35	3066	3.40	10424.40	573.34	580.56	19739.72	PENDENT
270	1	INC 100 CEIL	18	KILN	100	4	E	0.35	3066	0.40	1226.40	67.45	580.56	2322.32	PENDENT
271	1	INC 100 CEIL	18	1119 SHOP	100	36	E	0.35	3066	3.60	11037.60	607.07	580.56	20800.86	PENDENT
272	1	INC 100 CEIL	18	HALL	100	9	E	0.75	6570	0.90	5913.00	325.22	791.83	7126.47	
273	1	INC 100 CEIL	18	HALL	100	4	E	0.75	6570	0.40	2628.00	144.54	791.83	3167.32	PENDENT
274	1	INC 100 CEIL	18	4TH STOR	100	4	E	0.75	6570	0.40	2628.00	144.54	791.83	3167.32	PENDENT
275	1	INC 100 CEIL	18	Floor 2	100	1	E	1	8760	0.10	876.00	46.18	1055.9	1055.9	
276	1	FL 1X4 2-20 STD	Z1	ELEV.PNTHSE	49	2	E	0.01	87.6	0.10	8.56	0.47	8.48	12.96	CEIL MOUNT
277	1	FL 1X2 4-20 STD	Z1	METAL SHOP	98	2	E	0.35	3066	0.20	609.94	33.05	268.5	537	RECESSED
278	1	FL 1X2 2-20 STD	Z1	446	49	3	E	0.35	3066	0.15	450.70	24.79	268.5	1074	RECESSED
279	1	FL 1X2 2-20 STD	Z1	OFFICE	49	4	E	0.35	3066	0.20	600.94	33.05	268.5	537	PENDENT
280	1	FL 1X2 2-20 STD	Z1	423	49	2	E	0.35	3066	0.10	300.47	16.53	268.5	2416.5	
281	1	FL 1X2 2-20 STD	Z1	WOOD SHOP	49	9	E	0.35	3066	0.44	1352.11	74.37	268.5	1611	PENDENT
282	1	FL 1X2 2-20 STD	Z1	COPY	49	6	E	0.35	3066	0.29	901.40	49.58	268.5	5907	RECESSED
283	1	FL 1X2 2-20 STD	Z1	300	49	22	E	0.35	3066	1.06	3303.15	161.78	268.5	805.5	RECESSED
284	1	FL 1X2 2-20 STD	Z1	242	49	3	E	0.35	3066	0.15	450.70	24.79	268.5	0	PENDENT
285	1	METAL HALIDE	Z10	436	1000	9	E	0.35	3066	9.00	27594.00	1517.67	0	0	PENDENT
286	1	METAL HALIDE	Z10	436	1000	9	E	0.35	3066	9.00	27594.00	1517.67	0	0	PENDENT
287	1	METAL HAL	Z10	MECH. AT STAI	1000	4	E	0.35	3066	4.00	12264.00	674.52	0	0	100-120 lc
288	1	METAL HAL	Z10	MECH. AT STAI	1000	4	E	0.35	3066	4.00	12264.00	674.52	0	0	100-120 lc
289	1	PHOTO LIGHTS	Z11	LAB CHANGE/	5000	1	E	0.05	438	5.00	2190.00	120.45	0	0	
290	1	PHOTO LIGHTS	Z11	LAB CHANGE/	5000	1	E	0.05	438	5.00	2190.00	120.45	0	0	
291	1	FL 1X4 3-40 STD	Z3	454	147	16	E	0.35	3066	2.65	8112.64	446.19	666.7	12000.6	CONFERENCE
292	1	FL 1X4 3-40 STD	Z3	196	147	6	E	0.35	3066	0.86	2704.21	146.73	666.7	4000.2	RECESSED
293	1	FL 1X4 4-40 STD	Z4	438	196	2	E	0.35	3066	0.39	1201.87	66.10	451.51	903.02	PENDENT
294	1	FL 1X4 4-40 STD	Z4	207	196	4	E	0.35	3066	0.78	2403.74	132.21	451.51	1806.04	SUSP. PEND.
295	1	FL 1X4 4-40 STD	Z4	310	196	4	E	0.35	3066	0.78	2403.74	132.21	451.51	1806.04	RECESSED
296	1	FL 1X4 4-40 STD	Z4	206	196	2	E	0.35	3066	0.39	1201.87	66.10	451.51	903.02	
297	1	FL 1X4 4-40 STD	Z4	203	196	4	E	0.35	3066	0.78	2403.74	132.21	451.51	1806.04	RECESSED
298	1	FL 1X4 4-40 STD	Z4	HALL	196	2	E	0.35	3066	0.39	1201.87	66.10	451.51	903.02	
299	1	FL 1X4 4-40 STD	Z4	145A	196	4	E	0.35	3066	0.78	2403.74	132.21	451.51	1806.04	RECESSED
300	1	FL 1X4 4-40 STD	Z4	234	196	6	E	0.35	3066	1.18	3605.62	198.31	451.51	2709.06	RECESSED
301	1	FL 1X4 4-40 STD	Z4	OFFICES	196	2	E	0.35	3066	0.39	1201.87	66.10	451.51	903.02	PENDENT
302	1	FL 1X4 4-40 STD	Z4	232	196	4	E	0.35	3066	0.78	2403.74	132.21	451.51	1806.04	
303	1	FL 1X4 4-40 STD	Z4	228	196	2	E	0.35	3066	0.39	1201.87	66.10	451.51	903.02	RECESSED
304	1	FL 2X2 1-U STD	Z5	Floor 2	49	10	E	0.9	7884	0.49	3863.16	212.47	443.43	4434.3	
305	1	FL 2X2 4-20 STD	Z7	132 A/B	98	6	E	0.35	3066	0.59	1802.81	99.15	537.1	3222.6	DIRECTORS OFFICE
306	1	INC 135 CEIL	Z6	439	135	1	E	0.35	3066	0.14	413.91	22.77	580.55	580.55	
307	29	FL 2X4 4-40 STD	F1	501	196	16	E	0.27	2365	3.14	7417.27	407.95	870.14	13922.24	SURFACE
308	29	FL 2X4 4-40 STD	F1	219	196	5	E	0.27	2365	0.88	2317.90	127.48	870.14	4350.7	

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ROW	Bldg	Equipment type	Code	Location	Capacity	Units	Fuel	Duty Cycle	Annual Hours	Kw	Kwh	Energy cost	Life Cycle Cost Per Unit	Life Cycle Cost	Condition/comments
309	29	FL 2X4 4-40 STD	F1	217	196	8	E	0.27	2365	1.57	3708.63	203.97	870.14	6961.12	
310	29	FL 1X4 2-40 STD	F4	223	98	10	E	0.27	2365	0.98	2317.90	127.48	451.52	4515.2	PENDANT
311	29	FL 1X4 2-40 STD	F4	MEZZ	98	30	E	0.5	4380	2.94	12877.70	708.25	409.44	12283.2	PENDANT
312	29	FL 1X4 2-40 STD	F4	PUBLISHING	98	20	E	0.5	4380	1.96	8584.80	472.16	409.44	8186.8	PENDANT
313	29	FL 1X4 2-40 STD	F4	G45-G47	98	48	E	0.5	4380	4.70	20803.52	1133.19	409.44	19653.12	PENDANT
314	29	MERC	Z9	501	200	192	E	0.5	4380	38.40	168192.00	9250.56	740	142080	PENDANT
315	33	FL 2X4 4-40 STD	F1	252	196	14	E	0.3	2628	2.74	7211.23	396.62	466	6524	RECESSED
316	33	FL 1X4 2-40 STD	F4	111	98	10	E	0.4	3504	0.98	3433.92	188.87	451.52	4515.2	RECESSED
317	33	FL 1X4 2-40 STD	F4	115	98	4	E	0.4	3504	0.39	1373.57	75.55	451.52	1808.08	RECESSED
318	33	FL 1X4 2-40 STD	F4	416	98	10	E	0.4	3504	0.98	3433.92	188.87	451.52	4515.2	RECESSED
319	33	FL 1X4 2-40 STD	F4	117	98	10	E	0.4	3504	0.98	3433.92	188.87	451.52	4515.2	RECESSED
320	33	FL 1X4 2-40 STD	F4	429	98	4	E	0.4	3504	0.39	1373.57	75.55	451.52	1808.08	RECESSED
321	33	FL 1X4 2-40 STD	F4	118	98	4	E	0.4	3504	0.39	1373.57	75.55	451.52	1808.08	RECESSED
322	33	FL 1X4 2-40 STD	F4	HALL	98	10	E	0.4	3504	0.98	3433.92	188.87	451.52	4515.2	
323	33	FL 1X4 2-40 STD	F4	118	98	9	E	0.4	3504	0.88	3080.53	169.98	451.52	4063.08	RECESSED
324	33	FL 1X4 2-40 STD	F4	HALL	98	17	E	0.75	6570	1.87	10945.62	602.01	619.65	10534.05	RECESSED
325	33	FL 1X4 2-40 STD	F4	119	98	10	E	0.4	3504	0.98	3433.92	188.87	451.52	4515.2	RECESSED
326	33	FL 1X4 2-40 STD	F4	INSTR.LAB	98	4	E	0.4	3504	0.39	1373.57	75.55	451.52	1808.08	RECESSED
327	33	FL 1X4 2-40 STD	F4	120	98	20	E	0.4	3504	1.96	6867.84	377.73	451.52	9030.4	RECESSED
328	33	FL 1X4 2-40 STD	F4	MECH.	98	4	E	0.4	3504	0.39	1373.57	75.55	451.52	1808.08	RECESSED
329	33	FL 1X4 2-40 STD	F4	122	98	4	E	0.4	3504	0.39	1373.57	75.55	451.52	1808.08	RECESSED
330	33	FL 1X4 2-40 STD	F4	400	98	4	E	0.4	3504	0.39	1373.57	75.55	451.52	1808.08	RECESSED
331	33	FL 1X4 2-40 STD	F4	123	98	4	E	0.4	3504	0.39	1373.57	75.55	451.52	1808.08	RECESSED
332	33	FL 1X4 2-40 STD	F4	244	98	4	E	0.4	3504	0.39	1373.57	75.55	451.52	1808.08	RECESSED
333	33	FL 1X4 2-40 STD	F4	222	98	20	E	0.4	3504	1.96	6867.84	377.73	451.52	9030.4	RECESSED
334	33	FL 1X4 2-40 STD	F4	224	98	9	E	0.4	3504	0.88	3080.53	169.98	451.52	4063.08	RECESSED
335	33	FL 1X4 2-40 STD	F4	102-107	98	4	E	0.4	3504	0.39	1373.57	75.55	451.52	1808.08	RECESSED
336	33	FL 1X4 2-40 STD	F4	125	98	18	E	0.4	3504	1.76	6181.06	339.96	451.52	8127.38	RECESSED
337	33	FL 1X4 2-40 STD	F4	108	98	4	E	0.4	3504	0.39	1373.57	75.55	451.52	1808.08	PENDANT
338	33	FL 1X4 2-40 STD	F4	127A	98	10	E	0.4	3504	0.98	3433.92	188.87	451.52	4515.2	RECESSED
339	33	FL 1X4 2-40 STD	F4	110	98	8	E	0.4	3504	0.59	2080.35	113.32	451.52	2708.12	RECESSED
340	33	FL 1X4 2-40 STD	F4	134	98	10	E	0.4	3504	0.98	3433.92	188.87	451.52	4515.2	RECESSED
341	33	FL 1X4 2-40 STD	F4	419	98	4	E	0.4	3504	0.39	1373.57	75.55	451.52	1808.08	RECESSED
342	33	FL 1X4 2-40 STD	F4	14	98	4	E	0.4	3504	0.39	1373.57	75.55	451.52	1808.08	RECESSED
343	33	FL 1X4 2-40 STD	F4	HALL	98	11	E	0.75	6570	1.08	7082.46	389.54	619.65	8818.15	RECESSED
344	33	FL 1X4 2-40 STD	F4	15	98	4	E	0.4	3504	0.39	1373.57	75.55	451.52	1808.08	
345	33	FL 1X4 2-40 STD	F4	MAIL FILES	98	10	E	0.4	3504	0.98	3433.92	188.87	451.52	4515.2	RECESSED
346	33	FL 1X4 2-40 STD	F4	16	98	4	E	0.4	3504	0.39	1373.57	75.55	451.52	1808.08	RECESSED
347	33	FL 1X4 2-40 STD	F4	107	98	9	E	0.4	3504	0.88	3080.53	169.98	451.52	4063.08	RECESSED
348	33	FL 1X4 2-40 STD	F4	220	98	20	E	0.4	3504	1.96	6867.84	377.73	451.52	9030.4	RECESSED
349	33	FL 1X4 2-40 STD	F4	17	98	4	E	0.4	3504	0.39	1373.57	75.55	451.52	1808.08	RECESSED
350	33	FL 1X4 2-40 STD	F4	113	98	10	E	0.4	3504	0.98	3433.92	188.87	451.52	4515.2	RECESSED
351	33	FL 1X4 2-40 STD	F4	208	98	10	E	0.4	3504	0.98	3433.92	188.87	451.52	4515.2	RECESSED
352	33	FL 1X4 2-40 STD	F4	HALL	98	18	E	0.75	6570	1.76	11589.48	637.42	619.65	11153.7	RECESSED

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ROW	Bldg	Equipment type	Code	Location	Capacity	Units	Fuel	Duty Cycle	Annual Hours	Kw	Kwh	Energy-cost	Life Cycle Cost		Condition/comments
													Per Unit	# Units	
353	33	FL 1X4 2-40 STD	F4	218	98	18	E	0.4	3504	1.76	6181.06	339.96	451.52	8127.36	RECESSED
354	33	FL 1X4 2-40 STD	F4	108	98	8	E	0.4	3504	0.78	2747.14	151.08	451.52	3812.16	RECESSED
355	33	FL 1X4 2-40 STD	F4	PUBLISHING	98	4	E	0.4	3504	0.39	1373.57	75.55	451.52	1808.08	RECESSED
356	33	FL 1X4 2-40 STD	F4	G	98	5	E	0.3	2828	0.49	1287.72	70.82	240.68	1203.4	RECESSED
357	33	FL 1X4 2-40 STD	F4	218	98	54	E	0.4	3504	5.29	18543.17	1019.87	451.52	24382.08	RECESSED
358	33	FL 1X4 1-40 STD	F5	LOBBY	49	5	E	1	8760	0.25	2146.20	118.04	456.09	2280.45	RECESSED
359	33	INC 60 CEIL	I2	LOBBY	60	30	E	0.8	7884	1.80	14191.20	780.52	622.71	18881.3	RECESSED
360	33	INC 100 CEIL	I8	MECH.	100	18	E	0.4	3504	1.80	6307.20	346.90	580.58	10450.44	RECESSED
361	34	FL 2X4 4-40 STD	F1	408	186	1	E	0.39	3416	0.20	669.81	38.83	870.14	870.14	RECESSED
362	34	FL 1X4 2-40 STD	F4	251	98	20	E	0.39	3416	1.96	6696.14	368.29	451.52	9030.4	RECESSED
363	34	FL 1X4 2-40 STD	F4	215	98	7	E	0.39	3416	0.89	2343.85	128.90	451.52	3180.64	RECESSED
364	34	FL 1X4 2-40 STD	F4	213	98	4	E	0.39	3416	0.39	1339.23	73.66	451.52	1808.08	RECESSED
365	34	FL 1X4 2-40 STD	F4	253	98	20	E	0.39	3416	1.96	6696.14	368.29	451.52	9030.4	RECESSED
366	34	FL 1X4 2-40 STD	F4	203-207	98	10	E	0.39	3416	0.98	3348.07	184.14	451.52	4515.2	RECESSED
367	34	FL 1X4 2-40 STD	F4	41,41A	98	5	E	0.39	3416	0.49	1674.04	92.07	451.52	2257.6	RECESSED
368	34	FL 1X4 2-40 STD	F4	154	98	10	E	0.39	3416	0.98	3348.07	184.14	451.52	4515.2	RECESSED
369	34	FL 1X4 2-40 STD	F4	421	98	10	E	0.39	3416	0.98	3348.07	184.14	451.52	4515.2	RECESSED
370	34	FL 1X4 2-40 STD	F4	153	98	4	E	0.39	3416	0.39	1339.23	73.66	451.52	1808.08	RECESSED
371	34	FL 1X4 2-40 STD	F4	HALL	98	10	E	0.75	6570	0.98	6438.60	354.12	619.65	6196.5	RECESSED
372	34	FL 1X4 2-40 STD	F4	152	98	4	E	0.39	3416	0.39	1339.23	73.66	451.52	1808.08	RECESSED
373	34	FL 1X4 2-40 STD	F4	LIBRARY	98	13	E	0.39	3416	1.27	4352.49	239.39	451.52	5869.76	PENDANT
374	34	FL 1X4 2-40 STD	F4	151	98	4	E	0.39	3416	0.39	1339.23	73.66	451.52	1808.08	RECESSED
375	34	FL 1X4 2-40 STD	F4	MECH	98	10	E	0.39	3416	0.98	3348.07	184.14	451.52	4515.2	RECESSED
376	34	FL 1X4 2-40 STD	F4	150	98	4	E	0.39	3416	0.39	1339.23	73.66	451.52	1808.08	RECESSED
377	34	FL 1X4 2-40 STD	F4	PHOTO LAB	98	10	E	0.39	3416	0.98	3348.07	184.14	451.52	4515.2	RECESSED
378	34	FL 1X4 2-40 STD	F4	149	98	10	E	0.39	3416	0.98	3348.07	184.14	451.52	4515.2	RECESSED
379	34	FL 1X4 2-40 STD	F4	246	98	4	E	0.39	3416	0.39	1339.23	73.66	451.52	1808.08	RECESSED
380	34	FL 1X4 2-40 STD	F4	145-153	98	10	E	0.39	3416	0.98	3348.07	184.14	451.52	4515.2	RECESSED
381	34	FL 1X4 2-40 STD	F4	242	98	4	E	0.39	3416	0.39	1339.23	73.66	451.52	1808.08	RECESSED
382	34	FL 1X4 2-40 STD	F4	139	98	4	E	0.39	3416	0.39	1339.23	73.66	451.52	1808.08	RECESSED
383	34	FL 1X4 2-40 STD	F4	237	98	40	E	0.39	3416	3.92	13392.29	736.58	451.52	1808.08	RECESSED
384	34	FL 1X4 2-40 STD	F4	138	98	4	E	0.39	3416	0.39	1339.23	73.66	451.52	1808.08	RECESSED
385	34	FL 1X4 2-40 STD	F4	235	98	10	E	0.39	3416	0.98	3348.07	184.14	451.52	4515.2	RECESSED
386	34	FL 1X4 2-40 STD	F4	137	98	10	E	0.39	3416	0.98	3348.07	184.14	451.52	4515.2	RECESSED
387	34	FL 1X4 2-40 STD	F4	250	98	4	E	0.39	3416	0.39	1339.23	73.66	451.52	1808.08	RECESSED
388	34	FL 1X4 2-40 STD	F4	136	98	9	E	0.39	3416	0.88	3013.26	165.73	451.52	4083.68	RECESSED
389	34	FL 1X4 2-40 STD	F4	417A	98	9	E	0.39	3416	0.88	3013.26	165.73	451.52	4083.68	RECESSED
390	34	FL 1X4 2-40 STD	F4	135	98	20	E	0.39	3416	1.96	6696.14	368.29	451.52	9030.4	RECESSED
391	34	FL 1X4 2-40 STD	F4	HALL	98	11	E	0.75	6570	1.08	7082.46	389.54	619.65	6816.15	RECESSED
392	34	FL 1X4 2-40 STD	F4	13	98	34	E	0.39	3416	3.33	11383.44	626.09	451.52	15331.68	RECESSED
393	34	FL 1X4 2-40 STD	F4	OFFICE	98	4	E	0.39	3416	0.39	1339.23	73.66	451.52	1808.08	RECESSED
394	34	FL 1X4 2-40 STD	F4	123	98	10	E	0.39	3416	0.98	3348.07	184.14	451.52	4515.2	RECESSED
395	34	FL 1X4 2-40 STD	F4	243	98	10	E	0.39	3416	0.98	3348.07	184.14	451.52	4515.2	RECESSED
396	34	FL 1X4 2-40 STD	F4	121	98	9	E	0.39	3416	0.88	3013.26	165.73	451.52	4083.68	RECESSED

10/7/92
FPL LIGHTING WITH REBATES

ROW	Bldg	Equipment type	Code	Locallon	Capacity	Units	Fuel	Duty Cycle	Annual Hours	Kw	Kwh	Energy cost	Life Cycle Cost Per Unit	Life Cycle Cost	Condition/comments
397	34	FL 1X4 2-40 STD	F4	236	98	4	E	0.39	3416	0.39	1339.23	73.66	451.52	1806.08	RECESSED
398	34	FL 1X4 2-40 STD	F4	12	98	10	E	0.39	3416	0.98	3348.07	184.14	451.52	4515.2	RECESSED
399	34	FL 1X4 2-40 STD	F4	401A	98	10	E	0.39	3416	0.98	3348.07	184.14	451.52	4515.2	RECESSED
400	34	FL 1X4 2-40 STD	F4	118B	98	20	E	0.39	3416	1.96	6696.14	338.29	451.52	9030.4	RECESSED
401	34	FL 1X4 2-40 STD	F4	MECH	98	4	E	0.39	3416	0.39	1339.23	73.66	451.52	1806.08	RECESSED
402	34	FL 1X4 2-40 STD	F4	112	98	40	E	0.39	3416	3.92	13392.29	736.58	451.52	18060.8	RECESSED
403	34	FL 1X4 2-40 STD	F4	241	98	4	E	0.39	3416	0.39	1339.23	73.66	451.52	1806.08	RECESSED
404	34	FL 1X4 2-40 STD	F4	SHOP	98	10	E	0.39	3416	0.98	3348.07	184.14	451.52	4515.2	RECESSED
405	34	FL 1X4 2-40 STD	F4	9	98	4	E	0.39	3416	0.39	1339.23	73.66	451.52	1806.08	RECESSED
406	34	FL 1X4 2-40 STD	F4	221	98	10	E	0.39	3416	0.98	3348.07	184.14	451.52	4515.2	RECESSED
407	34	FL 1X4 2-40 STD	F4	SHOP	98	4	E	0.39	3416	0.39	1339.23	73.66	451.52	1806.08	RECESSED
408	34	FL 1X4 2-40 STD	F4	SHOP OFF.	98	4	E	0.39	3416	0.39	1339.23	73.66	451.52	1806.08	RECESSED
409	34	FL 1X4 2-40 STD	F4	11	98	4	E	0.39	3416	0.39	1339.23	73.66	451.52	1806.08	RECESSED

New Equipment

Retrofit Info with Rebate

ROW Code	Retrofit	Fixture name	Activity Type	Lumen Ratio	Watts	Ballast Life	Lamp Life	Installed Cost	Rebate Value	Annual kWh Savings	Value 1st Yr	Annual O&M Cost			Annual Cost		Life-Cycle Cost	Levelized Energy Cost
												Ballasts	Lamp Total	Energy	Capital	Total		
1 E5	EXIT - LED		LED	1	5	0	0	103.04	30	219	15.05	0	0	0	7.00	227	9.33	0.1489
2 E5	EXIT - LED		EXIT - LED	1	5	0	0	103.04	30	394.2	21.68	0	0	0	7.00	227	9.33	0.0107
3 E5	EXIT - LED		EXIT - LED	1	5	0	0	103.04	30	394.2	21.68	0	0	0	7.00	227	9.33	0.0107
4 E5	EXIT - LED		EXIT - LED	1	5	0	0	103.04	30	394.2	21.68	0	0	0	7.00	227	9.33	0.0107
5 E5	EXIT - LED		EXIT - LED	1	5	0	0	103.04	30	394.2	21.68	0	0	0	7.00	227	9.33	0.0107
6 E5	EXIT - LED		EXIT - LED	1	5	0	0	103.04	30	394.2	21.68	0	0	0	7.00	227	9.33	0.0107
7 NONE																		
8 NONE																		
9 F56	FL2X4.3-T8 ELC REF		DLI+T8+REF+E	0.85	97	19.57	6.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	0.0182
10 F56	FL2X4.3-T8 ELC REF		DLI+T8+REF+E	0.85	97	19.57	6.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	0.0182
11 F56	FL2X4.3-T8 ELC REF		DLI+T8+REF+E	0.85	97	19.57	6.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	0.0182
12 F56	FL2X4.3-T8 ELC REF		DLI+T8+REF+E	0.85	97	19.57	6.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	0.0182
13 F56	FL2X4.3-T8 ELC REF		DLI+T8+REF+E	0.85	97	19.57	6.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	0.0182
14 F56	FL2X4.3-T8 ELC REF		DLI+T8+REF+E	0.85	97	19.57	6.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	0.0182
15 F56	FL2X4.3-T8 ELC REF		DLI+T8+REF+E	0.85	97	19.57	6.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	0.0182
16 F56	FL2X4.3-T8 ELC REF		DLI+T8+REF+E	0.85	97	19.57	6.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	0.0182
17 F56	FL2X4.3-T8 ELC REF		DLI+T8+REF+E	0.85	97	19.57	6.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	0.0182
18 F56	FL2X4.3-T8 ELC REF		DLI+T8+REF+E	0.85	97	19.57	6.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	0.0182
19 F56	FL2X4.3-T8 ELC REF		DLI+T8+REF+E	0.85	97	19.57	6.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	0.0182
20 F56	FL2X4.3-T8 ELC REF		DLI+T8+REF+E	0.85	97	19.57	6.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	0.0182
21 F56	FL2X4.3-T8 ELC REF		DLI+T8+REF+E	0.85	97	19.57	6.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	0.0182
22 F56	FL2X4.3-T8 ELC REF		DLI+T8+REF+E	0.85	97	19.57	6.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	0.0182
23 F56	FL2X4.3-T8 ELC REF		DLI+T8+REF+E	0.85	97	19.57	6.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	0.0182
24 F56	FL2X4.3-T8 ELC REF		DLI+T8+REF+E	0.85	97	19.57	6.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	0.0182
25 F56	FL2X4.3-T8 ELC REF		DLI+T8+REF+E	0.85	97	19.57	6.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	0.0182
26 F56	FL2X4.3-T8 ELC REF		DLI+T8+REF+E	0.85	97	19.57	6.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	0.0182
27 F56	FL2X4.3-T8 ELC REF		DLI+T8+REF+E	0.85	97	19.57	6.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	0.0182
28 F56	FL2X4.3-T8 ELC REF		DLI+T8+REF+E	0.85	97	19.57	6.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	0.0182
29 F56	FL2X4.3-T8 ELC REF		DLI+T8+REF+E	0.85	97	19.57	6.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	0.0182
30 F56	FL2X4.3-T8 ELC REF		DLI+T8+REF+E	0.85	97	19.57	6.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	0.0182
31 F56	FL2X4.3-T8 ELC REF		DLI+T8+REF+E	0.85	97	19.57	6.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	0.0182
32 F56	FL2X4.3-T8 ELC REF		DLI+T8+REF+E	0.85	97	19.57	6.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	0.0182
33 F56	FL2X4.3-T8 ELC REF		DLI+T8+REF+E	0.85	97	19.57	6.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	0.0182
34 F56	FL2X4.3-T8 ELC REF		DLI+T8+REF+E	0.85	97	19.57	6.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	0.0182
35 F56	FL2X4.3-T8 ELC REF		DLI+T8+REF+E	0.85	97	19.57	6.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	0.0182
36 F56	FL2X4.3-T8 ELC REF		DLI+T8+REF+E	0.85	97	19.57	6.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	0.0182
37 F56	FL2X4.3-T8 ELC REF		DLI+T8+REF+E	0.85	97	19.57	6.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	0.0182
38 F56	FL2X4.3-T8 ELC REF		DLI+T8+REF+E	0.85	97	19.57	6.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	0.0182
39 F56	FL2X4.3-T8 ELC REF		DLI+T8+REF+E	0.85	97	19.57	6.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	0.0182
40 F56	FL2X4.3-T8 ELC REF		DLI+T8+REF+E	0.85	97	19.57	6.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	0.0182
41 F56	FL2X4.3-T8 ELC REF		DLI+T8+REF+E	0.85	97	19.57	6.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	0.0182
42 F56	FL2X4.3-T8 ELC REF		DLI+T8+REF+E	0.85	97	19.57	6.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	0.0182
43 F56	FL2X4.3-T8 ELC REF		DLI+T8+REF+E	0.85	97	19.57	6.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	0.0182
44 F56	FL2X4.3-T8 ELC REF		DLI+T8+REF+E	0.85	97	19.57	6.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	0.0182

Retrofit Info with Rebate																			
ROW Code	Retrofit	Fixture name	Activity Type	Lumen Ratio	Ballast Life	Lamp Life	Installed Cost	Rebate Value	Annual kWh	Value 1st Yr	Annual O&M Cost				Annual Cost		Life-Cycle Cost	Levelized Energy Cost	
											Savings	Ballasts	Lamp Total	Capital	Energy	Total			
45	F56	FL 2X4 3-T8 ELC REF	DL1+T8+REF+E	0.85	97	19.57	652	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
46	F56	FL 2X4 3-T8 ELC REF	DL1+T8+REF+E	0.85	97	19.57	652	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
47	F56	FL 2X4 3-T8 ELC REF	DL1+T8+REF+E	0.85	97	19.57	652	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
48	F56	FL 2X4 3-T8 ELC REF	DL1+T8+REF+E	0.85	97	19.57	652	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
49	F56	FL 2X4 3-T8 ELC REF	DL1+T8+REF+E	0.85	97	19.57	652	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
50	F56	FL 2X4 3-T8 ELC REF	DL1+T8+REF+E	0.85	97	19.57	652	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
51	F56	FL 2X4 3-T8 ELC REF	DL1+T8+REF+E	0.85	97	19.57	652	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
52	F56	FL 2X4 3-T8 ELC REF	DL1+T8+REF+E	0.85	97	19.57	652	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
53	F56	FL 2X4 3-T8 ELC REF	DL1+T8+REF+E	0.85	97	19.57	652	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
54	F56	FL 2X4 3-T8 ELC REF	DL1+T8+REF+E	0.85	97	19.57	652	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
55	F56	FL 2X4 3-T8 ELC REF	DL1+T8+REF+E	0.85	97	19.57	652	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
56	F56	FL 2X4 3-T8 ELC REF	DL1+T8+REF+E	0.85	97	19.57	652	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
57	F56	FL 2X4 3-T8 ELC REF	DL1+T8+REF+E	0.85	97	19.57	652	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
58	F56	FL 2X4 3-T8 ELC REF	DL1+T8+REF+E	0.85	97	19.57	652	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
59	F56	FL 2X4 3-T8 ELC REF	DL1+T8+REF+E	0.85	97	19.57	652	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
60	F56	FL 2X4 3-T8 ELC REF	DL1+T8+REF+E	0.85	97	19.57	652	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
61	F56	FL 2X4 3-T8 ELC REF	DL1+T8+REF+E	0.85	97	19.57	652	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
62	F56	FL 2X4 3-T8 ELC REF	DL1+T8+REF+E	0.85	97	19.57	652	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
63	F56	FL 2X4 3-T8 ELC REF	DL1+T8+REF+E	0.85	97	19.57	652	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
64	F56	FL 2X4 3-T8 ELC REF	DL1+T8+REF+E	0.85	97	19.57	652	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
65	F56	FL 2X4 3-T8 ELC REF	DL1+T8+REF+E	0.85	97	19.57	652	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
66	F56	FL 2X4 3-T8 ELC REF	DL1+T8+REF+E	0.85	97	19.57	652	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
67	F56	FL 2X4 3-T8 ELC REF	DL1+T8+REF+E	0.85	97	19.57	652	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
68	F56	FL 2X4 3-T8 ELC REF	DL1+T8+REF+E	0.85	97	19.57	652	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
69	F56	FL 2X4 3-T8 ELC REF	DL1+T8+REF+E	0.85	97	19.57	652	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
70	F56	FL 2X4 3-T8 ELC REF	DL1+T8+REF+E	0.85	97	19.57	652	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
71	F56	FL 2X4 3-T8 ELC REF	DL1+T8+REF+E	0.85	97	19.57	652	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
72	F56	FL 2X4 3-T8 ELC REF	DL1+T8+REF+E	0.85	97	19.57	652	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
73	F56	FL 2X4 3-T8 ELC REF	DL1+T8+REF+E	0.85	97	19.57	652	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
74	F56	FL 2X4 3-T8 ELC REF	DL1+T8+REF+E	0.85	97	19.57	652	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
75	F56	FL 2X4 3-T8 ELC REF	DL1+T8+REF+E	0.85	97	19.57	652	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
76	F56	FL 2X4 3-T8 ELC REF	DL1+T8+REF+E	0.85	97	19.57	652	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
77	F56	FL 2X4 3-T8 ELC REF	DL1+T8+REF+E	0.85	97	19.57	652	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
78	F56	FL 2X4 3-T8 ELC REF	DL1+T8+REF+E	0.85	97	19.57	652	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
79	F56	FL 2X4 3-T8 ELC REF	DL1+T8+REF+E	0.85	97	19.57	652	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
80	F56	FL 2X4 3-T8 ELC REF	DL1+T8+REF+E	0.85	97	19.57	652	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
81	F56	FL 2X4 3-T8 ELC REF	DL1+T8+REF+E	0.85	97	19.57	652	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
82	F56	FL 2X4 3-T8 ELC REF	DL1+T8+REF+E	0.85	97	19.57	652	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
83	F56	FL 2X4 3-T8 ELC REF	DL1+T8+REF+E	0.85	97	19.57	652	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
84	F56	FL 2X4 3-T8 ELC REF	DL1+T8+REF+E	0.85	97	19.57	652	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
85	F56	FL 2X4 3-T8 ELC REF	DL1+T8+REF+E	0.85	97	19.57	652	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
86	F56	FL 2X4 3-T8 ELC REF	DL1+T8+REF+E	0.85	97	19.57	652	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
87	F56	FL 2X4 3-T8 ELC REF	DL1+T8+REF+E	0.85	97	19.57	652	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
88	F56	FL 2X4 3-T8 ELC REF	DL1+T8+REF+E	0.85	97	19.57	652	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182

Retrofill Info with Nebate

ROW ID	Retrolit Code	Fixture name	Activity Type	Lumen Ratio	Ballast Life	Lamp Life	Installed Cost	Rebate Value	Annual kWh	Value \$/kWh	Annual O&M Cost				Life-Cycle Cost	Levelized Energy Cost			
											Savings	Ballasts	Lamp Total	Energy					
																	Annual	Capitol	Total
00	F50	FL 2X4 3-10 ELG REF	DL11+T0+REF+E	0.05	97	19.57	0.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
01	F50	FL 2X4 3-10 ELG REF	DL11+T0+REF+E	0.05	97	19.57	0.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
02	F50	FL 2X4 3-10 ELG REF	DL11+T0+REF+E	0.05	97	19.57	0.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
03	F50	FL 2X4 3-10 ELG REF	DL11+T0+REF+E	0.05	97	19.57	0.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
04	F50	FL 2X4 3-10 ELG REF	DL11+T0+REF+E	0.05	97	19.57	0.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
05	F50	FL 2X4 3-10 ELG REF	DL11+T0+REF+E	0.05	97	19.57	0.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
06	F50	FL 2X4 3-10 ELG REF	DL11+T0+REF+E	0.05	97	19.57	0.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
07	F50	FL 2X4 3-10 ELG REF	DL11+T0+REF+E	0.05	97	19.57	0.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
08	F50	FL 2X4 3-10 ELG REF	DL11+T0+REF+E	0.05	97	19.57	0.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
09	F50	FL 2X4 3-10 ELG REF	DL11+T0+REF+E	0.05	97	19.57	0.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
100	F50	FL 2X4 3-10 ELG REF	DL11+T0+REF+E	0.05	97	19.57	0.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
101	F50	FL 2X4 3-10 ELG REF	DL11+T0+REF+E	0.05	97	19.57	0.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
102	F50	FL 2X4 3-10 ELG REF	DL11+T0+REF+E	0.05	97	19.57	0.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
103	F50	FL 2X4 3-10 ELG REF	DL11+T0+REF+E	0.05	97	19.57	0.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
104	F50	FL 2X4 3-10 ELG REF	DL11+T0+REF+E	0.05	97	19.57	0.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
105	F50	FL 2X4 3-10 ELG REF	DL11+T0+REF+E	0.05	97	19.57	0.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
106	F50	FL 2X4 3-10 ELG REF	DL11+T0+REF+E	0.05	97	19.57	0.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
107	F50	FL 2X4 3-10 ELG REF	DL11+T0+REF+E	0.05	97	19.57	0.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
108	F50	FL 2X4 3-10 ELG REF	DL11+T0+REF+E	0.05	97	19.57	0.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
109	F50	FL 2X4 3-10 ELG REF	DL11+T0+REF+E	0.05	97	19.57	0.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
110	F50	FL 2X4 3-10 ELG REF	DL11+T0+REF+E	0.05	97	19.57	0.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
111	F50	FL 2X4 3-10 ELG REF	DL11+T0+REF+E	0.05	97	19.57	0.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
112	F50	FL 2X4 3-10 ELG REF	DL11+T0+REF+E	0.05	97	19.57	0.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
113	F50	FL 2X4 3-10 ELG REF	DL11+T0+REF+E	0.05	97	19.57	0.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
114	F50	FL 2X4 3-10 ELG REF	DL11+T0+REF+E	0.05	97	19.57	0.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
115	F50	FL 2X4 3-10 ELG REF	DL11+T0+REF+E	0.05	97	19.57	0.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
116	F50	FL 2X4 3-10 ELG REF	DL11+T0+REF+E	0.05	97	19.57	0.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
117	F50	FL 2X4 3-10 ELG REF	DL11+T0+REF+E	0.05	97	19.57	0.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
118	F50	FL 2X4 3-10 ELG REF	DL11+T0+REF+E	0.05	97	19.57	0.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
119	F50	FL 2X4 3-10 ELG REF	DL11+T0+REF+E	0.05	97	19.57	0.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
120	F50	FL 2X4 3-10 ELG REF	DL11+T0+REF+E	0.05	97	19.57	0.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
121	F50	FL 2X4 3-10 ELG REF	DL11+T0+REF+E	0.05	97	19.57	0.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
122	F50	FL 2X4 3-10 ELG REF	DL11+T0+REF+E	0.05	97	19.57	0.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
123	F50	FL 2X4 3-10 ELG REF	DL11+T0+REF+E	0.05	97	19.57	0.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
124	F50	FL 2X4 3-10 ELG REF	DL11+T0+REF+E	0.05	97	19.57	0.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
125	F50	FL 2X4 3-10 ELG REF	DL11+T0+REF+E	0.05	97	19.57	0.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
126	F50	FL 2X4 3-10 ELG REF	DL11+T0+REF+E	0.05	97	19.57	0.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
127	F50	FL 2X4 3-10 ELG REF	DL11+T0+REF+E	0.05	97	19.57	0.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
128	F50	FL 2X4 3-10 ELG REF	DL11+T0+REF+E	0.05	97	19.57	0.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
129	F50	FL 2X4 3-10 ELG REF	DL11+T0+REF+E	0.05	97	19.57	0.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
130	F50	FL 2X4 3-10 ELG REF	DL11+T0+REF+E	0.05	97	19.57	0.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
131	F50	FL 2X4 3-10 ELG REF	DL11+T0+REF+E	0.05	97	19.57	0.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
132	F50	FL 2X4 3-10 ELG REF	DL11+T0+REF+E	0.05	97	19.57	0.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182

Retrolit Info with Rebate

ROW	Code	Activity Type	Lumen Ratio	Ballast Life	Lamp Life	Installed Cost	Rebate Value	Annual kWh Savings	Value 1st Yr Savings	Annual O&M Cost			Annual Cost			Life-Cycle Cost		
										Ballasts	Lamp Total	Energy	Capital	Energy	Total	Cost	Cost	Cost
133	F58	DL1+T8+REF+E	0.85	97	19.37	6.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
134	F58	FL 2X4 3-16 ELC REF																
135	F58	DL1+T8+REF+E	0.85	97	19.37	6.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	397.3	0.0182
136	F58	FL 2X4 3-16 ELC REF																
137	F58	DL1+T8+REF+E	0.85	97	9.13	3.04	131.22	30	650.43	35.77	5.24	4.97	10.21	8.94	33.01	52.16	765.5	0.0071
138	F58	FL 2X4 3-16 ELC REF																
139	F58	DL1+T8+REF+E	0.85	97	9.13	3.04	131.22	30	650.43	35.77	5.24	4.97	10.21	8.94	33.01	52.16	765.5	0.0071
140	F171	FL 1X8 2-110 ELC REF	1.11	199	19.37	3.91	189.27	20	482.97	25.46	1.32	3.39	4.71	12.9	31.6	49.21	722.3	0.0134
140	F9	FL 2X4 2-40 STD REF	1.03	98	14.68	6.52	82.57	5	150.23	8.26	2.4	1.31	3.72	4.26	15.56	23.54	345.5	0.0188
141	F9	FL 2X4 2-40 STD REF	1.03	98	14.68	6.52	82.57	5	150.23	8.26	2.4	1.31	3.72	4.26	15.56	23.54	345.5	0.0188
142	F9	FL 2X4 2-40 STD REF	1.03	98	14.68	6.52	82.57	5	150.23	8.26	2.4	1.31	3.72	4.26	15.56	23.54	345.5	0.0188
143	F9	FL 2X4 2-40 STD REF	1.03	98	5.71	2.54	82.57	5	386.32	21.45	7.22	3.57	10.78	4.26	40.02	55.07	808.2	0.0003
144	NONE																	
145	NONE																	
146	NONE																	
147	NONE																	
148	NONE																	
149	F111	LW+REF+ELC	1.07	63	19.57	6.52	113.72	14	107.31	5.9	0.52	1.16	1.68	7.75	10.01	19.43	285.2	0.0532
150	F111	FL 2X4 2-34 ELC REF																
151	F111	LW+REF+ELC	1.07	63	19.57	6.52	113.72	14	107.31	5.9	0.52	1.16	1.68	7.75	10.01	19.43	285.2	0.0532
152	F111	FL 2X4 2-34 ELC REF																
153	F111	LW+REF+ELC	1.07	63	19.57	6.52	113.72	14	107.31	5.9	0.52	1.16	1.68	7.75	10.01	19.43	285.2	0.0532
154	F111	FL 2X4 2-34 ELC REF																
155	F111	LW+REF+ELC	1.07	63	19.57	6.52	113.72	14	107.31	5.9	0.52	1.16	1.68	7.75	10.01	19.43	285.2	0.0532
156	F111	FL 2X4 2-34 ELC REF																
157	F111	LW+REF+ELC	1.07	63	19.57	6.52	113.72	14	107.31	5.9	0.52	1.16	1.68	7.75	10.01	19.43	285.2	0.0532
158	F111	FL 2X4 2-34 ELC REF																
159	F111	LW+REF+ELC	1.07	63	19.57	6.52	113.72	14	107.31	5.9	0.52	1.16	1.68	7.75	10.01	19.43	285.2	0.0532
160	F111	FL 2X4 2-34 ELC REF																
161	F111	LW+REF+ELC	1.07	63	19.57	6.52	113.72	14	107.31	5.9	0.52	1.16	1.68	7.75	10.01	19.43	285.2	0.0532
162	F111	FL 2X4 2-34 ELC REF																
163	F111	LW+REF+ELC	1.07	63	19.57	6.52	113.72	14	107.31	5.9	0.52	1.16	1.68	7.75	10.01	19.43	285.2	0.0532
164	F111	FL 2X4 2-34 ELC REF																
165	F111	LW+REF+ELC	1.07	63	19.57	6.52	113.72	14	107.31	5.9	0.52	1.16	1.68	7.75	10.01	19.43	285.2	0.0532
166	F111	FL 2X4 2-34 ELC REF																
167	F111	LW+REF+ELC	1.07	63	19.57	6.52	113.72	14	107.31	5.9	0.52	1.16	1.68	7.75	10.01	19.43	285.2	0.0532
168	F111	FL 2X4 2-34 ELC REF																
169	F111	LW+REF+ELC	1.07	63	19.57	6.52	113.72	14	107.31	5.9	0.52	1.16	1.68	7.75	10.01	19.43	285.2	0.0532
170	F111	FL 2X4 2-34 ELC REF																
171	F111	LW+REF+ELC	1.07	63	19.57	6.52	113.72	14	107.31	5.9	0.52	1.16	1.68	7.75	10.01	19.43	285.2	0.0532
172	F111	FL 2X4 2-34 ELC REF																
173	NONE																	
174	NONE																	
175	NONE																	
176	F112	LW+REF+ELC	1.07	63	19.57	6.52	97.02	14	107.31	5.9	0.52	1.16	1.68	6.61	10.01	18.29	268.5	0.0170
177	F112	FL 1X4 2-34 ELC REF																

ROW	Reliofit Code	Fixture name	Activity Type	Lumen Ratio	Ballast Watts	Ballast Life	Lamp Life	Installed Cost	Rebate Value	Annual kWh	Value Savings 1st Yr	Annual O&M Cost			Annual Cost		Life-Cycle Cost	Levelized Energy Cost	
												Ballasts	Lamp Total	Capital	Energy	Total			
177	F112	FL 1X4 2-34 ELC REF	LW+ REF+ELC	1.07	63	19.57	652	97.02	14	107.31	5.9	5.2	1.16	1.08	6.81	10.01	18.29	268.5	0.0126
178	F112	FL 1X4 2-34 ELC REF	LW+ REF+ELC	1.07	63	19.57	652	97.02	14	107.31	5.9	5.2	1.16	1.08	6.81	10.01	18.29	268.5	0.0126
179	F112	FL 1X4 2-34 ELC REF	LW+ REF+ELC	1.07	63	19.57	652	97.02	14	107.31	5.9	5.2	1.16	1.08	6.81	10.01	18.29	268.5	0.0126
180	F112	FL 1X4 2-34 ELC REF	LW+ REF+ELC	1.07	63	19.57	652	97.02	14	107.31	5.9	5.2	1.16	1.08	6.81	10.01	18.29	268.5	0.0126
181	F112	FL 1X4 2-34 ELC REF	LW+ REF+ELC	1.07	63	19.57	652	97.02	14	107.31	5.9	5.2	1.16	1.08	6.81	10.01	18.29	268.5	0.0126
182	F112	FL 1X4 2-34 ELC REF	LW+ REF+ELC	1.07	63	19.57	652	97.02	14	107.31	5.9	5.2	1.16	1.08	6.81	10.01	18.29	268.5	0.0126
183	F112	FL 1X4 2-34 ELC REF	LW+ REF+ELC	1.07	63	19.57	652	97.02	14	107.31	5.9	5.2	1.16	1.08	6.81	10.01	18.29	268.5	0.0126
184	F112	FL 1X4 2-34 ELC REF	LW+ REF+ELC	1.07	63	19.57	652	97.02	14	107.31	5.9	5.2	1.16	1.08	6.81	10.01	18.29	268.5	0.0126
185	F112	FL 1X4 2-34 ELC REF	LW+ REF+ELC	1.07	63	19.57	652	97.02	14	107.31	5.9	5.2	1.16	1.08	6.81	10.01	18.29	268.5	0.0126
186	F112	FL 1X4 2-34 ELC REF	LW+ REF+ELC	1.07	63	19.57	652	97.02	14	107.31	5.9	5.2	1.16	1.08	6.81	10.01	18.29	268.5	0.0126
187	F112	FL 1X4 2-34 ELC REF	LW+ REF+ELC	1.07	63	19.57	652	97.02	14	107.31	5.9	5.2	1.16	1.08	6.81	10.01	18.29	268.5	0.0126
188	F112	FL 1X4 2-34 ELC REF	LW+ REF+ELC	1.07	63	19.57	652	97.02	14	107.31	5.9	5.2	1.16	1.08	6.81	10.01	18.29	268.5	0.0126
189	F112	FL 1X4 2-34 ELC REF	LW+ REF+ELC	1.07	63	19.57	652	97.02	14	107.31	5.9	5.2	1.16	1.08	6.81	10.01	18.29	268.5	0.0126
190	F112	FL 1X4 2-34 ELC REF	LW+ REF+ELC	1.07	63	19.57	652	97.02	14	107.31	5.9	5.2	1.16	1.08	6.81	10.01	18.29	268.5	0.0126
191	F112	FL 1X4 2-34 ELC REF	LW+ REF+ELC	1.07	63	19.57	652	97.02	14	107.31	5.9	5.2	1.16	1.08	6.81	10.01	18.29	268.5	0.0126
192	F112	FL 1X4 2-34 ELC REF	LW+ REF+ELC	1.07	63	19.57	652	97.02	14	107.31	5.9	5.2	1.16	1.08	6.81	10.01	18.29	268.5	0.0126
193	F112	FL 1X4 2-34 ELC REF	LW+ REF+ELC	1.07	63	19.57	652	97.02	14	107.31	5.9	5.2	1.16	1.08	6.81	10.01	18.29	268.5	0.0126
194	F112	FL 1X4 2-34 ELC REF	LW+ REF+ELC	1.07	63	19.57	652	97.02	14	107.31	5.9	5.2	1.16	1.08	6.81	10.01	18.29	268.5	0.0126
195	F112	FL 1X4 2-34 ELC REF	LW+ REF+ELC	1.07	63	19.57	652	97.02	14	107.31	5.9	5.2	1.16	1.08	6.81	10.01	18.29	268.5	0.0126
196	F112	FL 1X4 2-34 ELC REF	LW+ REF+ELC	1.07	63	19.57	652	97.02	14	107.31	5.9	5.2	1.16	1.08	6.81</				

Reetrofit Info with Rebate

ROW Code	Retrofit	Fixture name	Activity Type	Lumen Ratio	Ballast Life	Lamp Life	Installed Cost	Rebate Value	Annual kWh Savings	Value 1st Yr	Annual O&M Cost			Annual Cost		Life Cycle Cost	Levelized Energy Cost
											Ballasts	Lamp Total	Energy	Capital	Total		
221 F112		FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	19.57	652	97.02	14	107.31	5.9	0.52	1.16	6.61	10.01	18.29	0.0426
222 F112		FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	19.57	652	97.02	14	107.31	5.9	0.52	1.16	6.61	10.01	18.29	0.0426
223 F112		FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	19.57	652	97.02	14	107.31	5.9	0.52	1.16	6.61	10.01	18.29	0.0426
224 F112		FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	19.57	652	97.02	14	107.31	5.9	0.52	1.16	6.61	10.01	18.29	0.0426
225 F112		FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	19.57	652	97.02	14	107.31	5.9	0.52	1.16	6.61	10.01	18.29	0.0426
226 F112		FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	19.57	652	97.02	14	107.31	5.9	0.52	1.16	6.61	10.01	18.29	0.0426
227 F112		FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	19.57	652	97.02	14	107.31	5.9	0.52	1.16	6.61	10.01	18.29	0.0426
228 F112		FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	19.57	652	97.02	14	107.31	5.9	0.52	1.16	6.61	10.01	18.29	0.0426
229 F112		FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	19.57	652	97.02	14	107.31	5.9	0.52	1.16	6.61	10.01	18.29	0.0426
230 F112		FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	19.57	652	97.02	14	107.31	5.9	0.52	1.16	6.61	10.01	18.29	0.0426
231 F112		FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	19.57	652	97.02	14	107.31	5.9	0.52	1.16	6.61	10.01	18.29	0.0426
232 F112		FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	19.57	652	97.02	14	107.31	5.9	0.52	1.16	6.61	10.01	18.29	0.0426
233 NONE																	0
234 NONE																	0
235 NONE																	0
236 NONE																	0
237 NONE																	0
238 NONE																	0
239 F54		FL 2X2 2 UT8 ELC	T8+ELC	1.09	58	7.01	1.52	73.12	0	315.36	17.24	4.52	14.6	4.98	23.69	47.74	0.0116
240 F171		FL 1X6 2-110 ELC REF	DL2+HO+REF+E	1.11	199	19.57	3.91	189.27	20	482.97	25.46	1.32	3.39	12.9	31.6	49.21	0.0134
241 F171		FL 1X6 2-110 ELC REF	DL2+HO+REF+E	1.11	199	19.57	3.91	189.27	20	482.97	25.46	1.32	3.39	12.9	31.6	49.21	0.0134
242 F205		CFL 11 + BLST UNIT	CF RETRO (LR 1)	0.83	15	14.66	3.26	26.73	10	137.97	7.59	1.87	1.44	1.82	2.38	7.52	0.0132
243 NONE																	-0.0132
244 F205		CFL 11 + BLST UNIT	CF RETRO (LR 1)	0.83	15	14.66	3.26	26.73	10	137.97	7.59	1.87	1.44	1.82	2.38	7.52	0.0132
245 F205		CFL 11 + BLST UNIT	CF RETRO (LR 1)	0.83	15	6.85	1.52	26.73	10	295.65	16.26	4.01	3.16	1.82	5.1	14.69	-0.0181
246 F205		CFL 11 + BLST UNIT	CF RETRO (LR 1)	0.83	15	6.85	1.52	26.73	10	295.65	16.26	4.01	3.16	1.82	5.1	14.69	-0.0181
247 F205		CFL 11 + BLST UNIT	CF RETRO (LR 1)	0.83	15	6.85	1.52	26.73	10	295.65	16.26	4.01	3.16	1.82	5.1	14.69	-0.0181
248 F205		CFL 11 + BLST UNIT	CF RETRO (LR 1)	0.83	15	6.85	1.52	26.73	10	295.65	16.26	4.01	3.16	1.82	5.1	14.69	-0.0181
249 F205		CFL 11 + BLST UNIT	CF RETRO (LR 1)	0.83	15	6.85	1.52	26.73	10	295.65	16.26	4.01	3.16	1.82	5.1	14.69	-0.0181
250 F205		CFL 11 + BLST UNIT	CF RETRO (LR 1)	0.83	15	6.85	1.52	26.73	10	295.65	16.26	4.01	3.16	1.82	5.1	14.69	-0.0181
251 F205		CFL 11 + BLST UNIT	CF RETRO (LR 1)	0.83	15	5.71	1.27	26.73	10	354.78	19.51	5.02	3.8	1.82	6.13	17.37	-0.0186
252 NONE																	
253 NONE																	
254 NONE																	
255 NONE																	
256 NONE																	
257 NONE																	
258 NONE																	
259 F255		CFL 2.9 + BLST UNIT	CF RETROFIT	0.96	26	25.68	5.71	41.73	10	85.85	4.72	1.08	2.53	2.84	2.36	8.81	0.0135
260 F255		CFL 2.9 + BLST UNIT	CF RETROFIT	0.96	26	14.66	3.26	41.37	10	150.23	8.26	2.55	4.56	2.84	4.13	14.1	0.0116
261 F255		CFL 2.9 + BLST UNIT	CF RETROFIT	0.96	26	14.66	3.26	41.37	10	150.23	8.26	2.55	4.56	2.84	4.13	14.1	0.0116
262 NONE																	
263 NONE																	
264 NONE																	

Retrofit Info with Rebate

ROW Code	Retrofit	Fixture name	Activity Type	Lumen Ratio	Ballast Watts	Ballast Life	Lamp Life	Installed Cost	Rebate Value	Annual kWh Savings	Value 1st Yr	Annual O&M Cost			Annual Cost		Life-Cycle Cost	Levelized Energy Cost
												Ballast	Lamp Total	Capital	Energy	Total		
265 F253	CF RETRO (LR 1)	CFL 27 INTEGRAL UNIT	CF RETRO (LR 1)	0.85	27	5.14	5.14	17.6	5	127.9	7.03	0	2.84	2.84	1.2	2.45	6.48	0.0098
266 F253	CF RETRO (LR 1)	CFL 27 INTEGRAL UNIT	CF RETRO (LR 1)	0.85	27	2.94	2.94	17.6	5	223.82	12.31	0	0.05	5.11	1.2	6.74	16.07	0.015
267 F253	CF RETRO (LR 1)	CFL 27 INTEGRAL UNIT	CF RETRO (LR 1)	0.85	27	2.94	2.94	17.6	5	223.82	12.31	0	0.05	5.11	1.2	6.74	16.07	0.015
268 F253	CF RETRO (LR 1)	CFL 27 INTEGRAL UNIT	CF RETRO (LR 1)	0.85	27	2.94	2.94	17.6	5	223.82	12.31	0	0.05	5.11	1.2	6.74	16.07	0.015
269 F253	CF RETRO (LR 1)	CFL 27 INTEGRAL UNIT	CF RETRO (LR 1)	0.85	27	2.94	2.94	17.6	5	223.82	12.31	0	0.05	5.11	1.2	6.74	16.07	0.015
270 F253	CF RETRO (LR 1)	CFL 27 INTEGRAL UNIT	CF RETRO (LR 1)	0.85	27	2.94	2.94	17.6	5	223.82	12.31	0	0.05	5.11	1.2	6.74	16.07	0.015
271 F253	CF RETRO (LR 1)	CFL 27 INTEGRAL UNIT	CF RETRO (LR 1)	0.85	27	2.94	2.94	17.6	5	223.82	12.31	0	0.05	5.11	1.2	6.74	16.07	0.015
272 F253	CF RETRO (LR 1)	CFL 27 INTEGRAL UNIT	CF RETRO (LR 1)	0.85	27	2.94	2.94	17.6	5	223.82	12.31	0	0.05	5.11	1.2	6.74	16.07	0.015
273 F253	CF RETRO (LR 1)	CFL 27 INTEGRAL UNIT	CF RETRO (LR 1)	0.85	27	1.37	1.37	17.6	5	479.81	26.38	0	11.2	11.15	1.2	9.19	21.54	0.0185
274 F253	CF RETRO (LR 1)	CFL 27 INTEGRAL UNIT	CF RETRO (LR 1)	0.85	27	1.37	1.37	17.6	5	479.81	26.38	0	11.2	11.15	1.2	9.19	21.54	0.0185
275 F253	CF RETRO (LR 1)	CFL 27 INTEGRAL UNIT	CF RETRO (LR 1)	0.85	27	1.03	1.03	17.6	5	639.48	35.17	0	14.9	14.92	1.2	12.25	28.37	0.0183
276 NONE	FL 2X2 2-UT8 ELC		T8+ELC	1.09	29	12.45	2.49	36.56	0	96.36	5.3	0.975	4.25	5.225	2.49	7.235	14.95	0.00855
277 F54	FL 2X2 2-UT8 ELC		T8+ELC	1.09	29	12.45	2.49	36.56	0	96.36	5.3	0.975	4.25	5.225	2.49	7.235	14.95	0.00855
278 F54	FL 2X2 2-UT8 ELC		T8+ELC	1.09	29	12.45	2.49	36.56	0	96.36	5.3	0.975	4.25	5.225	2.49	7.235	14.95	0.00855
279 F54	FL 2X2 2-UT8 ELC		T8+ELC	1.09	29	12.45	2.49	36.56	0	96.36	5.3	0.975	4.25	5.225	2.49	7.235	14.95	0.00855
280 F54	FL 2X2 2-UT8 ELC		T8+ELC	1.09	29	12.45	2.49	36.56	0	96.36	5.3	0.975	4.25	5.225	2.49	7.235	14.95	0.00855
281 F54	FL 2X2 2-UT8 ELC		T8+ELC	1.09	29	12.45	2.49	36.56	0	96.36	5.3	0.975	4.25	5.225	2.49	7.235	14.95	0.00855
282 F54	FL 2X2 2-UT8 ELC		T8+ELC	1.09	29	12.45	2.49	36.56	0	96.36	5.3	0.975	4.25	5.225	2.49	7.235	14.95	0.00855
283 F54	FL 2X2 2-UT8 ELC		T8+ELC	1.09	29	12.45	2.49	36.56	0	96.36	5.3	0.975	4.25	5.225	2.49	7.235	14.95	0.00855
284 F54	FL 2X2 2-UT8 ELC		T8+ELC	1.09	29	12.45	2.49	36.56	0	96.36	5.3	0.975	4.25	5.225	2.49	7.235	14.95	0.00855
285 NONE																		0
286 NONE																		0
287 NONE																		0
288 NONE																		0
289 NONE																		0
290 NONE																		0
291 F9	FL 2X4 2-40 STD REF		DL1+REF	1.03	98	14.68	6.52	62.57	5	150.23	8.26	2.4	1.31	3.72	4.26	15.58	23.54	0.0188
292 F9	FL 2X4 2-40 STD REF		DL1+REF	1.03	98	14.68	6.52	62.57	5	150.23	8.26	2.4	1.31	3.72	4.26	15.58	23.54	0.0188
293 F56	FL 2X4 3-18 ELC REF		DL1+T8+REF+E	0.85	97	19.57	6.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	0.0182
294 F56	FL 2X4 3-18 ELC REF		DL1+T8+REF+E	0.85	97	19.57	6.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	0.0182
295 F56	FL 2X4 3-18 ELC REF		DL1+T8+REF+E	0.85	97	19.57	6.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	0.0182
296 F56	FL 2X4 3-18 ELC REF		DL1+T8+REF+E	0.85	97	19.57	6.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	0.0182
297 F56	FL 2X4 3-18 ELC REF		DL1+T8+REF+E	0.85	97	19.57	6.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	0.0182
298 F56	FL 2X4 3-18 ELC REF		DL1+T8+REF+E	0.85	97	19.57	6.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	0.0182
299 F56	FL 2X4 3-18 ELC REF		DL1+T8+REF+E	0.85	97	19.57	6.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	0.0182
300 F56	FL 2X4 3-18 ELC REF		DL1+T8+REF+E	0.85	97	19.57	6.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	0.0182
301 F56	FL 2X4 3-18 ELC REF		DL1+T8+REF+E	0.85	97	19.57	6.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	0.0182
302 F56	FL 2X4 3-18 ELC REF		DL1+T8+REF+E	0.85	97	19.57	6.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	0.0182
303 F56	FL 2X4 3-18 ELC REF		DL1+T8+REF+E	0.85	97	19.57	6.52	131.22	30	303.53	16.69	0.8	1.92	2.72	8.94	15.41	27.07	0.0182
304 F54	FL 2X2 2-UT8 ELC		T8+ELC	1.09	29	7.61	1.52	36.56	0	157.68	8.67	2.26	7.28	9.535	2.49	11.845	23.87	0.0050
305 F54	FL 2X2 2-UT8 ELC		T8+ELC	1.09	58	12.45	2.49	73.12	0	192.72	10.6	1.95	8.49	10.45	4.98	14.47	29.9	0.0171
306 F253	CF RETRO (LR 1)	CFL 27 INTEGRAL UNIT	CF RETRO (LR 1)	0.85	27	1.67	1.67	22.6	0	351.71	19.34	0	8.13	8.13	1.54	6.74	16.41	0.014
307 F56	FL 2X4 3-18 ELC REF		DL1+T8+REF+E	0.85	97	25.37	8.46	131.22	30	234.14	12.88	0	1.32	1.32	8.94	11.88	22.14	0.019
308 F56	FL 2X4 3-18 ELC REF		DL1+T8+REF+E	0.85	97	25.37	8.46	131.22	30	234.14	12.88	0	1.32	1.32	8.94	11.88	22.14	0.019

Retrofit Info with Rebate

ROW Code	Retrofit	Fixture name	Activity Type	Lumen Ratio	Ballast Life	Temp Life	Installed Cost	Rebate Value	Annual kWh Savings	Value 1st Yr	Annual O&M Cost			Annual Cost		Life-Cycle Cost	Levelized Energy Cost
											Ballasts	Lamp	Total	Capital	Energy		
309 F56	FL 2X4 3-T8 ELC REF	DL1+T8+REF+ELC	0.85	97	2537	946	131.22	30	234.14	12.88	0	1.32	1.32	6.94	11.88	22.14	0.0249
310 F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	2537	846	97.02	14	82.78	4.55	0	0.79	0.79	6.61	7.72	15.12	0.0573
311 F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	13.7	4.57	97.02	14	153.3	8.43	1.59	1.84	3.43	6.61	14.29	24.33	0.0286
312 F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	13.7	4.57	97.02	14	153.3	8.43	1.59	1.84	3.43	6.61	14.29	24.33	0.0286
313 F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	13.7	4.57	97.02	14	153.3	8.43	1.59	1.84	3.43	6.61	14.29	24.33	0.0286
314 Z12	100W TIPS	IPS+TIPS			10274	5479	94	0	351	19305						694	0
315 F56	FL 2X4 3-T8 ELC REF	DL1+T8+REF+ELC	0.85	97	22.83	7.61	131.22	30	260.17	14.31	0.27	1.84	1.81	6.94	13.2	23.96	0.0219
316 F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	17.12	5.71	97.02	14	122.64	6.75	0.87	1.38	2.26	6.61	11.43	20.3	0.0367
317 F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	17.12	5.71	97.02	14	122.64	6.75	0.87	1.38	2.26	6.61	11.43	20.3	0.0367
318 F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	17.12	5.71	97.02	14	122.64	6.75	0.87	1.38	2.26	6.61	11.43	20.3	0.0367
319 F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	17.12	5.71	97.02	14	122.64	6.75	0.87	1.38	2.26	6.61	11.43	20.3	0.0367
320 F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	17.12	5.71	97.02	14	122.64	6.75	0.87	1.38	2.26	6.61	11.43	20.3	0.0367
321 F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	17.12	5.71	97.02	14	122.64	6.75	0.87	1.38	2.26	6.61	11.43	20.3	0.0367
322 F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	17.12	5.71	97.02	14	122.64	6.75	0.87	1.38	2.26	6.61	11.43	20.3	0.0367
323 F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	17.12	5.71	97.02	14	122.64	6.75	0.87	1.38	2.26	6.61	11.43	20.3	0.0367
324 F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	8.13	3.04	97.02	14	229.85	12.85	3.42	2.98	6.4	6.61	21.44	34.45	0.018
325 F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	17.12	5.71	97.02	14	122.64	6.75	0.87	1.38	2.26	6.61	11.43	20.3	0.0367
326 F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	17.12	5.71	97.02	14	122.64	6.75	0.87	1.38	2.26	6.61	11.43	20.3	0.0367
327 F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	17.12	5.71	97.02	14	122.64	6.75	0.87	1.38	2.26	6.61	11.43	20.3	0.0367
328 F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	17.12	5.71	97.02	14	122.64	6.75	0.87	1.38	2.26	6.61	11.43	20.3	0.0367
329 F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	17.12	5.71	97.02	14	122.64	6.75	0.87	1.38	2.26	6.61	11.43	20.3	0.0367
330 F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	17.12	5.71	97.02	14	122.64	6.75	0.87	1.38	2.26	6.61	11.43	20.3	0.0367
331 F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	17.12	5.71	97.02	14	122.64	6.75	0.87	1.38	2.26	6.61	11.43	20.3	0.0367
332 F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	17.12	5.71	97.02	14	122.64	6.75	0.87	1.38	2.26	6.61	11.43	20.3	0.0367
333 F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	17.12	5.71	97.02	14	122.64	6.75	0.87	1.38	2.26	6.61	11.43	20.3	0.0367
334 F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	17.12	5.71	97.02	14	122.64	6.75	0.87	1.38	2.26	6.61	11.43	20.3	0.0367
335 F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	17.12	5.71	97.02	14	122.64	6.75	0.87	1.38	2.26	6.61	11.43	20.3	0.0367
336 F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	17.12	5.71	97.02	14	122.64	6.75	0.87	1.38	2.26	6.61	11.43	20.3	0.0367
337 F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	17.12	5.71	97.02	14	122.64	6.75	0.87	1.38	2.26	6.61	11.43	20.3	0.0367
338 F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	17.12	5.71	97.02	14	122.64	6.75	0.87	1.38	2.26	6.61	11.43	20.3	0.0367
339 F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	17.12	5.71	97.02	14	122.64	6.75	0.87	1.38	2.26	6.61	11.43	20.3	0.0367
340 F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	17.12	5.71	97.02	14	122.64	6.75	0.87	1.38	2.26	6.61	11.43	20.3	0.0367
341 F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	17.12	5.71	97.02	14	122.64	6.75	0.87	1.38	2.26	6.61	11.43	20.3	0.0367
342 F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	17.12	5.71	97.02	14	122.64	6.75	0.87	1.38	2.26	6.61	11.43	20.3	0.0367
343 F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	9.13	3.04	97.02	14	229.85	12.85	3.42	2.98	6.4	6.61	21.44	34.45	0.018
344 F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	17.12	5.71	97.02	14	122.64	6.75	0.87	1.38	2.26	6.61	11.43	20.3	0.0367
345 F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	17.12	5.71	97.02	14	122.64	6.75	0.87	1.38	2.26	6.61	11.43	20.3	0.0367
346 F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	17.12	5.71	97.02	14	122.64	6.75	0.87	1.38	2.26	6.61	11.43	20.3	0.0367
347 F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	17.12	5.71	97.02	14	122.64	6.75	0.87	1.38	2.26	6.61	11.43	20.3	0.0367
348 F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	17.12	5.71	97.02	14	122.64	6.75	0.87	1.38	2.26	6.61	11.43	20.3	0.0367
349 F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	17.12	5.71	97.02	14	122.64	6.75	0.87	1.38	2.26	6.61	11.43	20.3	0.0367
350 F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	17.12	5.71	97.02	14	122.64	6.75	0.87	1.38	2.26	6.61	11.43	20.3	0.0367
351 F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	17.12	5.71	97.02	14	122.64	6.75	0.87	1.38	2.26	6.61	11.43	20.3	0.0367
352 F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	9.13	3.04	97.02	14	229.85	12.85	3.42	2.98	6.4	6.61	21.44	34.45	0.018

Retrofit Info with Rebate

Retrofit ROW Code	Fixture name	Activity Type	Lumen Ratio	Ballast Life	Lamp Life	Installed Cost	Rebate Value	Annual Savings kWh	Value 1st Yr	Annual O&M Cost			Annual Cost		Life- Cycled Energy Cost	
										Ballasts	Lamp Total	Capital	Energy	Total	Cost	Cost
353 F112	FL 1X4 2 34 ELC REF	LW+REF+ELC	1.07	63	17.12	5.71	97.02	14	122.64	0.75	0.87 1.36	2.20	0.61	11.43	203	0.0367
354 F112	FL 1X4 2 34 ELC REF	LW+REF+ELC	1.07	63	17.12	5.71	97.02	14	122.64	0.75	0.87 1.36	2.20	0.61	11.43	203	0.0367
355 F112	FL 1X4 2 34 ELC REF	LW+REF+ELC	1.07	63	17.12	5.71	97.02	14	122.64	0.75	0.87 1.36	2.20	0.61	11.43	203	0.0367
356 NONE																
357 F112	FL 1X4 2 34 ELC REF	LW+REF+ELC	1.07	63	17.12	5.71	97.02	14	122.64	0.75	0.87 1.36	2.20	0.61	11.43	203	0.0367
358 F59	FL 1X4 1 18 ELC REF	T8+REF+ELC	1.14	29	8.85	2.28	98.47	8	175.2	0.64	5.26 2.29	7.55	0.71	13.16	27.42	0.0302
359 F205	CFL 11 + BLST UNIT	CF RETRO (LR 1)	0.83	15	5.71	1.27	20.73	10	354.76	19.51	5.82 3.8	9.42	1.82	6.13	17.37	-0.0188
360 F253	CFL 27 INTEGRAL UNIT	CF RETRO (LR 1)	0.85	27	2.57	2.57	17.6	5	255.78	14.07	0 5.86	5.86	1.2	4.8	11.08	-0.0139
361 F56	FL 2X4 3 18 ELC REF	DL1+T8+REF+ELC	0.85	97	17.56	5.85	131.22	30	336.18	18.6	1.23 2.23	3.46	0.94	17.18	29.58	0.016
362 F112	FL 1X4 2 34 ELC REF	LW+REF+ELC	1.07	63	17.56	5.85	97.02	14	119.56	0.58	0.8 1.34	2.14	0.61	11.15	199	0.0377
363 F112	FL 1X4 2 34 ELC REF	LW+REF+ELC	1.07	63	17.56	5.85	97.02	14	119.56	0.58	0.8 1.34	2.14	0.61	11.15	199	0.0377
364 F112	FL 1X4 2 34 ELC REF	LW+REF+ELC	1.07	63	17.56	5.85	97.02	14	119.56	0.58	0.8 1.34	2.14	0.61	11.15	199	0.0377
365 F112	FL 1X4 2 34 ELC REF	LW+REF+ELC	1.07	63	17.56	5.85	97.02	14	119.56	0.58	0.8 1.34	2.14	0.61	11.15	199	0.0377
366 F112	FL 1X4 2 34 ELC REF	LW+REF+ELC	1.07	63	17.56	5.85	97.02	14	119.56	0.58	0.8 1.34	2.14	0.61	11.15	199	0.0377
367 F112	FL 1X4 2 34 ELC REF	LW+REF+ELC	1.07	63	17.56	5.85	97.02	14	119.56	0.58	0.8 1.34	2.14	0.61	11.15	199	0.0377
368 F112	FL 1X4 2 34 ELC REF	LW+REF+ELC	1.07	63	17.56	5.85	97.02	14	119.56	0.58	0.8 1.34	2.14	0.61	11.15	199	0.0377
369 F112	FL 1X4 2 34 ELC REF	LW+REF+ELC	1.07	63	17.56	5.85	97.02	14	119.56	0.58	0.8 1.34	2.14	0.61	11.15	199	0.0377
370 F112	FL 1X4 2 34 ELC REF	LW+REF+ELC	1.07	63	17.56	5.85	97.02	14	119.56	0.58	0.8 1.34	2.14	0.61	11.15	199	0.0377
371 F112	FL 1X4 2 34 ELC REF	LW+REF+ELC	1.07	63	17.56	5.85	97.02	14	119.56	0.58	0.8 1.34	2.14	0.61	11.15	199	0.0377
372 F112	FL 1X4 2 34 ELC REF	LW+REF+ELC	1.07	63	17.56	5.85	97.02	14	119.56	0.58	0.8 1.34	2.14	0.61	11.15	199	0.0377
373 F112	FL 1X4 2 34 ELC REF	LW+REF+ELC	1.07	63	17.56	5.85	97.02	14	119.56	0.58	0.8 1.34	2.14	0.61	11.15	199	0.0377
374 F112	FL 1X4 2 34 ELC REF	LW+REF+ELC	1.07	63	17.56	5.85	97.02	14	119.56	0.58	0.8 1.34	2.14	0.61	11.15	199	0.0377
375 F112	FL 1X4 2 34 ELC REF	LW+REF+ELC	1.07	63	17.56	5.85	97.02	14	119.56	0.58	0.8 1.34	2.14	0.61	11.15	199	0.0377
376 F112	FL 1X4 2 34 ELC REF	LW+REF+ELC	1.07	63	17.56	5.85	97.02	14	119.56	0.58	0.8 1.34	2.14	0.61	11.15	199	0.0377
377 F112	FL 1X4 2 34 ELC REF	LW+REF+ELC	1.07	63	17.56	5.85	97.02	14	119.56	0.58	0.8 1.34	2.14	0.61	11.15	199	0.0377
378 F112	FL 1X4 2 34 ELC REF	LW+REF+ELC	1.07	63	17.56	5.85	97.02	14	119.56	0.58	0.8 1.34	2.14	0.61	11.15	199	0.0377
379 F112	FL 1X4 2 34 ELC REF	LW+REF+ELC	1.07	63	17.56	5.85	97.02	14	119.56	0.58	0.8 1.34	2.14	0.61	11.15	199	0.0377
380 F112	FL 1X4 2 34 ELC REF	LW+REF+ELC	1.07	63	17.56	5.85	97.02	14	119.56	0.58	0.8 1.34	2.14	0.61	11.15	199	0.0377
381 F112	FL 1X4 2 34 ELC REF	LW+REF+ELC	1.07	63	17.56	5.85	97.02	14	119.56	0.58	0.8 1.34	2.14	0.61	11.15	199	0.0377
382 F112	FL 1X4 2 34 ELC REF	LW+REF+ELC	1.07	63	17.56	5.85	97.02	14	119.56	0.58	0.8 1.34	2.14	0.61	11.15	199	0.0377
383 F112	FL 1X4 2 34 ELC REF	LW+REF+ELC	1.07	63	17.56	5.85	97.02	14	119.56	0.58	0.8 1.34	2.14	0.61	11.15	199	0.0377
384 F112	FL 1X4 2 34 ELC REF	LW+REF+ELC	1.07	63	17.56	5.85	97.02	14	119.56	0.58	0.8 1.34	2.14	0.61	11.15	199	0.0377
385 F112	FL 1X4 2 34 ELC REF	LW+REF+ELC	1.07	63	17.56	5.85	97.02	14	119.56	0.58	0.8 1.34	2.14	0.61	11.15	199	0.0377
386 F112	FL 1X4 2 34 ELC REF	LW+REF+ELC	1.07	63	17.56	5.85	97.02	14	119.56	0.58	0.8 1.34	2.14	0.61	11.15	199	0.0377
387 F112	FL 1X4 2 34 ELC REF	LW+REF+ELC	1.07	63	17.56	5.85	97.02	14	119.56	0.58	0.8 1.34	2.14	0.61	11.15	199	0.0377
388 F112	FL 1X4 2 34 ELC REF	LW+REF+ELC	1.07	63	17.56	5.85	97.02	14	119.56	0.58	0.8 1.34	2.14	0.61	11.15	199	0.0377
389 F112	FL 1X4 2 34 ELC REF	LW+REF+ELC	1.07	63	17.56	5.85	97.02	14	119.56	0.58	0.8 1.34	2.14	0.61	11.15	199	0.0377
390 F112	FL 1X4 2 34 ELC REF	LW+REF+ELC	1.07	63	17.56	5.85	97.02	14	119.56	0.58	0.8 1.34	2.14	0.61	11.15	199	0.0377
391 F112	FL 1X4 2 34 ELC REF	LW+REF+ELC	1.07	63	17.56	5.85	97.02	14	119.56	0.58	0.8 1.34	2.14	0.61	11.15	199	0.0377
392 F112	FL 1X4 2 34 ELC REF	LW+REF+ELC	1.07	63	17.56	5.85	97.02	14	119.56	0.58	0.8 1.34	2.14	0.61	11.15	199	0.0377
393 F112	FL 1X4 2 34 ELC REF	LW+REF+ELC	1.07	63	17.56	5.85	97.02	14	119.56	0.58	0.8 1.34	2.14	0.61	11.15	199	0.0377
394 F112	FL 1X4 2 34 ELC REF	LW+REF+ELC	1.07	63	17.56	5.85	97.02	14	119.56	0.58	0.8 1.34	2.14	0.61	11.15	199	0.0377
395 F112	FL 1X4 2 34 ELC REF	LW+REF+ELC	1.07	63	17.56	5.85	97.02	14	119.56	0.58	0.8 1.34	2.14	0.61	11.15	199	0.0377
396 F112	FL 1X4 2 34 ELC REF	LW+REF+ELC	1.07	63	17.56	5.85	97.02	14	119.56	0.58	0.8 1.34	2.14	0.61	11.15	199	0.0377

Retrofit Info with Rebate

ROW	Retrofit	Fixture name	Activity Type	Lumen Ratio	Ballast Life	Lamp Life	Installed Cost	Rebate Value	Annual kWh	Value Savings 1st Yr	Annual O&M Cost			Annual Cost		Life-Cycle Cost	Levelized Energy Cost		
											Ballasts	Lamp Total	Energy Total	Capital	Energy				
397	F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	17.56	5.85	97.02	14	119.56	6.58	0.8	1.34	2.14	6.61	11.15	19.9	292	0.0377
398	F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	17.56	5.85	97.02	14	119.56	6.58	0.8	1.34	2.14	6.61	11.15	19.9	292	0.0377
399	F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	17.56	5.85	97.02	14	119.56	6.58	0.8	1.34	2.14	6.61	11.15	19.9	292	0.0377
400	F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	17.56	5.85	97.02	14	119.56	6.58	0.8	1.34	2.14	6.61	11.15	19.9	292	0.0377
401	F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	17.56	5.85	97.02	14	119.56	6.58	0.8	1.34	2.14	6.61	11.15	19.9	292	0.0377
402	F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	17.56	5.85	97.02	14	119.56	6.58	0.8	1.34	2.14	6.61	11.15	19.9	292	0.0377
403	F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	17.56	5.85	97.02	14	119.56	6.58	0.8	1.34	2.14	6.61	11.15	19.9	292	0.0377
404	F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	17.56	5.85	97.02	14	119.56	6.58	0.8	1.34	2.14	6.61	11.15	19.9	292	0.0377
405	F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	17.56	5.85	97.02	14	119.56	6.58	0.8	1.34	2.14	6.61	11.15	19.9	292	0.0377
406	F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	17.56	5.85	97.02	14	119.56	6.58	0.8	1.34	2.14	6.61	11.15	19.9	292	0.0377
407	F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	17.56	5.85	97.02	14	119.56	6.58	0.8	1.34	2.14	6.61	11.15	19.9	292	0.0377
408	F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	17.56	5.85	97.02	14	119.56	6.58	0.8	1.34	2.14	6.61	11.15	19.9	292	0.0377
409	F112	FL 1X4 2-34 ELC REF	LW+REF+ELC	1.07	63	17.56	5.85	97.02	14	119.56	6.58	0.8	1.34	2.14	6.61	11.15	19.9	292	0.0377

Analysis with rebate Calculations * # units																
Net Value	Installed Cost	Rebate Value	Annual kWh	Annual Energy Savings (\$)	Value of 1st Year Savings	Annualized O&M Costs			Annualized Costs			Life- Cycle Cost	Net Present Value	Value Index		
						Ballast	Lamp	Total	Capital	Energy	Total					
1	207.28	60	438	24.09	24.1	0	0	0	0	14.12	4.54	18.66	273.88	1280.4	6.23	
2	103.64	30	394.2	21.68	21.68	0	0	0	0	7.06	2.27	9.33	138.94	301.38	3.49	
3	310.82	90	1182.6	65.04	65.04	0	0	0	0	21.18	6.81	27.99	410.82	1084.14	3.49	
4	103.64	30	394.2	21.68	21.68	0	0	0	0	7.06	2.27	9.33	138.94	301.38	3.49	
5	414.58	120	1578.8	88.72	88.72	0	0	0	0	28.24	9.08	37.32	547.76	1445.52	3.49	
6	103.64	30	394.2	21.68	21.68	0	0	0	0	7.06	2.27	9.33	138.94	301.38	3.49	
7	0	0	0	0.00	0	0	0	0	0	0	0	0	0	0	0.00	
8	0	0	0	0.00	0	0	0	0	0	0	0	0	0	0	0.00	
9	524.88	120	1214.12	66.78	66.78	3.2	7.68	10.88	10.88	35.76	61.64	108.28	1589.12	598.88	1.14	
10	524.88	120	1214.12	66.78	66.78	3.2	7.68	10.88	10.88	35.76	61.64	108.28	1589.12	598.88	1.14	
11	131.22	30	303.53	18.69	18.69	0.8	1.92	2.72	2.72	8.94	15.41	27.07	397.28	149.72	1.14	
12	131.22	30	303.53	18.69	18.69	0.8	1.92	2.72	2.72	8.94	15.41	27.07	397.28	149.72	1.14	
13	282.44	60	607.06	33.39	33.39	1.6	3.84	5.44	5.44	17.88	30.82	54.14	794.56	299.44	1.14	
14	282.44	60	607.06	33.39	33.39	1.6	3.84	5.44	5.44	17.88	30.82	54.14	794.56	299.44	1.14	
15	282.44	60	607.06	33.39	33.39	1.6	3.84	5.44	5.44	17.88	30.82	54.14	794.56	299.44	1.14	
16	1705.88	390	3945.89	217.02	216.97	10.4	24.96	35.36	35.36	116.22	200.33	351.91	5164.64	1946.36	1.14	
17	524.88	120	1214.12	66.78	66.78	3.2	7.68	10.88	10.88	35.76	61.64	108.28	1589.12	598.88	1.14	
18	524.88	120	1214.12	66.78	66.78	3.2	7.68	10.88	10.88	35.76	61.64	108.28	1589.12	598.88	1.14	
19	262.44	60	607.06	33.39	33.39	1.6	3.84	5.44	5.44	17.88	30.82	54.14	794.56	299.44	1.14	
20	524.88	120	1214.12	66.78	66.78	3.2	7.68	10.88	10.88	35.76	61.64	108.28	1589.12	598.88	1.14	
21	262.44	60	607.06	33.39	33.39	1.6	3.84	5.44	5.44	17.88	30.82	54.14	794.56	299.44	1.14	
22	262.44	60	607.06	33.39	33.39	1.6	3.84	5.44	5.44	17.88	30.82	54.14	794.56	299.44	1.14	
23	262.44	60	607.06	33.39	33.39	1.6	3.84	5.44	5.44	17.88	30.82	54.14	794.56	299.44	1.14	
24	2888.84	680	6677.88	367.27	367.18	17.6	42.24	59.84	59.84	198.88	339.02	595.54	8740.18	3293.84	1.14	
25	524.88	120	1214.12	66.78	66.78	3.2	7.68	10.88	10.88	35.76	61.64	108.28	1589.12	598.88	1.14	
26	262.44	60	607.06	33.39	33.39	1.6	3.84	5.44	5.44	17.88	30.82	54.14	794.56	299.44	1.14	
27	524.88	120	1214.12	66.78	66.78	3.2	7.68	10.88	10.88	35.76	61.64	108.28	1589.12	598.88	1.14	
28	262.44	60	607.06	33.39	33.39	1.6	3.84	5.44	5.44	17.88	30.82	54.14	794.56	299.44	1.14	
29	262.44	60	607.06	33.39	33.39	1.6	3.84	5.44	5.44	17.88	30.82	54.14	794.56	299.44	1.14	
30	856.1	150	1517.65	83.47	83.45	4	9.6	13.6	13.6	44.7	77.05	135.35	1986.4	748.6	1.14	
31	262.44	60	607.06	33.39	33.39	1.6	3.84	5.44	5.44	17.88	30.82	54.14	794.56	299.44	1.14	
32	262.44	60	607.06	33.39	33.39	1.6	3.84	5.44	5.44	17.88	30.82	54.14	794.56	299.44	1.14	
33	262.44	60	607.06	33.39	33.39	1.6	3.84	5.44	5.44	17.88	30.82	54.14	794.56	299.44	1.14	
34	524.88	120	1214.12	66.78	66.78	3.2	7.68	10.88	10.88	35.76	61.64	108.28	1589.12	598.88	1.14	
35	262.44	60	607.06	33.39	33.39	1.6	3.84	5.44	5.44	17.88	30.82	54.14	794.56	299.44	1.14	
36	262.44	60	607.06	33.39	33.39	1.6	3.84	5.44	5.44	17.88	30.82	54.14	794.56	299.44	1.14	
37	262.44	60	607.06	33.39	33.39	1.6	3.84	5.44	5.44	17.88	30.82	54.14	794.56	299.44	1.14	
38	524.88	120	1214.12	66.78	66.78	3.2	7.68	10.88	10.88	35.76	61.64	108.28	1589.12	598.88	1.14	
39	262.44	60	607.06	33.39	33.39	1.6	3.84	5.44	5.44	17.88	30.82	54.14	794.56	299.44	1.14	
40	524.88	120	1214.12	66.78	66.78	3.2	7.68	10.88	10.88	35.76	61.64	108.28	1589.12	598.88	1.14	
41	524.88	120	1214.12	66.78	66.78	3.2	7.68	10.88	10.88	35.76	61.64	108.28	1589.12	598.88	1.14	
42	262.44	60	607.06	33.39	33.39	1.6	3.84	5.44	5.44	17.88	30.82	54.14	794.56	299.44	1.14	
43	262.44	60	607.06	33.39	33.39	1.6	3.84	5.44	5.44	17.88	30.82	54.14	794.56	299.44	1.14	
44	262.44	60	607.06	33.39	33.39	1.6	3.84	5.44	5.44	17.88	30.82	54.14	794.56	299.44	1.14	

Analysis with rebate
Calculations • # units

Net Value	Net Present Value	Installed Cost	Rebate Value	Annual kWh Savings	Annual Energy Savings (\$)	Value of 1st Year Savings	Annualized O&M Costs			Annualized Costs			Life- Cycle Cost	Net Present Value	Value Index
							Ballast	Lamp	Total	Capital	Energy	Total			
45	149.72	262.44	60	607.06	33.39	33.38	1.6	3.64	5.44	17.66	30.82	54.14	794.56	299.44	1.14
46	149.72	262.44	60	607.06	33.39	33.38	1.6	3.84	5.44	17.66	30.82	54.14	794.56	299.44	1.14
47	149.72	303.66	90	910.59	50.08	50.07	2.4	5.76	8.16	26.82	46.23	81.21	1191.84	449.16	1.14
48	149.72	524.88	120	1214.12	66.78	66.76	3.2	7.68	10.88	35.76	61.64	108.28	1569.12	598.88	1.14
49	149.72	524.88	120	1214.12	66.78	66.76	3.2	7.68	10.88	35.76	61.64	108.28	1569.12	598.88	1.14
50	149.72	262.44	60	607.06	33.39	33.38	1.6	3.64	5.44	17.66	30.82	54.14	794.56	299.44	1.14
51	149.72	3280.5	750	7568.25	417.35	417.25	20	48	68	223.5	385.25	678.75	9832	3743	1.14
52	149.72	262.44	60	607.06	33.39	33.38	1.6	3.84	5.44	17.66	30.82	54.14	794.56	299.44	1.14
53	149.72	262.44	60	607.06	33.39	33.38	1.6	3.84	5.44	17.66	30.82	54.14	794.56	299.44	1.14
54	149.72	787.32	180	1821.18	100.18	100.14	4.8	11.52	16.32	53.64	92.46	162.42	2363.68	898.32	1.14
55	149.72	262.44	60	607.06	33.39	33.38	1.6	3.84	5.44	17.66	30.82	54.14	794.56	299.44	1.14
56	149.72	262.44	60	607.06	33.39	33.38	1.6	3.84	5.44	17.66	30.82	54.14	794.56	299.44	1.14
57	149.72	262.44	60	607.06	33.39	33.38	1.6	3.84	5.44	17.66	30.82	54.14	794.56	299.44	1.14
58	149.72	1312.2	300	3035.3	166.94	166.9	8	19.2	27.2	69.4	154.1	270.7	3972.8	1497.2	1.14
59	149.72	2361.96	540	5463.54	300.48	300.42	14.4	34.56	48.96	180.92	277.38	467.26	7151.04	2694.96	1.14
60	149.72	524.88	120	1214.12	66.78	66.76	3.2	7.68	10.88	35.76	61.64	108.28	1569.12	598.88	1.14
61	149.72	262.44	60	607.06	33.39	33.38	1.6	3.84	5.44	17.66	30.82	54.14	794.56	299.44	1.14
62	149.72	393.66	90	910.59	50.08	50.07	2.4	5.76	8.16	26.82	46.23	81.21	1191.84	449.16	1.14
63	149.72	393.66	90	910.59	50.08	50.07	2.4	5.76	8.16	26.82	46.23	81.21	1191.84	449.16	1.14
64	149.72	262.44	60	607.06	33.39	33.38	1.6	3.84	5.44	17.66	30.82	54.14	794.56	299.44	1.14
65	149.72	262.44	60	607.06	33.39	33.38	1.6	3.84	5.44	17.66	30.82	54.14	794.56	299.44	1.14
66	149.72	524.88	120	1214.12	66.78	66.76	3.2	7.68	10.88	35.76	61.64	108.28	1569.12	598.88	1.14
67	149.72	787.32	180	1821.18	100.18	100.14	4.8	11.52	16.32	53.64	92.46	162.42	2363.68	898.32	1.14
68	149.72	524.88	120	1214.12	66.78	66.76	3.2	7.68	10.88	35.76	61.64	108.28	1569.12	598.88	1.14
69	149.72	524.88	120	1214.12	66.78	66.76	3.2	7.68	10.88	35.76	61.64	108.28	1569.12	598.88	1.14
70	149.72	1049.76	240	2428.24	133.55	133.52	8.4	15.36	21.76	71.52	123.28	216.56	3178.24	1197.76	1.14
71	149.72	262.44	60	607.06	33.39	33.38	1.6	3.84	5.44	17.66	30.82	54.14	794.56	299.44	1.14
72	149.72	262.44	60	607.06	33.39	33.38	1.6	3.84	5.44	17.66	30.82	54.14	794.56	299.44	1.14
73	149.72	262.44	60	607.06	33.39	33.38	1.6	3.84	5.44	17.66	30.82	54.14	794.56	299.44	1.14
74	149.72	524.88	120	1214.12	66.78	66.76	3.2	7.68	10.88	35.76	61.64	108.28	1569.12	598.88	1.14
75	149.72	393.66	90	910.59	50.08	50.07	2.4	5.76	8.16	26.82	46.23	81.21	1191.84	449.16	1.14
76	149.72	1049.76	240	2428.24	133.55	133.52	8.4	15.36	21.76	71.52	123.28	216.56	3178.24	1197.76	1.14
77	149.72	393.66	90	910.59	50.08	50.07	2.4	5.76	8.16	26.82	46.23	81.21	1191.84	449.16	1.14
78	149.72	262.44	60	607.06	33.39	33.38	1.6	3.84	5.44	17.66	30.82	54.14	794.56	299.44	1.14
79	149.72	524.88	120	1214.12	66.78	66.76	3.2	7.68	10.88	35.76	61.64	108.28	1569.12	598.88	1.14
80	149.72	262.44	60	607.06	33.39	33.38	1.6	3.64	5.44	17.66	30.82	54.14	794.56	299.44	1.14
81	149.72	262.44	60	607.06	33.39	33.38	1.6	3.84	5.44	17.66	30.82	54.14	794.56	299.44	1.14
82	149.72	262.44	60	607.06	33.39	33.38	1.6	3.84	5.44	17.66	30.82	54.14	794.56	299.44	1.14
83	149.72	262.44	60	607.06	33.39	33.38	1.6	3.84	5.44	17.66	30.82	54.14	794.56	299.44	1.14
84	149.72	262.44	60	607.06	33.39	33.38	1.6	3.84	5.44	17.66	30.82	54.14	794.56	299.44	1.14
85	149.72	524.88	120	1214.12	66.78	66.76	3.2	7.68	10.88	35.76	61.64	108.28	1569.12	598.88	1.14
86	149.72	524.88	120	1214.12	66.78	66.76	3.2	7.68	10.88	35.76	61.64	108.28	1569.12	598.88	1.14
87	149.72	524.88	120	1214.12	66.78	66.76	3.2	7.68	10.88	35.76	61.64	108.28	1569.12	598.88	1.14
88	149.72	262.44	60	607.06	33.39	33.38	1.6	3.84	5.44	17.66	30.82	54.14	794.56	299.44	1.14

Analysis with rebate
Calculations * # units

Net NOW Present Value	Installed Cost	Rebate Value	Annual kWh	Annual Savings	Annual Energy Savings (\$)	Value of 1st Year Savings	Annualized O&M Costs			Annualized Costs			Life- Cycle Cost	Net Present Value	Value Index
							Ballast	Lamp	Total	Capital	Energy	Total			
89	149.72	180	1821.18	100.16	100.16	100.14	4.8	11.52	16.32	53.64	92.46	162.42	2363.86	898.32	1.14
90	149.72	60	607.06	33.39	33.39	33.38	1.6	3.84	5.44	17.88	30.82	54.14	794.56	289.44	1.14
91	149.72	80	810.59	50.06	50.06	50.07	2.4	5.76	8.16	26.82	46.23	81.21	1181.84	449.16	1.14
92	149.72	80	607.06	33.39	33.39	33.38	1.6	3.84	5.44	17.88	30.82	54.14	794.56	289.44	1.14
93	149.72	30	303.53	16.68	16.68	16.69	0.8	1.82	2.72	8.94	15.41	27.07	397.28	149.72	1.14
94	149.72	80	607.06	33.39	33.39	33.38	1.6	3.84	5.44	17.88	30.82	54.14	794.56	289.44	1.14
95	149.72	80	607.06	33.39	33.39	33.38	1.6	3.84	5.44	17.88	30.82	54.14	794.56	289.44	1.14
96	149.72	80	607.06	33.39	33.39	33.38	1.6	3.84	5.44	17.88	30.82	54.14	794.56	289.44	1.14
97	149.72	80	607.06	33.39	33.39	33.38	1.6	3.84	5.44	17.88	30.82	54.14	794.56	289.44	1.14
98	149.72	80	607.06	33.39	33.39	33.38	1.6	3.84	5.44	17.88	30.82	54.14	794.56	289.44	1.14
99	149.72	80	607.06	33.39	33.39	33.38	1.6	3.84	5.44	17.88	30.82	54.14	794.56	289.44	1.14
100	149.72	80	607.06	33.39	33.39	33.38	1.6	3.84	5.44	17.88	30.82	54.14	794.56	289.44	1.14
101	149.72	120	1214.12	66.76	66.76	66.76	3.2	7.68	10.88	35.76	61.64	108.28	1589.12	598.88	1.14
102	149.72	80	607.06	33.39	33.39	33.38	1.6	3.84	5.44	17.88	30.82	54.14	794.56	289.44	1.14
103	149.72	80	607.06	33.39	33.39	33.38	1.6	3.84	5.44	17.88	30.82	54.14	794.56	289.44	1.14
104	149.72	80	607.06	33.39	33.39	33.38	1.6	3.84	5.44	17.88	30.82	54.14	794.56	289.44	1.14
105	149.72	80	607.06	33.39	33.39	33.38	1.6	3.84	5.44	17.88	30.82	54.14	794.56	289.44	1.14
106	149.72	80	607.06	33.39	33.39	33.38	1.6	3.84	5.44	17.88	30.82	54.14	794.56	289.44	1.14
107	149.72	120	1214.12	66.76	66.76	66.76	3.2	7.68	10.88	35.76	61.64	108.28	1589.12	598.88	1.14
108	149.72	80	607.06	33.39	33.39	33.38	1.6	3.84	5.44	17.88	30.82	54.14	794.56	289.44	1.14
109	149.72	80	607.06	33.39	33.39	33.38	1.6	3.84	5.44	17.88	30.82	54.14	794.56	289.44	1.14
110	149.72	80	607.06	33.39	33.39	33.38	1.6	3.84	5.44	17.88	30.82	54.14	794.56	289.44	1.14
111	149.72	80	607.06	33.39	33.39	33.38	1.6	3.84	5.44	17.88	30.82	54.14	794.56	289.44	1.14
112	149.72	120	1214.12	66.76	66.76	66.76	3.2	7.68	10.88	35.76	61.64	108.28	1589.12	598.88	1.14
113	149.72	80	607.06	33.39	33.39	33.38	1.6	3.84	5.44	17.88	30.82	54.14	794.56	289.44	1.14
114	149.72	80	607.06	33.39	33.39	33.38	1.6	3.84	5.44	17.88	30.82	54.14	794.56	289.44	1.14
115	149.72	360	3642.36	200.33	200.33	200.28	9.6	23.04	32.64	107.26	184.92	324.84	4767.36	1796.94	1.14
116	149.72	80	607.06	33.39	33.39	33.38	1.6	3.84	5.44	17.88	30.82	54.14	794.56	289.44	1.14
117	149.72	80	607.06	33.39	33.39	33.38	1.6	3.84	5.44	17.88	30.82	54.14	794.56	289.44	1.14
118	149.72	180	1821.18	100.16	100.16	100.14	4.8	11.52	16.32	53.64	92.46	162.42	2363.86	898.32	1.14
119	149.72	80	607.06	33.39	33.39	33.38	1.6	3.84	5.44	17.88	30.82	54.14	794.56	289.44	1.14
120	149.72	120	1214.12	66.76	66.76	66.76	3.2	7.68	10.88	35.76	61.64	108.28	1589.12	598.88	1.14
121	149.72	80	607.06	33.39	33.39	33.38	1.6	3.84	5.44	17.88	30.82	54.14	794.56	289.44	1.14
122	149.72	80	607.06	33.39	33.39	33.38	1.6	3.84	5.44	17.88	30.82	54.14	794.56	289.44	1.14
123	149.72	90	910.59	50.06	50.06	50.07	2.4	5.76	8.16	26.82	46.23	81.21	1181.84	449.16	1.14
124	149.72	80	607.06	33.39	33.39	33.38	1.6	3.84	5.44	17.88	30.82	54.14	794.56	289.44	1.14
125	149.72	80	607.06	33.39	33.39	33.38	1.6	3.84	5.44	17.88	30.82	54.14	794.56	289.44	1.14
126	149.72	80	607.06	33.39	33.39	33.38	1.6	3.84	5.44	17.88	30.82	54.14	794.56	289.44	1.14
127	149.72	120	1214.12	66.76	66.76	66.76	3.2	7.68	10.88	35.76	61.64	108.28	1589.12	598.88	1.14
128	149.72	80	607.06	33.39	33.39	33.38	1.6	3.84	5.44	17.88	30.82	54.14	794.56	289.44	1.14
129	149.72	210	2124.71	116.86	116.86	116.83	5.6	13.44	19.04	62.58	107.87	189.48	2780.86	1048.04	1.14
130	149.72	120	1214.12	66.76	66.76	66.76	3.2	7.68	10.88	35.76	61.64	108.28	1589.12	598.88	1.14
131	149.72	120	1214.12	66.76	66.76	66.76	3.2	7.68	10.88	35.76	61.64	108.28	1589.12	598.88	1.14
132	149.72	120	1214.12	66.76	66.76	66.76	3.2	7.68	10.88	35.76	61.64	108.28	1589.12	598.88	1.14

Analysis with rebate
Calculations - # units

IOW	Net Present Value	Installed Cost	Rebate Value	kWh Savings	Energy Savings (\$)	1st Year			Total	Capital	Energy	Total	Cost	Value	Index
						Savings	Baltest	Lamp							
133	149.72	262.44	60	607.06	33.39	33.36	1.6	3.64	5.44	17.56	30.82	54.14	794.56	299.44	1.14
134	149.72	524.88	120	1214.12	66.78	66.76	3.2	7.68	10.88	35.76	61.64	108.28	1588.12	598.88	1.14
135	149.72	1049.76	240	2428.24	133.55	133.52	6.4	15.36	21.76	71.52	123.28	216.56	3176.24	1197.76	1.14
136	427.11	131.22	30	650.43	35.77	35.77	5.24	4.97	10.21	8.94	33.01	52.16	765.53	427.11	3.25
137	427.11	262.44	60	1300.86	71.55	71.54	10.48	9.94	20.42	17.88	66.02	104.32	1531.06	854.22	3.25
138	598.94	916.54	210	6070.58	333.89	333.9	58.49	48.09	104.85	62.58	308.07	475.3	6975.78	4192.58	4.56
139	261.12	1135.62	120	2777.82	152.76	152.76	7.92	20.34	26.26	77.4	189.6	295.26	4333.74	1566.72	1.38
140	72.84	312.85	25	751.15	41.31	41.3	12	6.55	16.6	21.3	77.8	117.7	1727.7	364.2	1.16
141	72.84	250.28	20	600.92	33.05	33.04	9.6	5.24	14.88	17.04	62.24	94.16	1382.16	291.36	1.16
142	72.84	563.13	45	1352.07	74.36	74.34	21.6	11.79	33.46	36.34	140.04	211.66	3109.66	655.56	1.16
143	291.98	187.71	15	1158.96	63.74	64.35	21.06	10.71	32.34	12.78	120.06	185.21	2424.6	875.94	4.67
144		0	0	0	0.00	0	0	0	0	0	0	0	0	0	0.00
145		0	0	0	0.00	0	0	0	0	0	0	0	0	0	0.00
146		0	0	0	0.00	0	0	0	0	0	0	0	0	0	0.00
147		0	0	0	0.00	0	0	0	0	0	0	0	0	0	0.00
148		0	0	0	0.00	0	0	0	0	0	0	0	0	0	0.00
149	-2.22	454.88	56	429.24	23.61	23.6	2.08	4.64	6.72	31	40.04	77.72	1140.76	-8.88	-0.02
150	-2.22	341.16	42	321.93	17.71	17.7	1.56	3.46	5.04	23.25	30.03	56.29	855.57	-6.66	-0.02
151	-2.22	682.32	84	643.66	35.41	35.4	3.12	6.96	10.08	46.5	60.06	116.58	1711.14	-13.32	-0.02
152	-2.22	454.88	56	429.24	23.61	23.6	2.08	4.64	6.72	31	40.04	77.72	1140.76	-8.88	-0.02
153	-2.22	1476.36	182	1395.03	76.73	76.7	6.76	15.08	21.84	100.75	130.13	252.59	3707.47	-28.86	-0.02
154	-2.22	1819.52	224	1716.96	94.43	94.4	8.32	18.56	26.88	124	160.16	310.88	4563.04	-35.52	-0.02
155	-2.22	454.88	56	429.24	23.61	23.6	2.08	4.64	6.72	31	40.04	77.72	1140.76	-8.88	-0.02
156	-2.22	227.44	28	214.62	11.60	11.6	1.04	2.32	3.36	15.5	20.02	36.86	570.38	-4.44	-0.02
157	-2.22	1364.64	168	1287.72	70.82	70.8	6.24	13.92	20.16	83	120.12	233.16	3422.28	-26.64	-0.02
158	-2.22	341.16	42	321.93	17.71	17.7	1.56	3.46	5.04	23.25	30.03	56.29	855.57	-6.66	-0.02
159	-2.22	454.88	56	429.24	23.61	23.6	2.08	4.64	6.72	31	40.04	77.72	1140.76	-8.88	-0.02
160	-2.22	113.72	14	107.31	5.90	5.9	0.52	1.16	1.68	7.75	10.01	19.43	285.19	-2.22	-0.02
161	-2.22	227.44	28	214.62	11.60	11.6	1.04	2.32	3.36	15.5	20.02	36.86	570.38	-4.44	-0.02
162	-2.22	454.88	56	429.24	23.61	23.6	2.08	4.64	6.72	31	40.04	77.72	1140.76	-8.88	-0.02
163	-2.22	227.44	28	214.62	11.60	11.6	1.04	2.32	3.36	15.5	20.02	36.86	570.38	-4.44	-0.02
164	-2.22	796.04	98	751.17	41.31	41.3	3.64	8.12	11.76	54.25	70.07	136.01	1986.33	-15.54	-0.02
165	-2.22	454.88	56	429.24	23.61	23.6	2.08	4.64	6.72	31	40.04	77.72	1140.76	-8.88	-0.02
166	-2.22	682.32	84	643.66	35.41	35.4	3.12	6.96	10.08	46.5	60.06	116.58	1711.14	-13.32	-0.02
167	-2.22	227.44	28	214.62	11.60	11.6	1.04	2.32	3.36	15.5	20.02	36.86	570.38	-4.44	-0.02
168	-2.22	454.88	56	429.24	23.61	23.6	2.08	4.64	6.72	31	40.04	77.72	1140.76	-8.88	-0.02
169	-2.22	568.6	70	536.55	29.51	29.5	2.6	5.8	8.4	38.75	50.05	97.15	1425.95	-11.1	-0.02
170	-2.22	2843	350	2882.75	147.55	147.5	13	29	42	183.75	250.25	465.75	7129.75	-55.5	-0.02
171	134.06	227.44	28	551.86	30.35	30.36	9.04	7.34	16.36	15.5	51.46	83.34	1223.14	268.12	1.18
172	158.51	113.72	14	308	16.83	16.86	5.26	4.13	9.39	7.75	28.59	45.72	671.72	158.51	1.39
173		0	0	0	0.00	0	0	0	0	0	0	0	0	0	0.00
174		0	0	0	0.00	0	0	0	0	0	0	0	0	0	0.00
175		0	0	0	0.00	0	0	0	0	0	0	0	0	0	0.00
176	14.49	1940.4	280	2146.2	116.04	118	10.4	23.2	33.6	132.2	200.2	365.6	5369.6	269.6	0.15

Analysis with rebate
Calculations - # units

ROW	Net Present Value	Calculations - # units										Annualized O&M Costs					Annualized Costs			Life-Cycle Cost	Net Present Value	Value Index
		Installed Cost	Rebate Value	Annual kWh Savings	Annual Energy Savings (\$)	Value of 1st Year Savings	Annualized O&M Costs			Annualized Costs												
							Ballast	Lamp	Total	Capital	Energy	Total										
177	14.49	5821.2	840	6438.6	354.12	354	31.2	69.6	100.8	396.6	600.6	1097.4	16108.6	869.4	0.15	0.15						
178	14.49	388.08	56	429.24	23.61	23.6	2.08	4.64	6.72	26.44	40.04	73.16	1073.92	57.96	0.15	0.15						
179	14.49	582.12	84	643.86	35.41	35.4	3.12	6.96	10.08	39.66	60.06	109.74	1610.86	86.94	0.15	0.15						
180	14.49	582.12	84	643.86	35.41	35.4	3.12	6.96	10.08	39.66	60.06	109.74	1610.86	86.94	0.15	0.15						
181	14.49	1358.28	196	1502.34	82.63	82.6	7.28	16.24	23.52	92.54	140.14	256.06	3758.72	202.86	0.15	0.15						
182	14.49	1067.22	154	1180.41	64.92	64.9	5.72	12.76	18.48	72.71	110.11	201.19	2953.28	159.39	0.15	0.15						
183	14.49	582.12	84	643.86	35.41	35.4	3.12	6.96	10.08	39.66	60.06	109.74	1610.86	86.94	0.15	0.15						
184	14.49	582.12	84	643.86	35.41	35.4	3.12	6.96	10.08	39.66	60.06	109.74	1610.86	86.94	0.15	0.15						
185	14.49	291.06	42	321.93	17.71	17.7	1.56	3.48	5.04	19.83	30.03	54.87	805.44	43.47	0.15	0.15						
186	14.49	388.08	56	429.24	23.61	23.6	2.08	4.64	6.72	26.44	40.04	73.16	1073.92	57.96	0.15	0.15						
187	14.49	776.16	112	858.48	47.22	47.2	4.16	9.28	13.44	52.88	80.08	146.32	2147.84	115.92	0.15	0.15						
188	14.49	1455.3	210	1609.65	88.53	88.5	7.8	17.4	25.2	99.15	150.15	274.35	4027.2	217.35	0.15	0.15						
189	14.49	1164.24	168	1287.72	70.82	70.8	6.24	13.92	20.16	79.32	120.12	219.48	3221.76	173.88	0.15	0.15						
190	14.49	485.1	70	536.55	29.51	29.5	2.6	5.8	8.4	33.05	50.05	91.45	1342.4	72.45	0.15	0.15						
191	14.49	388.08	56	429.24	23.61	23.6	2.08	4.64	6.72	26.44	40.04	73.16	1073.92	57.96	0.15	0.15						
192	14.49	485.1	70	536.55	29.51	29.5	2.6	5.8	8.4	33.05	50.05	91.45	1342.4	72.45	0.15	0.15						
193	14.49	1455.3	210	1609.65	88.53	88.5	7.8	17.4	25.2	99.15	150.15	274.35	4027.2	217.35	0.15	0.15						
194	14.49	582.12	84	643.86	35.41	35.4	3.12	6.96	10.08	39.66	60.06	109.74	1610.86	86.94	0.15	0.15						
195	14.49	1261.26	182	1395.03	78.73	78.7	6.76	15.08	21.84	85.93	130.13	237.77	3490.24	186.37	0.15	0.15						
196	14.49	1746.36	252	1931.58	108.24	108.2	9.36	20.88	30.24	118.98	180.18	329.22	4632.64	260.82	0.15	0.15						
197	14.49	1164.24	168	1287.72	70.82	70.8	6.24	13.92	20.16	79.32	120.12	219.48	3221.76	173.88	0.15	0.15						
198	14.49	870.2	140	1073.1	59.02	59	5.2	11.6	16.8	66.1	100.1	182.9	2684.8	144.9	0.15	0.15						
199	14.49	5724.16	826	6331.29	348.1	348.1	30.68	68.44	99.12	389.99	590.59	1079.11	15840.32	854.91	0.15	0.15						
200	14.49	388.08	56	429.24	23.61	23.6	2.08	4.64	6.72	26.44	40.04	73.16	1073.92	57.96	0.15	0.15						
201	14.49	1552.32	224	1716.96	94.43	94.4	8.32	18.56	26.88	105.76	160.16	292.64	4295.68	231.84	0.15	0.15						
202	14.49	291.06	42	321.93	17.71	17.7	1.56	3.48	5.04	19.83	30.03	54.87	805.44	43.47	0.15	0.15						
203	14.49	97.02	14	107.31	5.90	5.9	0.52	1.16	1.68	6.61	10.01	18.29	268.48	14.49	0.15	0.15						
204	14.49	388.08	56	429.24	23.61	23.6	2.08	4.64	6.72	26.44	40.04	73.16	1073.92	57.96	0.15	0.15						
205	14.49	388.08	56	429.24	23.61	23.6	2.08	4.64	6.72	26.44	40.04	73.16	1073.92	57.96	0.15	0.15						
206	14.49	873.16	126	965.79	53.12	53.1	4.68	10.44	15.12	59.49	90.09	164.61	2416.32	130.41	0.15	0.15						
207	14.49	776.16	112	858.48	47.22	47.2	4.16	9.28	13.44	52.88	80.08	146.32	2147.84	115.92	0.15	0.15						
208	14.49	873.16	126	965.79	53.12	53.1	4.68	10.44	15.12	59.49	90.09	164.61	2416.32	130.41	0.15	0.15						
209	14.49	1552.32	224	1716.96	94.43	94.4	8.32	18.56	26.88	105.76	160.16	292.64	4295.68	231.84	0.15	0.15						
210	14.49	194.04	28	214.62	11.80	11.8	1.04	2.32	3.36	13.22	20.02	36.58	536.96	28.98	0.15	0.15						
211	14.49	1746.36	252	1931.58	108.24	108.2	9.36	20.88	30.24	118.98	180.18	329.22	4632.64	260.82	0.15	0.15						
212	14.49	194.04	28	214.62	11.80	11.8	1.04	2.32	3.36	13.22	20.02	36.58	536.96	28.98	0.15	0.15						
213	14.49	1067.22	154	1180.41	64.92	64.9	5.72	12.76	18.48	72.71	110.11	201.19	2953.28	159.39	0.15	0.15						
214	14.49	873.16	126	965.79	53.12	53.1	4.68	10.44	15.12	59.49	90.09	164.61	2416.32	130.41	0.15	0.15						
215	14.49	388.08	56	429.24	23.61	23.6	2.08	4.64	6.72	26.44	40.04	73.16	1073.92	57.96	0.15	0.15						
216	14.49	194.04	28	214.62	11.80	11.8	1.04	2.32	3.36	13.22	20.02	36.58	536.96	28.98	0.15	0.15						
217	14.49	194.04	28	214.62	11.80	11.8	1.04	2.32	3.36	13.22	20.02	36.58	536.96	28.98	0.15	0.15						
218	14.49	873.16	126	965.79	53.12	53.1	4.68	10.44	15.12	59.49	90.09	164.61	2416.32	130.41	0.15	0.15						
219	14.49	1940.4	280	2146.2	118.04	118	10.4	23.2	33.6	132.2	200.2	365.6	5369.6	289.8	0.15	0.15						
220	14.49	388.08	56	429.24	23.61	23.6	2.08	4.64	6.72	26.44	40.04	73.16	1073.92	57.96	0.15	0.15						

Analysis with rebate
Calculations * # units

Net 10W Present Value	Installed Cost	Rebate Value	Annual kWh Savings	Annual Energy Savings (\$)	Value of 1st Year Savings	Annualized O&M Costs			Annualized Costs			Life- Cycle Cost	Net Present Value		Value Index
						Ballast	Lamp	Total	Capital	Energy	Total				
221	14.49	291.06	42	321.93	17.71	1.56	3.48	5.04	19.93	30.03	54.87	805.44	43.47	0.15	
222	14.49	562.12	84	643.86	35.41	3.12	6.96	10.08	39.86	60.06	109.74	1610.68	86.94	0.15	
223	14.49	1455.3	210	1609.65	86.53	7.8	17.4	25.2	99.15	150.15	274.35	4027.2	217.35	0.15	
224	14.49	291.06	42	321.93	17.71	1.56	3.48	5.04	19.93	30.03	54.87	805.44	43.47	0.15	
225	14.49	873.18	126	965.79	53.12	4.08	10.44	15.12	59.49	90.09	164.61	2416.32	130.41	0.15	
226	14.49	670.2	140	1073.1	59.02	5.2	11.6	16.8	66.1	100.1	182.9	2694.8	144.9	0.15	
227	14.49	4559.94	658	5043.57	277.40	24.44	54.52	78.96	310.87	470.47	859.63	12618.58	681.03	0.15	
228	14.49	970.2	140	1073.1	59.02	5.2	11.6	16.8	66.1	100.1	182.9	2694.8	144.9	0.15	
229	14.49	388.08	56	429.24	23.61	2.08	4.64	6.72	26.44	40.04	73.16	1073.92	57.96	0.15	
230	14.49	1649.34	238	1824.27	100.33	8.64	19.72	28.56	112.37	170.17	310.93	4564.16	246.33	0.15	
231	14.49	485.1	70	536.55	29.51	2.6	5.8	8.4	33.05	50.05	91.45	1342.4	72.45	0.15	
232	14.49	388.08	56	429.24	23.61	2.08	4.64	6.72	26.44	40.04	73.16	1073.92	57.96	0.15	
233		0	0	0	0.00	0	0	0	0	0	0	0	0	0.00	
234		0	0	0	0.00	0	0	0	0	0	0	0	0	0.00	
235		0	0	0	0.00	0	0	0	0	0	0	0	0	0.00	
236		0	0	0	0.00	0	0	0	0	0	0	0	0	0.00	
237		0	0	0	0.00	0	0	0	0	0	0	0	0	0.00	
238		0	0	0	0.00	0	0	0	0	0	0	0	0	0.00	
239	186.17	5678.1	600	13889.1	763.90	39.6	101.7	141.3	567	948	1476.3	21688.7	7633.6	1.38	
240	261.12	5110.26	540	12500.19	687.42	35.64	91.53	127.17	348.3	853.2	1328.67	19501.83	7050.24	1.38	
241	261.12	26.73	10	137.97	7.59	1.87	1.44	3.31	1.62	2.38	7.52	110.32	131.6	4.92	
242	131.6	0	0	0	0.00	0	0	0	0	0	0	0	0	0.00	
243		0	0	0	0.00	0	0	0	0	0	0	0	0	0.00	
244	131.6	60.19	30	413.91	22.77	5.91	4.32	9.93	5.46	7.14	22.56	330.96	394.8	4.92	
245	303.23	187.11	70	2069.55	113.83	32.27	22.12	54.32	12.74	35.7	102.83	1509.2	2122.61	11.34	
246	303.23	213.84	80	2385.2	130.08	36.88	25.28	62.08	14.56	40.8	117.52	1724.8	2425.64	11.34	
247	303.23	160.36	80	1773.9	97.58	27.66	18.96	46.56	10.92	30.6	66.14	1293.6	1619.38	11.34	
248	303.23	106.92	40	1182.6	65.04	18.44	12.64	31.04	7.28	20.4	58.76	862.4	1212.92	11.34	
249	303.23	160.36	80	1773.9	97.58	27.66	18.96	46.56	10.92	30.6	66.14	1293.6	1619.38	11.34	
250	303.23	133.85	50	1476.25	81.30	23.05	15.8	38.8	9.1	25.5	73.45	1078	1516.15	11.34	
251	367.78	26.73	10	354.78	19.51	5.62	3.6	9.42	1.92	6.13	17.37	254.89	367.78	13.76	
252		0	0	0	0.00	0	0	0	0	0	0	0	0	0.00	
253		0	0	0	0.00	0	0	0	0	0	0	0	0	0.00	
254		0	0	0	0.00	0	0	0	0	0	0	0	0	0.00	
255		0	0	0	0.00	0	0	0	0	0	0	0	0	0.00	
256		0	0	0	0.00	0	0	0	0	0	0	0	0	0.00	
257		0	0	0	0.00	0	0	0	0	0	0	0	0	0.00	
258		0	0	0	0.00	0	0	0	0	0	0	0	0	0.00	
259	48.21	918.06	220	1888.7	103.88	23.76	55.66	79.42	62.46	51.92	193.82	2846.14	1060.62	1.16	
260	104.07	82.74	20	300.46	16.53	5.1	9.16	14.26	5.68	8.26	26.2	413.92	208.14	2.52	
261	104.07	41.37	10	150.23	8.26	2.55	4.58	7.13	2.84	4.13	14.1	206.96	104.07	2.52	
262		0	0	0	0.00	0	0	0	0	0	0	0	0	0.00	
263		0	0	0	0.00	0	0	0	0	0	0	0	0	0.00	
264		0	0	0	0.00	0	0	0	0	0	0	0	0	0.00	

Analysis with rebate
Calculations • # units

Net NOW Present Value	Installed Cost	Rebate Value	Annual kWh Savings	Annual Energy Savings (\$)	Value of 1st Year Savings	Annualized O&M Costs			Annualized Costs			Life- Cycle Cost	Net Present Value		Value Index
						Ballast	Lamp	Total	Capital	Energy	Total				
265	115.71	528	150	3837	211.04	210.9	0	85.2	85.2	36	73.5	194.4	2855.1	3471.3	6.57
266	344.75	352	100	4476.4	246.20	246.2	0	1.022	102.2	24	134.6	321.4	4716	6895	18.59
267	344.75	140.8	40	1780.56	98.48	98.48	0	0.4088	40.88	9.6	53.92	128.56	1886.4	2758	19.59
268	344.75	35.2	10	447.64	24.62	24.62	0	0.1022	10.22	2.4	13.46	32.14	471.6	689.5	19.59
269	344.75	598.4	170	7606.4	418.54	418.54	0	1.7374	173.74	40.8	229.16	546.36	8017.2	11721.5	19.59
270	344.75	70.4	20	895.28	49.24	49.24	0	0.2044	20.44	4.8	28.88	64.28	943.2	1379	19.59
271	344.75	633.6	180	8057.52	443.16	443.16	0	1.8396	183.96	43.2	242.64	576.52	8488.8	12411	19.59
272	475.69	158.4	45	4318.48	237.41	237.42	0	100.35	100.35	10.8	62.71	193.86	2844.81	4281.21	27.03
273	475.69	70.4	20	1918.44	105.51	105.52	0	44.6	44.6	4.8	36.76	86.16	1284.36	1902.76	27.03
274	475.69	70.4	20	1918.44	105.51	105.52	0	44.6	44.6	4.8	36.76	86.16	1284.36	1902.76	27.03
275	639.39	17.6	5	639.48	35.17	35.17	0	14.92	14.92	1.2	12.25	26.37	416.45	639.39	36.33
276		0	0	0	0.00	0	0	0	0	0	0	0	0	0	0.00
277	49.12	73.12	0	192.72	10.60	10.6	1.95	8.49	10.45	4.98	14.47	29.9	438.87	98.24	1.34
278	49.12	108.08	0	289.08	15.90	15.9	2.925	12.735	15.675	7.47	21.705	44.95	658.305	147.36	1.34
279	49.12	148.24	0	385.44	21.20	21.2	3.9	16.98	20.9	9.98	28.94	59.8	877.74	198.48	1.34
280	49.12	73.12	0	192.72	10.60	10.6	1.95	8.49	10.45	4.98	14.47	29.9	438.87	98.24	1.34
281	49.12	329.04	0	867.24	47.70	47.7	8.775	38.205	47.025	22.41	65.115	134.55	1974.915	442.08	1.34
282	49.12	218.36	0	576.16	31.80	31.8	5.85	25.47	31.35	14.94	43.41	89.7	1316.61	294.72	1.34
283	49.12	604.32	0	2119.92	116.60	116.6	21.45	93.39	114.95	54.78	159.17	328.9	4827.57	1080.64	1.34
284	49.12	108.88	0	289.08	15.90	15.9	2.925	12.735	15.675	7.47	21.705	44.95	658.305	147.36	1.34
285		0	0	0	0.00	0	0	0	0	0	0	0	0	0	0.00
286		0	0	0	0.00	0	0	0	0	0	0	0	0	0	0.00
287		0	0	0	0.00	0	0	0	0	0	0	0	0	0	0.00
288		0	0	0	0.00	0	0	0	0	0	0	0	0	0	0.00
289		0	0	0	0.00	0	0	0	0	0	0	0	0	0	0.00
290		0	0	0	0.00	0	0	0	0	0	0	0	0	0	0.00
291	72.84	1126.26	90	2704.14	148.73	148.68	43.2	23.58	66.99	76.86	280.06	423.72	6219.72	1311.12	1.16
292	72.84	375.42	30	901.38	49.58	49.58	14.4	7.66	22.32	25.58	93.36	141.24	2073.24	437.04	1.16
293	149.72	262.44	60	607.06	33.39	33.38	1.6	3.84	5.44	17.88	30.82	54.14	794.56	298.44	1.14
294	149.72	524.88	120	1214.12	66.78	66.76	3.2	7.68	10.88	35.76	61.64	108.28	1589.12	598.88	1.14
295	149.72	524.88	120	1214.12	66.78	66.76	3.2	7.68	10.88	35.76	61.64	108.28	1589.12	598.88	1.14
296	149.72	262.44	60	607.06	33.39	33.38	1.6	3.84	5.44	17.88	30.82	54.14	794.56	298.44	1.14
297	149.72	524.88	120	1214.12	66.78	66.76	3.2	7.68	10.88	35.76	61.64	108.28	1589.12	598.88	1.14
298	149.72	262.44	60	607.06	33.39	33.38	1.6	3.84	5.44	17.88	30.82	54.14	794.56	298.44	1.14
299	149.72	524.88	120	1214.12	66.78	66.76	3.2	7.68	10.88	35.76	61.64	108.28	1589.12	598.88	1.14
300	149.72	787.32	180	1821.18	100.16	100.14	4.8	11.52	16.32	53.64	92.46	162.42	2383.88	890.32	1.14
301	149.72	262.44	60	607.06	33.39	33.38	1.6	3.84	5.44	17.88	30.82	54.14	794.56	298.44	1.14
302	149.72	524.88	120	1214.12	66.78	66.76	3.2	7.68	10.88	35.76	61.64	108.28	1589.12	598.88	1.14
303	149.72	262.44	60	607.06	33.39	33.38	1.6	3.84	5.44	17.88	30.82	54.14	794.56	298.44	1.14
304	93.085	365.6	0	1576.8	86.72	86.7	22.6	72.75	95.35	24.9	118.45	236.7	3503.45	930.65	2.55
305	98.24	438.72	0	1156.32	63.60	63.6	11.7	50.94	62.7	29.88	86.82	179.4	2633.22	589.44	1.34
306	339.75	22.6	0	351.71	19.34	19.34	0	8.13	8.13	1.54	6.74	16.41	240.8	339.75	15.03
307	92.32	2099.52	480	3746.24	208.04	208.08	0	21.12	21.12	143.04	190.08	354.24	5199.04	1477.12	0.70
308	92.32	656.1	150	1170.7	64.39	64.4	0	6.6	6.6	44.7	59.4	110.7	1824.7	461.6	0.70

Analysis with rebate Calculations - # units																
Net Value	Installed Cost	Rebate Value	Annual kWh	Annual Energy Savings (\$)	Value of 1st Year Savings	Annualized O&M Costs			Annualized Costs			Life- Cycle Cost	Net Present Value	Value Index		
						Baltest	Lamp	Total	Capital	Energy	Total					
309	1049.76	240	1873.12	103.02	103.04	0	10.56	10.56	71.52	95.04	177.12	2599.52	738.56	0.70		
310	970.2	140	827.8	45.53	45.5	0	7.9	7.9	66.1	77.2	151.2	2210	-66.7	-0.07		
311	2910.6	420	4599	252.9	252.9	47.7	55.2	102.9	198.3	428.7	729.9	10714.5	1568.4	0.54		
312	1940.4	280	3066	186.63	186.6	31.6	36.6	68.6	132.2	265.8	486.6	7143	1045.6	0.54		
313	4656.86	672	7356.4	404.71	404.64	76.32	88.32	164.64	317.28	685.92	1167.84	17143.2	2509.44	0.54		
314	1804.8	0	67392	3706.56	3706.56	0	0	0	0	0	0	133248	0	0.00		
315	1837.08	420	3642.36	200.33	200.34	3.76	21.56	25.34	125.16	164.8	335.44	4922.96	1601.04	0.67		
316	970.2	140	1226.4	67.45	67.5	8.7	13.8	22.6	66.1	114.3	203	2879.8	272	0.28		
317	388.08	56	490.56	26.98	26.98	27	3.48	5.52	26.44	45.72	61.2	1191.92	108.8	0.28		
318	970.2	140	1226.4	67.45	67.5	8.7	13.8	22.6	66.1	114.3	203	2879.8	272	0.28		
319	970.2	140	1226.4	67.45	67.5	8.7	13.8	22.6	66.1	114.3	203	2879.8	272	0.28		
320	388.08	56	490.56	26.98	26.98	27	3.48	5.52	26.44	45.72	61.2	1191.92	108.8	0.28		
321	388.08	56	490.56	26.98	26.98	27	3.48	5.52	26.44	45.72	61.2	1191.92	108.8	0.28		
322	970.2	140	1226.4	67.45	67.5	8.7	13.8	22.6	66.1	114.3	203	2879.8	272	0.28		
323	873.16	126	1103.76	60.71	60.75	7.83	12.42	20.34	59.49	102.87	182.7	2681.92	244.8	0.26		
324	1649.34	238	3906.14	215.00	215.05	58.14	50.66	108.8	112.37	364.46	585.65	8595.54	1936.34	1.16		
325	970.2	140	1226.4	67.45	67.5	8.7	13.8	22.6	66.1	114.3	203	2879.8	272	0.28		
326	388.08	56	490.56	26.98	26.98	27	3.48	5.52	26.44	45.72	61.2	1191.92	108.8	0.28		
327	1940.4	280	2452.8	134.90	135	17.4	27.6	45.2	132.2	228.6	406	5959.6	544	0.26		
328	388.08	56	490.56	26.98	26.98	27	3.48	5.52	26.44	45.72	61.2	1191.92	108.8	0.28		
329	388.08	56	490.56	26.98	26.98	27	3.48	5.52	26.44	45.72	61.2	1191.92	108.8	0.28		
330	388.08	56	490.56	26.98	26.98	27	3.48	5.52	26.44	45.72	61.2	1191.92	108.8	0.28		
331	388.08	56	490.56	26.98	26.98	27	3.48	5.52	26.44	45.72	61.2	1191.92	108.8	0.28		
332	388.08	56	490.56	26.98	26.98	27	3.48	5.52	26.44	45.72	61.2	1191.92	108.8	0.28		
333	1940.4	280	2452.8	134.90	135	17.4	27.6	45.2	132.2	228.6	406	5959.6	544	0.26		
334	873.16	126	1103.76	60.71	60.75	7.83	12.42	20.34	59.49	102.87	182.7	2681.92	244.8	0.26		
335	388.08	56	490.56	26.98	26.98	27	3.48	5.52	26.44	45.72	61.2	1191.92	108.8	0.28		
336	1746.36	252	2207.52	121.41	121.5	15.66	24.84	40.66	118.98	205.74	365.4	5363.64	489.6	0.26		
337	388.08	56	490.56	26.98	26.98	27	3.48	5.52	26.44	45.72	61.2	1191.92	108.8	0.28		
338	970.2	140	1226.4	67.45	67.5	8.7	13.8	22.6	66.1	114.3	203	2879.8	272	0.28		
339	582.12	64	735.84	40.47	40.5	5.22	8.28	13.56	39.66	68.56	121.6	1787.86	163.2	0.26		
340	970.2	140	1226.4	67.45	67.5	8.7	13.8	22.6	66.1	114.3	203	2879.8	272	0.28		
341	388.08	56	490.56	26.98	26.98	27	3.48	5.52	26.44	45.72	61.2	1191.92	108.8	0.28		
342	388.08	56	490.56	26.98	26.98	27	3.48	5.52	26.44	45.72	61.2	1191.92	108.8	0.28		
343	1067.22	154	2529.45	139.12	139.15	37.62	32.78	70.4	72.71	235.84	378.95	5561.82	1254.22	1.18		
344	388.08	56	490.56	26.98	26.98	27	3.48	5.52	26.44	45.72	61.2	1191.92	108.8	0.28		
345	970.2	140	1226.4	67.45	67.5	8.7	13.8	22.6	66.1	114.3	203	2879.8	272	0.28		
346	388.08	56	490.56	26.98	26.98	27	3.48	5.52	26.44	45.72	61.2	1191.92	108.8	0.28		
347	873.16	126	1103.76	60.71	60.75	7.83	12.42	20.34	59.49	102.87	182.7	2681.92	244.8	0.26		
348	1940.4	280	2452.8	134.90	135	17.4	27.6	45.2	132.2	228.6	406	5959.6	544	0.28		
349	388.08	56	490.56	26.98	26.98	27	3.48	5.52	26.44	45.72	61.2	1191.92	108.8	0.28		
350	970.2	140	1226.4	67.45	67.5	8.7	13.8	22.6	66.1	114.3	203	2879.8	272	0.28		
351	870.2	140	1226.4	67.45	67.5	8.7	13.8	22.6	66.1	114.3	203	2879.8	272	0.28		
352	1746.36	252	2207.52	121.41	121.5	15.66	24.84	40.66	118.98	205.74	365.4	5363.64	489.6	1.16		

Analysis with rebate
Calculations - # units

ROW	Net Present Value	Installed Cost	Rebate Value	kWh Savings	Energy Savings (\$)	1st Year			Cycle			Total	Value	Index	
						Savings	Ballast	Lamp	Capital	Energy	Cost				
353	27.2	1740.36	252	2207.52	121.41	121.5	15.66	24.84	40.68	116.96	205.74	365.4	5363.64	489.6	0.26
354	27.2	776.16	112	981.12	53.96	54	6.96	11.04	18.08	52.66	91.44	162.4	2363.84	217.6	0.26
355	27.2	388.08	56	480.56	26.98	27	3.48	5.52	9.04	26.44	45.72	81.2	1191.92	108.6	0.26
356															0.00
357	27.2	5239.08	756	6622.56	364.24	364.5	46.98	74.52	122.04	356.94	617.22	1096.2	16090.92	1468.8	0.26
358	55.66	492.35	40	876	48.18	48.2	26.3	11.45	37.75	33.55	65.8	137.1	2012.15	278.3	0.37
359	367.76	601.9	300	10643.4	585.39	585.3	168.6	114	282.6	54.6	193.9	521.1	7646.7	11033.4	13.76
360	246.56	316.8	90	4604.22	253.23	253.26	0	105.46	105.46	21.6	86.2	215.26	3160.08	4438.08	14.01
361	177.76	131.22	30	336.18	18.60	18.6	1.23	2.23	3.46	8.94	17.16	29.56	433.87	177.76	1.35
362	24.66	1940.4	280	2391.2	131.52	131.6	16	26.8	42.8	132.2	223	398	5840.8	493.2	0.25
363	24.66	978.14	98	836.92	48.03	48.06	5.6	9.38	14.98	46.27	78.05	139.3	2044.28	172.82	0.25
364	24.66	368.08	56	478.24	26.30	26.32	3.2	5.36	8.56	26.44	44.6	79.6	1168.16	98.64	0.25
365	24.66	1940.4	280	2391.2	131.52	131.6	16	26.8	42.8	132.2	223	398	5840.8	493.2	0.25
366	24.66	970.2	140	1195.6	65.76	65.8	8	13.4	21.4	66.1	111.5	199	2920.4	246.6	0.25
367	24.66	485.1	70	597.8	32.88	32.9	4	6.7	10.7	33.05	55.75	99.5	1460.2	123.3	0.25
368	24.66	970.2	140	1195.6	65.76	65.8	8	13.4	21.4	66.1	111.5	199	2920.4	246.6	0.25
369	24.66	970.2	140	1195.6	65.76	65.8	8	13.4	21.4	66.1	111.5	199	2920.4	246.6	0.25
370	24.66	388.08	56	478.24	26.30	26.32	3.2	5.36	8.56	26.44	44.6	79.6	1168.16	98.64	0.25
371	114.02	970.2	140	2299.5	126.47	126.5	34.2	29.6	64	66.1	214.4	344.5	5056.2	1140.2	1.18
372	24.66	388.08	56	478.24	26.30	26.32	3.2	5.36	8.56	26.44	44.6	79.6	1168.16	98.64	0.25
373	24.66	1291.26	182	1554.26	85.49	85.54	10.4	17.42	27.82	85.93	144.95	256.7	3788.52	320.58	0.25
374	24.66	388.08	56	478.24	26.30	26.32	3.2	5.36	8.56	26.44	44.6	79.6	1168.16	98.64	0.25
375	24.66	970.2	140	1195.6	65.76	65.8	8	13.4	21.4	66.1	111.5	199	2920.4	246.6	0.25
376	24.66	388.08	56	478.24	26.30	26.32	3.2	5.36	8.56	26.44	44.6	79.6	1168.16	98.64	0.25
377	24.66	970.2	140	1195.6	65.76	65.8	8	13.4	21.4	66.1	111.5	199	2920.4	246.6	0.25
378	24.66	970.2	140	1195.6	65.76	65.8	8	13.4	21.4	66.1	111.5	199	2920.4	246.6	0.25
379	24.66	388.08	56	478.24	26.30	26.32	3.2	5.36	8.56	26.44	44.6	79.6	1168.16	98.64	0.25
380	24.66	970.2	140	1195.6	65.76	65.8	8	13.4	21.4	66.1	111.5	199	2920.4	246.6	0.25
381	24.66	388.08	56	478.24	26.30	26.32	3.2	5.36	8.56	26.44	44.6	79.6	1168.16	98.64	0.25
382	24.66	388.08	56	478.24	26.30	26.32	3.2	5.36	8.56	26.44	44.6	79.6	1168.16	98.64	0.25
383	24.66	3880.8	560	4782.4	263.03	263.2	32	53.6	85.6	264.4	446	796	11681.6	986.4	0.25
384	24.66	388.08	56	478.24	26.30	26.32	3.2	5.36	8.56	26.44	44.6	79.6	1168.16	98.64	0.25
385	24.66	970.2	140	1195.6	65.76	65.8	8	13.4	21.4	66.1	111.5	199	2920.4	246.6	0.25
386	24.66	970.2	140	1195.6	65.76	65.8	8	13.4	21.4	66.1	111.5	199	2920.4	246.6	0.25
387	24.66	388.08	56	478.24	26.30	26.32	3.2	5.36	8.56	26.44	44.6	79.6	1168.16	98.64	0.25
388	24.66	873.18	126	1076.04	59.18	59.22	7.2	12.08	19.26	59.49	100.35	179.1	2628.36	221.94	0.25
389	24.66	673.18	126	1076.04	59.18	59.22	7.2	12.08	19.26	59.49	100.35	179.1	2628.36	221.94	0.25
390	24.66	1940.4	280	2391.2	131.52	131.6	16	26.8	42.8	132.2	223	398	5840.8	493.2	0.25
391	114.02	1067.22	154	2529.45	139.12	139.15	37.62	32.78	70.4	72.71	235.84	378.95	5561.82	1254.22	1.18
392	24.66	3298.68	478	4065.04	223.56	223.72	27.2	45.56	72.76	224.74	379.1	676.6	9929.36	638.44	0.25
393	24.66	388.08	56	478.24	26.30	26.32	3.2	5.36	8.56	26.44	44.6	79.6	1168.16	98.64	0.25
394	24.66	970.2	140	1195.6	65.76	65.8	8	13.4	21.4	66.1	111.5	199	2920.4	246.6	0.25
395	24.66	970.2	140	1195.6	65.76	65.8	8	13.4	21.4	66.1	111.5	199	2920.4	246.6	0.25
396	24.66	873.18	126	1076.04	59.18	59.22	7.2	12.08	19.26	59.49	100.35	179.1	2628.36	221.94	0.25

Analysis with rebate Calculations * # units															
ROW	Net Present Value	Installed Cost	Rebate Value	Annual kWh Savings	Annual Energy Savings (\$)	Value of 1st Year Savings	Annualized O&M Costs			Annualized Costs			Life- Cycle Cost	Net Present Value	Value Index
							Balast	Lamp	Total	Capital	Energy	Total			
397	24.66	368.08	56	478.24	26.30	26.32	3.2	5.36	8.56	26.44	44.6	70.6	1168.16	98.64	0.25
398	24.66	970.2	140	1195.6	65.76	65.8	8	13.4	21.4	66.1	111.5	199	2920.4	246.6	0.25
399	24.66	970.2	140	1195.6	65.76	65.8	8	13.4	21.4	66.1	111.5	199	2920.4	246.6	0.25
400	24.66	1940.4	280	2391.2	131.52	131.6	16	26.8	42.8	132.2	223	398	5840.8	493.2	0.25
401	24.66	368.08	56	478.24	26.30	26.32	3.2	5.36	8.56	26.44	44.6	70.6	1168.16	98.64	0.25
402	24.66	3680.8	580	4782.4	263.03	263.2	32	53.6	85.6	264.4	446	796	11681.6	986.4	0.25
403	24.66	368.08	56	478.24	26.30	26.32	3.2	5.36	8.56	26.44	44.6	70.6	1168.16	98.64	0.25
404	24.66	970.2	140	1195.6	65.76	65.8	8	13.4	21.4	66.1	111.5	199	2920.4	246.6	0.25
405	24.66	368.08	56	478.24	26.30	26.32	3.2	5.36	8.56	26.44	44.6	70.6	1168.16	98.64	0.25
406	24.66	970.2	140	1195.6	65.76	65.8	8	13.4	21.4	66.1	111.5	199	2920.4	246.6	0.25
407	24.66	368.08	56	478.24	26.30	26.32	3.2	5.36	8.56	26.44	44.6	70.6	1168.16	98.64	0.25
408	24.66	368.08	56	478.24	26.30	26.32	3.2	5.36	8.56	26.44	44.6	70.6	1168.16	98.64	0.25
409	24.66	368.08	56	478.24	26.30	26.32	3.2	5.36	8.56	26.44	44.6	70.6	1168.16	98.64	0.25

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