

AR No. 5

Turn Off Lights

Recommended Action

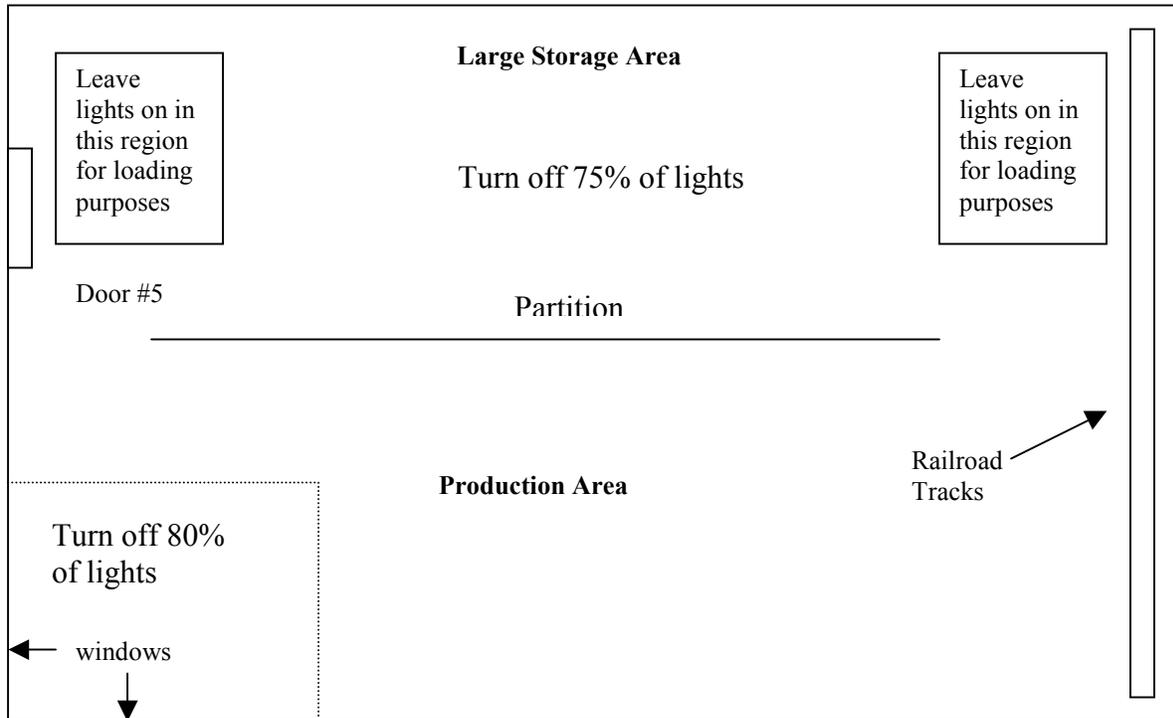
Turn off 75% of the metal halide fixtures in the large storage area and 80% of the fixtures in the printer area during operating hours. These areas are not used heavily during operating hours and do not require their current level of lighting. This measure will reduce annual lighting costs by approximately 35%.

Assessment Recommendation Summary			
Energy (10 ⁶ Btu)	Cost Savings	Implementation Cost	Payback (years)
273	\$3,812	\$1,990	0.5

Background

There are 78 metal halide fixtures in the large storage area behind the production line which are turned on at least 2,450 hr/yr during normal operating hours. Train and truck loading on the extreme ends of this storage area are the primary activities that require sufficient lighting. According to the maintenance supervisor, approximately 75% of the lights in the large storage area can be turned off without interfering with production during operating hours. A majority of these lights should be turned off in the center portion of the storage area, as activity is lowest in this area.

There are 16 metal halide fixtures in the region surrounding the printer (these metal halides are accounted for in the inventory under 'General Mill Lights') that are turned on at least 2,450 hr/yr during normal operating hours. This area is not used heavily during operation hours and there are windows that provide additional lighting. According to the maintenance supervisor, it is estimated that 80% of the lights can be turned off. See schematic for visual representation.



Mill Building

For the purpose of lighting requirements, both of these areas were considered to be “inactive warehouses,” requiring only 5-10 footcandles. Our recommendation takes into account these standards as illustrated in the lighting worksheet. These standard industry benchmarks are outlined in the following table.

Illuminance Category	Footcandles	Example Activity/Area
A	2-5	Building Entrances, Parking Lots
B	5-10	Dining, Inactive Warehouses
C	10-20	Lobbies, Active Warehouses, and Locker Rooms
D	20-50	Reading Print, Conference Rooms and Simple Assembly
E	50-100	Map Reading, Mail Sorting and Moderately Difficult Assembly
F	100-200	Clothes Pressing and Difficult Assembly
G	200-500	Fine Inspecting and Very Difficult Assembly
H	500-1000	Precision Manual Arc-Welding and Exacting Assembly
I	1000-2000	Cloth Inspection

Source: *Illuminating Engineering Society Handbook*.

Anticipated Savings

Savings occur because of a decrease in lamp operating hours. Shorter operating time decreases energy costs as well as ballast and lamp maintenance material and labor costs. The annual energy and cost savings are calculated in the following lighting worksheets. The methods and terminology used in the lighting worksheets are described in Appendix B.

Power (P) and energy (E) will be:

$$\begin{aligned} P &= 33\text{kW/yr} \\ E &= 79,870 \text{ kWh/yr} \\ &= 273 \times 10^6 \text{ Btu/yr} \end{aligned}$$

The power cost saving (PC) is found by multiplying power savings by the monthly demand cost (DC).

$$\begin{aligned} PC &= P \times DC \times 12 \text{ months/yr} \\ &= 33 \text{ kW/yr} \times \$3.18/\text{kW-months} \times 12 \text{ months/yr} \\ &= \$1,244 \end{aligned}$$

The energy cost savings (EC\$) is found by multiplying the energy savings by the energy cost (\$E).

$$\begin{aligned} EC\$ &= E \times \$E \\ &= 79,870 \text{ kWh/yr} \times \$0.02237 \\ &= \$1,787 \end{aligned}$$

Itemized savings is summarized in the following table.

Savings Summary			
Source	Quantity	Units	Energy Cost 10 ⁶ Btu \$
Energy Cost	79,870	kWh	273 \$1,787
Power Cost	33	kW	\$1,244
Maintenance Material Cost			\$716
Maintenance Labor Cost			\$65
Total			273 \$3,812

Implementation Cost

Implementation may require rewiring at the breakers in order to turn off specific metal halide fixtures. We recommend adding control switches for convenience. Conduit will be needed to run to relays that will be mounted in boxes next to the circuit breakers. This estimate includes the cost of materials and the labor costs of rewiring. An electrician will be needed to estimate the precise costs of material and labor. The following table gives a breakdown of how we obtained an implementation cost value.

Implementation Cost Summary			
Item	Quantity	Unit Cost	Total Cost
20 amp circuits in 1/2" conduit, 3#12 copper wire (labor included)	500 feet	\$2.70/ft	\$1,350
20 amp switch (labor included)	3	\$50	\$150
20-30 amp power relay	3	\$40	\$120
Electrical Enclosure	3	\$50	\$150
Additional labor (maintenance/electrician)	10 hours	\$22/hr	\$220
Total			\$1,990

The simple payback is 0.6 years.

TURN OFF METAL HALIDE FIXTURES IN PRINTER/LARGE STORAGE AREA

PLANT DATA		Report Number:			
Bldg.: Main Mill		Demand Cost (D\$):		\$3.18	/kW-mo.
Area: Printer/Large Storage		Energy Cost (E\$):		\$0.02237	/kWh
Lamp Replacement Time:	1/6 hours	Rec. Foot-candles:		19	
Ballast Replacement Time:	1/2 hours	Maintenance Labor Rate:(\$/H)		\$15.00	/hour
Fixture Replacement Time:	1 hours	Electrician Labor Rate:(\$/H)		\$30.00	/hour
FIXTURES	Symbol	Existing	Proposed	Savings	Units
LAMP CODE		M400	M400		
Description:	FID	Metal Halide	Metal Halide		
Quantity:	F#	94	23	71	
Operating Hours:	H	2450	2450	0	hours
Use Factor:	UF	100%	100%	0%	
Lamps/Fixture:	L/F	1	1	0	
Ballasts/Fixture:	B/F	1	1	0	
Cost:	C/F	\$117.25	\$117.25	\$0.00	
LAMPS					
Description:	LID	ED37	ED37		
Quantity:	L#	94	23	71	
Life:	LL	20,000	20,000	0	hours
Cost:	C/L	\$38.95	\$38.95	\$0.00	
Replacement Fraction:	Lf	12%	12%	0%	
Watts/Lamp:	W/L	400	400	0	watts
Lumens:	LM	36,000	36,000	0	
Maintenance Replacement Cost:	LRC	\$448.51	\$109.74	\$338.77	
Maintenance Labor Cost:	LLC	\$28.67	\$7.02	\$21.66	
BALLASTS					
BALLAST CODE		B-M400-1	B-M400-1		
Description:	BID	M-59/H-33	M-59/H-33		
Quantity:	B#	94	23	71	
Life:	BL	60,000	60,000	0	hours
Cost:	C/B	\$130.20	\$130.20	\$0.00	
Replacement Fraction:	Bf	4%	4%	0%	
Ballast Factor:	BEF	100%	100%	0%	
Input Watts:	IW	458	458	0	watts
Maintenance Replacement Cost:	BRC	\$499.75	\$122.28	\$377.47	
Maintenance Labor Cost:	BLC	\$57.58	\$14.09	\$43.49	
POWER AND ENERGY					
Total Power:	P	43.1	10.5	32.6	kW
Energy Use:	E	105,595	25,725	79,870	kWh
LIGHT LEVEL CHECK					
Total Lumens:	TLM	3,384,000	828,000	2,556,000	
Foot-candles:	FC	19	5	14	
Lighting Efficiency:	LM/W	78.6	78.6	0.0	
ANNUAL OPERATING COST					
Total Power Cost:	PC	\$1,645	\$401	\$1,244	
Energy Cost:	EC	\$2,362	\$575	\$1,787	
Maintenance Material Cost:	MMC	\$948	\$232	\$716	
Maintenance Labor Cost:	MLC	\$86	\$21	\$65	
Total Operating Cost:	OC	\$5,042	\$1,229	\$3,812	
IMPLEMENTATION COST					
Total Cost:	IC		\$2,340	\$1,990	
SIMPLE PAYBACK	SP			0.5	years