Shining a Light on Energy Savings: LED Conversion at the Indianapolis Museum of Art

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NEWFIELDS

A PLACE FOR NATURE & THE ARTS

COMING EARLY OCTOBER

Newfields Campus Overview

- Indianapolis Museum of Art
- Virginia B. Fairbanks Art and Nature Park:
  - 100 Acres
- Lilly House and Gardens – Oldfields
- Miller House and Gardens
- Westerley House and Garden

IMA's Collection

- The IMA has an encyclopedic collection of approximately 54,000 works of art representing more than 5,000 years of art and culture from around the world including:
  - African art
  - American and European painting and sculpture
  - Antiquities
  - Asian porcelain, bronzes and paintings
  - Decorative Arts and Contemporary Design
  - Contemporary Art

Why LED?

- 2006: IMA became an Energy Star Partner
- 2007: Energy Independence and Security Act was issued in US
- 2009: IMA began investigating existing LEDs for campus-wide conversion
- 2018: Conversion complete

Experiments

Eiteljorg Suite of African and Oceanic Art, Installation view 2012

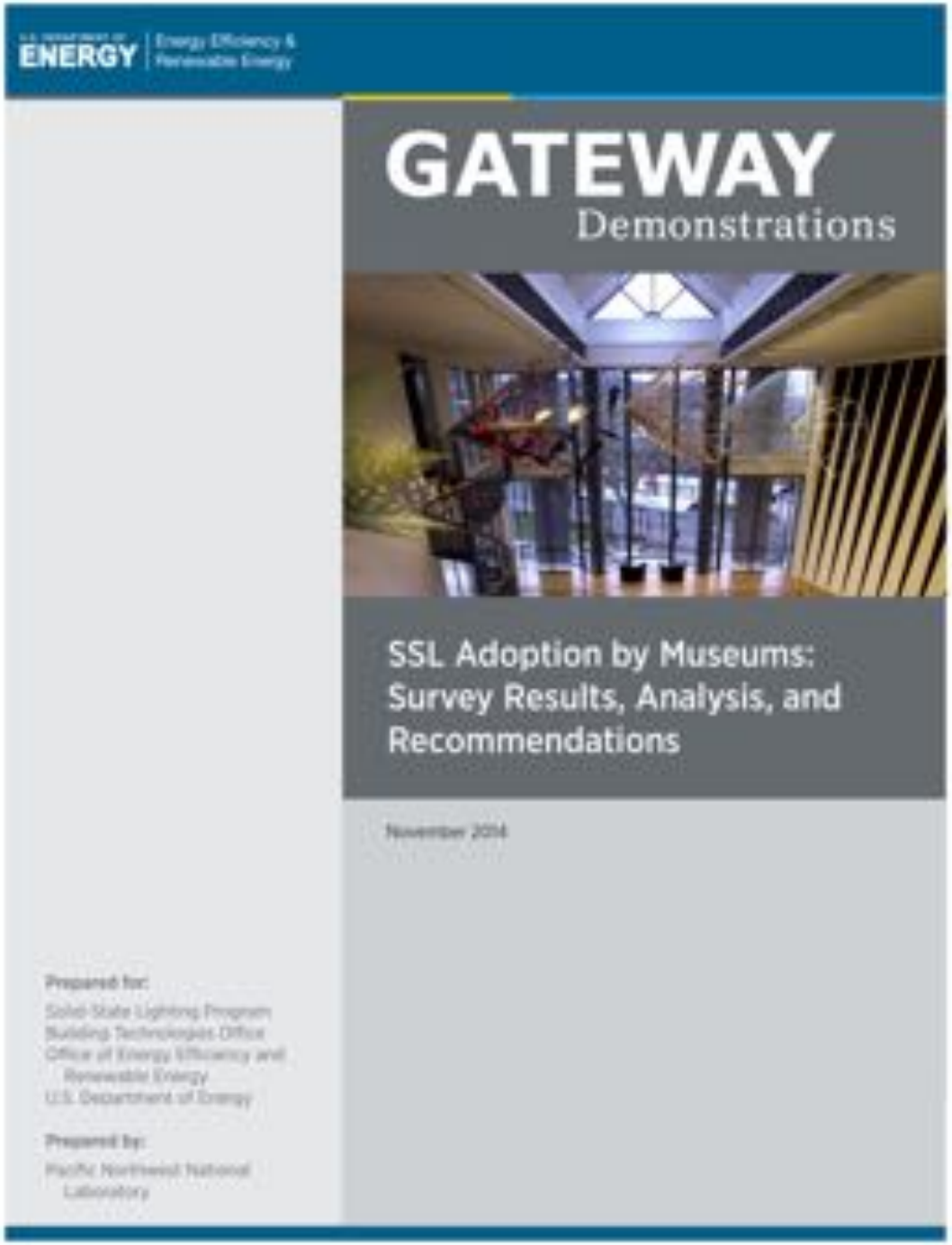
Experiments

Before

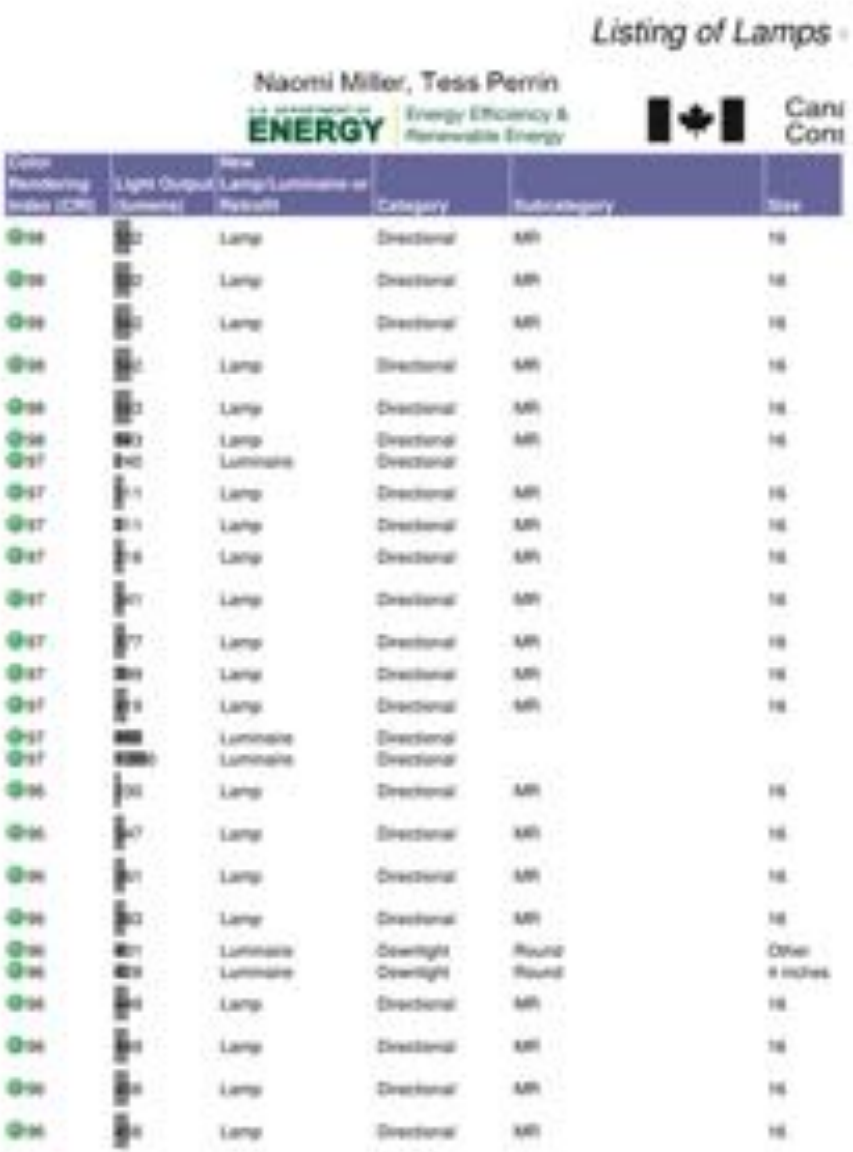
After

Frederick Wilson, designer, Tiffany Studios, manufacturer, *Angel of the Resurrection* (detail), 1903-1904. Indianapolis Museum of Art at Newfields, Gift of the First Meridian Heights Presbyterian Church, Indianapolis, 72.75

Research


ENERGY
Energy Efficiency &
GATEWAY
Demonstrations
SSL Adoption by Museums:
Survey Results, Analysis, and
Recommendations
November 2014
Prepared for:
Solid-State Lighting Program
Building Technologies Office
Office of Energy Efficiency and
Renewable Energy
U.S. Department of Energy
Prepared by:
Pacific Northwest National
Laboratory

Research



Listing of Lamps

Naomi Miller, Tess Perrin

ENERGY Energy Efficiency & Renewable Energy

Cani Com

Color Rendering Index (CRI)	Light Output (lumens)	New Lamp/Luminaire or Retrofit	Category	Subcategory	Size
98	[illegible]	Lamp	Directional	MR	16
98	[illegible]	Lamp	Directional	MR	16
98	[illegible]	Lamp	Directional	MR	16
98	[illegible]	Lamp	Directional	MR	16
98	[illegible]	Lamp	Directional	MR	16
98	[illegible]	Lamp	Directional	MR	16
97	[illegible]	Luminaire	Directional		
97	[illegible]	Lamp	Directional	MR	16
97	[illegible]	Lamp	Directional	MR	16
97	[illegible]	Lamp	Directional	MR	16
97	[illegible]	Lamp	Directional	MR	16
97	[illegible]	Lamp	Directional	MR	16
97	[illegible]	Lamp	Directional	MR	16
97	[illegible]	Lamp	Directional	MR	16
97	[illegible]	Luminaire	Directional		
97	[illegible]	Luminaire	Directional		
96	[illegible]	Lamp	Directional	MR	16
96	[illegible]	Lamp	Directional	MR	16
96	[illegible]	Lamp	Directional	MR	16
96	[illegible]	Lamp	Directional	MR	16
96	[illegible]	Luminaire	Downlight	Round	Other
96	[illegible]	Luminaire	Downlight	Round	6 inches
94	[illegible]	Lamp	Directional	MR	16
94	[illegible]	Lamp	Directional	MR	16
94	[illegible]	Lamp	Directional	MR	16
94	[illegible]	Lamp	Directional	MR	16

Research - Schnitzer Model

Wilkinson Test Gallery using Schnitzer model

Lamp Selection - Blind Test

	Type of lamp	Description	Wattage/ K	Lumens	Life (at 9 hours per day)	Yearly energy cost at 3 hours (at 9 hours per day)
A	*Philips LED*	Indoor spot/PAR30L/flood	10.5/ 3000K	750	25,000 hours/ 7.6 years	$1.26 yearly ($3.79 yearly)
B	*G.E. LED*	15 degree spot/PAR30	12/ 2700K	820	25,000 hours/ 7.6 years	$1.45 yearly ($4.34 yearly)
C	*Sylvania Ultra High Definition LED*	15 degree spot/PAR30	11/ 3000K	650	25,000 hours/ 7.6 years	$1.32 yearly ($3.97 yearly)
D	*Cree LED*	20 degree/PAR38	12/ 2700K	600	50,000 hours/ 15.2 years	$1.45 yearly ($4.34 yearly)
E	*Sylvania Double Life Halogen*	10 degree spot/PAR30	60/ 2850K	1100	2.7 years/ .91 of a year	$7.23 yearly ($21.68 yearly)
F	*Soraa LED*	9 degree spot/PAR30	18.5/ 2700K	1190	32 years	$2.23 yearly ($6.68 yearly)

Blind Test-Questionnaire

Lighting Questionnaire for Indianapolis Museum of Art

Your name (optional):_____ Title (optional):_____

Please circle the response that most closely matches your own opinion for each of the four groups of artwork. We are interested in your honest opinion.

1. The pattern of light (smoothness or unevenness) on the art is:

A	B	C	D	E	F
Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable
Poor	Poor	Poor	Poor	Poor	Poor
Fair	Fair	Fair	Fair	Fair	Fair
Good	Good	Good	Good	Good	Good
Excellent	Excellent	Excellent	Excellent	Excellent	Excellent

2. Look at the color appearance of the light on each set of artworks. "Cool" means bluish-white in color, and "Warm" means yellowish-white or reddish-white.
   The lighting on the art is:

A	B	C	D	E	F
Too cool	Too cool	Too cool	Too cool	Too cool	Too cool
Somewhat cool	Somewhat cool	Somewhat cool	Somewhat cool	Somewhat cool	Somewhat cool
Just right	Just right	Just right	Just right	Just right	Just right
Somewhat warm	Somewhat warm	Somewhat warm	Somewhat warm	Somewhat warm	Somewhat warm
Too warm	Too warm	Too warm	Too warm	Too warm	Too warm

3. The light's ability to render the artwork colors accurately is:

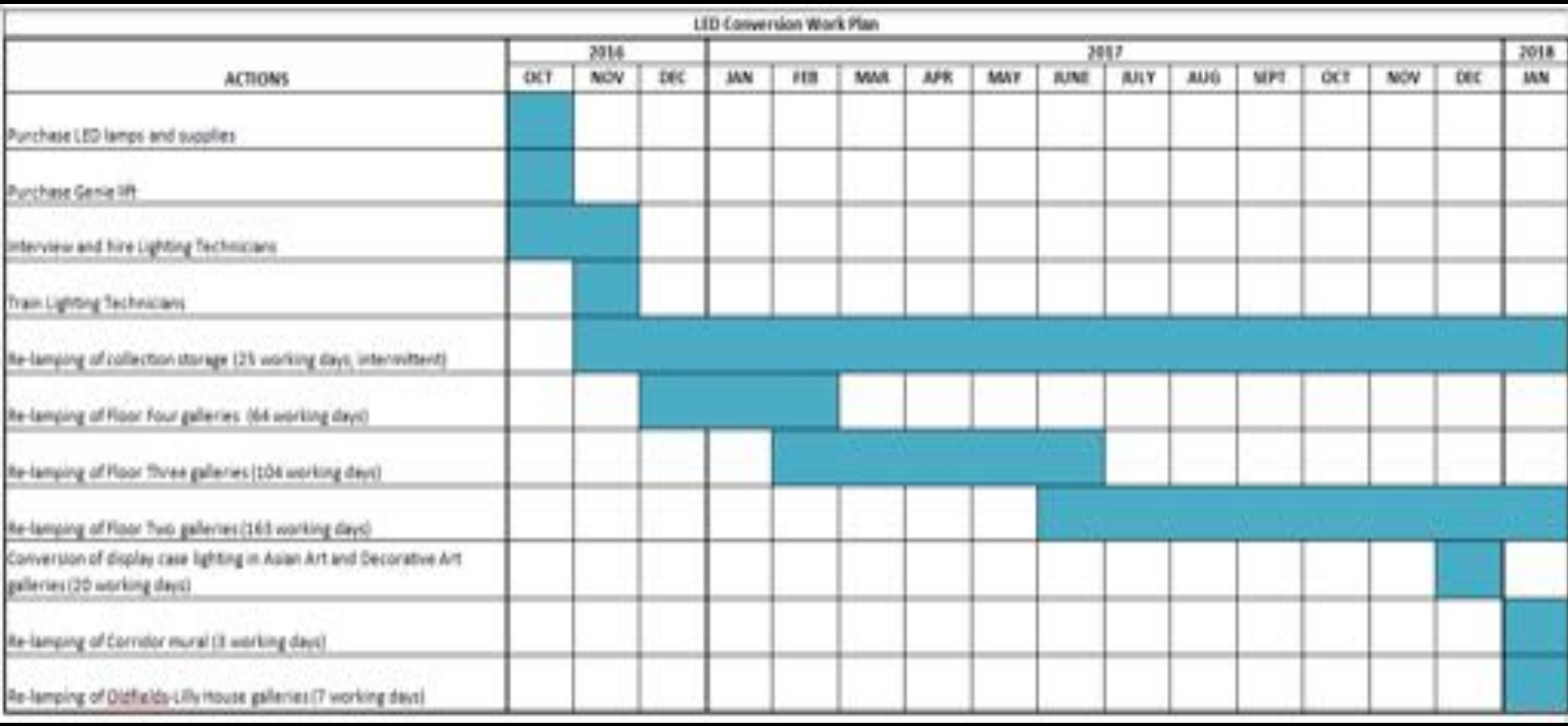
A	B	C	D	E	F
Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable
Poor	Poor	Poor	Poor	Poor	Poor
Fair	Fair	Fair	Fair	Fair	Fair
Good	Good	Good	Good	Good	Good
Excellent	Excellent	Excellent	Excellent	Excellent	Excellent
Reason:_____	Reason:_____	Reason:_____	Reason:_____	Reason:_____	Reason:_____

(Reasons might include "richer reds," "better blues," etc.)

Live Test

Andrew and Jane Paine Galleries,
Installation view American Art

Plan of Work


LED Conversion Work Plan
ACTIONS
2016
2017
2018
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEPT
OCT
NOV
DEC
JAN
Purchase LED lamps and supplies
Purchase Genie lift
Interview and hire Lighting Technicians
Train Lighting Technicians
Re-lamping of collection storage (25 working days, intermittent)
Re-lamping of Floor Four galleries. (64 working days)
Re-lamping of Floor Three galleries (104 working days)
Re-lamping of Floor Two galleries (163 working days)
Conversion of display case lighting in Asian Art and Decorative Art galleries (20 working days)
Re-lamping of Corridor mural (3 working days)
Re-lamping of Oldfields-Lilly House galleries (7 working days)

Light Fixture Conversion

Remove bulb, lens holder, filter(s), len(s), baffle, scrim(s)

Light Fixture Conversion

Use hole template to locate drill points on top of fixture to create air flow holes

Light Fixture Conversion

Drill holes with drill press

Light Fixture Conversion

Modify lens holder with pliers to create air flow apertures between lens and holder

Light Fixture Conversion

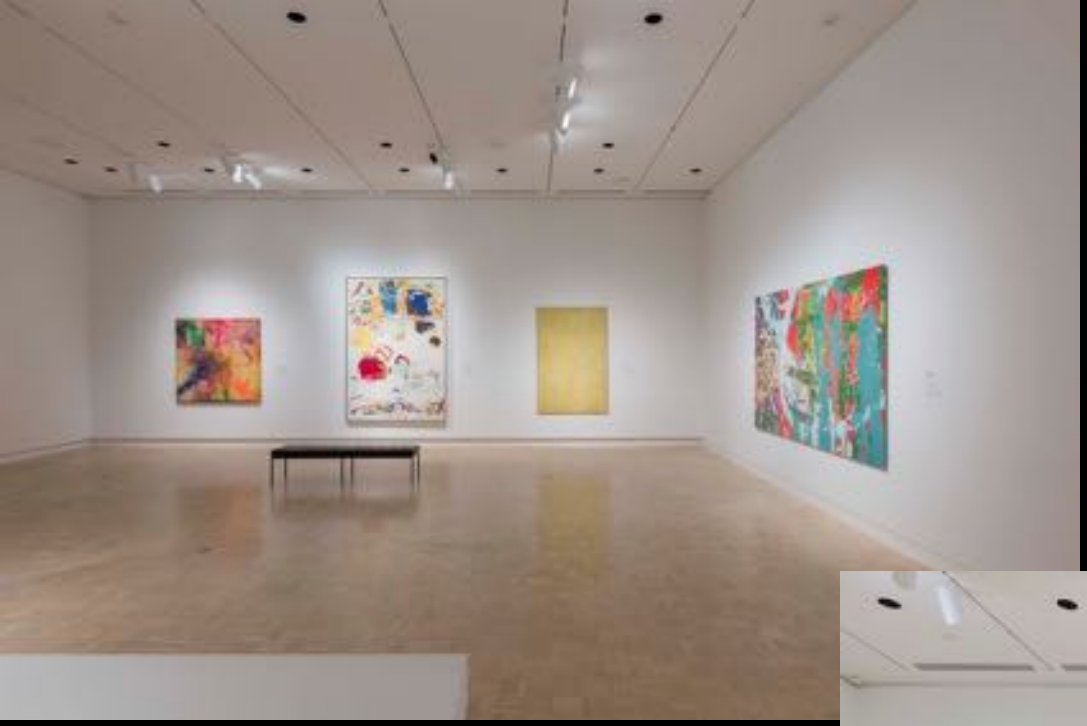
Insert lens into holder; insert holder into can snout; insert LED bulb in fixture; date bulb and close fixture

Statistics

- 4,880 lamps replaced in galleries
- 13 months
- 2 people
- 4 gallery levels
- 10 art storage / prep areas
- 1 historic house

Results - LED vs. Halogen

Andrew and Jane Paine Galleries, Installation view American Art



Nicholas H. and Marguerite L. Noyes Gallery, Installation view Contemporary Art

Christel DeHaan Family Foundation Galleries,
Installation view American Art

Gerald and Dorit Paul Galleries,
Installation view Suite for Textiles and Fashion Arts

Steve and Livia Russell Gallery, Installation View
Contemporary Design

Outcome: Benefits

- Reduced number of lamps by one third
- Reduced energy consumption:
  - Previous wattage total using halogen:…..152,653 watts
  - Current wattage using LED:……31,404 watts
  - Difference:……121,249 watts
- Completely eliminated UV
- LED Light is more intense
- Improved color rendering
- Lamps last 5x longer
- Less labor to change lamps
- Reduced annual operating expenses

Outcome: Challenges

- Potential for heat build-up inside fixture
- Textiles and upholstered surfaces are more challenging to light
- LED technology is constantly evolving
- Potential increase in gas usage for heat since LED lamps are cooler

QUESTIONS?

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