AR No. 3

Install Lighting Controls

Recommended Action

The roof of the machine shop was built to offer abundant skylighting. Although the skylights offer sufficient light during the day, the high-bay lights in the shop are left on at all times. Installing photocells or timer lighting controls to turn these lights off during the day will result in lighting operating cost savings of nearly 40%.

Assessment Recommendation Summary			
Energy (10^6Btu)	Cost Savings	Implementation Cost	Payback (years)
1,066	$19,090	$5,610	0.3

Background

During our visit, we used a light meter to check the lighting level in the machine shop with the lights turned on and off. The average lighting level with the high bay lights on was between 65 and 90 foot candles. With the lights turned off, area light levels were reduced by 1 to 2 foot candles, even during overcast sky conditions. These results suggest that the skylights offer sufficient lighting.

The machine shop currently has 167 high pressure sodium fixtures and 31 metal halide fixtures. All of the high pressure sodium and 22 of the metal halide lights are rated at 400W. The 9 remaining metal halides are 250W fixtures. All of the lights in the shop are turned on 8,760 hr/yr. Since there is sufficient light from the skylights approximately 40% of the day there is no need for these lights to be turned on.

Anticipated Savings

Savings occur because of a decrease in operating hours. Shorter operating time decreases energy costs as well as ballast and lamp maintenance material and labor costs. Turning the lights off during the day will reduce annual lighting operation by 3,504 hr/yr.

Since the lights may still operate during periods of peak demand, only energy savings have been claimed. 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.

Reducing the operating time for the 198 fixtures will decrease electrical energy use by 312,556 kWh. Total energy cost savings (EC), based on a unit energy cost of $0.05190/kWh, is:

ES = 312,556 kWh/yr x $.05190/kWh
= $16,221

The total cost savings (CS), including energy (EC), maintenance material (MMC) and maintenance labor (MLC).

CS = EC + MMC +MLC

Combined savings are summarized in the following table.

Savings Summary, Install Photocells					
		TOTAL	High Pressure Sodium	400W Metal Halide	250W Metal Halide
Quantity:	F#	198	167	22	9
POWER AND ENERGY					
Total Power (kW):	P	0	0	0	0
Energy Use (kWh):	E	312,556	267,355	35,390	9,811
ANNUAL OPERATING COST					
Total Power Cost:	PC	$0	$0	$0	$0
Energy Cost:	EC	$16,221	$13,875	$1,837	$509
Maintenance Material Cost:	MMC	$2,682	$2,248	$231	$203
Maintenance Labor Cost:	MLC	$187	$148	$23	$16
Total Operating Cost:	OC	$19,090	$16270	$2,091	$728

Implementation Cost

Implementation requires installation of timer controlled photocells on banks of 3 light fixtures. For the 198 fixtures in the machine shop, 66 photocells will be needed, at a cost of approximately $25 each. We estimate each control will require 2 hours of electrician labor for installaion, at a labor rate of $30/hr. Anticipated implementation costs are summarized in the following table. The combined simple payback for this recommendation is 0.3 years.

Implementation Cost					
		TOTAL	High Pressure Sodium	400W Metal Halide	250W Metal Halide
Materials:	M$	$1,650	$1,400	$175	$75
Labor:	L$	$3,960	$3,360	$420	$180
Total Cost:	IC	$5,610	$4,760	$595	$255
SIMPLE PAYBACK	SP	0.3	0.3	0.3	0.4

Install Photocells

PLANT DATA			Report Number:		395	
Bldg.:	Machine Shop		Demand Cost (D$):		$0.23	/kW-mo.
Area:	Machine Shop		Energy Cost (E$):		$0.05190	/kWh
Lamp Replacement Time:	1/6	hours	Rec. Foot-candles:		0	
Ballast Replacement Time:	1/2	hours	Maintenance Labor Rate:($/H)		$15.00	/hour
Fixture Replacement Time:	1	hours	Electrician Labor Rate:($/H)		$30.00	/hour

FIXTURES	Symbol	Existing	Proposed	Savings	Units
Description:	FID	High Pressure Sodium	High Pressure Sodium		
Quantity:	F#	167	167	0	
Operating Hours:	H	8760	5256	(3,504)	hours
Use Factor:	UF	100%	100%	0%	
Lamps/Fixture:	L/F	1	1	0	
Ballasts/Fixture:	B/F	1	1	0	
Cost:	C/F	$134.50	$134.50	$0.00	
LAMPS					
Description:	LID	ED18	ED18		
Quantity:	L#	167	167	0	
Life:	LL	31,200	24,000	7,200	hours
Cost:	C/L	$25.46	$25.46	$0.00	
Replacement Fraction:	Lf	28%	22%	6%	
Watts/Lamp:	W/L	400	400	0	watts
Lumens:	LM	50,000	50,000	0	
Maintenance Replacement Cost:	LRC	$1,193.78	$931.15	$262.63	
Maintenance Labor Cost:	LLC	$116.75	$91.07	$25.69	
BALLASTS					
BALLAST CODE		B-H400-1	B-H400-1		
Description:	BID	S-51	S-51		
Quantity:	B#	167	167	0	
Life:	BL	72,000	72,000	0	hours
Cost:	C/B	$244.25	$244.25	$0.00	
Replacement Fraction:	Bf	12%	7%	5%	
Ballast Factor:	BEF	100%	100%	0%	
Input Watts:	IW	457	457	0	watts
Maintenance Replacement Cost:	BRC	$4,962.75	$2,977.65	$1,985.10	
Maintenance Labor Cost:	BLC	$304.78	$182.87	$121.91	
POWER AND ENERGY					
Total Power:	P	76.3	76.3	0.0	kW
Energy Use:	E	668,388	401,033	267,355	kWh
LIGHT LEVEL CHECK					
Total Lumens:	TLM	8,350,000	8,350,000	0	
Foot-candles:	FC	0	0	0	
Lighting Efficiency:	LM/W	109.4	109.4	0.0	
ANNUAL OPERATING COST					
Total Power Cost:	PC	$211	$211	$0	
Energy Cost:	EC	$34,689	$20,814	$13,875	
Maintenance Material Cost:	MMC	$6,157	$3,909	$2,248	
Maintenance Labor Cost:	MLC	$422	$274	$148	
Total Operating Cost:	OC	$41,478	$25,208	$16,270	
IMPLEMENTATION COST					
Materials:	M$			$1,400	
Labor:	L$			$3,360	
Total Cost:	IC			$4,760	

SIMPLE PAYBACK	SP	0.3	years

Install Photocells

PLANT DATA			Report Number:		395	
Bldg.:	Machine Shop		Demand Cost (D$):		$0.23	/kW-mo.
Area:	Machine Shop		Energy Cost (E$):		$0.05190	/kWh
Lamp Replacement Time:	1/6	hours	Rec. Foot-candles:		0	
Ballast Replacement Time:	1/2	hours	Maintenance Labor Rate:($/H)		$15.00	/hour
Fixture Replacement Time:	1	hours	Electrician Labor Rate:($/H)		$30.00	/hour

FIXTURES	Symbol	Existing	Proposed	Savings	Units
Description:	FID	Metal Halide	Metal Halide		
Quantity:	F#	22	22	0	
Operating Hours:	H	8760	5256	(3,504)	hours
Use Factor:	UF	100%	100%	0%	
Lamps/Fixture:	L/F	1	1	0	
Ballasts/Fixture:	B/F	1	1	0	
Cost:	C/F	$0.00	$0.00	$0.00	
LAMPS					
Description:	LID	ED37	ED37		
Quantity:	L#	22	22	0	
Life:	LL	26,000	20,000	6,000	hours
Cost:	C/L	$38.95	$38.95	$0.00	
Replacement Fraction:	Lf	34%	26%	7%	
Watts/Lamp:	W/L	400	400	0	watts
Lumens:	LM	36,000	36,000	0	
Maintenance Replacement Cost:	LRC	$288.71	$225.19	$63.52	
Maintenance Labor Cost:	LLC	$18.46	$14.40	$4.06	
BALLASTS					
BALLAST CODE		B-M400-1	B-M400-1		
Description:	BID	M-59/H-33	M-59/H-33		
Quantity:	B#	22	22	0	
Life:	BL	60,000	60,000	0	hours
Cost:	C/B	$130.20	$130.20	$0.00	
Replacement Fraction:	Bf	15%	9%	6%	
Ballast Factor:	BEF	100%	100%	0%	
Input Watts:	IW	458	458	0	watts
Maintenance Replacement Cost:	BRC	$418.20	$250.92	$167.28	
Maintenance Labor Cost:	BLC	$48.18	$28.91	$19.27	
POWER AND ENERGY					
Total Power:	P	10.1	10.1	0.0	kW
Energy Use:	E	88,476	53,086	35,390	kWh
LIGHT LEVEL CHECK					
Total Lumens:	TLM	792,000	792,000	0	
Foot-candles:	FC	0	0	0	
Lighting Efficiency:	LM/W	78.6	78.6	0.0	
ANNUAL OPERATING COST					
Total Power Cost:	PC	$28	$28	$0	
Energy Cost:	EC	$4,592	$2,755	$1,837	
Maintenance Material Cost:	MMC	$707	$476	$231	
Maintenance Labor Cost:	MLC	$67	$43	$23	
Total Operating Cost:	OC	$5,394	$3,302	$2,091	
IMPLEMENTATION COST					
Materials:	M$			$175	
Labor:	L$			$420	
Total Cost:	IC			$595	

SIMPLE PAYBACK	SP	0.3	years

Install Photocells

PLANT DATA					
Bldg.:	Machine Shop		Report Number:	395	
Area:	Machine Shop		Demand Cost (D$):	$0.23	/kW-mo.
Lamp Replacement Time:	1/6	hours	Energy Cost (E$):	$0.05190	/kWh
Ballast Replacement Time:	1/2	hours	Rec. Foot-candles:	0	
Fixture Replacement Time:	1	hours	Maintenance Labor Rate:($/H)	$15.00	/hour
			Electrician Labor Rate:($/H)	$30.00	/hour

FIXTURES	Symbol	Existing	Proposed	Savings	Units
Description:	FID	Metal Halide	Metal Halide		
Quantity:	F#	9	9	0	
Operating Hours:	H	8760	5256	(3,504)	hours
Use Factor:	UF	100%	100%	0%	
Lamps/Fixture:	L/F	1	1	0	
Ballasts/Fixture:	B/F	1	1	0	
Cost:	C/F	$106.00	$106.00	$0.00	
LAMPS					
Description:	LID	ED28	ED28		
Quantity:	L#	22	22	0	
Life:	LL	13,000	10,000	3,000	hours
Cost:	C/L	$45.22	$45.22	$0.00	
Replacement Fraction:	Lf	67%	53%	15%	
Watts/Lamp:	W/L	250	250	0	watts
Lumens:	LM	13,500	13,500	0	
Maintenance Replacement Cost:	LRC	$670.37	$522.89	$147.48	
Maintenance Labor Cost:	LLC	$36.91	$28.79	$8.12	
BALLASTS					
BALLAST CODE		B-M250-1	B-M250-1		
Description:	BID	M-58/H-37	M-58/H-37		
Quantity:	B#	9	9	0	
Life:	BL	60,000	60,000	0	hours
Cost:	C/B	$106.25	$106.25	$0.00	
Replacement Fraction:	Bf	15%	9%	6%	
Ballast Factor:	BEF	100%	100%	0%	
Input Watts:	IW	310	310	0	watts
Maintenance Replacement Cost:	BRC	$139.61	$83.77	$55.85	
Maintenance Labor Cost:	BLC	$19.71	$11.83	$7.88	
POWER AND ENERGY					
Total Power:	P	2.8	2.8	0.0	kW
Energy Use:	E	24,528	14,717	9,811	kWh
LIGHT LEVEL CHECK					
Total Lumens:	TLM	297,000	297,000	0	
Foot-candles:	FC	0	0	0	
Lighting Efficiency:	LM/W	106.5	106.5	0.0	
ANNUAL OPERATING COST					
Total Power Cost:	PC	$8	$8	$0	
Energy Cost:	EC	$1,273	$764	$509	
Maintenance Material Cost:	MMC	$810	$607	$203	
Maintenance Labor Cost:	MLC	$57	$41	$16	
Total Operating Cost:	OC	$2,148	$1,419	$728	
IMPLEMENTATION COST					
Materials:	M$			$75	
Labor:	L$			$180	
Total Cost:	IC			$255	

SIMPLE PAYBACK	SP	0.4	years