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Florida Power & Light Company, P. O. Box 029100, Miami, FL 33102-9100

FPL

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RECORDS AND REPORTING

March 24, 2000

Blanca S. Bayo, Director
Records and Reporting
Florida Public Service Commission
4075 Esplanade Way, Room 110
Tallahassee, Florida 32399-0850

Re: Florida Power and Light Company's Commercial/Industrial Daylight Dimming Research Project
Docket Nos. 960817-EG & 981253-EG
Order Nos. PSC-96-1366-FOF-EG & PSC-98-1610-FOF-EG

Enclosed for filing on behalf of Florida Power & Light Company (FPL) are the original and fifteen (15) copies of FPL's Commercial/Industrial Daylight Dimming Research Project findings as well as copies of the cost-effectiveness analysis performed.

This research was performed by the Florida Solar Energy Center.

The study shows that the concept of daylight dimming is technically feasible and can be accomplished with known, commercially available, technologies.

However, the study also shows that daylight dimming systems retrofitted into buildings that were not originally designed for them are not sufficiently effective at demand reduction to be viable demand side management measure. Furthermore, the study shows that customer acceptance of the system could be a significant problem. Since it has been shown that customers will disable these systems if they are not pleased with the short-term results, there is no guarantee that daylight dimming systems installed with a DSM incentive would actually be used.

Based on the findings from this effort, FPL determined the cost-effectiveness of this technology using the FPSC approved methodology. The resulting cost-effectiveness ratios for each of FPL's major commercial/industrial rate classes are as follows:

	RIM	TRC	Participant
General Service	0.09	0.09	1.01
General Service Demand	0.09	0.09	1.01
General Service Large Demand	0.09	0.09	1.01

AFA ____
APP ____
CAF ____
CMU ____
CTR ____
EAG ____
LEG 1
MAS ____
OPC ____
RRR ____
SEC 1
WAW ____
OTH ____

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The FPSC approved budget for this project was $377,000. Actual expenditures were $257,699.

FPL will continue to monitor the development of this technology.

Dennis Brandt
Director
Product Support & Services

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Commercial Building Daylight Dimming Field Monitoring Research Project

Final Report

FSEC-CR-1122-99
October 1999

Prepared for:

Florida Power and Light Company
PO Box 029100
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Commercial Building Daylight Dimming
Field Monitoring Research Project

Final Report

David B. Floyd and Danny S. Parker

Executive Summary

This report summarizes data collected in two commercial office buildings for the Commercial Building Daylight Dimming Field Monitoring Research Project. This 24 month project monitored the energy savings and peak demand reduction in two commercial buildings where the perimeter lighting system was replaced with one that dims in response to available daylight. The project examined in detail the application of daylight dimming lighting systems in side-lighted office buildings.

During 1997 two sites were selected that could be retrofitted with a fluorescent lighting system that would dim in response to available daylight. One floor of each building was retrofitted with fluorescent dimming ballasts where daylight was available. A variety of sensors and meters were also installed to capture interior and exterior conditions and energy use. These included two photometers per building orientation (8 total) to measure interior light levels, watt-hour meters for lighting and HVAC use, interior and exterior air temperature and humidity, and solar irradiance.

Initial baseline data is compared with two sets of post period data (pre and post commissioning). Lighting energy savings averaged 6.5 % for the north site and 8.5 % for the south site. Consumer acceptance of the technology was unacceptable at the north site to acceptable at the south site. We were unable to measure any interaction of the lighting energy savings with the cooling systems. Regardless, the very low level of measured direct lighting energy savings from the project suggests that any by-product cooling savings would be very small (<3%).

The difference in consumer acceptance may be due to the difference in tasks performed (reading versus computer use), differences in the occupations (attorneys versus engineers and business professionals), and the installation. Other research has concluded that the ceiling mounted photo-sensors could be improved to provide more consistent light levels and savings.

While the savings for this project were lower than other buildings designed for daylighting, controlled lighting systems can provide benefits to both the utility and the consumer. Although not part of the described investigation, other cited studies have shown that buildings specifically designed for daylighting (typically with perimeter offices, spectrally selective glass and light shelves) can significant lighting energy reductions. Thus, results from this study cannot be used to judge performance of new commercial construction designed to take advantage of daylighting. Other applications such as load shedding, may be better suited for a utility DSM program for existing buildings.

Introduction

A significant portion of the commercial building stock in Florida consists of buildings with windows. Typically these buildings are illuminated by electric lighting systems that are controlled by manual switching or an energy management system. Switching, if any, occurs during the start and at the end of the day. Recently, dynamic controls, such as continuous daylight dimming systems, have become available to reduce lighting energy use. In theory, a daylight dimming system continuously adjusts the electric lighting level based on the amount of daylight available. Daylight is measured through a ceiling-mounted photocell or ambient light sensor. Ideally, the photosensor would be mounted directly on the work surface but wiring and inadvertent covering discourages this design. According to manufacturers, these systems can save 20%-70% of lighting energy usage.

Past Research

Until recently, little data have been collected *in situ* to quantify the energy savings, demand reduction and human reaction as a result of daylight dimming systems.

Actual savings may vary dependent on the window orientation, window management strategies (operation of venetian blinds), available daylight and system installation (Schrum et al., 1996). In addition to quantifying energy savings, the time at which these savings occur is unclear. This information is valuable for determining kW reduction potential for utility programs.

Early evaluation of automated daylight dimming systems have shown large potential (Crisp, 1977). Recent evaluation of current generation daylight dimming systems under a controlled laboratory environment designed to emulate performance within a windowed office showed a daytime lighting energy savings that varied from 20 - 57% depending on available daylight (Parker et al., 1996). Evaluation of the technology in a series of identical offices facing differing orientations showed long-term lighting energy reductions of 22 - 51% with the lower values showing the influence of blinds (Schrum and Parker, 1996).

The limited field tests performed so far have shown generally lower levels of performance reduction than controlled studies. An early study showed large potential for automated daylighting systems, although with system set-up and adjustment being critical to performance (Benton and Fountain, 1990). In another evaluation, Reed et al. (1994) showed that savings in monitored offices were greatest on the south orientation, although strongly influenced by blind operation. A carefully adjusted daylight dimming system in a Florida school cafeteria was shown to reduce lighting energy use by 27% (Floyd and Parker, 1995) although with significant difficulties in commissioning the system controls. Finally, evaluation of automated dimming systems in an office building designed for daylighting found dimming energy reductions of 33% to 53% defending on blind operation and the availability of light shelves (Schrum et al., 1996). Occupants in the study also reported strong preference for south perimeter offices with light shelves in order to control glare. Those without light shelves desired blinds or other means of controlling excessive sunlight and heat during fall and spring months.

Even with good potential reductions, however, user acceptance of automated controls may be problematic. For instance, an early evaluation of stepped dimming by Diamond and Heerwagen

(1992) found that blind operation and glare reduction would often defeat the intent of automated systems: "...in all buildings with daylight controls, the control system was made inoperable."

Objectives

This project evaluated daylight dimming through the monitoring of two multi-story office buildings in Florida Power & Light's (FP&L) territory. One office was selected in the northern area of FP&L's territory (Daytona Beach) and the other was located in the southern area (Sunrise). The field project evaluated the energy usage pre-and post-retrofit of offices with windows and blinds. Specific research objectives were to:

1. Monitor, collect and evaluate the performance of a daylight dimming system in a commercial office building as compared with the same building without the technology installed.

2. Use the research to establish the potential demand and energy savings of a daylight dimming system as well as the impact this technology has on the air-conditioning load. The information provided should allow FP&L to make a business decision for the possible inclusion of daylight dimming systems as a viable and qualifying option in its lighting rebate program.

3. Provide a general assessment of daylight dimming technology with regard to application, commissioning, and feasibility as well as an indication of customer acceptance.

4. Establish qualification and installation guidelines for a possible program based on research experience. This would indicate audit facilities that are likely to benefit from such a measure. The procedures to identify installation guidelines would provide information to improve installation quality and maximize potential performance.

Site Descriptions

North Site – First Union Tower, Daytona Beach

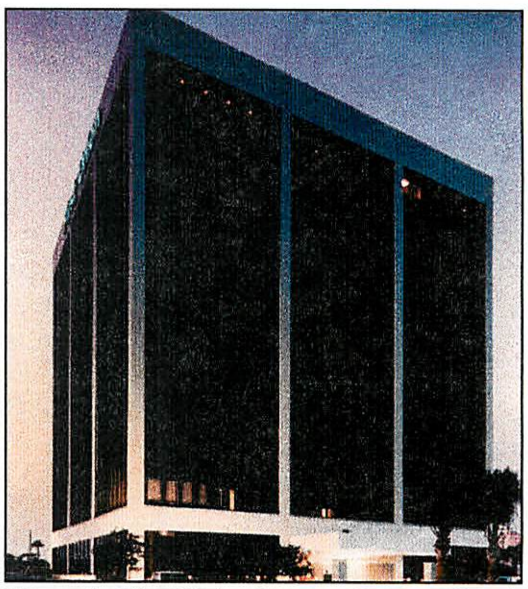
Figure 1. First Union Tower, Daytona Beach Florida.

The north site, located in Daytona Beach at the First Union Tower, was instrumented in early August, 1997. The fifth floor of the 10 story office tower was selected by the building management and FSEC as the most appropriate floor to monitor. The current tenant on that floor is the Florida States Attorney's Office. The floor is almost entirely private offices with a law library located on a portion of the west side. The building is daylighted by perimeter glazing around the entire circumference of the building that begins two feet from the floor and extends to the ceiling. The three sides that receive the most heat gain (east, south and west) have had a window film applied. The window film has a visual light transmittence of 61% and a shading coefficient of 0.45. All glazings have horizontal mini blinds to control heat and glare. The building also has beautiful views of both the Atlantic ocean and the intercoastal waterway which may result in increased daylighting since occupants may open blinds for the view.

Figure 2. The law library with a view of the intercoastal water way (west side).

The seventy-one four-lamp luminaires in the perimeter offices were retrofitted with the new generation Advance Mark VII dimming ballasts (5-100% dimming) withT8 lamps. Thirty-two ceiling mounted photo sensors (*Wattstopper LS-30*) were also installed to automatically control dimming based on available daylight (Appendix E). The photo sensors were activated on July 19, 1998 and tuned by the contractor per the manufacturer's instructions. During the retrofit, FSEC also contracted with the electrical contractor to split several of the floors lighting circuits to accurately sub-meter each perimeter side. All rewiring and hardware installation was completed on October 8, 1997. Monitoring was continuous since the preceding August.

South Site – Equinox, Sunrise

The second site, Equinox, was selected since it offered the best opportunity for daylight harvesting and met all other monitoring criteria. All four sides of the rectangular building were well daylighted from perimeter windows and two areas in the interior were daylighted from 12 skylights.

Figure 3. Equinox building Sunrise, Florida.

The Equinox building differs from the northern site in that the luminaires are three lamp with paracube diffusers, there are a variety of both private offices and open cubicles, interior daylighting is available and the building is off the cardinal axis by approximately 45°.

The only drawback to selecting this site is that the windows were retrofitted with gray Lexan® sheets (shading coefficient 0.79, visible light transmittance of 50%) for hurricane protection after the site was selected. While the visible light that passes through the glazing will be reduced by 50%, the similar reduction in the solar heat gain and glare may effect the way the

Figure 4. Open cubicles on the southwest side.

horizontal mini blinds are operated. This could actually increase the effectiveness of the dimming system if heat gain and glare are reduced and occupants leave blinds open more often. In any event, large glazings with solar film appear to be the norm rather than the exception in most commercial offices.

The building's lighting system initially consisted of 3-lamp 2x4 lay-in troffers that had been retrofitted with T8 lamps and electronic ballasts. Prior to this study, each troffer was delamped from four to three lamps without re-centering the sockets. Initially we had planned to use a single 3-lamp electronic dimming ballast, however few manufactures offered 3-lamp versions and long lead times dictated the use of two 2 - lamp ballasts per troffer. The second floor of the 24,000 ft^2 building was retrofitted with two-lamp dimming ballasts (ELI Model D232-C277-P) and ceiling mounted photo sensors (PS1) manufactured by Electronic Lighting Inc.

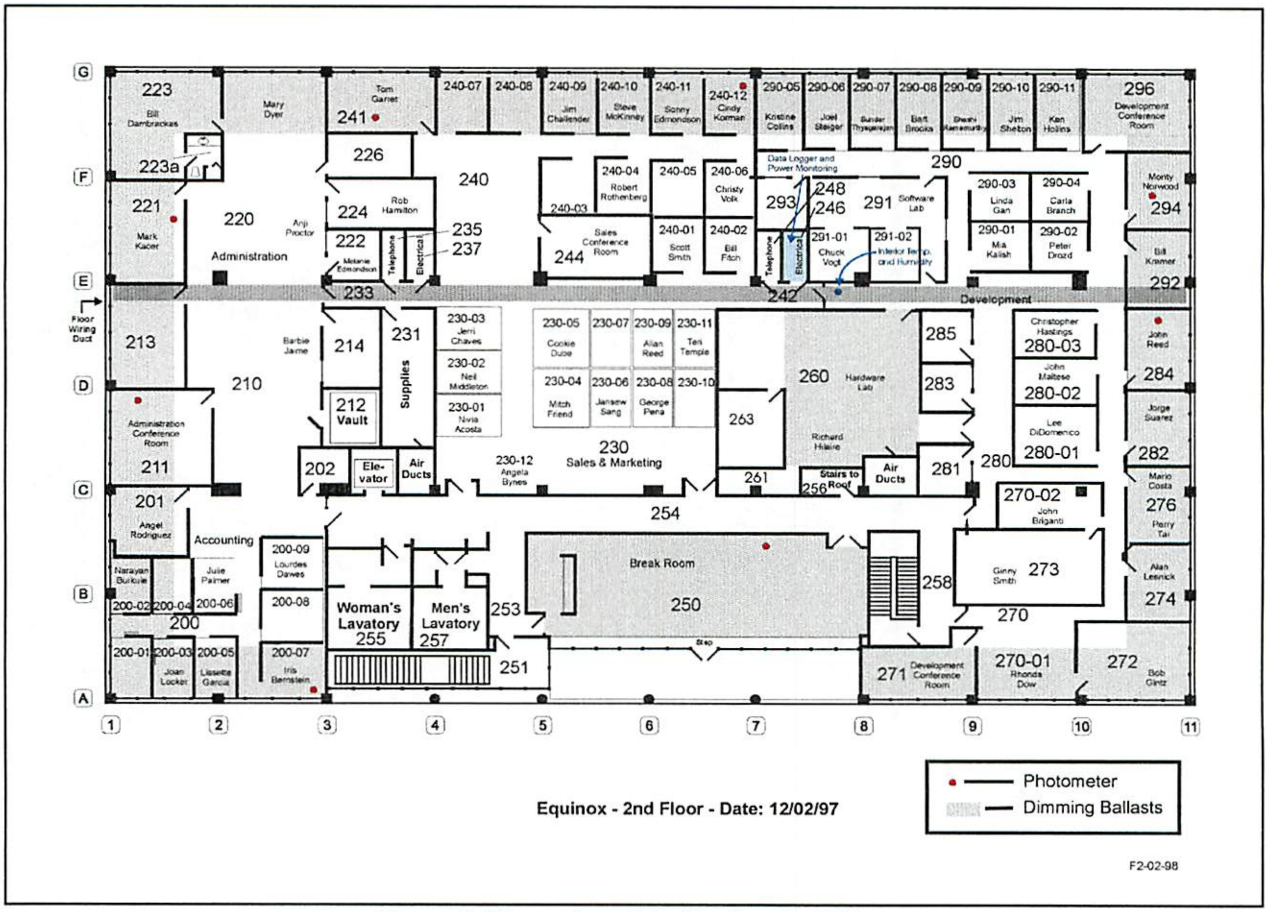

Figure 5. Floor plan of the Equinox building.

Instrumentation

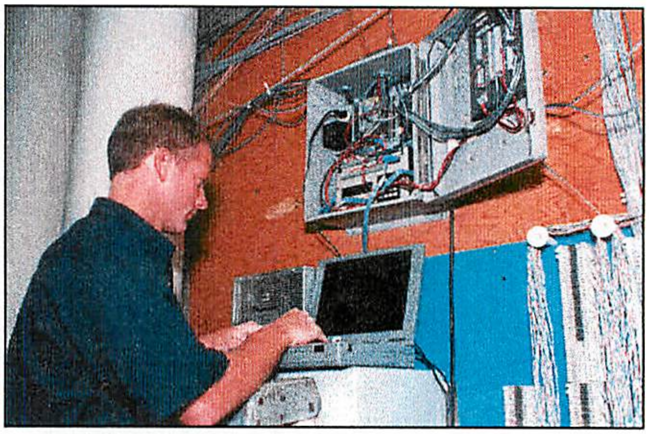
Figure 6. North site datalogger.

At each site, twenty-five channels of data were recorded to a datalogger (Figure 6) which was downloaded nightly by the FSEC VAX via modem on a dedicated phone line. Photometers in two locations on each side of the building were installed to verify that IES recommended light levels are met. Lighting circuits on each side of building's perimeter were submetered to record lighting energy savings.

In order to measure AC power for the floor, thousand Btu of cooling (Kbtus) were calculated by measuring the chilled water temperatures into and out of the air handling unit and the flow rate for the northern site. The south site used simple watt-hour meters to sub-meter the two roof-mounted air conditioners.


Figure 7. Meteorological station located on the roof of the north site.

Meteorological stations (Figure 7) at each site were used to record the ambient air temperature, relative humidity, and solar insolation. Interior conditions (temperature and relative humidity) were also recorded.

Daily plots of the previous day's data was printed and analyzed by an FSEC researcher to insure that all instrumentation is functioning properly. Photometers were periodically cleaned to insure accurate illumination measurement. Data collection has been continuous since the datalogger were first installed except for a few days when the backup battery failed at the southern site. The meteorological station at the northern site failed once during the course of monitoring due to a lighting strike but was promptly replaced. Several photometers also had to be remounted at both sites due to office rearrangements, inadvertent dismounting, and intentional covering. All the sensors were calibrated prior to deployment at each site. Data for each of these sensors were filtered from the analysis. Typical daily plots for each site is shown in Appendix A.

Results

Energy savings and illumination levels were compared for three separate periods during the project. Due to a change in the AC system at the south site and several failures at the north site the monitored AC data was unuseable. The three separate monitoring periods were:

1. <u>Preperiod</u> – Prior to the activation of the dimming system using the dimming ballasts.

2. Postperiod – After the dimming system was connected and adjusted by the contractor.

3. Postperiod 2 – After the system was tuned and optimized by FSEC.

Achieved lighting energy savings were lower than expected. This likely has to do with use of the technology in buildings not specifically designed for daylighting as well as occupant influence from blind operation and/or defeat of automated controls. Measured lighting energy savings varied considerably by orientation and by site. For instance average savings from the pre to post periods at the Northern Site were negative for both North (-4.5%) and South orientation (-5.3%). However, savings were positive in the East (20.9% savings) and West (23.3%) directions. The over-all lighting electrical savings ranged from 3% at the north site to 8.3% at the south site after the sites were commissioned (postperiod 2).

The four perimeter sections in the southern site was oriented somewhat off axis. Here the savings produced varied from 1.5% in the Northeast direction, 27% for the Southeast direction and 13.5% in the Northwest and 9.7% in the Southwest orientations.

There are several factors that could account for the difference in savings. These include the proficiency of the installation contractor, disabling of the controls by the occupant and the difference in tasks performed at the two sites. In the north site the contractor neglected to connect several of the ambient light sensors which resulted in no savings for those areas (primarily the north side). Lighting levels also had to be corrected in several areas at the north site.

The north site was also occupied by attorneys who read for long hours documents with fine print. The light levels at the north site fell below acceptable levels and the occupants frequently disabled the ceiling mounted photosensor by simply covering it with tape or post-it notes during the post period.

In contrast, the south site has many occupants who use computers, and require lower light levels. There were no instances of the system being disabled by the occupants at the south site and occupant satisfaction was good.

Figure 8. Ceiling mounted photosensor covered with post-it note by occupant making it inoperable.

We were not able to successfully measure the interaction of the lighting energy reduction with space cooling. In the south site, the air conditioning system was changed out during the post lighting retrofit period, confounding any attempt to sort out the differences. In the north site, difficulties with the chilled water system flow measurement made meaningful comparison impossible. In any case, with the very low magnitude of lighting energy reduction (6 - 9%), the expected impact on the cooling system operation is very low.[1]

[1] As example, if lighting was a third of the overall cooling load (typical in commercial office buildings) a lighting energy reduction of 9% would be expected to reduce space cooling energy use by about 3%.

Results for the two sites are analyzed separately:

North Site

Lighting energy savings for the north site averaged 10.3 % during the first postperiod, however occupant satisfaction with the system was poor and the system was adjusted in an attempt to improve occupant satisfaction during postperiod 2. Unfortunately no increase in occupant satisfaction was achieved during postperiod 2 when the light level was increased. Lighting energy savings also suffered (dropped to 3 %) when the lighting was adjusted. The occupants at the north site were all attorneys and require high light levels for reading. It appears that before the dimming system was installed the light level was just adequate for reading and when the dimming system was installed light levels dropped to an unacceptable level. It is also possible that the fluctuations in the light level could have made reading difficult. This theory is based solely on the responses that the occupants submitted.

The average illumination levels recorded also support the hypothesis that illumination dropped below a critical level since the average dropped from 48.8 Dlux to 44.2 Dlux from the preperiod to postperiod 2. Illumination levels were only recorded in eight locations and are influenced greatly by the blinds, manual switching by the occupant, and the sensor placement. Therefore, validation of this theory would require more detailed data collection.

Interestingly, the east and west orientations also had the best energy savings. These orientations have attractive views of the ocean on the east and the intercoastal waterway on the west. Blinds were often found to be open more often in these orientations and likely have some influence on the savings. This conclusion is also similar to that reached in a more controlled study of blind position influence on dimming performance (Schrum and Parker, 1996). The south side received substantial heat gain and glare and therefore often had the blinds left closed. On the north side, blinds were commonly left open and probably had little influence on the functionality of the dimming system.

Figure 9. Blinds were frequently left open on the north side.

South Site

The savings and level of occupant satisfaction at the south site were better compared to the north site. Average daily energy savings for the lighting alone averaged 8.5 % for both postperiods and overall users expressed few complaints of the system. The northwest and southeast sides of the building performed the best, which agrees somewhat to findings at the north site. Tasks performed at this site were primarily computer related, which generally require lower light levels. Measured light levels were in the range which is considered acceptable to the Illuminating Engineering Society's standards. This may account somewhat for the better savings and occupant satisfaction.

Table 1
Daylight Dimming Performance Results

Summary of Lighting Energy Savings - North Site					
	North	East	South	West	Total
From Preperiod to Postperiod	-5.7 %	20.6 %	2.5 %	31.4 %	10.3 %
From Preperiod to Postperiod 2	-3.2 %	21.2 %	-13.1 %	15.1 %	3.0%
Summer Peak (4-6PM) Reduction Pre to Post	-1.4 kW	3.4 kW	0.6 kW	6 kW	8.6 kW
Summer Peak (4-6PM) Reduction Pre to Post 2	-0.8 kW	3.5 kW	-3.1 kW	2.9 kW	2.5 kW

Average Weekday Illumination Levels (Dlux) - North Site					
	North	East	South	West	Average
Preperiod	64.0	51.5	37.1	42.6	48.8
Postperiod 1	70.1	49.2	44.9	28.8	48.2
Postperiod 2	68.4	59.2	30.3	19.0	44.2

Summary of Lighting Energy Savings - South Site					
	Northeast	Northwest	Southeast	Southwest	Total
From Preperiod to Postperiod 1	5.6 %	12.5 %	21.5 %	6.9 %	8.8 %
From Preperiod to Postperiod 2	-2.7 %	14.2 %	32.5 %	12.5 %	8.3 %
Summer Peak (4-6PM) Reduction Pre to Post	6.7 kW	9.6 kW	4.3 kW	5.8 kW	26.4 kW
Summer Peak (4-6PM) Reduction Pre to Post 2	-3.2 kW	10.9 kW	6.5 kW	10.5 kW	24.7 kW

Average Weekday Illumination Levels (Dlux) - South Site					
	Northeast	Northwest	Southeast	Southwest	Average
Preperiod	60.9	55.1	32.5	40.7	47.3
Postperiod 1	48.5	33.8	32.8	34.9	37.5
Postperiod 2	57.0	30.4	29.9	34.3	37.9

Dynamically-Controlled Lighting Systems

In dynamically controlled lighting systems, electronic dimming ballasts are automatically-controlled by a variety of sensors including photo-sensors, occupancy sensors, and energy management systems. Manual control is also possible through wall, desk, or infrared controls. There are several strategies to utilize dimming ballasts to achieve savings. Proportional controls such as daylight-dimming and manual dimming (conference rooms). Other strategies such as occupancy based dimming, lumen maintenance and load shedding are not as popular but can extend the functionality of dimming ballasts.

In a daylight dimming strategy, a photosensor reads the ambient light levels in a space where daylight is available from windows or skylights. If light levels exceed or fall below the desired maintained level, the photocell, in theory, signals a dimming ballast to ramp up or dim fluorescent light output. Energy savings are realized by recognizing the variable contribution of daylight to the space. The ballast can either step-dim or continuously dim light output. Photocells can control a single compatible ballast on up to multiple ballasts, and some systems require an integrated controller wired between the photosensor and the ballast.

In typical daylight dimming systems, low-voltage wiring connects the photo-sensors and ballasts – installed in the ceiling plenum and operating independently of the power circuits so that specific zones of fixtures can be established for dimming (such as a group closest to the windows). Some systems offer the option to transmit a pulse signal over the standard line, adding flexibility and eliminating the need for hard-wiring. Most dimming ballasts allow dimming down to 5-20 percent; minimum light levels can be manually adjusted at the photosensor by the user, however several attempts were necessary at both sites. Newer dimming ballasts can operate up to four lamps. Daylight dimming controls are application-sensitive, requiring careful placement and calibration. Photocells are generally installed in the ceiling two-thirds of the way into the zone containing the dimmable fixtures. The photosensor should be mounted above a work area that is representative of the other areas in the space. The use of blinds can reduce energy savings by restricting the access of daylight to the space; the blinds should be adjusted so that reflected light impacts the ceiling, or window film can be applied to the windows. If the space includes partitions, where occupants do not receive much daylight, the fixtures over these spaces can be left out of the dimming zone. Or a single photosensor can be assigned to each fixture.

Consumer Acceptance

Both sites were surveyed before and after the commissioning to determine consumer acceptance of the dimming system. Consumer acceptance differed significantly between the two sites. At the southern site users were generally pleased with the system and complaints were normally resolved by adjusting the system to suit the illumination required by the user. However, at the northern site the users were disappointed with the lighting system, even after it was commissioned by FSEC. Ceiling photo-sensors were often disabled by users placing tape over the lens forcing the systems to full brightness. An example of this is shown in Figure 8. At the end of the study, at the request of the tenant, the dimming was disabled. It is important to note that at the northern site the occupants were primarily attorneys in private offices as opposed to professionals working for a private company in the southern site. Attorneys may be more forthcoming in their requests for changes to their environment than professionals working for a corporation. The attorneys also performed more reading tasks that required higher light levels than the occupants in the southern site. Table 2 below summarizes the results obtained through the survey.

Table 2
Occupant Survey Results

Occupant Perception of Adequacy of Light Level After Installation					
	Too Dim	Dim	Average	Bright	Too Bright
South Site	5%	5%	68%	17%	5%
North Site	36%	23%	27%	14%	0%

Quality of Lighting					
	Poor	Below	Average	Good	Excellent
South Site	0%	13%	61%	13%	13%
North Site	36%	23%	31%	14%	9%

Perceived Change in Lighting Level		
	Increase	Decrease
South Site	29 %	71 %
North Site	0 %	100 %

Photosensor Design Issues

During the commissioning of the two sites, performance issues were identified with the ceiling mounted photo-sensors. These issues were also discovered in during previous research (Floyd and Parker, 1995).

Also the practice of measuring light using a ceiling mounted photosensor appears to have limitations due to the response of the photosensor to stray light. It appears that an improved design that recessed the Fresnel lens to minimize response from direct window light would perform better. This agrees with earlier investigations of controls (Rubin et al. 1989). Also the practice of controlling desktop light levels by measuring it's reflection through a ceiling mounted photosensor appears to be flawed. A previous research project proved that for that particular application there was little correlation between the measurement of the reflected light off a work surface to it's actual value. Improved sensor design or location is needed to provide a more accurate control of the dimming ballasts.

Load Shedding Opportunities

Current energy-saving automatic dimming strategies include daylight dimming, lumen maintenance control, scheduled dimming, occupancy-sensed dimming and load shedding. Recently, daylight dimming has been the most popular for energy management. Load shedding, however, can offer significant value to both the end user and FPL. Systems are now available which can be controlled through a variety of communication protocols including the internet, RF transmission, power line carrier, and modems (see Appendix E). The system works by dimming selective areas (up to 30%), typically non-critical, as the building load peaks. Manufacturers claim that the dimming is so subtle that it is rarely noticed by the buildings occupants. Of course, this may or may not be the case, as evidenced b the occupant acceptance data from this project.

Manual Dimming Opportunities

Building controls are becoming more sophisticated, and sensing and control systems are enabling this trend. Control of lighting systems entails on/off switching, step-dimming or continuous dimming. In an energy efficiency context, automatic switching is essential to reduce the operating hours of the lighting system. But when it comes to dimming in the office environment, who is best to judge whether to lower light levels – the photosensor or the occupant?

Manual dimming controls allow occupants to choose their own light levels via wall dimmers, desk dimmers, task lighting dimmers or hand-held remote controllers to dim the light output from individual fixtures or groups of fixtures. A common configuration includes low-voltage wiring between the dimmer and the ballast to relay the dimming signal. Some manufacturers offer dimmable ballasts operating T8 lamps that do not require additional wiring. However, since the performance of occupant controlled dimming systems would be necessarily influenced by behavior, empirical studies would be necessary to establish relative impact on utility coincident peak loads.

Conclusions

The Florida Solar Energy Center (FSEC), under contract with Florida Power And Light (FPL) has evaluated daylight dimming systems as a commercial demand side management program. FSEC installed dimmable fluorescent lighting systems in two commercial buildings in south and central Florida (the south and north sites respectively). The dimming systems were installed in perimeter offices on one floor and were designed to dim in response to available daylight.

Both systems were evaluated for consumer acceptance, seasonal savings, utility peak demand reduction, and cost effectiveness for introduction as a demand side management program. Lighting energy savings averaged 6.7 % for the north site and 8.5 % for the south site during the two year monitoring period. The low level of savings likely has to due with use of the technology in buildings not specifically designed for daylighting as well as the influence of occupant blind operation. After commissioning by FSEC, Consumer acceptance for the system ranged from unacceptable at the north site to acceptable at the south site.

The level of energy savings or peak demand reduction for daylight harvesting applications is greatly dependant upon a building's design, current light level and the tasks performed, blind operation, and proper installation of controls. This makes the savings difficult to predict for a building prior to the installation of the system. Controlled lighting systems that dim gradually during the utilities peak demand period coupled with other controls including daylight harvesting may offer the best value for both the customer and FPL. Unfortunately little third party data is available to quantify the actual field performance of these systems and occupant satisfaction.

Other cited studies have shown that daylighting systems *can* produce large reductions to daytime lighting energy demand in specific buildings designed for daylighting. Such buildings would often feature perimeter offices with spectrally selective glass (allows a large amount of daylight into the work space with large heat gain) and light shelves to project daylight to the interior while protecting occupants from direct sun and resulting glare. Specifically, several previous investigations have shown that school classrooms can often benefit from properly set up daylight dimming systems. Thus, the results of this study should not be used to conclude that such systems are not viable. However, the outlined investigation does indicate the potential hazards of adding the technology on to buildings not specifically designed to take advantage of daylight.

Until a metric is developed to predict savings from daylight dimming, load shedding and other strategies should be investigated for existing buildings. Ideally, the controlled lighting system should be custom tailored to each building. Multiple controls such as occupancy sensors, manual dimmers, load shedding devices, and photo-sensors could be combined to maximize the savings and provide utility peak demand reduction. Since the utility peak reduction potential of all but the load shedding controls is difficult to predict, it seems prudent to only include this strategy in a utility peak reduction program. The potential for load shedding appears to be substantial, if manufacturers claims of 30 % load shedding can be achieved without occupant rejection.

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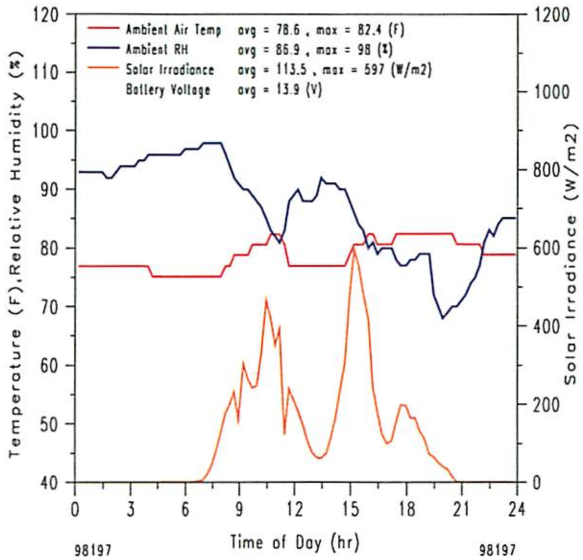
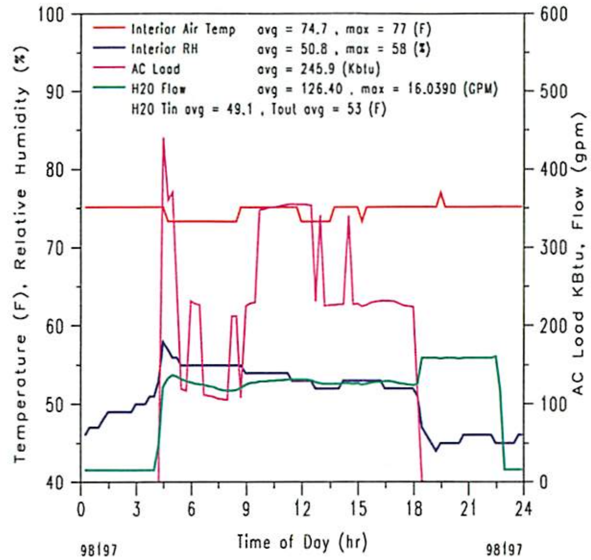
Appendix A

Typical Daily Plots for Both Sites

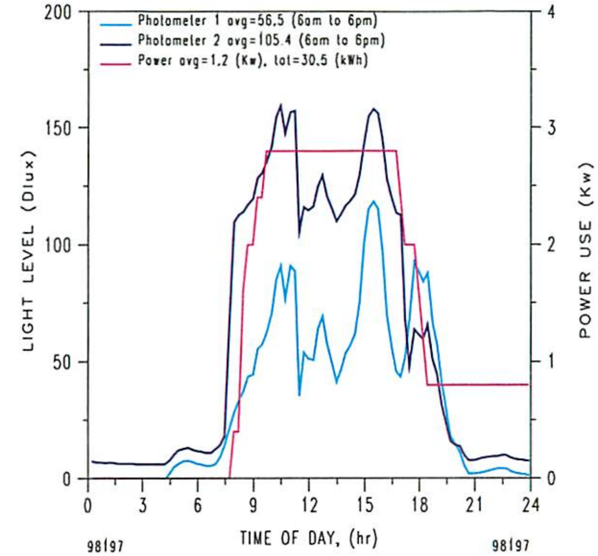
EXTERIOR SITE CONDITIONS



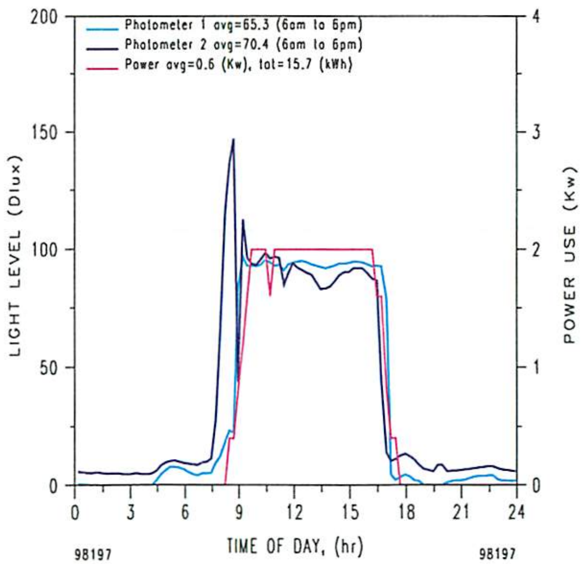
FIFTH FLOOR INTERIOR CONDITIONS



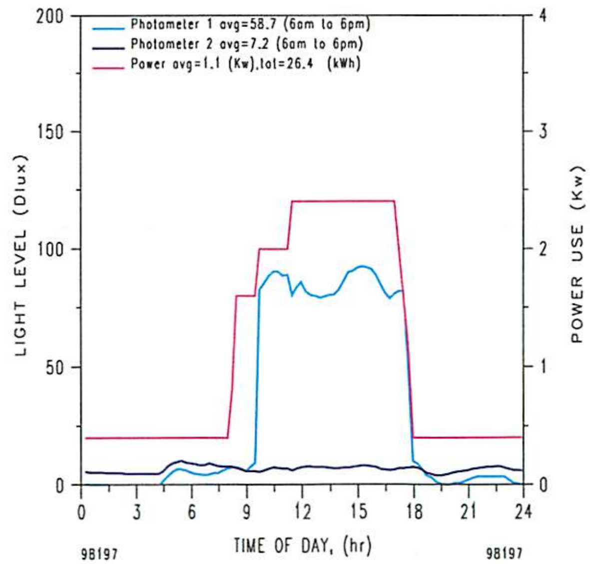
NORTH SIDE LIGHTING POWER AND LEVEL



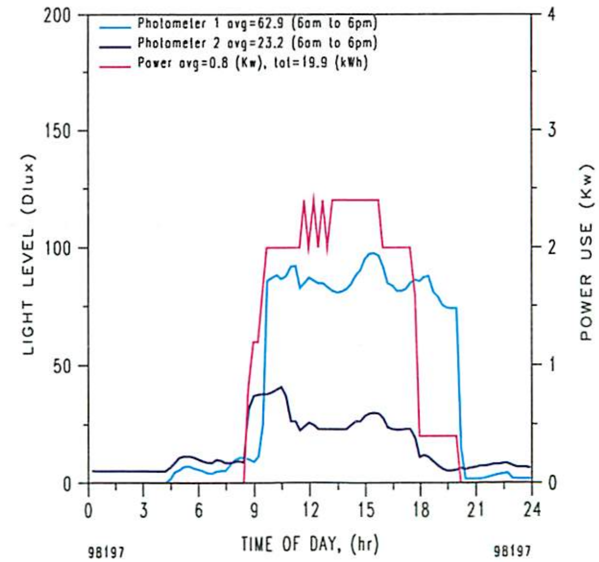
EAST SIDE LIGHTING POWER AND LEVEL



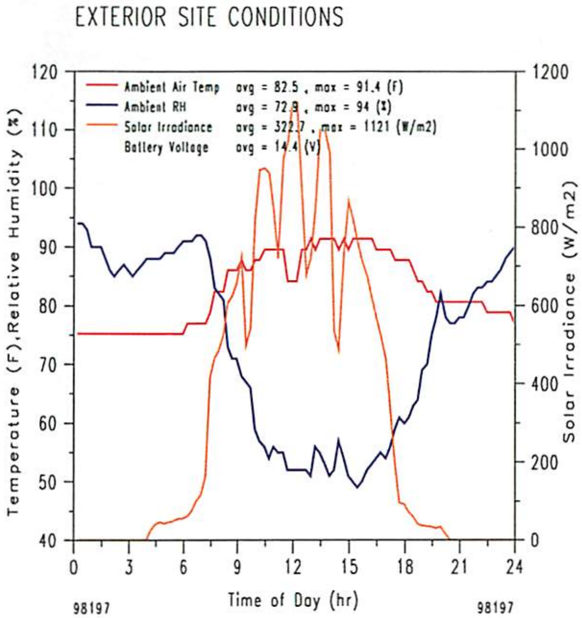
SOUTH SIDE LIGHTING POWER AND LEVEL

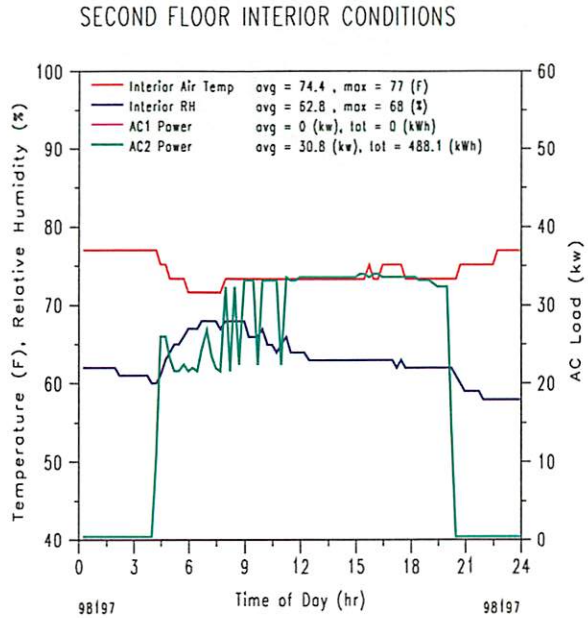


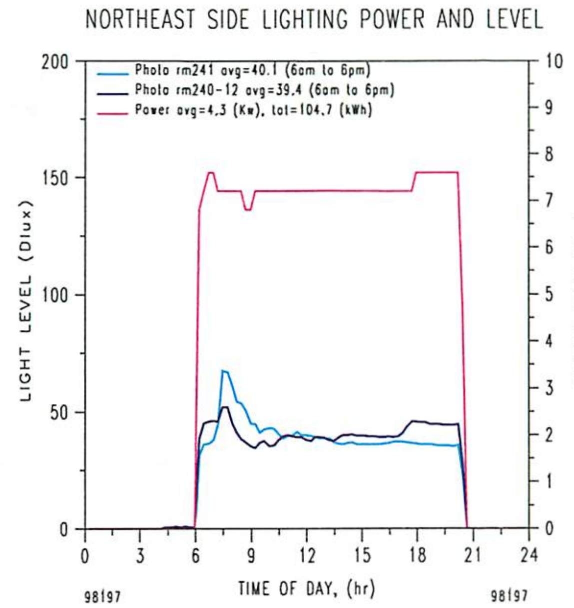
WEST SIDE LIGHTING POWER AND LEVEL

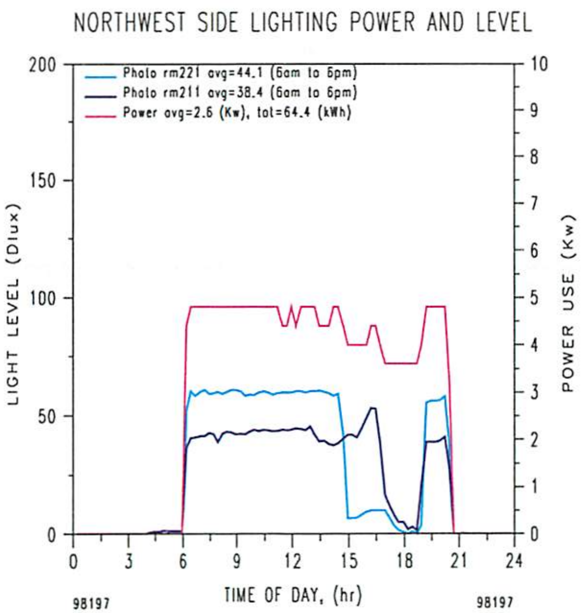


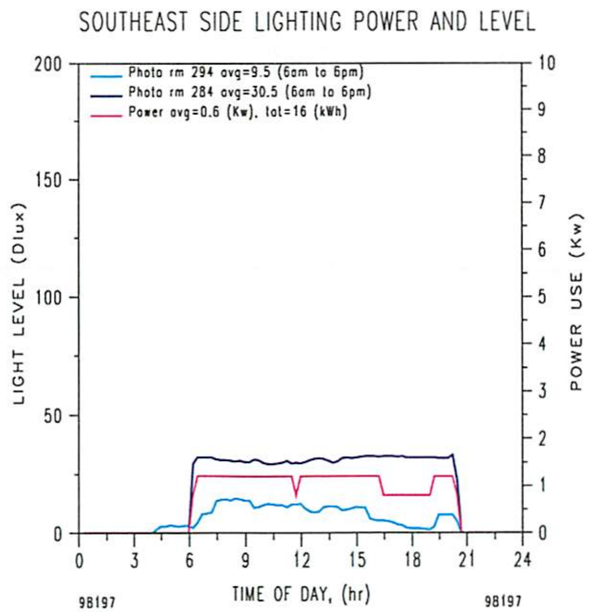
NORTH SITE

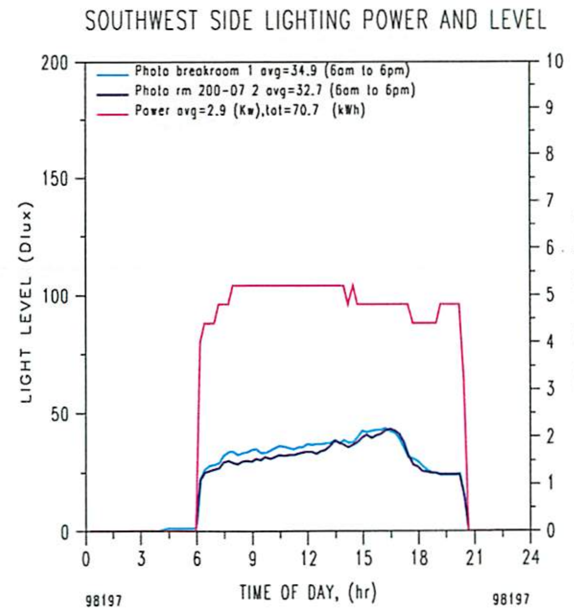

EXTERIOR SITE CONDITIONS
Ambient Air Temp avg = 82.5 , max = 91.4 (F)
Ambient RH avg = 72.9 , max = 94 (%)
Solar Irradiance avg = 322.7 , max = 1121 (W/m2)
Battery Voltage avg = 14.4 (V)
Temperature (F), Relative Humidity (%)
Solar Irradiance (W/m2)
Time of Day (hr)
98197
98197


SECOND FLOOR INTERIOR CONDITIONS
Interior Air Temp avg = 74.4 , max = 77 (F)
Interior RH avg = 62.8 , max = 68 (%)
AC1 Power avg = 0 (kw), tot = 0 (kWh)
AC2 Power avg = 30.8 (kw), tot = 488.1 (kWh)
Temperature (F), Relative Humidity (%)
AC Load (kw)
Time of Day (hr)
98197
98197


NORTHEAST SIDE LIGHTING POWER AND LEVEL
Photo rm241 avg=40.1 (6am to 6pm)
Photo rm240-12 avg=39.4 (6am to 6pm)
Power avg=4.3 (Kw), tot=104.7 (kWh)
LIGHT LEVEL (Dlux)
POWER USE (Kw)
TIME OF DAY, (hr)
98197
98197


NORTHWEST SIDE LIGHTING POWER AND LEVEL
Photo rm221 avg=44.1 (6am to 6pm)
Photo rm211 avg=38.4 (6am to 6pm)
Power avg=2.6 (Kw), tot=64.4 (kWh)
LIGHT LEVEL (Dlux)
POWER USE (Kw)
TIME OF DAY, (hr)
98197
98197

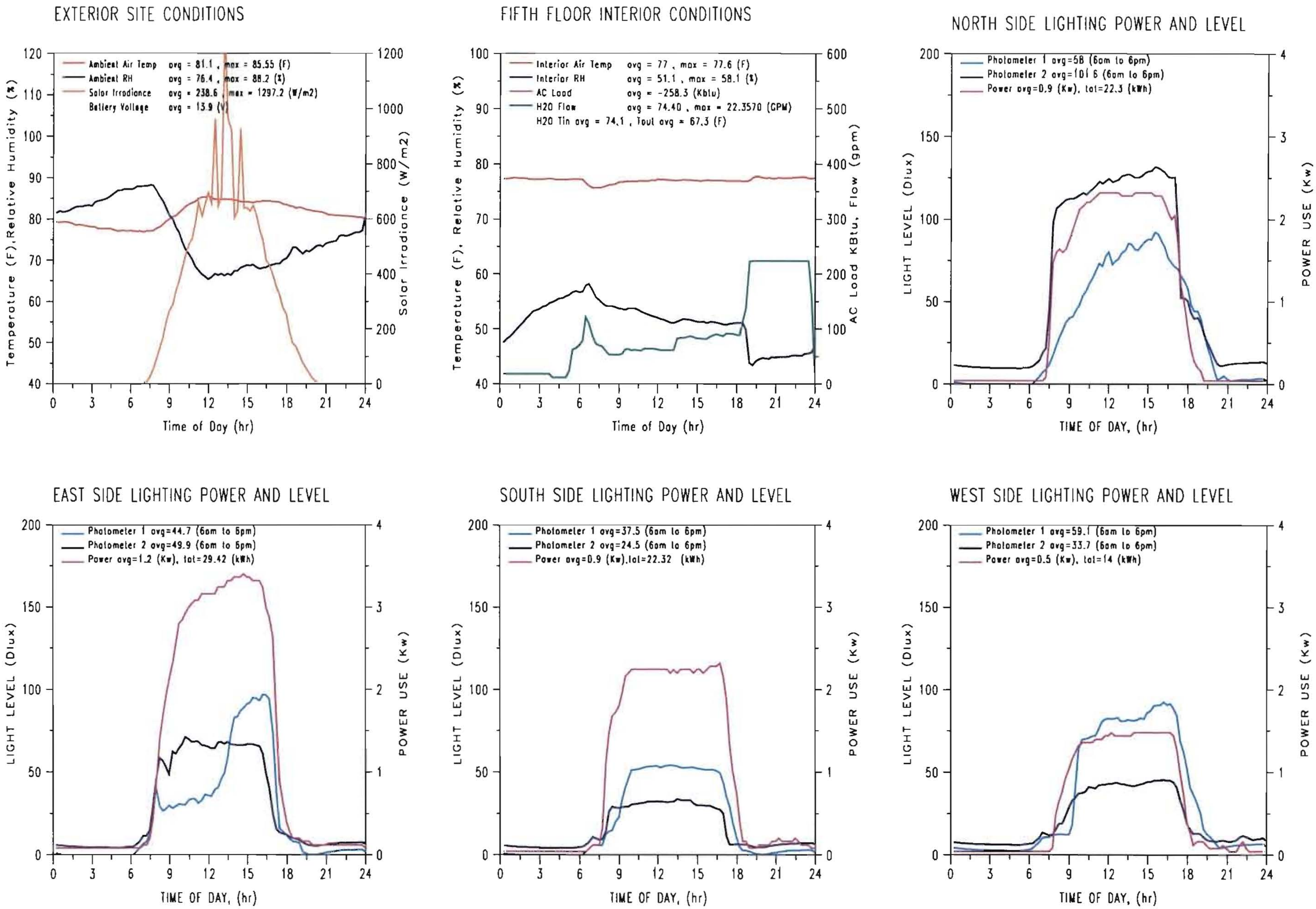

SOUTHEAST SIDE LIGHTING POWER AND LEVEL
Photo rm 294 avg=9.5 (6am to 6pm)
Photo rm 284 avg=30.5 (6am to 6pm)
Power avg=0.6 (Kw), tot=16 (kWh)
LIGHT LEVEL (Dlux)
POWER USE (Kw)
TIME OF DAY, (hr)
98197
98197


SOUTHWEST SIDE LIGHTING POWER AND LEVEL
Photo breakroom 1 avg=34.9 (6am to 6pm)
Photo rm 200-07 2 avg=32.7 (6am to 6pm)
Power avg=2.9 (Kw),tot=70.7 (kWh)
LIGHT LEVEL (Dlux)
POWER USE (Kw)
TIME OF DAY, (hr)
98197
98197

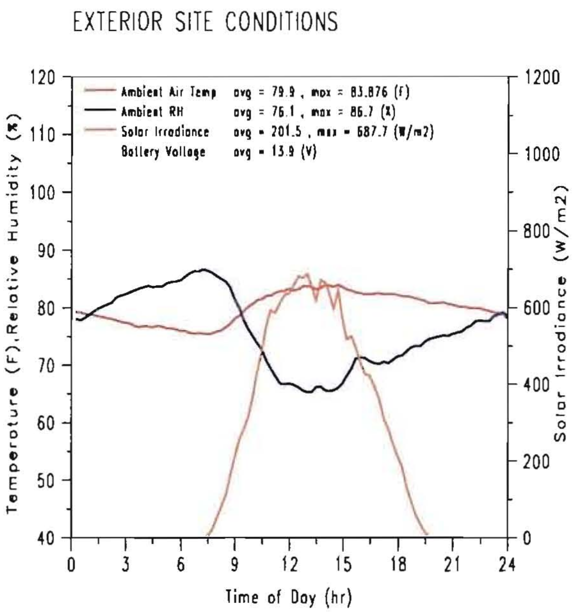
SOUTH SITE

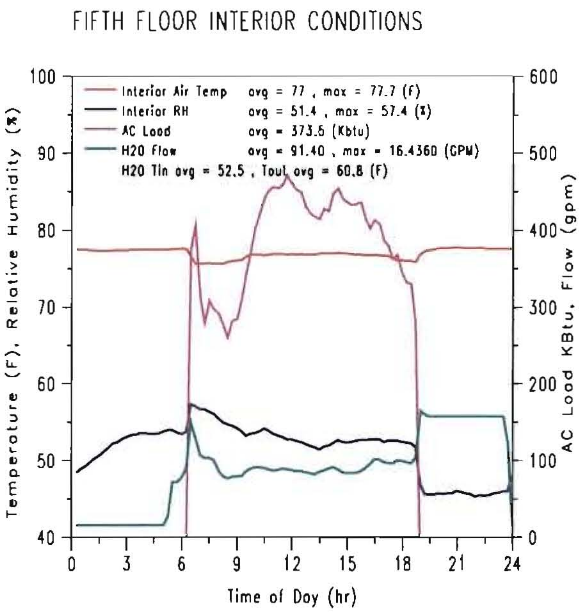
Appendix B

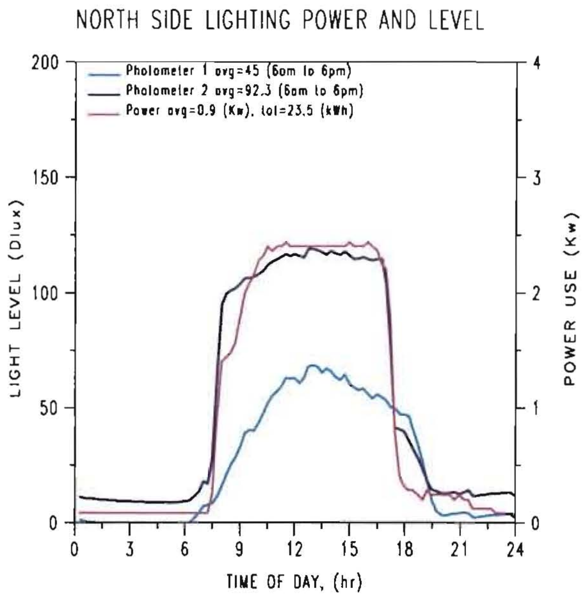
Monthly Average for Both Sites

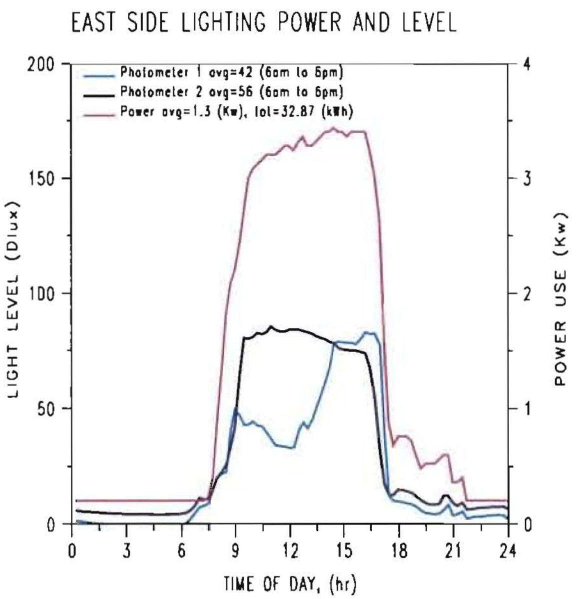


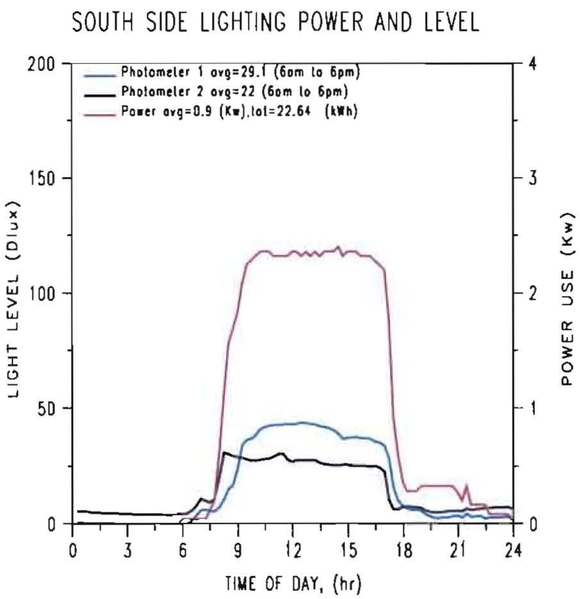
AUGUST 1997 DAILY AVERAGE FOR WEEKDAYS - NORTHERN SITE

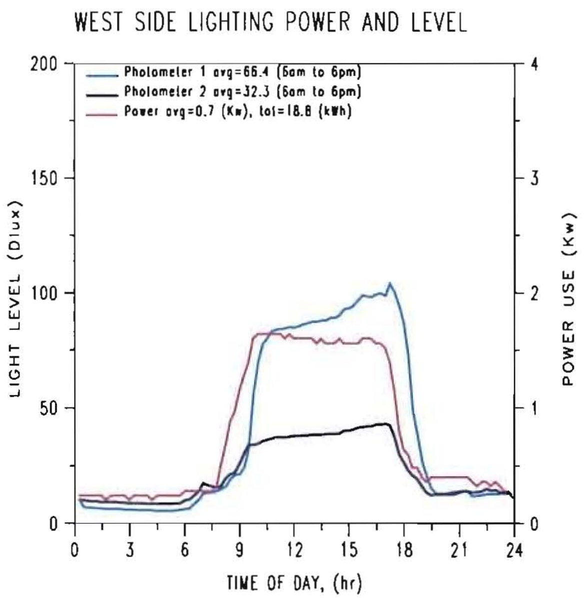






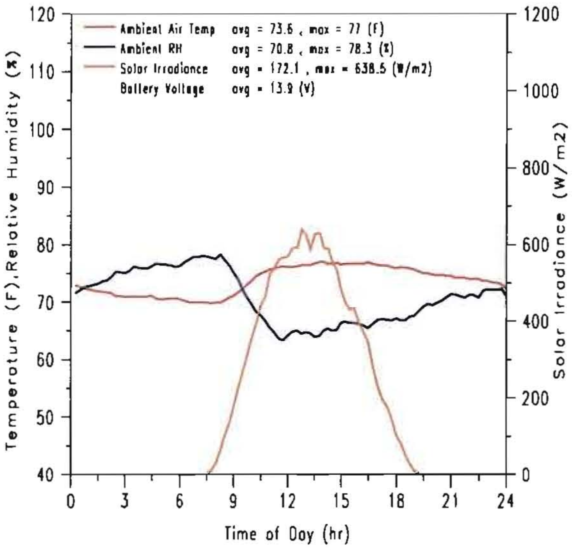




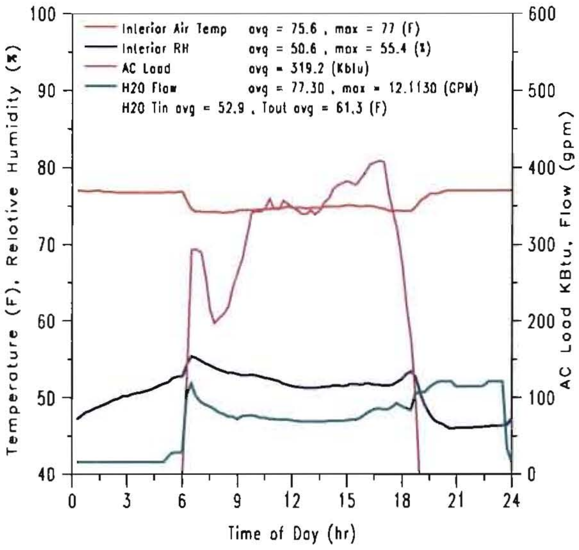


SEPTEMBER 1997 DAILY AVERAGE FOR WEEKDAYS - NORTHERN SITE

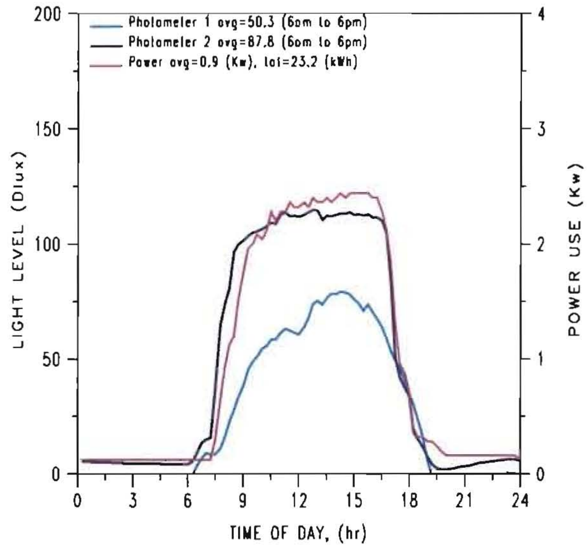
EXTERIOR SITE CONDITIONS



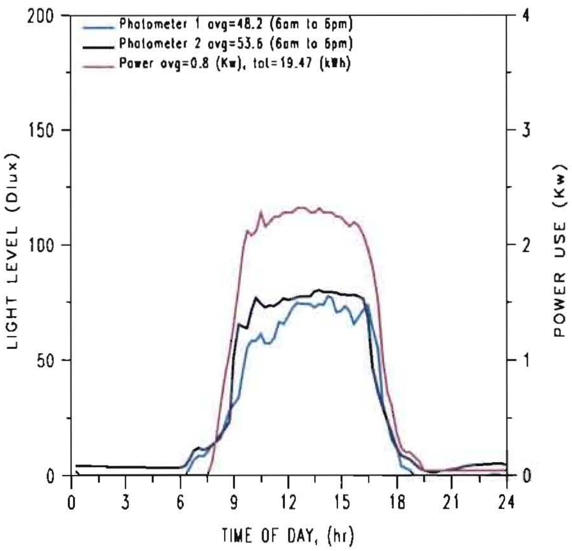
FIFTH FLOOR INTERIOR CONDITIONS



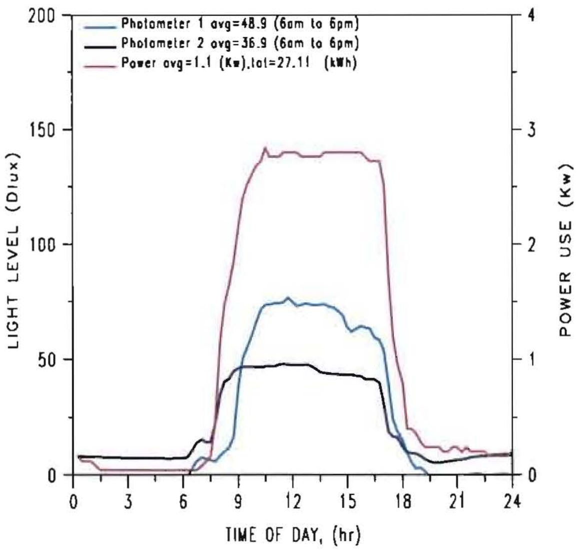
NORTH SIDE LIGHTING POWER AND LEVEL



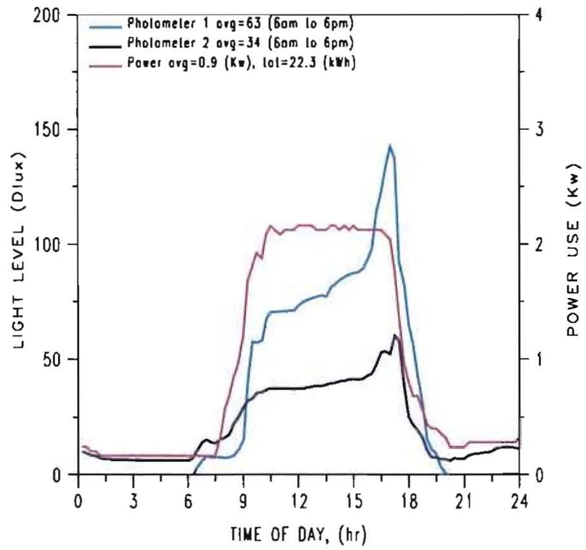
EAST SIDE LIGHTING POWER AND LEVEL



SOUTH SIDE LIGHTING POWER AND LEVEL

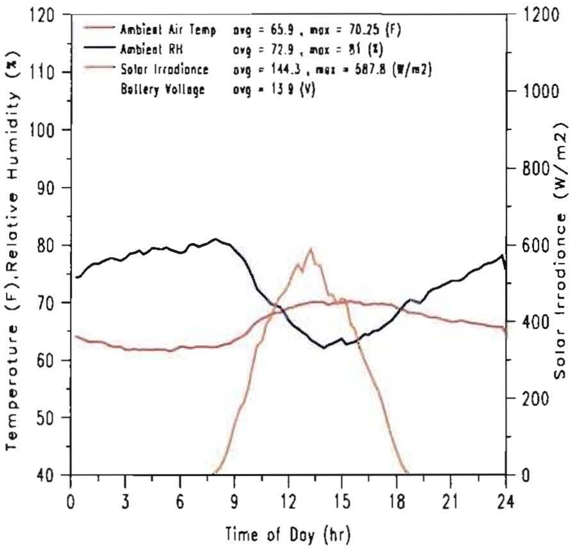


WEST SIDE LIGHTING POWER AND LEVEL

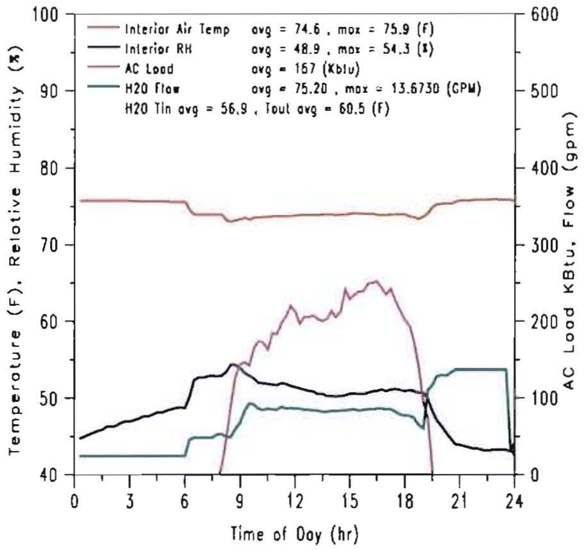


OCTOBER 1997 DAILY AVERAGE FOR WEEKDAYS - NORTHERN SITE

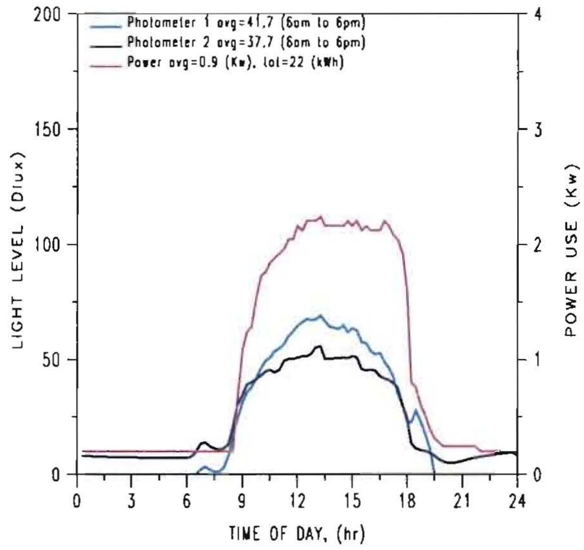
EXTERIOR SITE CONDITIONS



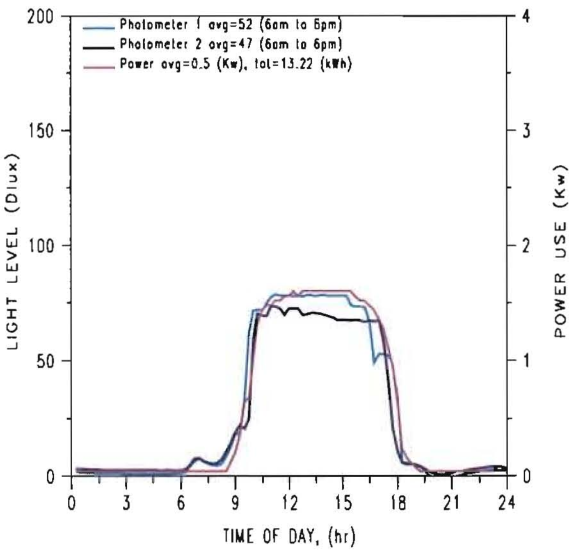
FIFTH FLOOR INTERIOR CONDITIONS



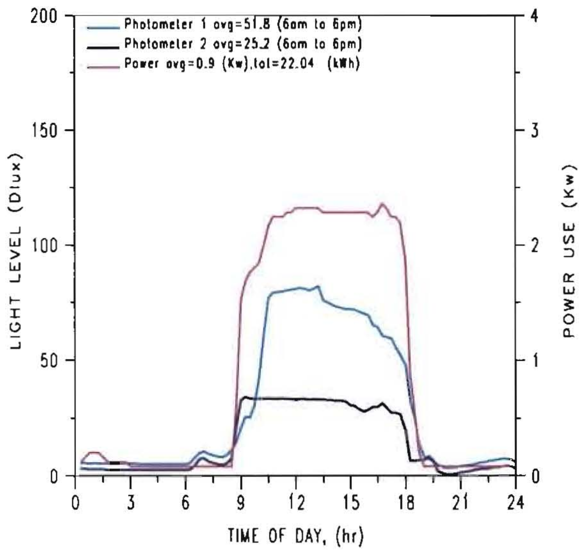
NORTH SIDE LIGHTING POWER AND LEVEL



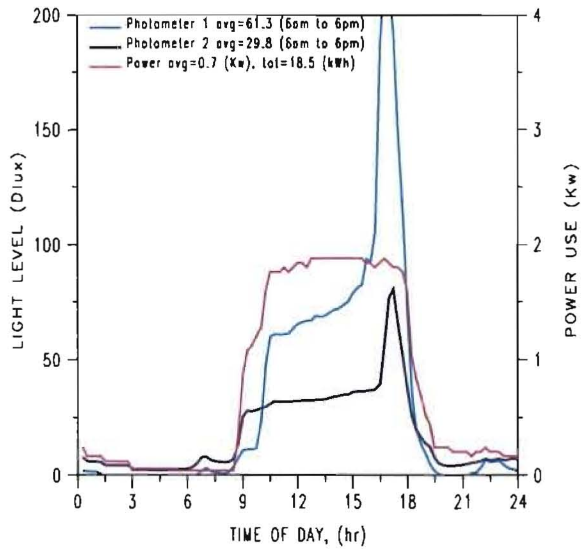
EAST SIDE LIGHTING POWER AND LEVEL



SOUTH SIDE LIGHTING POWER AND LEVEL

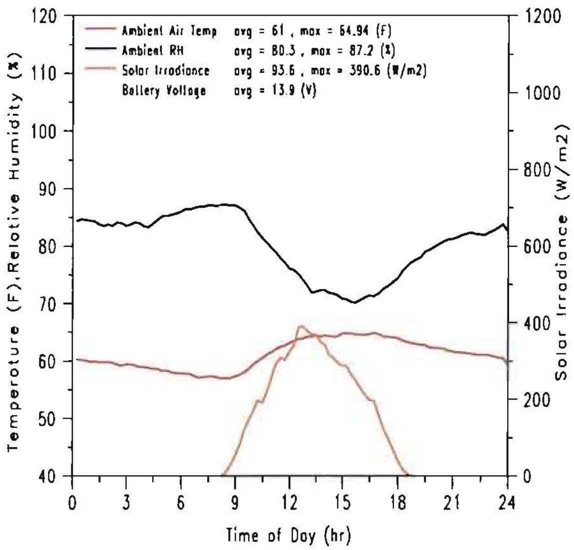


WEST SIDE LIGHTING POWER AND LEVEL

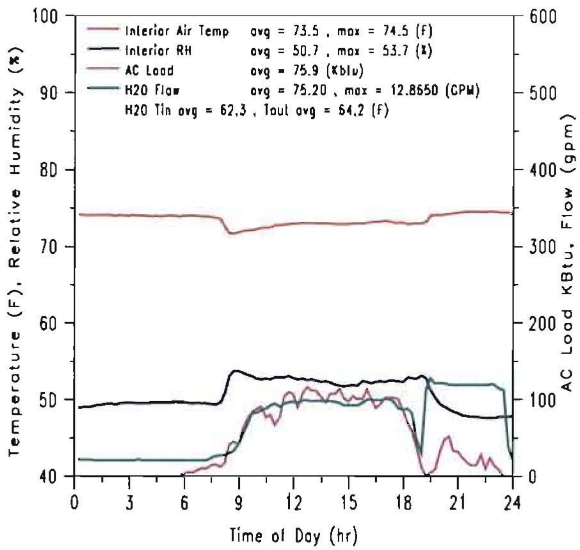


NOVEMBER 1997 DAILY AVERAGE FOR WEEKDAYS - NORTHERN SITE

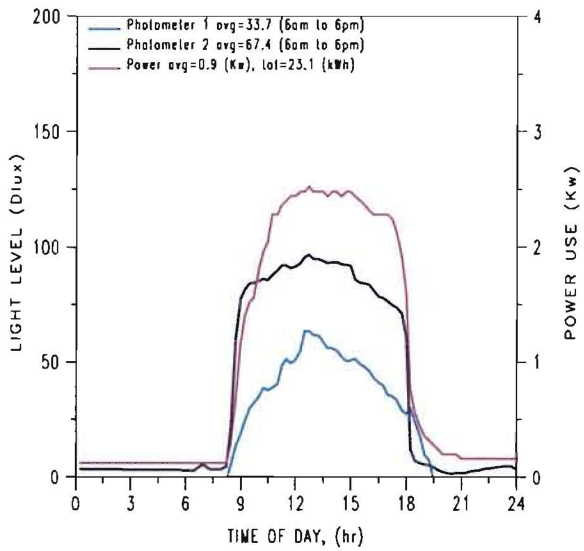
EXTERIOR SITE CONDITIONS



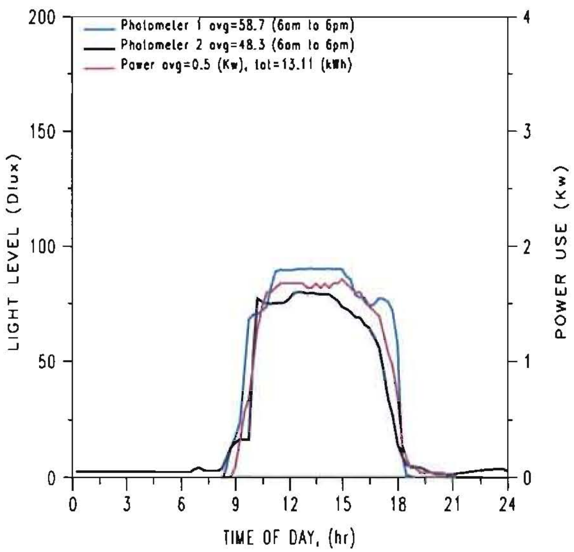
FIFTH FLOOR INTERIOR CONDITIONS



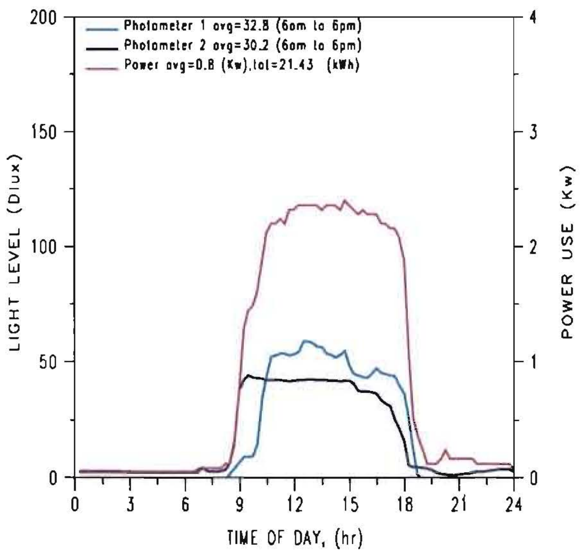
NORTH SIDE LIGHTING POWER AND LEVEL



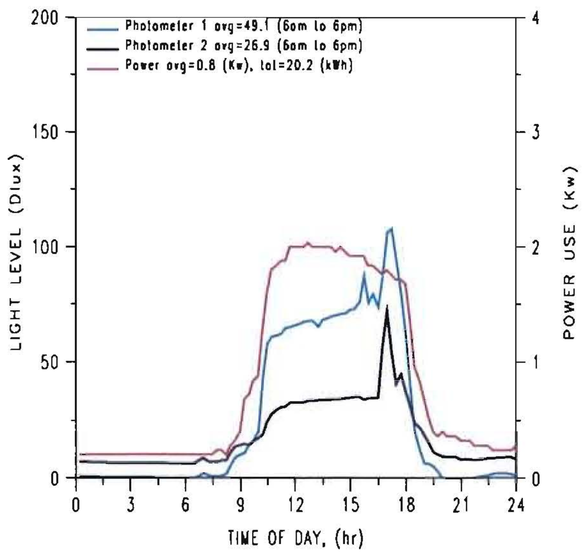
EAST SIDE LIGHTING POWER AND LEVEL



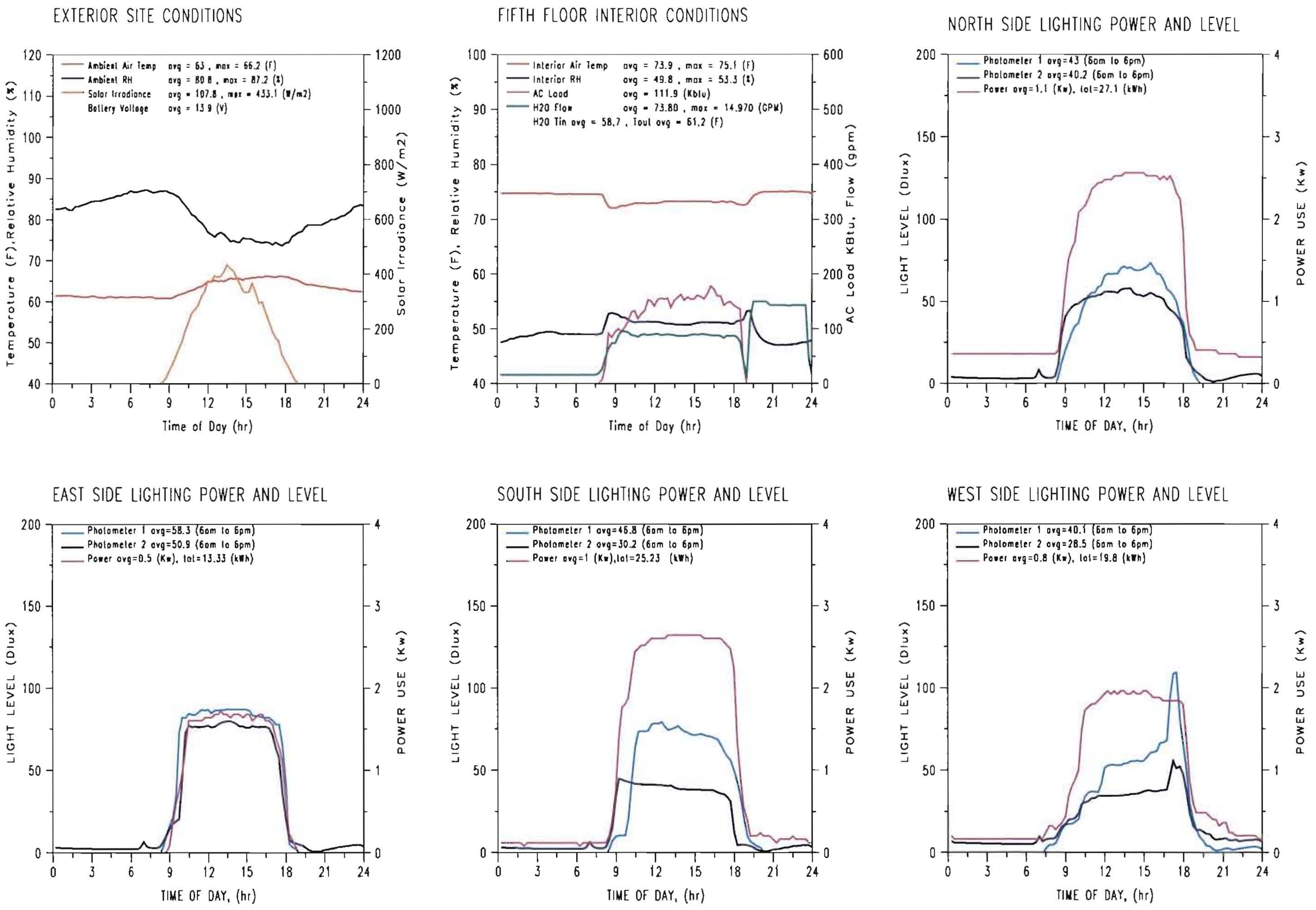
SOUTH SIDE LIGHTING POWER AND LEVEL



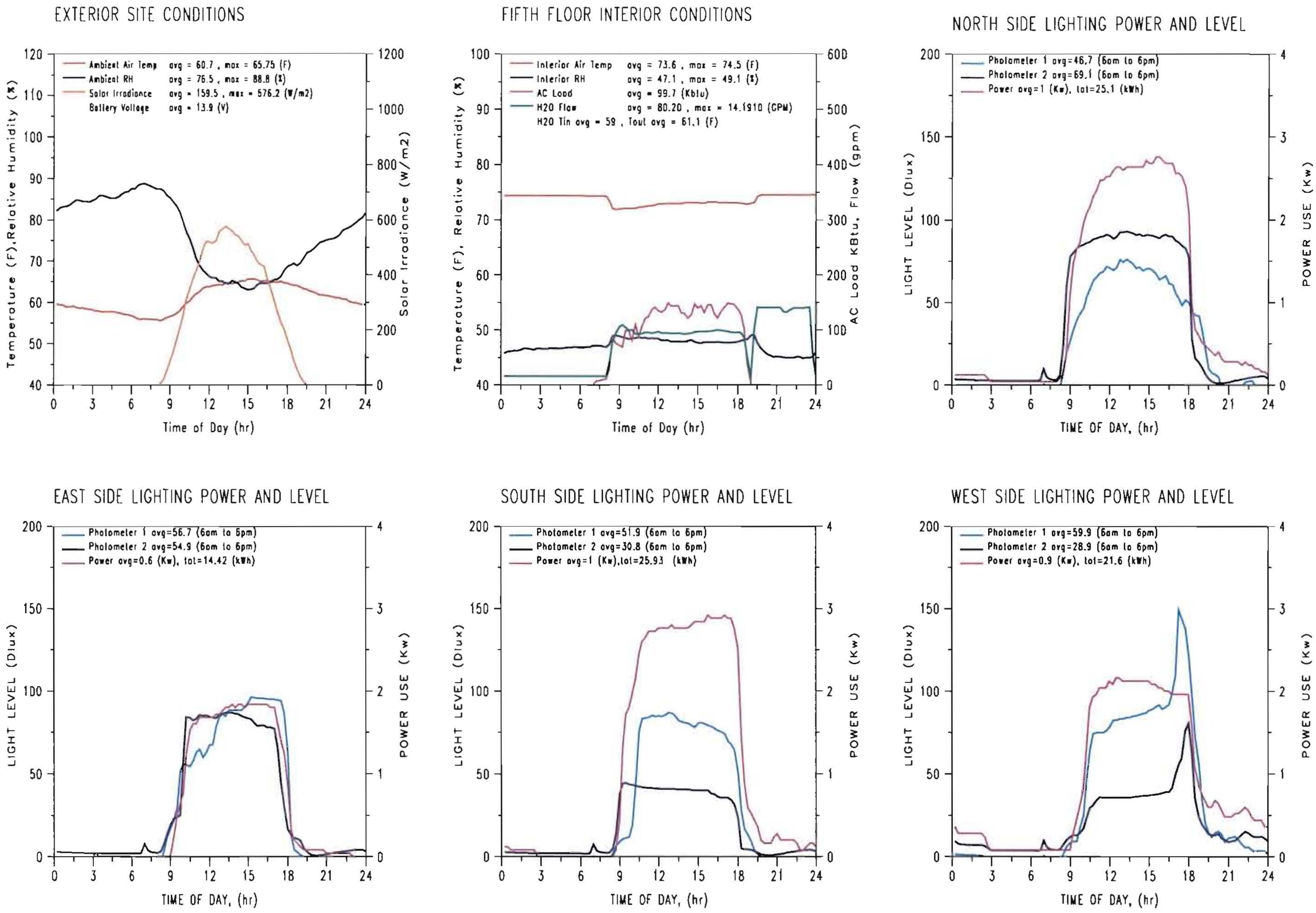
WEST SIDE LIGHTING POWER AND LEVEL



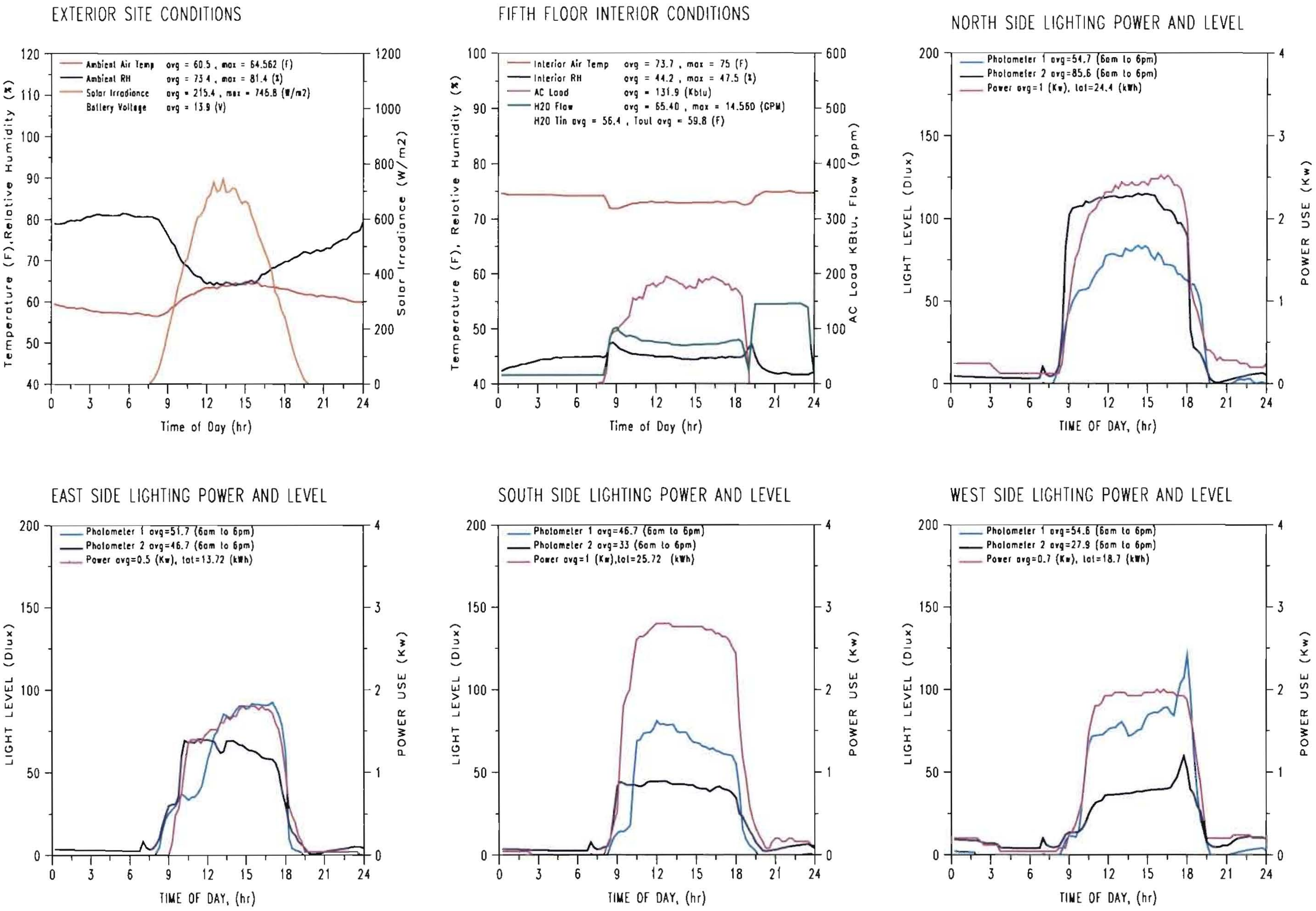
DECEMBER 1997 DAILY AVERAGE FOR WEEKDAYS - NORTHERN SITE



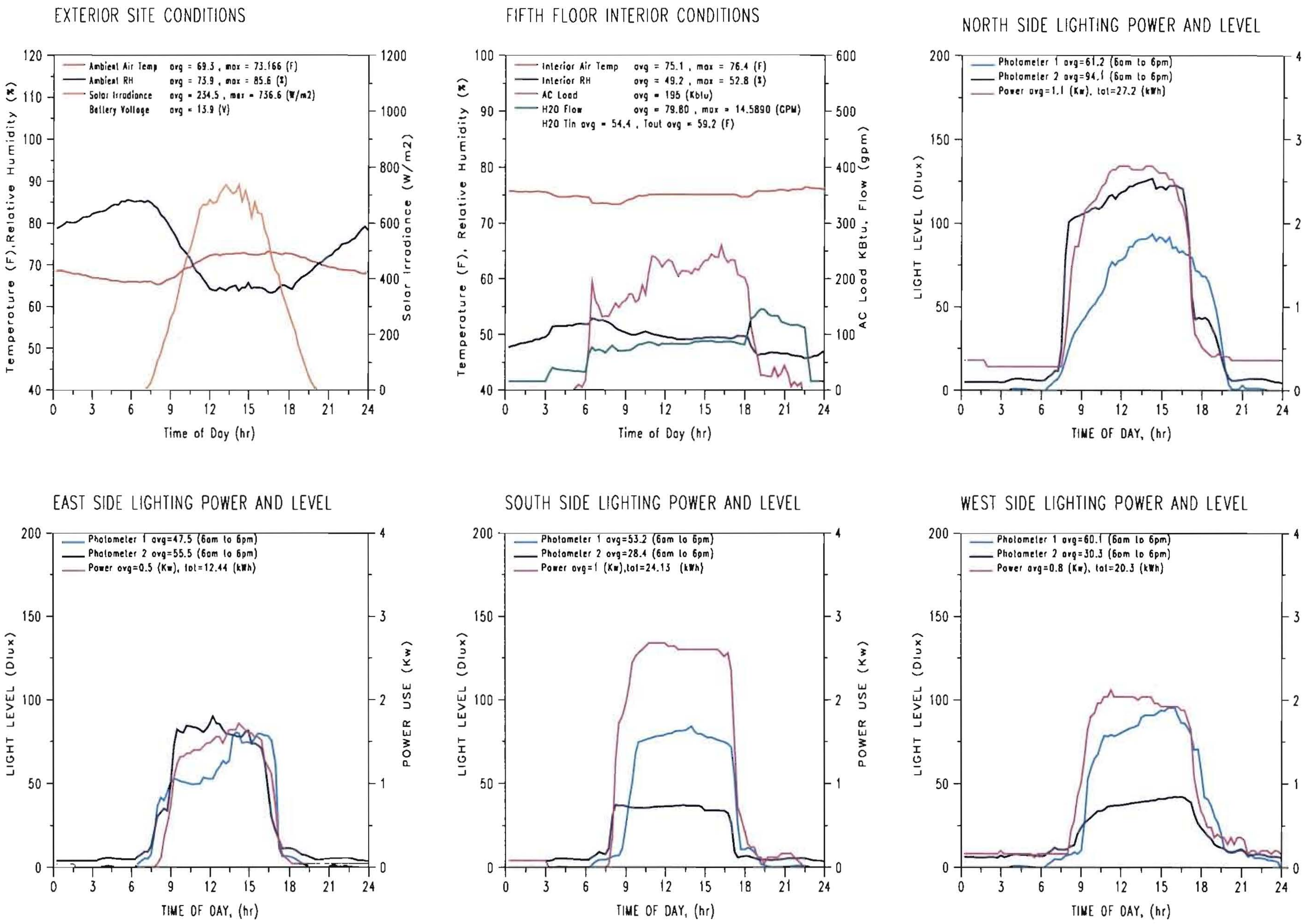
JANUARY 1998 DAILY AVERAGE FOR WEEKDAYS - NORTHERN SITE



FEBRUARY 1998 DAILY AVERAGE FOR WEEKDAYS - NORTHERN SITE

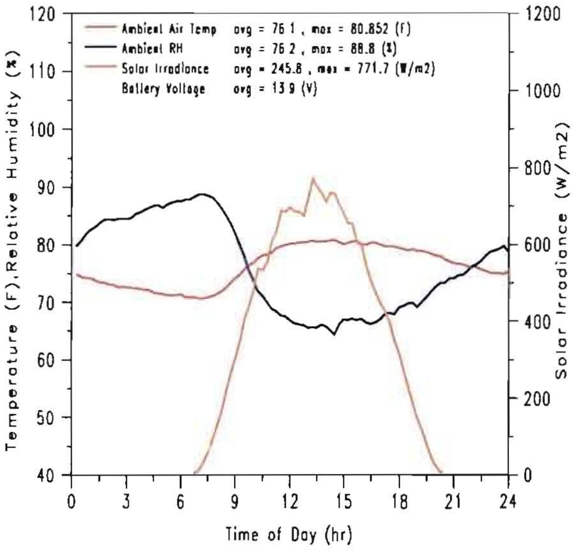


MARCH 1998 DAILY AVERAGE FOR WEEKDAYS - NORTHERN SITE

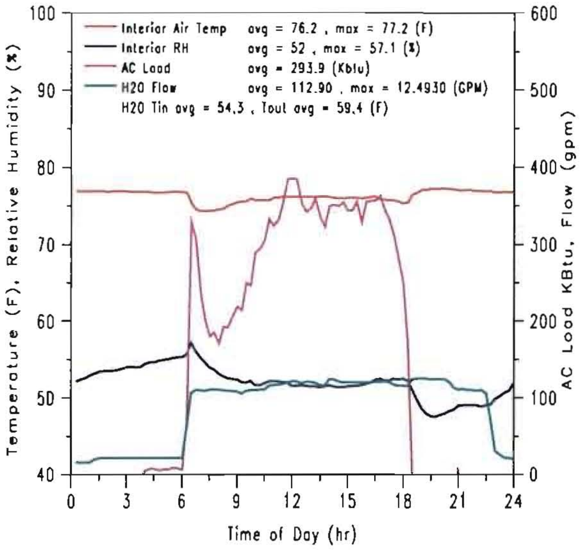


APRIL 1998 DAILY AVERAGE FOR WEEKDAYS - NORTHERN SITE

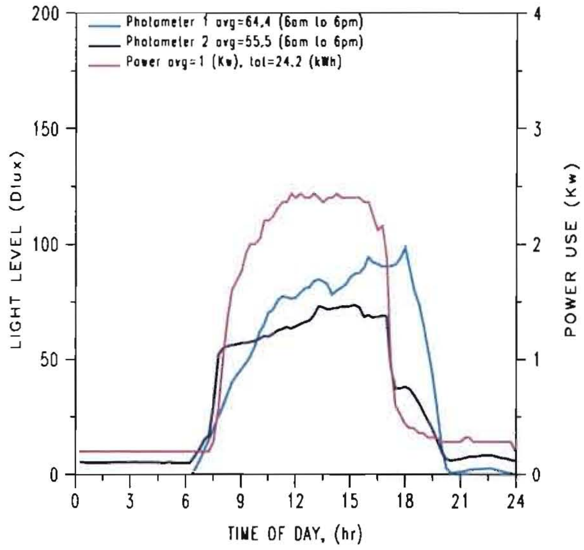
EXTERIOR SITE CONDITIONS



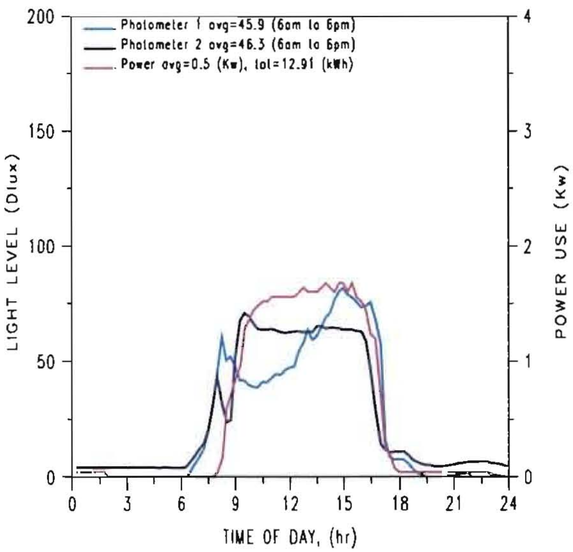
FIFTH FLOOR INTERIOR CONDITIONS



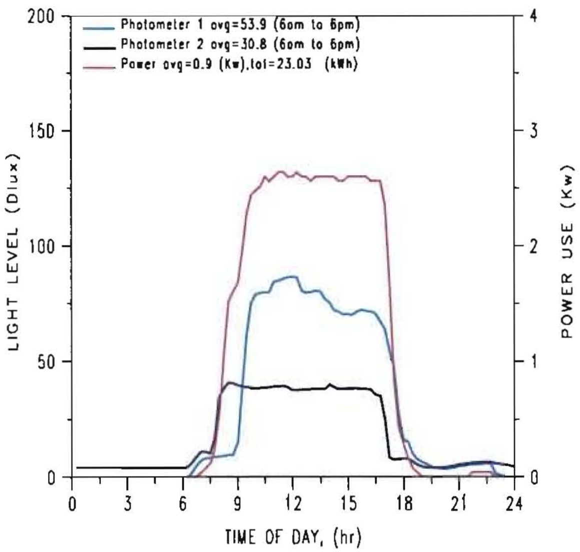
NORTH SIDE LIGHTING POWER AND LEVEL



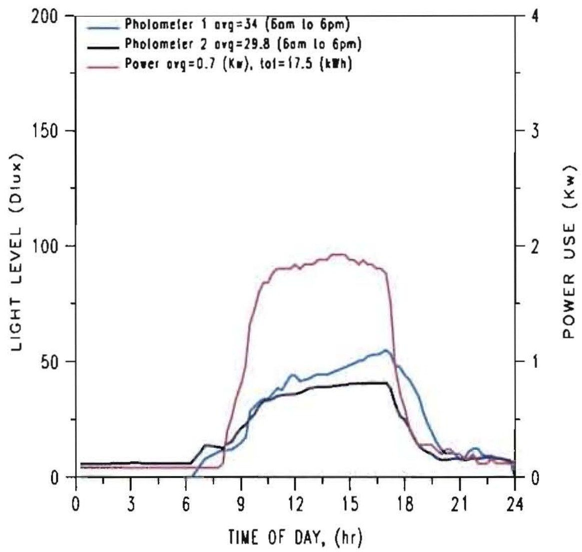
EAST SIDE LIGHTING POWER AND LEVEL



SOUTH SIDE LIGHTING POWER AND LEVEL

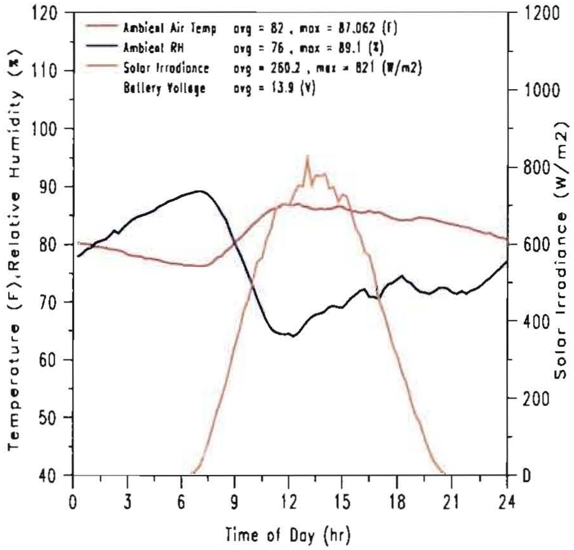


WEST SIDE LIGHTING POWER AND LEVEL

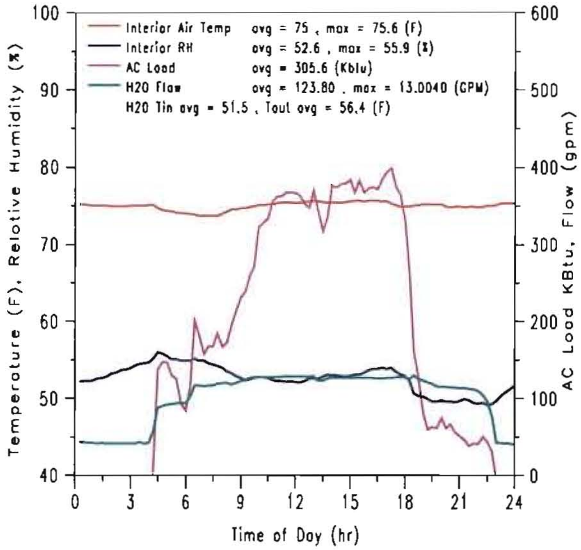


MAY 1998 DAILY AVERAGE FOR WEEKDAYS - NORTHERN SITE

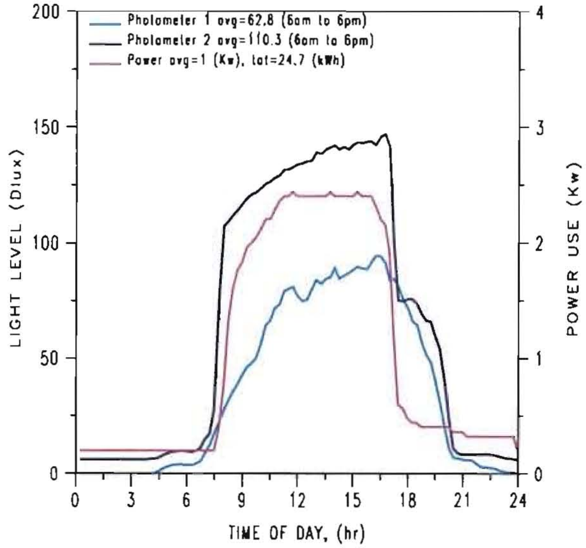
EXTERIOR SITE CONDITIONS



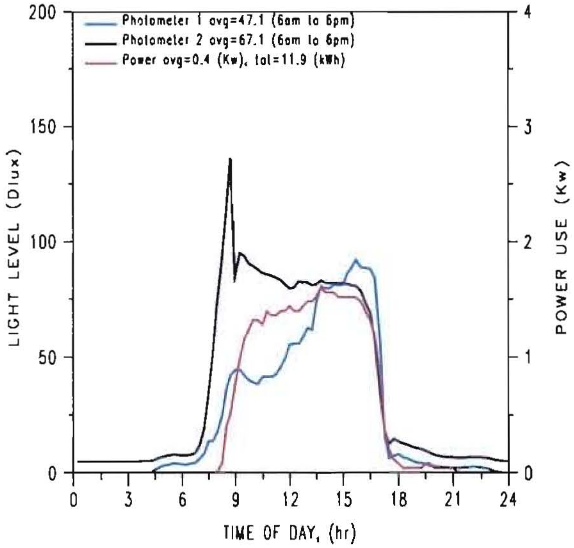
FIFTH FLOOR INTERIOR CONDITIONS



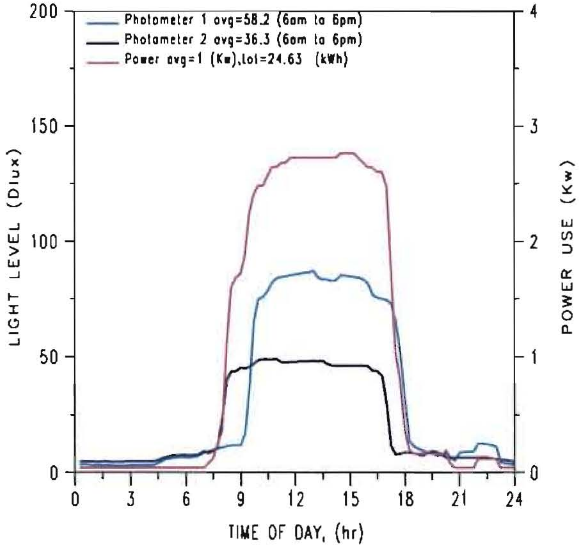
NORTH SIDE LIGHTING POWER AND LEVEL



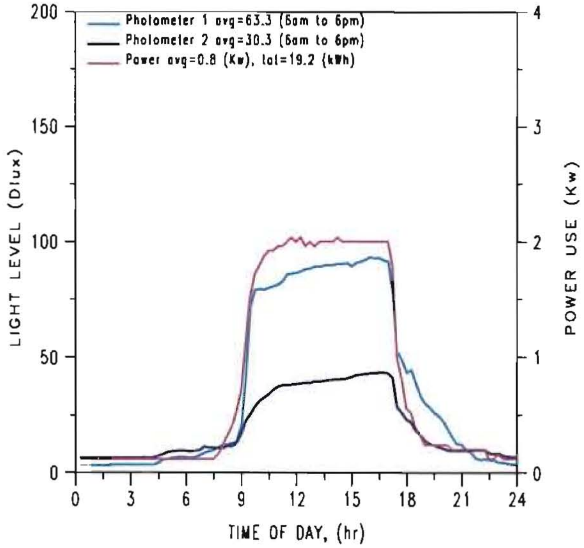
EAST SIDE LIGHTING POWER AND LEVEL



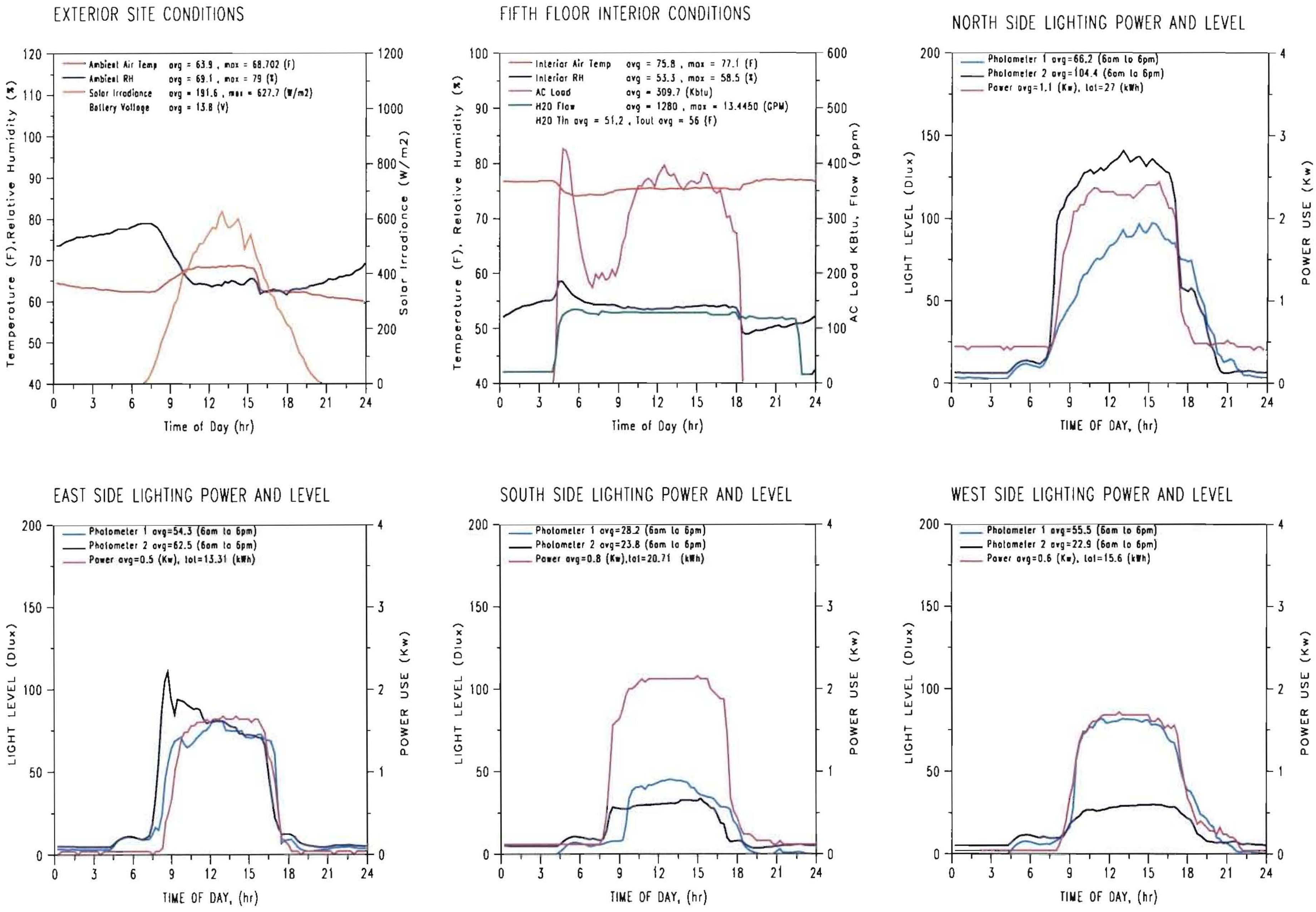
SOUTH SIDE LIGHTING POWER AND LEVEL



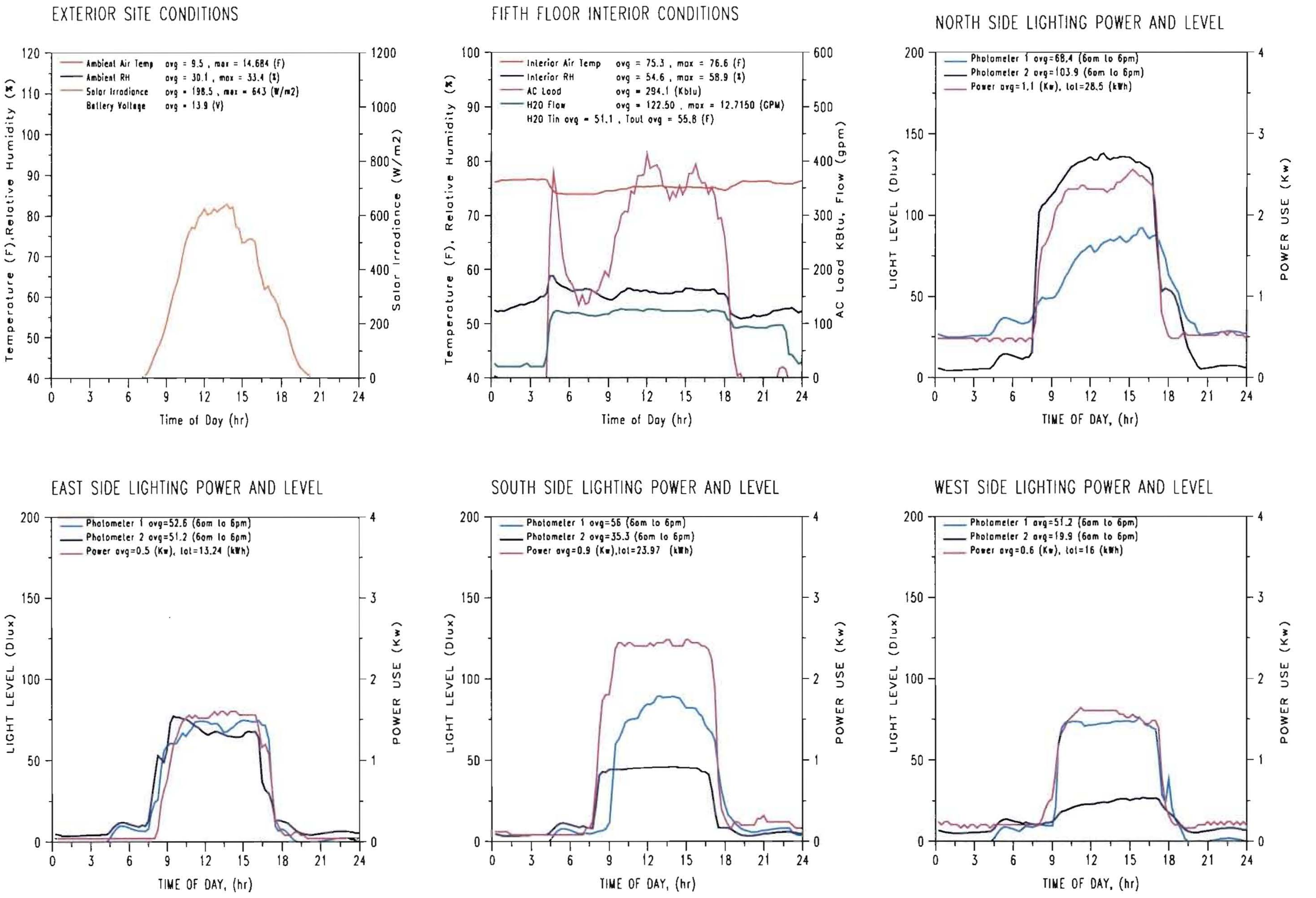
WEST SIDE LIGHTING POWER AND LEVEL



JUNE 1998 DAILY AVERAGE FOR WEEKDAYS - NORTHERN SITE

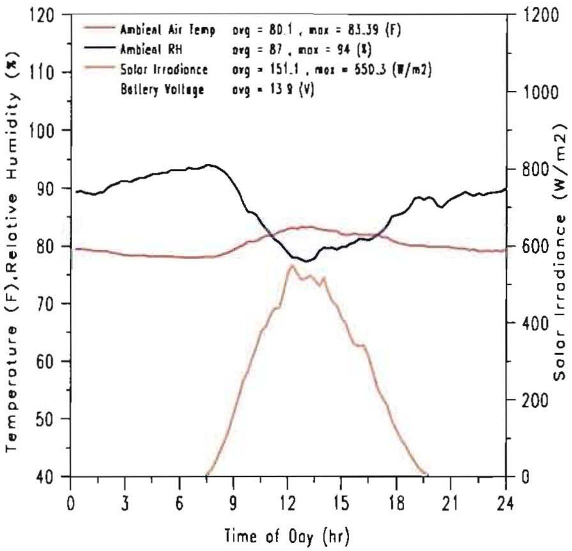


JULY 1998 DAILY AVERAGE FOR WEEKDAYS - NORTHERN SITE

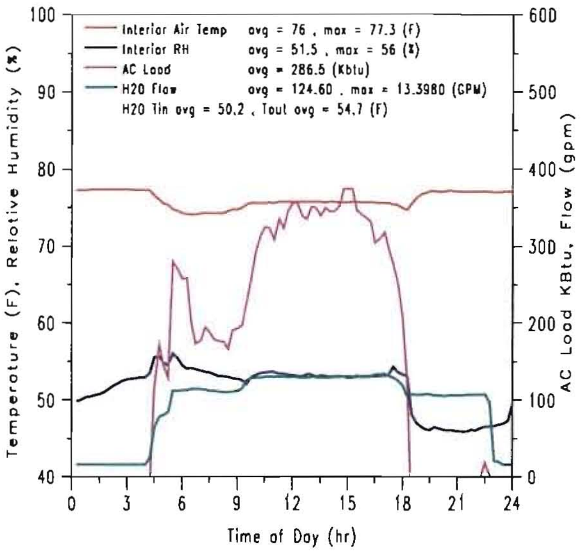


AUGUST 1998 DAILY AVERAGE FOR WEEKDAYS - NORTHERN SITE

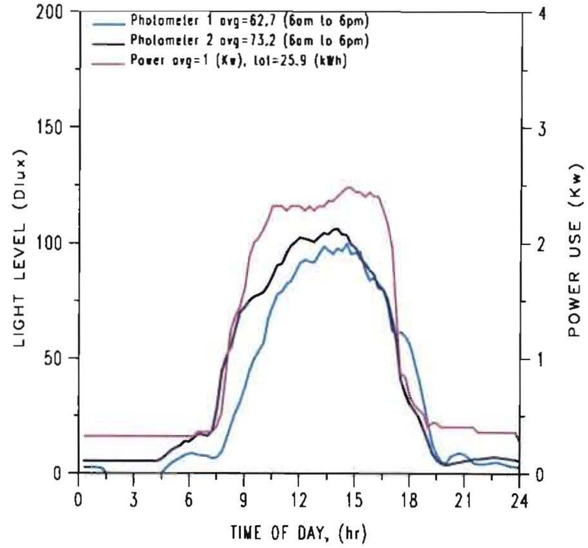
EXTERIOR SITE CONDITIONS



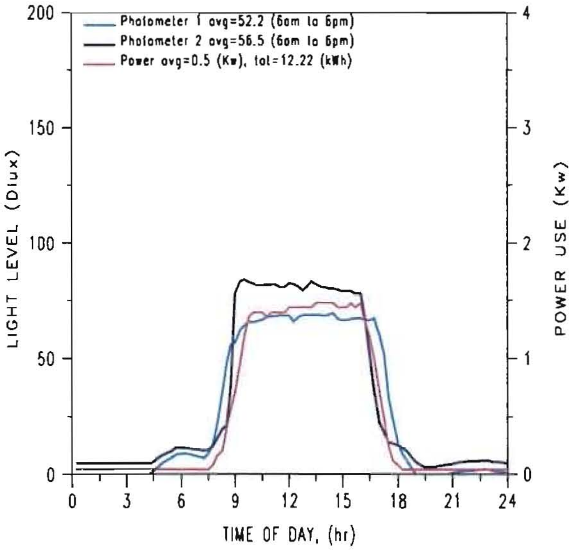
FIFTH FLOOR INTERIOR CONDITIONS



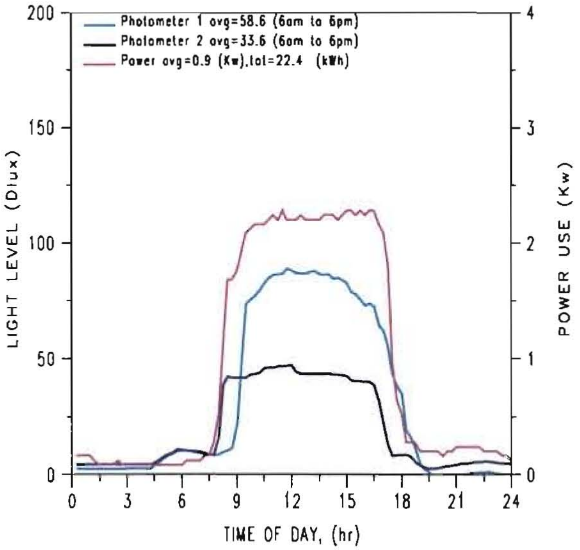
NORTH SIDE LIGHTING POWER AND LEVEL



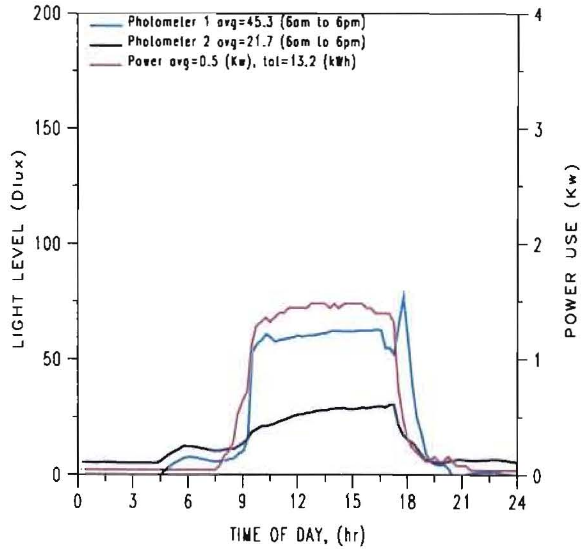
EAST SIDE LIGHTING POWER AND LEVEL



SOUTH SIDE LIGHTING POWER AND LEVEL

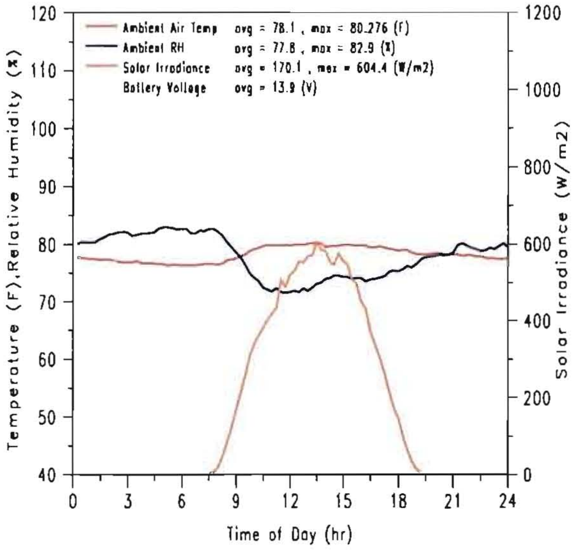


WEST SIDE LIGHTING POWER AND LEVEL

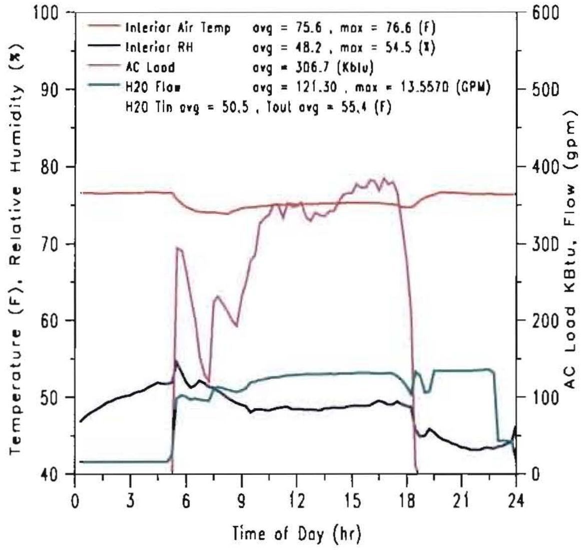


SEPTEMBER 1998 DAILY AVERAGE FOR WEEKDAYS - NORTHERN SITE

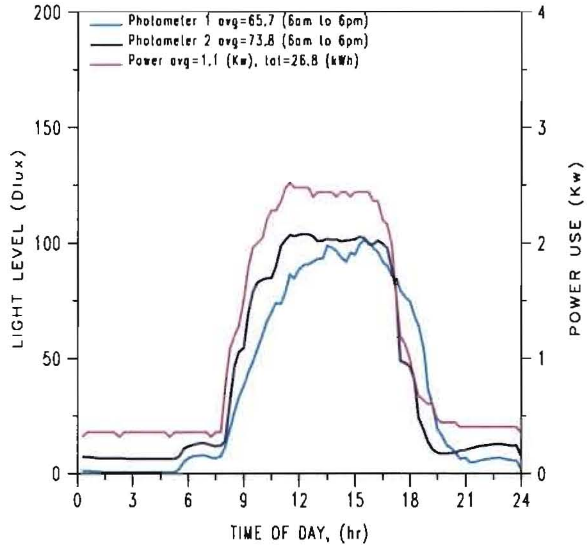
EXTERIOR SITE CONDITIONS



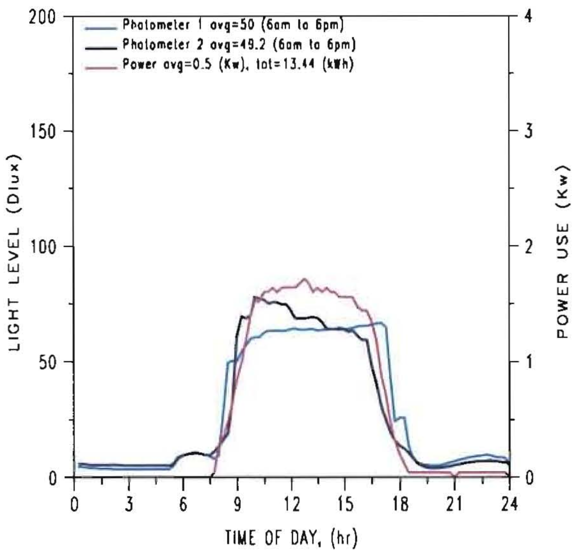
FIFTH FLOOR INTERIOR CONDITIONS



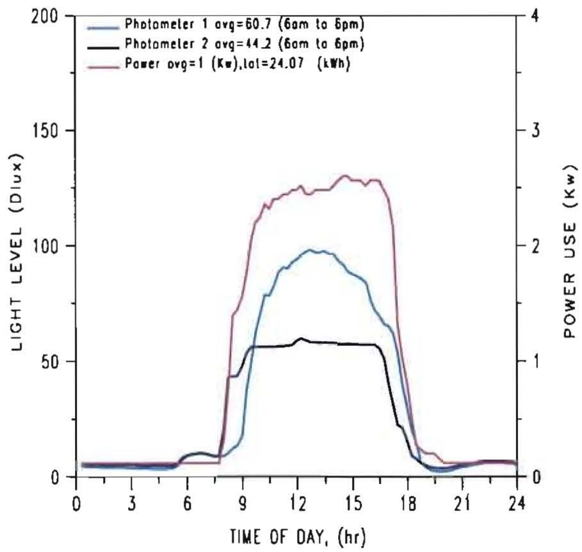
NORTH SIDE LIGHTING POWER AND LEVEL



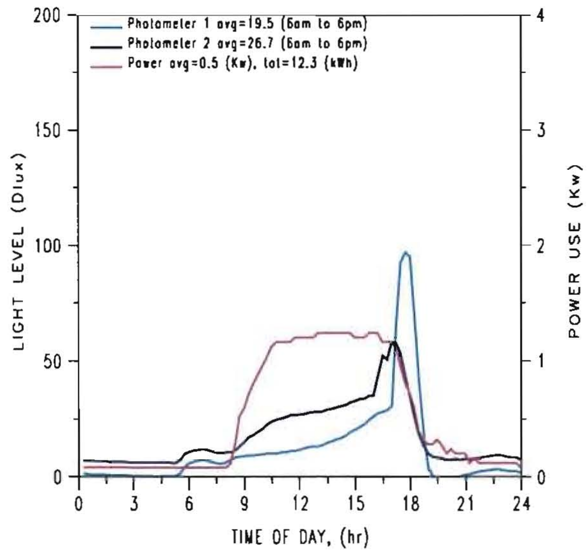
EAST SIDE LIGHTING POWER AND LEVEL



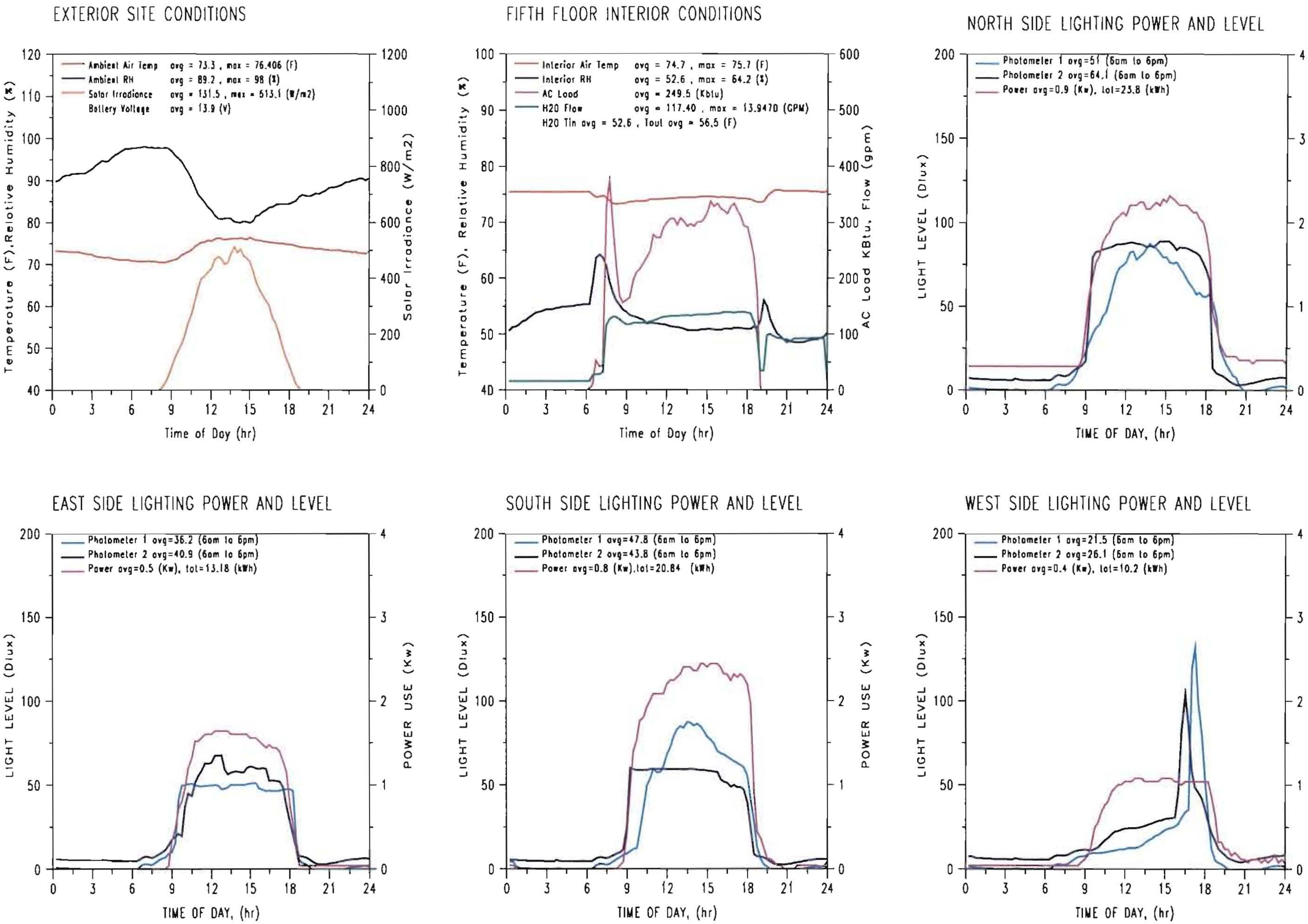
SOUTH SIDE LIGHTING POWER AND LEVEL



WEST SIDE LIGHTING POWER AND LEVEL

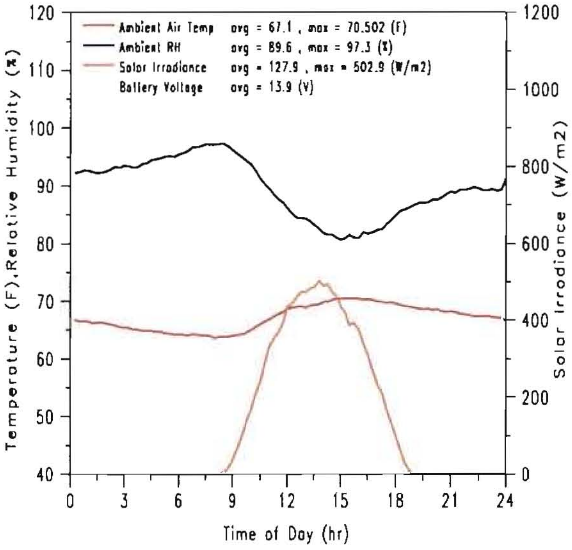


OCTOBER 1998 DAILY AVERAGE FOR WEEKDAYS - NORTHERN SITE

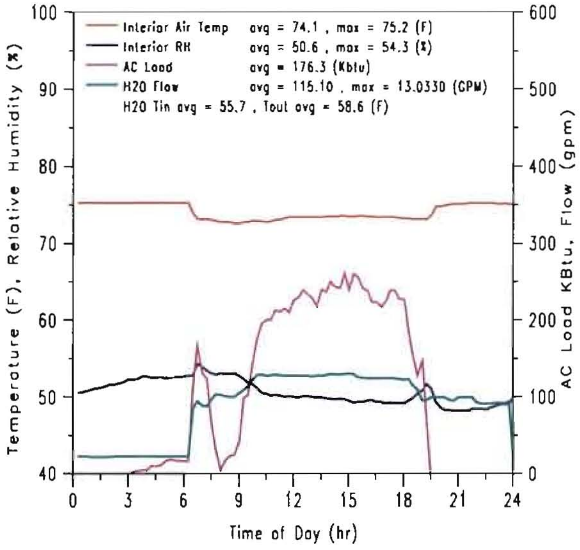


NOVEMBER 1998 DAILY AVERAGE FOR WEEKDAYS - NORTHERN SITE

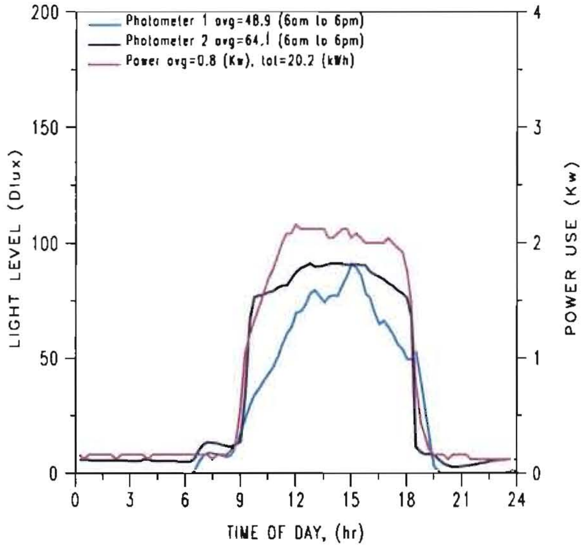
EXTERIOR SITE CONDITIONS



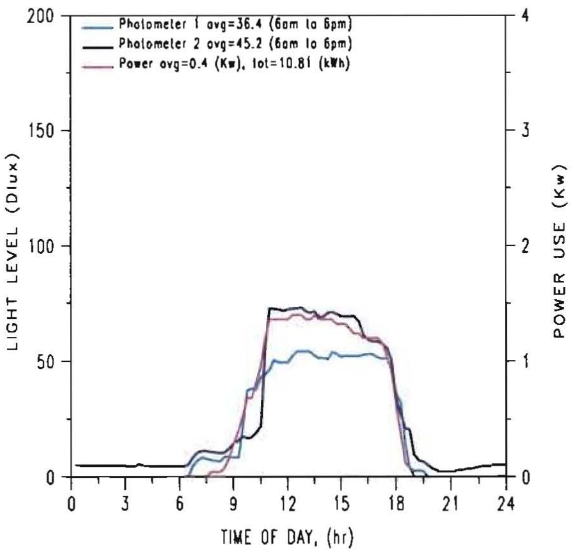
FIFTH FLOOR INTERIOR CONDITIONS



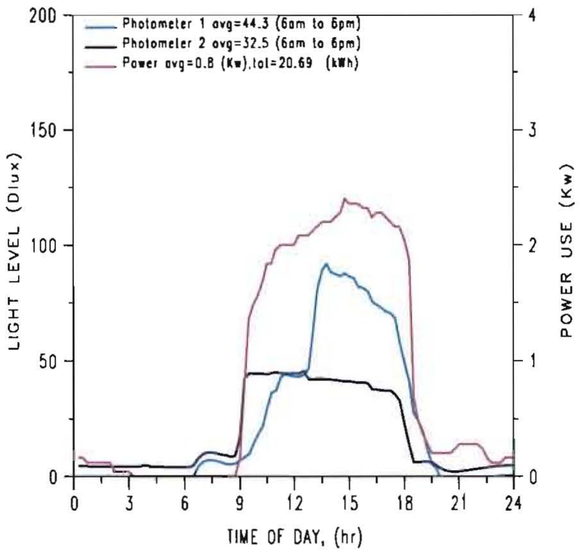
NORTH SIDE LIGHTING POWER AND LEVEL



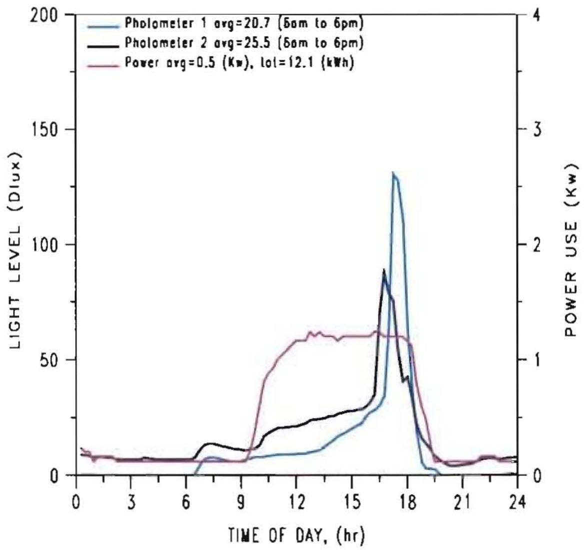
EAST SIDE LIGHTING POWER AND LEVEL



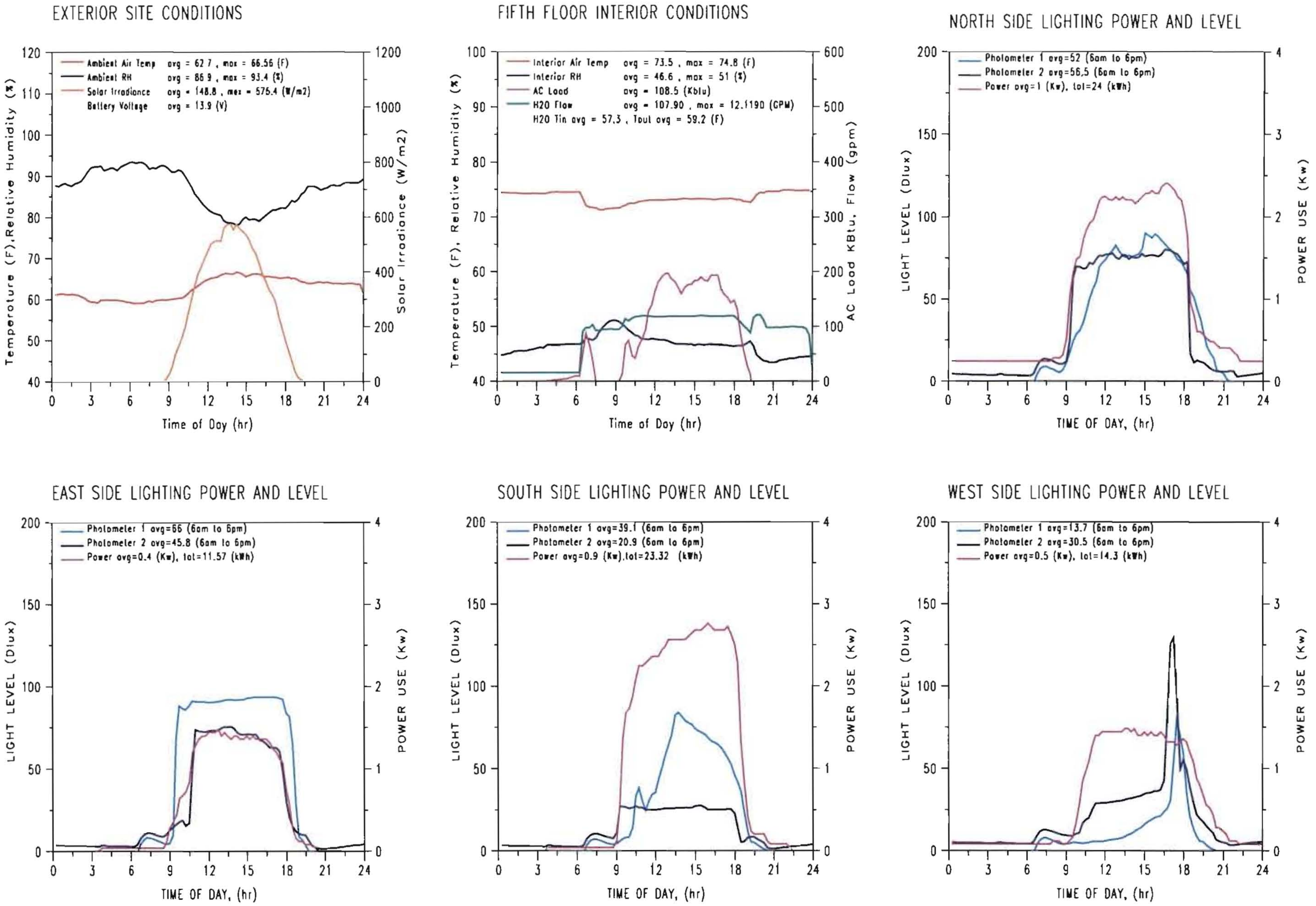
SOUTH SIDE LIGHTING POWER AND LEVEL



WEST SIDE LIGHTING POWER AND LEVEL

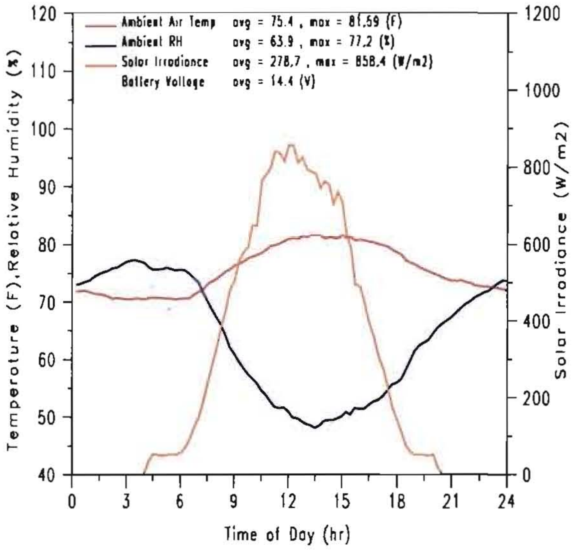


DECEMBER 1998 DAILY AVERAGE FOR WEEKDAYS - NORTHERN SITE

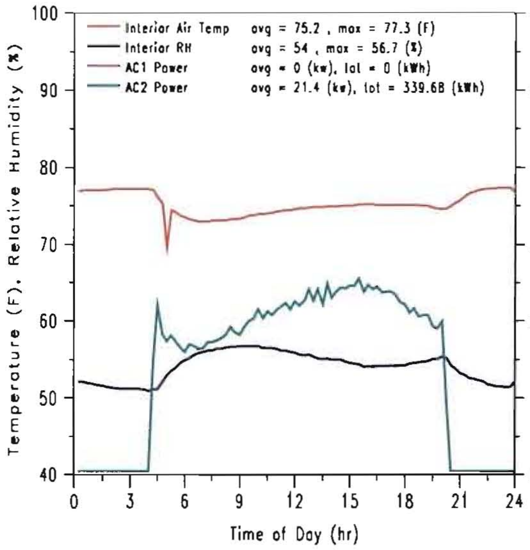


JANUARY 1999 DAILY AVERAGE FOR WEEKDAYS - NORTHERN SITE

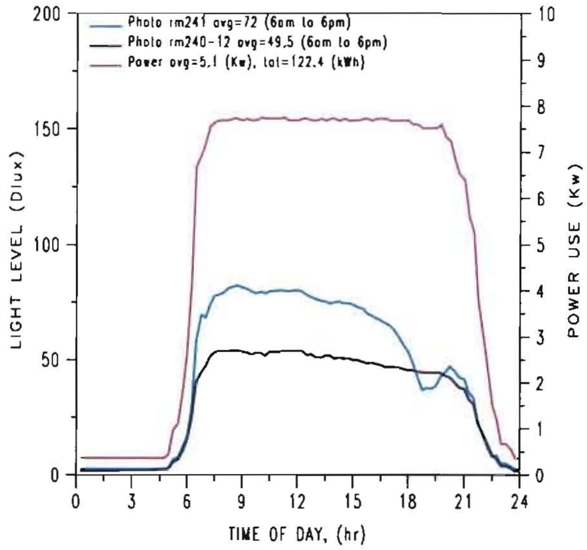
EXTERIOR SITE CONDITIONS



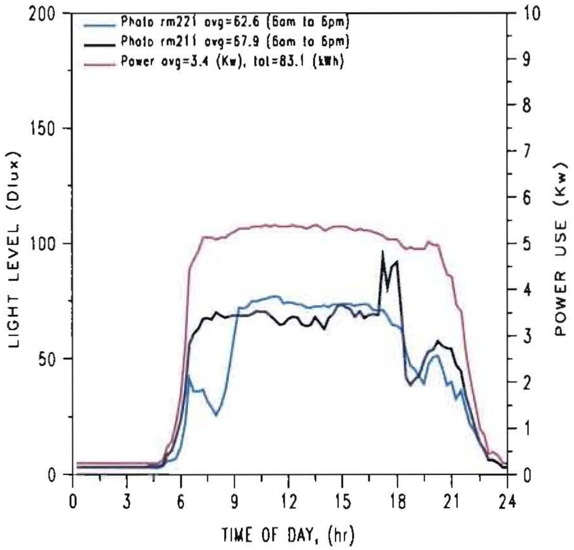
SECOND FLOOR INTERIOR CONDITIONS



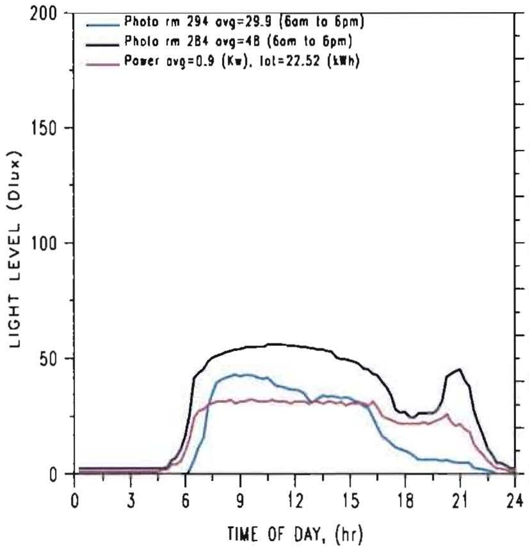
NORTHEAST SIDE LIGHTING POWER AND LEVEL



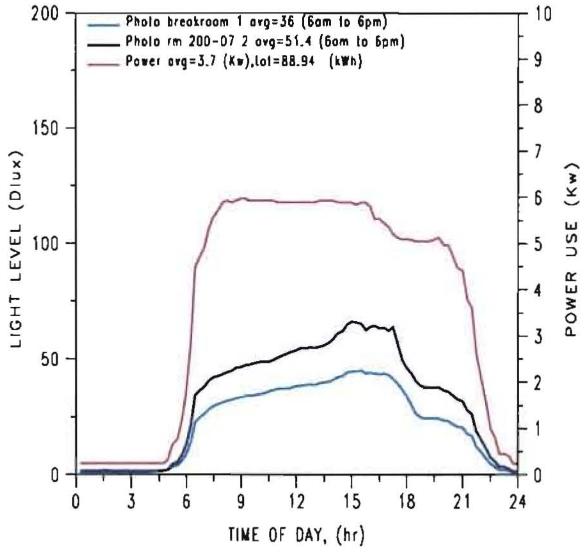
NORTHWEST SIDE LIGHTING POWER AND LEVEL



SOUTHEAST SIDE LIGHTING POWER AND LEVEL

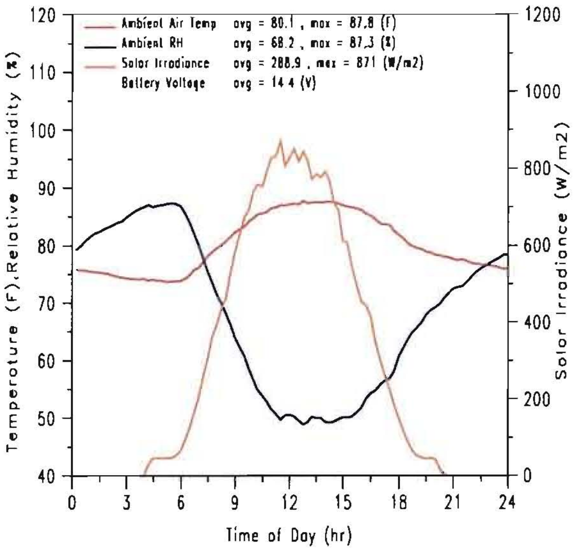


SOUTHWEST SIDE LIGHTING POWER AND LEVEL

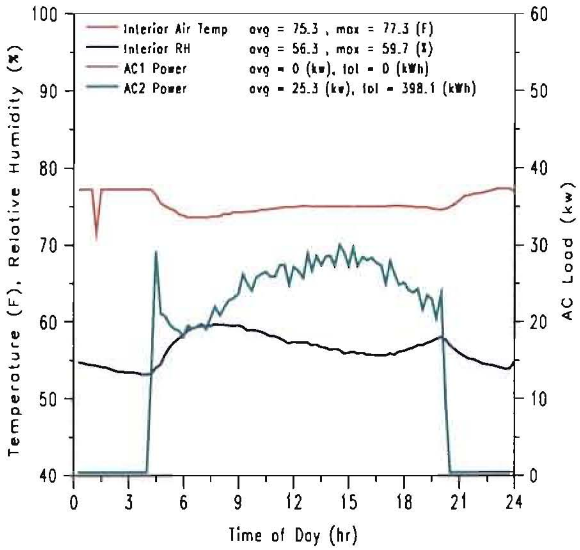


APRIL 1998 DAILY AVERAGE FOR WEEKDAYS - SOUTHERN SITE

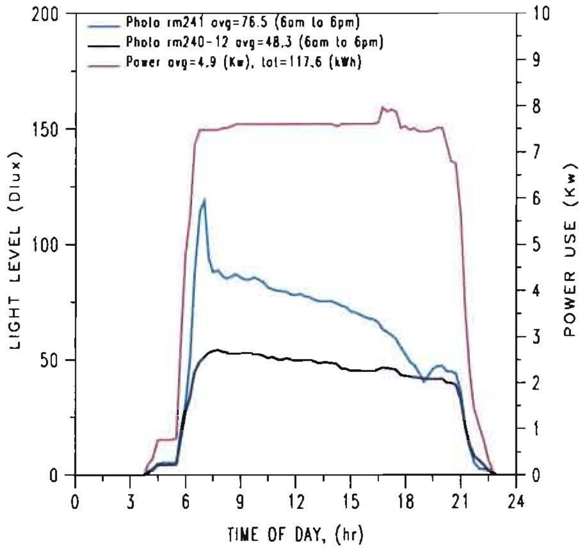
EXTERIOR SITE CONDITIONS



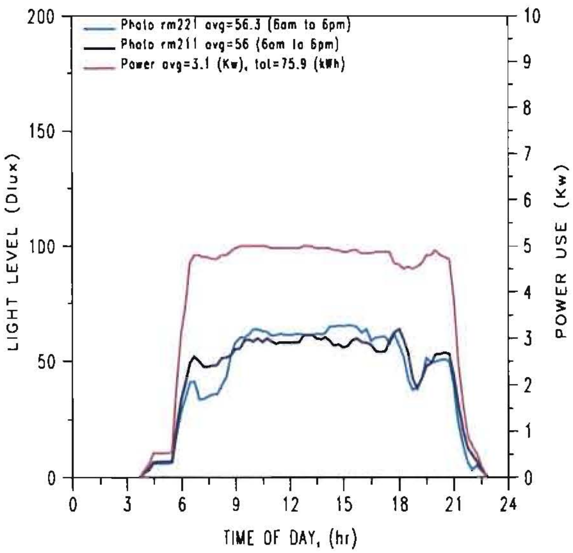
SECOND FLOOR INTERIOR CONDITIONS



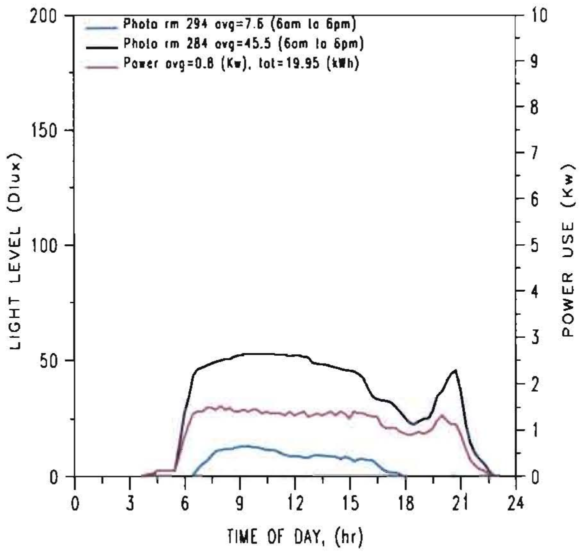
NORTHEAST SIDE LIGHTING POWER AND LEVEL



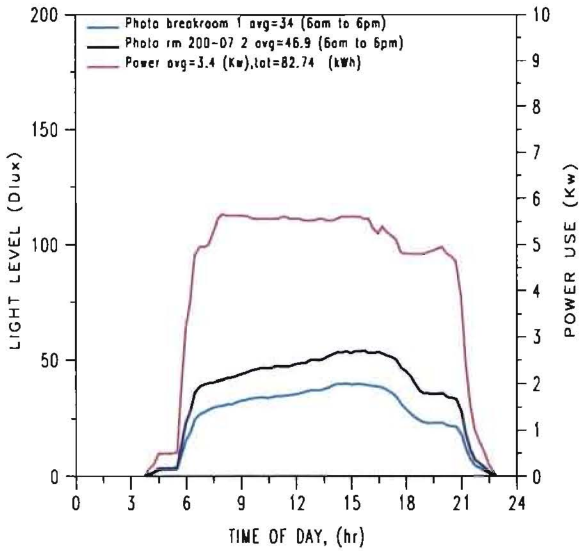
NORTHWEST SIDE LIGHTING POWER AND LEVEL



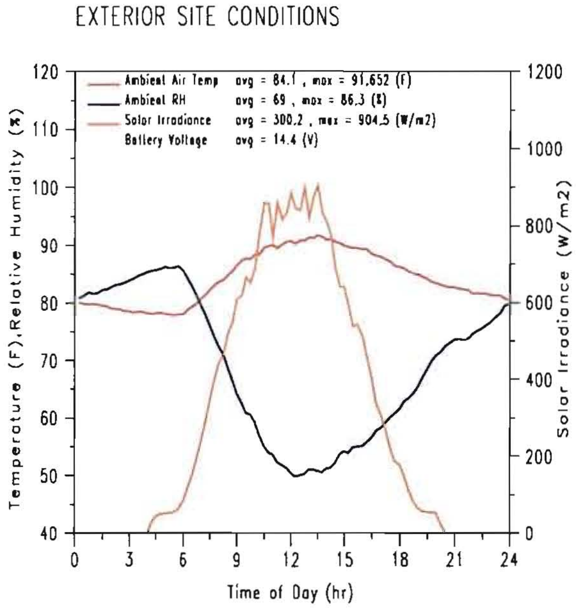
SOUTHEAST SIDE LIGHTING POWER AND LEVEL

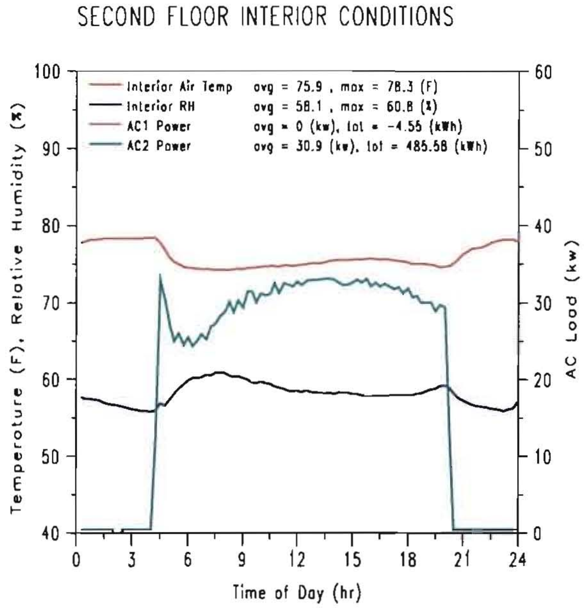


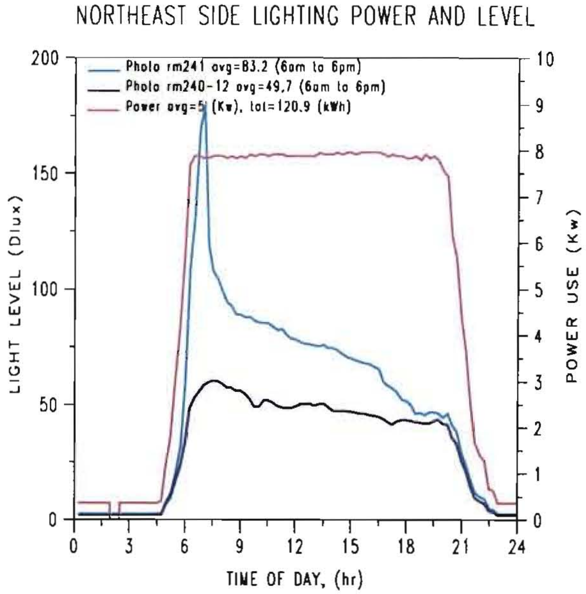
SOUTHWEST SIDE LIGHTING POWER AND LEVEL

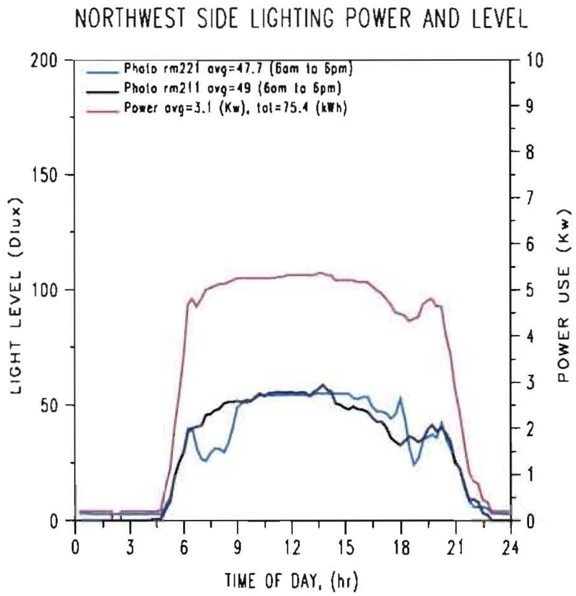


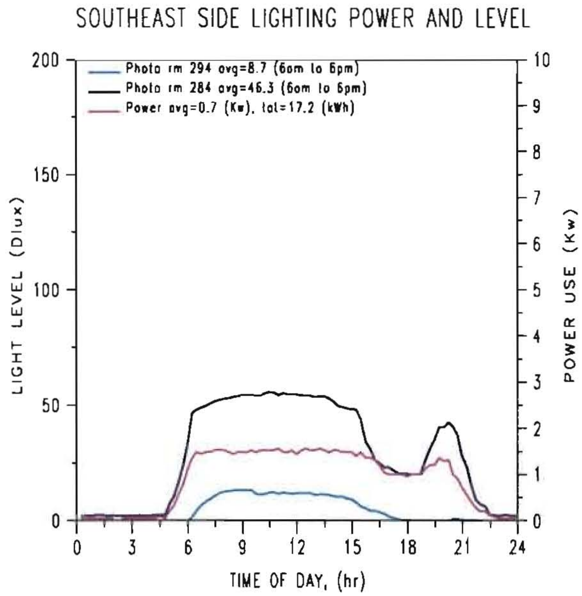
MAY 1998 DAILY AVERAGE FOR WEEKDAYS - SOUTHERN SITE

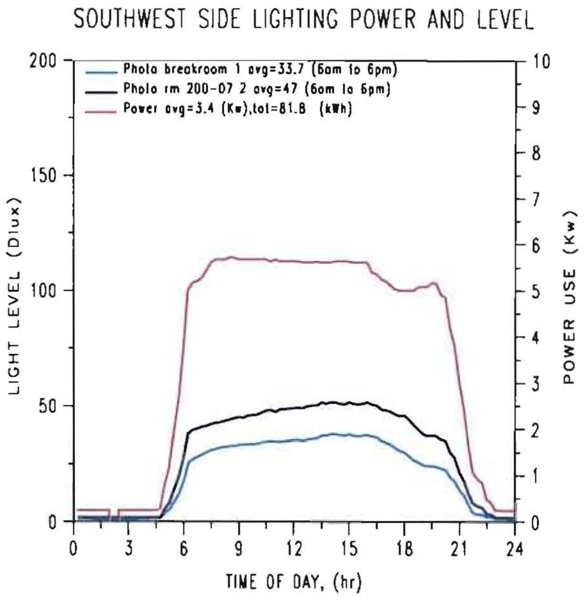






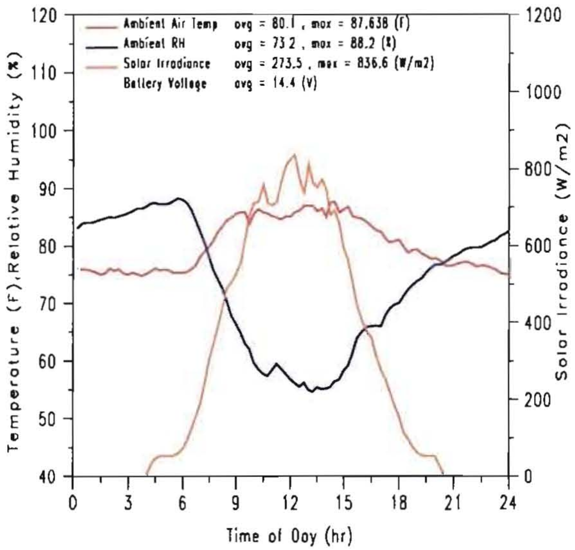




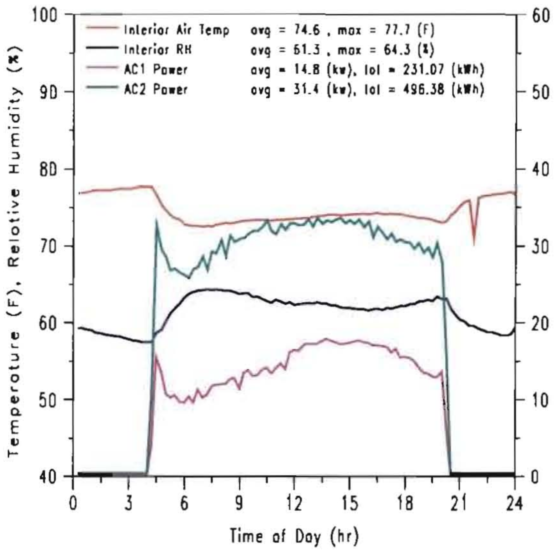


JUNE 1998 DAILY AVERAGE FOR WEEKDAYS - SOUTHERN SITE

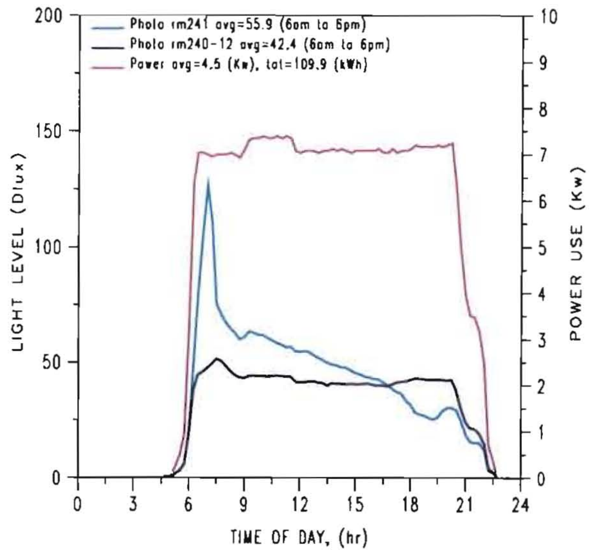
EXTERIOR SITE CONDITIONS



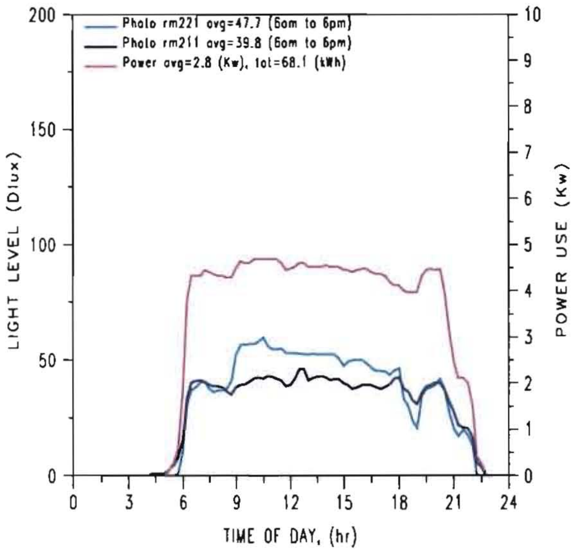
SECOND FLOOR INTERIOR CONDITIONS



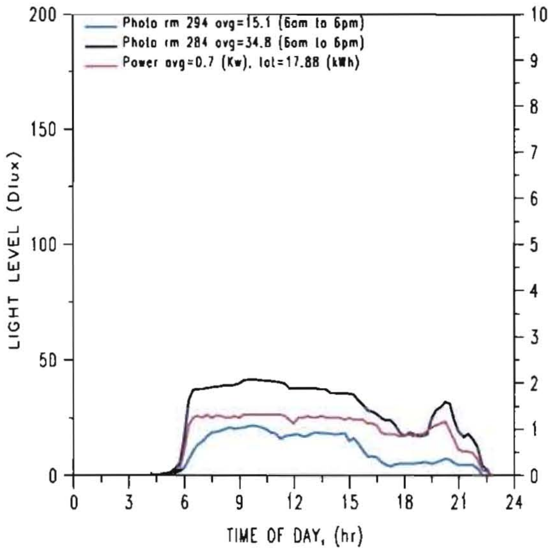
NORTHEAST SIDE LIGHTING POWER AND LEVEL



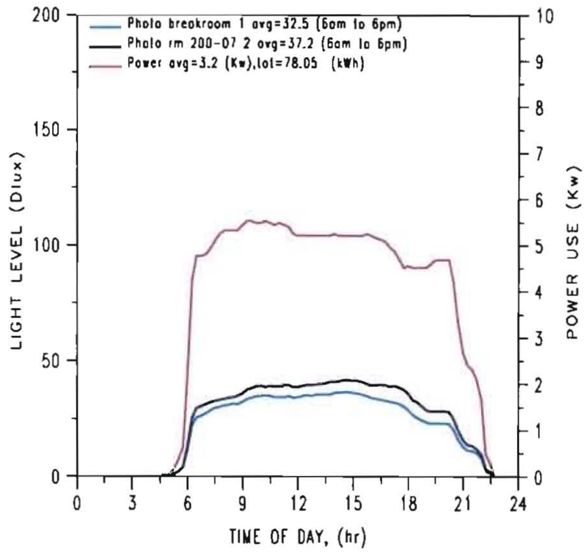
NORTHWEST SIDE LIGHTING POWER AND LEVEL



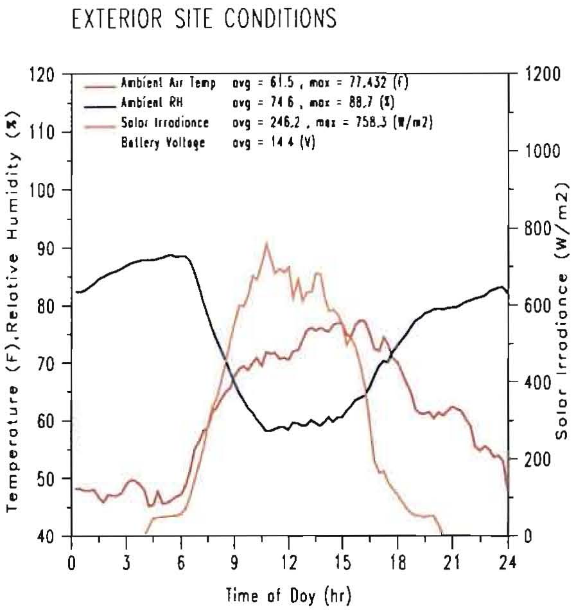
SOUTHEAST SIDE LIGHTING POWER AND LEVEL

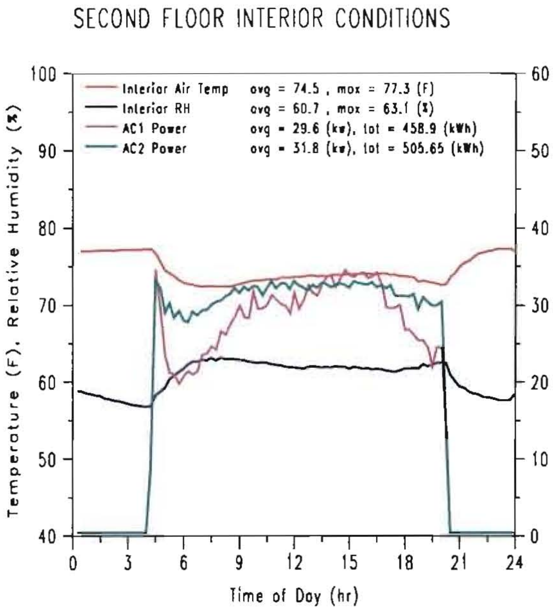


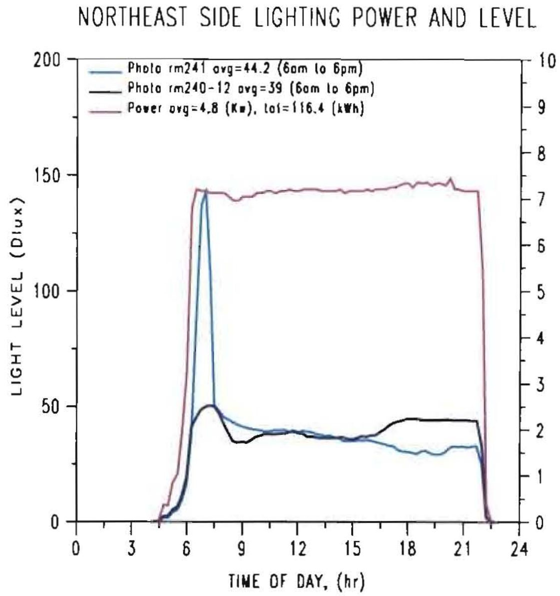
SOUTHWEST SIDE LIGHTING POWER AND LEVEL

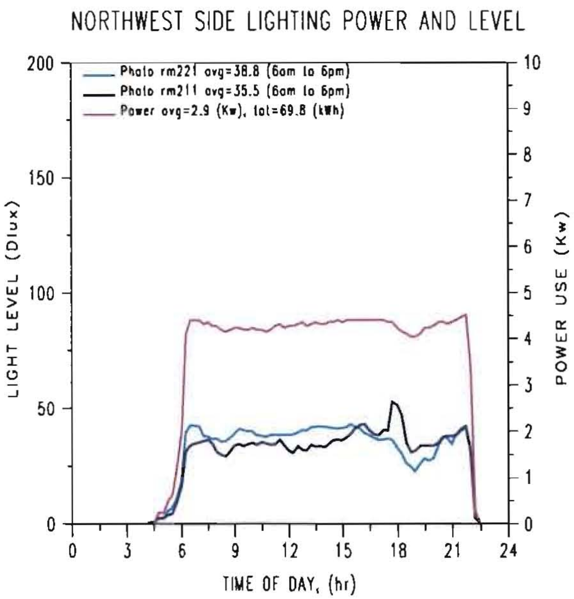


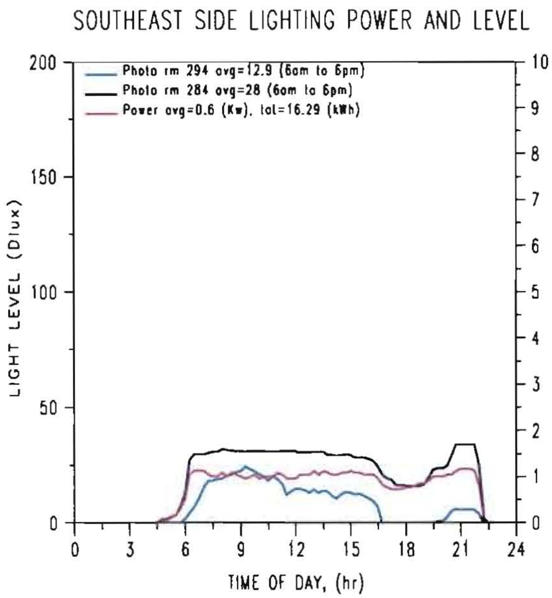
JULY 1998 DAILY AVERAGE FOR WEEKDAYS - SOUTHERN SITE

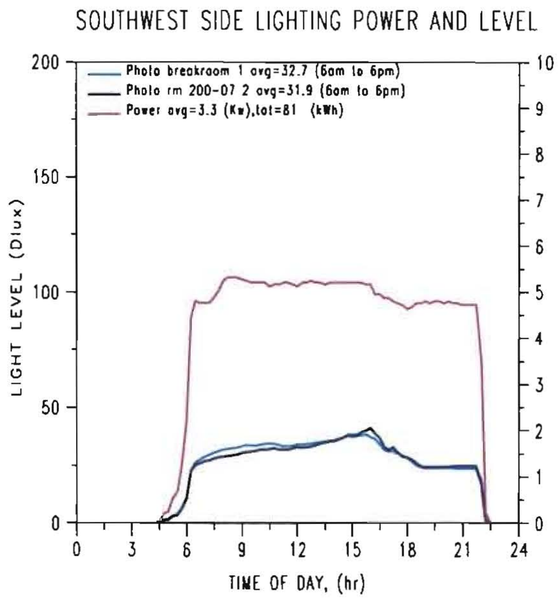




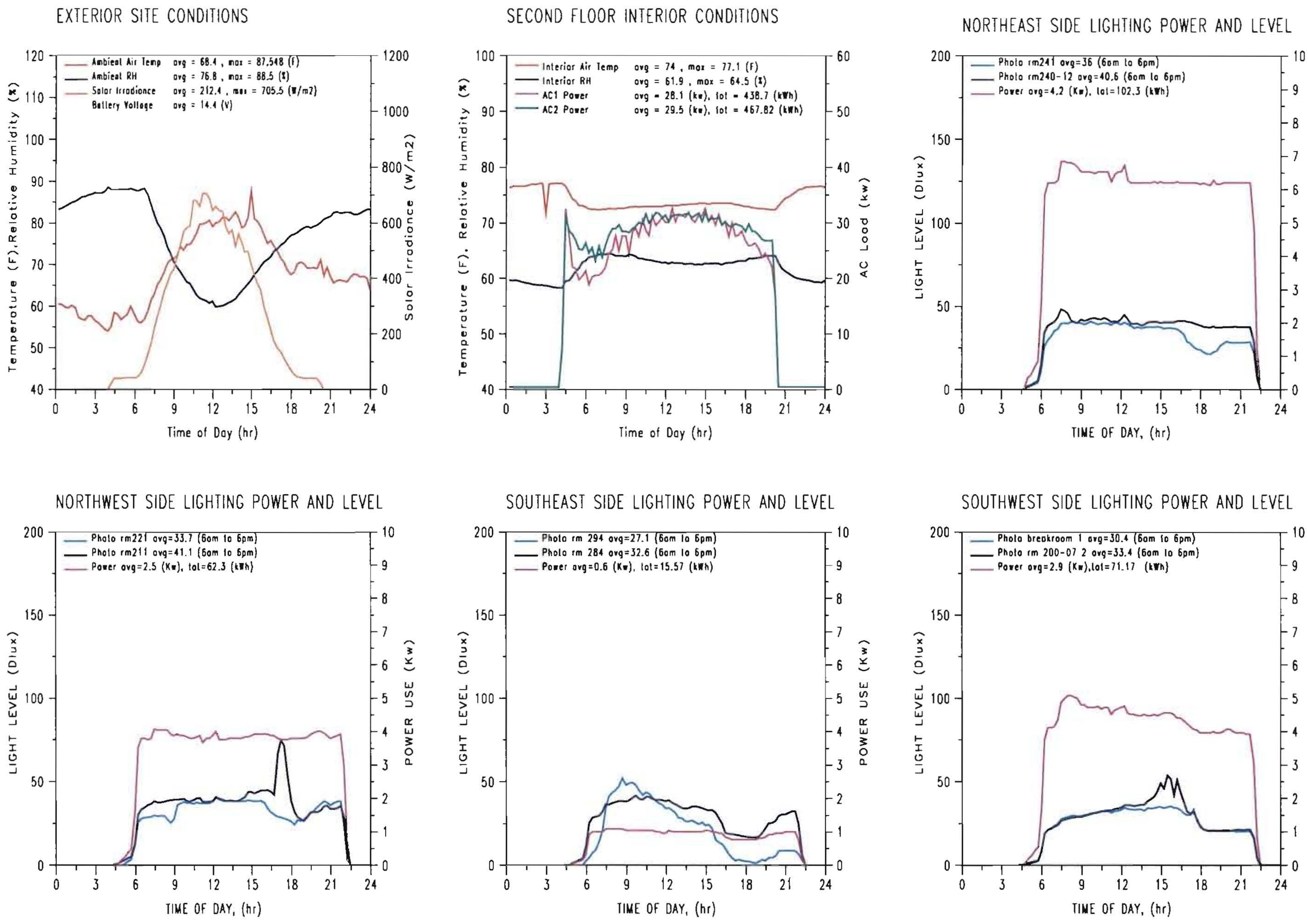




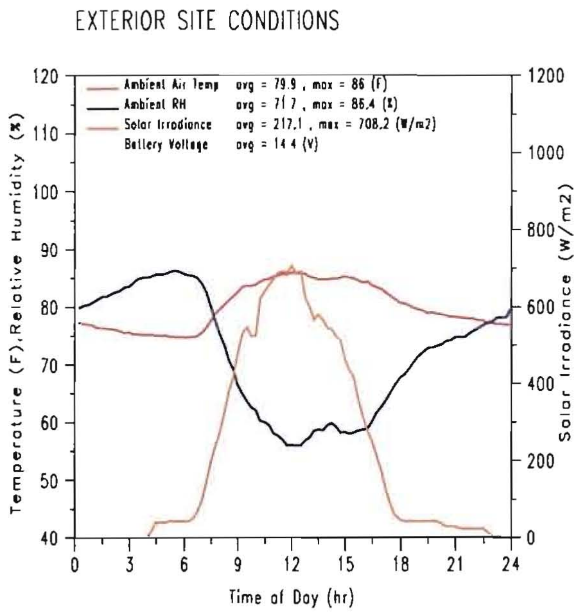


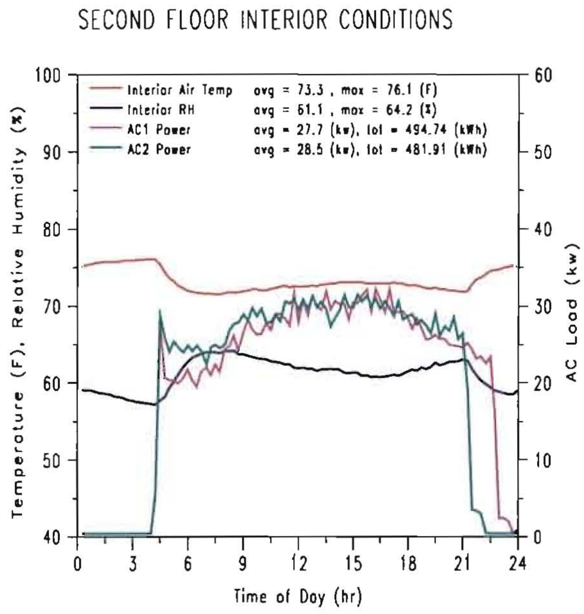


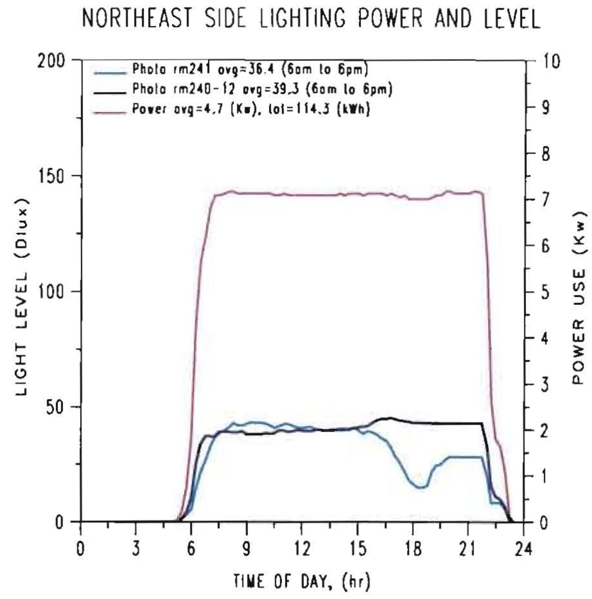
AUGUST 1998 DAILY AVERAGE FOR WEEKDAYS - SOUTHERN SITE

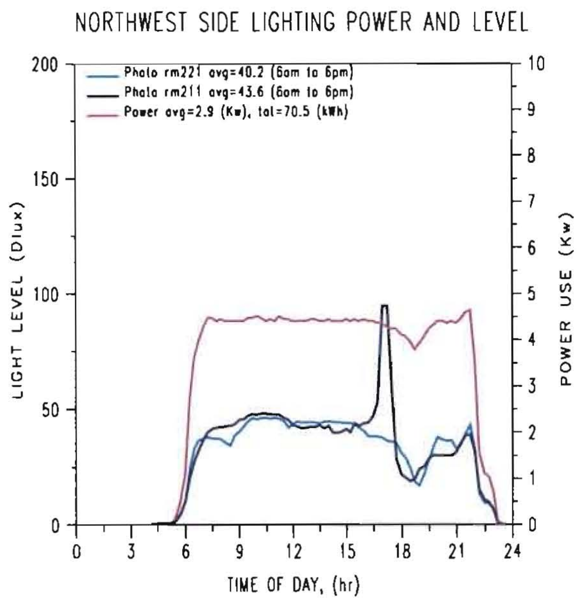


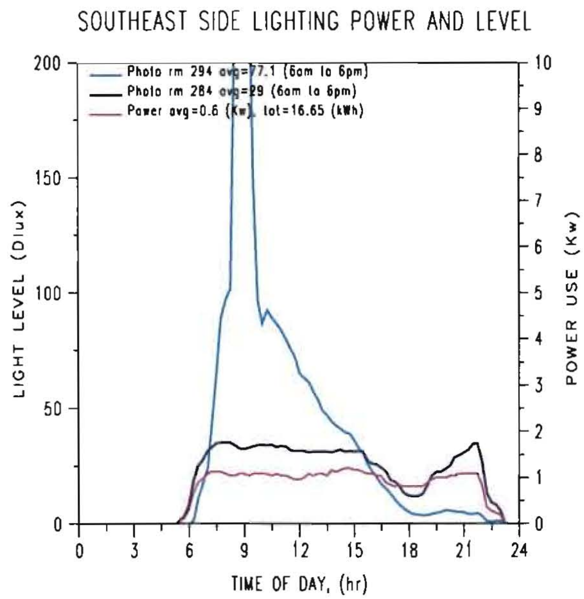
SEPTEMBER 1998 DAILY AVERAGE FOR WEEKDAYS - SOUTHERN SITE

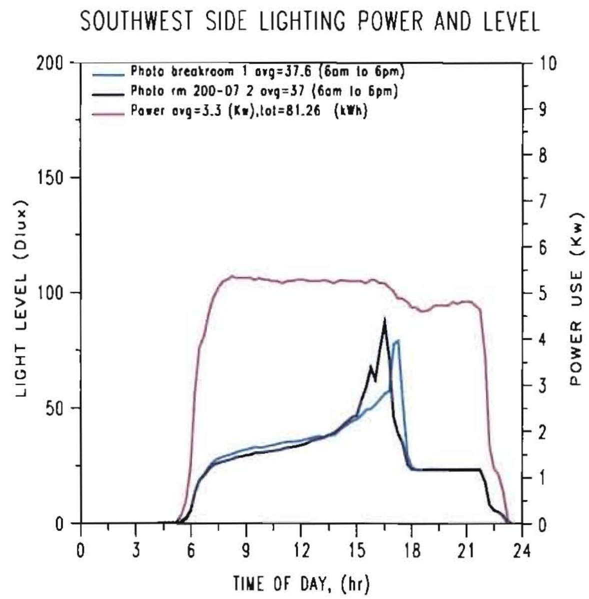




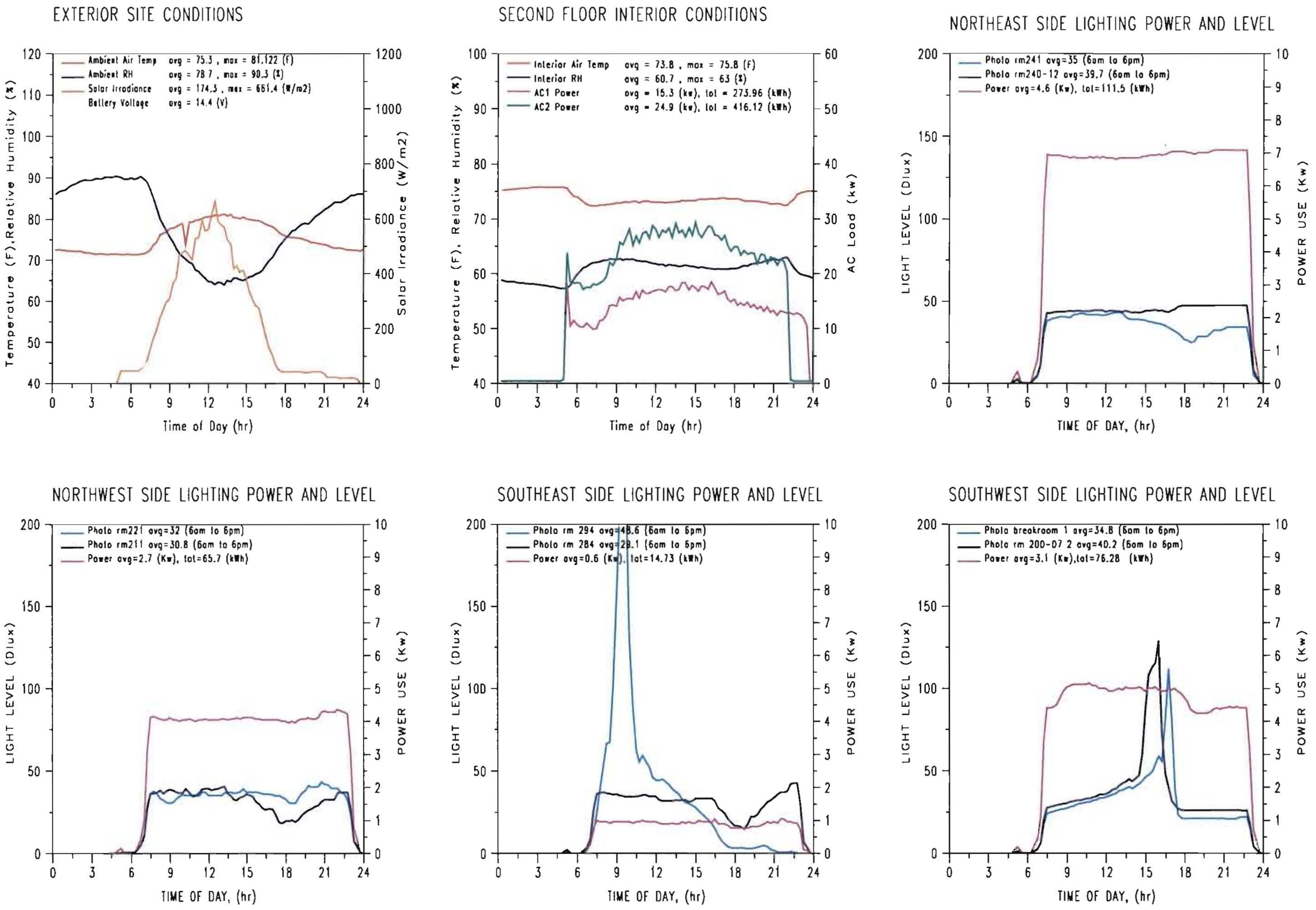




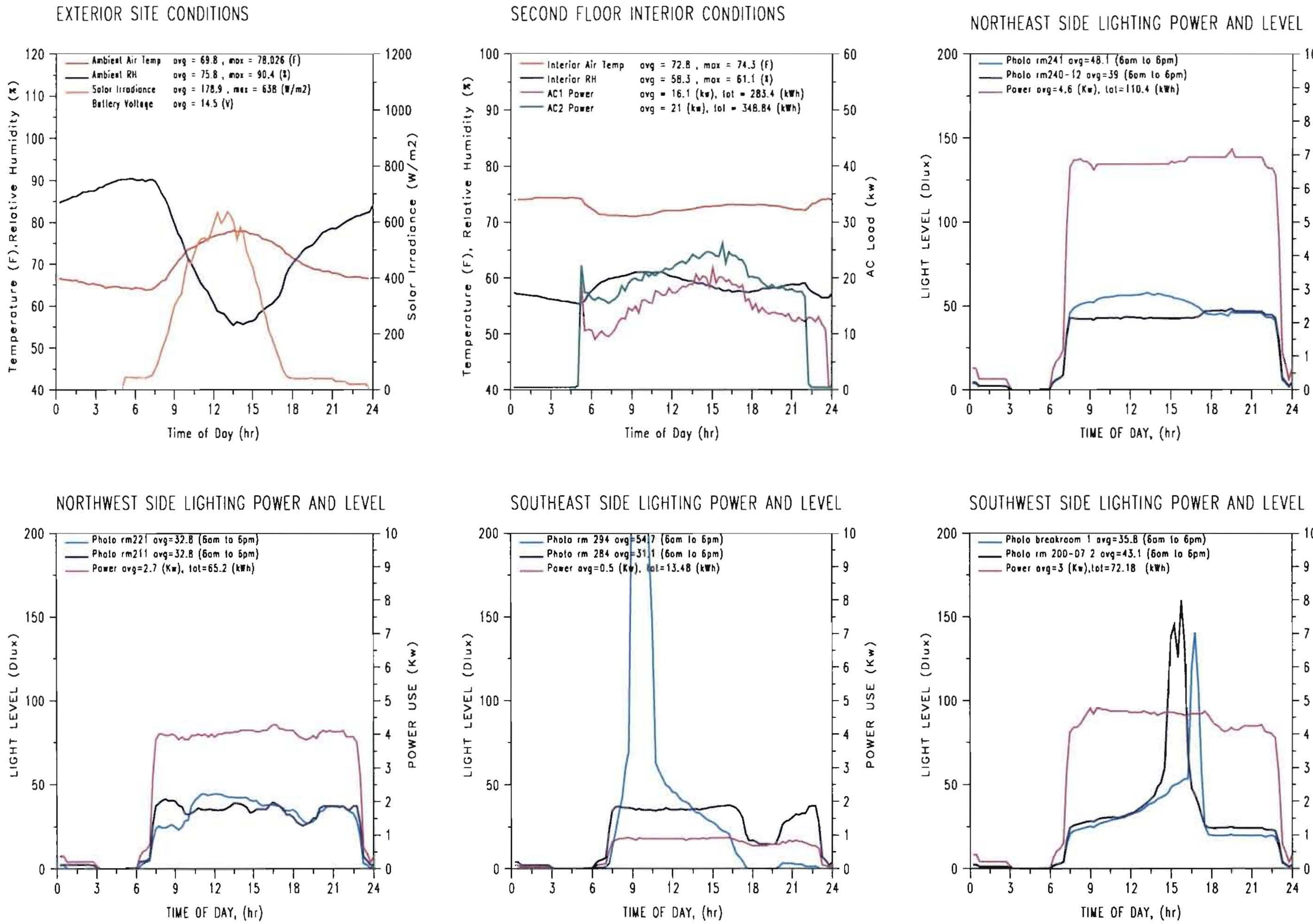




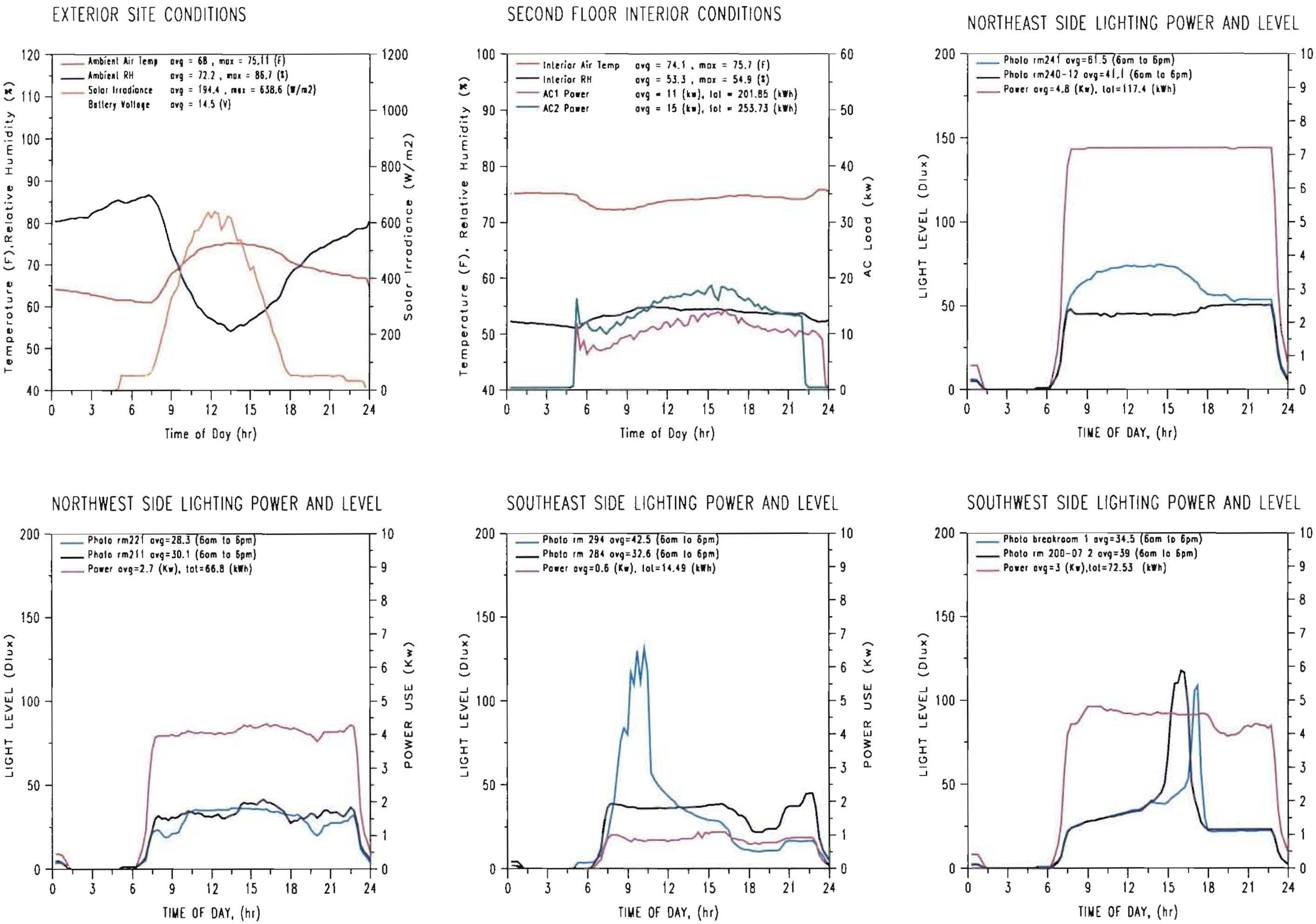
OCTOBER 1998 DAILY AVERAGE FOR WEEKDAYS - SOUTHERN SITE



NOVEMBER 1998 DAILY AVERAGE FOR WEEKDAYS - SOUTHERN SITE

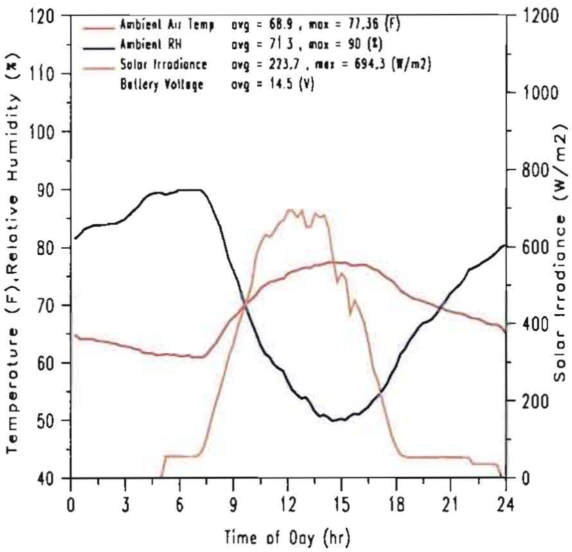


DECEMBER 1998 DAILY AVERAGE FOR WEEKDAYS - SOUTHERN SITE

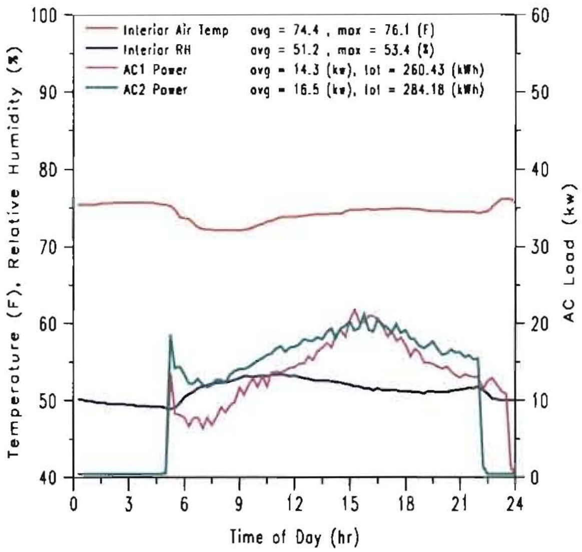


JANUARY 1999 DAILY AVERAGE FOR WEEKDAYS - SOUTHERN SITE

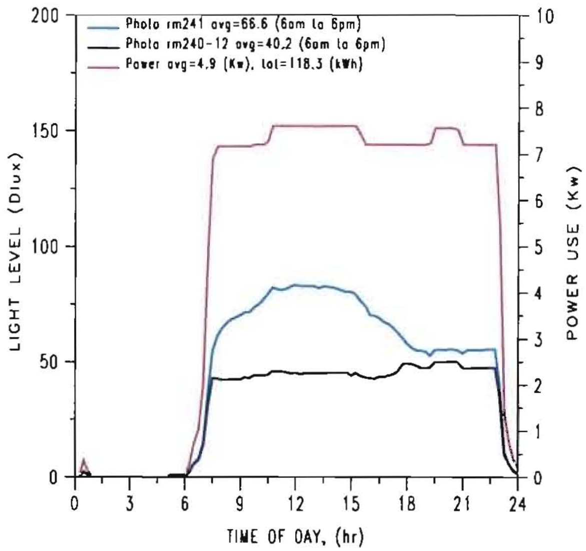
EXTERIOR SITE CONDITIONS



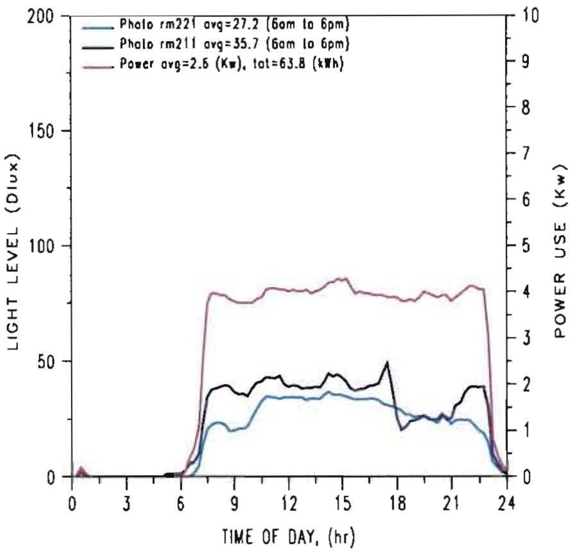
SECOND FLOOR INTERIOR CONDITIONS



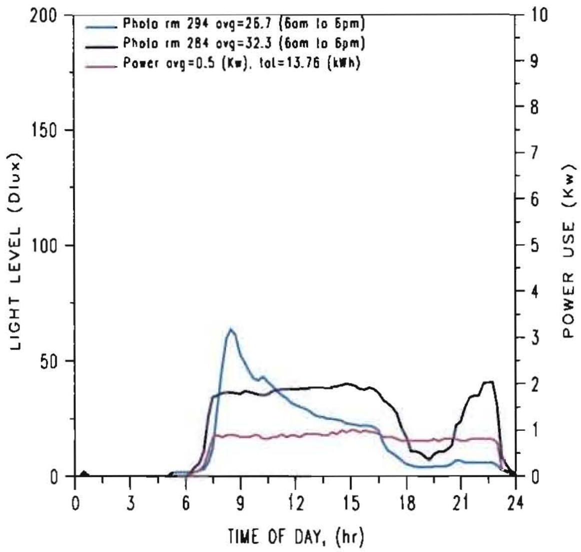
NORTHEAST SIDE LIGHTING POWER AND LEVEL



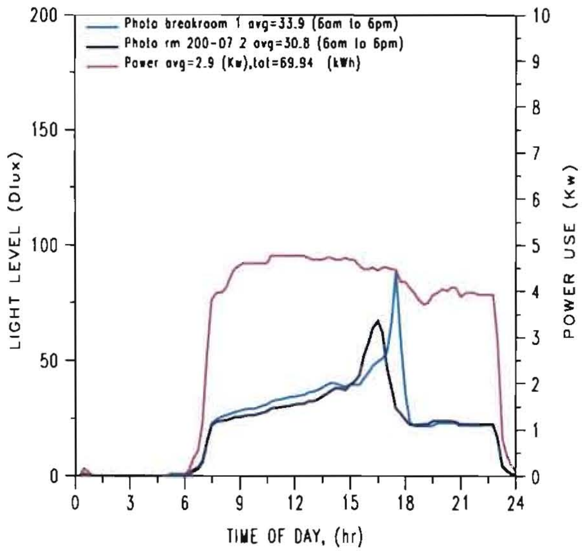
NORTHWEST SIDE LIGHTING POWER AND LEVEL



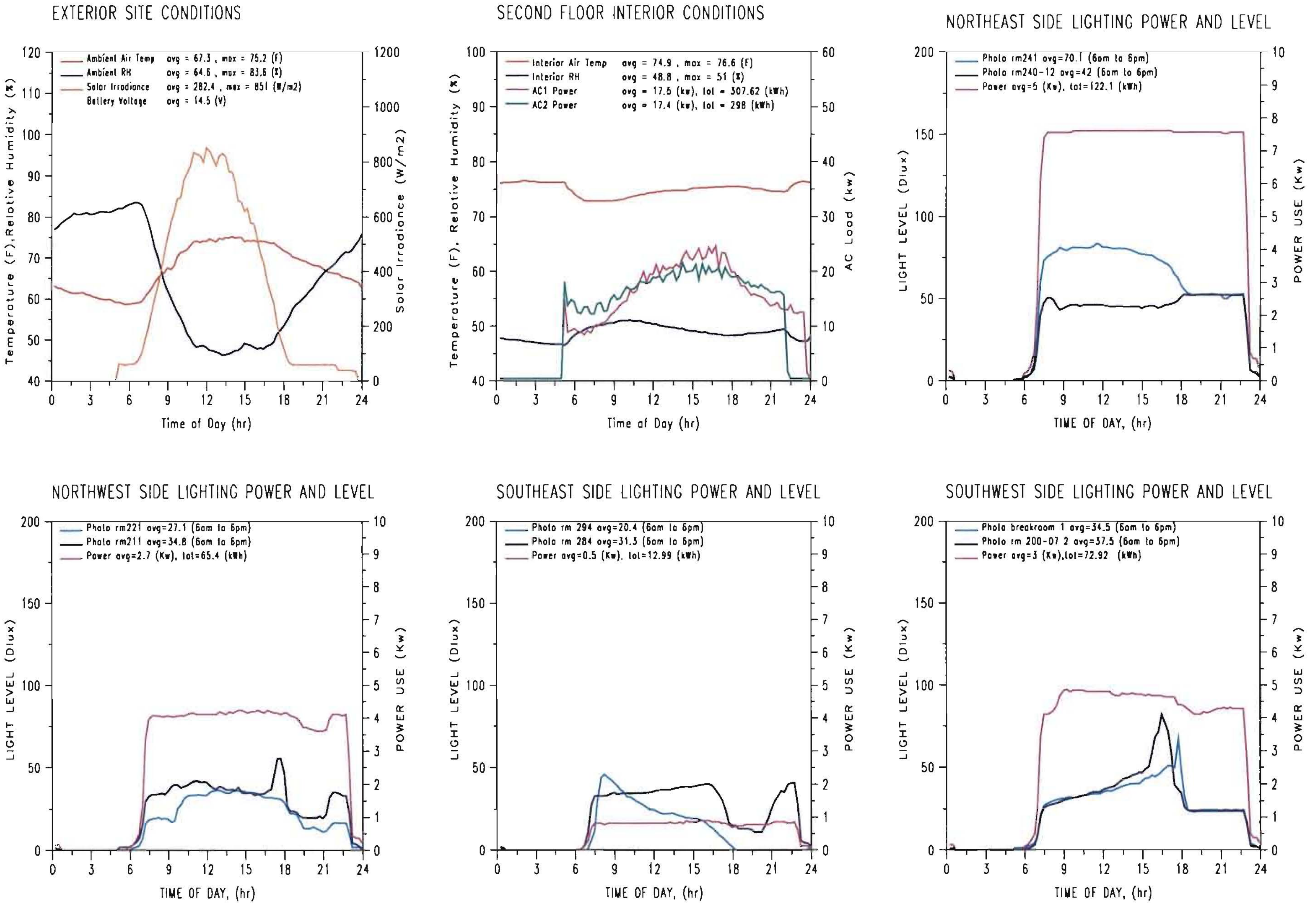
SOUTHEAST SIDE LIGHTING POWER AND LEVEL



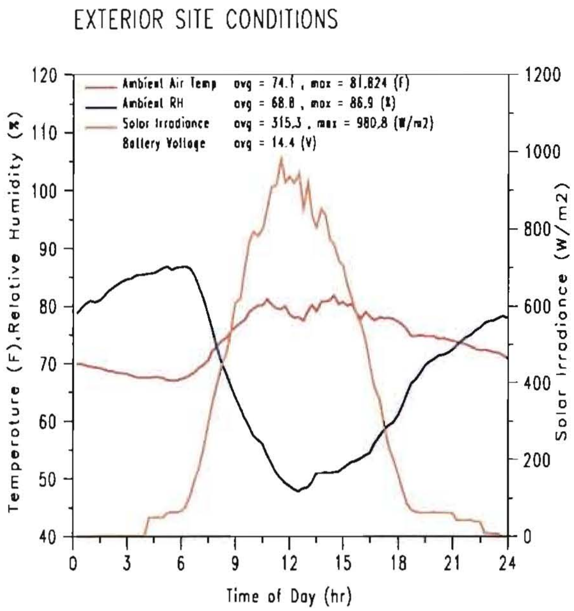
SOUTHWEST SIDE LIGHTING POWER AND LEVEL

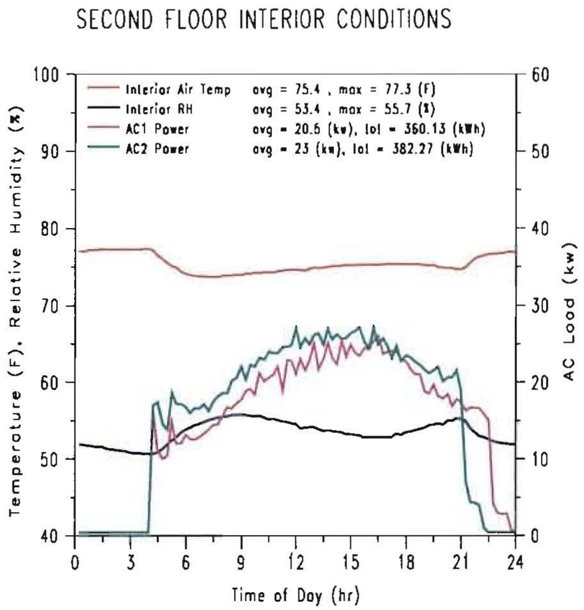


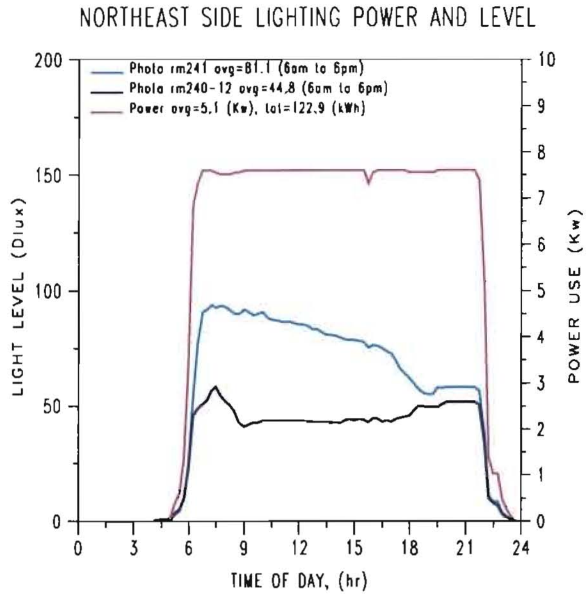
FEBRUARY 1999 DAILY AVERAGE FOR WEEKDAYS - SOUTHERN SITE

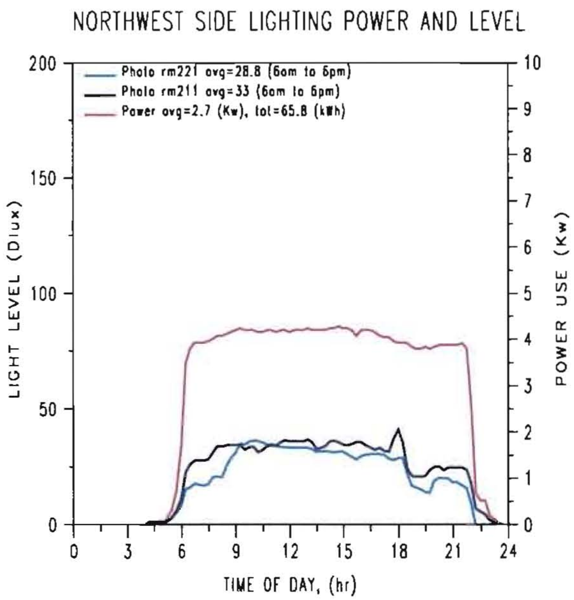


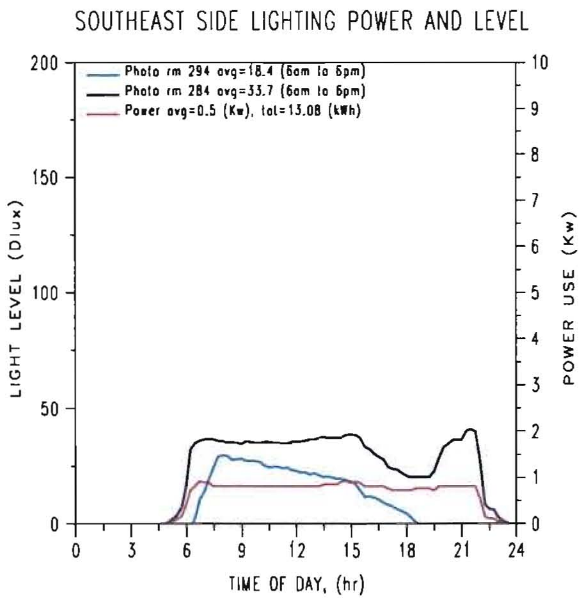
MARCH 1999 DAILY AVERAGE FOR WEEKDAYS - SOUTHERN SITE

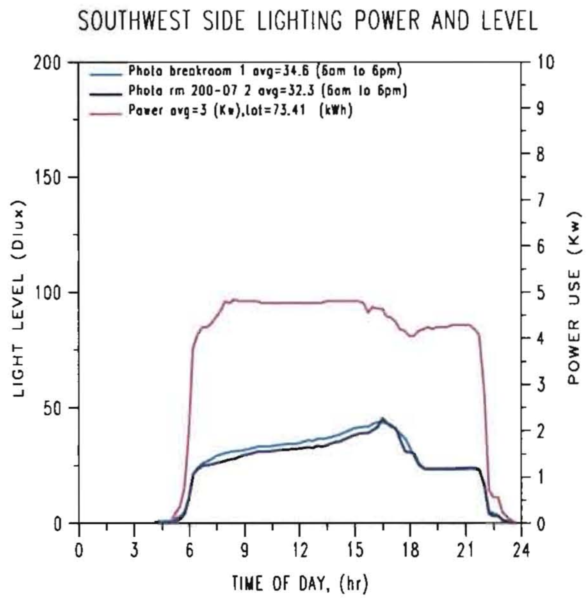






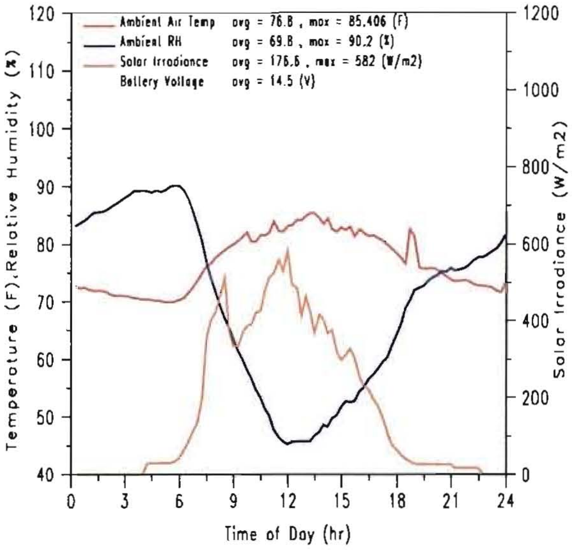




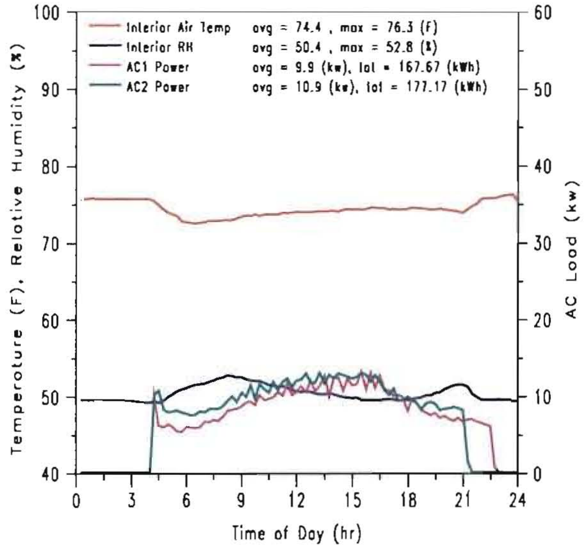


APRIL 1999 DAILY AVERAGE FOR WEEKDAYS - SOUTHERN SITE

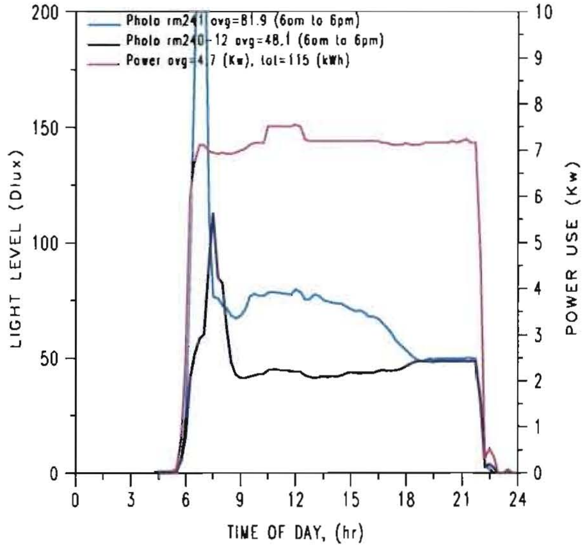
EXTERIOR SITE CONDITIONS



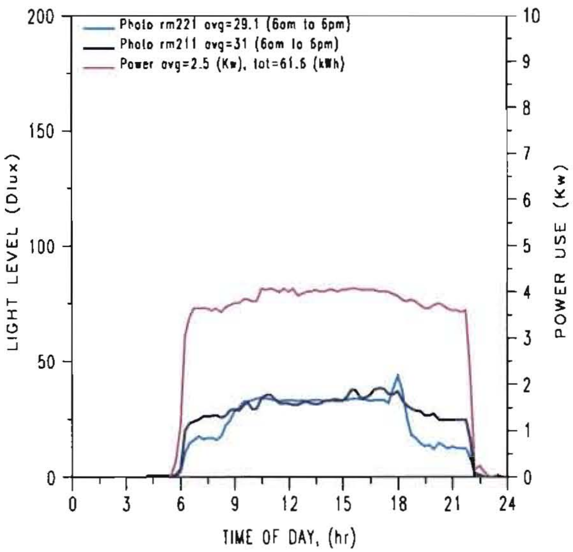
SECOND FLOOR INTERIOR CONDITIONS



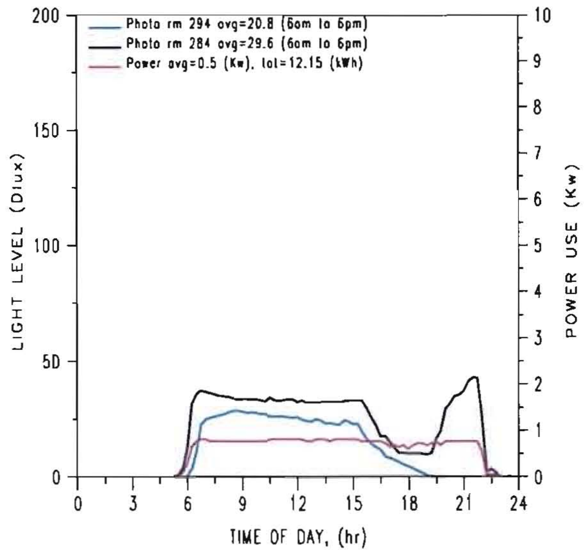
NORTHEAST SIDE LIGHTING POWER AND LEVEL



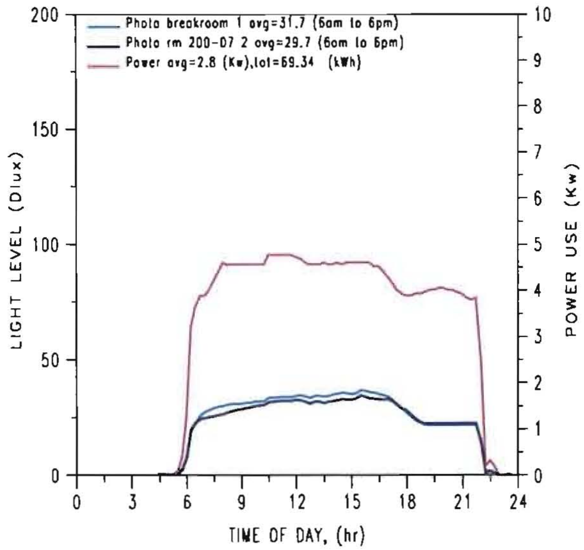
NORTHWEST SIDE LIGHTING POWER AND LEVEL



SOUTHEAST SIDE LIGHTING POWER AND LEVEL



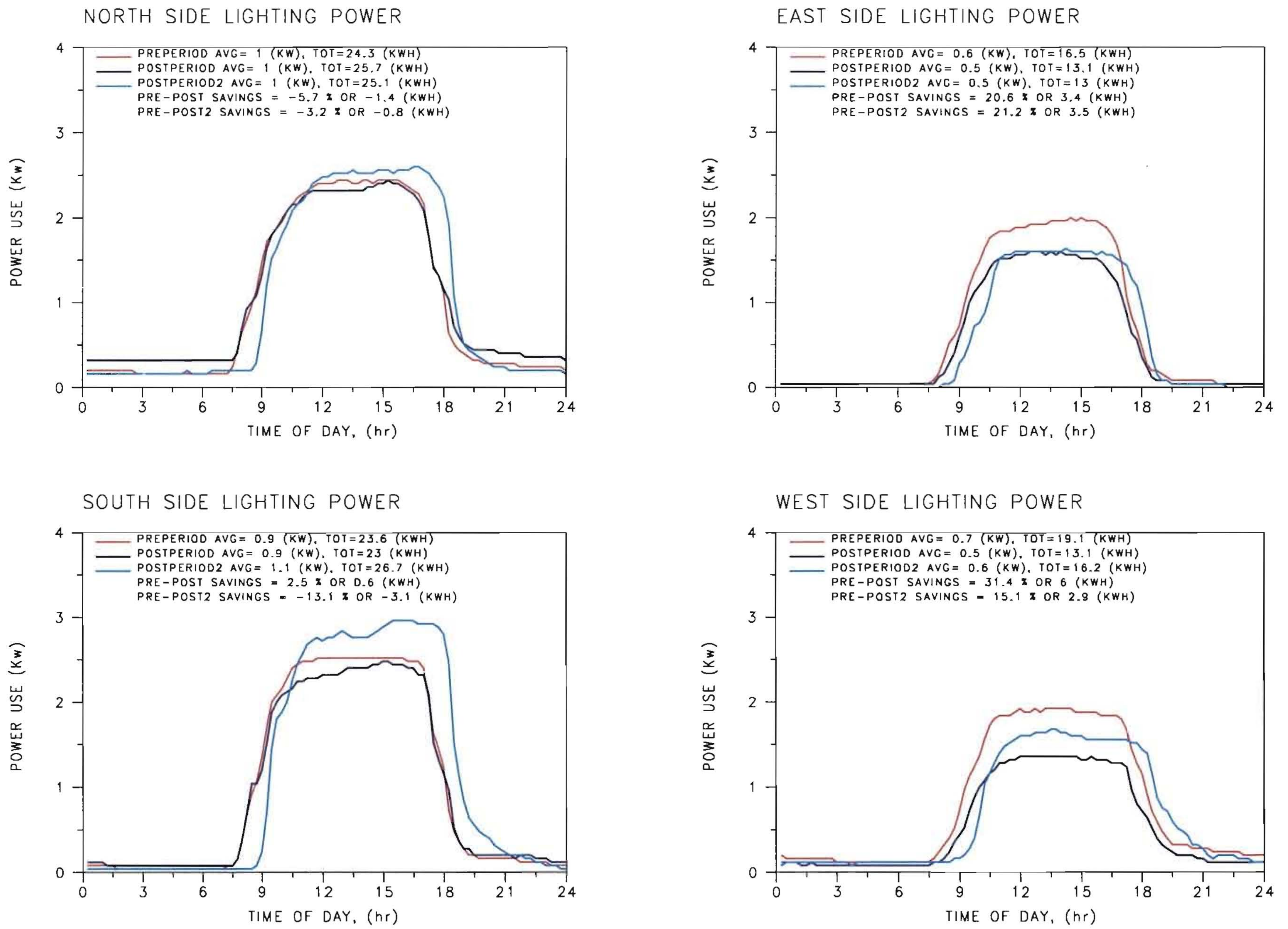
SOUTHWEST SIDE LIGHTING POWER AND LEVEL



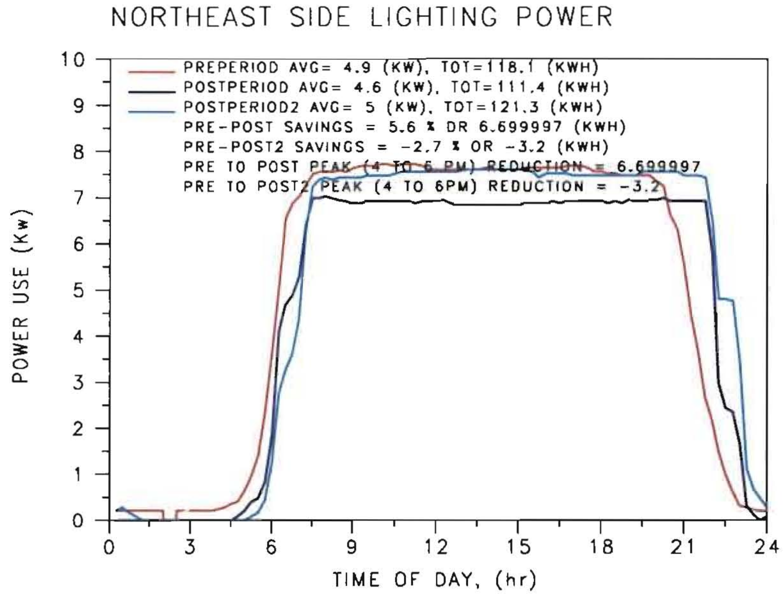
MAY 1999 DAILY AVERAGE FOR WEEKDAYS - SOUTHERN SITE

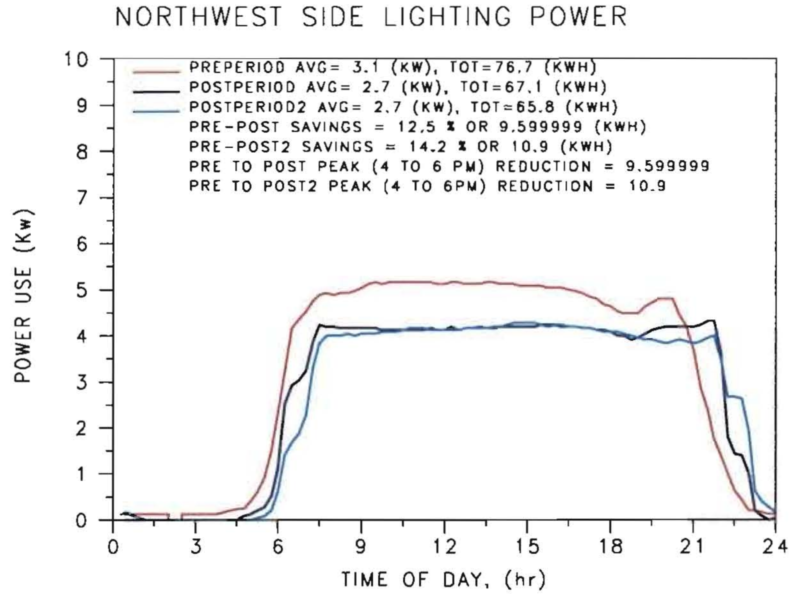
Appendix C

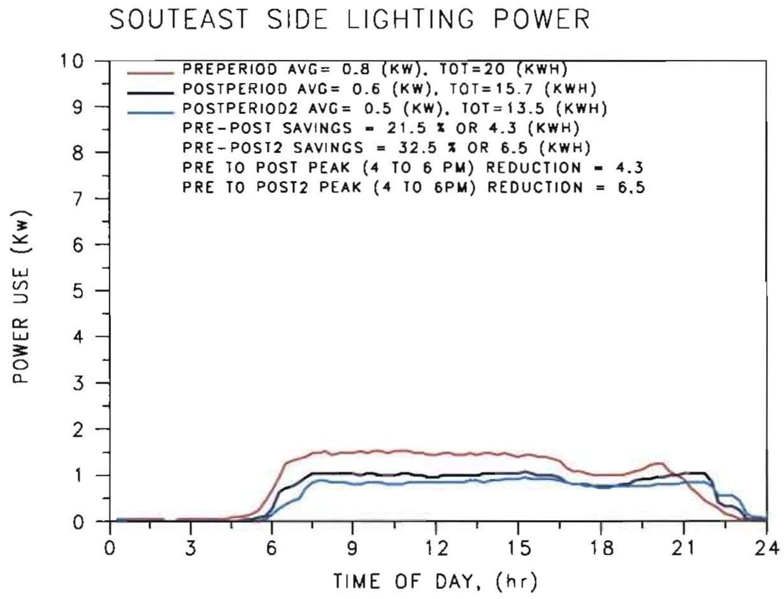
Before and After Comparison of Daily Lighting Power Use

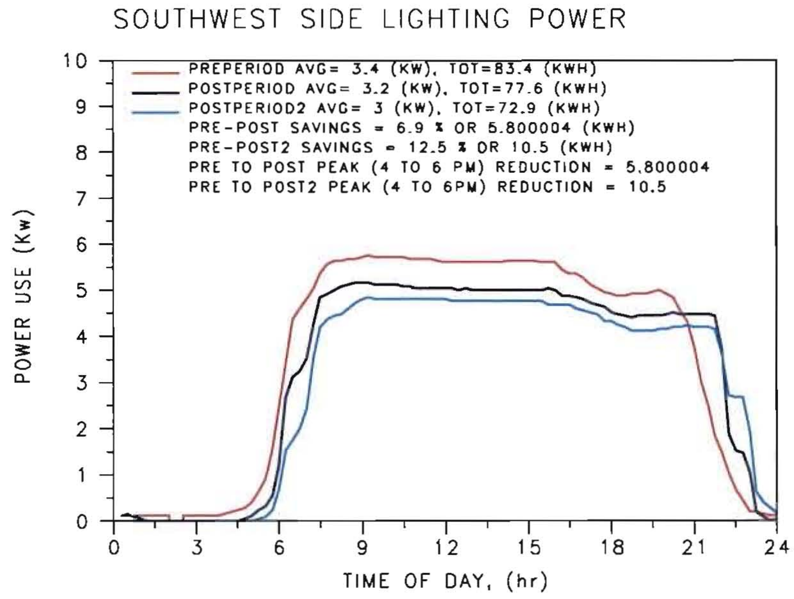


PRE/POST COMPARISON OF LIGHTING POWER USE FOR WEEKDAYS - NORTHERN SITE





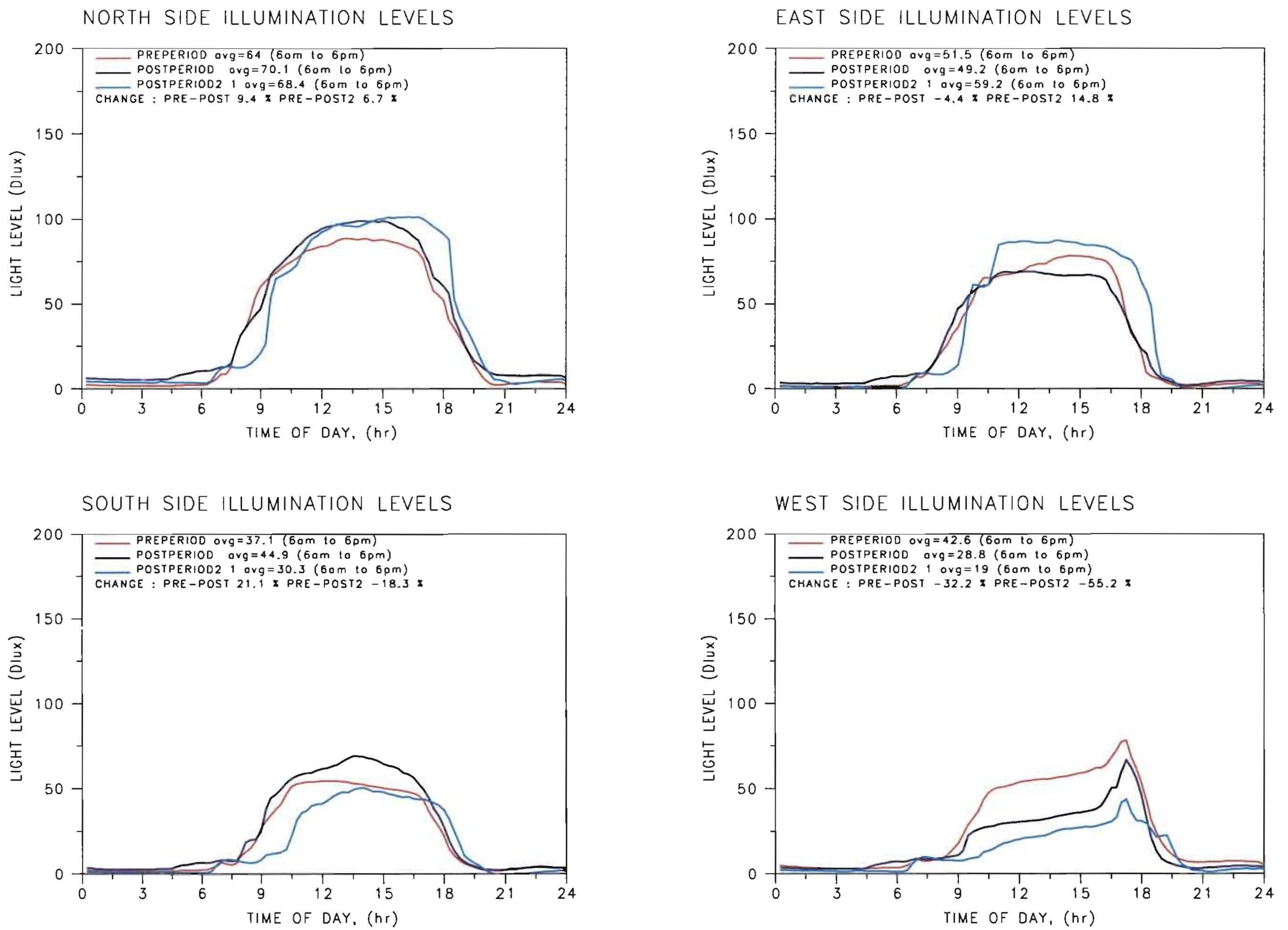




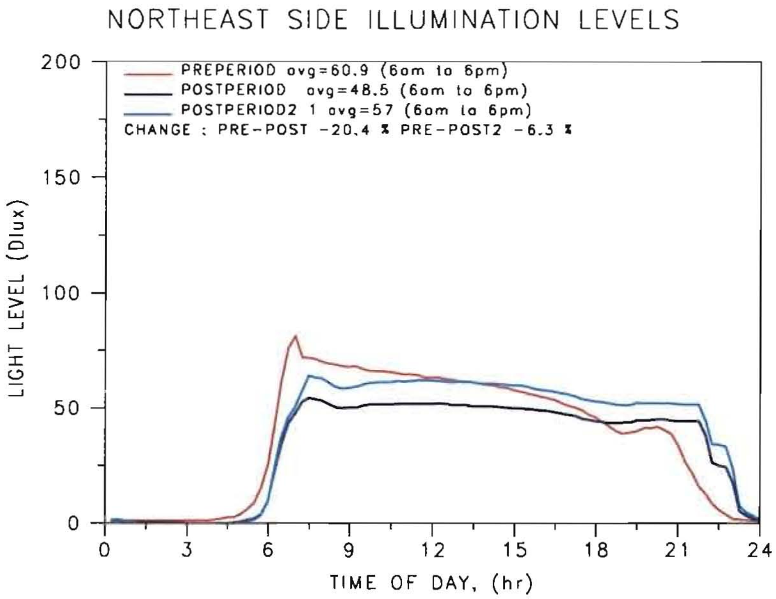
PRE/POST COMPARISON OF LIGHTING POWER FOR WEEKDAYS - SOUTHERN SITE

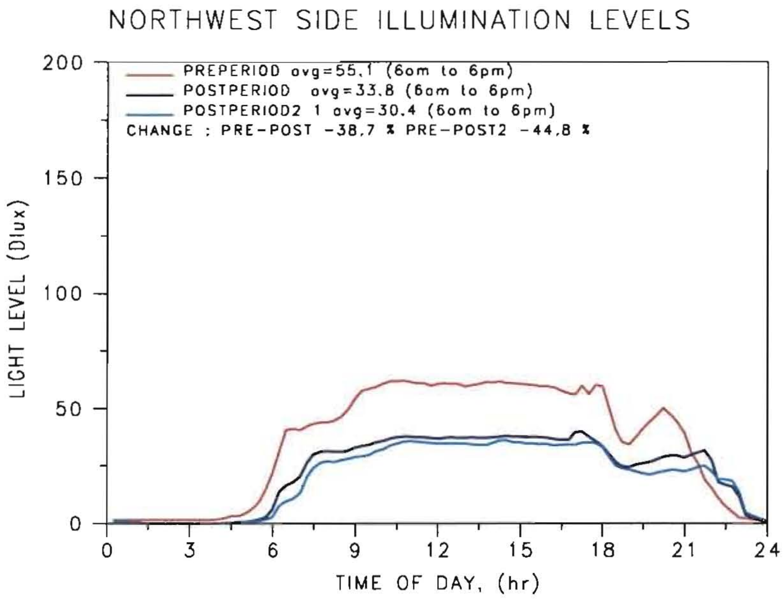
Appendix D

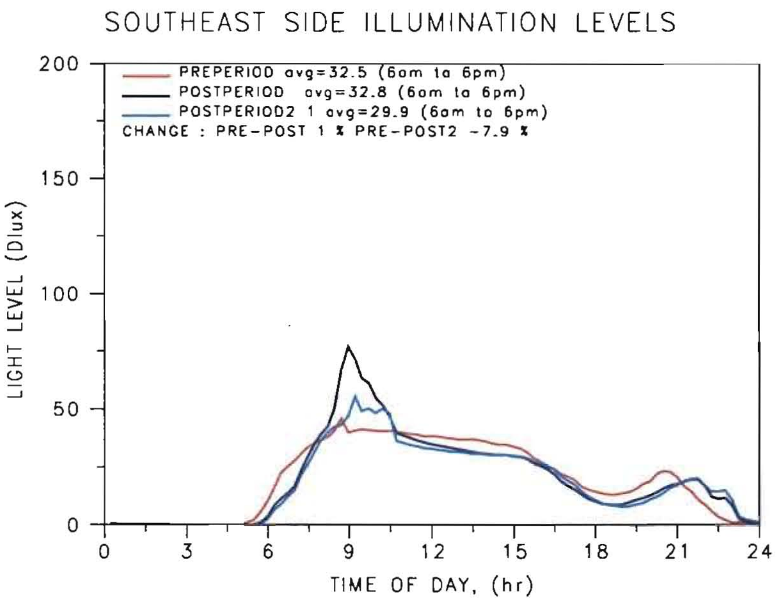
Before and After Comparison of Daily Illumination

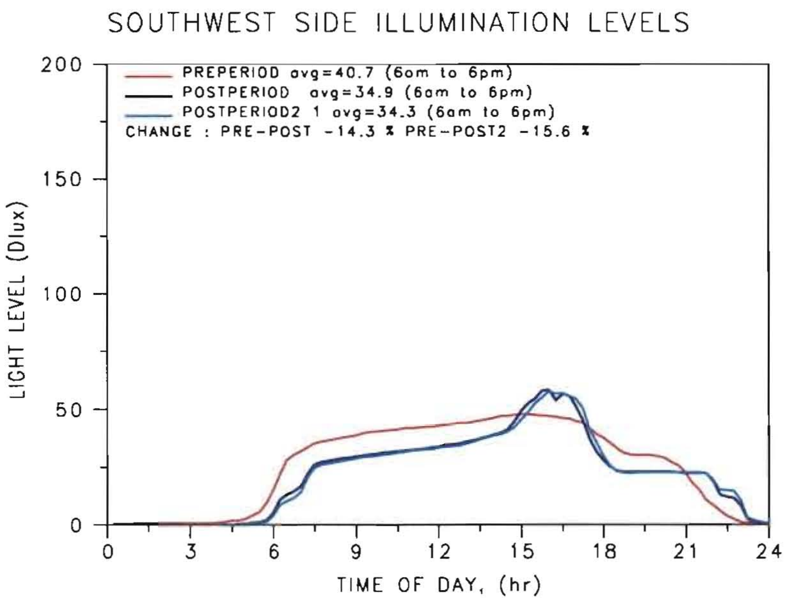


PRE/POST COMPARISON OF ILLUMINATION LEVELS FOR WEEKDAYS - NORTHERN SITE









PRE/POST COMPARISON OF ILLUMINATION LEVELS FOR WEEKDAYS - SOUTHERN SITE

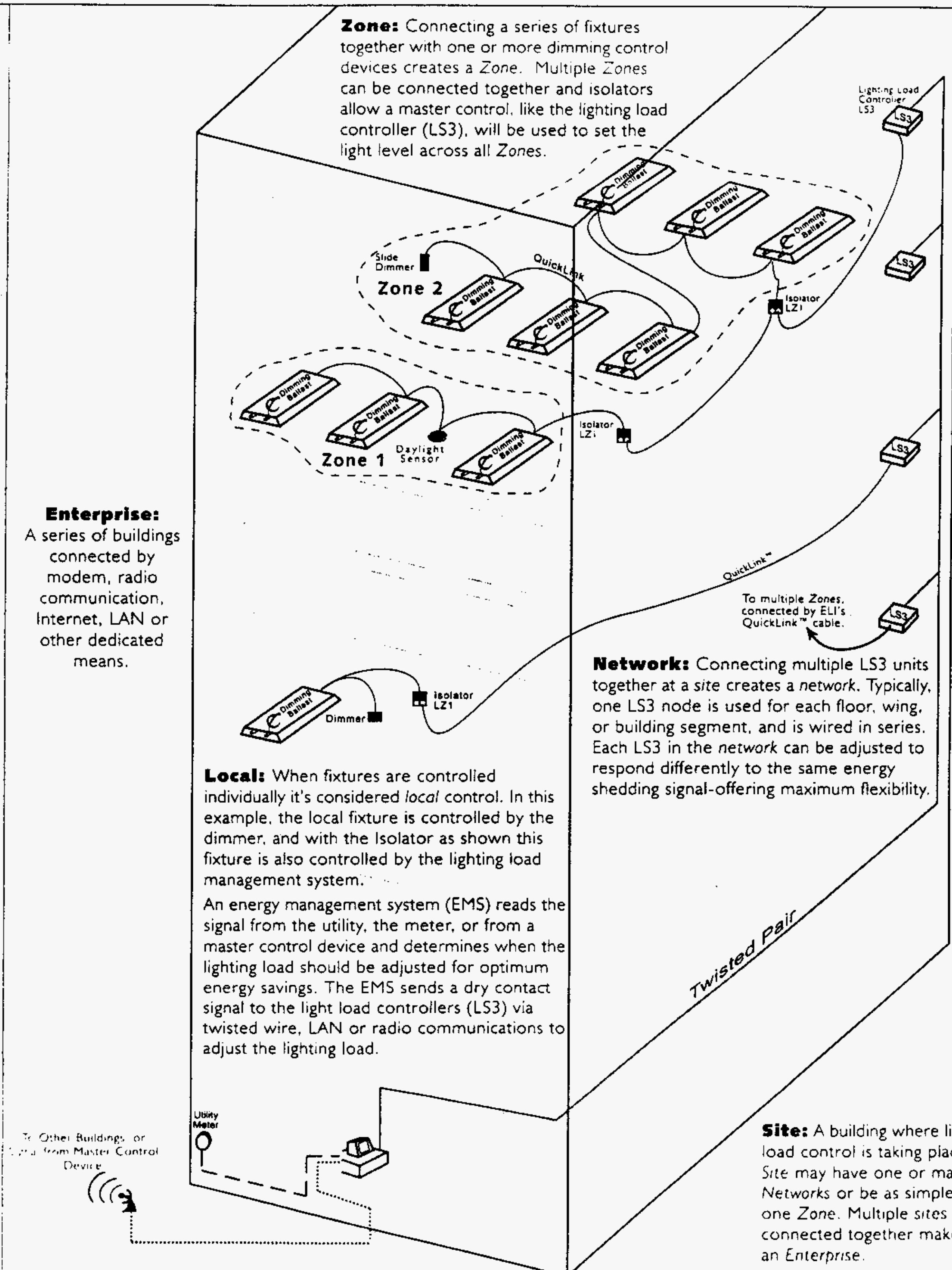
Appendix E

Manufacturer Literature

ELI Controllable Lighting

Control Your Lighting Load Globally

Enterprise
↓
Site
↓
Network
↓
Zone
↓
Local



Zone: Connecting a series of fixtures together with one or more dimming control devices creates a *Zone*. Multiple *Zones* can be connected together and isolators allow a master control, like the lighting load controller (LS3), will be used to set the light level across all *Zones*.

Enterprise: A series of buildings connected by modem, radio communication, Internet, LAN or other dedicated means.

Network: Connecting multiple LS3 units together at a *site* creates a *network*. Typically, one LS3 node is used for each floor, wing, or building segment, and is wired in series. Each LS3 in the *network* can be adjusted to respond differently to the same energy shedding signal-offering maximum flexibility.

Local: When fixtures are controlled individually it's considered *local* control. In this example, the local fixture is controlled by the dimmer, and with the Isolator as shown this fixture is also controlled by the lighting load management system.

An energy management system (EMS) reads the signal from the utility, the meter, or from a master control device and determines when the lighting load should be adjusted for optimum energy savings. The EMS sends a dry contact signal to the light load controllers (LS3) via twisted wire, LAN or radio communications to adjust the lighting load.

Site: A building where lighting load control is taking place. A *Site* may have one or many *Networks* or be as simple as one *Zone*. Multiple *sites* connected together make up an *Enterprise*.

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Web: www.ELInet.com

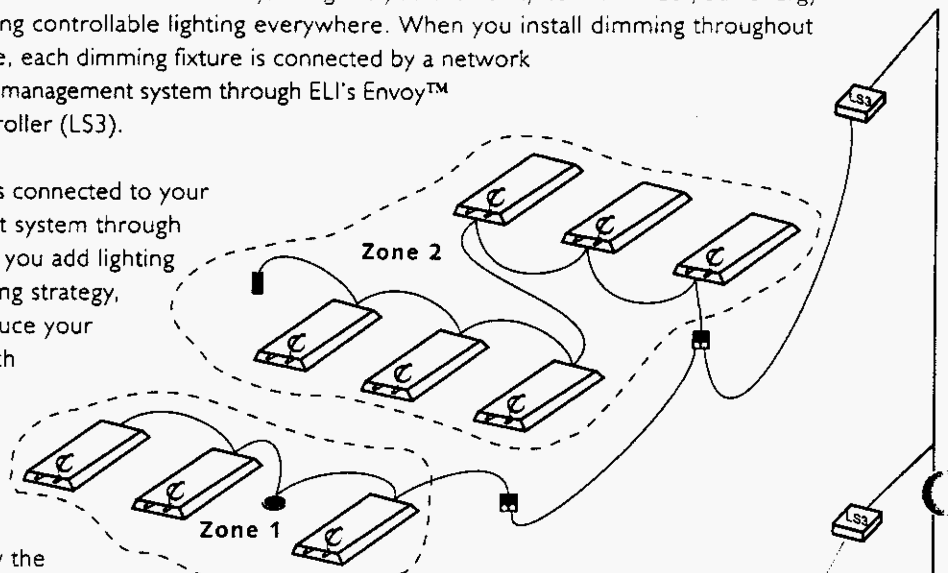
ELI Controllable Lighting

Give Lighting Control Locally

Enterprise
↓
Site
↓
Network
↓
Zone
↓
Local

Traditional dimming retrofits focused on dimming in conference rooms and daylight harvesting in perimeter offices. When you install dimming ballasts in this way, connected together and controlled by a manual dimmer or a photocell, you've created a zone that gives local control.

Until now, each zone in your building (your conference room, for example) stood alone – controlled only by a slide dimmer or remote control. Today, ELI gives you the ability to maximize your energy reduction by installing controllable lighting everywhere. When you install dimming throughout your building, or site, each dimming fixture is connected by a network back to your energy management system through ELI's Envoy™ Lighting Load Controller (LS3).



Once your lighting is connected to your energy management system through a network of LS3's, you add lighting to your load shedding strategy, enabling you to reduce your peak demand at each fixture throughout your site.

In the example shown, Zone 1 is controlled locally by the daylight harvesting photocell while Zone 2 is controlled by a simple slide dimmer. What makes this installation unique is that both zones are connected together to the LS3 network. Each zone operates independently and without limitation until the EMS system sends a signal to reduce the lighting load. At that point the LS3 network slowly reduces the light level – and energy consumption – of every zone in the network. The reduction is so slow it goes unnoticed while allowing the EMS to drop more than 30% of the energy consumption per ballast.

An added benefit to dimming everywhere is that fixtures, once uncontrollable, can now be controlled on an individual or local basis, giving your occupants freedom to reduce energy consumption lower than any automatic control would.

As you retrofit your buildings and connect each building together, you create an enterprise, whereas the entire system of buildings can be controlled by a single signal. Each building can communicate through the individual EMS systems, or your utility could communicate directly with your enterprise and allow you to negotiate lower utility rates. Commit to installing dimming everywhere and your options are limitless.

Lighting control starts at the local level, by the user or by an automatic control. Each local fixture is connected to create a zone. Individual zones are connected together to create a network. A site is the entire building, and can have one or many networks. Finally, several sites create an enterprise.

Electronic Lighting, Inc.
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APPLICATIONS @ Work

Dimming In A Commercial Facility

From passive to dynamic, an adjustable lighting system should be designed to control lighting within a space to ensure occupant comfort while maximizing energy savings.

A combination of lighting control strategies including daylight harvesting, occupancy recognition, and manual dimming were implemented at the Alachua County Office of the State Attorney. The most impressive impact on reducing energy consumption was achieved with active lighting load management using the ELI Envoy™ Lighting Load Controller.

Lighting load management is the latest breakthrough strategy from ELI. The savings impact of the project was immediate. Even at a low 6.2-cent/kWh blended rate, the payback was just 2.4 years – and without sacrificing light levels.

Alachua County Office of the State Attorney

120 W. University Avenue
Gainesville, Florida

Energy Savings	*34% of total energy* *76% of lighting energy*
Installed Cost	*$49,293*
Rebate	*None*
Blended Utility Rate	*$0.062/kWh*
Internal Rate of Return	*40%*
Simple Payback	*2.4 years*
Annual kWh Savings	*270,300 kWh*
Footcandle Levels	
Pre-retrofit	*40 footcandles*
Post-retrofit (full output)	*54 footcandles*
Post-retrofit (load shed)	*47 footcandles*
Pollution Prevented	
CO2	*381,123 lbs/yr*
SO2	*3,244 lbs/yr*
NOx	*1,352 lbs/yr*

CASE STUDY

Alachua County

Charles Balanis, Energy Management Specialist

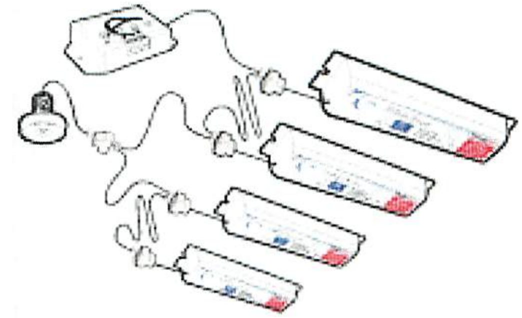
ALACHUA COUNTY

"It's working! We're seeing tremendous drops in kWh consumption. No one can believe it – they don't know it's dimming and I get to watch the energy savings."

Lighting Load Management

Building Profile

The Alachua County Office of the State Attorney is located at 120 West University Avenue in Gainesville, Florida. The 20-year-old, three-story brick building houses approximately 70 employees engaged in primarily administrative duties and computer work. The 34,000 ft.^{2} building has a typical office environment on all three floors with banks of cubicles in the open interior office area and offices around the perimeter. The full-length windows, located primarily on the south side of the building, are heavily tinted and utilize vertical blinds.



Prior to the retrofit, 400 four-lamp prismatic lens fixtures utilized standard magnetic ballasts and a mix of standard and energy saving T12 lamps. Another six fixtures were three-lamp open-cell parabolics with T12 lamps.

Employees occupy the building Monday through Friday during standard 8 AM to 5 PM business hours, and up to six hours during the weekend. Nonetheless, Charles Balanis, Energy Management Specialist for 40 of Alachua County's buildings, estimated that at least 80% of the lighting was operating 24 hours a day. "We didn't have a building management system on the lighting and no one cared about turning the lights off. I don't think they even thought about it."

Balanis selected ELI technology in part due to "the exceptional powerline carrier compatibility offered by ELI's controlled lighting system." Balanis' other

Envoy Lighting Load Controller @ Work

The introduction of ELI's "Killer Application," the Envoy Lighting Load Controller (Model LS3), makes lighting load management a valuable asset to a dynamic energy reduction strategy.

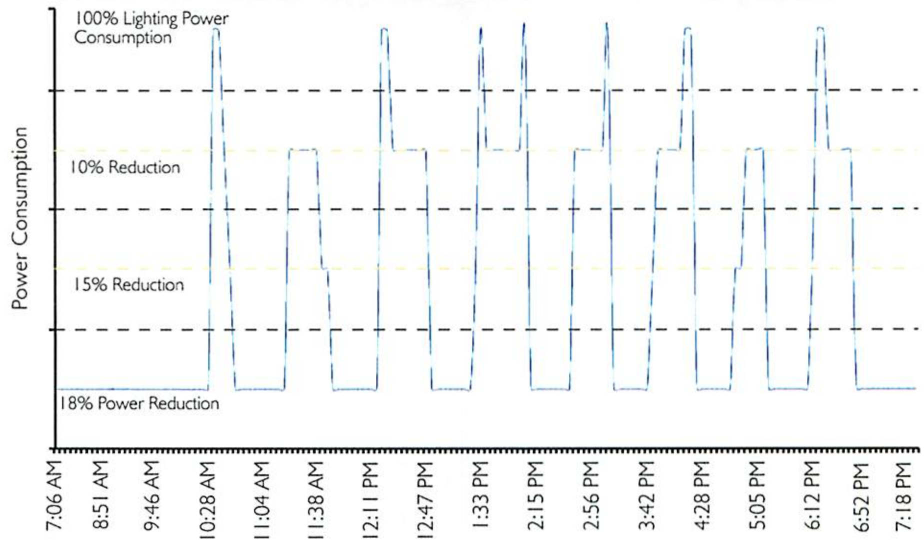
The LS3 is the link – joining the lighting system to any control point with a dry contact. The LS3 can be commanded by a fully-deployed energy management system (EMS) or a simple time clock. The first adjusts the lighting load based on actual demand and the latter based on a time setting. In either case, energy is reduced without occupant intervention, and more importantly, without occupant recognition.

The LS3 accepts three inputs, each from a relay or dry-contact. Each input has a corresponding, user-adjustable energy level; for example, trimming the entire lighting energy load 10% when the first relay signal is sent to the LS3 from the EMS. The activation of the control signal may be based on a set demand level or a time-of-day setting. If the demand level is reached again, the EMS sends additional relay

closures for further lighting load reductions.

Each LS3 offers a dimming range of 100-10% and can manage up to 1000 ELI PowerPlus® dimming ballasts.

considerations in choosing a lighting system included reliability, ballast factor and the realization of the promised energy savings.



To Balanis the decision was easy. "A slam dunk," he said. "Swapping out the existing standard magnetic ballasts for dimming electronic ballasts would still yield substantial energy savings." Assuming no dimming savings (a worst-case scenario), his proposal anticipated a four- to six-year payback and was accepted by the Board of County Commissioners during the budget process. Balanis believed that the savings from the dimming would be harder to quantify but he was certain that the savings would be there.

Dimming Strategy

Balanis first turned to more traditional strategies like delamping and occupancy sensing. However, once introduced to the concept of controlling the lighting loads throughout the building – or even in multiple buildings – he learned that he could use this "killer application" to broaden his energy-savings strategy. With ELI's guidance, Balanis chose to maximize energy savings by applying a variety of dimming control strategies. Task dimming, daylight harvesting and load management with the ELI Envoy Lighting Load Controller were employed to design a lighting system to control energy consumption.

Fixtures were delamped and replaced with a single ELI dimming ballast using 2-T8 lamps and a specular reflector; this immediately reduced energy consumption to 58 Watts per fixture. Prior to the retrofit, each fixture was using between 158 and 174 Watts. Without the addition of any controls and with the dimming ballasts running at full light output, each fixture experienced an immediate wattage reduction of at least 100 Watts, which would be typical of a standard retrofit.

The lighting retrofit and installation of daylight harvesting, manual dimming and occupancy sensors was completed in January 1998; however, the lighting load management system wasn't activated until May so that the benefits of the system could be isolated. (See Chart 2 on reverse.) After the initial installation, occupant comments were made which required adjustments on the photosensor.

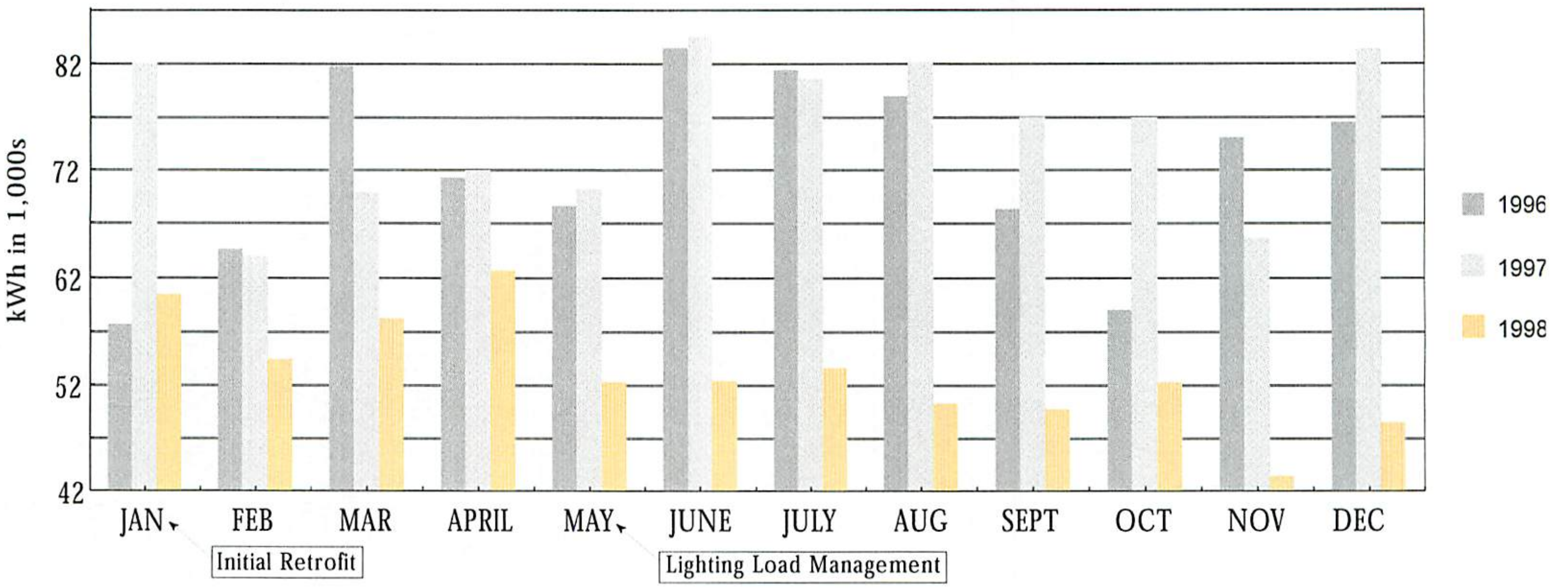
However, *no one* noticed the activation of the Envoy Lighting Load Controller. "Load shedding is just less troublesome than daylight harvesting. They don't notice as the light level slowly changes," says Balanis. (See at left for more information about the LS3.)

Occupancy sensors by The Watt Stopper® for on/off control were used in wall switches for offices and in the ceiling above cubicles. Some of the offices were also fitted with manual dimmers and the perimeter offices with windows received photosensors for daylight harvesting.

Every ballast in the building was connected back to an Envoy Lighting Load Controller. Balanis was striving for maximum control over the lighting system and divided each floor into quadrants. (A similar strategy could have been applied using two LS3s per floor: one to control the perimeter and the other to control the interior of the building to allow for more aggressive dimming in areas where daylight is more than adequate. In many cases, one LS3 per floor is sufficient.)

For this project, each LS3 first responded when the total building load demand exceeded 65 kW; in essence, managing and flattening the load curve every day as needed. Chart 1 above illustrates the active control of the lighting load as it gradually adjusted the lighting over a five to fifteen minute time period in response to load thresholds. In this building, an Alerton® IBEX™

Chart 2 Monthly kWh Consumption



energy management system continuously monitored the electrical load. When the meter remained above 65 kW, the LS3 received additional lighting load shedding signals every 30 minutes. Balanis chose the three input settings on the LS3 to reduce the lighting energy load by 10%, 15% and 18%. The lighting load is restored in reverse order when demand drops below 60 kW.

Chem Light Plus of Gainesville installed the ELI controlled lighting system. According to Vice President Douglas Robinson, "It was an easy installation. The connections were easy with the QuickLink™ system and we were able to install efficiently."

Looking Ahead

The savings from the retrofit were immediately evident as shown in Chart 2 which illustrates monthly kWh consumption. Energy consumption dropped 21,600 kWh in January 1998 compared to 1997 and resulted in a $1,313 savings for that month alone. Even more dramatic were the reductions following the activation of the Envoy Lighting Load Controllers. June's consumption in 1998 was 32,200 kWh less than the previous year – a $2,098 savings.

The first six months of lighting load management (May – October 1998) yielded an average consumption of 51,700 kWh per month with an average demand of 153 kW. Those same six months in 1997 averaged 78,534 kWh per month with an average demand of 177 kW. Lighting load management with the Envoy Lighting Controller resulted in a 26,834 kWh average monthly energy savings, a 24 kW average monthly reduction in demand and a $1,826 average monthly utility bill savings.

Annually, this amounts to savings in excess of $20,000 with a 76% reduction in lighting energy consumption and a 34% savings in total energy usage. Lighting load management delivers savings far beyond those possible with a standard lighting retrofit.

Given an average 51,700 kWh consumption per month, Alachua County will realize a 2.4 year simple payback – significantly better than the payback expected by Balanis and the County Commissioners.

As far as his plans for other Alachua County buildings, Balanis said, "I'll use lighting load management in the future for managing total building demand with controlled lighting. I reap the savings by regulating the load on demand and I don't have to worry about employee complaints. All they see are brighter lights and better color rendition."

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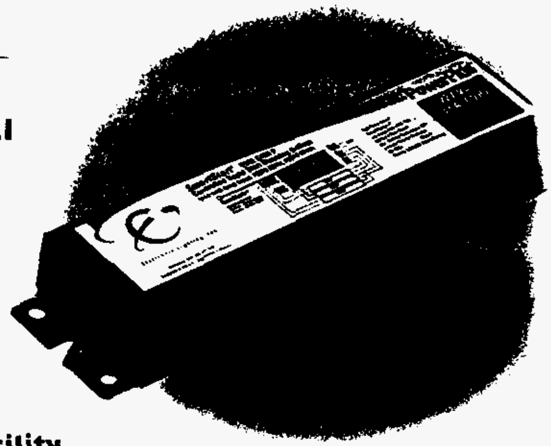
visit us @ www.elinet.com

PowerPlus®

Fluorescent Dimming Ballast for 3-T8 Lamps

Light Output: 100-10% Control: 0-10 Vdc



- **All the energy saving and performance features you've come to expect from ELI**
  - **Low input wattage**
  - **Lamp friendly programmed start**
  - **Low inrush current**
  - **Power line carrier friendly**
  - **Efficient, cool operation**
  - **Reliable, rugged design**
  - **Low THD**
  - **Manufactured in ISO 9002 certified facility**
  - ***And...***
- **Continuous dimming to 10%**
- **Standard low-voltage interface**
- **Equipped with QuickLink™ connection system**
- **Provides power for control devices**
- **Low-voltage, controlled off for increased flexibility**

Description

One ballast, many applications. ELI's PowerPlus dimming ballasts (Models D332-C120-P and D332-C277- operate three 2', 3' or 4' linear fluorescent or U-bend lamps. The innovator in controllable lighting systems, ELI continues to offer products that simplify specifying, installing and using energy-efficient lightir With every ELI controllable lighting system you receive the energy saving, reliability and performance benefits of the patented ELI PowerPlus ballast; the simplicity and ease-of-use of the QuickLink connectic system; and QuickLink compatible controls that are powered by the patented PowerPlus feature.

Application

ELI's three-lamp PowerPlus continuously dimming ballast is the perfect solution for new construction installations. The energy savings of the controllable ballast meet the requirements of the ASHRAE Energy Standard for Buildings and eliminate the requirement for separate circuit switching required by California Title 24.

The kits (available in one-pack and ten-pack) provide everything needed to create a controlled lighting system: ballast, QuickLink connections and protective knockout bushing. Everything for the job is right where you need it – in one package, in the quantities you need, and organized for the most efficient installation.

The ballast is lightweigh packaged in a standa footprint and runs cool to th touch. The QuickLin connection system mak installation fast and easy. T cable exits the fixture throu a standard knock-out ar provides snap-together ea to an endless array of contr options. The kit also inclu a knockout bushing to protect the QuickL cable from any sharp edges.

Packaged for the way you use it. Simple solutic at your fingertips.

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Email: ELI@EL
Web: www.EL

Model D332-C120-P & D332-C277-P

PowerPlus

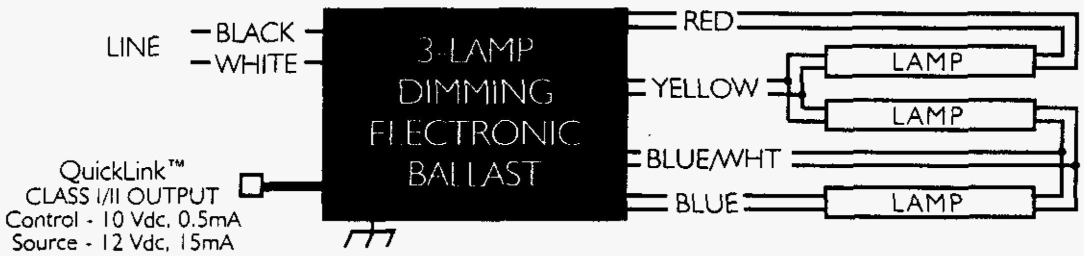
Energy-Efficient Electronic Dimming Ballast

Specifications

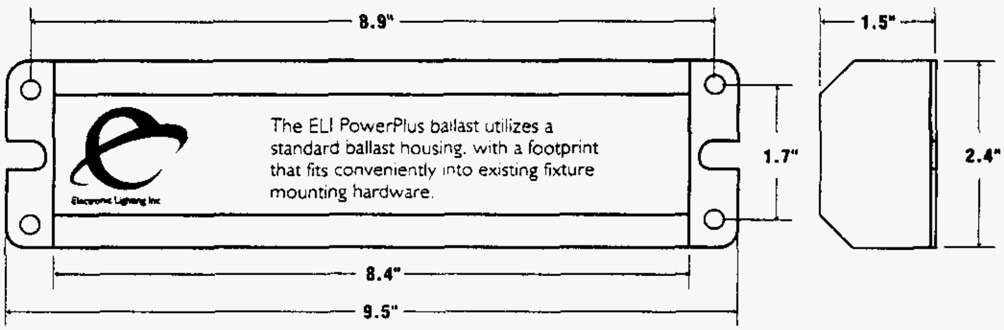
	D332-C120-P	D332-C277-P
Voltage	120 Volts ac	277 Volts ac
Line Current	0.78 Amps	0.34 Amps
Input Wattage	93 Watts at 100%	89 Watts at 100%
	24 Watts at 10%	20 Watts at 10%
Lamp Frequency	45 kHz	41 kHz
Hot-to-Cold Cathode Ratio (Rh/Rc)	>4.5	>4.5
Crest Factor	<1.7	<1.7
Ballast Factor	0.86	0.86
BEF	0.92	0.95
Power Factor	0.99	0.99
THD	<17%	<10%
Third Harmonic	<10%	<6%
Inrush Current Peak	<6 Amps	<2 Amps
Warranty	5 years	5 years
Safety	UL, cUL	UL, cUL
EMI/RFI	FCC Part 18	FCC Part 18
Performance	ETL pending	ETL pending

Specifications shown are for ballast operation at 100% light output with three T8 32-watt lamps, unless otherwise noted. Ballast operates 25 watt and 32 watt; 3' and 4' linear and U-bend lamps; and 36 watt Biax.

Wiring Diagram



Dimensions



Ordering Information

Model #	Description
D332-C120-P-K1	PowerPlus Kit, 120 Vac (includes ballast, QuickLink connectors and knockout reducer)
D332-C120-P-K10	Ten pack Kit, 120 Vac (includes 10 ballasts, 10 QuickLink connectors and 10 knockout reducers)
D332-C277-P-K1	PowerPlus kit, 277 Vac (includes ballast, QuickLink connectors and knockout reducer)
D332-C277-P-K10	Ten pack Kit, 277 Vac (includes 10 ballasts, 10 QuickLink connectors and 10 knockout reducers)

Electronic Lighting, Inc.
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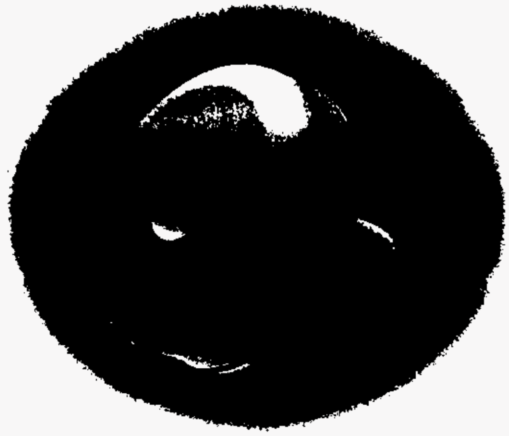
DayWatt™ Photosensor

Daylight Harvesting System



- Use the energy of the sun, not the utility
- Automatic light level adjustment
- Adjustable footcandle range
- Easy to install
- Low profile, attractive appearance
- Flexible lighting control
- QuickLink™ compatible
- NEC Class II, low-voltage wiring

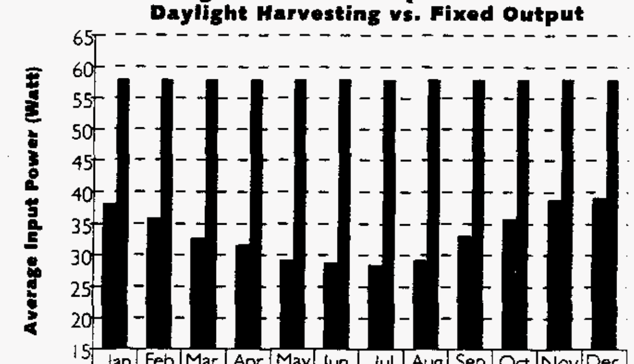
Description

The DayWatt photosensor, part of the Envoy™ family of controls, is a low-voltage, active daylight harvesting control that mounts in the ceiling and provides continuous, unnoticed light level adjustments based on the availability of natural light. The photosensor operates without human intervention and maintains a uniform light level on the work surface. As with all ELI controls, the DayWatt photosensor provides the simplicity of snap-and-go connections with the QuickLink connection system. Daylight harvesting from one source – ELI (with a little help from the sun).

Application

Harnessing the energy of the sun is both economical and friendly to the environment. Peak daylight, often coincident with peak electrical energy demand, offers an often-untapped resource of lighting for commercial buildings, retail stores, restaurants, schools and hospitals. Additional energy savings from avoided HVAC costs make daylight harvesting a rapid payback strategy.

Average Power Consumption Per Ballast
Daylight Harvesting vs. Fixed Output



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
■ Dimming	38	36	33	32	29	29	29	29	33	36	39	39
■ Fixed	58	58	58	58	58	58	58	58	58	58	58	58

Optimized for superior energy savings, the DayWatt photosensor responds readily to available sunlight while never dipping below the set illumination level. Annual energy reductions of 40-60% are achievable using daylight harvesting throughout most geographic areas. Reflection of natural light on hazy or cloudy days is often better than or equal to clear, sunny days.

Daylighting savings are achievable not only in perimeter office areas or areas with skylights, but often extend into the interior of a building when open office plans are in place.

In addition to energy savings, daylight harvesting systems can provide increased occupant comfort by reducing excessive lighting in daylit areas and providing a more consistent illumination level.

For more information on Daylight Harvesting, see the How To... section of the ELI binder.

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Email: ELI@ELInet.com
Web: www.ELInet.com

DayWatt Photosensor

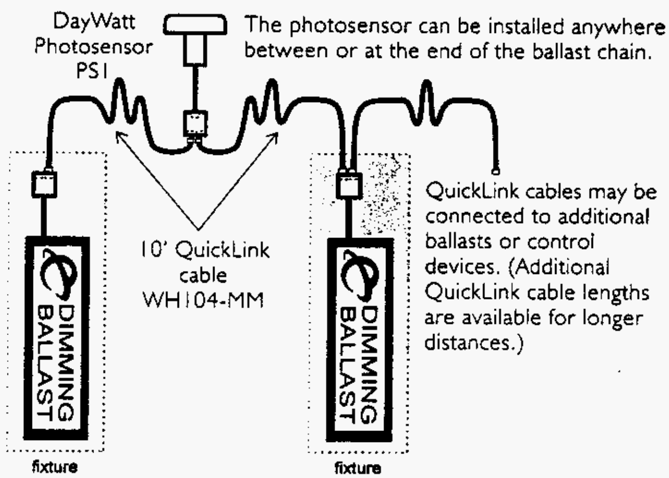
Daylight Harvesting System

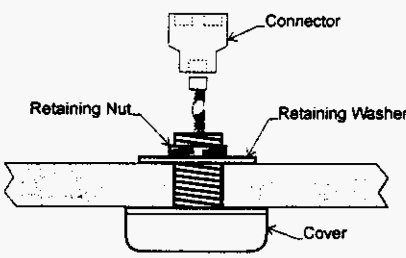
Specifications

DayWatt Photosensor, Model PS1

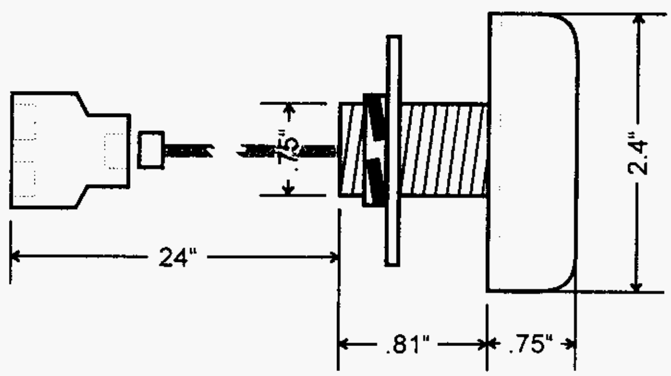
- Blue/green photodiode
- 10 VDC input voltage; .7 VDC (min) to 10 VDC (max)
- Dims to 16% light output with PowerPlus® ballasts; 28% light output with Series 700 ballasts
- Controls maximum of 30 ballasts
- ± 1% accuracy
- 60° Fresnel lens
- QuickLink compatible
- Available in white housing only
- One year warranty

Wiring Diagram





Dimensions



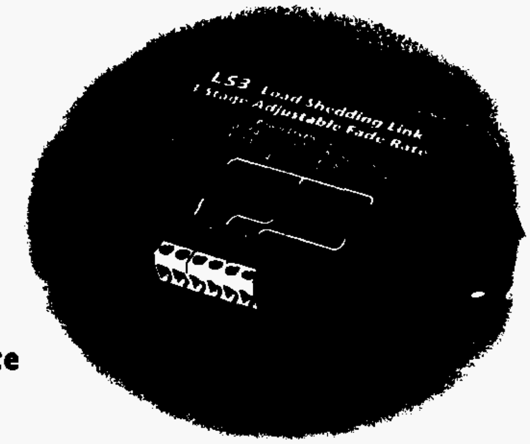
Ordering Information

Model #	Description
PS1	DayWatt Photosensor (one WC4-FFF QuickLink connector included)

Electronic Lighting, Inc.
Lighting @ Work™

Envoy™ Load Controlle

Lighting Load Controller



- Enables peak demand reduction
- Flexible lighting control
- Easy to install
- Simple to modify
- User programmable
- Simple energy management system interface
- QuickLink™ compatible
- Negotiate better rates with your utility

Description

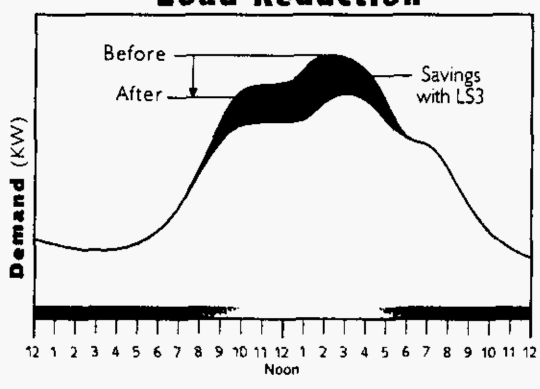
The Envoy LS3 is a "smart" lighting load controller that provides gradual, unnoticed light level reductior at critical times, allowing for significant reduction in energy usage. Optimized to work with ELI's famil of PowerPlus® controllable ballasts, the LS3 is compatible with ELI's QuickLink connection system anc accepts input signals in three stages from any energy management system. With simple plug-and-gc connections, zones can be created and changed quickly as building usage changes. Zone isolators (Mode LZ1) allow the LS3 to control zones, while local control devices – like photosensors and slide dimmers – can be used to save additional energy. Connected to any automated building energy management system (EMS) with a twisted pair and simple relay contacts, the LS3 allows a building automation systerr to control the lighting system as part of the building's load management strategy.

Application

A building's electrical load typically peaks midday when most employees are present, most equipment is operating and HVAC loads are highest. Traditional load management strategies attempted to manage peak electric loads through the reduction of air conditioning and hot water heaters – actions immediately noticeable to building occupants.

Lighting represents 30-40% of a building's total electric load. Load management with the LS3 allows for the gradual reduction of the lighting system by 30% – completely unnoticed. The LS3 reduces the peak load, preventing the building from exceeding its target demand level, and thus avoiding expensive demand charges and other capacity-basec penalties. The flexibility of the system also allows complete lighting control during holidays and evening hours when full-light output car be substantially reduced.

Load Reduction



The savings during peak periods, when electricity costs are the highest, are even more dramatic, as the marginal cost of electricity can easily reach more than 20 times the cost at off-peak hours.

Call Electronic Lighting today for more information on how you can best utilize ar ELI controlled lighting system - including the LS3 – in your business.

Electronic Lighting, Inc.
Lighting @ Work™
37200 Central Court
Newark, CA 94560
Ph: 800-395-5767
Fx: 510-795-0870
Email: ELI@ELInet.
Web: www.ELInet.

Envoy Load Controller

For Strategic Lighting Load Management

Specifications

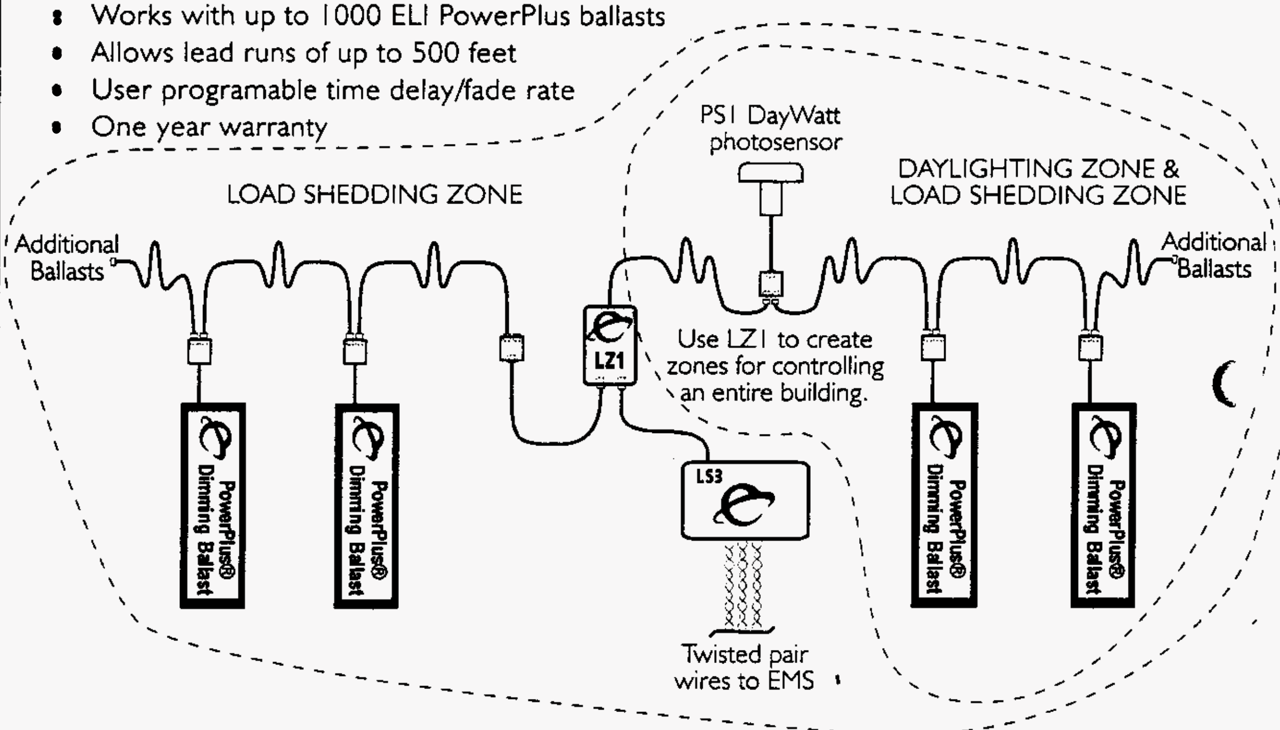
Lighting Load Controller, Model LS3

- Three channel inputs from EMS
- User programmable variable dimming
- Variable energy consumption from 100% to 54%
- Three independent energy saving stages
- Low voltage, NEC Class II, simple wiring
- No external power required
- Standard 0-10 Vdc dimming control signal
- ELI QuickLink compatible
- Works with up to 1000 ELI PowerPlus ballasts
- Allows lead runs of up to 500 feet
- User programable time delay/fade rate
- One year warranty

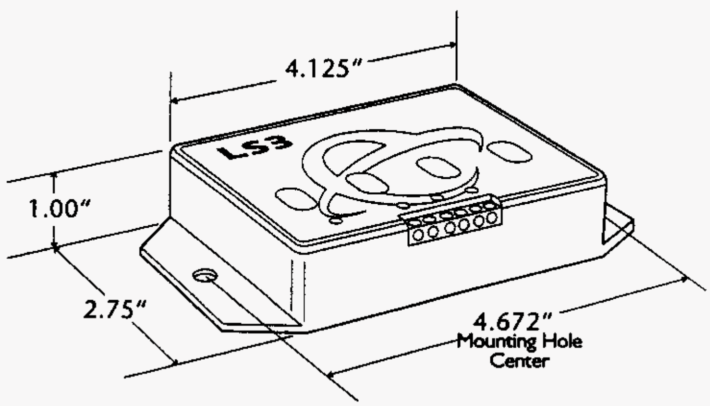
Lighting Zone Isolator, Model LZ1

- QuickLink compatible
- Creates isolated zones
- Prevents control device interference
- No external power necessary
- Low voltage, NEC Class II, simple wiring
- Compact enclosure
- One year warranty

iring Diagram



Dimensions



The LS3 can be mounted in a utility closet or left in the ceiling space. The LS3 mounts easily to any hard surface using two screws and the mounting ears provided. Since the unit is compact and lightweight, the LS3 can also be secured by a strip of velcro applied to the back. All ELI controls – including the LS3 – are built to be simple to use while providing maximum flexibility.

Ordering Information

Model #	Description
LS3	Lighting Load Controller with three-stage adjustable power levels and adjustable fade rate.
LZ1	Zone isolator to create local lighting zones when using other ELI controls.

Electronic Lighting, Inc.
Lighting @ Work™

800-395-5767

LightSaver® LS-30 Dimming Light Level Sensor

The LS-30 is a low voltage indoor photo control system which interfaces with electronic dimming ballasts using low voltage (0-10 VDC) control signal.

The LS-30 mounts on a ceiling and utilizes a photodiode to detect the light level in a given space. It controls the output of light from the connected ballast based on the availability of natural light and task illumination and will hold illumination to the set level.

The LS-30 measures the amount of illumination in its field of view and has an analog output to the control ballast to provide a dimming range from 10% to 100% illumination output. When maximum dim is required, 2 volts is supplied to the ballast; maximum brightness supplies 10 volts. The Fresnel lens allows the LS-30 to measure light levels uniformally across a 60° field of view. Because of the even field of view, the sensor is less likely to be affected by temporary changes in reflectance caused by papers on a desk top.

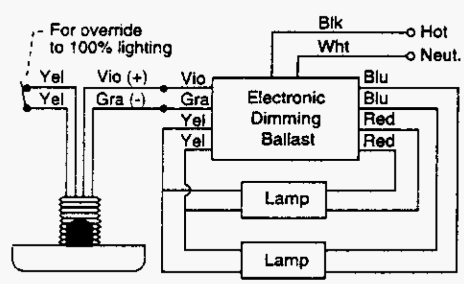
Light level is set by adjusting a trim pot. The LS-30 offers two rate of change speeds that are adjustable with an external jumper pin which will vary depending on the illumination level in the space. With the adjustment set to the fast rate, the rate of change from minimum to maximum will not occur in less than 10 seconds. With the slow rate, the rate of change will not occur in less than 60 seconds. Under extreme light level conditions, the rate of change will occur at the quickest selected speed. The LS-30 contains an external override for 100% lighting that can be achieved with a switch opening.

The LS-30 has a very low profile and attractive appearance. It was specifically designed to be unnoticed when installed in any office environment.

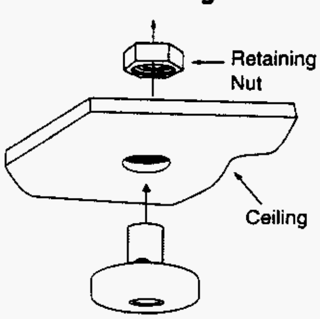
Specifications

- Blue/green photodiode
- 10 VDC input voltage; 2 VDC (minimum) to 10 VDC (100% lighting) output voltage
- 10 to 150 footcandle adjustment range
- Adjustable rate of change speeds
- Accuracy of ± 1%
- 60° Fresnel lens
- One LS-30 controls up to 50 ballasts
- 2.4" diameter x 0.75" depth (61mm x 19mm)
- 5 year warranty

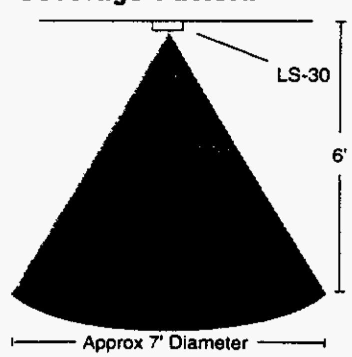
LS-30 Wiring Diagram



LS-30 Mounting



Coverage Pattern



Coverage for ceiling height of 8' 6" and desk top height of 30" is a 7' diameter.

Order Information

CATALOG #	INPUT VOLTAGE	OUTPUT VOLTAGE	FOOTCANDLE RANGE
LS-30	10 VDC	2 VDC (minimum) to 10 VDC (100% lighting)	10 to 150 fc

All units are white

New Mark VII™ Controllable Electronic Ballast

for 1, 2, and 3 Rapid Start F32T8 and F25T8 Fluorescent Lamps

PRODUCT PROFILE

Definition

The New Mark VII ballast from Advance is the cost-effective full-range controllable electronic ballast for T8 lighting systems. The New Mark VII ballast combines the ease of a 0-10V Class 1 or Class 2 low voltage control system with the industry leading 5% dim level. The New Mark VII ballast may be controlled by a wide variety of compatible 0-10VDC controllers available from over 20 manufacturers.

Description

- Delivers continuous, flicker-free controllable light output from a ballast factor of .88 to .05 (100-5% relative light output)
- Models to operate 1, 2, and 3 F32T8 and F25T8 rapid start linear and U-bend fluorescent lamps
- Operates from a wide variety of compatible controls from the leading manufacturers. Contact Customer Service or Technical Service for updated listings. Or, contact your preferred control supplier
- Designed for easy installation in new construction and retrofit energy management applications
- Programmed rapid start design optimizes lamp life and dimming performance. Integrated Circuit-based control technology monitors lamp and ballast conditions to ensure optimum lighting system performance

Features and Benefits

Feature	Benefit
100-5% controllable light output	Gives the user the full control over the lighting and energy use of his local space or entire building
Operates from compatible 0-10VDC controllers	A wide variety of controls are readily available to meet all of your energy management needs
Lamp ignition at any light output setting	Ballast does not have to ramp up to full light output and then dim. Will start at the 5% dim level. Increases the comfort level of the occupants, and increases user acceptance
Energy efficient	Similar efficiency compared to non-dimming electronic rapid start ballasts, plus the added benefit of reduced energy consumption at reduced light levels
Can be connected to building management systems	Gain full control over energy use by time of day, or based on utility real-time pricing signals
Operates above 42Khz	Reduces potential interference with infrared remote control systems by not operating in the 30-42Khz band where IR controls typically operate

ADVANCE™
TRANSFORMER CO.
A DIVISION OF PHILIPS ELECTRONICS NORTH AMERICA CORPORATION

New Mark VII™ Controllable Electronic Ballast

for 1, 2, and 3 Rapid Start F32T8 and F25T8 Fluorescent Lamps

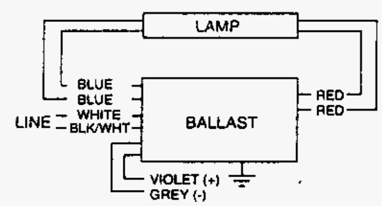
New Mark VII Ballast Specifications

1. Ballast shall be controlled via a Class 1 or Class 2 low voltage 0-10VDC circuit.
2. Ballast shall operate from a nominal line voltage of (120, 277) volts, 50/60 Hz. 120V ballast shall operate at constant light output from 100V-145V. 277V ballast shall operate at constant light output from 200V-305V.
3. **Ballast shall control lamp light output from a ballast factor of .88 -.05 (100% to 5% of relative full light output).**
4. Ballast shall operate 1, 2, and 3 F32T8 and F25T8 fluorescent rapid start lamps.
5. **Ballast ANSI input wattage must be listed clearly in the catalog, and be 33, 64, and 93 watts or less for 1, 2, and 3 F32T8 lamp operation.**
6. Maximum ballast case temperature for full warranty rating shall be 70°C.
7. Ballast shall meet ANSI C62.41 Category A transient voltage protection requirements.
8. Ballast shall be programmed rapid start (Advance soft start).
9. **Ballast Power Factor shall be >98% at full light output, and >90% throughout the control range.**
10. Ballast THD shall be <10% at maximum light output, and total harmonic current at minimum light output shall not exceed full light output levels.
11. Ballast shall meet FCC Class A (non-consumer) specifications for EMI/RFI.
12. Ballast shall start the lamp at a minimum temperature of 50°F.
13. Ballast shall have a lamp current crest factor <1.6 throughout the dimming range.
14. **Ballast shall ignite the lamps at any light output setting selected without first having to go to full light output.**
15. Ballast shall be sound rated A.
16. Ballast shall be UL Listed Class P and CSA Approved.
17. Ballast must contain potting to secure PC board, provide lead strain relief, provide a moisture barrier, and to improve thermal transmission.
18. Ballast shall contain no PCBs.
19. Ballast shall be controlled by a Mark VII compatible dimmer.
20. **Ballast output to the lamps shall be above 42Khz to minimize interference with infrared control systems.**
21. **Manufacturer of controllable ballast must have a 5 year history of producing 0-10VDC controllable ballasts. Ballast shall be the New Mark VII from Advance, catalog #______________, no equal.**

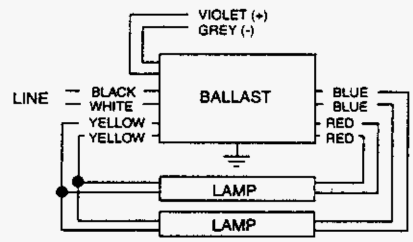
Applications

- Building-wide in almost every lighting application
- With occupancy detectors
- With daylight sensors
- With manual controls
- With energy management systems
- In place of non-dimming magnetic and electronic ballasts
- New construction and retrofit installation

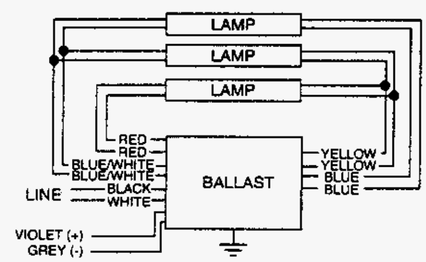
SINGLE LAMP BALLAST



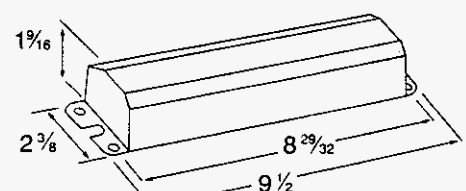
2-LAMP BALLAST



3-LAMP BALLAST



NOTE: Control circuit is Class 1 and Class 2 listed. Typical circuit is 10VDC .0005 amps.



NOTE: 1. One and two lamp ballasts may be remote mounted up to eight feet away from the lamp(s). Three lamp ballasts may not be remote mounted.
2. Burn-in new lamps 100 hours at full light output before dimming.
3. 1⅝" and 6" U-bend lamps also acceptable.
4. Lamps must be mounted within ¾" of a ground plane.

Ballast Selection Guide

Catalog Number	Volts	Number Lamps and Type	ANSI Wattage Range Max.-Min.	Ballast Factor Range	Ballast Power Factor	Ballast THD (Full Light Output)
RZT-132	120	(1) F32T8 (1) F25T8	33-9 25-8	.88-.05 .94-.05	>.98 >.98	<10% <10%
RZT-2S32	120	(2) F32T8 (2) F25T8	64-14 49-13	.88-.05 .94-.05	>.98 >.98	<10% <10%
RZT-3S32	120	(3) F32T8 (3) F25T8	93-18 76-16	.88-.05 .94-.05	>.98 >.98	<10% <10%
VZT-132	277	(1) F32T8 (1) F25T8	33-9 25-8	.88-.05 .94-.05	>.98 >.98	<10% <10%
VZT-2S32	277	(2) F32T8 (2) F25T8	64-14 49-13	.88-.05 .94-.05	>.98 >.98	<10% <10%
VZT-3S32	277	(3) F32T8 (3) F25T8	93-18 76-16	.88-.05 .94-.05	>.98 >.98	<10% <10%

Specifications subject to change without notice.

Form No. 1934--8/96

ADVANCE TRANSFORMER CO.

O'HARE INTERNATIONAL CENTER
10275 WEST HIGGINS ROAD
ROSEMONT, ILLINOIS 60018
TELEPHONE: 847/390-5000
FAX: 847/390-5109

Cost-Effectiveness Analysis

INPUT DATA – PART 1 CONTINUED
PROGRAM METHOD SELECTED: REV_REQ
PROGRAM NAME: Daylight Dimming - GS Rate Class

I. PROGRAM DEMAND SAVINGS & LINE LOSSES

(1) CUSTOMER kW REDUCTION AT METER	0.87	kW
(2) GENERATOR kW REDUCTION PER CUSTOMER	1.12	kW
(3) kW LINE LOSS PERCENTAGE	9.01	%
(4) GENERATOR kWh REDUCTION PER CUSTOMER	16.1	kWh
(5) kWh LINE LOSS PERCENTAGE	7.02	%
(6) GROUP LINE LOSS MULTIPLIER	1.0000	
(7) CUSTOMER kWh INCREASE AT METER	0.0	kWh

II. ECONOMIC LIFE & K FACTORS

(1) STUDY PERIOD FOR THE CONSERVATION PROGRAM	27	YEARS
(2) GENERATOR ECONOMIC LIFE	30	YEARS
(3) T&D ECONOMIC LIFE	35	YEARS
(4) K FACTOR FOR GENERATION	1.61524	
(5) K FACTOR FOR T & D	1.46985	

III. UTILITY & CUSTOMER COSTS

	(1) UTILITY NON RECURRING COST PER CUSTOMER	***	$/CUST
	(2) UTILITY RECURRING COST PER CUSTOMER	***	$/CUST
	(3) UTILITY COST ESCALATION RATE	***	%**
	(4) CUSTOMER EQUIPMENT COST	***	$/CUST
	(5) CUSTOMER EQUIPMENT ESCALATION RATE	***	%**
	(6) CUSTOMER O & M COST	***	$/CUST/YR
	(7) CUSTOMER O & M COST ESCALATION RATE	***	%**
*	(8) INCREASED SUPPLY COSTS	***	$/CUST/YR
*	(9) SUPPLY COSTS ESCALATION RATES	***	%**
*	(10) UTILITY DISCOUNT RATE	8.98	%
*	(11) UTILITY AFUDC RATE	10.30	%
*	(12) UTILITY NON RECURRING REBATE/INCENTIVE	***	$/CUST
*	(13) UTILITY RECURRING REBATE/INCENTIVE	***	$/CUST
*	(14) UTILITY REBATE/INCENTIVE ESCALATION RATE	***	%

* SUPPLEMENTAL INFORMATION NOT SPECIFIED IN WORKBOOK
** VALUE SHOWN IS FOR FIRST YEAR ONLY (VALUE VARIES OVER TIME)
*** PROGRAM COST CALCULATION VALUES ARE SHOWN ON PAGE 2

IV. AVOIDED GENERATOR AND T&D COSTS

(1) BASE YEAR	1998	
(2) IN-SERVICE YEAR FOR AVOIDED GENERATING UNIT	2005	
(3) IN-SERVICE YEAR FOR AVOIDED T&D	2001-2005	
(4) BASE YEAR AVOIDED GENERATING COST	519	$/kW
(5) BASE YEAR AVOIDED TRANSMISSION COST	70	$/kW
(6) BASE YEAR DISTRIBUTION COST	50	$/kW
(7) GEN, TRAN & DIST COST ESCALATION RATE	1.78	%**
(8) GENERATOR FIXED O & M COST	35	$/kW/YR
(9) GENERATOR FIXED O&M ESCALATION RATE	4.10	%**
(10) TRANSMISSION FIXED O & M COST	2.73	$/kW
(11) DISTRIBUTION FIXED O & M COST	13.01	$/kW
(12) T&D FIXED O&M ESCALATION RATE	4.10	%**
(13) AVOIDED GEN UNIT VARIABLE O & M COSTS	0.067	CENTS/kWh
(14) GENERATOR VARIABLE O&M COST ESCALATION RATE	2.70	%**
(15) GENERATOR CAPACITY FACTOR	91%	** (In-service year)
(16) AVOIDED GENERATING UNIT FUEL COST	2.17	CENTS PER kWh** (In-service y
(17) AVOIDED GEN UNIT FUEL COST ESCALATION RATE	1.75	%**

V. NON-FUEL ENERGY AND DEMAND CHARGES

(1) NON FUEL COST IN CUSTOMER BILL	***	CENTS/kWh
(2) NON-FUEL COST ESCALATION RATE	***	%
(3) DEMAND CHARGE IN CUSTOMER BILL	***	$/kW/MO
(4) DEMAND CHARGE ESCALATION RATE	***	%

* INPUT DATA -- PART 1 CONTINUED
PROGRAM METHOD SELECTED: REV_REQ
PROGRAM NAME: Daylight Dimming - GS Rate Class

YEAR	(1) UTILITY PROGRAM COSTS WITHOUT INCENTIVES $(000)	(2) UTILITY INCENTIVES $(000)	(3) OTHER UTILITY COSTS $(000)	(4) TOTAL UTILITY PROGRAM COSTS $(000)	(5) ENERGY CHARGE REVENUE LOSSES $(000)	(6) DEMAND CHARGE REVENUE LOSSES $(000)	(7) PARTICIPANT EQUIPMENT COSTS $(000)	(8) PARTICIPANT O&M COSTS $(000)	(9) OTHER PARTICIPANT COSTS $(000)	(10) TOTAL PARTICIPANT COSTS $(000)
1998	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0
2001	0	12,100	0	12,100	1	0	11,529	0	0	11,529
2002	0	12,100	0	12,100	2	0	11,829	0	0	11,829
2003	0	12,100	0	12,100	3	0	12,148	0	0	12,148
2004	0	12,100	0	12,100	4	0	12,464	0	0	12,464
2005	0	0	0	0	5	0	0	0	0	0
2006	0	0	0	0	5	0	0	0	0	0
2007	0	0	0	0	5	0	0	0	0	0
2008	0	0	0	0	5	0	0	0	0	0
2009	0	0	0	0	5	0	0	0	0	0
2010	0	0	0	0	5	0	0	0	0	0
2011	0	0	0	0	5	0	0	0	0	0
2012	0	0	0	0	5	0	0	0	0	0
2013	0	0	0	0	5	0	0	0	0	0
2014	0	0	0	0	5	0	0	0	0	0
2015	0	0	0	0	5	0	0	0	0	0
2016	0	0	0	0	5	0	0	0	0	0
2017	0	0	0	0	5	0	0	0	0	0
2018	0	0	0	0	5	0	0	0	0	0
2019	0	0	0	0	5	0	0	0	0	0
2020	0	0	0	0	5	0	0	0	0	0
2021	0	0	0	0	5	0	0	0	0	0
2022	0	0	0	0	5	0	0	0	0	0
2023	0	0	0	0	5	0	0	0	0	0
2024	0	0	0	0	5	0	0	0	0	0
NOM	0	48,400	0	48,400	105	0	47,971	0	0	47,971
NPV	0	33,027	0	33,027	32	0	32,642	0	0	32,642

* SUPPLEMENTAL INFORMATION NOT SPECIFIED IN WORKBOOK
** NEGATIVE COSTS WILL BE CALCULATED AS POSITIVE BENEFITS FOR TRC AND RIM TESTS

CALCULATION OF GEN K-FACTOR
PROGRAM METHOD SELECTED REV_REQ
PROGRAM NAME: Daylight Dimming - GS Rate Class

	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
YEAR	MID-YEAR RATE BASE $(000)	DEBT $(000)	PREFERRED STOCK $(000)	COMMON EQUITY $(000)	INCOME TAXES $(000)	OTHER TAXES & INSURANCE $(000)	DEPREC. $(000)	DEFERRED TAXES $(000)	TOTAL FIXED CHARGES $(000)	PRESENT WORTH FIXED CHARGES $(000)	CUMULATIVE PW FIXED CHARGES $(000)
2005	2,922	100	0	201	125	41	98	6	570	570	570
2006	2,800	96	0	192	81	41	98	44	552	507	1,077
2007	2,661	91	0	183	81	41	98	38	532	448	1,525
2008	2,528	86	0	174	81	41	98	33	512	396	1,920
2009	2,400	82	0	165	80	41	98	28	494	350	2,271
2010	2,278	78	0	157	80	41	98	23	476	310	2,580
2011	2,159	74	0	148	79	41	98	19	459	274	2,854
2012	2,045	70	0	141	78	41	98	15	442	242	3,096
2013	1,933	66	0	133	74	41	98	14	425	214	3,310
2014	1,822	62	0	125	69	41	98	14	409	189	3,499
2015	1,710	58	0	118	64	41	98	14	393	166	3,665
2016	1,599	55	0	110	60	41	98	14	377	146	3,811
2017	1,487	51	0	102	55	41	98	14	360	128	3,940
2018	1,376	47	0	95	50	41	98	14	344	113	4,052
2019	1,264	43	0	87	45	41	98	14	328	98	4,151
2020	1,153	39	0	79	40	41	98	14	311	86	4,236
2021	1,041	36	0	72	36	41	98	14	295	75	4,311
2022	930	32	0	64	31	41	98	14	279	65	4,376
2023	818	28	0	56	26	41	98	14	263	56	4,432
2024	707	24	0	49	21	41	98	14	246	48	4,480
2025	608	21	0	42	41	41	98	(10)	232	42	4,521
2026	533	18	0	37	62	41	98	(35)	221	36	4,558
2027	470	16	0	32	60	41	98	(35)	212	32	4,590
2028	407	14	0	28	57	41	98	(35)	203	28	4,618
2029	345	12	0	24	54	41	98	(35)	193	25	4,642
2030	282	10	0	19	52	41	98	(35)	184	21	4,664
2031	219	8	0	15	49	41	98	(35)	175	19	4,682
2032	157	5	0	11	46	41	98	(35)	166	16	4,699
2033	94	3	0	6	43	41	98	(35)	157	14	4,713
2034	31	1	0	2	41	41	98	(35)	148	12	4,725

IN SERVICE COS ($000)	2,925
IN SERVICE YEAR	2005
BOOK LIFE (YRS)	30
EFFEC. TAX RATE	38.575
DISCOUNT RATE	8.98%
OTAX & INS RATE	1.40%

CAPITAL STRUCTURE

SOURCE	WEIGHT	COST	
DEBT	45%	7.60	%
P/S	0%	0.00	%
C/S	55%	12.50	%

K-FACTOR = CPWFC / IN-SVC COST = 1.61524

DEFERRED TAX AND MID-YEAR RATE BASE CALCULATION
PROGRAM METHOD SELECTED: REV_REQ
PROGRAM NAI Daylight Dimming - GS Rate Cl

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
YEAR	TAX DEPRECIATION SCHEDULE	TAX DEPRECIATION $(000)	ACCUMULATED TAX DEPRECIATION $(000)	BOOK DEPRECIATION $(000)	ACCUMULATED BOOK DEPRECIATION $(000)	BOOK DEPRECIATION FOR DEFERRED TAX $(000)	ACCUMULATED BOOK DEPR FOR DEFERRED TAX $(000)	DEFERRED TAX DUE TO DEPRECIATION $(000)	TOTAL EQUITY AFUDC $(000)	BOOK DEPR RATE MINUS 1/LIFE	(10)*(11) TAX RATE $(000)	SALVAGE TAX RATE $(000)	ANNUAL DEFERRED TAX (9)-(12)+(13) $(000)	ACCUMULATED DEFERRED TAX $(000)
2005	3.75%	106	106	98	98	90	90	6	216	0	0	0	6	(43)
2006	7.22%	205	311	98	195	90	181	44	216	0	0	0	44	1
2007	6.68%	189	500	98	293	90	271	38	216	0	0	0	38	39
2008	6.18%	175	676	98	390	90	361	33	216	0	0	0	33	72
2009	5.71%	162	838	98	488	90	451	28	216	0	0	0	28	100
2010	5.29%	150	988	98	585	90	542	23	216	0	0	0	23	123
2011	4.89%	139	1,126	98	683	90	632	19	216	0	0	0	19	142
2012	4.52%	128	1,254	98	780	90	722	15	216	0	0	0	15	156
2013	4.46%	127	1,381	98	878	90	813	14	216	0	0	0	14	170
2014	4.46%	127	1,508	98	975	90	903	14	216	0	0	0	14	184
2015	4.46%	127	1,634	98	1,073	90	993	14	216	0	0	0	14	198
2016	4.46%	127	1,761	98	1,170	90	1,084	14	216	0	0	0	14	212
2017	4.46%	127	1,887	98	1,268	90	1,174	14	216	0	0	0	14	226
2018	4.46%	127	2,014	98	1,365	90	1,264	14	216	0	0	0	14	240
2019	4.46%	127	2,140	98	1,463	90	1,354	14	216	0	0	0	14	254
2020	4.46%	127	2,267	98	1,560	90	1,445	14	216	0	0	0	14	268
2021	4.46%	127	2,393	98	1,658	90	1,535	14	216	0	0	0	14	282
2022	4.46%	127	2,520	98	1,755	90	1,625	14	216	0	0	0	14	296
2023	4.46%	127	2,646	98	1,853	90	1,716	14	216	0	0	0	14	310
2024	4.46%	127	2,773	98	1,950	90	1,806	14	216	0	0	0	14	324
2025	2.23%	63	2,836	98	2,048	90	1,896	(10)	216	0	0	0	(10)	314
2026	0.00%	0	2,836	98	2,145	90	1,986	(35)	216	0	0	0	(35)	279
2027	0.00%	0	2,836	98	2,243	90	2,077	(35)	216	0	0	0	(35)	244
2028	0.00%	0	2,836	98	2,340	90	2,167	(35)	216	0	0	0	(35)	209
2029	0.00%	0	2,836	98	2,438	90	2,257	(35)	216	0	0	0	(35)	174
2030	0.00%	0	2,836	98	2,535	90	2,348	(35)	216	0	0	0	(35)	139
2031	0.00%	0	2,836	98	2,633	90	2,438	(35)	216	0	0	0	(35)	105
2032	0.00%	0	2,836	98	2,730	90	2,528	(35)	216	0	0	0	(35)	70
2033	0.00%	0	2,836	98	2,828	90	2,619	(35)	216	0	0	0	(35)	35
2034	0.00%	0	2,836	98	2,925	90	2,709	(35)	216	0	0	0	(35)	0

SALVAGE / REMOVAL COST	0.00
YEAR SALVAGE / COST OF REMOVAL	2029
DEFERRED TAXES DURING CONSTRUCTION (SEE PAGE 5)	(49)
TOTAL EQUITY AFUDC CAPITALIZED (SEE PAGE 5)	216
BOOK DEPR RATE - 1/USEFUL LIFE	3.33%

DEFERRED TAX AND MID-YEAR RATE BASE CALCULATION
PROGRAM METHOD SELECTED: REV_REQ
PROGRAM NA! Daylight Dimming - GS Rate Class

(1)	(2)	(3)	(4)	(5)	(5a)*	(5b)*	(6)	(7)	(8)
YEAR	TAX DEPRECIATION SCHEDULE	TAX DEPRECIATION $(000)	DEFERRED TAX $(000)	END OF YEAR NET PLANT IN SERVICE $(000)	ACCUMULATED DEPRECIATION $(000)	ACCUMULATED DEF TAXES $(000)	BEGINNING YEAR RATE BASE $(000)	ENDING OF YEAR RATE BASE $(000)	MID-YEAR RATE BASE $(000)
2005	3.75%	106	6	2,828	98	(43)	2,974	2,871	2,922
2006	7.22%	205	44	2,730	195	1	2,871	2,729	2,800
2007	6.68%	189	38	2,633	293	39	2,729	2,593	2,661
2008	6.18%	175	33	2,535	390	72	2,593	2,463	2,528
2009	5.71%	162	28	2,438	488	100	2,463	2,338	2,400
2010	5.29%	150	23	2,340	585	123	2,338	2,217	2,278
2011	4.89%	139	19	2,243	683	142	2,217	2,101	2,159
2012	4.52%	128	15	2,145	780	156	2,101	1,989	2,045
2013	4.46%	127	14	2,048	878	170	1,989	1,877	1,933
2014	4.46%	127	14	1,950	975	184	1,877	1,766	1,822
2015	4.46%	127	14	1,853	1,073	198	1,766	1,654	1,710
2016	4.46%	127	14	1,755	1,170	212	1,654	1,543	1,599
2017	4.46%	127	14	1,658	1,268	226	1,543	1,432	1,487
2018	4.46%	127	14	1,560	1,365	240	1,432	1,320	1,376
2019	4.46%	127	14	1,463	1,463	254	1,320	1,209	1,264
2020	4.46%	127	14	1,365	1,560	268	1,209	1,097	1,153
2021	4.46%	127	14	1,268	1,658	282	1,097	986	1,041
2022	4.46%	127	14	1,170	1,755	296	986	874	930
2023	4.46%	127	14	1,073	1,853	310	874	763	818
2024	4.46%	127	14	975	1,950	324	763	651	707
2025	2.23%	63	(10)	878	2,048	314	651	564	608
2026	0.00%	0	(35)	780	2,145	279	564	501	533
2027	0.00%	0	(35)	683	2,243	244	501	439	470
2028	0.00%	0	(35)	585	2,340	209	439	376	407
2029	0.00%	0	(35)	488	2,438	174	376	313	345
2030	0.00%	0	(35)	390	2,535	139	313	251	282
2031	0.00%	0	(35)	293	2,633	105	251	188	219
2032	0.00%	0	(35)	195	2,730	70	188	125	157
2033	0.00%	0	(35)	98	2,828	35	125	63	94
2034	0.00%	0	(35)	0	2,925	0	63	0	31

* Column not specified in workbook

(1) YEAR	(2) NO.YEARS BEFORE IN-SERVICE	(3) PLANT ESCALATION RATE	(4) CUMULATIVE ESCALATION FACTOR	(5) YEARLY EXPENDITURE (%)	(6) ANNUAL SPENDING ($/kW)	(7) CUMULATIVE AVERAGE SPENDING ($/kW)
1998	-7	0.00%	1.000	0.00%	0.00	0.00
1999	-6	1.78%	1.018	0.00%	0.00	0.00
2000	-5	1.53%	1.033	0.32%	1.72	0.86
2001	-4	2.64%	1.061	0.65%	3.58	3.51
2002	-3	2.62%	1.088	13.85%	78.24	44.42
2003	-2	2.28%	1.113	35.34%	204.20	185.63
2004	-1	2.27%	1.139	49.84%	294.50	434.98
				100.00%	582.24	

YEAR	NO.YEARS BEFORE IN-SERVICE	(8) CUMULATIVE SPENDING WITH AFUDC ($/kW)	(8a)* DEBT AFUDC ($/kW)	(8b)* CUMULATIVE DEBT AFUDC ($/kW)	(9) YEARLY TOTAL AFUDC ($/kW)	(9a)* CUMULATIVE TOTAL AFUDC ($/kW)	(9b)* CONSTRUCTION PERIOD INTEREST ($/kW)	(9c)* CUMULATIVE CPI ($/kW)	(9d)* DEFERRED TAXES ($/kW)	(9e)* CUMULATIVE DEFERRED TAXES ($/kW)	(10) INCREMENTAL YEAR-END BOOK VALUE ($/kW)	(11) CUMULATIVE YEAR-END BOOK VALUE ($/kW)
1998	-7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1999	-6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2000	-5	0.86	0.03	0.03	0.09	0.09	0.07	0.07	(0.01)	(0.01)	1.80	1.80
2001	-4	3.59	0.12	0.15	0.37	0.46	0.27	0.34	(0.06)	(0.07)	3.95	5.75
2002	-3	44.88	1.54	1.69	4.63	5.09	3.40	3.74	(0.72)	(0.79)	82.87	88.62
2003	-2	190.72	6.55	8.24	19.72	24.80	14.39	18.13	(3.03)	(3.82)	223.91	312.54
2004	-1	459.79	15.86	24.09	47.73	72.53	34.44	52.57	(7.17)	(10.98)	342.23	654.77
			24.09		72.53		52.57		(10.98)		654.77	

IN SERVICE YEAR	2005
PLANT COSTS	519
AFUDC RATE	10.30%

	BOOK BASIS	BOOK BASIS FOR DEF TAX	TAX BASIS
CONSTRUCTION CASH	2,601	2,601	2,601
EQUITY AFUDC	216		
DEBT AFUDC	108	108	
CPI			235
TOTAL	2,925	2,709	2,836

* Column not specified in workbook

INPUT DATA -- PART 2
PROGRAM METHOD SELECTED : REV_REQ
PROGRAM NAMI Daylight Dimming - GS Rate Class

(1) YEAR	(2) CUMULATIVE TOTAL PARTICIPATING CUSTOMERS	(3) ADJUSTED CUMULATIVE PARTICIPATING CUSTOMERS	(4) UTILITY AVERAGE SYSTEM FUEL COST (C/kWh)	(5) AVOIDED MARGINAL FUEL COST (C/kWh)	(6)* INCREASED MARGINAL FUEL COST (C/kWh)	(7) REPLACEMENT FUEL COST (C/kWh)	(8) PROGRAM kW EFFECTIVENESS FACTOR	(9) PROGRAM kWh EFFECTIVENESS FACTOR
1998	0	0	2.00	4.01	2.00	0.00	1.00	1.00
1999	0	0	2.23	3.92	2.23	0.00	1.00	1.00
2000	0	0	2.45	4.75	2.45	0.00	1.00	1.00
2001	1,000	1,000	2.73	5.52	2.73	0.00	1.00	1.00
2002	2,000	2,000	2.61	3.63	2.61	0.00	1.00	1.00
2003	3,000	3,000	2.60	3.97	2.60	0.00	1.00	1.00
2004	4,000	4,000	2.78	4.48	2.78	0.00	1.00	1.00
2005	4,000	4,000	2.93	5.33	2.93	3.25	1.00	1.00
2006	4,000	4,000	3.01	5.42	3.01	3.34	1.00	1.00
2007	4,000	4,000	3.13	6.29	3.13	3.49	1.00	1.00
2008	4,000	4,000	3.07	5.47	3.07	3.45	1.00	1.00
2009	4,000	4,000	3.15	5.57	3.15	3.60	1.00	1.00
2010	4,000	4,000	3.14	6.05	3.14	3.57	1.00	1.00
2011	4,000	4,000	3.32	6.31	3.32	3.71	1.00	1.00
2012	4,000	4,000	3.38	6.42	3.38	3.77	1.00	1.00
2013	4,000	4,000	3.47	6.48	3.47	3.84	1.00	1.00
2014	4,000	4,000	3.55	6.62	3.55	3.92	1.00	1.00
2015	4,000	4,000	3.58	6.63	3.58	3.95	1.00	1.00
2016	4,000	4,000	3.62	6.58	3.62	4.00	1.00	1.00
2017	4,000	4,000	3.75	7.54	3.75	4.13	1.00	1.00
2018	4,000	4,000	3.93	8.80	3.93	4.35	1.00	1.00
2019	4,000	4,000	4.09	10.25	4.09	4.55	1.00	1.00
2020	4,000	4,000	4.23	10.47	4.23	4.79	1.00	1.00
2021	4,000	4,000	4.32	10.81	4.32	4.88	1.00	1.00
2022	4,000	4,000	4.41	11.31	4.41	4.97	1.00	1.00
2023	4,000	4,000	4.53	11.92	4.53	5.10	1.00	1.00
2024	4,000	4,000	4.64	12.54	4.64	5.23	1.00	1.00

* THIS COLUMN IS USED ONLY FOR LOAD SHIFTING PROGRAMS WHICH SHIFT CONSUMPTION TO OFF-PEAK PERIODS.
THE VALUES REPRESENT THE OFF PEAK SYSTEM FUEL COSTS.

AVOIDED GENERATING BENEFITS
PROGRAM METHOD SELECTED: REV_REQ
PROGRAM NAMI Daylight Dimming - GS Rate Class

YEAR	(2) AVOIDED GEN UNIT CAPACITY COS $(000)	(3) AVOIDED GEN UNIT FIXED O&M $(000)	(4) AVOIDED GEN UNIT VARIABLE O&N $(000)	(5) AVOIDED GEN UNIT FUEL COST $(000)	(6) REPLACEMEN FUEL COST $(000)	(7) AVOIDED GEN UNIT BENEFITS $(000)
1998	0	0	0	0	0	0
1999	0	0	0	0	0	0
2000	0	0	0	0	0	0
2001	0	0	0	0	0	0
2002	0	0	0	0	0	0
2003	0	0	0	0	0	0
2004	0	0	0	0	0	0
2005	570	205	29	771	1,156	418
2006	552	213	30	808	1,223	380
2007	532	221	32	832	1,296	321
2008	512	230	32	842	1,279	338
2009	494	239	33	843	1,319	290
2010	476	249	33	821	1,260	319
2011	459	259	34	833	1,310	273
2012	442	269	35	857	1,331	272
2013	425	280	35	883	1,342	282
2014	409	291	36	909	1,357	288
2015	393	303	37	925	1,365	292
2016	377	315	38	941	1,369	300
2017	360	327	39	969	1,420	276
2018	344	341	40	999	1,500	223
2019	328	354	42	1,034	1,586	172
2020	311	368	43	1,065	1,670	118
2021	295	383	44	1,089	1,700	111
2022	279	398	45	1,114	1,733	104
2023	263	414	47	1,257	1,775	206
2024	246	431	48	1,257	1,821	161
NOM	8,067	6,091	750	19,050	28,813	5,145
NPV	2,454	1,490	191	4,880	7,415	1,601

AVOIDED T&D AND PROGRAM FUEL SAVINGS
PROGRAM METHOD SELECTED: REV_REQ
PROGRAM NAME Daylight Dimming - GS Rate Class

(1) YEAR	(2) AVOIDED TRANSMISSION CAP COST $(000)	(3) AVOIDED TRANSMISSION O&M COST $(000)	(4) TOTAL AVOIDED TRANSMISSION COST $(000)	(5) AVOIDED DISTRIBUTION CAP COST $(000)	(6) AVOIDED DISTRIBUTION O&M COST $(000)	(7) TOTAL AVOIDED DISTRIBUTION COST $(000)	(8) PROGRAM FUEL SAVINGS $(000)	(8a)* PROGRAM OFF-PEAK PAYBACK $(000)
1998	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	1	0
2002	15	4	19	10	16	25	1	0
2003	30	7	37	19	32	52	2	0
2004	44	12	56	29	50	79	3	0
2005	59	16	75	38	70	108	4	0
2006	56	17	73	37	73	109	4	0
2007	54	17	72	35	75	111	5	0
2008	52	18	70	34	79	112	4	0
2009	50	19	69	33	82	114	4	0
2010	48	20	68	31	85	116	5	0
2011	46	20	67	30	88	118	5	0
2012	45	21	66	29	92	121	5	0
2013	43	22	65	28	96	123	5	0
2014	41	23	64	27	99	126	5	0
2015	39	24	63	25	103	129	5	0
2016	37	25	62	24	107	132	5	0
2017	35	26	61	23	112	135	6	0
2018	34	27	60	22	116	138	7	0
2019	32	28	60	21	121	142	8	0
2020	30	29	59	20	126	145	8	0
2021	28	30	58	18	131	149	8	0
2022	26	31	58	17	136	153	9	0
2023	25	33	57	16	141	158	9	0
2024	23	34	57	15	147	162	10	0
NOM.	893	502	1,395	581	2,177	2,757	126	0
NPV	304	132	435	197	571	768	32	0

* THESE VALUES REPRESENT THE COST OF THE INCREASED FUEL CONSUMPTION DUE TO GREATER OFF-PEAK ENERGY USAGE. USED FOR LOAD SHIFTING PROGRAMS ONLY.

TOTAL RESOURCE COST TEST
PROGRAM METHOD SELECTED: REV_REQ
PROGRAM NAMI Daylight Dimming - GS Rate Class

(1) YEAR	(2) INCREASED SUPPLY COSTS $(000)	(3) UTILITY PROGRAM COSTS $(000)	(4) PARTICIPANT PROGRAM COSTS $(000)	(5) OTHER COSTS $(000)	(6) TOTAL COSTS $(000)	(7) AVOIDED GEN UNIT BENEFITS $(000)	(8) AVOIDED T&D BENEFITS $(000)	(9) PROGRAM FUEL SAVINGS $(000)	(10) OTHER BENEFITS $(000)	(11) TOTAL BENEFITS $(000)	(12) NET BENEFITS $(000)	(13) CUMULATIVE DISCOUNTED NET BENEFITS $(000)
1998	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	11,529	0	11,529	0	0	1	0	1	(11,529)	(8,908)
2002	0	0	11,829	0	11,829	0	44	1	0	45	(11,784)	(17,264)
2003	0	0	12,148	0	12,148	0	89	2	0	91	(12,058)	(25,109)
2004	0	0	12,464	0	12,464	0	135	3	0	138	(12,326)	(32,469)
2005	0	0	0	0	0	418	182	4	0	605	605	(32,138)
2006	0	0	0	0	0	380	182	4	0	566	566	(31,853)
2007	0	0	0	0	0	321	182	5	0	508	508	(31,619)
2008	0	0	0	0	0	338	183	4	0	525	525	(31,396)
2009	0	0	0	0	0	290	183	4	0	478	478	(31,211)
2010	0	0	0	0	0	319	184	5	0	507	507	(31,030)
2011	0	0	0	0	0	273	185	5	0	463	463	(30,878)
2012	0	0	0	0	0	272	187	5	0	463	463	(30,739)
2013	0	0	0	0	0	282	188	5	0	474	474	(30,609)
2014	0	0	0	0	0	288	190	5	0	483	483	(30,486)
2015	0	0	0	0	0	292	192	5	0	489	489	(30,373)
2016	0	0	0	0	0	300	194	5	0	499	499	(30,267)
2017	0	0	0	0	0	276	196	6	0	477	477	(30,174)
2018	0	0	0	0	0	223	199	7	0	429	429	(30,097)
2019	0	0	0	0	0	172	201	8	0	381	381	(30,034)
2020	0	0	0	0	0	118	204	8	0	330	330	(29,984)
2021	0	0	0	0	0	111	207	8	0	326	326	(29,939)
2022	0	0	0	0	0	104	211	9	0	324	324	(29,898)
2023	0	0	0	0	0	206	215	9	0	430	430	(29,848)
2024	0	0	0	0	0	161	220	10	0	391	391	(29,806)
NOM	0	0	47,971	0	47,971	5,145	4,153	126	0	9,424	(38,547)	
NPV	0	0	32,642	0	32,642	1,601	1,203	32	0	2,837	(29,806)	

Discount Rate: 8.96 %

Benefit/Cost Ratio (Col(11) / Col(6)) : 0.09

PARTICIPANT COSTS AND BENEFITS
PROGRAM METHOD SELECTED: REV_REQ
PROGRAM NAME Daylight Dimming - GS Rate Class

(1) YEAR	(2) SAVINGS IN PARTICIPANTS BILLS $(000)	(3) TAX CREDITS $(000)	(4) UTILITY REBATES $(000)	(5) OTHER BENEFITS $(000)	(6) TOTAL BENEFITS $(000)	(7) CUSTOMER EQUIPMENT COSTS $(000)	(8) CUSTOMER O&M COSTS $(000)	(9) OTHER COSTS $(000)	(10) TOTAL COSTS $(000)	(11) NET BENEFITS $(000)	(12) CUMULATIVE DISCOUNTED NET BENEFITS $(000)
1998	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0
2001	1	0	12,100	0	12,101	11,529	0	0	11,529	572	442
2002	2	0	12,100	0	12,102	11,829	0	0	11,829	273	635
2003	4	0	12,100	0	12,104	12,148	0	0	12,148	(45)	606
2004	5	0	12,100	0	12,105	12,464	0	0	12,464	(359)	392
2005	6	0	0	0	6	0	0	0	0	6	395
2006	6	0	0	0	6	0	0	0	0	6	398
2007	6	0	0	0	6	0	0	0	0	6	401
2008	6	0	0	0	6	0	0	0	0	6	404
2009	6	0	0	0	6	0	0	0	0	6	406
2010	6	0	0	0	6	0	0	0	0	6	409
2011	6	0	0	0	6	0	0	0	0	6	411
2012	6	0	0	0	6	0	0	0	0	6	413
2013	6	0	0	0	6	0	0	0	0	6	414
2014	7	0	0	0	7	0	0	0	0	7	416
2015	7	0	0	0	7	0	0	0	0	7	418
2016	7	0	0	0	7	0	0	0	0	7	419
2017	7	0	0	0	7	0	0	0	0	7	420
2018	7	0	0	0	7	0	0	0	0	7	421
2019	7	0	0	0	7	0	0	0	0	7	423
2020	7	0	0	0	7	0	0	0	0	7	424
2021	7	0	0	0	7	0	0	0	0	7	425
2022	7	0	0	0	7	0	0	0	0	7	425
2023	7	0	0	0	7	0	0	0	0	7	426
2024	7	0	0	0	7	0	0	0	0	7	427
NOM	143	0	48,400	0	48,543	47,971	0	0	47,971	572	
NPV	43	0	33,027	0	33,069	32,642	0	0	32,642	427	

In Service of Gen Unit: 2005
Discount Rate : 8.98 %
Benefit/Cost Ratio (Col(6) / Col(10)) 1.01

RATE IMPACT TEST
PROGRAM METHOD SELECTED: REV_REQ
PROGRAM NAMI Daylight Dimming - GS Rate Class

(1) YEAR	(2) INCREASED SUPPLY COSTS $(000)	(3) UTILITY PROGRAM COSTS $(000)	(4) INCENTIVES $(000)	(5) REVENUE LOSSES $(000)	(6) OTHER COSTS $(000)	(7) TOTAL COSTS $(000)	(8) AVOIDED GEN UNIT & FUEL BENEFITS $(000)	(9) AVOIDED T&D BENEFITS $(000)	(10) REVENUE GAINS $(000)	(11) OTHER BENEFITS $(000)	(12) TOTAL BENEFITS $(000)	(13) NET BENEFITS $(000)	(14) CUMULATIVE DISCOUNTED NET BENEFITS $(000)
1998	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	12,100	1	0	12,101	1	0	0	0	1	(12,100)	(9,350)
2002	0	0	12,100	2	0	12,102	1	44	0	0	45	(12,057)	(17,899)
2003	0	0	12,100	3	0	12,103	2	89	0	0	91	(12,012)	(25,714)
2004	0	0	12,100	4	0	12,104	3	135	0	0	138	(11,966)	(32,859)
2005	0	0	0	5	0	5	422	182	0	0	605	600	(32,530)
2006	0	0	0	5	0	5	384	182	0	0	566	562	(32,248)
2007	0	0	0	5	0	5	326	182	0	0	508	503	(32,015)
2008	0	0	0	5	0	5	342	183	0	0	525	520	(31,795)
2009	0	0	0	5	0	5	295	183	0	0	478	473	(31,611)
2010	0	0	0	5	0	5	323	184	0	0	507	503	(31,432)
2011	0	0	0	5	0	5	278	185	0	0	463	459	(31,282)
2012	0	0	0	5	0	5	276	187	0	0	463	458	(31,145)
2013	0	0	0	5	0	5	286	188	0	0	474	470	(31,015)
2014	0	0	0	5	0	5	293	190	0	0	483	478	(30,894)
2015	0	0	0	5	0	5	297	192	0	0	489	484	(30,782)
2016	0	0	0	5	0	5	305	194	0	0	499	494	(30,677)
2017	0	0	0	5	0	5	281	196	0	0	477	473	(30,585)
2018	0	0	0	5	0	5	230	199	0	0	429	424	(30,509)
2019	0	0	0	5	0	5	180	201	0	0	381	376	(30,447)
2020	0	0	0	5	0	5	126	204	0	0	330	325	(30,398)
2021	0	0	0	5	0	5	119	207	0	0	326	321	(30,353)
2022	0	0	0	5	0	5	113	211	0	0	324	318	(30,313)
2023	0	0	0	5	0	5	215	215	0	0	430	425	(30,263)
2024	0	0	0	5	0	5	171	220	0	0	391	386	(30,222)
NOM.	0	0	48,400	105	0	48,505	5,271	4,153	0	0	9,424	(39,082)	
NPV	0	0	33,027	32	0	33,058	1,633	1,203	0	0	2,837	(30,222)	

Discount Rate 8.98 %
Benefit/Cost Ratio (Col(12) / Col(7)) : 0.09

INPUT DATA -- PART 1 CONTINUED
PROGRAM METHOD SELECTED: REV_REQ
PROGRAM NAME: Daylight Dimming - GSD Rate Class

I.	PROGRAM DEMAND SAVINGS & LINE LOSSES		
	(1) CUSTOMER kW REDUCTION AT METER	0.87	kW
	(2) GENERATOR kW REDUCTION PER CUSTOMER	1.12	kW
	(3) kW LINE LOSS PERCENTAGE	9.01	%
	(4) GENERATOR kWh REDUCTION PER CUSTOMER	16.1	kWh
	(5) kWh LINE LOSS PERCENTAGE	7.02	%
	(6) GROUP LINE LOSS MULTIPLIER	1.0000	
	(7) CUSTOMER kWh INCREASE AT METER	0.0	kWh
II.	ECONOMIC LIFE & K FACTORS		
	(1) STUDY PERIOD FOR THE CONSERVATION PROGRAM	27	YEARS
	(2) GENERATOR ECONOMIC LIFE	30	YEARS
	(3) T&D ECONOMIC LIFE	35	YEARS
	(4) K FACTOR FOR GENERATION	1.61524	
	(5) K FACTOR FOR T & D	1.46985	
III.	UTILITY & CUSTOMER COSTS		
	(1) UTILITY NON RECURRING COST PER CUSTOMER	***	$/CUST
	(2) UTILITY RECURRING COST PER CUSTOMER	***	$/CUST
	(3) UTILITY COST ESCALATION RATE	***	%**
	(4) CUSTOMER EQUIPMENT COST	***	$/CUST
	(5) CUSTOMER EQUIPMENT ESCALATION RATE	***	%**
	(6) CUSTOMER O & M COST	***	$/CUST/YR
	(7) CUSTOMER O & M COST ESCALATION RATE	***	%**
*	(8) INCREASED SUPPLY COSTS	***	$/CUST/YR
*	(9) SUPPLY COSTS ESCALATION RATES	***	%**
*	(10) UTILITY DISCOUNT RATE	8.98	%
*	(11) UTILITY AFUDC RATE	10.30	%
*	(12) UTILITY NON RECURRING REBATE/INCENTIVE	***	$/CUST
*	(13) UTILITY RECURRING REBATE/INCENTIVE	***	$/CUST
*	(14) UTILITY REBATE/INCENTIVE ESCALATION RATE	***	%

* SUPPLEMENTAL INFORMATION NOT SPECIFIED IN WORKBOOK
** VALUE SHOWN IS FOR FIRST YEAR ONLY (VALUE VARIES OVER TIME)
*** PROGRAM COST CALCULATION VALUES ARE SHOWN ON PAGE 2

IV.	AVOIDED GENERATOR AND T&D COSTS		
	(1) BASE YEAR	1998	
	(2) IN-SERVICE YEAR FOR AVOIDED GENERATING UNIT	2005	
	(3) IN-SERVICE YEAR FOR AVOIDED T&D	2001-2005	
	(4) BASE YEAR AVOIDED GENERATING COST	519	$/kW
	(5) BASE YEAR AVOIDED TRANSMISSION COST	70	$/kW
	(6) BASE YEAR DISTRIBUTION COST	50	$/kW
	(7) GEN, TRAN & DIST COST ESCALATION RATE	1.78	%**
	(8) GENERATOR FIXED O & M COST	35	$/kW/YR
	(9) GENERATOR FIXED O&M ESCALATION RATE	4.10	%**
	(10) TRANSMISSION FIXED O & M COST	2.73	$/kW
	(11) DISTRIBUTION FIXED O & M COST	13.01	$/kW
	(12) T&D FIXED O&M ESCALATION RATE	4.10	%**
	(13) AVOIDED GEN UNIT VARIABLE O & M COSTS	0.067	CENTS/kWh
	(14) GENERATOR VARIABLE O&M COST ESCALATION RATE	2.70	%**
	(15) GENERATOR CAPACITY FACTOR	91%	** (In-service year)
	(16) AVOIDED GENERATING UNIT FUEL COST	2.17	CENTS PER kWh** (In-service y
	(17) AVOIDED GEN UNIT FUEL COST ESCALATION RATE	1.75	%**
V.	NON-FUEL ENERGY AND DEMAND CHARGES		
	(1) NON FUEL COST IN CUSTOMER BILL	***	CENTS/kWh
	(2) NON-FUEL COST ESCALATION RATE	***	%
	(3) DEMAND CHARGE IN CUSTOMER BILL	***	$/kW/MO
	(4) DEMAND CHARGE ESCALATION RATE	***	%

* INPUT DATA -- PART 1 CONTINUED
PROGRAM METHOD SELECTED: REV_REQ
PROGRAM NAME: Daylight Dimming - GSD Rate Class

YEAR	(1) UTILITY PROGRAM COSTS WITHOUT INCENTIVES $(000)	(2) UTILITY INCENTIVES $(000)	(3) OTHER UTILITY COSTS $(000)	(4) TOTAL UTILITY PROGRAM COSTS $(000)	(5) ENERGY CHARGE REVENUE LOSSES $(000)	(6) DEMAND CHARGE REVENUE LOSSES $(000)	(7) PARTICIPANT EQUIPMENT COSTS $(000)	(8) PARTICIPANT O&M COSTS $(000)	(9) OTHER PARTICIPANT COSTS $(000)	(10) TOTAL PARTICIPANT COSTS $(000)
1998	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0
2001	0	11,100	0	11,100	0	52	11,529	0	0	11,529
2002	0	11,100	0	11,100	1	155	11,829	0	0	11,829
2003	0	11,100	0	11,100	2	258	12,148	0	0	12,148
2004	0	11,100	0	11,100	2	360	12,464	0	0	12,464
2005	0	0	0	0	3	411	0	0	0	0
2006	0	0	0	0	3	403	0	0	0	0
2007	0	0	0	0	3	403	0	0	0	0
2008	0	0	0	0	3	403	0	0	0	0
2009	0	0	0	0	3	402	0	0	0	0
2010	0	0	0	0	3	389	0	0	0	0
2011	0	0	0	0	3	379	0	0	0	0
2012	0	0	0	0	3	379	0	0	0	0
2013	0	0	0	0	3	376	0	0	0	0
2014	0	0	0	0	3	375	0	0	0	0
2015	0	0	0	0	3	374	0	0	0	0
2016	0	0	0	0	3	369	0	0	0	0
2017	0	0	0	0	3	370	0	0	0	0
2018	0	0	0	0	3	368	0	0	0	0
2019	0	0	0	0	3	366	0	0	0	0
2020	0	0	0	0	3	365	0	0	0	0
2021	0	0	0	0	3	363	0	0	0	0
2022	0	0	0	0	3	361	0	0	0	0
2023	0	0	0	0	3	359	0	0	0	0
2024	0	0	0	0	3	358	0	0	0	0
NOM	0	44,400	0	44,400	67	8,397	47,971	0	0	47,971
NPV	0	30,297	0	30,297	20	2,643	32,642	0	0	32,642

* SUPPLEMENTAL INFORMATION NOT SPECIFIED IN WORKBOOK
** NEGATIVE COSTS WILL BE CALCULATED AS POSITIVE BENEFITS FOR TRC AND RIM TESTS

CALCULATION OF GEN K-FACTOR
PROGRAM METHOD SELECTED REV_REQ
PROGRAM NAME: Daylight Dimming - GSD Rate Class

	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
YEAR	MID-YEAR RATE BASE $(000)	DEBT $(000)	PREFERRED STOCK $(000)	COMMON EQUITY $(000)	INCOME TAXES $(000)	OTHER TAXES & INSURANCE $(000)	DEPREC. $(000)	DEFERRED TAXES $(000)	TOTAL FIXED CHARGES $(000)	PRESENT WORTH FIXED CHARGES $(000)	CUMULATIVE PW FIXED CHARGES $(000)
2005	2,922	100	0	201	125	41	98	6	570	570	570
2006	2,800	96	0	192	81	41	98	44	552	507	1,077
2007	2,661	91	0	183	81	41	98	38	532	448	1,525
2008	2,528	86	0	174	81	41	98	33	512	396	1,920
2009	2,400	82	0	165	80	41	98	28	494	350	2,271
2010	2,278	78	0	157	80	41	98	23	476	310	2,580
2011	2,159	74	0	148	79	41	98	19	459	274	2,854
2012	2,045	70	0	141	78	41	98	15	442	242	3,096
2013	1,933	66	0	133	74	41	98	14	425	214	3,310
2014	1,822	62	0	125	69	41	98	14	409	189	3,499
2015	1,710	58	0	118	64	41	98	14	393	166	3,665
2016	1,599	55	0	110	60	41	98	14	377	146	3,811
2017	1,487	51	0	102	55	41	98	14	360	128	3,940
2018	1,376	47	0	95	50	41	98	14	344	113	4,052
2019	1,264	43	0	87	45	41	98	14	328	98	4,151
2020	1,153	39	0	79	40	41	98	14	311	86	4,236
2021	1,041	36	0	72	36	41	98	14	295	75	4,311
2022	930	32	0	64	31	41	98	14	279	65	4,376
2023	818	28	0	56	26	41	98	14	263	56	4,432
2024	707	24	0	49	21	41	98	14	246	48	4,480
2025	608	21	0	42	41	41	98	(10)	232	42	4,521
2026	533	18	0	37	62	41	98	(35)	221	36	4,558
2027	470	16	0	32	60	41	98	(35)	212	32	4,590
2028	407	14	0	28	57	41	98	(35)	203	28	4,618
2029	345	12	0	24	54	41	98	(35)	193	25	4,642
2030	282	10	0	19	52	41	98	(35)	184	21	4,664
2031	219	8	0	15	49	41	98	(35)	175	19	4,682
2032	157	5	0	11	46	41	98	(35)	166	16	4,699
2033	94	3	0	6	43	41	98	(35)	157	14	4,713
2034	31	1	0	2	41	41	98	(35)	148	12	4,725

IN SERVICE COS ($000)	2,925
IN SERVICE YEAR	2005
BOOK LIFE (YRS)	30
EFFEC. TAX RATE	38.575
DISCOUNT RATE	8.98%
OTAX & INS RATE	1.40%

CAPITAL STRUCTURE

SOURCE	WEIGHT	COST	
DEBT	45%	7.60	%
P/S	0%	0.00	%
C/S	55%	12.50	%

K-FACTOR = CPWFC / IN-SVC COST = 1.61524

DEFERRED TAX AND MID-YEAR RATE BASE CALCULATION
PROGRAM METHOD SELECTED: REV_REQ
PROGRAM NA! Daylight Dimming - GSD Rate C

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
YEAR	TAX DEPRECIATION SCHEDULE	TAX DEPRECIATION $(000)	ACCUMULATED TAX DEPRECIATION $(000)	BOOK DEPRECIATION $(000)	ACCUMULATED BOOK DEPRECIATION $(000)	BOOK DEPRECIATION FOR DEFERRED TAX $(000)	ACCUMULATED BOOK DEPR FOR DEFERRED TAX $(000)	DEFERRED TAX DUE TO DEPRECIATION $(000)	TOTAL EQUITY AFUDC $(000)	BOOK DEPR RATE MINUS 1/LIFE	(10)*(11) TAX RATE $(000)	SALVAGE TAX RATE $(000)	ANNUAL DEFERRED TAX (9)-(12)+(13) $(000)	ACCUMULATED DEFERRED TAX $(000)
2005	3.75%	106	106	98	98	90	90	6	216	0	0	0	6	(43)
2006	7.22%	205	311	98	195	90	181	44	216	0	0	0	44	1
2007	6.68%	189	500	98	293	90	271	38	216	0	0	0	38	39
2008	6.18%	175	676	98	390	90	361	33	216	0	0	0	33	72
2009	5.71%	162	838	98	488	90	451	28	216	0	0	0	28	100
2010	5.29%	150	988	98	585	90	542	23	216	0	0	0	23	123
2011	4.89%	139	1,126	98	683	90	632	19	216	0	0	0	19	142
2012	4.52%	128	1,254	98	780	90	722	15	216	0	0	0	15	156
2013	4.46%	127	1,381	98	878	90	813	14	216	0	0	0	14	170
2014	4.46%	127	1,508	98	975	90	903	14	216	0	0	0	14	184
2015	4.46%	127	1,634	98	1,073	90	993	14	216	0	0	0	14	198
2016	4.46%	127	1,761	98	1,170	90	1,084	14	216	0	0	0	14	212
2017	4.46%	127	1,887	98	1,268	90	1,174	14	216	0	0	0	14	226
2018	4.46%	127	2,014	98	1,365	90	1,264	14	216	0	0	0	14	240
2019	4.46%	127	2,140	98	1,463	90	1,354	14	216	0	0	0	14	254
2020	4.46%	127	2,267	98	1,560	90	1,445	14	216	0	0	0	14	268
2021	4.46%	127	2,393	98	1,658	90	1,535	14	216	0	0	0	14	282
2022	4.46%	127	2,520	98	1,755	90	1,625	14	216	0	0	0	14	296
2023	4.46%	127	2,646	98	1,853	90	1,716	14	216	0	0	0	14	310
2024	4.46%	127	2,773	98	1,950	90	1,806	14	216	0	0	0	14	324
2025	2.23%	63	2,836	98	2,048	90	1,896	(10)	216	0	0	0	(10)	314
2026	0.00%	0	2,836	98	2,145	90	1,986	(35)	216	0	0	0	(35)	279
2027	0.00%	0	2,836	98	2,243	90	2,077	(35)	216	0	0	0	(35)	244
2028	0.00%	0	2,836	98	2,340	90	2,167	(35)	216	0	0	0	(35)	209
2029	0.00%	0	2,836	98	2,438	90	2,257	(35)	216	0	0	0	(35)	174
2030	0.00%	0	2,836	98	2,535	90	2,348	(35)	216	0	0	0	(35)	139
2031	0.00%	0	2,836	98	2,633	90	2,438	(35)	216	0	0	0	(35)	105
2032	0.00%	0	2,836	98	2,730	90	2,528	(35)	216	0	0	0	(35)	70
2033	0.00%	0	2,836	98	2,828	90	2,619	(35)	216	0	0	0	(35)	35
2034	0.00%	0	2,836	98	2,925	90	2,709	(35)	216	0	0	0	(35)	0

SALVAGE / REMOVAL COST	0.00
YEAR SALVAGE / COST OF REMOVAL	2029
DEFERRED TAXES DURING CONSTRUCTION (SEE PAGE 5)	(49)
TOTAL EQUITY AFUDC CAPITALIZED (SEE PAGE 5)	216
BOOK DEPR RATE - 1/USEFUL LIFE	3.33%

DEFERRED TAX AND MID-YEAR RATE BASE CALCULATION
PROGRAM METHOD SELECTED: REV_REQ
PROGRAM NAI Daylight Dimming - GSD Rate Class

(1) YEAR	(2) TAX DEPRECIATION SCHEDULE	(3) TAX DEPRECIATION $(000)	(4) DEFERRED TAX $(000)	(5) END OF YEAR NET PLANT IN SERVICE $(000)	(5a)* ACCUMULATED DEPRECIATION $(000)	(5b)* ACCUMULATED DEF TAXES $(000)	(6) BEGINNING YEAR RATE BASE $(000)	(7) ENDING OF YEAR RATE BASE $(000)	(8) MID-YEAR RATE BASE $(000)
2005	3.75%	106	6	2,828	98	(43)	2,974	2,871	2,922
2006	7.22%	205	44	2,730	195	1	2,871	2,729	2,800
2007	6.68%	189	38	2,633	293	39	2,729	2,593	2,661
2008	6.18%	175	33	2,535	390	72	2,593	2,463	2,528
2009	5.71%	162	28	2,438	488	100	2,463	2,338	2,400
2010	5.29%	150	23	2,340	585	123	2,338	2,217	2,278
2011	4.89%	139	19	2,243	683	142	2,217	2,101	2,159
2012	4.52%	128	15	2,145	780	156	2,101	1,989	2,045
2013	4.46%	127	14	2,048	878	170	1,989	1,877	1,933
2014	4.46%	127	14	1,950	975	184	1,877	1,766	1,822
2015	4.46%	127	14	1,853	1,073	198	1,766	1,654	1,710
2016	4.46%	127	14	1,755	1,170	212	1,654	1,543	1,599
2017	4.46%	127	14	1,658	1,268	226	1,543	1,432	1,487
2018	4.46%	127	14	1,560	1,365	240	1,432	1,320	1,376
2019	4.46%	127	14	1,463	1,463	254	1,320	1,209	1,264
2020	4.46%	127	14	1,365	1,560	268	1,209	1,097	1,153
2021	4.46%	127	14	1,268	1,658	282	1,097	986	1,041
2022	4.46%	127	14	1,170	1,755	296	986	874	930
2023	4.46%	127	14	1,073	1,853	310	874	763	818
2024	4.46%	127	14	975	1,950	324	763	651	707
2025	2.23%	63	(10)	878	2,048	314	651	564	608
2026	0.00%	0	(35)	780	2,145	279	564	501	533
2027	0.00%	0	(35)	683	2,243	244	501	439	470
2028	0.00%	0	(35)	585	2,340	209	439	376	407
2029	0.00%	0	(35)	488	2,438	174	376	313	345
2030	0.00%	0	(35)	390	2,535	139	313	251	282
2031	0.00%	0	(35)	293	2,633	105	251	188	219
2032	0.00%	0	(35)	195	2,730	70	188	125	157
2033	0.00%	0	(35)	98	2,828	35	125	63	94
2034	0.00%	0	(35)	0	2,925	0	63	0	31

* Column not specified in workbook

(1) YEAR	(2) NO.YEARS BEFORE IN-SERVICE	(3) PLANT ESCALATION RATE	(4) CUMULATIVE ESCALATION FACTOR	(5) YEARLY EXPENDITURE (%)	(6) ANNUAL SPENDING ($/kW)	(7) CUMULATIVE AVERAGE SPENDING ($/kW)
1998	-7	0.00%	1.000	0.00%	0.00	0.00
1999	-6	1.78%	1.018	0.00%	0.00	0.00
2000	-5	1.53%	1.033	0.32%	1.72	0.86
2001	-4	2.64%	1.061	0.65%	3.58	3.51
2002	-3	2.62%	1.088	13.85%	78.24	44.42
2003	-2	2.28%	1.113	35.34%	204.20	185.63
2004	-1	2.27%	1.139	49.84%	294.50	434.98
				100.00%	582.24	

YEAR	NO.YEARS BEFORE IN-SERVICE	(8) CUMULATIVE SPENDING WITH AFUDC ($/kW)	(8a)* DEBT AFUDC ($/kW)	(8b)* CUMULATIVE DEBT AFUDC ($/kW)	(9) YEARLY TOTAL AFUDC ($/kW)	(9a)* CUMULATIVE TOTAL AFUDC ($/kW)	(9b)* CONSTRUCTION PERIOD INTEREST ($/kW)	(9c)* CUMULATIVE CPI ($/kW)	(9d)* DEFERRED TAXES ($/kW)	(9e)* CUMULATIVE DEFERRED TAXES ($/kW)	(10) INCREMENTAL YEAR-END BOOK VALUE ($/kW)	(11) CUMULATIVE YEAR-END BOOK VALUE ($/kW)
1998	-7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1999	-6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2000	-5	0.86	0.03	0.03	0.09	0.09	0.07	0.07	(0.01)	(0.01)	1.80	1.80
2001	-4	3.59	0.12	0.15	0.37	0.46	0.27	0.34	(0.06)	(0.07)	3.95	5.75
2002	-3	44.88	1.54	1.69	4.63	5.09	3.40	3.74	(0.72)	(0.79)	82.87	88.62
2003	-2	190.72	6.55	8.24	19.72	24.80	14.39	18.13	(3.03)	(3.82)	223.91	312.54
2004	-1	459.79	15.86	24.09	47.73	72.53	34.44	52.57	(7.17)	(10.98)	342.23	654.77
			24.09		72.53		52.57		(10.98)		654.77	

IN SERVICE YEAR	2005
PLANT COSTS	519
AFUDC RATE	10.30%

	BOOK BASIS	BOOK BASIS FOR DEF TAX	TAX BASIS
CONSTRUCTION CASH	2,601	2,601	2,601
EQUITY AFUDC	216		
DEBT AFUDC	108	108	
CPI			235
TOTAL	2,925	2,709	2,836

* Column not specified in workbook

INPUT DATA -- PART 2
PROGRAM METHOD SELECTED : REV_REQ
PROGRAM NAME Daylight Dimming - GSD Rate Class

(1) YEAR	(2) CUMULATIVE TOTAL PARTICIPATING CUSTOMERS	(3) ADJUSTED CUMULATIVE PARTICIPATING CUSTOMERS	(4) UTILITY AVERAGE SYSTEM FUEL COST (C/kWh)	(5) AVOIDED MARGINAL FUEL COST (C/kWh)	(6)* INCREASED MARGINAL FUEL COST (C/kWh)	(7) REPLACEMENT FUEL COST (C/kWh)	(8) PROGRAM kW EFFECTIVENESS FACTOR	(9) PROGRAM kWh EFFECTIVENESS FACTOR
1998	0	0	2.00	4.01	2.00	0.00	1.00	1.00
1999	0	0	2.23	3.92	2.23	0.00	1.00	1.00
2000	0	0	2.45	4.75	2.45	0.00	1.00	1.00
2001	1,000	1,000	2.73	5.52	2.73	0.00	1.00	1.00
2002	2,000	2,000	2.61	3.63	2.61	0.00	1.00	1.00
2003	3,000	3,000	2.60	3.97	2.60	0.00	1.00	1.00
2004	4,000	4,000	2.78	4.48	2.78	0.00	1.00	1.00
2005	4,000	4,000	2.93	5.33	2.93	3.25	1.00	1.00
2006	4,000	4,000	3.01	5.42	3.01	3.34	1.00	1.00
2007	4,000	4,000	3.13	6.29	3.13	3.49	1.00	1.00
2008	4,000	4,000	3.07	5.47	3.07	3.45	1.00	1.00
2009	4,000	4,000	3.15	5.57	3.15	3.60	1.00	1.00
2010	4,000	4,000	3.14	6.05	3.14	3.57	1.00	1.00
2011	4,000	4,000	3.32	6.31	3.32	3.71	1.00	1.00
2012	4,000	4,000	3.38	6.42	3.38	3.77	1.00	1.00
2013	4,000	4,000	3.47	6.48	3.47	3.84	1.00	1.00
2014	4,000	4,000	3.55	6.62	3.55	3.92	1.00	1.00
2015	4,000	4,000	3.58	6.63	3.58	3.95	1.00	1.00
2016	4,000	4,000	3.62	6.58	3.62	4.00	1.00	1.00
2017	4,000	4,000	3.75	7.54	3.75	4.13	1.00	1.00
2018	4,000	4,000	3.93	8.80	3.93	4.35	1.00	1.00
2019	4,000	4,000	4.09	10.25	4.09	4.55	1.00	1.00
2020	4,000	4,000	4.23	10.47	4.23	4.79	1.00	1.00
2021	4,000	4,000	4.32	10.81	4.32	4.88	1.00	1.00
2022	4,000	4,000	4.41	11.31	4.41	4.97	1.00	1.00
2023	4,000	4,000	4.53	11.92	4.53	5.10	1.00	1.00
2024	4,000	4,000	4.64	12.54	4.64	5.23	1.00	1.00

* THIS COLUMN IS USED ONLY FOR LOAD SHIFTING PROGRAMS WHICH SHIFT CONSUMPTION TO OFF-PEAK PERIODS.
THE VALUES REPRESENT THE OFF PEAK SYSTEM FUEL COSTS.

AVOIDED GENERATING BENEFITS
PROGRAM METHOD SELECTED: REV_REQ
PROGRAM NAME Daylight Dimming - GSD Rate Class

YEAR	(2) AVOIDED GEN UNIT CAPACITY COST $(000)	(3) AVOIDED GEN UNIT FIXED O&M $(000)	(4) AVOIDED GEN UNIT VARIABLE O&M $(000)	(5) AVOIDED GEN UNIT FUEL COST $(000)	(6) REPLACEMENT FUEL COST $(000)	(7) AVOIDED GEN UNIT BENEFITS $(000)
1998	0	0	0	0	0	0
1999	0	0	0	0	0	0
2000	0	0	0	0	0	0
2001	0	0	0	0	0	0
2002	0	0	0	0	0	0
2003	0	0	0	0	0	0
2004	0	0	0	0	0	0
2005	570	205	29	771	1,156	418
2006	552	213	30	808	1,223	380
2007	532	221	32	832	1,296	321
2008	512	230	32	842	1,279	338
2009	494	239	33	843	1,319	290
2010	476	249	33	821	1,260	319
2011	459	259	34	833	1,310	273
2012	442	269	35	857	1,331	272
2013	425	280	35	883	1,342	282
2014	409	291	36	909	1,357	288
2015	393	303	37	925	1,365	292
2016	377	315	38	941	1,369	300
2017	360	327	39	969	1,420	276
2018	344	341	40	999	1,500	223
2019	328	354	42	1,034	1,586	172
2020	311	368	43	1,065	1,670	118
2021	295	383	44	1,089	1,700	111
2022	279	398	45	1,114	1,733	104
2023	263	414	47	1,257	1,775	206
2024	246	431	48	1,257	1,821	161
NOM	8,067	6,091	750	19,050	28,813	5,145
NPV	2,454	1,490	191	4,880	7,415	1,601

AVOIDED T&D AND PROGRAM FUEL SAVINGS
PROGRAM METHOD SELECTED: REV_REQ
PROGRAM NAME Daylight Dimming - GSD Rate Class

(1) YEAR	(2) AVOIDED TRANSMISSION CAP COST $(000)	(3) AVOIDED TRANSMISSION O&M COST $(000)	(4) TOTAL AVOIDED TRANSMISSION COST $(000)	(5) AVOIDED DISTRIBUTION CAP COST $(000)	(6) AVOIDED DISTRIBUTION O&M COST $(000)	(7) TOTAL AVOIDED DISTRIBUTION COST $(000)	(8) PROGRAM FUEL SAVINGS $(000)	(8a)* PROGRAM OFF-PEAK PAYBACK $(000)
1998	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	1	0
2002	15	4	19	10	16	25	1	0
2003	30	7	37	19	32	52	2	0
2004	44	12	56	29	50	79	3	0
2005	59	16	75	38	70	108	4	0
2006	56	17	73	37	73	109	4	0
2007	54	17	72	35	75	111	5	0
2008	52	18	70	34	79	112	4	0
2009	50	19	69	33	82	114	4	0
2010	48	20	68	31	85	116	5	0
2011	46	20	67	30	88	118	5	0
2012	45	21	66	29	92	121	5	0
2013	43	22	65	28	96	123	5	0
2014	41	23	64	27	99	126	5	0
2015	39	24	63	25	103	129	5	0
2016	37	25	62	24	107	132	5	0
2017	35	26	61	23	112	135	6	0
2018	34	27	60	22	116	138	7	0
2019	32	28	60	21	121	142	8	0
2020	30	29	59	20	126	145	8	0
2021	28	30	58	18	131	149	8	0
2022	26	31	58	17	136	153	9	0
2023	25	33	57	16	141	158	9	0
2024	23	34	57	15	147	162	10	0
NOM.	893	502	1,395	581	2,177	2,757	126	0
NPV	304	132	435	197	571	768	32	0

* THESE VALUES REPRESENT THE COST OF THE INCREASED FUEL CONSUMPTION DUE TO GREATER OFF-PEAK ENERGY USAGE. USED FOR LOAD SHIFTING PROGRAMS ONLY.

TOTAL RESOURCE COST TEST
PROGRAM METHOD SELECTED: REV_REQ
PROGRAM NAM! Daylight Dimming - GSD Rate Class

(1) YEAR	(2) INCREASED SUPPLY COSTS $(000)	(3) UTILITY PROGRAM COSTS $(000)	(4) PARTICIPANT PROGRAM COSTS $(000)	(5) OTHER COSTS $(000)	(6) TOTAL COSTS $(000)	(7) AVOIDED GEN UNIT BENEFITS $(000)	(8) AVOIDED T&D BENEFITS $(000)	(9) PROGRAM FUEL SAVINGS $(000)	(10) OTHER BENEFITS $(000)	(11) TOTAL BENEFITS $(000)	(12) NET BENEFITS $(000)	(13) CUMULATIVE DISCOUNTED NET BENEFITS $(000)
1998	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	11,529	0	11,529	0	0	1	0	1	(11,529)	(8,908)
2002	0	0	11,829	0	11,829	0	44	1	0	45	(11,784)	(17,264)
2003	0	0	12,148	0	12,148	0	89	2	0	91	(12,058)	(25,109)
2004	0	0	12,464	0	12,464	0	135	3	0	138	(12,326)	(32,469)
2005	0	0	0	0	0	418	182	4	0	605	605	(32,138)
2006	0	0	0	0	0	380	182	4	0	566	566	(31,853)
2007	0	0	0	0	0	321	182	5	0	508	508	(31,619)
2008	0	0	0	0	0	338	183	4	0	525	525	(31,396)
2009	0	0	0	0	0	290	183	4	0	478	478	(31,211)
2010	0	0	0	0	0	319	184	5	0	507	507	(31,030)
2011	0	0	0	0	0	273	185	5	0	463	463	(30,878)
2012	0	0	0	0	0	272	187	5	0	463	463	(30,739)
2013	0	0	0	0	0	282	188	5	0	474	474	(30,609)
2014	0	0	0	0	0	288	190	5	0	483	483	(30,486)
2015	0	0	0	0	0	292	192	5	0	489	489	(30,373)
2016	0	0	0	0	0	300	194	5	0	499	499	(30,267)
2017	0	0	0	0	0	276	196	6	0	477	477	(30,174)
2018	0	0	0	0	0	223	199	7	0	429	429	(30,097)
2019	0	0	0	0	0	172	201	8	0	381	381	(30,034)
2020	0	0	0	0	0	118	204	8	0	330	330	(29,984)
2021	0	0	0	0	0	111	207	8	0	326	326	(29,939)
2022	0	0	0	0	0	104	211	9	0	324	324	(29,898)
2023	0	0	0	0	0	206	215	9	0	430	430	(29,848)
2024	0	0	0	0	0	161	220	10	0	391	391	(29,806)

NOM	0	0	47,971	0	47,971	5,145	4,153	126	0	9,424	(38,547)
NPV	0	0	32,642	0	32,642	1,601	1,203	32	0	2,837	(29,806)

Discount Rate: 8.98 %

Benefit/Cost Ratio (Col(11) / Col(6)) : 0.09

PARTICIPANT COSTS AND BENEFITS
PROGRAM METHOD SELECTED: REV_REQ
PROGRAM NAMI Daylight Dimming - GSD Rate Class

(1) YEAR	(2) SAVINGS IN PARTICIPANTS BILLS $(000)	(3) TAX CREDITS $(000)	(4) UTILITY REBATES $(000)	(5) OTHER BENEFITS $(000)	(6) TOTAL BENEFITS $(000)	(7) CUSTOMER EQUIPMENT COSTS $(000)	(8) CUSTOMER O&M COSTS $(000)	(9) OTHER COSTS $(000)	(10) TOTAL COSTS $(000)	(11) NET BENEFITS $(000)	(12) CUMULATIVE DISCOUNTED NET BENEFITS $(000)
1998	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0
2001	52	0	11,100	0	11,152	11,529	0	0	11,529	(377)	(291)
2002	156	0	11,100	0	11,256	11,829	0	0	11,829	(573)	(696)
2003	260	0	11,100	0	11,360	12,148	0	0	12,148	(788)	(1,211)
2004	363	0	11,100	0	11,463	12,464	0	0	12,464	(1,001)	(1,808)
2005	414	0	0	0	414	0	0	0	0	414	(1,581)
2006	407	0	0	0	407	0	0	0	0	407	(1,377)
2007	407	0	0	0	407	0	0	0	0	407	(1,189)
2008	407	0	0	0	407	0	0	0	0	407	(1,017)
2009	406	0	0	0	406	0	0	0	0	406	(859)
2010	393	0	0	0	393	0	0	0	0	393	(719)
2011	383	0	0	0	383	0	0	0	0	383	(594)
2012	383	0	0	0	383	0	0	0	0	383	(479)
2013	380	0	0	0	380	0	0	0	0	380	(374)
2014	379	0	0	0	379	0	0	0	0	379	(278)
2015	378	0	0	0	378	0	0	0	0	378	(191)
2016	374	0	0	0	374	0	0	0	0	374	(111)
2017	374	0	0	0	374	0	0	0	0	374	(38)
2018	373	0	0	0	373	0	0	0	0	373	29
2019	371	0	0	0	371	0	0	0	0	371	90
2020	369	0	0	0	369	0	0	0	0	369	145
2021	367	0	0	0	367	0	0	0	0	367	196
2022	365	0	0	0	365	0	0	0	0	365	243
2023	364	0	0	0	364	0	0	0	0	364	285
2024	362	0	0	0	362	0	0	0	0	362	324

NOM	8,487	0	44,400	0	52,887	47,971	0	0	47,971	4,916
NPV	2,669	0	30,297	0	32,966	32,642	0	0	32,642	324

In Service of Gen Unit:	2005	
Discount Rate :	8.98	%
Benefit/Cost Ratio (Col(6) / Col(10))	1.01	

RATE IMPACT TEST
PROGRAM METHOD SELECTED: REV_REQ
PROGRAM NAME Daylight Dimming - GSD Rate Class

(1) YEAR	(2) INCREASED SUPPLY COSTS $(000)	(3) UTILITY PROGRAM COSTS $(000)	(4) INCENTIVES $(000)	(5) REVENUE LOSSES $(000)	(6) OTHER COSTS $(000)	(7) TOTAL COSTS $(000)	(8) AVOIDED GEN UNIT & FUEL BENEFITS $(000)	(9) AVOIDED T&D BENEFITS $(000)	(10) REVENUE GAINS $(000)	(11) OTHER BENEFITS $(000)	(12) TOTAL BENEFITS $(000)	(13) NET BENEFITS $(000)	(14) CUMULATIVE DISCOUNTED NET BENEFITS $(000)
1998	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	11,100	52	0	11,152	1	0	0	0	1	(11,151)	(8,617)
2002	0	0	11,100	156	0	11,256	1	44	0	0	45	(11,211)	(16,566)
2003	0	0	11,100	260	0	11,360	2	89	0	0	91	(11,269)	(23,898)
2004	0	0	11,100	362	0	11,462	3	135	0	0	138	(11,325)	(30,659)
2005	0	0	0	414	0	414	422	182	0	0	605	191	(30,555)
2006	0	0	0	406	0	406	384	182	0	0	566	160	(30,474)
2007	0	0	0	406	0	406	326	182	0	0	508	102	(30,427)
2008	0	0	0	406	0	406	342	183	0	0	525	119	(30,377)
2009	0	0	0	405	0	405	295	183	0	0	478	73	(30,348)
2010	0	0	0	392	0	392	323	184	0	0	507	115	(30,307)
2011	0	0	0	382	0	382	278	185	0	0	463	82	(30,280)
2012	0	0	0	382	0	382	276	187	0	0	463	81	(30,256)
2013	0	0	0	379	0	379	286	188	0	0	474	96	(30,230)
2014	0	0	0	378	0	378	293	190	0	0	483	105	(30,203)
2015	0	0	0	377	0	377	297	192	0	0	489	112	(30,177)
2016	0	0	0	372	0	372	305	194	0	0	499	127	(30,150)
2017	0	0	0	373	0	373	281	196	0	0	477	104	(30,130)
2018	0	0	0	371	0	371	230	199	0	0	429	57	(30,120)
2019	0	0	0	369	0	369	180	201	0	0	381	12	(30,118)
2020	0	0	0	368	0	368	126	204	0	0	330	(37)	(30,123)
2021	0	0	0	366	0	366	119	207	0	0	326	(40)	(30,129)
2022	0	0	0	364	0	364	113	211	0	0	324	(41)	(30,134)
2023	0	0	0	363	0	363	215	215	0	0	430	68	(30,126)
2024	0	0	0	361	0	361	171	220	0	0	391	30	(30,123)
NOM.	0	0	44,400	8,463	0	52,863	5,271	4,153	0	0	9,424	(43,440)	
NPV	0	0	30,297	2,662	0	32,959	1,633	1,203	0	0	2,837	(30,123)	

Discount Rate 8.98 %
Benefit/Cost Ratio (Col(12) / Col(7)) : 0.09

INPUT DATA – PART 1 CONTINUED
PROGRAM METHOD SELECTED: REV_REQ
PROGRAM NAME: Daylight Dimming - GSLD Rate Class

I.	PROGRAM DEMAND SAVINGS & LINE LOSSES		
	(1) CUSTOMER kW REDUCTION AT METER	0.87	kW
	(2) GENERATOR kW REDUCTION PER CUSTOMER	1.12	kW
	(3) kW LINE LOSS PERCENTAGE	9.01	%
	(4) GENERATOR kWh REDUCTION PER CUSTOMER	16.1	kWh
	(5) kWh LINE LOSS PERCENTAGE	7.02	%
	(6) GROUP LINE LOSS MULTIPLIER	1.0000	
	(7) CUSTOMER kWh INCREASE AT METER	0.0	kWh
II.	ECONOMIC LIFE & K FACTORS		
	(1) STUDY PERIOD FOR THE CONSERVATION PROGRAM	27	YEARS
	(2) GENERATOR ECONOMIC LIFE	30	YEARS
	(3) T&D ECONOMIC LIFE	35	YEARS
	(4) K FACTOR FOR GENERATION	1.61524	
	(5) K FACTOR FOR T & D	1.46985	
III.	UTILITY & CUSTOMER COSTS		
	(1) UTILITY NON RECURRING COST PER CUSTOMER	***	$/CUST
	(2) UTILITY RECURRING COST PER CUSTOMER	***	$/CUST
	(3) UTILITY COST ESCALATION RATE	***	%**
	(4) CUSTOMER EQUIPMENT COST	***	$/CUST
	(5) CUSTOMER EQUIPMENT ESCALATION RATE	***	%**
	(6) CUSTOMER O & M COST	***	$/CUST/YR
	(7) CUSTOMER O & M COST ESCALATION RATE	***	%**
*	(8) INCREASED SUPPLY COSTS	***	$/CUST/YR
*	(9) SUPPLY COSTS ESCALATION RATES	***	%**
*	(10) UTILITY DISCOUNT RATE	8.98	%
*	(11) UTILITY AFUDC RATE	10.30	%
*	(12) UTILITY NON RECURRING REBATE/INCENTIVE	***	$/CUST
*	(13) UTILITY RECURRING REBATE/INCENTIVE	***	$/CUST
*	(14) UTILITY REBATE/INCENTIVE ESCALATION RATE	***	%

IV.	AVOIDED GENERATOR AND T&D COSTS		
	(1) BASE YEAR	1998	
	(2) IN-SERVICE YEAR FOR AVOIDED GENERATING UNIT	2005	
	(3) IN-SERVICE YEAR FOR AVOIDED T&D	2001-2005	
	(4) BASE YEAR AVOIDED GENERATING COST	519	$/kW
	(5) BASE YEAR AVOIDED TRANSMISSION COST	70	$/kW
	(6) BASE YEAR DISTRIBUTION COST	50	$/kW
	(7) GEN, TRAN & DIST COST ESCALATION RATE	1.78	%**
	(8) GENERATOR FIXED O & M COST	35	$/kW/YR
	(9) GENERATOR FIXED O&M ESCALATION RATE	4.10	%**
	(10) TRANSMISSION FIXED O & M COST	2.73	$/kW
	(11) DISTRIBUTION FIXED O & M COST	13.01	$/kW
	(12) T&D FIXED O&M ESCALATION RATE	4.10	%**
	(13) AVOIDED GEN UNIT VARIABLE O & M COSTS	0.067	CENTS/kWh
	(14) GENERATOR VARIABLE O&M COST ESCALATION RATE	2.70	%**
	(15) GENERATOR CAPACITY FACTOR	91%	** (In-service year)
	(16) AVOIDED GENERATING UNIT FUEL COST	2.17	CENTS PER kWh** (In-service y
	(17) AVOIDED GEN UNIT FUEL COST ESCALATION RATE	1.75	%**
V.	NON-FUEL ENERGY AND DEMAND CHARGES		
	(1) NON FUEL COST IN CUSTOMER BILL	***	CENTS/kWh
	(2) NON-FUEL COST ESCALATION RATE	***	%
	(3) DEMAND CHARGE IN CUSTOMER BILL	***	$/kW/MO
	(4) DEMAND CHARGE ESCALATION RATE	***	%

* SUPPLEMENTAL INFORMATION NOT SPECIFIED IN WORKBOOK
** VALUE SHOWN IS FOR FIRST YEAR ONLY (VALUE VARIES OVER TIME)
*** PROGRAM COST CALCULATION VALUES ARE SHOWN ON PAGE 2

* INPUT DATA -- PART 1 CONTINUED
PROGRAM METHOD SELECTED: REV_REQ
PROGRAM NAME: Daylight Dimming - GSLD Rate Class

YEAR	(1) UTILITY PROGRAM COSTS WITHOUT INCENTIVES $(000)	(2) UTILITY INCENTIVES $(000)	(3) OTHER UTILITY COSTS $(000)	(4) TOTAL UTILITY PROGRAM COSTS $(000)	(5) ENERGY CHARGE REVENUE LOSSES $(000)	(6) DEMAND CHARGE REVENUE LOSSES $(000)	(7) PARTICIPANT EQUIPMENT COSTS $(000)	(8) PARTICIPANT O&M COSTS $(000)	(9) OTHER PARTICIPANT COSTS $(000)	(10) TOTAL PARTICIPANT COSTS $(000)
1998	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0
2001	0	11,100	0	11,100	0	54	11,529	0	0	11,529
2002	0	11,100	0	11,100	1	161	11,829	0	0	11,829
2003	0	11,100	0	11,100	2	269	12,148	0	0	12,148
2004	0	11,100	0	11,100	2	375	12,464	0	0	12,464
2005	0	0	0	0	3	429	0	0	0	0
2006	0	0	0	0	3	421	0	0	0	0
2007	0	0	0	0	3	420	0	0	0	0
2008	0	0	0	0	3	421	0	0	0	0
2009	0	0	0	0	3	420	0	0	0	0
2010	0	0	0	0	3	405	0	0	0	0
2011	0	0	0	0	3	394	0	0	0	0
2012	0	0	0	0	3	394	0	0	0	0
2013	0	0	0	0	3	391	0	0	0	0
2014	0	0	0	0	3	390	0	0	0	0
2015	0	0	0	0	3	389	0	0	0	0
2016	0	0	0	0	3	384	0	0	0	0
2017	0	0	0	0	3	384	0	0	0	0
2018	0	0	0	0	3	382	0	0	0	0
2019	0	0	0	0	3	380	0	0	0	0
2020	0	0	0	0	3	378	0	0	0	0
2021	0	0	0	0	3	377	0	0	0	0
2022	0	0	0	0	3	374	0	0	0	0
2023	0	0	0	0	3	373	0	0	0	0
2024	0	0	0	0	3	371	0	0	0	0
NOM	0	44,400	0	44,400	63	8,737	47,971	0	0	47,971
NPV	0	30,297	0	30,297	18	2,752	32,642	0	0	32,642

* SUPPLEMENTAL INFORMATION NOT SPECIFIED IN WORKBOOK
** NEGATIVE COSTS WILL BE CALCULATED AS POSITIVE BENEFITS FOR TRC AND RIM TESTS

CALCULATION OF GEN K-FACTOR
PROGRAM METHOD SELECTED REV_REQ
PROGRAM NAME: Daylight Dimming - GSLD Rate Class

	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
YEAR	MID-YEAR RATE BASE $(000)	DEBT $(000)	PREFERRED STOCK $(000)	COMMON EQUITY $(000)	INCOME TAXES $(000)	OTHER TAXES & INSURANCE $(000)	DEPREC. $(000)	DEFERRED TAXES $(000)	TOTAL FIXED CHARGES $(000)	PRESENT WORTH FIXED CHARGES $(000)	CUMULATIVE PW FIXED CHARGES $(000)
2005	2,922	100	0	201	125	41	98	6	570	570	570
2006	2,800	96	0	192	81	41	98	44	552	507	1,077
2007	2,661	91	0	183	81	41	98	38	532	448	1,525
2008	2,528	86	0	174	81	41	98	33	512	396	1,920
2009	2,400	82	0	165	80	41	98	28	494	350	2,271
2010	2,278	78	0	157	80	41	98	23	476	310	2,580
2011	2,159	74	0	148	79	41	98	19	459	274	2,854
2012	2,045	70	0	141	78	41	98	15	442	242	3,096
2013	1,933	66	0	133	74	41	98	14	425	214	3,310
2014	1,822	62	0	125	69	41	98	14	409	189	3,499
2015	1,710	58	0	118	64	41	98	14	393	166	3,665
2016	1,599	55	0	110	60	41	98	14	377	146	3,811
2017	1,487	51	0	102	55	41	98	14	360	128	3,940
2018	1,376	47	0	95	50	41	98	14	344	113	4,052
2019	1,264	43	0	87	45	41	98	14	328	98	4,151
2020	1,153	39	0	79	40	41	98	14	311	86	4,236
2021	1,041	36	0	72	36	41	98	14	295	75	4,311
2022	930	32	0	64	31	41	98	14	279	65	4,376
2023	818	28	0	56	26	41	98	14	263	56	4,432
2024	707	24	0	49	21	41	98	14	246	48	4,480
2025	608	21	0	42	41	41	98	(10)	232	42	4,521
2026	533	18	0	37	62	41	98	(35)	221	36	4,558
2027	470	16	0	32	60	41	98	(35)	212	32	4,590
2028	407	14	0	28	57	41	98	(35)	203	28	4,618
2029	345	12	0	24	54	41	98	(35)	193	25	4,642
2030	282	10	0	19	52	41	98	(35)	184	21	4,664
2031	219	8	0	15	49	41	98	(35)	175	19	4,682
2032	157	5	0	11	46	41	98	(35)	166	16	4,699
2033	94	3	0	6	43	41	98	(35)	157	14	4,713
2034	31	1	0	2	41	41	98	(35)	148	12	4,725

IN SERVICE COS ($000)	2,925
IN SERVICE YEAR	2005
BOOK LIFE (YRS)	30
EFFEC. TAX RATE	38.575
DISCOUNT RATE	8.98%
OTAX & INS RATE	1.40%

CAPITAL STRUCTURE

SOURCE	WEIGHT	COST	
DEBT	45%	7.60	%
P/S	0%	0.00	%
C/S	55%	12.50	%

K-FACTOR = CPWFC / IN-SVC COST = 1.61524

DEFERRED TAX AND MID-YEAR RATE BASE CALCULATION
PROGRAM METHOD SELECTED: REV_REQ
PROGRAM NAI Daylight Dimming - GSLD Rate

(1) YEAR	(2) TAX DEPRECIATION SCHEDULE	(3) TAX DEPRECIATION $(000)	(4) ACCUMULATED TAX DEPRECIATION $(000)	(5) BOOK DEPRECIATION $(000)	(6) ACCUMULATED BOOK DEPRECIATION $(000)	(7) BOOK DEPRECIATION FOR DEFERRED TAX $(000)	(8) ACCUMULATED BOOK DEPR FOR DEFERRED TAX $(000)	(9) DEFERRED TAX DUE TO DEPRECIATION $(000)	(10) TOTAL EQUITY AFUDC $(000)	(11) BOOK DEPR RATE MINUS 1/LIFE	(12) (10)*(11) TAX RATE $(000)	(13) SALVAGE TAX RATE $(000)	(14) ANNUAL DEFERRED TAX (9)-(12)+(13) $(000)	(15) ACCUMULATED DEFERRED TAX $(000)
2005	3.75%	106	106	98	98	90	90	6	216	0	0	0	6	(43)
2006	7.22%	205	311	98	195	90	181	44	216	0	0	0	44	1
2007	6.68%	189	500	98	293	90	271	38	216	0	0	0	38	39
2008	6.18%	175	676	98	390	90	361	33	216	0	0	0	33	72
2009	5.71%	162	838	98	488	90	451	28	216	0	0	0	28	100
2010	5.29%	150	988	98	585	90	542	23	216	0	0	0	23	123
2011	4.89%	139	1,126	98	683	90	632	19	216	0	0	0	19	142
2012	4.52%	128	1,254	98	780	90	722	15	216	0	0	0	15	156
2013	4.46%	127	1,381	98	878	90	813	14	216	0	0	0	14	170
2014	4.46%	127	1,508	98	975	90	903	14	216	0	0	0	14	184
2015	4.46%	127	1,634	98	1,073	90	993	14	216	0	0	0	14	198
2016	4.46%	127	1,761	98	1,170	90	1,084	14	216	0	0	0	14	212
2017	4.46%	127	1,887	98	1,268	90	1,174	14	216	0	0	0	14	226
2018	4.46%	127	2,014	98	1,365	90	1,264	14	216	0	0	0	14	240
2019	4.46%	127	2,140	98	1,463	90	1,354	14	216	0	0	0	14	254
2020	4.46%	127	2,267	98	1,560	90	1,445	14	216	0	0	0	14	268
2021	4.46%	127	2,393	98	1,658	90	1,535	14	216	0	0	0	14	282
2022	4.46%	127	2,520	98	1,755	90	1,625	14	216	0	0	0	14	296
2023	4.46%	127	2,646	98	1,853	90	1,716	14	216	0	0	0	14	310
2024	4.46%	127	2,773	98	1,950	90	1,806	14	216	0	0	0	14	324
2025	2.23%	63	2,836	98	2,048	90	1,896	(10)	216	0	0	0	(10)	314
2026	0.00%	0	2,836	98	2,145	90	1,986	(35)	216	0	0	0	(35)	279
2027	0.00%	0	2,836	98	2,243	90	2,077	(35)	216	0	0	0	(35)	244
2028	0.00%	0	2,836	98	2,340	90	2,167	(35)	216	0	0	0	(35)	209
2029	0.00%	0	2,836	98	2,438	90	2,257	(35)	216	0	0	0	(35)	174
2030	0.00%	0	2,836	98	2,535	90	2,348	(35)	216	0	0	0	(35)	139
2031	0.00%	0	2,836	98	2,633	90	2,438	(35)	216	0	0	0	(35)	105
2032	0.00%	0	2,836	98	2,730	90	2,528	(35)	216	0	0	0	(35)	70
2033	0.00%	0	2,836	98	2,828	90	2,619	(35)	216	0	0	0	(35)	35
2034	0.00%	0	2,836	98	2,925	90	2,709	(35)	216	0	0	0	(35)	0

SALVAGE / REMOVAL COST	0.00
YEAR SALVAGE / COST OF REMOVAL	2029
DEFERRED TAXES DURING CONSTRUCTION (SEE PAGE 5)	(49)
TOTAL EQUITY AFUDC CAPITALIZED (SEE PAGE 5)	216
BOOK DEPR RATE - 1/USEFUL LIFE	3.33%

DEFERRED TAX AND MID-YEAR RATE BASE CALCULATION
PROGRAM METHOD SELECTED: REV_REQ
PROGRAM NAI Daylight Dimming - GSLD Rate Class

(1)	(2)	(3)	(4)	(5)	(5a)*	(5b)*	(6)	(7)	(8)
YEAR	TAX DEPRECIATION SCHEDULE	TAX DEPRECIATION $(000)	DEFERRED TAX $(000)	END OF YEAR NET PLANT IN SERVICE $(000)	ACCUMULATED DEPRECIATION $(000)	ACCUMULATED DEF TAXES $(000)	BEGINNING YEAR RATE BASE $(000)	ENDING OF YEAR RATE BASE $(000)	MID-YEAR RATE BASE $(000)
2005	3.75%	106	6	2,828	98	(43)	2,974	2,871	2,922
2006	7.22%	205	44	2,730	195	1	2,871	2,729	2,800
2007	6.68%	189	38	2,633	293	39	2,729	2,593	2,661
2008	6.18%	175	33	2,535	390	72	2,593	2,463	2,528
2009	5.71%	162	28	2,438	488	100	2,463	2,338	2,400
2010	5.29%	150	23	2,340	585	123	2,338	2,217	2,278
2011	4.89%	139	19	2,243	683	142	2,217	2,101	2,159
2012	4.52%	128	15	2,145	780	156	2,101	1,989	2,045
2013	4.46%	127	14	2,048	878	170	1,989	1,877	1,933
2014	4.46%	127	14	1,950	975	184	1,877	1,766	1,822
2015	4.46%	127	14	1,853	1,073	198	1,766	1,654	1,710
2016	4.46%	127	14	1,755	1,170	212	1,654	1,543	1,599
2017	4.46%	127	14	1,658	1,268	226	1,543	1,432	1,487
2018	4.46%	127	14	1,560	1,365	240	1,432	1,320	1,376
2019	4.46%	127	14	1,463	1,463	254	1,320	1,209	1,264
2020	4.46%	127	14	1,365	1,560	268	1,209	1,097	1,153
2021	4.46%	127	14	1,268	1,658	282	1,097	986	1,041
2022	4.46%	127	14	1,170	1,755	296	986	874	930
2023	4.46%	127	14	1,073	1,853	310	874	763	818
2024	4.46%	127	14	975	1,950	324	763	651	707
2025	2.23%	63	(10)	878	2,048	314	651	564	608
2026	0.00%	0	(35)	780	2,145	279	564	501	533
2027	0.00%	0	(35)	683	2,243	244	501	439	470
2028	0.00%	0	(35)	585	2,340	209	439	376	407
2029	0.00%	0	(35)	488	2,438	174	376	313	345
2030	0.00%	0	(35)	390	2,535	139	313	251	282
2031	0.00%	0	(35)	293	2,633	105	251	188	219
2032	0.00%	0	(35)	195	2,730	70	188	125	157
2033	0.00%	0	(35)	98	2,828	35	125	63	94
2034	0.00%	0	(35)	0	2,925	0	63	0	31

* Column not specified in workbook

(1) YEAR	(2) NO.YEARS BEFORE IN-SERVICE	(3) PLANT ESCALATION RATE	(4) CUMULATIVE ESCALATION FACTOR	(5) YEARLY EXPENDITURE (%)	(6) ANNUAL SPENDING ($/kW)	(7) CUMULATIVE AVERAGE SPENDING ($/kW)
1998	-7	0.00%	1.000	0.00%	0.00	0.00
1999	-6	1.78%	1.018	0.00%	0.00	0.00
2000	-5	1.53%	1.033	0.32%	1.72	0.86
2001	-4	2.64%	1.061	0.65%	3.58	3.51
2002	-3	2.62%	1.088	13.85%	78.24	44.42
2003	-2	2.28%	1.113	35.34%	204.20	185.63
2004	-1	2.27%	1.139	49.84%	294.50	434.98
				100.00%	582.24	

YEAR	NO.YEARS BEFORE IN-SERVICE	(8) CUMULATIVE SPENDING WITH AFUDC ($/kW)	(8a)* DEBT AFUDC ($/kW)	(8b)* CUMULATIVE DEBT AFUDC ($/kW)	(9) YEARLY TOTAL AFUDC ($/kW)	(9a)* CUMULATIVE TOTAL AFUDC ($/kW)	(9b)* CONSTRUCTION PERIOD INTEREST ($/kW)	(9c)* CUMULATIVE CPI ($/kW)	(9d)* DEFERRED TAXES ($/kW)	(9e)* CUMULATIVE DEFERRED TAXES ($/kW)	(10) INCREMENTAL YEAR-END BOOK VALUE ($/kW)	(11) CUMULATIVE YEAR-END BOOK VALUE ($/kW)
1998	-7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1999	-6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2000	-5	0.86	0.03	0.03	0.09	0.09	0.07	0.07	(0.01)	(0.01)	1.80	1.80
2001	-4	3.59	0.12	0.15	0.37	0.46	0.27	0.34	(0.06)	(0.07)	3.95	5.75
2002	-3	44.88	1.54	1.69	4.63	5.09	3.40	3.74	(0.72)	(0.79)	82.87	88.62
2003	-2	190.72	6.55	8.24	19.72	24.80	14.39	18.13	(3.03)	(3.82)	223.91	312.54
2004	-1	459.79	15.86	24.09	47.73	72.53	34.44	52.57	(7.17)	(10.98)	342.23	654.77
			24.09		72.53		52.57		(10.98)		654.77	

IN SERVICE YEAR	2005
PLANT COSTS	519
AFUDC RATE	10.30%

	BOOK BASIS	BOOK BASIS FOR DEF TAX	TAX BASIS
CONSTRUCTION CASH	2,601	2,601	2,601
EQUITY AFUDC	216		
DEBT AFUDC	108	108	
CPI			235
TOTAL	2,925	2,709	2,836

* Column not specified in workbook

INPUT DATA – PART 2
PROGRAM METHOD SELECTED : REV_REQ
PROGRAM NAMI Daylight Dimming - GSLD Rate Class

(1) YEAR	(2) CUMULATIVE *TOTAL* PARTICIPATING CUSTOMERS	(3) ADJUSTED *CUMULATIVE* PARTICIPATING CUSTOMERS	(4) UTILITY AVERAGE *SYSTEM* FUEL COST (C/kWh)	(5) AVOIDED *MARGINAL* FUEL COST (C/kWh)	(6)* INCREASED *MARGINAL* FUEL COST (C/kWh)	(7) *REPLACEMEN'* FUEL COST (C/kWh)	(8) PROGRAM kW :FFECTIVENES FACTOR	(9) PROGRAM kWh :FFECTIVENESS FACTOR
1998	0	0	2.00	4.01	2.00	0.00	1.00	1.00
1999	0	0	2.23	3.92	2.23	0.00	1.00	1.00
2000	0	0	2.45	4.75	2.45	0.00	1.00	1.00
2001	1,000	1,000	2.73	5.52	2.73	0.00	1.00	1.00
2002	2,000	2,000	2.61	3.63	2.61	0.00	1.00	1.00
2003	3,000	3,000	2.60	3.97	2.60	0.00	1.00	1.00
2004	4,000	4,000	2.78	4.48	2.78	0.00	1.00	1.00
2005	4,000	4,000	2.93	5.33	2.93	3.25	1.00	1.00
2006	4,000	4,000	3.01	5.42	3.01	3.34	1.00	1.00
2007	4,000	4,000	3.13	6.29	3.13	3.49	1.00	1.00
2008	4,000	4,000	3.07	5.47	3.07	3.45	1.00	1.00
2009	4,000	4,000	3.15	5.57	3.15	3.60	1.00	1.00
2010	4,000	4,000	3.14	6.05	3.14	3.57	1.00	1.00
2011	4,000	4,000	3.32	6.31	3.32	3.71	1.00	1.00
2012	4,000	4,000	3.38	6.42	3.38	3.77	1.00	1.00
2013	4,000	4,000	3.47	6.48	3.47	3.84	1.00	1.00
2014	4,000	4,000	3.55	6.62	3.55	3.92	1.00	1.00
2015	4,000	4,000	3.58	6.63	3.58	3.95	1.00	1.00
2016	4,000	4,000	3.62	6.58	3.62	4.00	1.00	1.00
2017	4,000	4,000	3.75	7.54	3.75	4.13	1.00	1.00
2018	4,000	4,000	3.93	8.80	3.93	4.35	1.00	1.00
2019	4,000	4,000	4.09	10.25	4.09	4.55	1.00	1.00
2020	4,000	4,000	4.23	10.47	4.23	4.79	1.00	1.00
2021	4,000	4,000	4.32	10.81	4.32	4.88	1.00	1.00
2022	4,000	4,000	4.41	11.31	4.41	4.97	1.00	1.00
2023	4,000	4,000	4.53	11.92	4.53	5.10	1.00	1.00
2024	4,000	4,000	4.64	12.54	4.64	5.23	1.00	1.00

* THIS COLUMN IS USED ONLY FOR LOAD SHIFTING PROGRAMS WHICH SHIFT CONSUMPTION TO OFF-PEAK PERIODS.
THE VALUES REPRESENT THE OFF PEAK SYSTEM FUEL COSTS.

AVOIDED GENERATING BENEFITS
PROGRAM METHOD SELECTED: REV_REQ
PROGRAM NAMI Daylight Dimming - GSLD Rate Class

YEAR	(2) AVOIDED GEN UNIT CAPACITY COS $(000)	(3) AVOIDED GEN UNIT FIXED O&M $(000)	(4) AVOIDED GEN UNIT VARIABLE O&M $(000)	(5) AVOIDED GEN UNIT FUEL COST $(000)	(6) REPLACEMENT FUEL COST $(000)	(7) AVOIDED GEN UNIT BENEFITS $(000)
1998	0	0	0	0	0	0
1999	0	0	0	0	0	0
2000	0	0	0	0	0	0
2001	0	0	0	0	0	0
2002	0	0	0	0	0	0
2003	0	0	0	0	0	0
2004	0	0	0	0	0	0
2005	570	205	29	771	1,156	418
2006	552	213	30	808	1,223	380
2007	532	221	32	832	1,296	321
2008	512	230	32	842	1,279	338
2009	494	239	33	843	1,319	290
2010	476	249	33	821	1,260	319
2011	459	259	34	833	1,310	273
2012	442	269	35	857	1,331	272
2013	425	280	35	883	1,342	282
2014	409	291	36	909	1,357	288
2015	393	303	37	925	1,365	292
2016	377	315	38	941	1,369	300
2017	360	327	39	969	1,420	276
2018	344	341	40	999	1,500	223
2019	328	354	42	1,034	1,586	172
2020	311	368	43	1,065	1,670	118
2021	295	383	44	1,089	1,700	111
2022	279	398	45	1,114	1,733	104
2023	263	414	47	1,257	1,775	206
2024	246	431	48	1,257	1,821	161

NOM	8,067	6,091	750	19,050	28,813	5,145
NPV	2,454	1,490	191	4,880	7,415	1,601

AVOIDED T&D AND PROGRAM FUEL SAVINGS
PROGRAM METHOD SELECTED: REV_REQ
PROGRAM NAME Daylight Dimming - GSLD Rate Class

(1) YEAR	(2) AVOIDED TRANSMISSION CAP COST $(000)	(3) AVOIDED TRANSMISSION O&M COST $(000)	(4) TOTAL AVOIDED TRANSMISSION COST $(000)	(5) AVOIDED DISTRIBUTION CAP COST $(000)	(6) AVOIDED DISTRIBUTION O&M COST $(000)	(7) TOTAL AVOIDED DISTRIBUTION COST $(000)	(8) PROGRAM FUEL SAVINGS $(000)	(8a)* PROGRAM OFF-PEAK PAYBACK $(000)
1998	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	1	0
2002	15	4	19	10	16	25	1	0
2003	30	7	37	19	32	52	2	0
2004	44	12	56	29	50	79	3	0
2005	59	16	75	38	70	108	4	0
2006	56	17	73	37	73	109	4	0
2007	54	17	72	35	75	111	5	0
2008	52	18	70	34	79	112	4	0
2009	50	19	69	33	82	114	4	0
2010	48	20	68	31	85	116	5	0
2011	46	20	67	30	88	118	5	0
2012	45	21	66	29	92	121	5	0
2013	43	22	65	28	96	123	5	0
2014	41	23	64	27	99	126	5	0
2015	39	24	63	25	103	129	5	0
2016	37	25	62	24	107	132	5	0
2017	35	26	61	23	112	135	6	0
2018	34	27	60	22	116	138	7	0
2019	32	28	60	21	121	142	8	0
2020	30	29	59	20	126	145	8	0
2021	28	30	58	18	131	149	8	0
2022	26	31	58	17	136	153	9	0
2023	25	33	57	16	141	158	9	0
2024	23	34	57	15	147	162	10	0

NOM.	893	502	1,395	581	2,177	2,757	126	0
NPV	304	132	435	197	571	768	32	0

* THESE VALUES REPRESENT THE COST OF THE INCREASED FUEL CONSUMPTION DUE TO GREATER OFF-PEAK ENERGY USAGE. USED FOR LOAD SHIFTING PROGRAMS ONLY.

TOTAL RESOURCE COST TEST
PROGRAM METHOD SELECTED: REV_REQ
PROGRAM NAMI Daylight Dimming - GSLD Rate Class

(1) YEAR	(2) INCREASED SUPPLY COSTS $(000)	(3) UTILITY PROGRAM COSTS $(000)	(4) PARTICIPANT PROGRAM COSTS $(000)	(5) OTHER COSTS $(000)	(6) TOTAL COSTS $(000)	(7) AVOIDED GEN UNIT BENEFITS $(000)	(8) AVOIDED T&D BENEFITS $(000)	(9) PROGRAM FUEL SAVINGS $(000)	(10) OTHER BENEFITS $(000)	(11) TOTAL BENEFITS $(000)	(12) NET BENEFITS $(000)	(13) CUMULATIVE DISCOUNTED NET BENEFITS $(000)
1998	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	11,529	0	11,529	0	0	1	0	1	(11,529)	(8,908)
2002	0	0	11,829	0	11,829	0	44	1	0	45	(11,784)	(17,264)
2003	0	0	12,148	0	12,148	0	89	2	0	91	(12,058)	(25,109)
2004	0	0	12,464	0	12,464	0	135	3	0	138	(12,326)	(32,469)
2005	0	0	0	0	0	418	182	4	0	605	605	(32,138)
2006	0	0	0	0	0	380	182	4	0	566	566	(31,853)
2007	0	0	0	0	0	321	182	5	0	508	508	(31,619)
2008	0	0	0	0	0	338	183	4	0	525	525	(31,396)
2009	0	0	0	0	0	290	183	4	0	478	478	(31,211)
2010	0	0	0	0	0	319	184	5	0	507	507	(31,030)
2011	0	0	0	0	0	273	185	5	0	463	463	(30,878)
2012	0	0	0	0	0	272	187	5	0	463	463	(30,739)
2013	0	0	0	0	0	282	188	5	0	474	474	(30,609)
2014	0	0	0	0	0	288	190	5	0	483	483	(30,486)
2015	0	0	0	0	0	292	192	5	0	489	489	(30,373)
2016	0	0	0	0	0	300	194	5	0	499	499	(30,267)
2017	0	0	0	0	0	276	196	6	0	477	477	(30,174)
2018	0	0	0	0	0	223	199	7	0	429	429	(30,097)
2019	0	0	0	0	0	172	201	8	0	381	381	(30,034)
2020	0	0	0	0	0	118	204	8	0	330	330	(29,984)
2021	0	0	0	0	0	111	207	8	0	326	326	(29,939)
2022	0	0	0	0	0	104	211	9	0	324	324	(29,898)
2023	0	0	0	0	0	206	215	9	0	430	430	(29,848)
2024	0	0	0	0	0	161	220	10	0	391	391	(29,806)
NOM	0	0	47,971	0	47,971	5,145	4,153	126	0	9,424	(38,547)	
NPV	0	0	32,642	0	32,642	1,601	1,203	32	0	2,837	(29,806)	

Discount Rate: 8.98 %

Benefit/Cost Ratio (Col(11) / Col(6)) : 0.09

PARTICIPANT COSTS AND BENEFITS
PROGRAM METHOD SELECTED: REV_REQ
PROGRAM NAMI Daylight Dimming - GSLD Rate Class

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
YEAR	SAVINGS IN PARTICIPANTS BILLS $(000)	TAX CREDITS $(000)	UTILITY REBATES $(000)	OTHER BENEFITS $(000)	TOTAL BENEFITS $(000)	CUSTOMER EQUIPMENT COSTS $(000)	CUSTOMER O&M COSTS $(000)	OTHER COSTS $(000)	TOTAL COSTS $(000)	NET BENEFITS $(000)	CUMULATIVE DISCOUNTED NET BENEFITS $(000)
1998	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0
2001	54	0	11,100	0	11,154	11,529	0	0	11,529	(375)	(290)
2002	162	0	11,100	0	11,262	11,829	0	0	11,829	(567)	(692)
2003	271	0	11,100	0	11,371	12,148	0	0	12,148	(778)	(1,198)
2004	378	0	11,100	0	11,478	12,464	0	0	12,464	(986)	(1,786)
2005	432	0	0	0	432	0	0	0	0	432	(1,550)
2006	424	0	0	0	424	0	0	0	0	424	(1,336)
2007	424	0	0	0	424	0	0	0	0	424	(1,141)
2008	424	0	0	0	424	0	0	0	0	424	(961)
2009	423	0	0	0	423	0	0	0	0	423	(797)
2010	409	0	0	0	409	0	0	0	0	409	(651)
2011	398	0	0	0	398	0	0	0	0	398	(521)
2012	398	0	0	0	398	0	0	0	0	398	(401)
2013	395	0	0	0	395	0	0	0	0	395	(293)
2014	394	0	0	0	394	0	0	0	0	394	(193)
2015	393	0	0	0	393	0	0	0	0	393	(102)
2016	388	0	0	0	388	0	0	0	0	388	(19)
2017	388	0	0	0	388	0	0	0	0	388	57
2018	386	0	0	0	386	0	0	0	0	386	126
2019	385	0	0	0	385	0	0	0	0	385	189
2020	382	0	0	0	382	0	0	0	0	382	247
2021	381	0	0	0	381	0	0	0	0	381	300
2022	379	0	0	0	379	0	0	0	0	379	348
2023	377	0	0	0	377	0	0	0	0	377	392
2024	376	0	0	0	376	0	0	0	0	376	432

NOM	8,822	0	44,400	0	53,222	47,971	0	0	47,971	5,251
NPV	2,777	0	30,297	0	33,074	32,642	0	0	32,642	432

In Service of Gen Unit:	2005
Discount Rate :	8.98 %
Benefit/Cost Ratio (Col(6) / Col(10))	1.01

RATE IMPACT TEST
PROGRAM METHOD SELECTED: REV_REQ
PROGRAM NAME Daylight Dimming - GSLD Rate Class

(1) YEAR	(2) INCREASED SUPPLY COSTS $(000)	(3) UTILITY PROGRAM COSTS $(000)	(4) INCENTIVES $(000)	(5) REVENUE LOSSES $(000)	(6) OTHER COSTS $(000)	(7) TOTAL COSTS $(000)	(8) AVOIDED GEN UNIT & FUEL BENEFITS $(000)	(9) AVOIDED T&D BENEFITS $(000)	(10) REVENUE GAINS $(000)	(11) OTHER BENEFITS $(000)	(12) TOTAL BENEFITS $(000)	(13) NET BENEFITS $(000)	(14) CUMULATIVE DISCOUNTED NET BENEFITS $(000)
1998	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	11,100	54	0	11,154	1	0	0	0	1	(11,153)	(8,618)
2002	0	0	11,100	162	0	11,262	1	44	0	0	45	(11,217)	(16,572)
2003	0	0	11,100	270	0	11,370	2	89	0	0	91	(11,280)	(23,911)
2004	0	0	11,100	378	0	11,478	3	135	0	0	138	(11,340)	(30,682)
2005	0	0	0	431	0	431	422	182	0	0	605	174	(30,586)
2006	0	0	0	423	0	423	384	182	0	0	566	143	(30,514)
2007	0	0	0	423	0	423	326	182	0	0	508	85	(30,475)
2008	0	0	0	423	0	423	342	183	0	0	525	101	(30,432)
2009	0	0	0	422	0	422	295	183	0	0	478	56	(30,411)
2010	0	0	0	408	0	408	323	184	0	0	507	99	(30,375)
2011	0	0	0	397	0	397	278	185	0	0	463	66	(30,354)
2012	0	0	0	397	0	397	276	187	0	0	463	66	(30,334)
2013	0	0	0	394	0	394	286	188	0	0	474	81	(30,312)
2014	0	0	0	393	0	393	293	190	0	0	483	90	(30,289)
2015	0	0	0	392	0	392	297	192	0	0	489	97	(30,266)
2016	0	0	0	387	0	387	305	194	0	0	499	112	(30,242)
2017	0	0	0	387	0	387	281	196	0	0	477	90	(30,225)
2018	0	0	0	385	0	385	230	199	0	0	429	43	(30,217)
2019	0	0	0	384	0	384	180	201	0	0	381	(2)	(30,217)
2020	0	0	0	381	0	381	126	204	0	0	330	(51)	(30,225)
2021	0	0	0	380	0	380	119	207	0	0	326	(53)	(30,232)
2022	0	0	0	378	0	378	113	211	0	0	324	(54)	(30,239)
2023	0	0	0	376	0	376	215	215	0	0	430	54	(30,233)
2024	0	0	0	374	0	374	171	220	0	0	391	17	(30,231)

NOM.	0	0	44,400	8,800	0	53,200	5,271	4,153	0	0	9,424	(43,776)
NPV	0	0	30,297	2,771	0	33,068	1,633	1,203	0	0	2,837	(30,231)

Discount Rate 8.98 %
Benefit/Cost Ratio (Col(12) / Col(7)) : 0.09