

# FAA Standards for LED Lighting and Energy Efficiencies

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# FAA Standards

- ◇ Program Guidance Letter 12-02
  - ◇ Issued March 5, 2012
  - ◇ *This was just recently cancelled and updated to new AIP Handbook Order 5100.38D (Issued September 30, 2014)*
  
- ◇ Engineering Brief No. 67D: Light Sources Other Than Incandescent and Xenon For Airport and Obstruction Lighting Fixtures
  - ◇ Issued March 6, 2012

# FAA Standards

- ◇ Advisory Circular 150/5340-30H: Design and Installation Details for Airport Visual Aids
  - ◇ Issued July 21, 2014

# Program Guidance Letter 12-02

- A life cycle cost analysis is no longer required for use of LED on an AIP funded project
- L-XXX(L) must be specified as listed in AC 150/5345-53C Addendum
- Must use standard FAA equipment
- Airfield Lighting Design must meet AC 150/5340-30 Design Standards

# Program Guidance Letter 12-02

- ◇ Exceptions:
  - ◇ LED Obstruction Lights
  - ◇ LED Approach Lights
    - ◇ MALSR
  - ◇ LED High Intensity Runway Lights
  - ◇ Alternate Power Source
  - ◇ AIP funds cannot be used to replace an item that has not met its useful life.

# Engineering Brief NO. 67D

- ◇ Must be Certified under AC 150/5345-53 and/or other applicable documents.
  
- ◇ Intensity Ratios:
  - ◇ The intensity of the fixture operated on a 3 or 5 step constant current regulator must increase and decrease with increasing or decreasing of the CCR output current as stated in AC 150/5340-30.

# Engineering Brief No. 67D

- ◇ Additional Qualification Requirements/  
Testing
  - ◇ High Temperature Test
  - ◇ Accelerated Fixture Life Test
  - ◇ Light Fixture Performance Criteria
  - ◇ Light Fixture Power Factor
  - ◇ Fixture Daytime Viewing
  - ◇ Optional Arctic Kit

# AC 150/5340-30H

- ◇ Section 1.4 Mixing of light source technologies.
  - ◇ Runway Guard Lights - Each pair of elevated RGLs must be the same technology. For in-pavement lights, do not mix LED with incandescent fixtures in the same bar.
  - ◇ Touchdown Zone Lights
  - ◇ Runway Edge Lights including Threshold



# AC 150/5340-30H

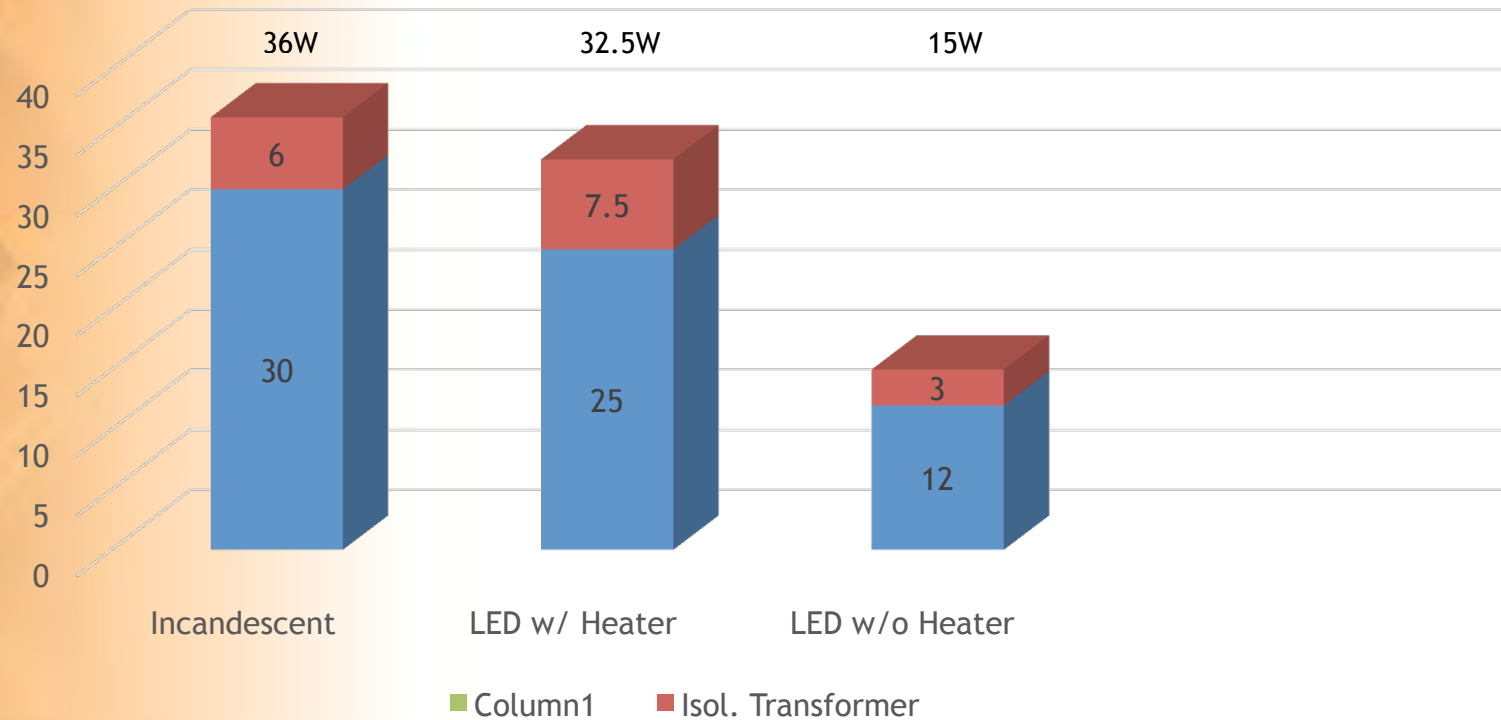
- ◇ Section 1.4 Mixing of light source technologies.
  - ◇ Signs per location - do not collocate LED signs with incandescent signs.
  - ◇ Taxiway Curved segment (centerline and edge)
  - ◇ Taxiway Straight Segment (centerline and edge)

# AC 150/5340-30H

- ◇ Section 1.4 Mixing of light source technologies.
  - ◇ Runway Centerline Lights
  - ◇ Stop Bars
  - ◇ Precision Approach Path Indicators (PAPI)

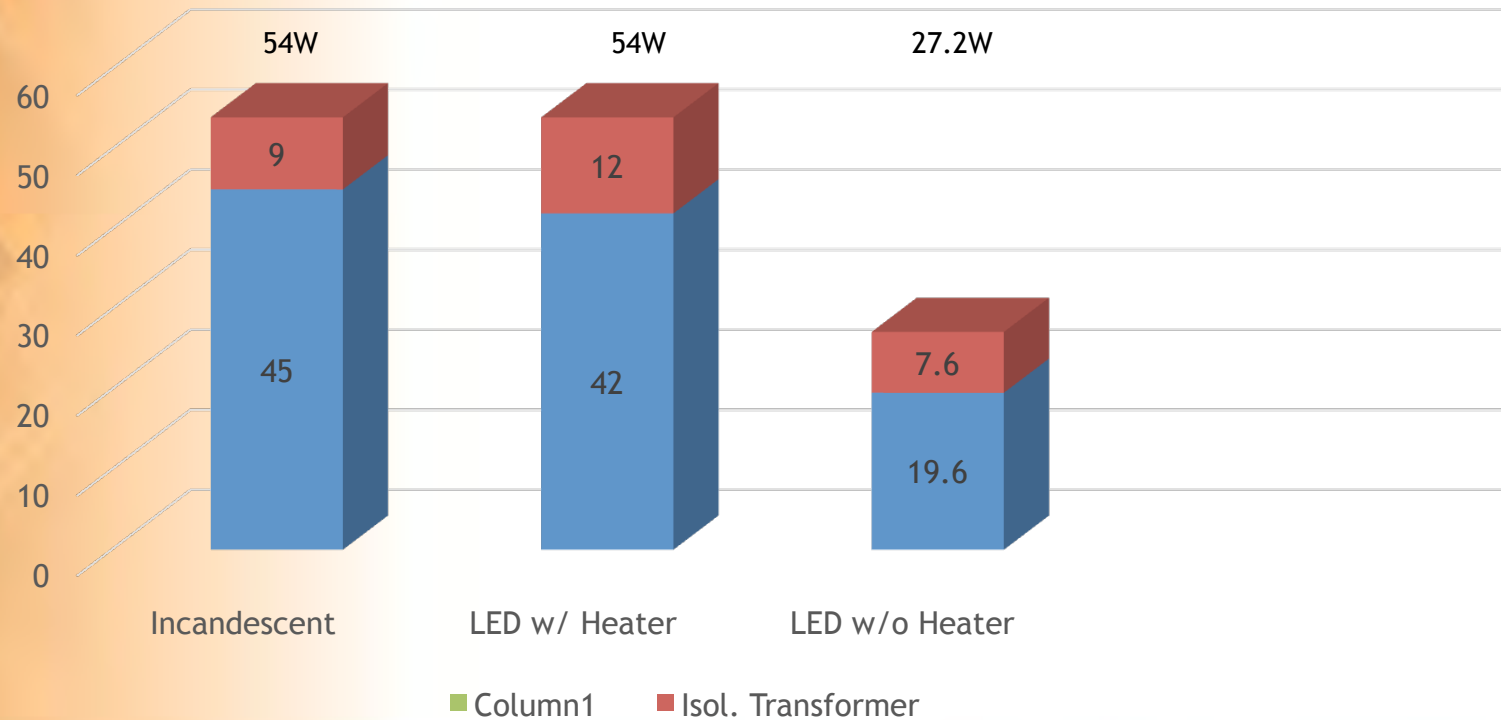
# Power Consumption

## L-861T Taxiway Light Comparison



# Power Consumption

## L-861 Runway Light Comparison

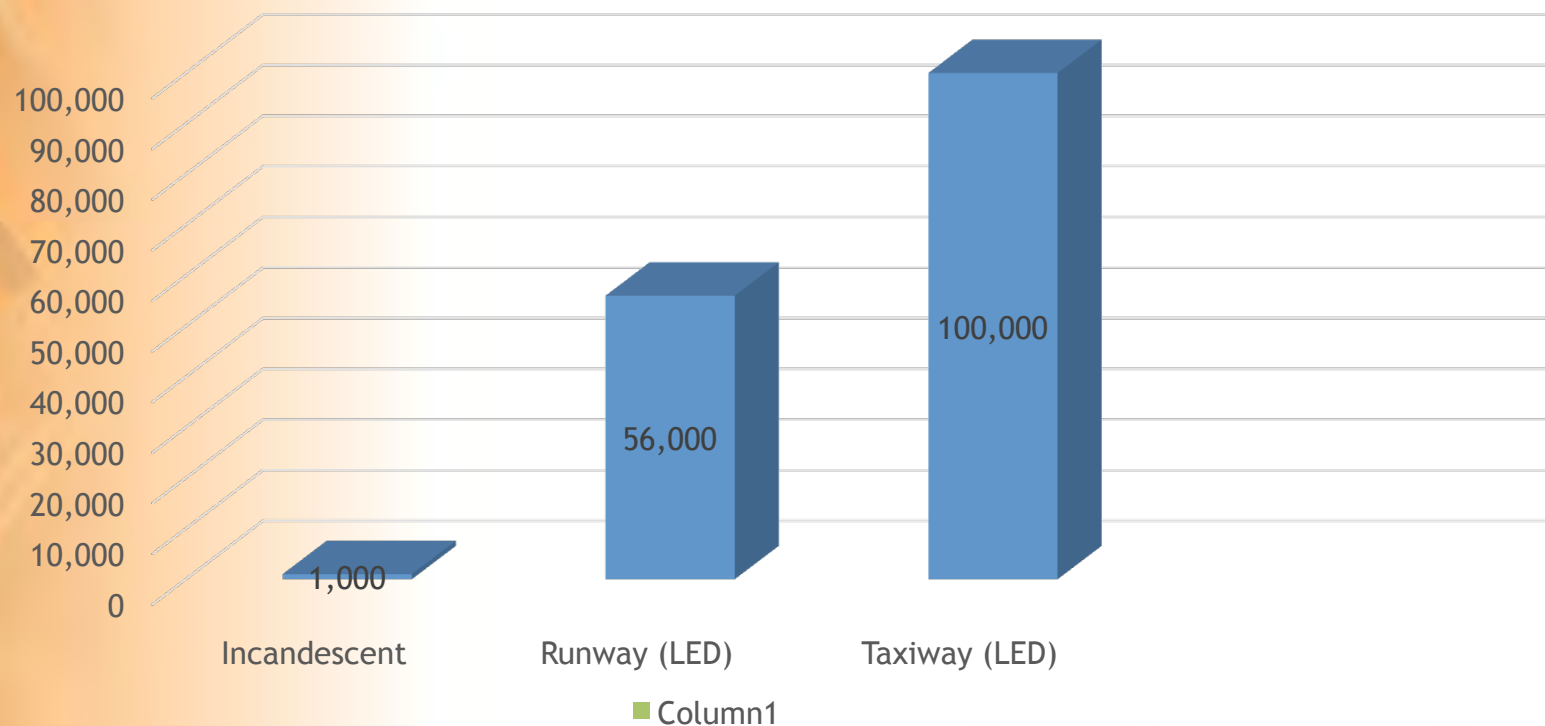


# Power Consumption

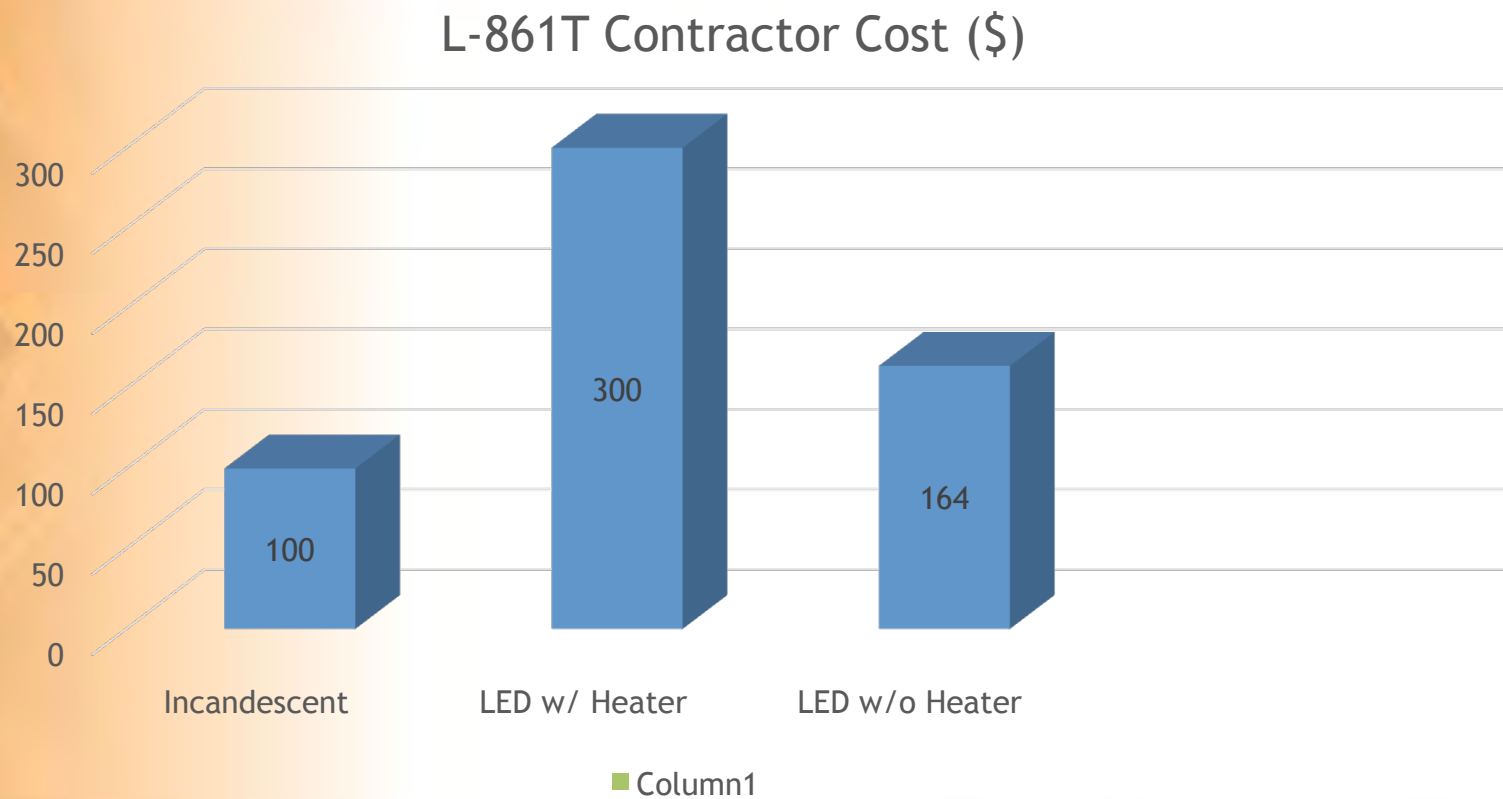
- ↳ LED heater is controlled through an internal thermostat.
- ↳ Is an internal heater required?

# Lamp Life

Lamp Life @ 6.6 Amps



# Initial Investment



# Past Projects with LED

- ◇ Rapid City, SD
  - ◇ New MITL LED System, 2004
- ◇ Baker, MT
  - ◇ New MIRL and MITL LED System, 2012
- ◇ Mandan, ND
  - ◇ New MIRL and MITL LED System, 2013
- ◇ Roundup, MT
  - ◇ MIRL LED system, under construction
- ◇ Grand Forks, ND
  - ◇ New MIRL and MITL LED System designed for RWY 17L-35R and TWY C



# Mandan Airport: Runway 13-31



Mandan Airport Specifics	
Parallel Runway/Taxiway length	4500 FT
Maximum CCR Output Current	6.6 Amps
Number of CCR Steps	3-Step (4.8A-6.6A)
Input Voltage	240 Vac
Frequency	60 Hz

Device Description	QTY	Incandescent				LED (without heater kit)			
		Individual Load (VA)	Isolation Transformer	Transformer Load (VA)	Total (VA)	Individual Load (VA)	Isolation Transformer	Transformer Load (VA)	Total (VA)
L-861 Runway Edge Lts	44	45	30/45 Watt	9	2376	19.6	20/25 Watt	7.5	1192.4
L-861E Threshold Lts	16	45	30/45 Watt	9	864	11.8	20/25 Watt	7.5	308.8
L-858 2 Module Sign	8	155	200 Watt	N/A - included	1240	86	200 Watt	N/A - included	688
L-849 REIL	2	600	N/A (internal)	N/A - included	1200	296	200 Watt	N/A - included	592
L-824 AWG 8 Cable Loss					533				533
				<b>Total Load on CCR</b>	<b>6213</b>				
				<b>Regulator Size</b>	<b>7.5 kW</b>				
						<b>Total Load on CCR</b>			
						<b>3314</b>			
						<b>Regulator Size</b>			
						<b>4 kW</b>			

(7.5 kW used)

# Mandan Airport: Taxiway A

Device Description	QTY	Incandescent				LED (without heater kit)			
		Individual Load (VA)	Isolation Transformer	Transformer Load (VA)	Total (VA)	Individual Load (VA)	Isolation Transformer	Transformer Load (VA)	Total (VA)
L-861T Taxiway Edge Lts	146	30	30/45 Watt	9	5694	12	10/15 Watt	3	2190
L-858 2 Module Sign	10	155	200 Watt	N/A - included	1550	86	200 Watt	N/A - included	860
L-858 3 Module Sign	4	202	300 Watt	N/A - included	808	120	200 Watt	N/A - included	480
L-824 AWG 8 Cable Loss					460				460
				<b>Total Load on CCR</b>	<b>8512</b>				
				<b>Regulator Size</b>	<b>10 kW</b>				
						<b>Total Load on CCR</b>			
						<b>3990</b>			
						<b>Regulator Size</b>			
						<b>4 kW</b>			

(7.5 kW used)

## Design Hint:

- ◇ Depending on type of CCR that is installed, adjusting of the output taps on larger regulators may be possible to optimize power savings.
- ◇ Sign loads need to be taken into consideration as well when sizing a constant current regulator. Having LED signs instead of incandescent may allow you to maintain a smaller sign as well. See appendix 6 in AC 150/5340-30H



# Runway Payback

Energy Use Assumptions	
(a) Energy Price (Mandan, ND) per kWh	\$ 0.119
(b) Light operation time per day (in hours)	5
4 kW Regulator 90% efficiency, extra energy use	0.4 kW
7.5 kW Regulator 90% efficiency, extra energy use	0.75 kW

Device Description	QTY	Incandescent / Quartz				LED (without heater kit)			
		Unit Cost Each*	Total Fixture Cost	(c) Total Energy Consumed (kW)	Total Energy Cost/Year =a*b*c*365	Unit Cost Each*	Total Fixture Cost	(d) Total Energy Consumed (kW)	Total Energy Cost/Year =a*b*d*365
L-861 Runway Edge Lts	44	\$ 125	\$ 5,500	2.376	\$ 516	\$ 300	\$ 13,200	1.192	\$ 259
L-861E Threshold Lts	16	\$ 145	\$ 2,320	0.864	\$ 188	\$ 300	\$ 4,800	0.309	\$ 67
L-858, 2-Module Sign	8	\$ 1,247	\$ 9,976	1.24	\$ 269	\$ 1,907	\$ 15,256	0.688	\$ 149
L-849 REIL (per Rwy end)	2	\$ 9,220	\$ 18,440	1.2	\$ 261	\$ 13,622	\$ 27,244	0.592	\$ 129
Regulator Cost †	1	\$ 12,189	\$ 12,189	0.75	\$ 163	\$ 5,200	\$ 5,200	0.4	\$ 87
		Installation Total Cost:	\$ 48,425	Energy Total Cost per year:	\$ 1,396.44	Installation Total Cost:	\$ 65,700	Energy Total Cost per year:	\$ 691
						LED Extra Purchasing Cost Investment	\$ 17,275	LED Energy Savings per year	\$ 706
								**Payback in Years:	24.5

\*\* Does not include maintenance cost benefits.

\* Equipment cost from supplier. Does not include labor or installation cost.

† Only Ferroresonant regulators may be used due to flashing loads.



# Taxiway Payback

Energy Use Assumptions	
(a) Energy Price (Mandan, ND) per kWh	\$ 0.119
(b) Light operation time per day (in hours)	5
4 kW Regulator 90% efficiency, extra energy use	0.4 kW
10 kW Regulator 90% efficiency, extra energy use	1 kW

Device Description	QTY	Incandescent / Quartz				LED (without heater kit)			
		Unit Cost Each*	Total Fixture Cost	(c) Total Energy Consumed (kW)	Total Energy Cost/Year =a*b*c*365	Unit Cost Each*	Total Fixture Cost	(d) Total Energy Consumed (kW)	Total Energy Cost/Year =a*b*d*365
L-861T Taxiway Edge Lts	146	\$ 102	\$ 14,892	5.69	\$ 1,237	\$ 165	\$ 24,090	2.19	\$ 476
L-858, 2-Module Sign	10	\$ 1,247	\$ 12,470	1.55	\$ 337	\$ 1,907	\$ 19,070	0.86	\$ 187
L-858, 3-Module Sign	4	\$ 1,685	\$ 6,740	0.81	\$ 175	\$ 2,577	\$ 10,308	0.48	\$ 104
Regulator Cost	1	\$ 8,500	\$ 8,500	1	\$ 217	\$ 4,200	\$ 4,200	0.4	\$ 87
		<b>Equipment Total Cost*:</b>	<b>\$ 42,602</b>	<b>Energy Total Cost per year:</b>	<b>\$ 1,966</b>	<b>Equipment Total Cost*:</b>	<b>\$ 57,668</b>	<b>Energy Total Cost per year:</b>	<b>\$ 853</b>
						<b>LED Extra Purchasing Cost Investment</b>	<b>\$ 15,066</b>	<b>LED Energy Savings per year</b>	<b>\$ 1,112</b>
								<b>**Payback in Years:</b>	<b>13.5</b>

\*\* Does not include maintenance cost benefits.

\* Equipment cost from supplier. Does not include labor or installation cost.



# Total Project Payback

	Incandescent / Quartz				LED (without heater kit)			
Runway	Installation Total Cost:	\$ 48,425	Energy Total Cost per year:	\$ 1,396.44	Installation Total Cost:	\$ 65,700	Energy Total Cost per year:	\$ 691
Taxiway	Installation Total Cost:	\$ 42,602	Energy Total Cost per year:	\$ 1,966.00	Installation Total Cost:	\$ 57,668	Energy Total Cost per year:	\$ 853
	Total Cost:	\$ 91,027		\$ 3,362.44	Total Cost:	\$ 123,368		\$ 1,544
					LED Extra Purchasing Cost Investment	\$ 32,341	LED Energy Savings per year	\$ 1,818
							**Payback in Years:	17.8

\*\* Does not include maintenance cost benefits.

\* Equipment cost from supplier. Does not include labor or installation cost.

◇ In this example the utility charges \$18/kw demand over 15kw used. For this project there was an additional 6.1kw airfield load on the service. LED circuits keeps us right at the 15kw demand range which would result in little to no additional charges. If incandescent lights were used our demand would be at approximately 20.8kw. This would add on an additional \$108 per month to the airport for the additional load. Over a course of a year that is an additional \$1,296. If you figure in this savings the payback in years gets reduced to about 10 years for the overall system.



Thank You

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