



# Business Opportunities For The Future

*The Future of LED's (Solid State Lighting)*

# Veteran Energy Technology



- Sales and Marketing Agents for Manufacturers of Sustainable Products
- Small, Service-Disabled, Veteran-Owned Business (SSDVOB)
- Focus of efforts on:

**Day Lighting  
Geothermal**

**LED Lighting      Solar, Wind,**

**SSDVOB Construction  
Recycling**

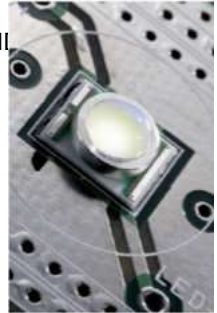
**Controls**

**HazMat**

**State and National Rebates, Incentives and Grants**

# Basic Advantages of LED Light

- Very **Efficient** – up to 85 lumens per watt - near term roadmap > 150 LPW
- **Directional** – no wasted light, any pattern possible
- Have a **Long Life** – normally 50,000 to 70% lumen maintenance
- Are inherently **Rugged** – no filament to break
- **Start Instantly** – nanoseconds vs > 10 minute re-strike (HID)
- Are **Environmentally Sound** – no Hg, Pb, heavy metals
- Are **Dimmable** and controllable
- **Love Cold** temperatures



# The Promise of LED's

## Data from DOE Conference in July:

- By 2030, potential to cut US lighting energy use by one-third
- Cumulative energy savings: \$280 billion
- Annual energy saving equivalent to:
  - 348 billion kilowatt hours
  - Output of forty-four (44) 1,000 megawatt power plants
  - Greenhouse emissions equal to 47 million cars
- Additional benefits:
  - US global leadership in new technology
  - High tech, value add jobs



# The Future is NOW!



# The Future is NOW?



# Application Dependent

Color

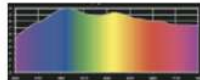
Usage

kWh Cost

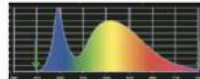
Maintenance

# The Color in Light

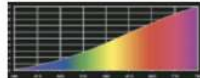
Daylight (5000K)



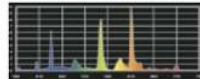
LED (4000K)



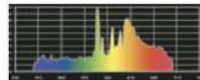
Incandescent (2700K)



Fluorescent (4100K)



CDM (3000K)



# Color Rendering Index

- CRI is an objective standard used to judge how well a light source renders colors compared to a black-body radiator or daylight
  - Incandescent bulbs are, by definition, equal to 100
  - Eight pastel colors are measured under the test light source
- CRI measures how much these colors are affected by the light source

Light Source	CRI
Low pressure sodium	10-20
High pressure sodium	25
Warm white fluorescent tube	55
Typical Cool White LED	70-80
Daylight fluorescent tube	78-80
Metal halide	75-85
Typical Warm White LED	75-85
TruWhite LED Technology	90-95
Halogen MR16	95-100
Incandescent	100

# Color Rendering



82 CRI – 80w

# Color Rendering



92 CRI – 40w

# Color Rendering



One 16w Fluorescent Spot



One 12w LED PAR 38

# Color Rendering



Fluorescent 2' x 4'



LED 2' x 2'

# Usage, kWh Cost, Maintenance

## Datapoints for Each Analysis

	6w LED	50w Halogen
Watts used per lamp :	6	50
Total life of Lamp (in hours) :	50,000	2,000
Life expectancy of Lamp (in months) :	191.8	7.7
Total bulb changes over the life of the LED :	0	2,500
Cooling Weeks :	20	
Number of Fixtures :	100	
New LED Fixture Cost :	\$75	



When does the investment Pay back?



# Low: Usage, kWh Cost, Maintenance

## Usage

Total Annual Usage (in hours) :	3,129	12 hours per day, 5 days a week
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## Kilowatt Hour Cost

Cost per kWh :	\$0.10
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## Maintenance

Bulb replacement time (in minutes) :	10
Labor rate (\$ per hour) :	\$35.00
Halogen bulb replacement cost :	\$2.50

Low occupancy,  
Schools, Day Lit

## ROI and Payback

Lifetime ROI :	32%
Months required to achieve payback using	37.5

## Energy Savings

Annual kWh saved using LED :	13,766
Lifetime kWh saved using LED :	220,000
Lifetime CO2 emissions avoided using LED (in	95
Lifetime Savings using LED :	\$27,360

# High Usage

## Usage

Total Annual Usage (in hours) :	8,760	24 hours per day, 7 days a week
---------------------------------	-------	---------------------------------

## Kilowatt Hour Cost

Cost per KWh :	\$0.10
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## Maintenance

Bulb replacement time (in minutes) :	10
Labor rate (\$ per hour) :	\$35.00
Halogen bulb replacement cost :	\$2.50

Hospitality, City  
Residential, Security

## ROI and Payback

Lifetime ROI :	84%
Months required to achieve payback using	14.0

## Energy Savings

Annual Kwh saved using LED :	38,544
Lifetime Kwh saved using LED :	220,000
Lifetime CO2 emissions avoided using LED (in	95
Lifetime Savings using LED :	\$32,369

# High KWH

## Usage

Total Annual Usage (in hours) :	3,129	12 hours per day, 5 days a week
---------------------------------	-------	---------------------------------

## Kilowatt Hour Cost

Cost per KWh :	\$0.20
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## Maintenance

Bulb replacement time (in minutes) :	10
Labor rate (\$ per hour) :	\$35.00
Halogen bulb replacement cost :	\$2.50

KWH Increases  
are projected

## ROI and Payback

Lifetime ROI :	56%
Months required to achieve payback using	22.6

## Energy Savings

Annual Kwh saved using LED :	13,766
Lifetime Kwh saved using LED :	220,000
Lifetime CO2 emissions avoided using LED (in	95
Lifetime Savings using LED :	\$46,894

# High Maintenance

## Usage

Total Annual Usage (in hours) :	3,129	12 hours per day, 5 days a week
---------------------------------	-------	---------------------------------

## Kilowatt Hour Cost

Cost per kWh :	\$0.10
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## Maintenance

Bulb replacement time (in minutes) :	30
Labor rate (\$ per hour) :	\$35.00
Halogen bulb replacement cost :	\$20.00

Hard to reach,  
Industrial, Outdoor

## ROI and Payback

Lifetime ROI :	86%
Months required to achieve payback using	14.6

## Energy Savings

Annual kWh saved using LED :	13,766
Lifetime kWh saved using LED :	220,000
Lifetime CO2 emissions avoided using LED (in	95
Lifetime Savings using LED :	\$54,748

# Hi: Usage, kWh Cost, Maintenance

## Usage

Total Annual Usage (in hours) :	8,760	24 hours per day, 7 days a week
---------------------------------	-------	---------------------------------

## Kilowatt Hour Cost

Cost per kWh :	\$0.20
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## Maintenance

Bulb replacement time (in minutes) :	30
Labor rate (\$ per hour) :	\$35.00
Halogen bulb replacement cost :	\$20.00

## ROI and Payback

Lifetime ROI :	311%
Months required to achieve payback using	3.9

## Energy Savings

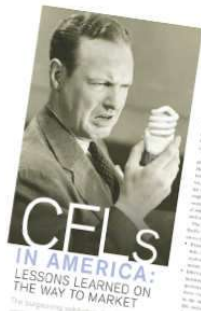
Annual kWh saved using LED :	38,544
Lifetime kWh saved using LED :	220,000
Lifetime CO2 emissions avoided using LED (in	95
Lifetime Savings using LED :	\$89,449

# Credibility – SSL Standards

## SSL Standards Status

Status of ANSI, IESNA, and CIE Solid State Lighting Standards (Partial List)

Standard	Draft	Comment	Comment Resolution	Projected Publication
IESNA RP-16 <i>Definitions</i>	X	X	X	Complete
ANSI 8SR C78.377A <i>Chromaticity</i>	X	X	X	Complete
IESNA LM 79, <i>Luminous Flux</i>	X	X	X	Complete
IESNA LM 80, <i>Lumen Depreciation</i>	X	X	X	Complete
NEMA SSL-1, <i>SSL Drivers</i>	X			
NEMA LSD-44 & 45, (SSL-2) <i>SSL Interconnect</i>	X	X		
NEMA SSL-3, <i>LED Binning</i>	X			
TM-21, <i>Lumen Maintenance Extrapolation Method</i>	X			
NEMA-ALA Joint White Paper <i>Definition of Functional &amp; Decorative Lighting</i>	X			
IESNA LM-xx, <i>LED Light Engine &amp; Lamp Measurement</i>	X			
CIE 009, <i>Photobiological Safety</i>	X	X		



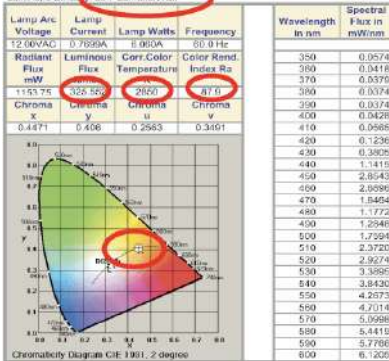
**Illuminating**  
ENGINEERING SOCIETY



# Credibility – Independent Testing



Catalog Number: MR16 LED Replacement Lamp Narrow Beam  
 Luminaire: Aluminum heat sink housing, clear patterned plastic lens.  
 Lamp: One MR16 LED replacement lamp with 7 white LEDs  
 Luminaire Efficacy: 53.7 Lumens/Watt



12 Questions to Ask

TESTING WAS PERFORMED IN ACCORDANCE WITH IES LM-79-08. Approved By:

# Credibility – DOE Programs



U.S. Department of Energy  
Energy Efficiency and Renewable Energy

Programs provide unbiased information, education, tools

- CALiPER reports offer independent test results, analysis of market trends
- Quality Advocates promote truth in advertising
- Design competitions recognize quality products

Growing arsenal of reports, analysis, product lists



CALiPER

lighting  
facts

SSL Quality Advocates

## Lighting Facts™

LED Product

Light Output (Lumens)	840
Watts	9
Lumens per Watt (Efficacy)	93

Color Accuracy	87
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Color Rendering Index (CRI)

Light Color  
Correlated Color Temperature (CCT) 3100 (Warm White)



Visit [www.lightingfacts.com](http://www.lightingfacts.com) for the Label Reference Guide.

All marks are according to IESNA LM-79-08. Approved Method for the Electrical and Photometric Testing of Solid-State Lighting. Issue 4: 1/15/09 (1/15/09) 4/15/09

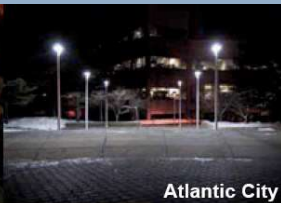
# Credibility – DOE Gateway Demos



U.S. Department of Energy  
Energy Efficiency and Renewable Energy

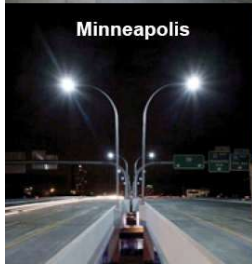


San Francisco



Atlantic City

**GATEWAY  
Demos**



Minneapolis



Oakland



Portland

18

# Am I An Early Adopter??

The following organizations are either using or testing LED down-light products:

 **Bank Financial Group**



 **PNC**

 **Harris Teeter**  
Your Neighborhood Food Market

*Johnson & Johnson*



 **Sheraton**  
HOTELS & RESORTS

 **IHOP**  
celebrating 50 years



**Bank of America** 



**THE CLEVELAND CLINIC** 

**Walmart**   
Save money. Live better.

**Albert Einstein Healthcare Network**

**Marriott** 

*Friendly's*  
 *Pizza Inn*

**Denny's**

**BEN & JERRY'S**  
All Natural  
VERMONT'S FINEST

# Leading the LED Lighting Revolution

McDonald's

## McDonald's



*Courtesy of  
Derry Berrigan,  
DBLD*

- **52%/70% below ASHRAE 90.1 2007 (interior/exterior)**
- **78% energy reduction from baseline store**
- **97% of lighting is high-performance LEDs**

# Leading the LED Lighting Revolution

YUM Brands

## Yum Brands



- 46%/77% below ASHRAE 90.1 2007 (interior/external)
- 81% energy reduction from baseline store
- 95% of lighting is high-performance LEDs



Courtesy of  
Derry Berrigan,  
DBLD



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