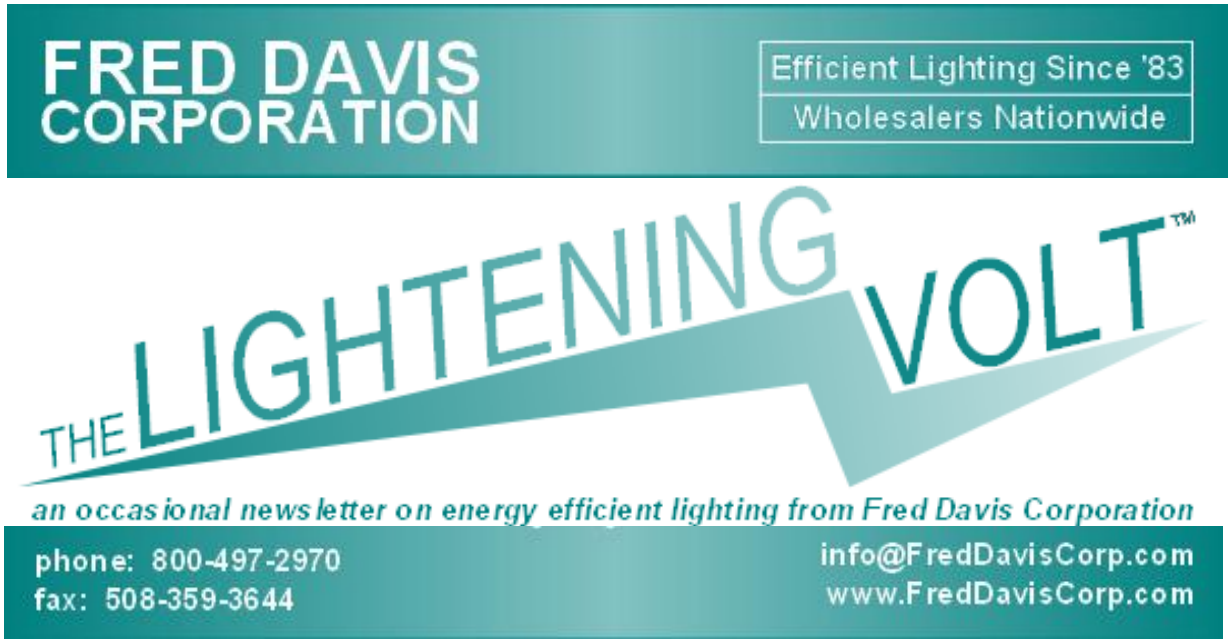
Fred Davis Lighting Sessions Moderator

NESEA
BuildingEnergy 2015
WTC, Boston



Please subscribe to our free occasional e-newsletter on developments in efficient lighting

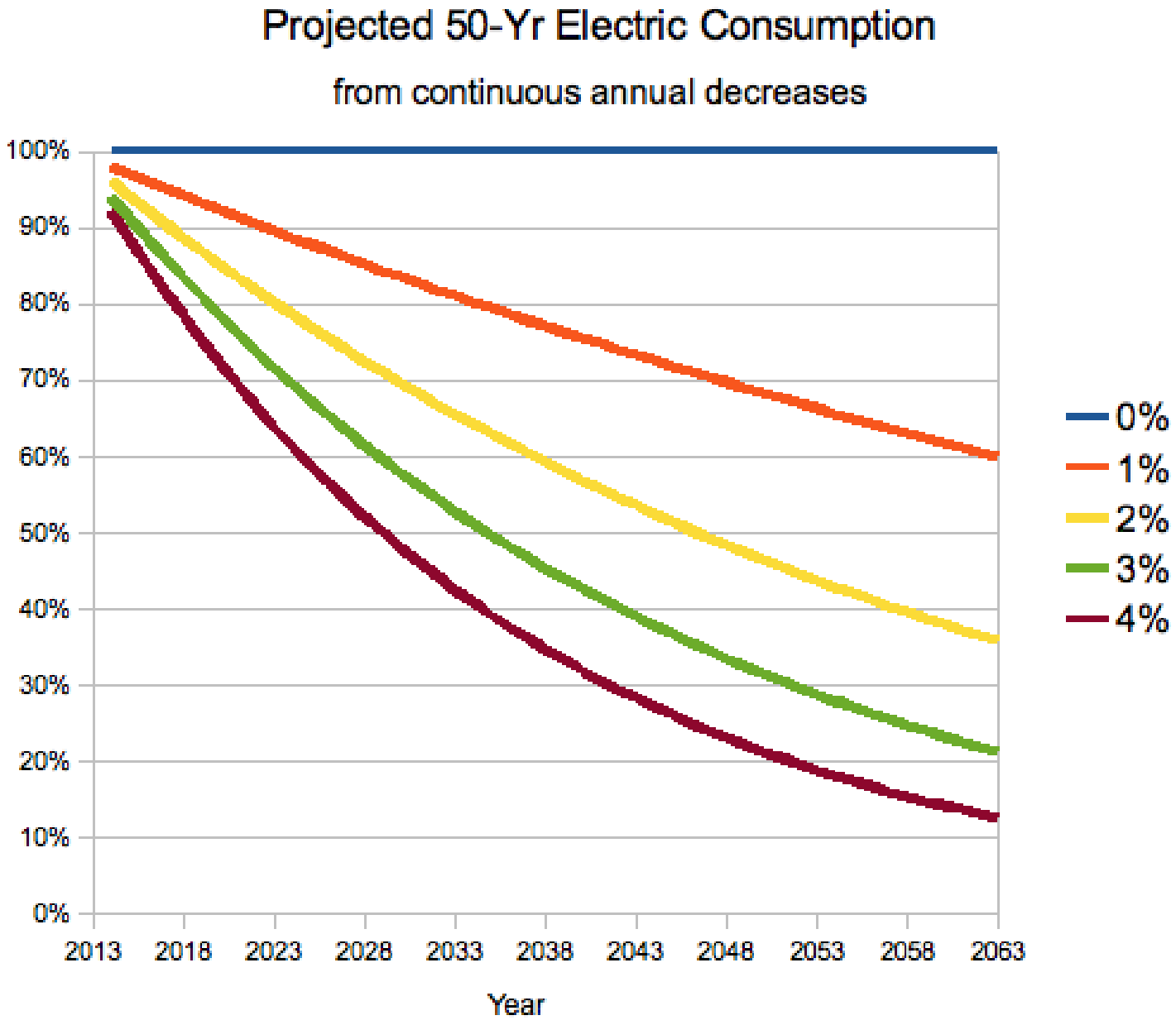
...and stop by our booth.

We must reduce use of fossil fuels 80% by 2050.

It is up to all of us.

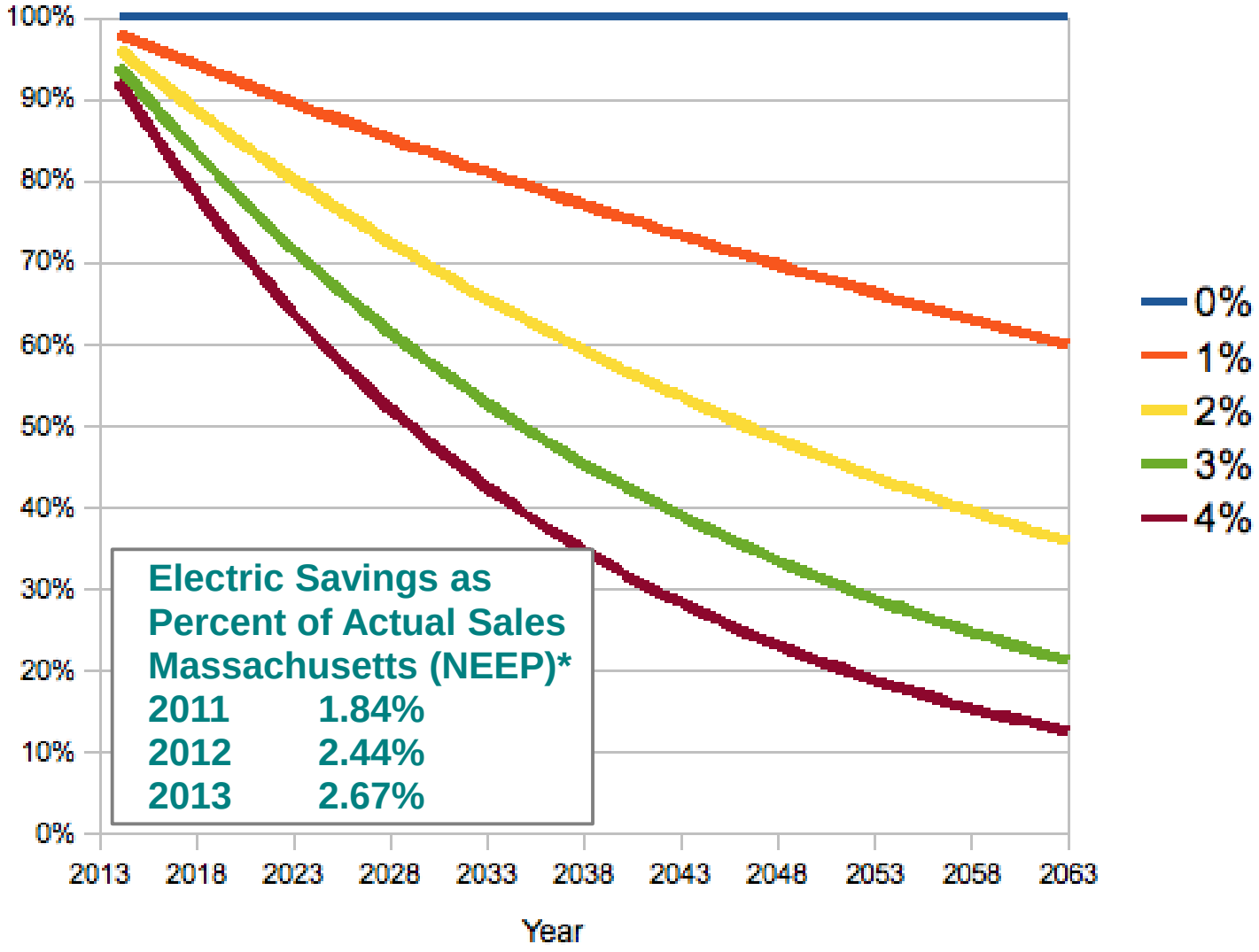
We must save 80% by 2050.

Anyone know how to do that?


Projected 50-Yr Electric Consumption
from continuous annual decreases
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
2013
2018
2023
2028
2033
2038
2043
2048
2053
2058
2063
Year
0%
1%
2%
3%
4%

Projected 50-Yr Electric Consumption

from continuous annual decreases



* Gross Annual Energy Savings Electric Meter Level
Northeast Energy Efficiency Partnerships, Inc. Regional Energy Efficiency Database. Retrieved 2/26/15,from www.neep-reed.org

Fred's Formidable Formula:

If efficiency doubles,

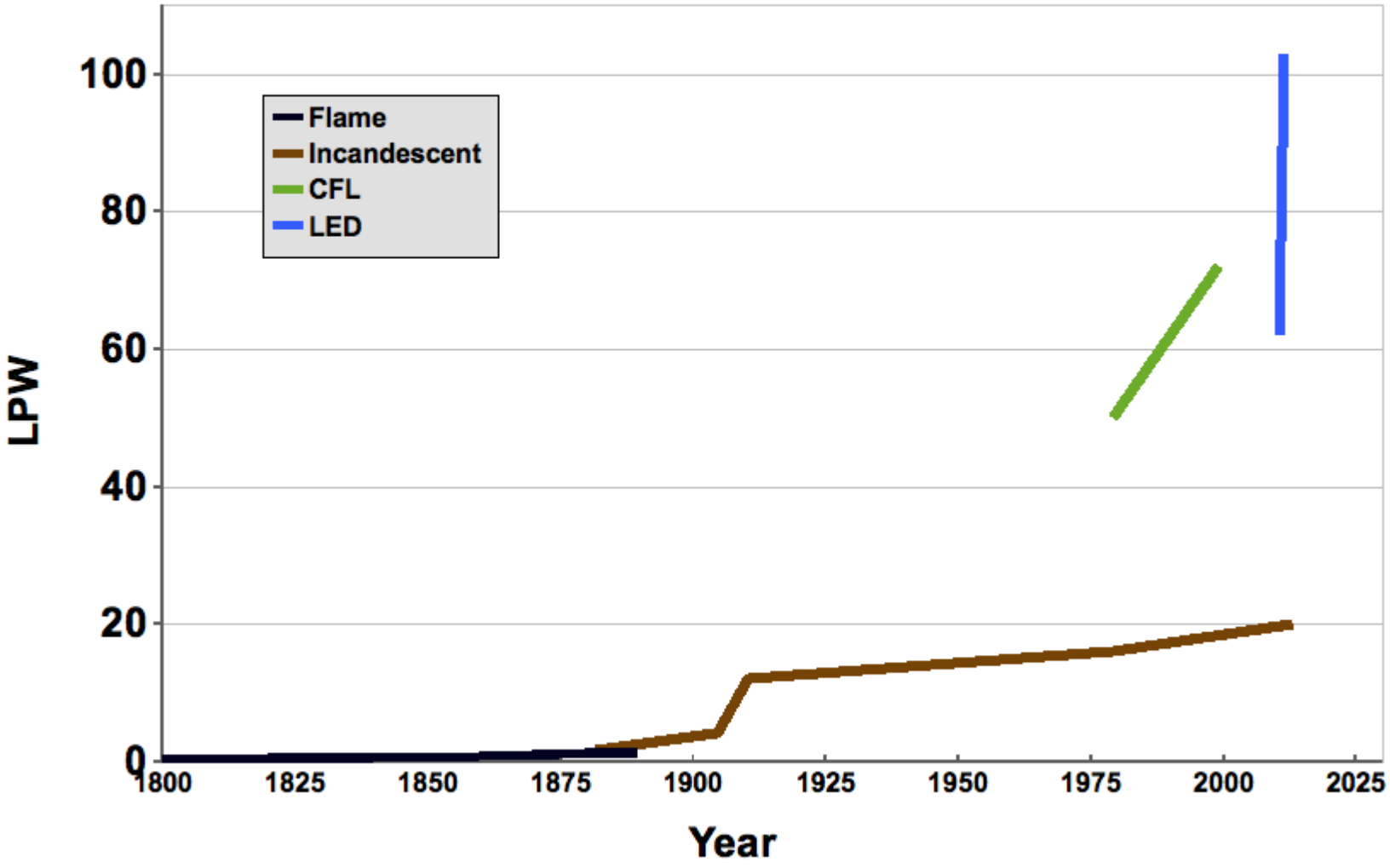
and amenity halves,

that's a net 75% reduction.

Historical Context

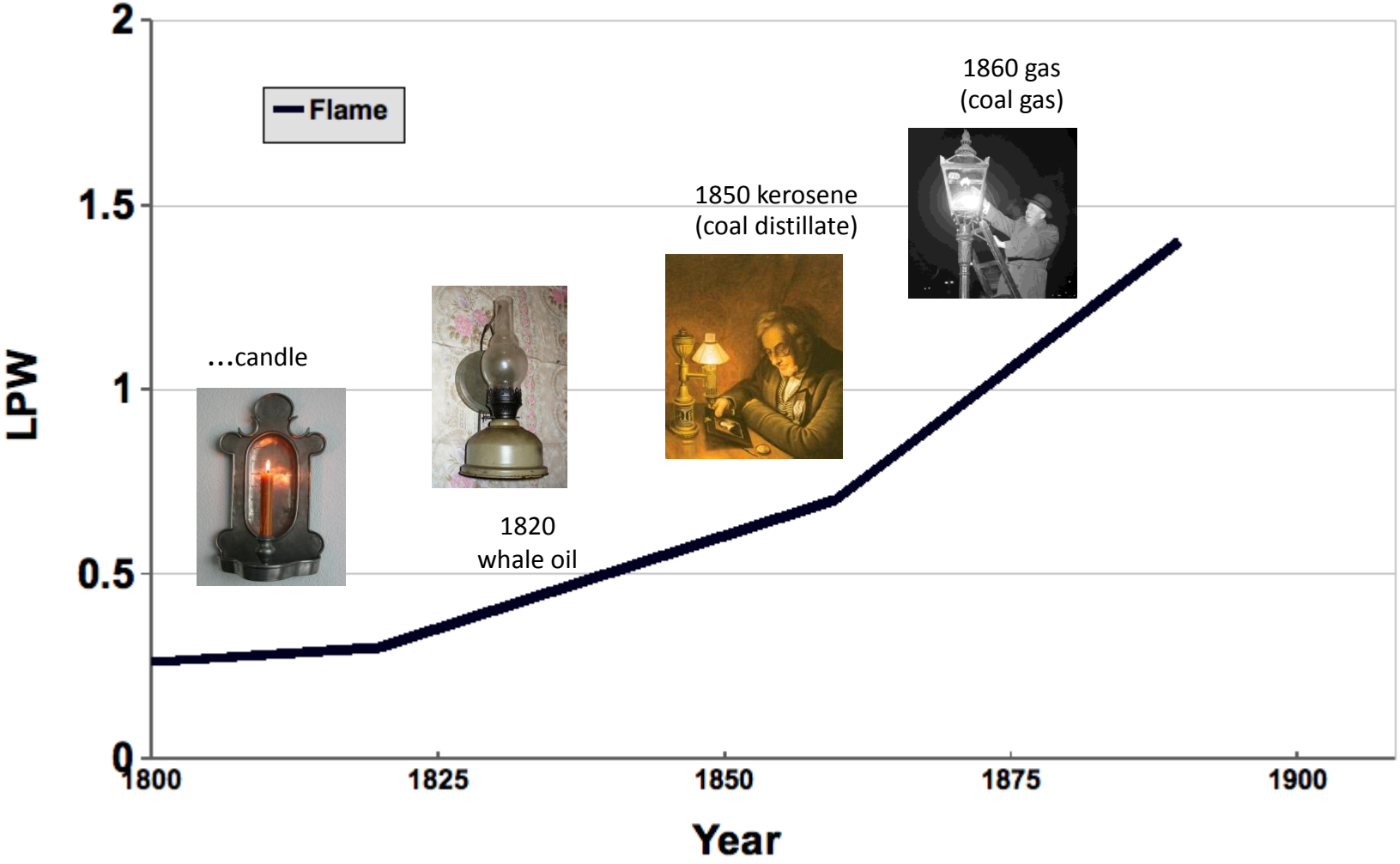
History of Lamp Efficiency

Best Source Efficacy in Lumens per Watt

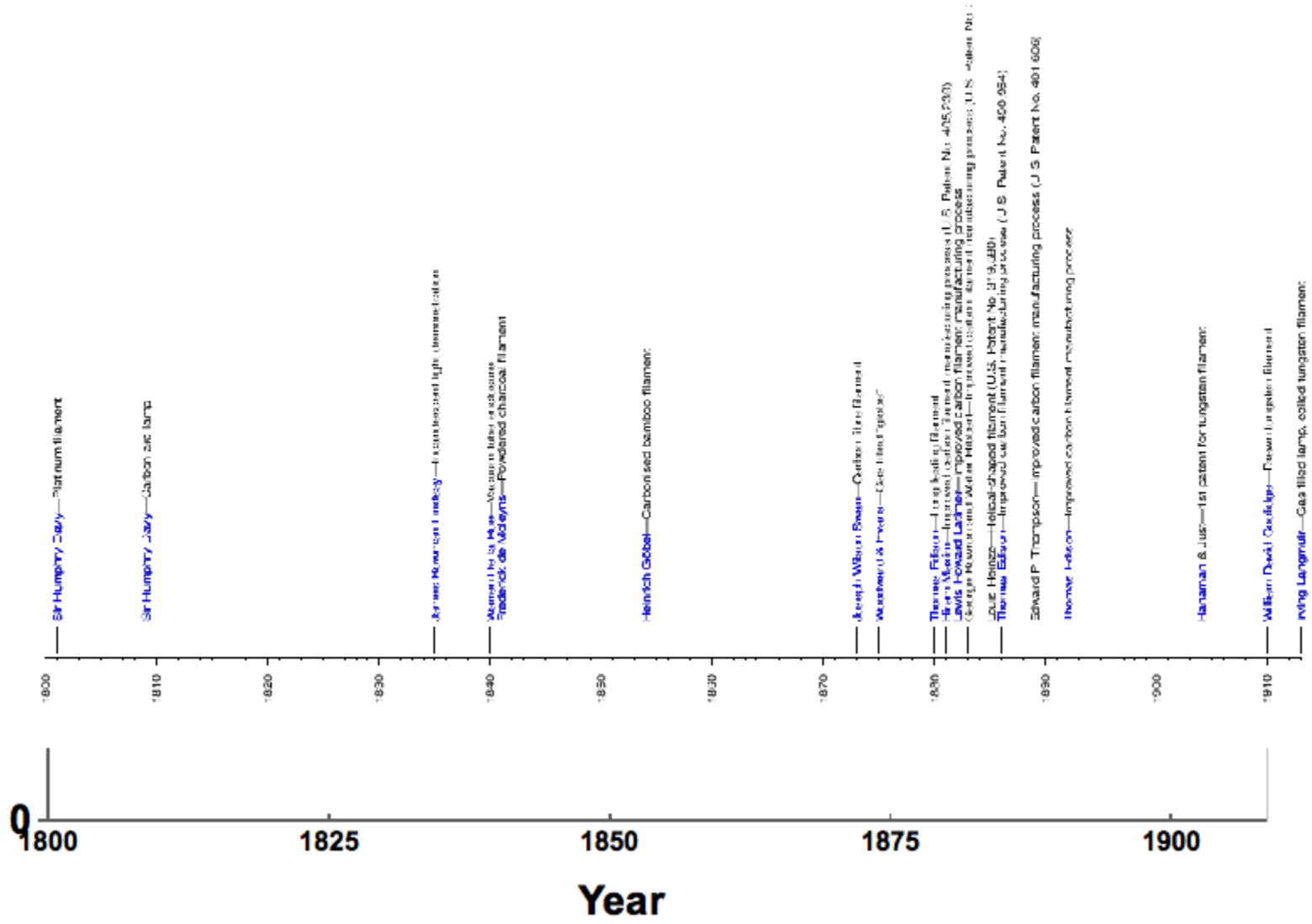


History of Lamp Efficiency

Best Source Efficacy in Lumens per Watt



History of Lamp Efficiency



History of Lamp Efficiency

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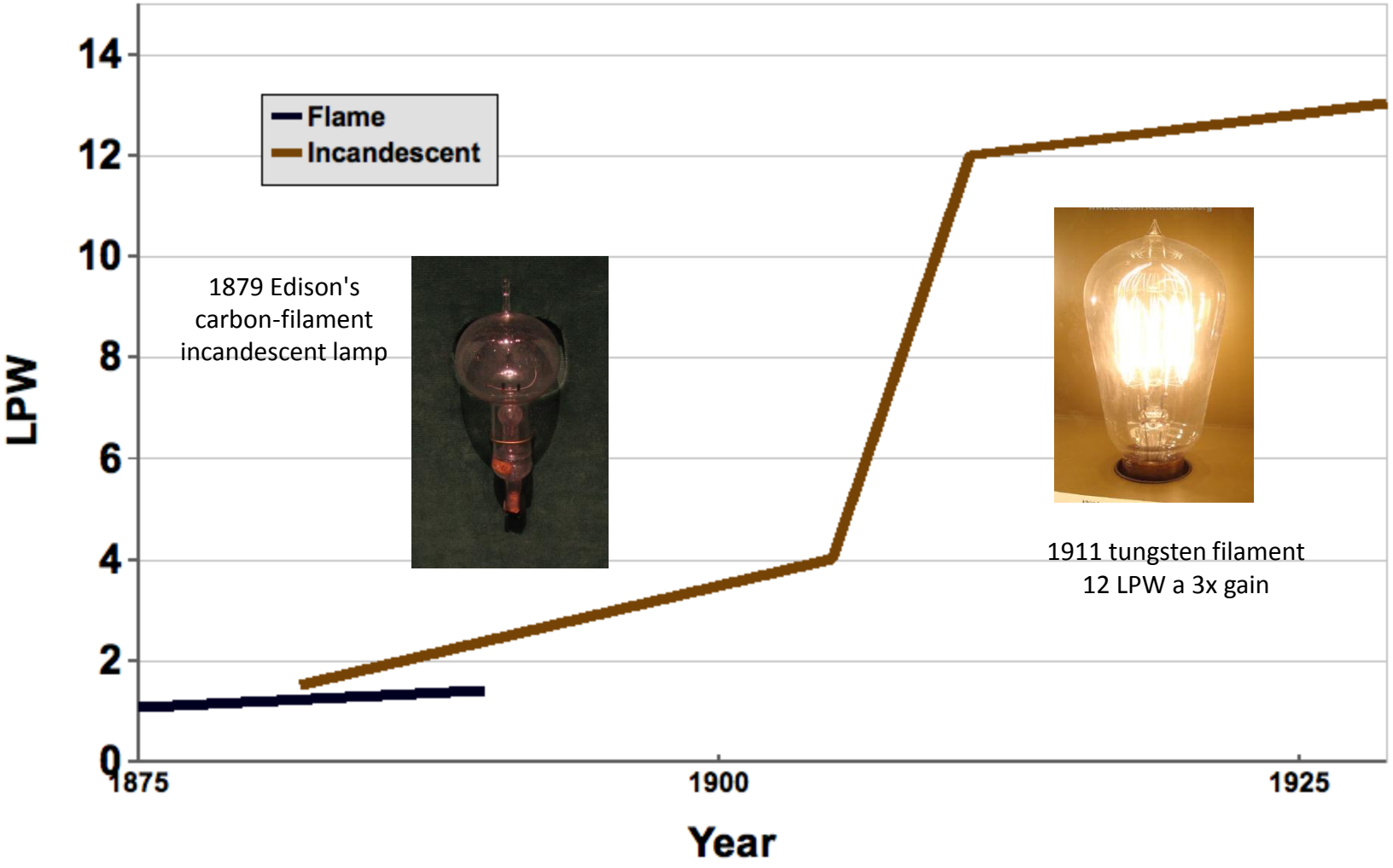


“Vintage” or “antique” incandescents are being sold today.
Appropriate in museums...if turned off.
Otherwise they should be illegal.

60 watts
305 lumens

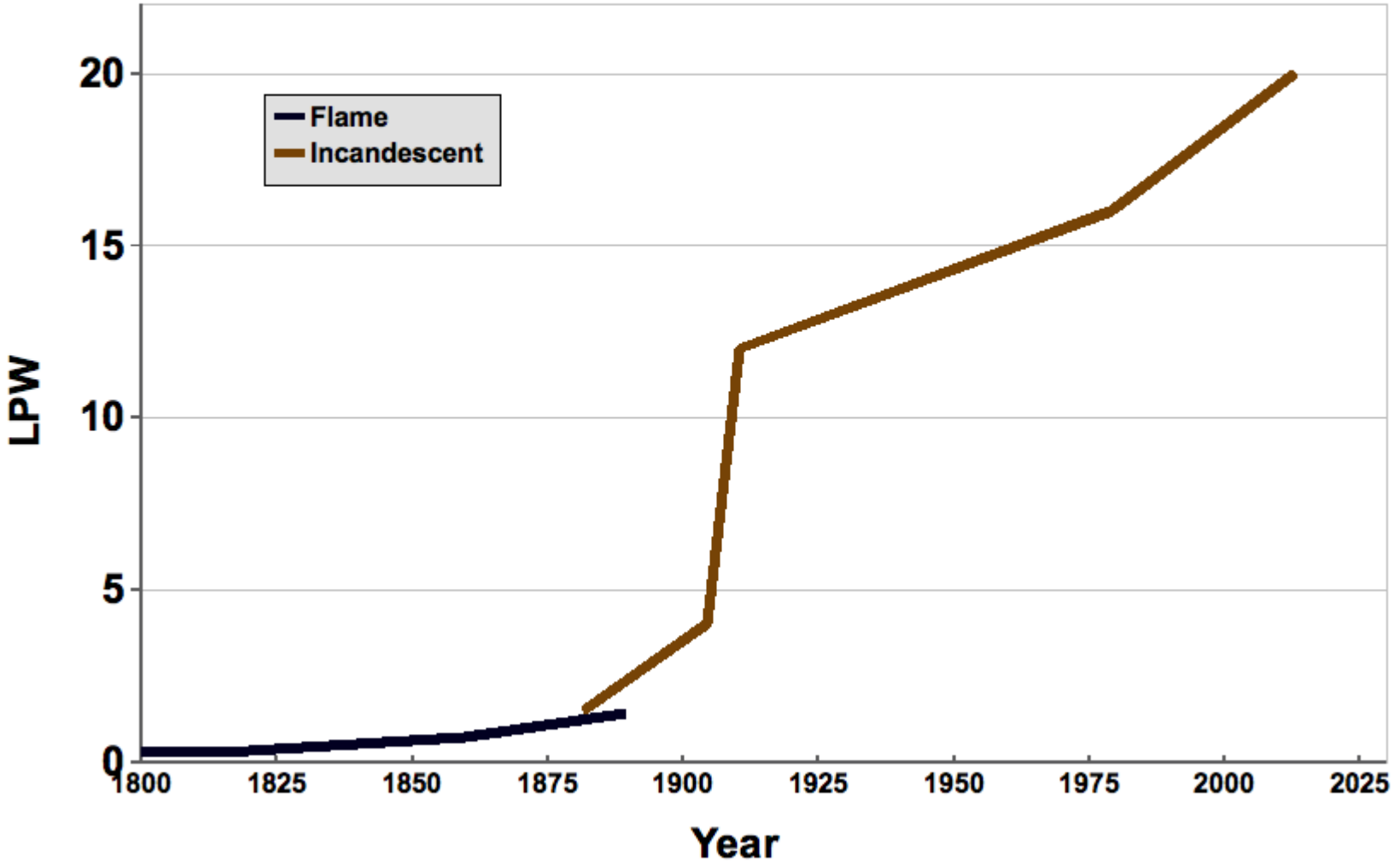
= 5 LPW !!!

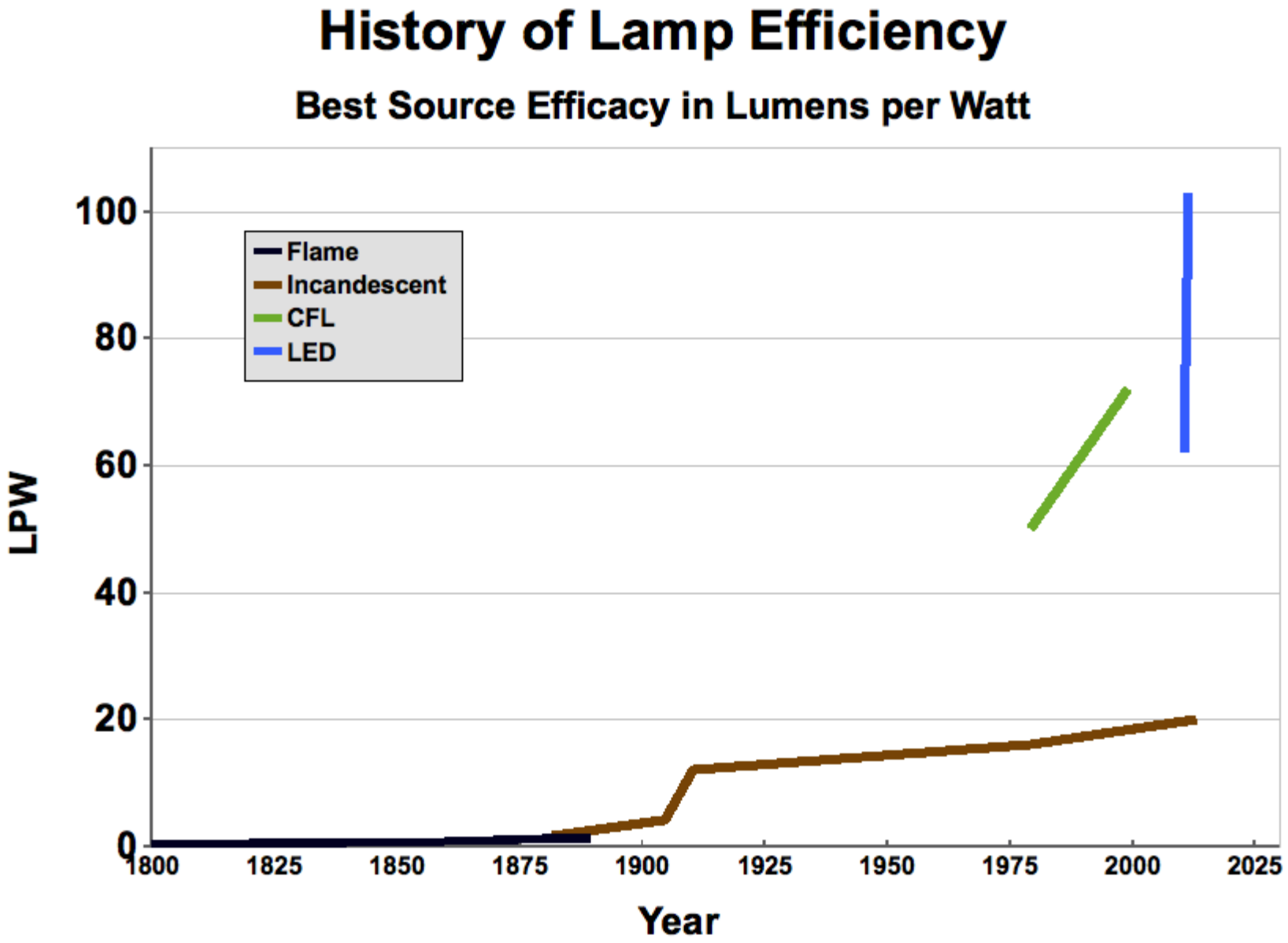
Efficacy is circa <u>1900</u>!
Predates tungsten filament!

Please educate people.

History of Lamp Efficiency

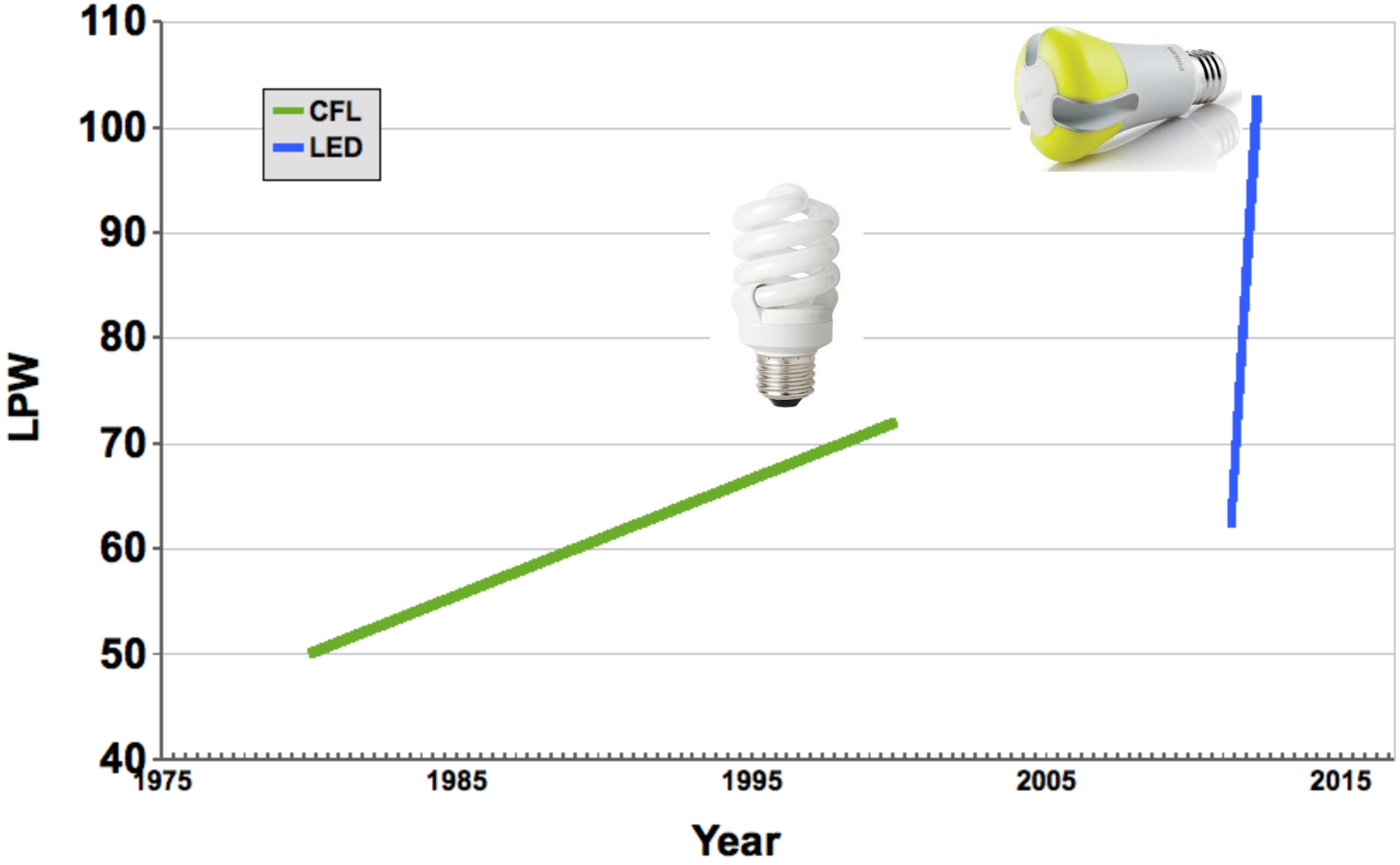
Best Source Efficacy in Lumens per Watt




History of Lamp Efficiency
Best Source Efficacy in Lumens per Watt
Flame
Incandescent
CFL
LED
LPW
100
80
60
40
20
0
1800
1825
1850
1875
1900
1925
1950
1975
2000
2025
Year

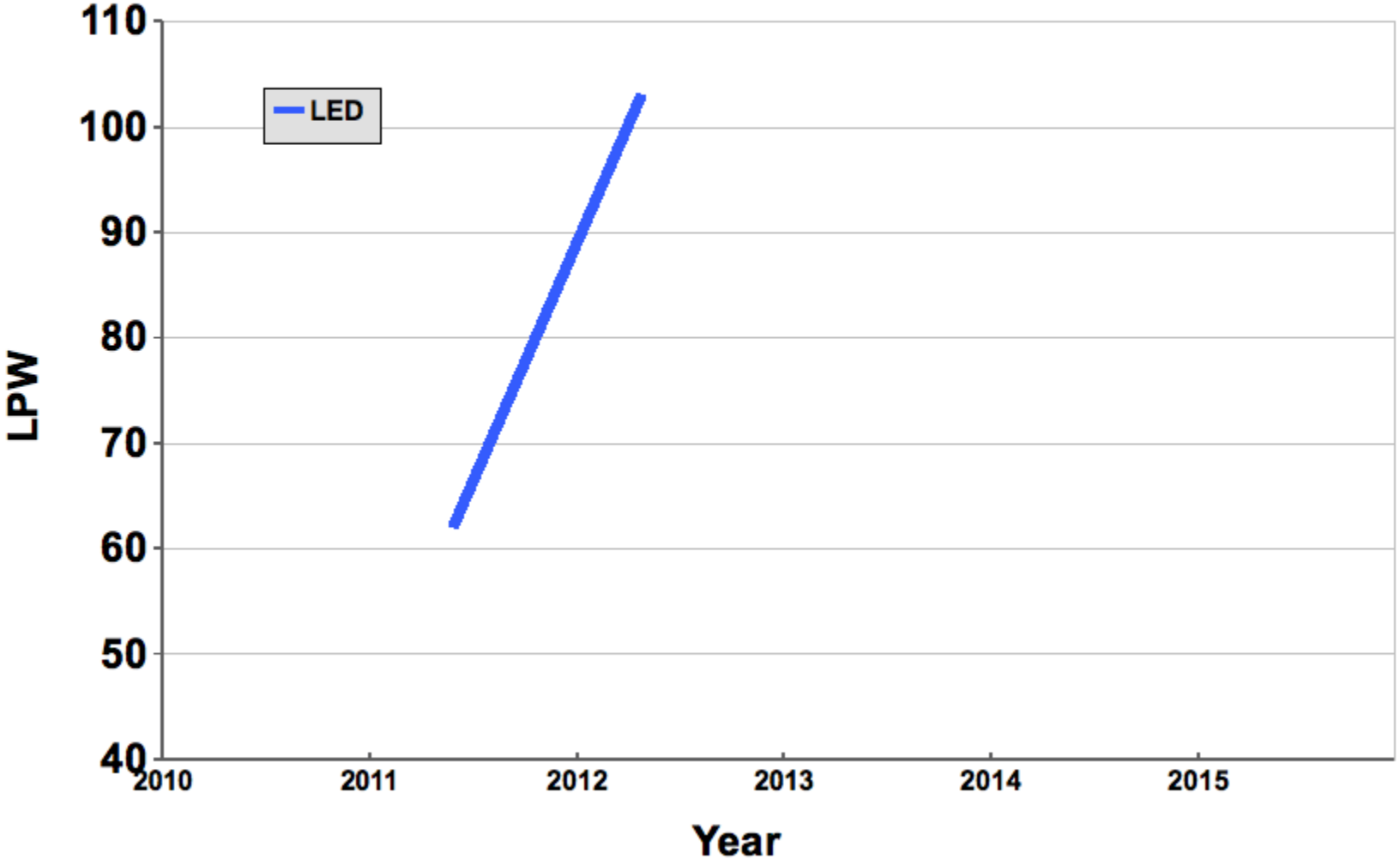
History of Lamp Efficiency

Best Source Efficacy in Lumens per Watt



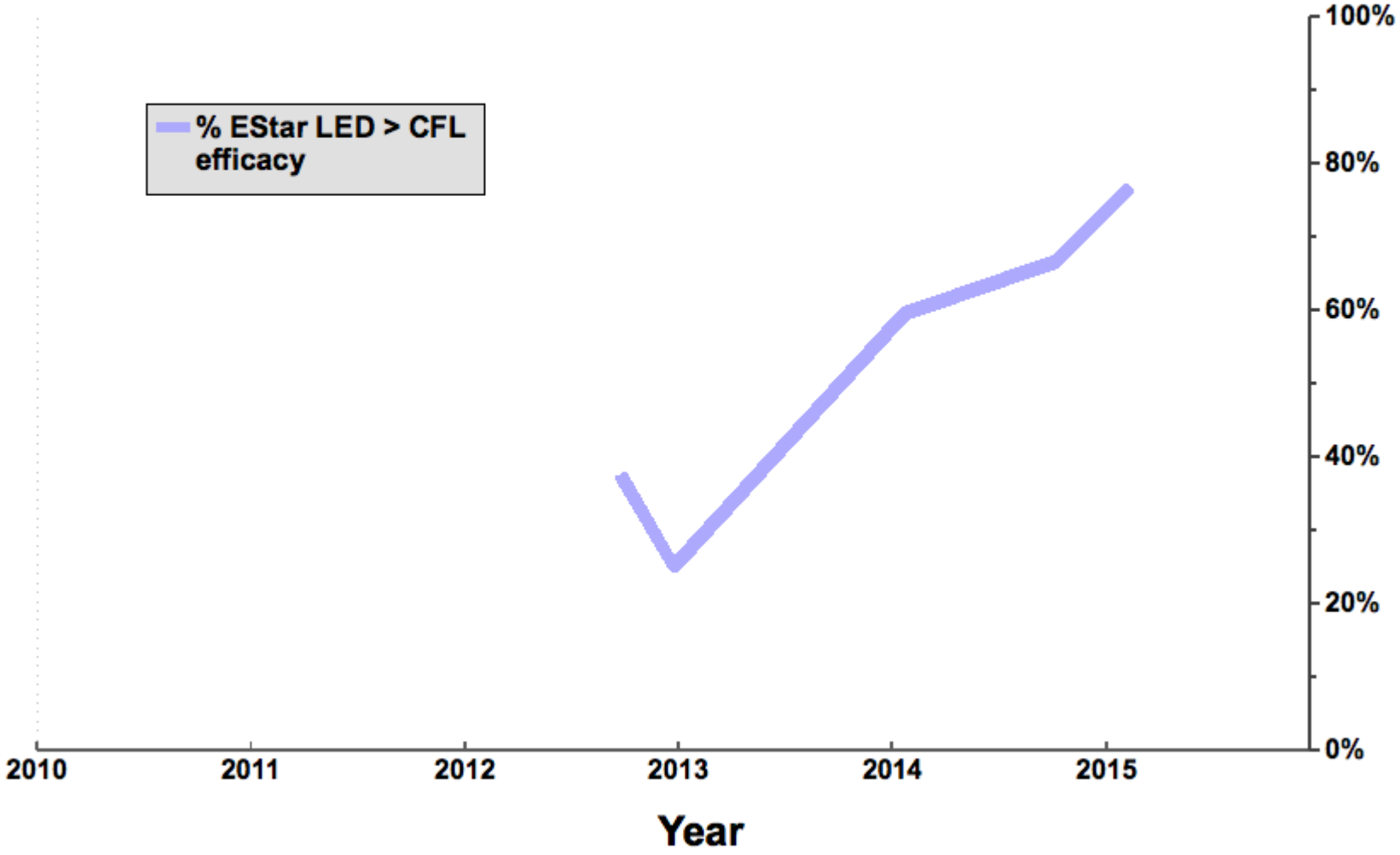
History of Lamp Efficiency

Best Source Efficacy in Lumens per Watt



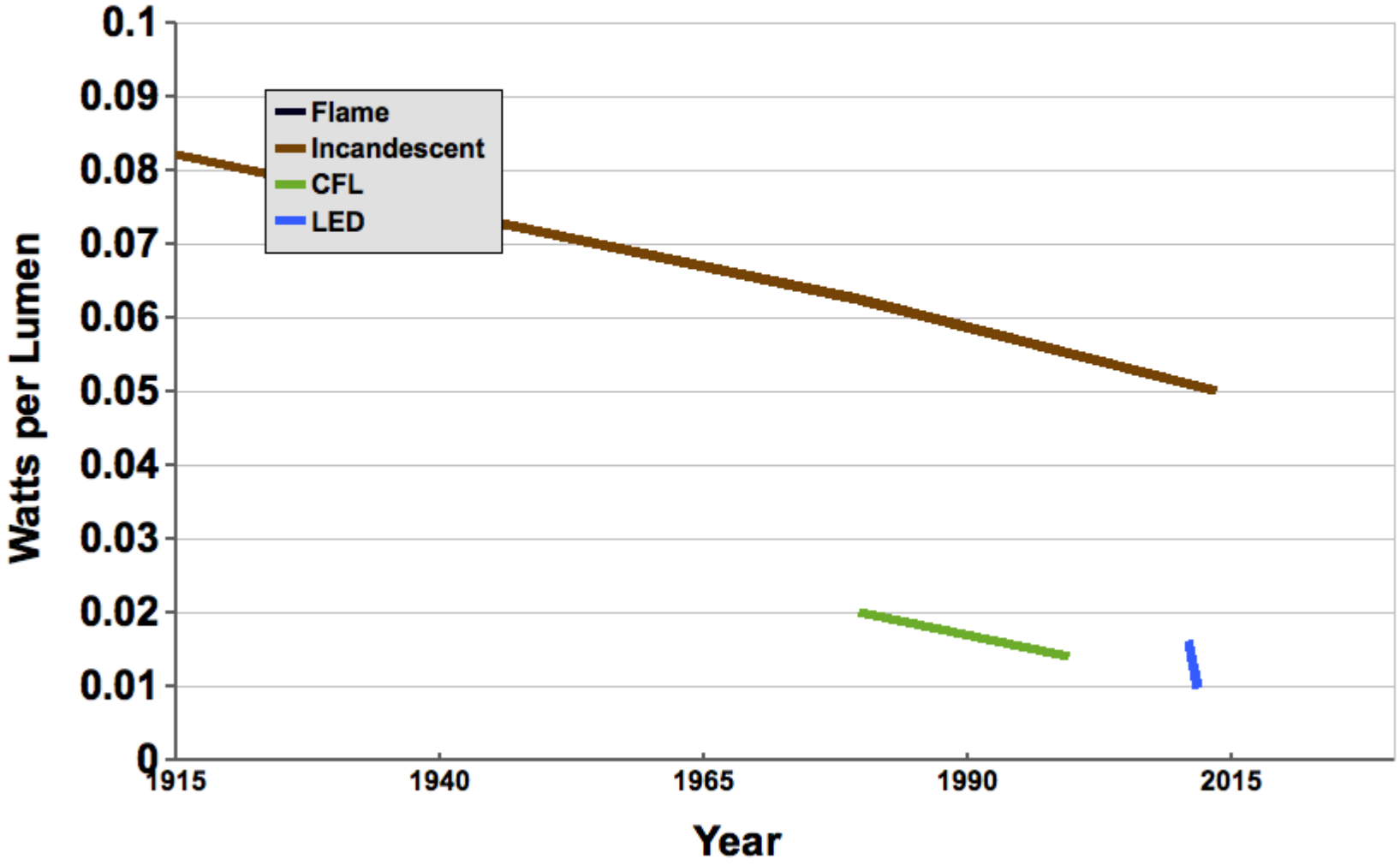
History of Lamp Efficiency

Percentage of LED A-Lamps Beating CFL Efficacy

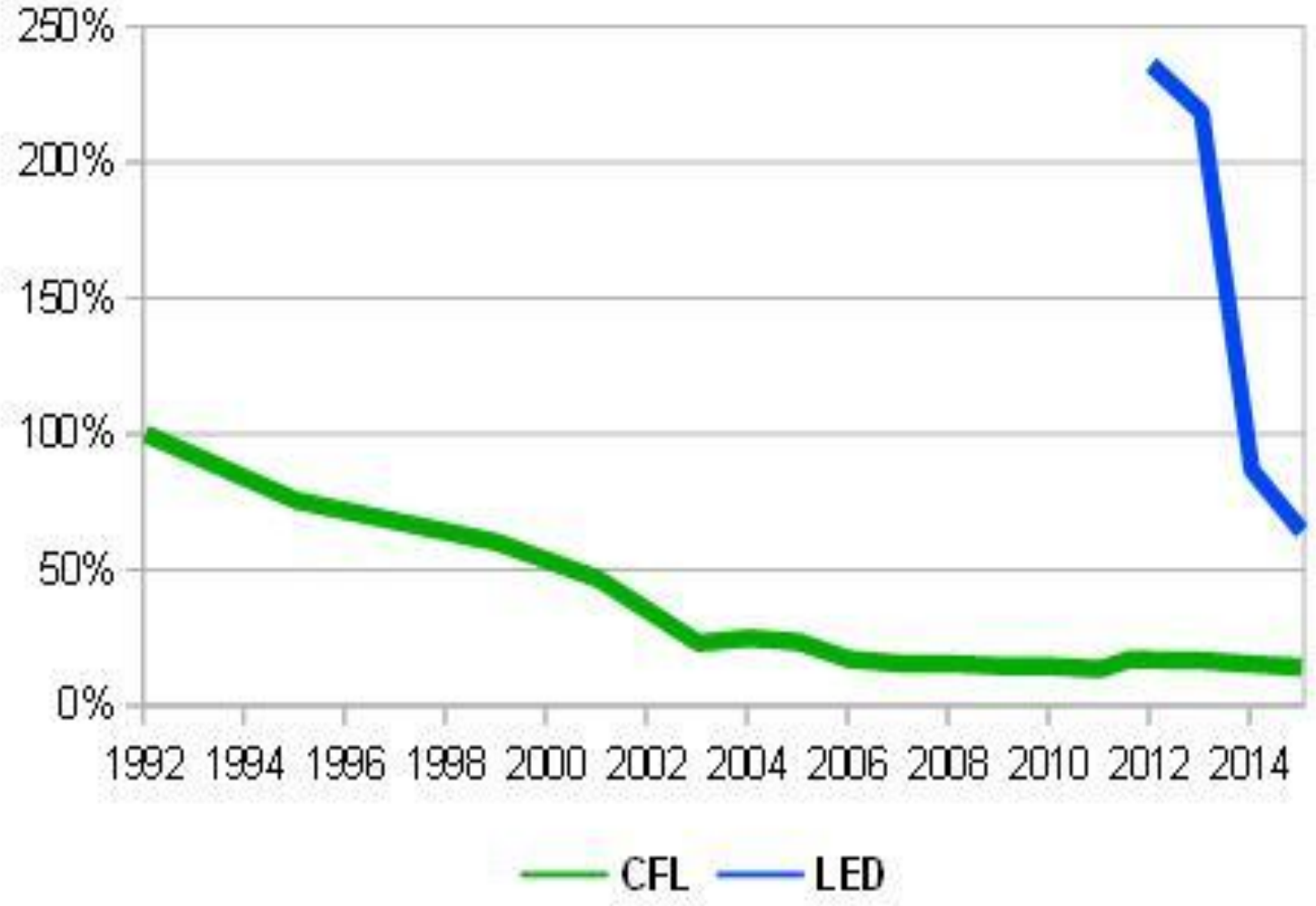


History of Lamp Efficiency

Wattage input needed per unit of light



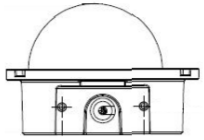
Benchmark Wholesale Pricing Over 23 years



We must reduce use of fossil fuels
80% by 2050.

We have the tools.
Let's implement.

Introductory Lighting Glossary



L.E.D. = Light Emitting Diode: a semiconductor device, as are computer chip and PV cell.

Lumen = unit of visible light power (output)

Watt = unit of power (input)

LPW = lumen per watt = unit of efficiency (lamp efficacy)

Light bulb =

screw-in bulb
general purpose lamp
A-lamp with medium E26 base or its equivalent

(presume all of these refer more or less to the same thing)

BUILDING ENERGY 15

MARCH 3-5, 2015 AT THE SEAPORT WORLD TRADE CENTER

AIA Provider: Northeast Sustainable Energy Association

Provider Number: G338

Course Title

BE1557

Fred Davis, Jim Gaines, Taylor Jantz-Sell

March 5, 2015

Credit(s) earned on completion of this course will be reported to AIA CES for AIA members. Certificates of Completion for both AIA members and non-AIA members are available upon request.

This course is registered with AIA CES for continuing professional education. As such, it does not include content that may be deemed or construed to be an approval or endorsement by the AIA of any material of construction or any method or manner of handling, using, distributing, or dealing in any material or product.

Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.


FRED DAVIS
CORPORATION
Wholesale Distributors of Energy
Efficient Lighting Products


PHILIPS


energy
ENERGY STAR

Course Description

If LEDs are the next best thing, why do so many building professionals still feel “in the dark” about the technology? Welcome to modern lighting where counter-intuitive chaotic tension is the hallmark of the LED revolution. Part one will focus on the most accessible, yet possibly most frustrating, LED product category: the replacement light bulb. Expectations for LED bulbs are great but until this year, any advantage was both marginal and expensive. In the past year, the best LED lamps have pushed efficiency significantly upwards. Years into the incandescent phase-out, is LED technology living up to its promise? Why are some approved LED lamps still less efficient than a cheap CFL? What are industry leaders doing to maximize mainstream adoption? What should we expect in pricing? And should building professionals even be promoting screw-in bulbs, or do new LED fixtures provide better savings?

Learning Objectives

At the end of the this course, participants will be able to:

1. Understand what efficiencies are actually gained by using LED bulbs and at what cost
2. Understand the differences between LED and CFL and how to compare them when considering a project
3. Learn about new lighting technologies and how they affect what is available
4. Learn about fixture types and what works best in different applications

Outline

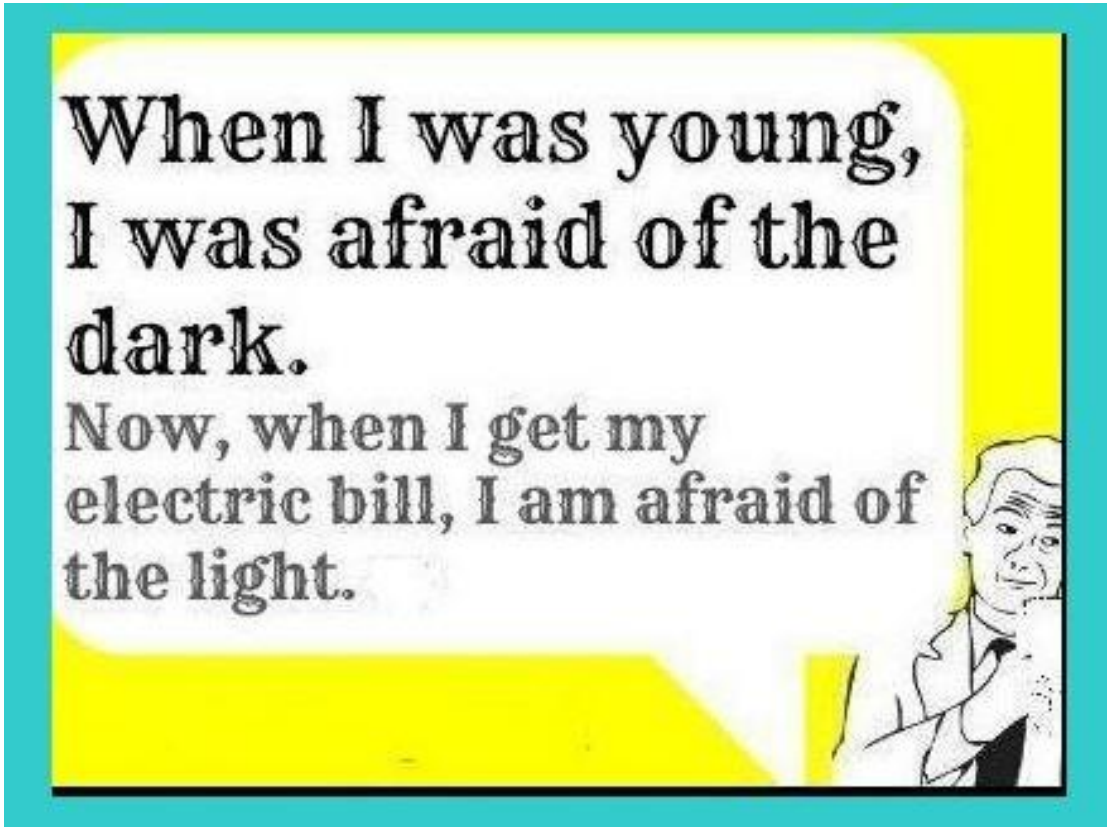
History

Adoption

Manufacturer aims

Further improvement

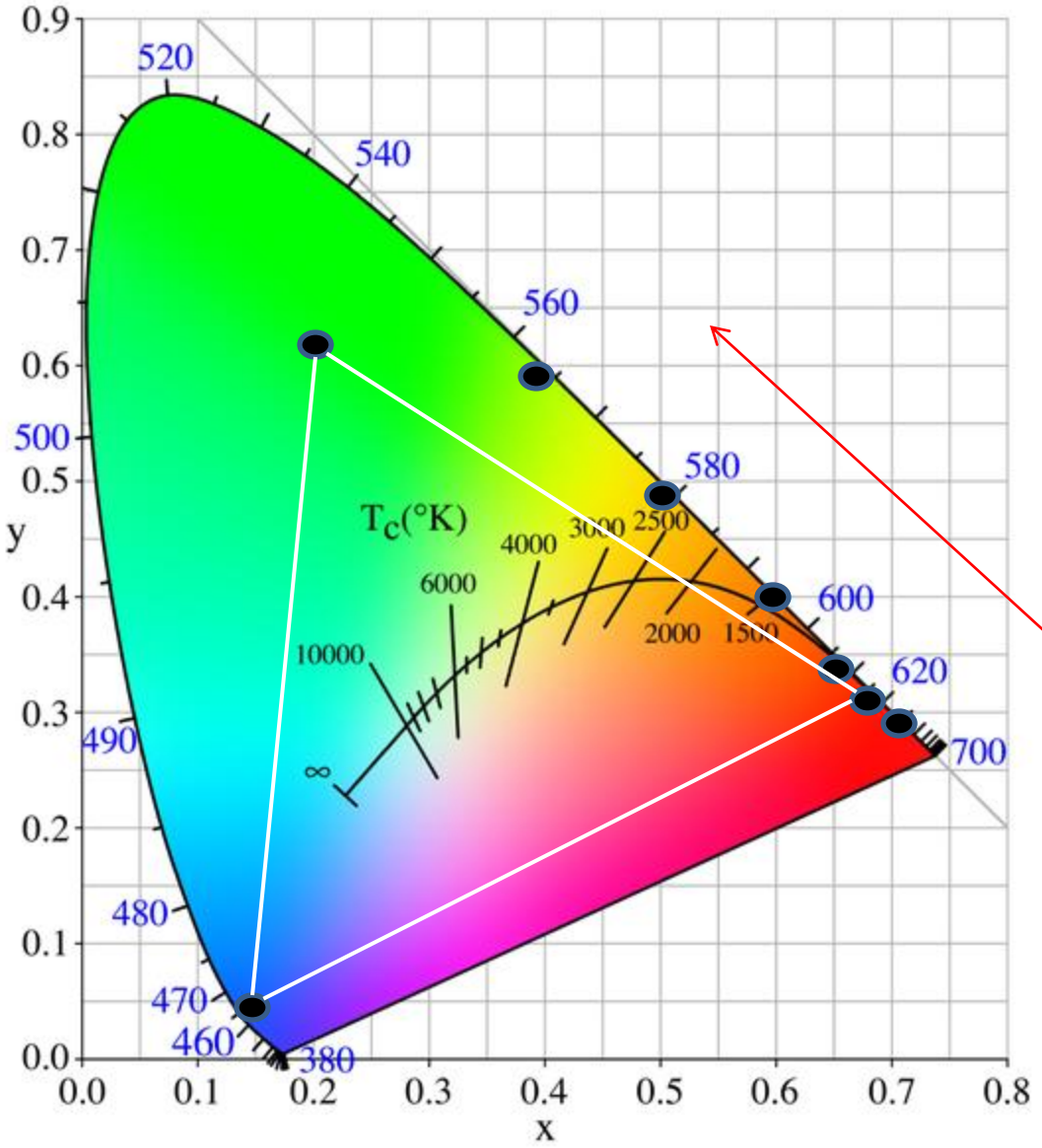
Compare to CFL



Promise of SSL: Save energy

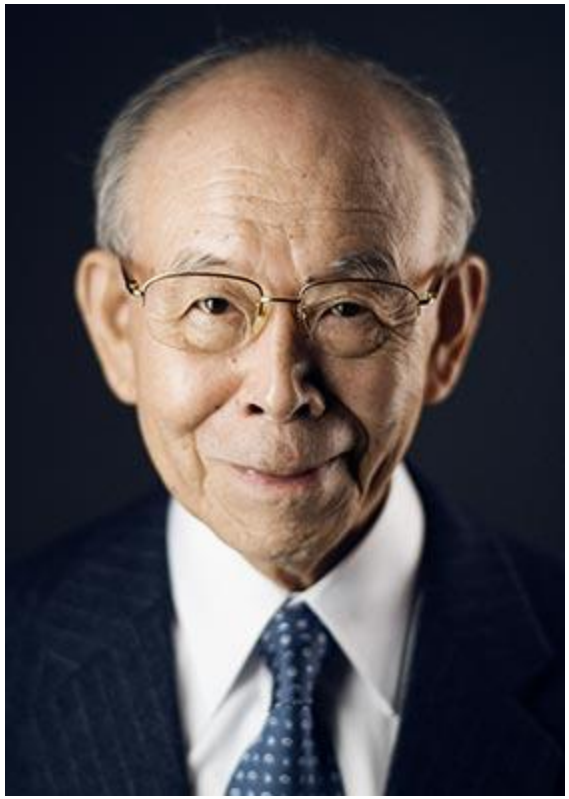
LED Lighting might make this guy feel better!

White light with LEDs



1950's,
1960's

2014 Nobel Prize for Blue LEDs



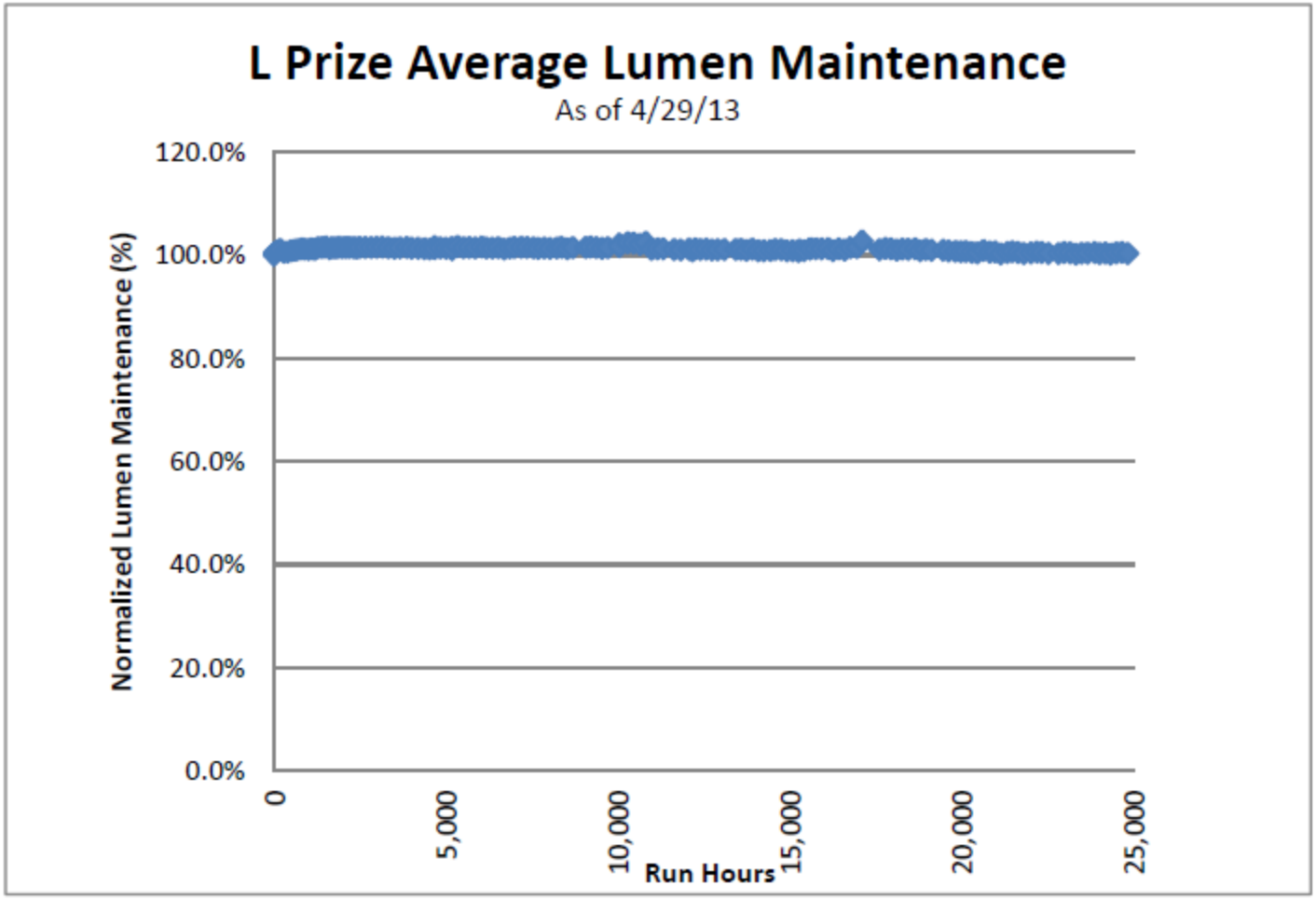
Isamu Akasaki

Hiroshi Amano

Shuji Nakamura

Photos by A. Mahmoud

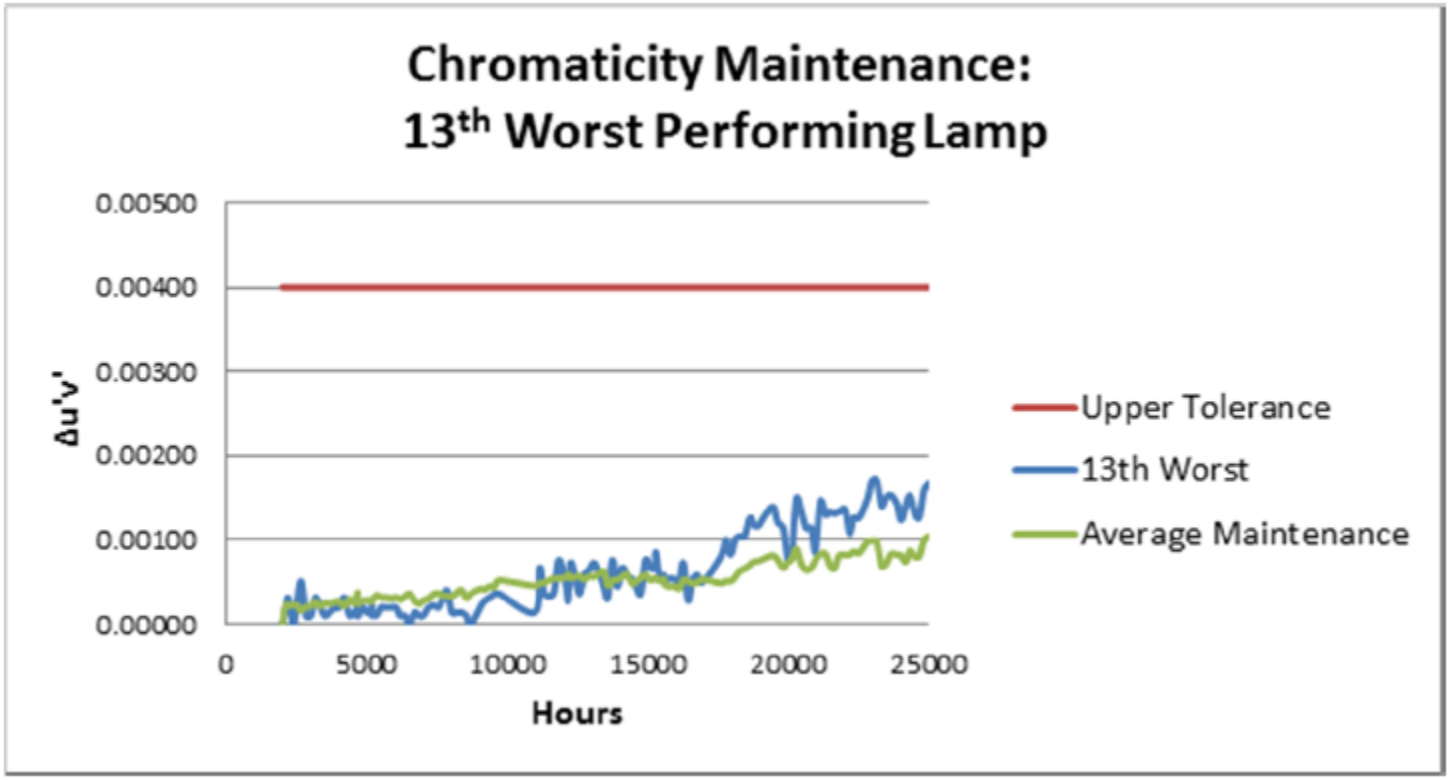
L Prize - Yardstick



http://www.lightingprize.org/pdfs/lprize_60w-lumen-maint-testing.pdf

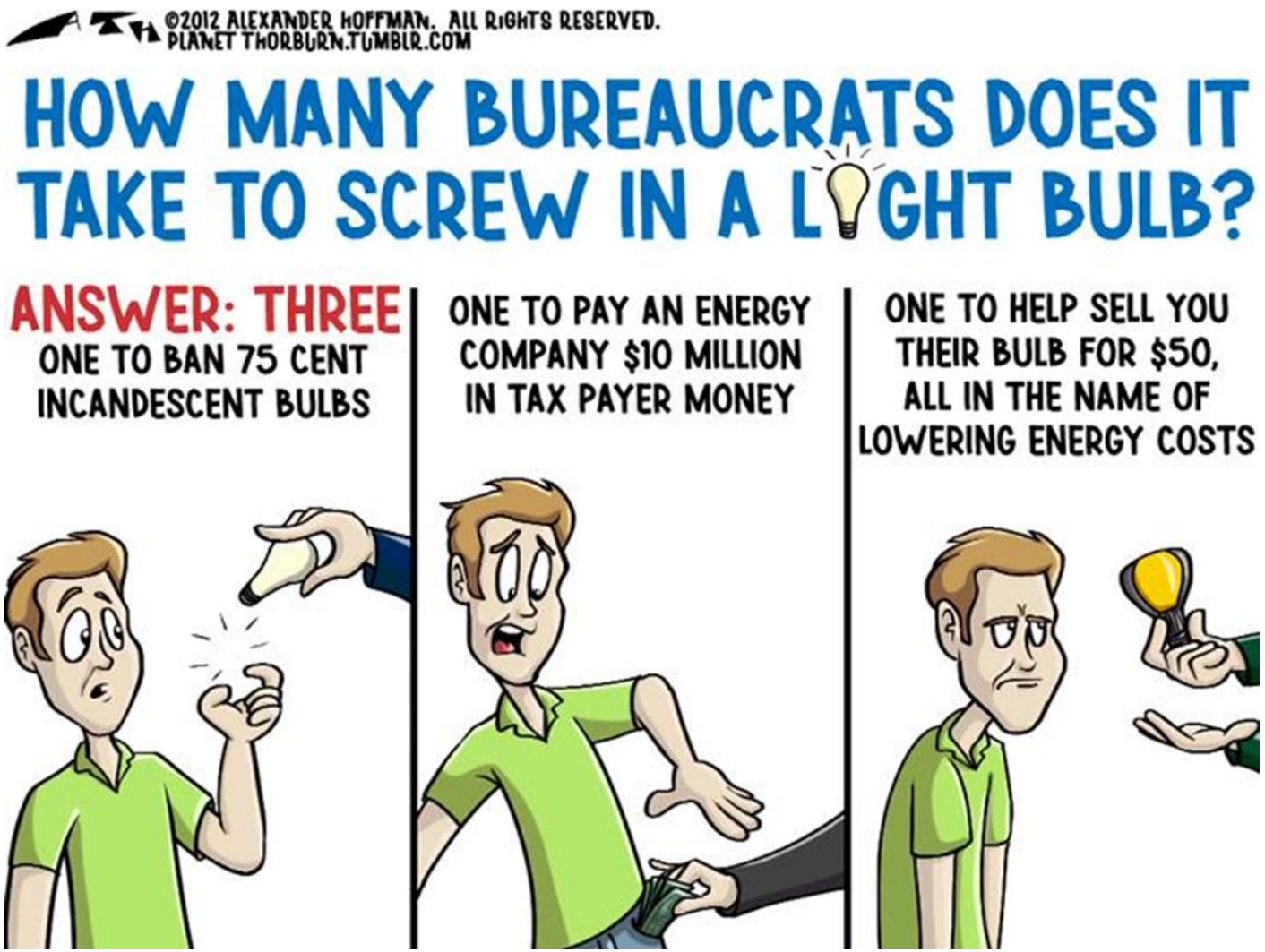
August 2011

L Prize - Yardstick

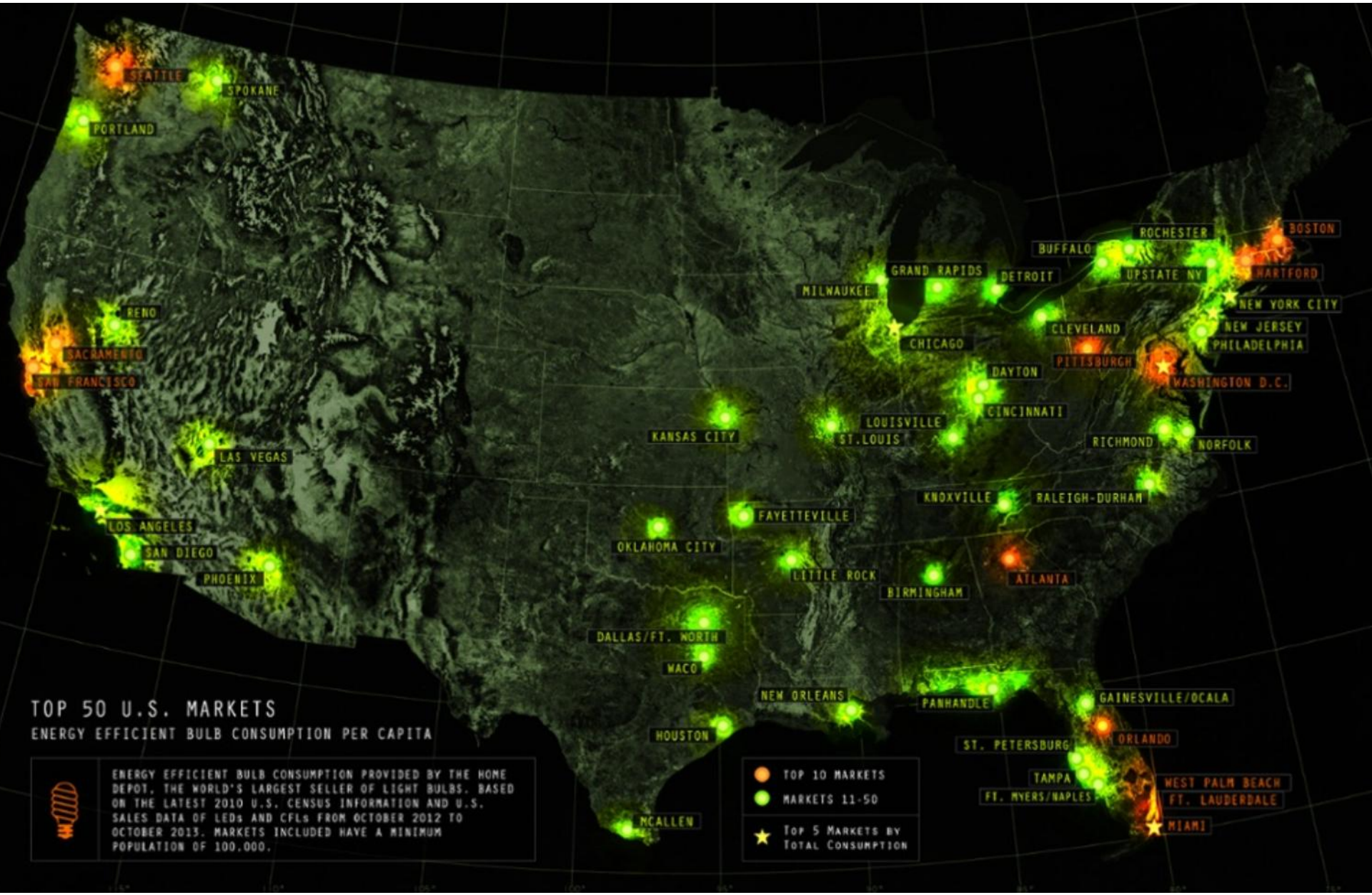


http://www.lightingprize.org/pdfs/lprize_60w-lumen-maint-testing.pdf

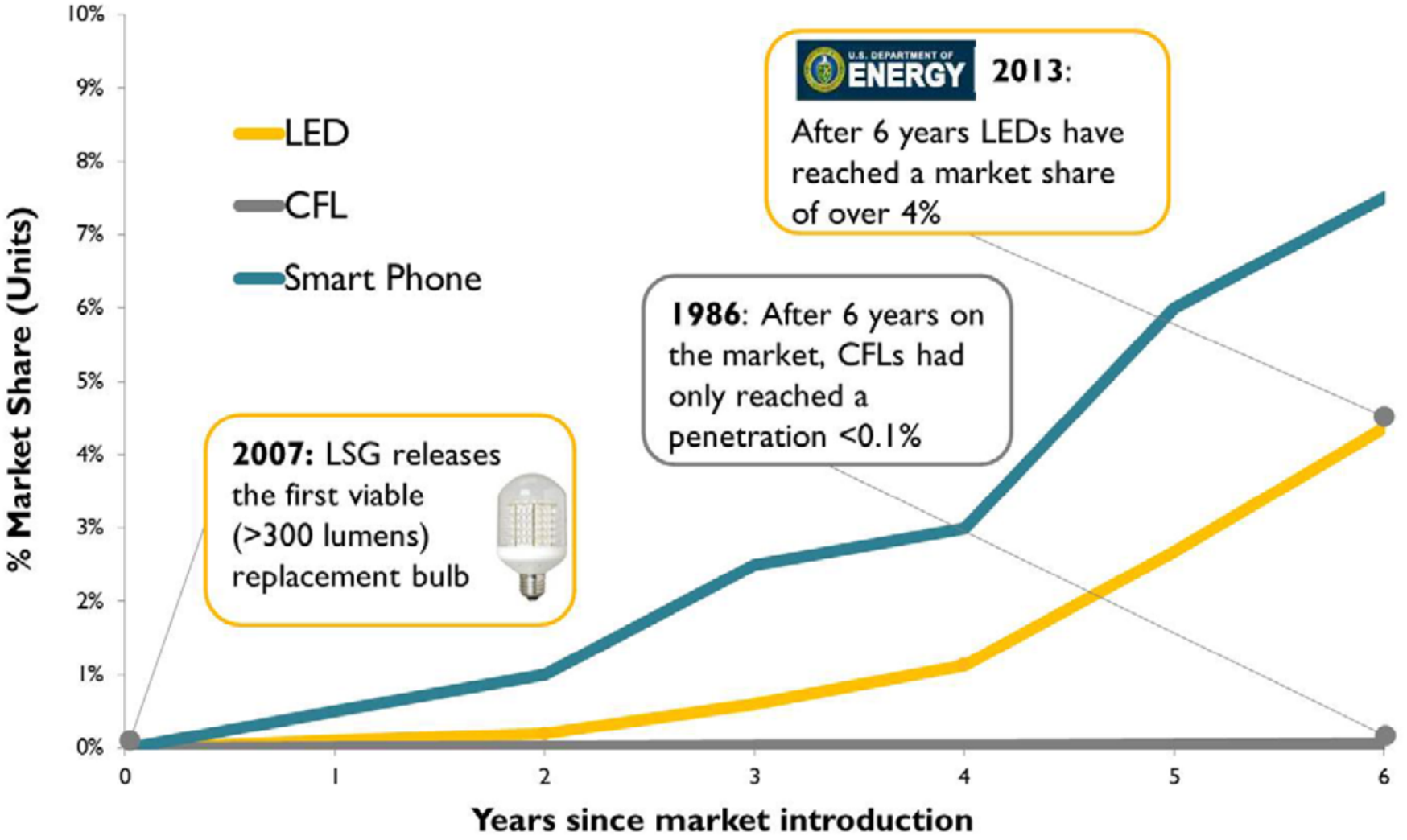
Are people buying LED products?



Home Depot sales information

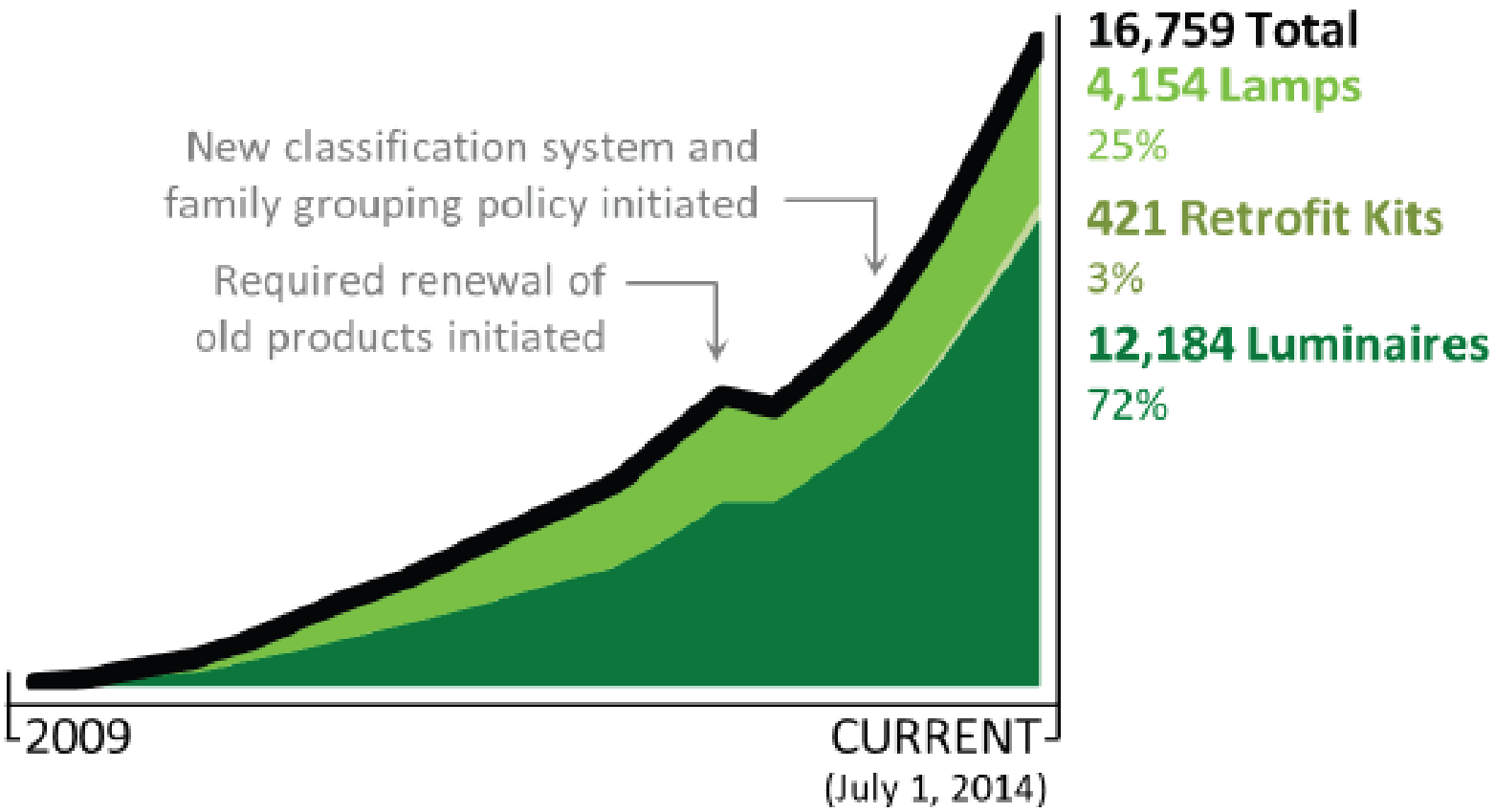


http://cleantechnica.com/2014/01/03/top-led-cfl-cities-us-map/



DOE report: "Solid-State Lighting: Early Lessons Learned on the Way to the Market" Published January 2014
http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/ssl_lessons-learned_2014.pdf

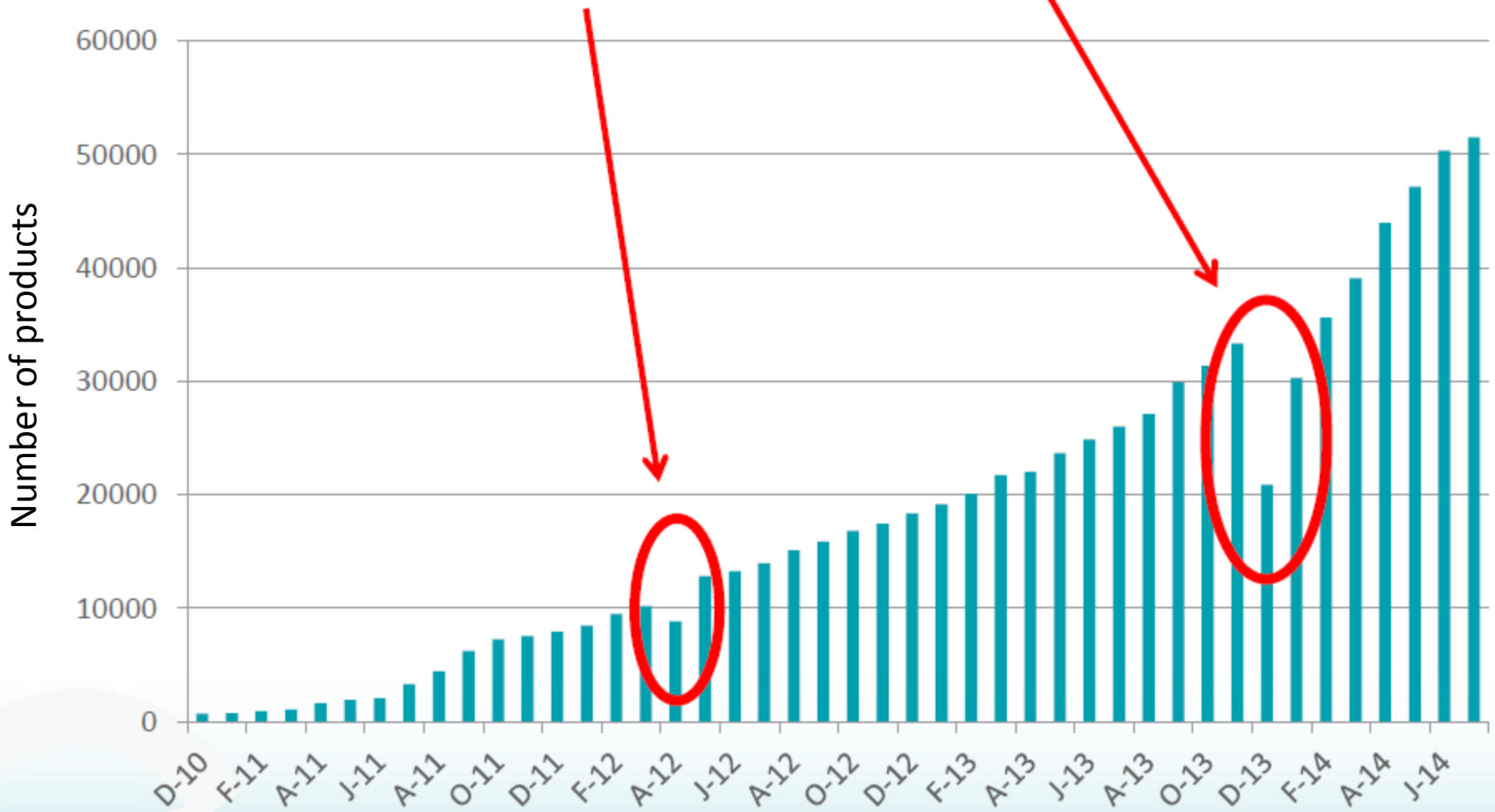
Growth in Lighting Facts products



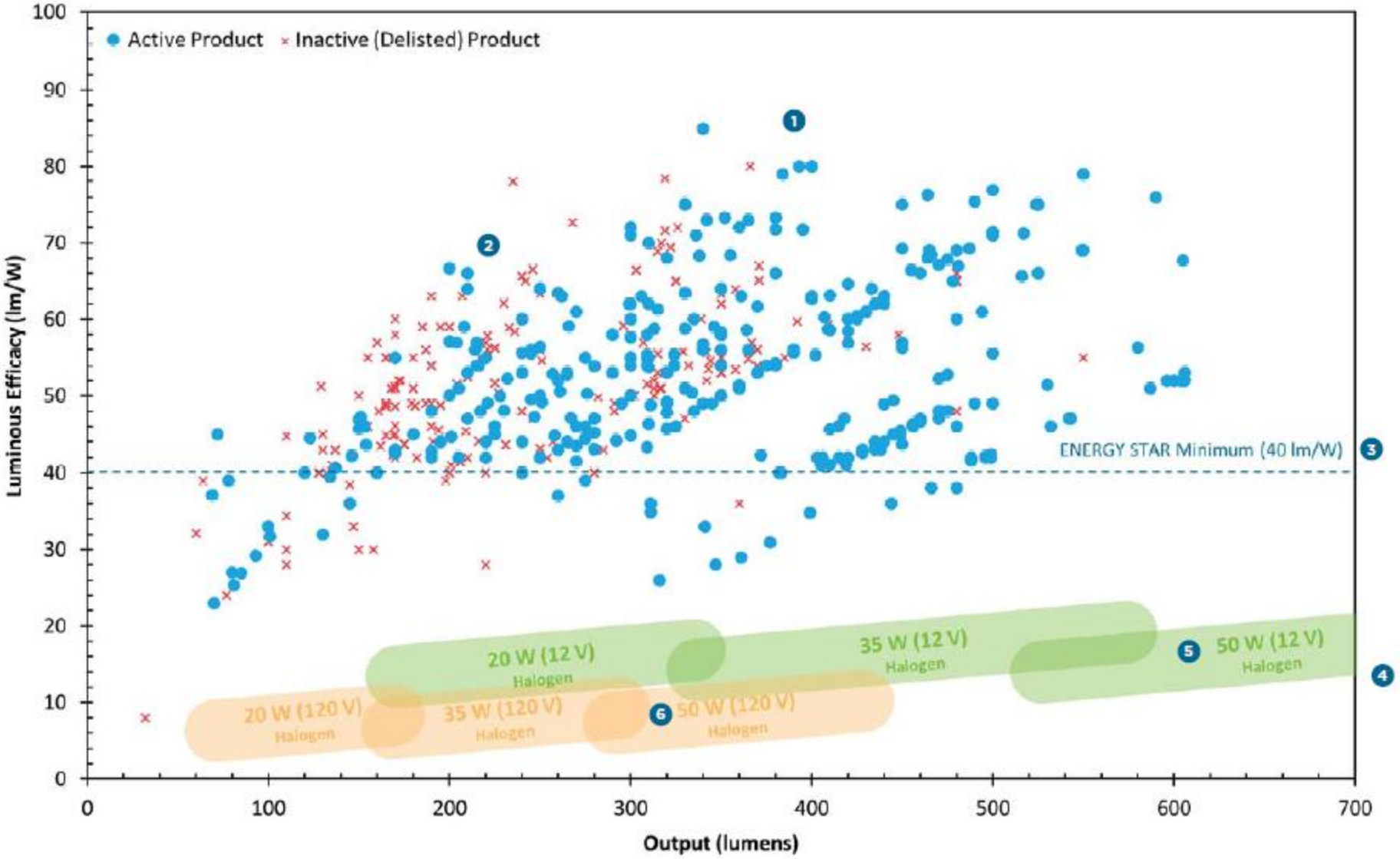
22730 on Feb 23, 2015

DESIGNLIGHTS CONSORTIUM

Specification Revision History



LED Lighting Facts – MR16 lamps



Big distribution!

http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/snapshot2014_mr16.pdf

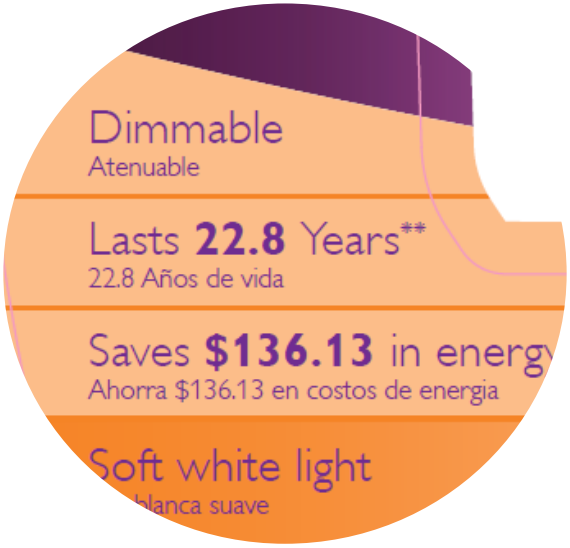
Product lifetime

Dilemma: Products that last 25 years, but only last 18 months on the market.

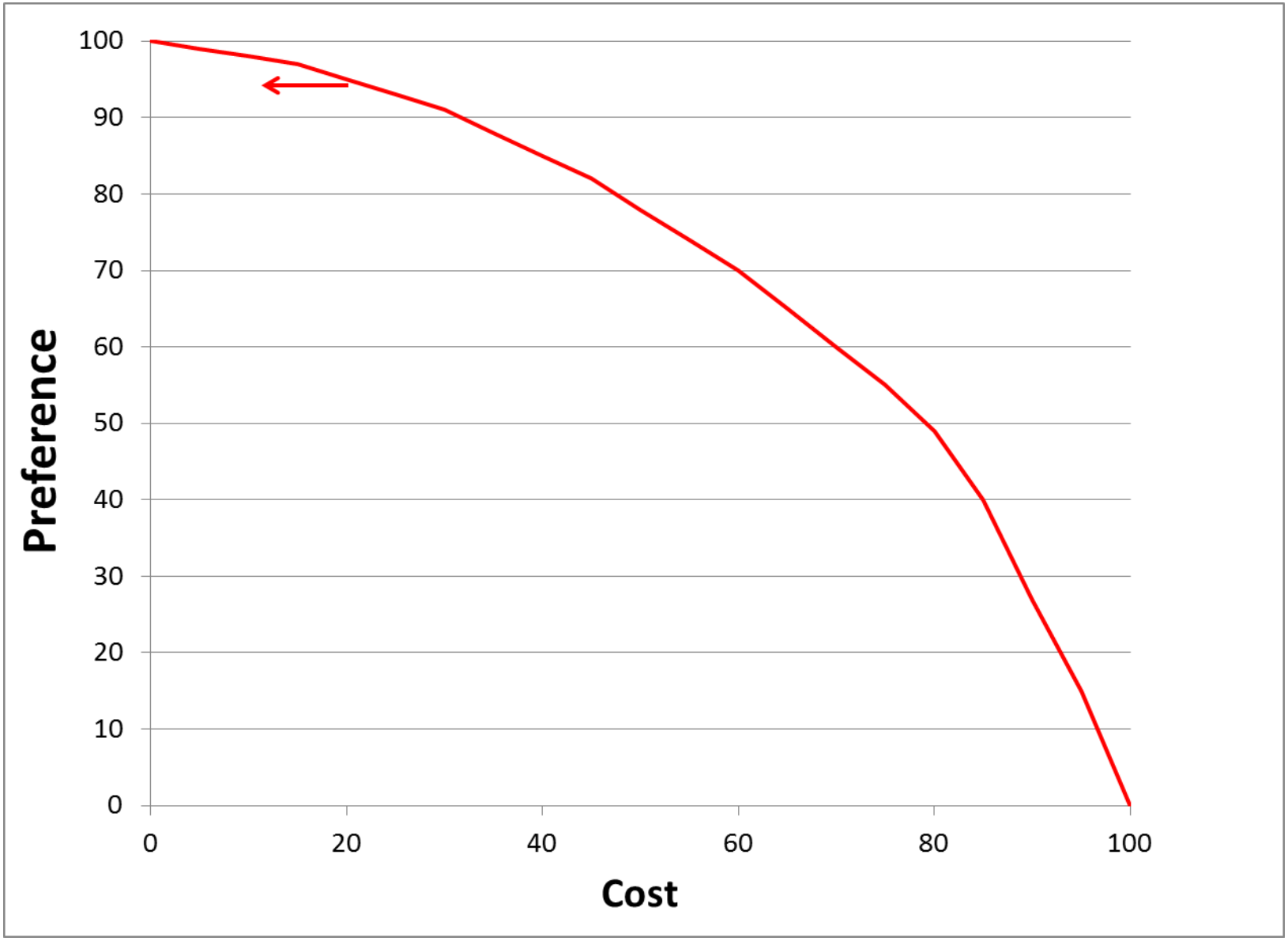
Super design – in a super short time

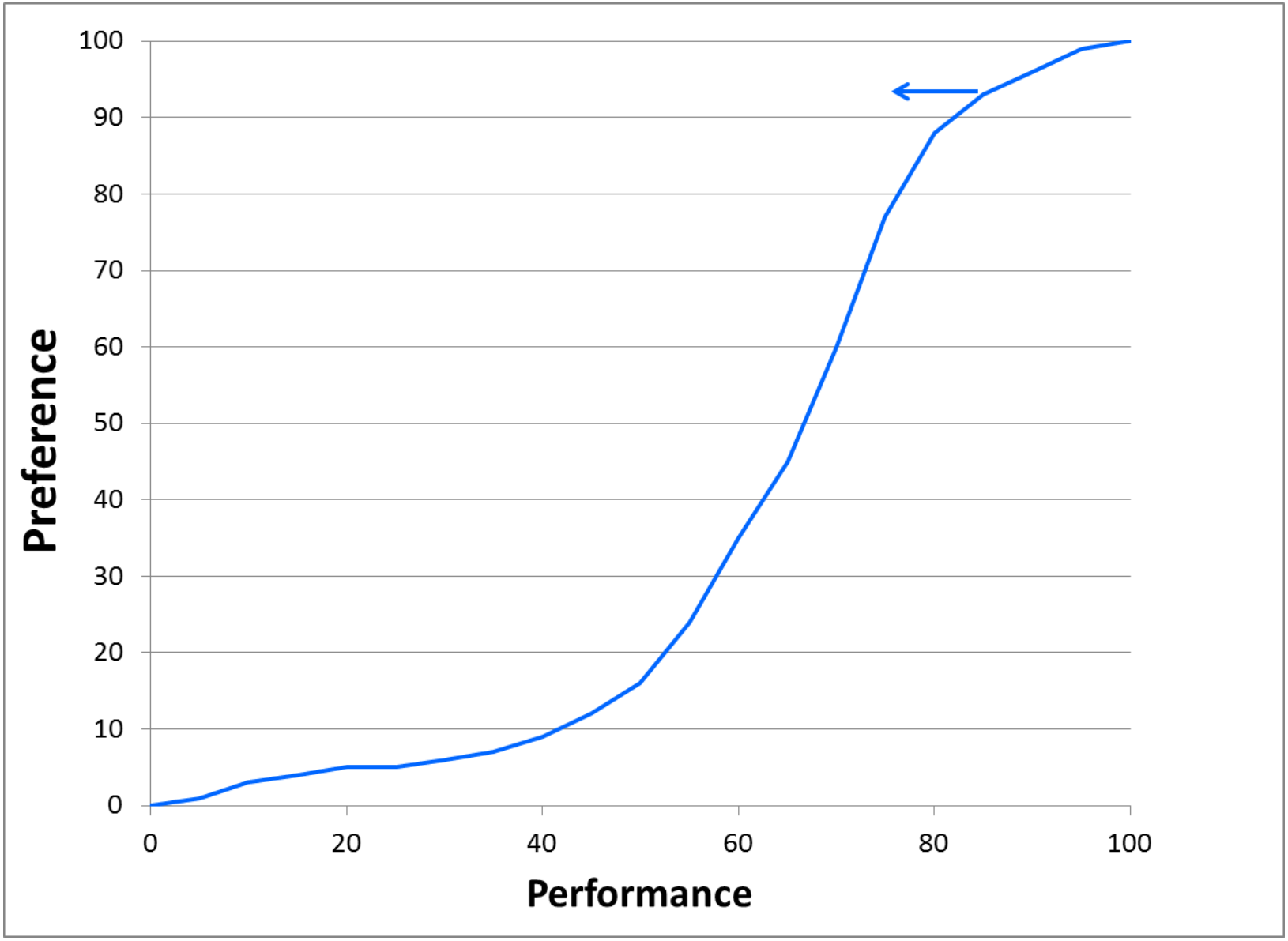
Lighting field blown wide open by SSL.
Lots of competitors → Fast pace

High expectations



> 100 lm/W


Preference
100
90
80
70
60
50
40
30
20
10
0
0
20
40
60
80
100
Cost


Preference
100
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0
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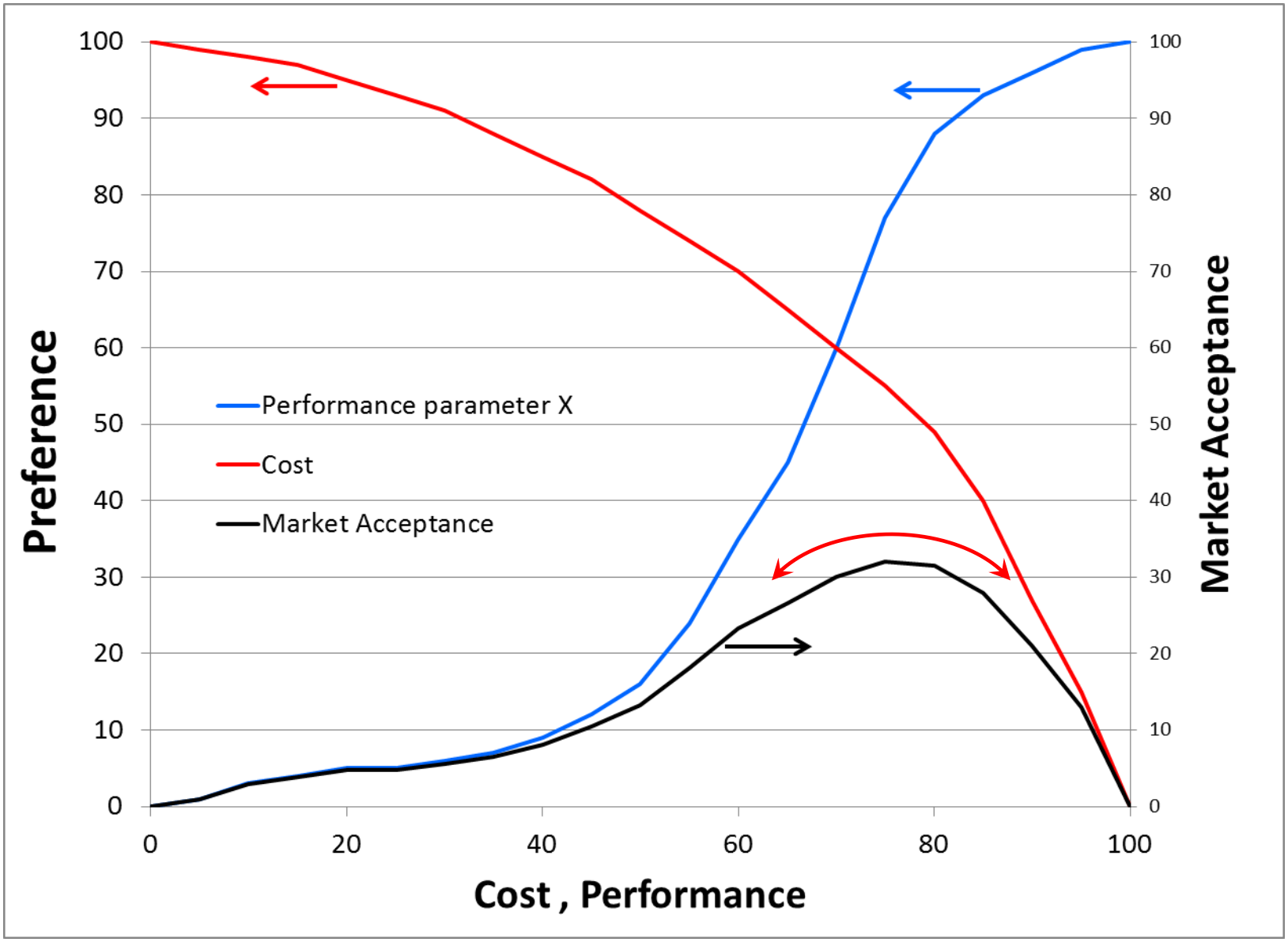
40
60
80
100
Performance



Over-focus on performance is just as likely to hurt market adoption as over focus on cost.

New, wonderful LED technology!

But, we keep trying to imitate incandescent.

Why?

This *is* an LED Lamp!

Retrofit Lamps

Expectations for LED Lamp Market, Luminaires, etc

Retrofit will only last awhile – or will it?

- Connected
- Thermal
- Force of habit/installed base/installation cost

Why do we still have screw-in CFLs?

Should building professionals even be promoting standard bulbs, or do new LED fixtures provide better savings?

…it depends…on the application

Usage per day
Installation cost
Cost of electricity
Desire for “new look”

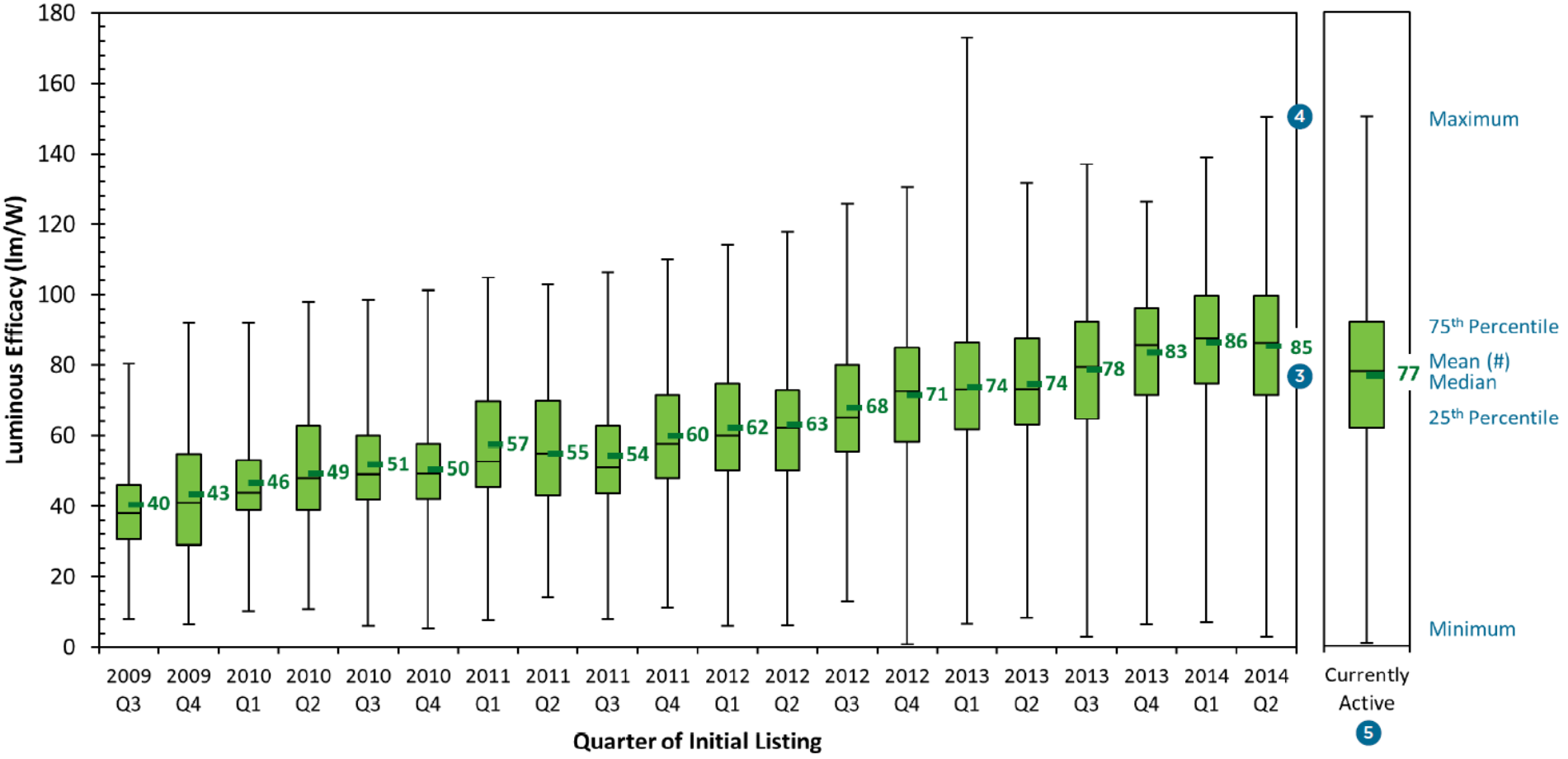
+Familiar
+Easy installation
+Lowest initial cost

-What if ballast dies?
-Luminaire efficiency

+New look
+Integrated sensing/controls option (?)
±Intermediate installation cost

+New look
+Integrated sensing/controls option (?)
-Highest installation cost

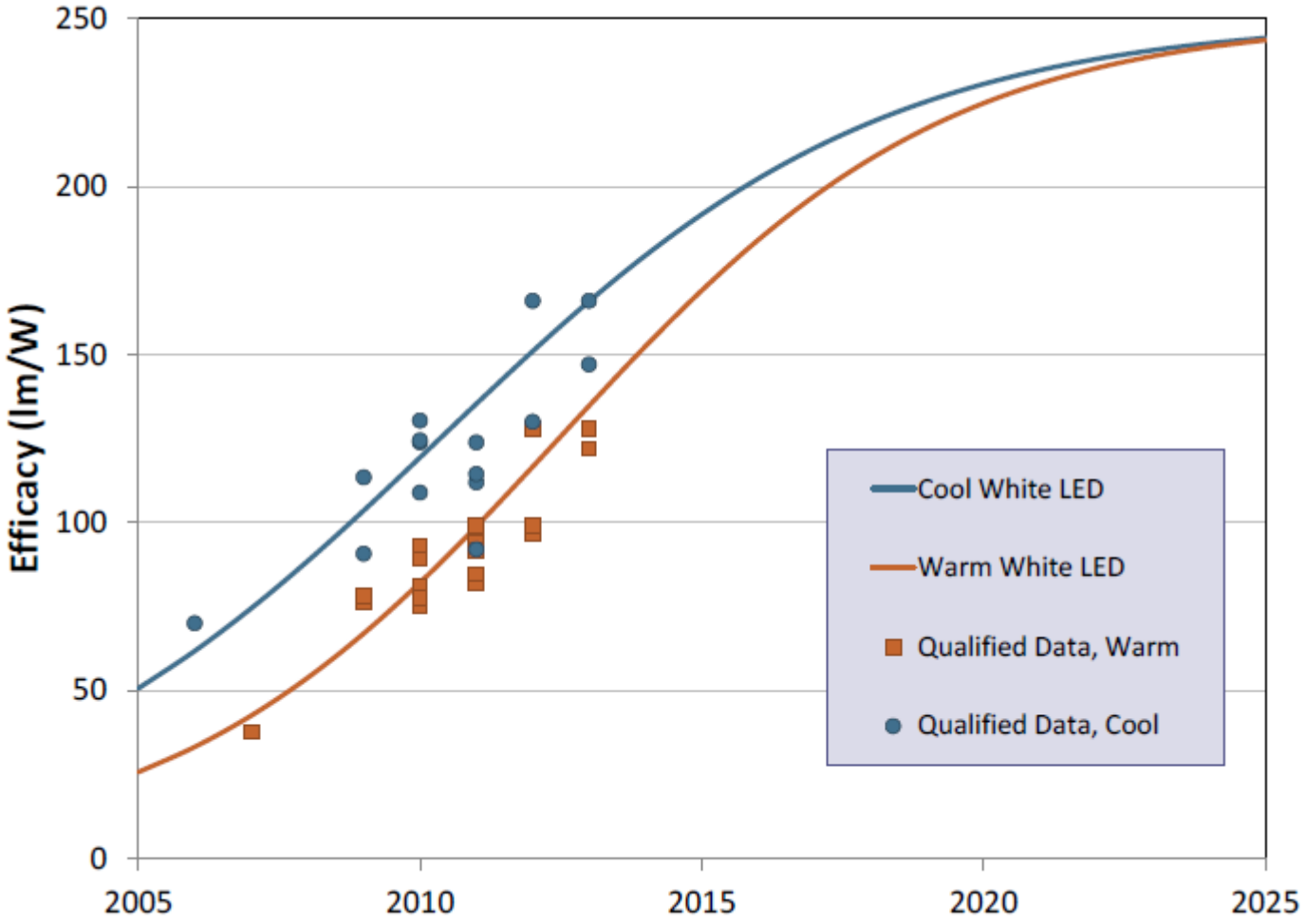
Efficacy Improvement, according to Lighting Facts



http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/snapshot2014_outdoor-area.pdf

How Efficient can SSL get?

DOE forecast, from May 2014 MYPP:



How Efficient can SSL get?

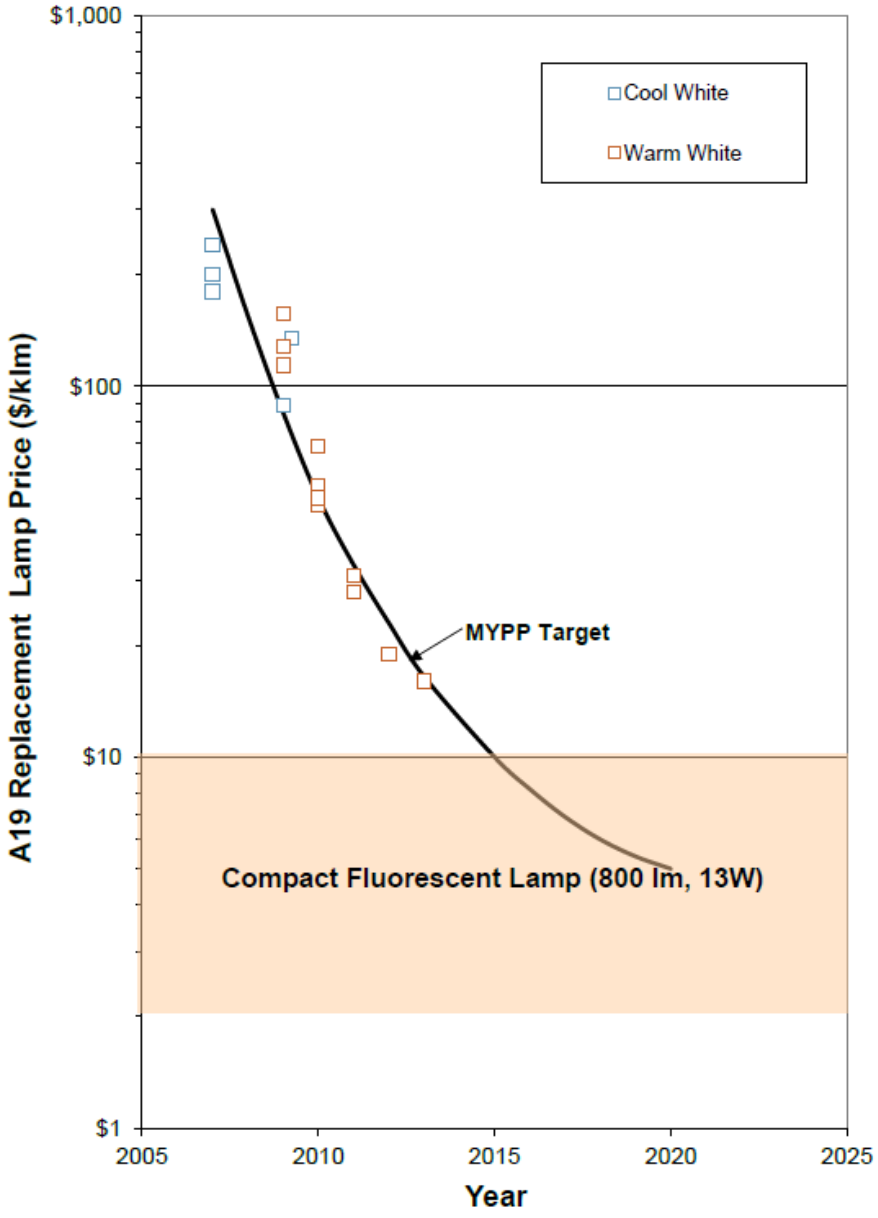
DOE forecast, from May 2014 MYPP:

TABLE 3.10 BREAKDOWN OF WARM-WHITE[1] LED LUMINAIRE EFFICIENCY PROJECTIONS

Efficiency Channel	2013	2015	2020	Goal
Package Efficacy Projection[2] (lm/W)	135	169	225	250
Thermal Efficiency (increased T_{op})	86%	88%	93%	95%
Driver Efficiency	85%	87%	93%	96%
Fixture/Optical Efficiency	85%	89%	94%	96%
Electrical Efficiency (reduced I_{op})	115%	113%	109%	105%
Overall Luminaire Efficiency	71%	77%	89%	92%
Luminaire Efficacy[3] (lm/W)	96	130	200	230

Notes:

1. Warm-white packages and luminaires have CCT = 2580-3710K and CRI>80.
2. Package efficacy projections are for the warm-white, pc-LED, per Figure 4.1.
3. Luminaire efficacy is obtained by multiplying the resultant luminaire efficiency by the package efficacy.



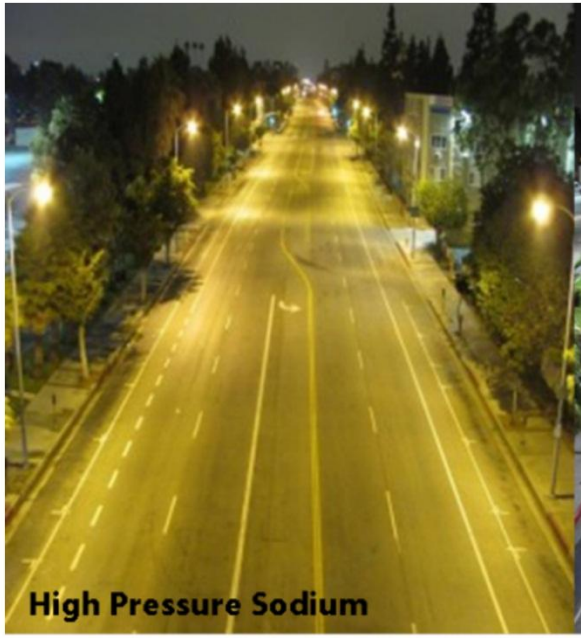
DOE forecast, from May 2014 MYPP.

Several lamps can be bought for less than $10 now (without rebate).

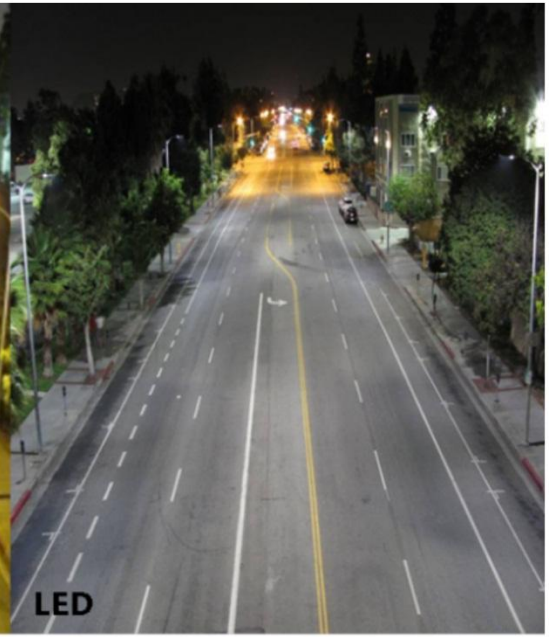
Effect of ability to direct light – efficacy isn't the only benefit

- Streetlights
- TLEDs
- MR's

Luminaire efficiency



Los Angeles' Hoover Street before ... Credit: Los Angeles Bureau of Street Lighting



... and after the conversion to LED street lighting. Credit: Los Angeles Bureau of Street Lighting

Controls

An LED is a semiconductor diode.

Current → Light

Vary the current → vary the light

By controlling the current, we control the amount of light. Dimming is simple, *in principal*.

Complications:

- Phase cut dimmer compatibility
- Protocols (many – no clear winner)
  - Wired (Phase cut, 0-10V, DALI, DMX)
  - Wireless (Zigbee x 12, WiFi, 6LoWPAN, Z-Wave, Insteon, Bluetooth, proprietary systems

Everyone wants to avoid a repeat of the CFL "failure" in the market.

DOE publication:
Solid-State Lighting: Early Lessons Learned on the Way to Market
http://energy.gov/eere/femp/articles/new-report-early-lessons-learned-bringing-ssl-market

They also list 12 lessons/cautions about things that could still go wrong.

Lesson 1: Rigorous testing requirements adopted in the early days of SSL industry development were necessary to counter exaggerated claims of performance by some manufacturers, but they eventually led to unreasonably high testing costs

Lesson 2: Despite the promise of long life, there is no standard way to rate the lifetime and reliability of LED products

Lesson 4: The range of color quality available with LED-based products and the limitations of existing color metrics may confuse users

Lesson 5: The color delivered by some LEDs shifts over time, enough to negatively impact adoption in some applications

Lesson 9: Greater interoperability of lighting control components and more sensible specifications of lighting control systems are required to maximize the energy savings delivered by LED-based sources


SMUD
CEE
SM
SDGE
PG&E
SOUTHERN CALIFORNIA EDISON
FCC
ASHRAE
FEDERAL TRADE COMMISSION · UNITED STATES OF AMERICA · MCMXV
DEPARTMENT OF ENERGY · UNITED STATES OF AMERICA
LEDA
LA DWP
Los Angeles Department of Water & Power
TITLE 20 CA LISTED
TITLE 24 COMPLIANT
NSF
IES
Illuminating ENGINEERING SOCIETY
lighting design lab
STATE OF CALIFORNIA · ENERGY COMMISSION
LED lighting facts
A Program of the U.S. DOE
IEC
IEEE
UL
SA
ETL LISTED
energy
ENERGY STAR
DLC QPL
DLC LISTED
TM

CFL lamps – what went wrong?

Poor start in the market:

- Color variation too large
- Color quality (CRI) poor
- Slow start up
- Heavy
- Bulky, won't fit in fixtures
- Life not as long as expected
- Flicker (magnetic ballasts)
- Poor or no dimming
- Noise
- Cost too high
- New light quality parameters that public does not understand (CCT, CRI)

Result:

- The public was turned off early

Additional complications:

- CA Utilities selected low quality CFLs for massive rebate programs, perpetuating poor impressions, and giving manufacturers the wrong message about what products they should make.

The public has a long memory.

LED lamps – what might go wrong?

- Color variation too large
- Color quality (CRI) poor
- ~~Slow start up~~
- ~~Heavy~~
- ~~Bulky, won't fit in fixtures~~
- Life not as long as expected
- Flicker
- Poor dimming
- Noise
- Cost too high
- New light quality parameters that public does not understand (CCT, CRI)

None of these thing has to happen. But they *could* happen, if we don't pay attention.

DOE has done a good job to understand the problems with CFL, and take steps to avoid them with LED.

- CALiPER program
- Gateway program
- Product performance testing and reporting
- Funded performance improvement research

Lessons from California

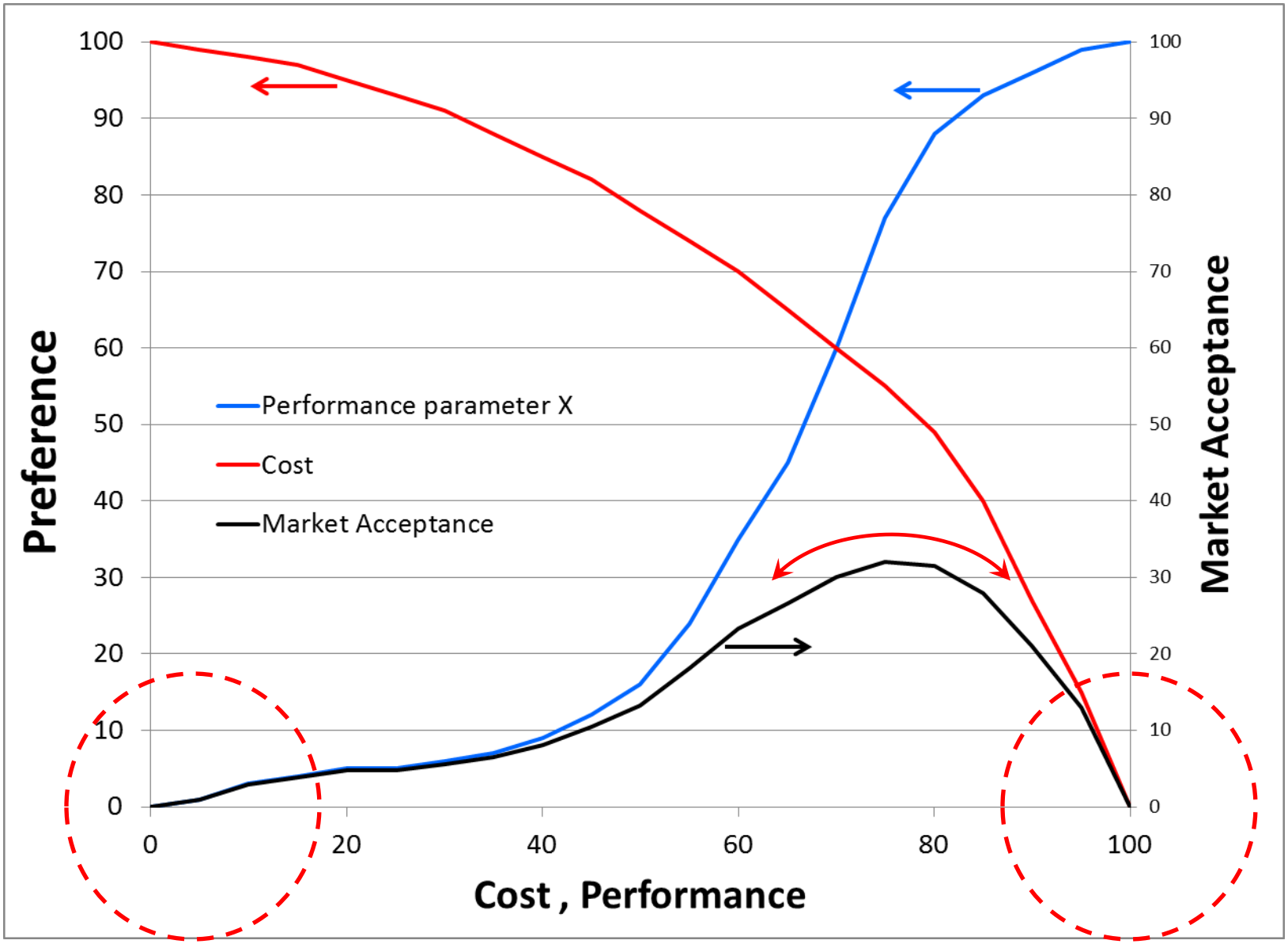
CFL: CA sold (and rebated) many CFLs that were not Energy Star and had CRI's that were around 65. Customer perception and adoption are likely to be based on these low performance CFLs.

Philosophy: "Give it to 'em cheap and they'll learn to love the light"

Nearly all of these problems have been corrected, but it took two decades, and CFLs still don't do well.

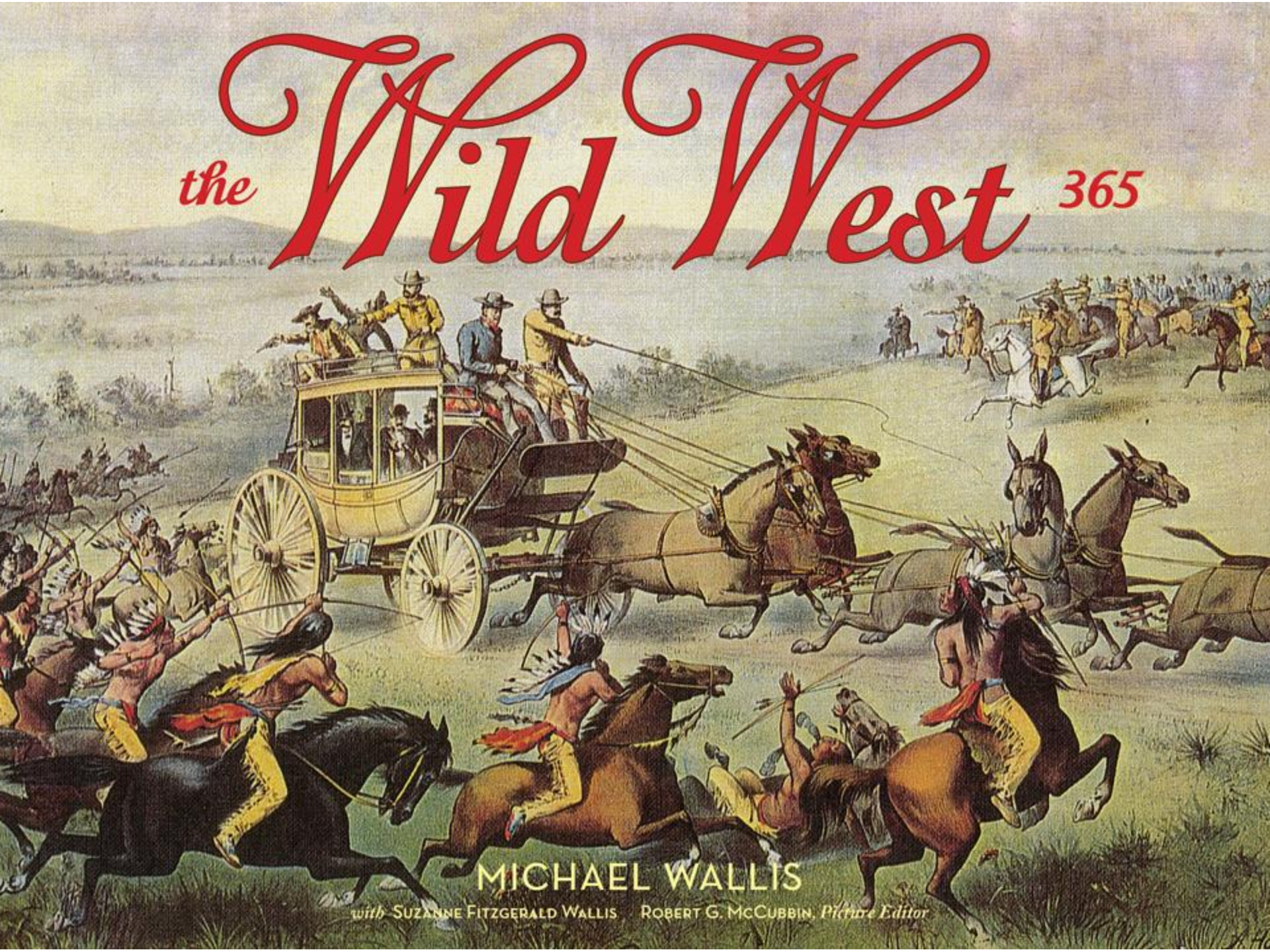
LED: CA realizes that their policy with CFL failed. New policy: The California Quality LED Lamp Specification and Title 20/24.

Philosophy: "Give it to 'em just like an incandescent and they'll learn to love paying for it"



Over-focus on performance is just as likely to hurt market adoption as over focus on cost.

the Wild West 365



MICHAEL WALLIS
with SUZANNE FITZGERALD WALLIS · ROBERT G. MCCUBBIN, *Picture Editor*

counter-intuitive chaotic tension

High power, high light-output light sources are the last places that LED will go

- Streetlights

Troffer luminaires belong to OLEDs

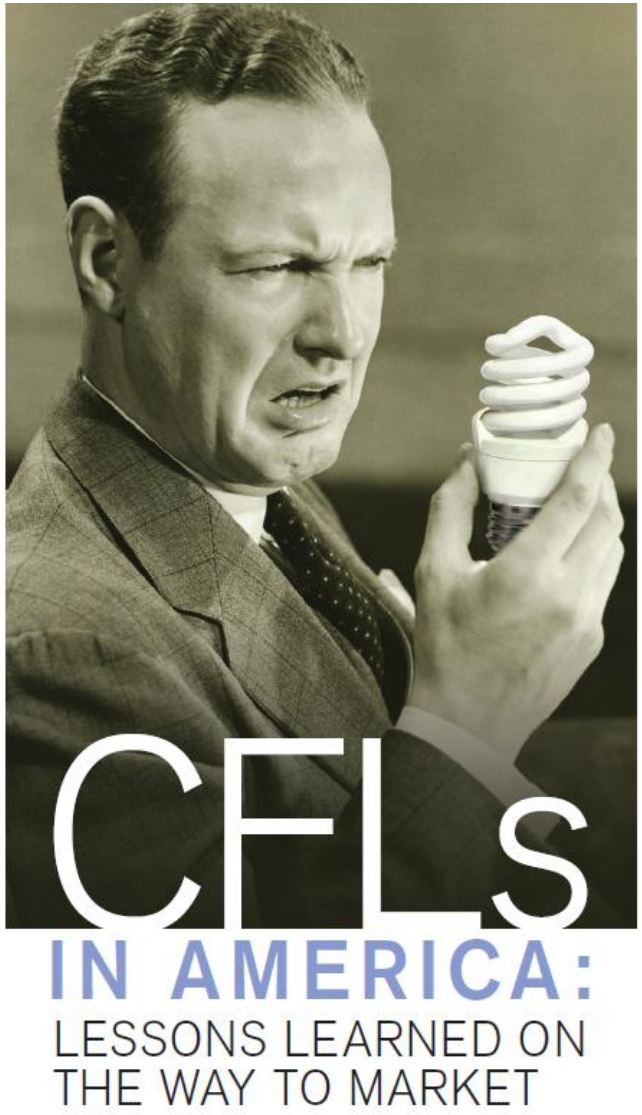
LED Lamps cost $50 and you're telling me they'll be less than $10 when?

Fred Davis *Jim Gaines* *Taylor Jantz-Sell*

This concludes The American Institute of Architects
Continuing Education Systems Course

LEDing the Lighting Revolution Part 1: How Many Light Bulbs Will it Take?
Thursday, March 05, 2015
10:30 am to 12:00 pm

- In the past year, the best LED lamps have pushed efficiency significantly upwards.
- Years into the incandescent phase-out, is LED technology living up to its promise?
- Why are some approved LED lamps still less efficient than a cheap CFL?
- What are industry leaders doing to maximize mainstream adoption?
- What should we expect in pricing?
- And should building professionals even be promoting screw-in bulbs, or do new LED fixtures provide better savings?

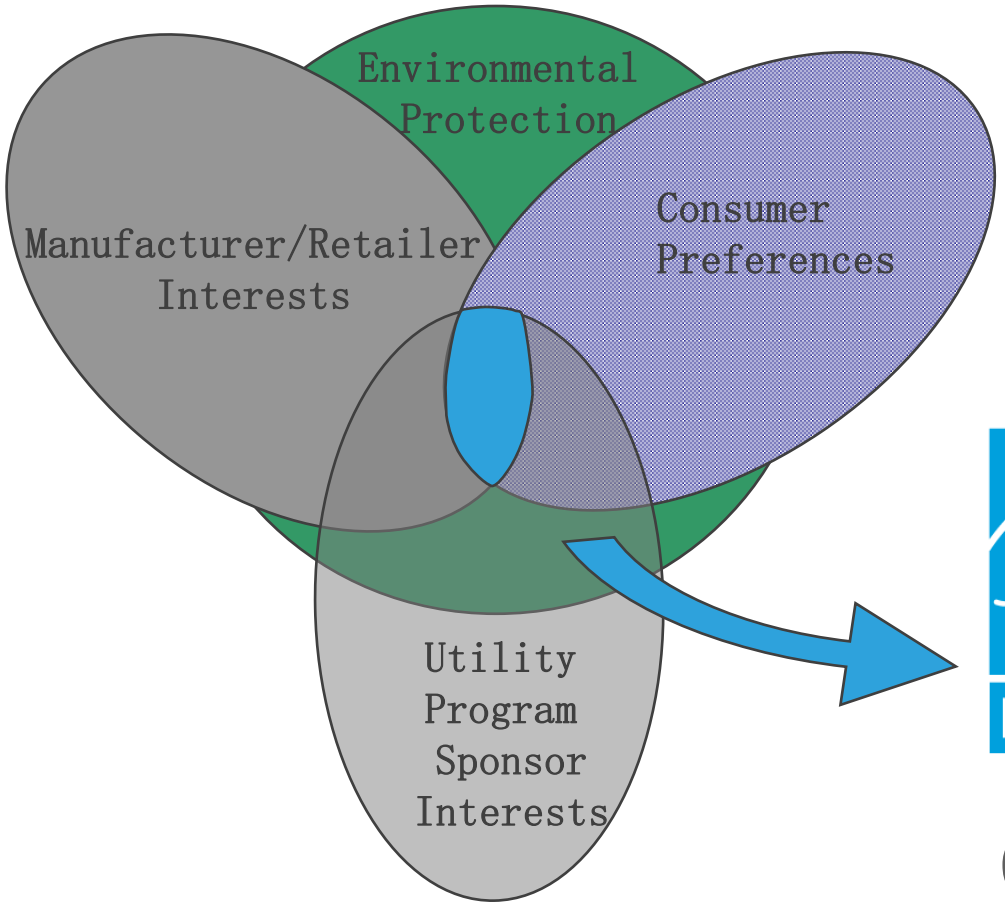


"Actions by DOE, voluntary energy-efficiency programs, and standards organizations have helped the U.S. market to avoid some problems with early SSL products. Standardized testing, minimum performance and reporting requirements, and publication of testing and demonstration results have made it more difficult for poor-performing products to remain on the market, and rewarded manufacturers whose products perform well."

What is ENERGY STAR?

- Created by the U.S. Environmental Protection Agency in 1992 to reduce greenhouse gas emissions
- Voluntary product certification and labeling program
- Products that have earned the ENERGY STAR label meet strict energy efficiency & performance guidelines set by the US EPA with open and broad stakeholder engagement

Builds Upon Intersection of Interests



ENERGY STAR

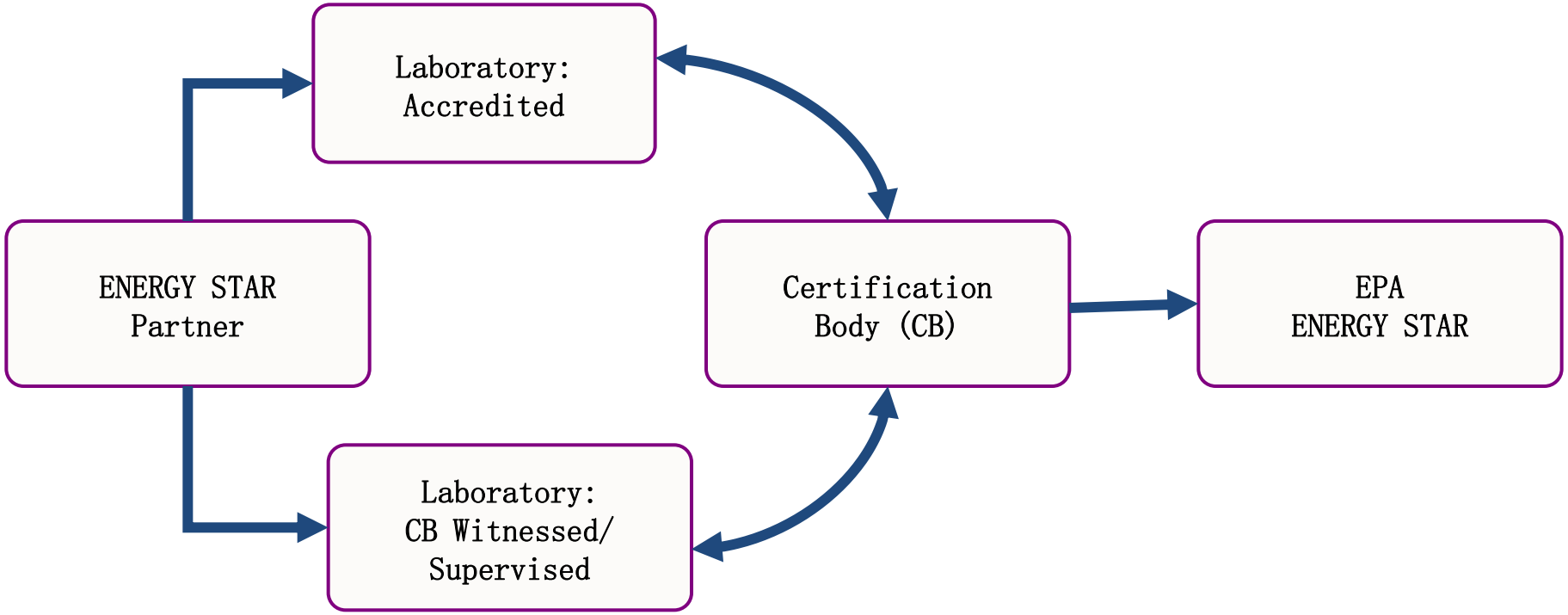
Cost-effective

No sacrifice in performance

Gov't backed

Consumer is Key

ENERGY STAR
Product Certification Process



ENERGY STAR Certification for Lighting Products

- More than just efficiency
- Designed to ensure quality and performance consumers expect:
  - Minimum warranty requirement
  - 6 different requirements for color to ensure quality up front & over time
  - Light output and distribution requirements
  - Size and shape requirements for light bulbs
  - Long term high heat testing & rapid cycling
- ENERGY STAR third-party **certification and verification testing** help confirm **delivery on performance**

ENERGY STAR Lighting

Residentially focused scope: Not all inclusive

Energy saving replacements for the most common residential light bulbs

Eligible to Earn the ENERGY STAR	NOT Eligible to Earn the ENERGY STAR
General purpose CFL and LED lamps	Linear fluorescent lamps and their solid state retrofits
Accent lights (line-voltage and directional track lights)	High bay fixtures and recessed troffers
Down lights: recessed, pendant, surface-mounted, solid state retrofit kits	Outdoor street and area lighting: wall packs, garage, canopy lighting and wall packs
Wall sconces, chandeliers, bath vanities, ceiling and close-to-ceiling mount, floor and table lamps	Signage of any type, including EXIT signs and channel letter backlighting systems
Under cabinet or shelf-mounted task lighting	Linear fluorescent pendants
Ceiling and ventilation fans with lighting	Party or entertainment lighting
Portable desk task lights	Adapters or converters

ENERGY STAR Lamp Specification

- Important but lesser known requirements
  - If it looks like a general purpose A lamp it has to act like one – omnidirectional light distribution requirements and strict guidelines for equivalency claims

Long term elevated temperature testing to ensure bulbs perform as expected in higher temperature scenarios, e.g. recessed can,

How Many Bulbs Will it Take?

Remaining potential for bulbs is HUGE:

- A-Type
  - 3 billion sockets
- Directional
  - 240 million
- MR16
  - 46 million
- Decorative
  - 1.2 billion

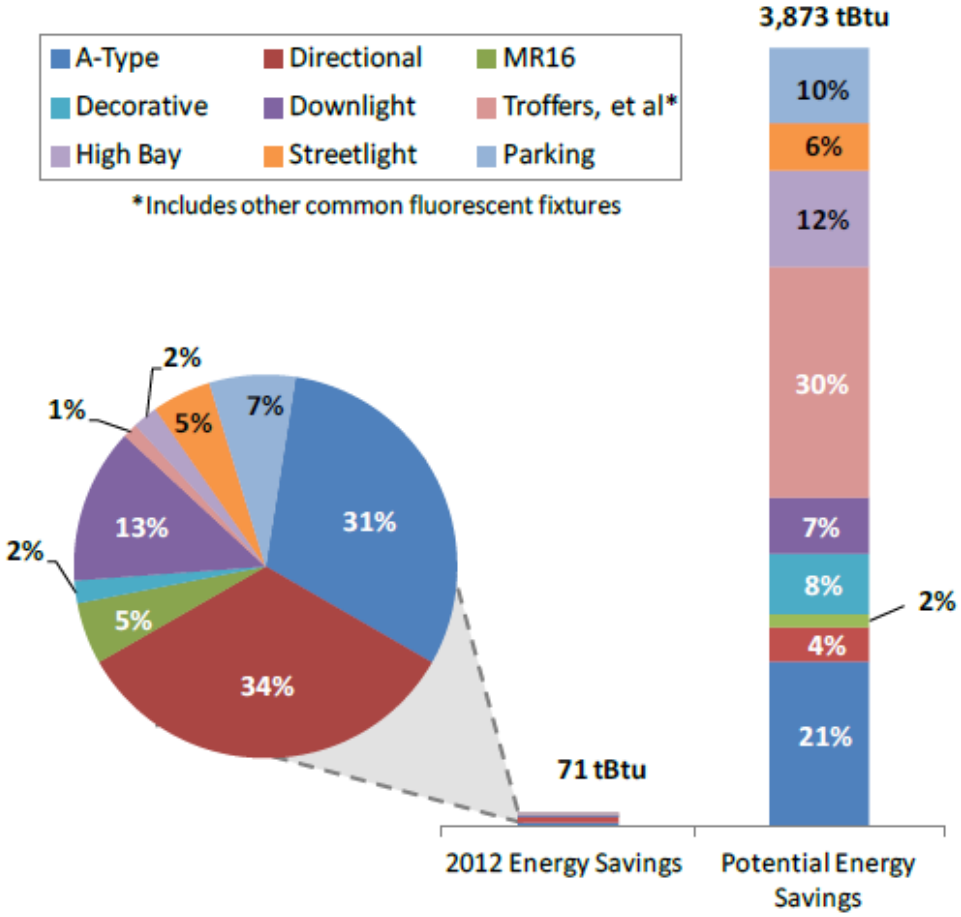
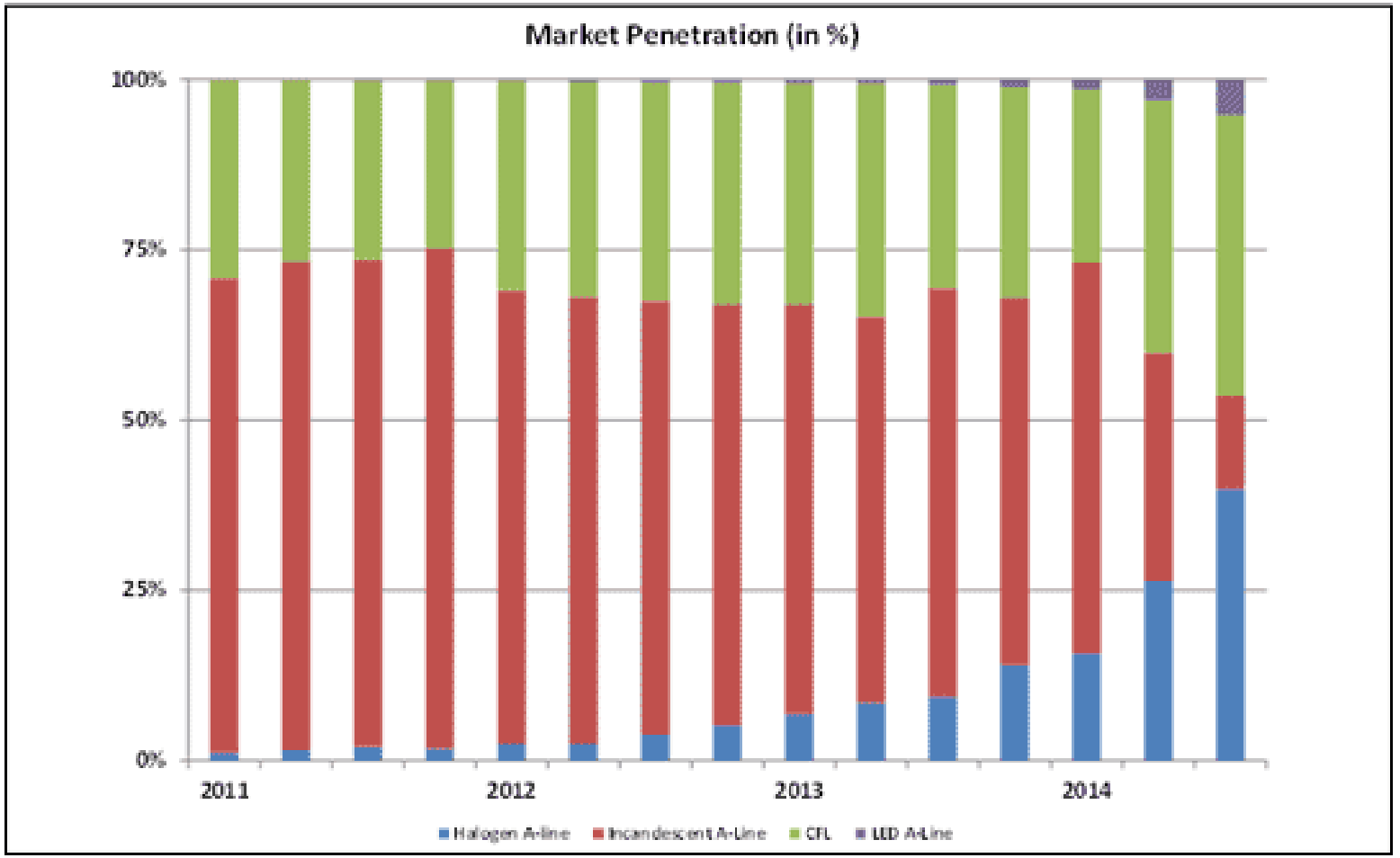


Figure ES.1 – Comparison of Current and Potential Source Energy Savings

Source: U.S. Department of Energy, Adoption of Light-Emitting Diodes in Common Lighting Applications 2013

A lamp Shipments up to Q3 2014



LED A Line

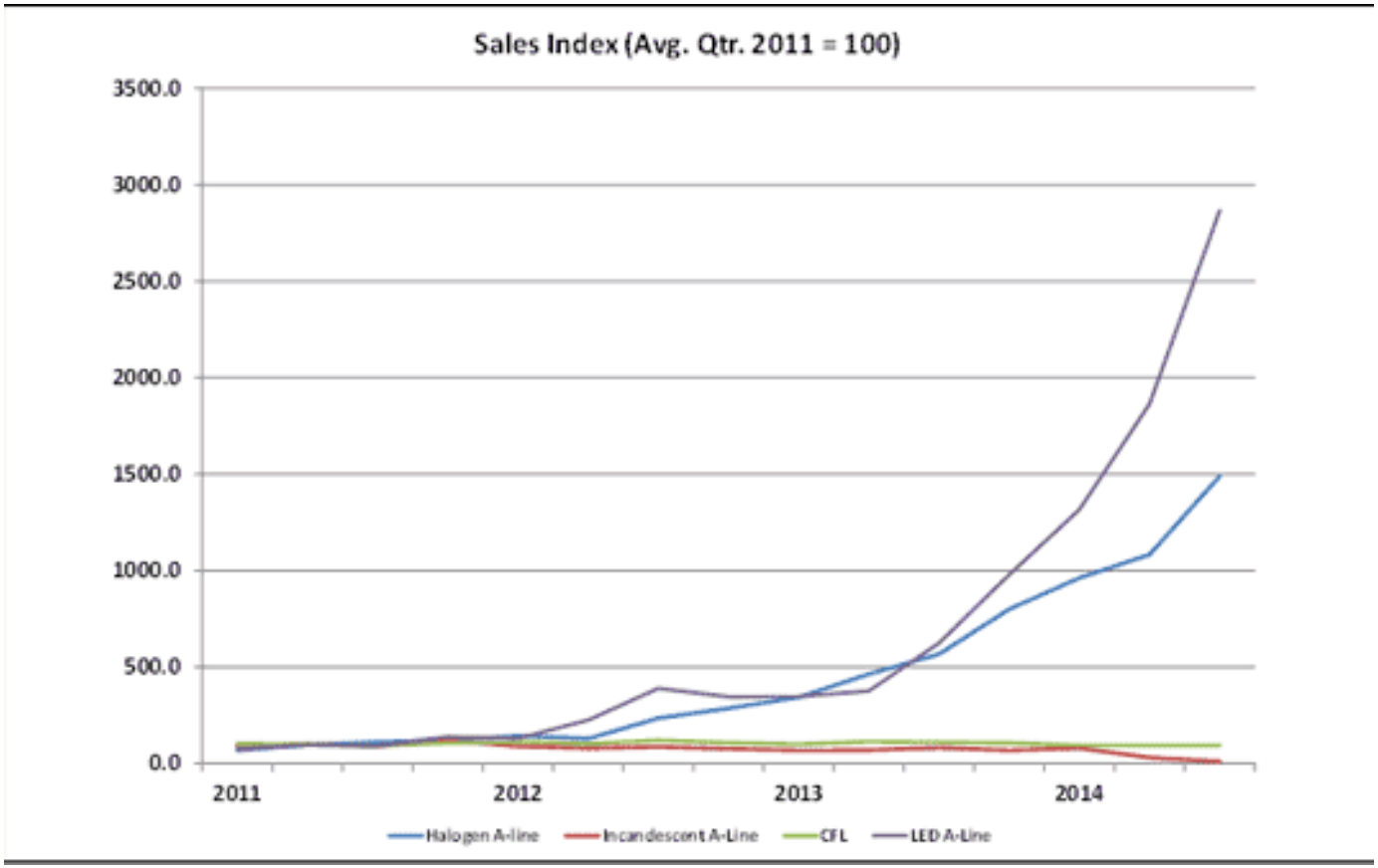
CFL

Incandescent

Halogen

Source: NEMA (U.S. association of electrical equipment and medical imaging manufacturers) http://www.nema.org/news/Pages/Compact-Fluorescent-Lamp-Shipments-Continue-to-Lag.aspx

A lamp Shipments up to Q3 2014



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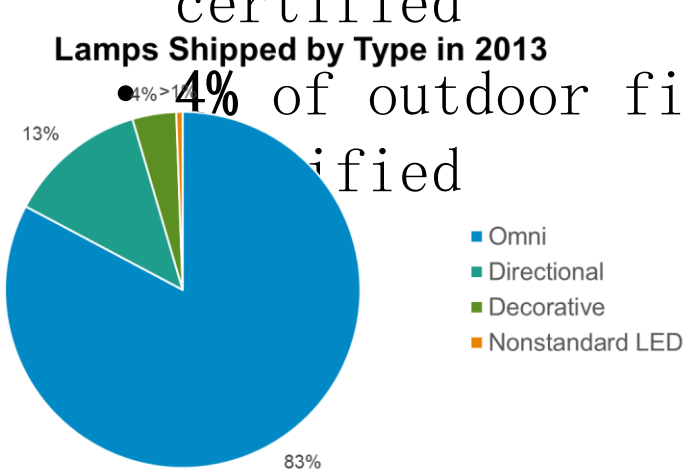
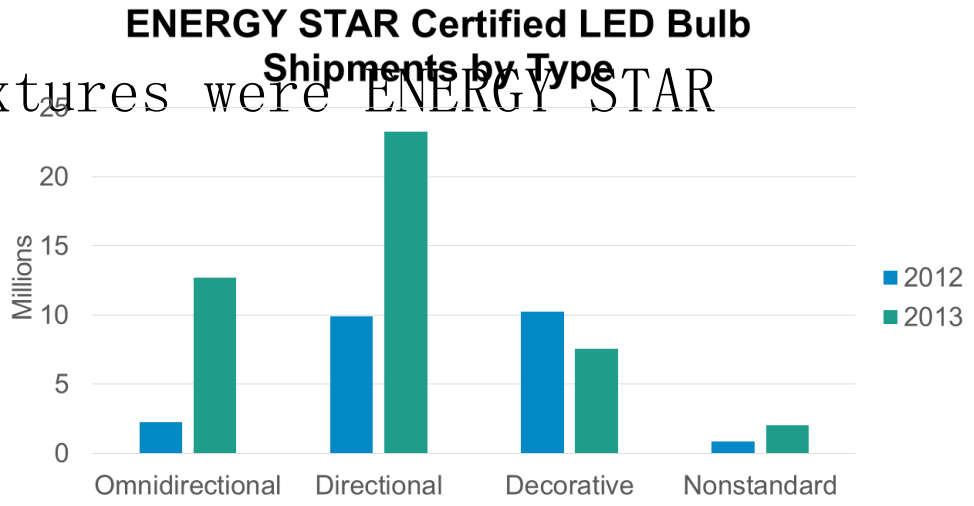
Source: NEMA (U.S. association of electrical equipment and medical imaging manufacturers) http://www.nema.org/news/Pages/Compact-Fluorescent-Lamp-Shipments-Continue-to-Lag.aspx

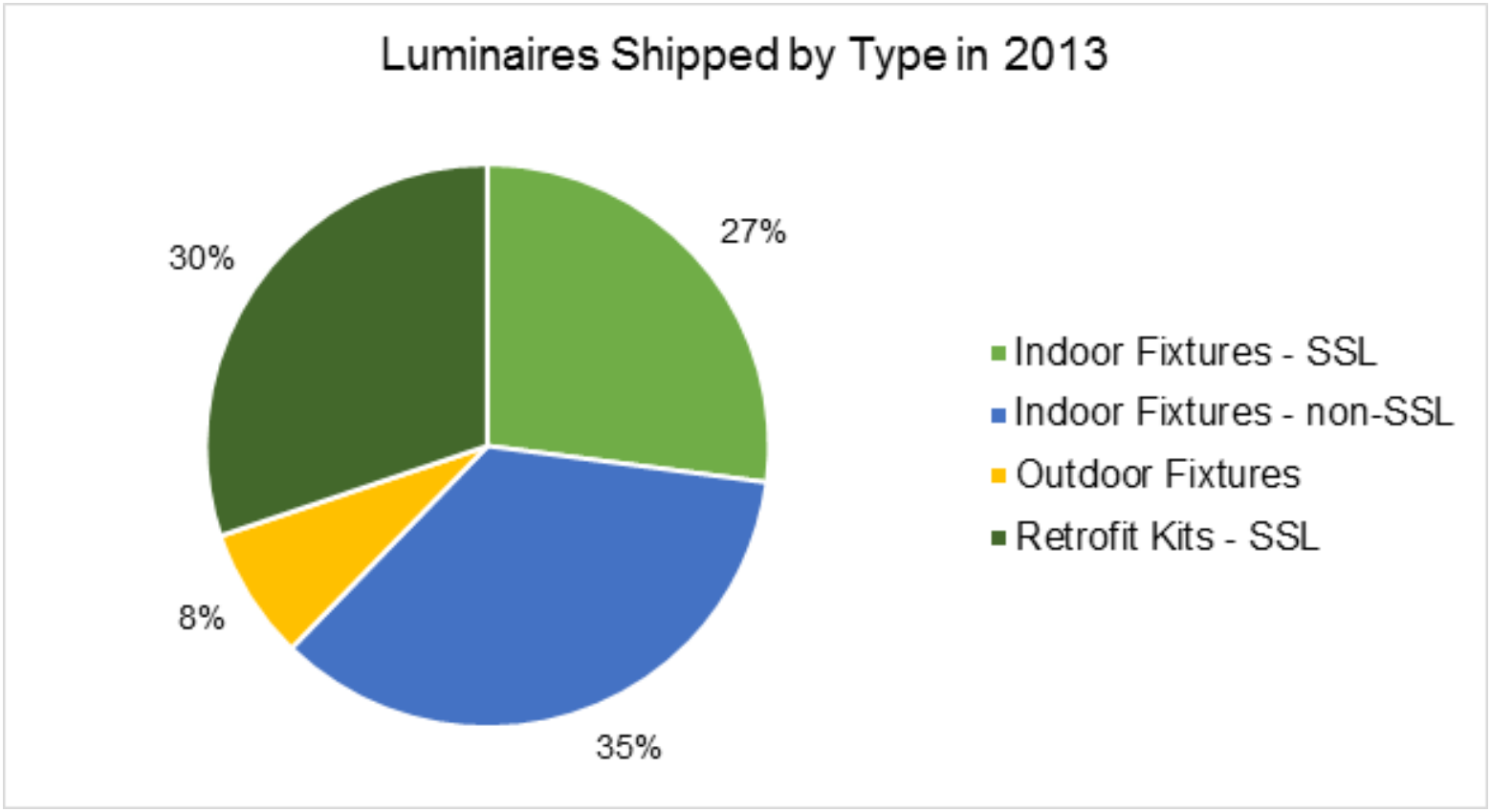
ENERGY STAR Shipments from 2013

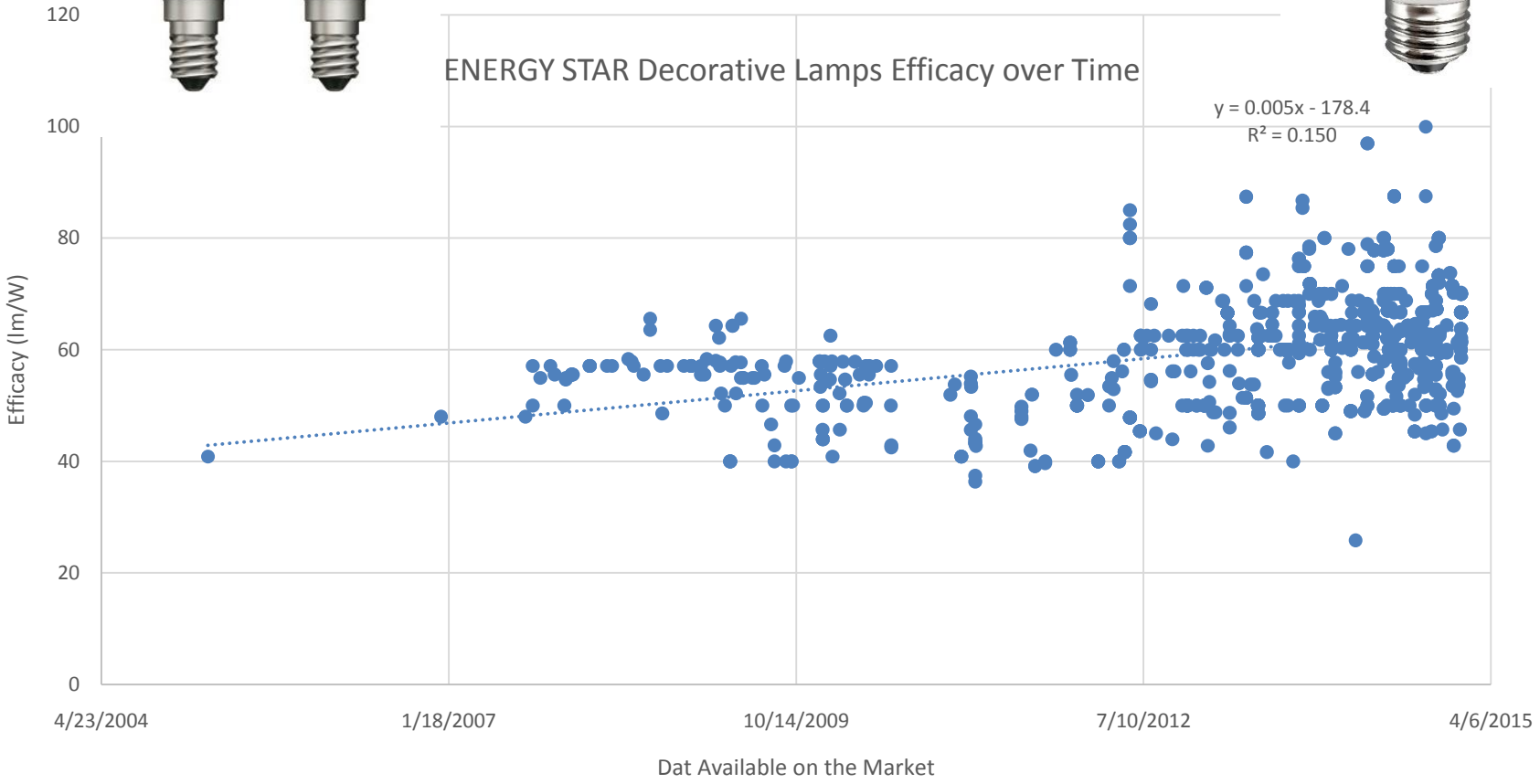
- 18% of light bulbs shipped in 2013 were ENERGY STAR certified – more than 350,000,000 units
  - **83%** of CFLs were ENERGY STAR certified
  - **76%** of LED bulbs were ENERGY STAR certified
  - **13%** of indoor fixtures were ENERGY STAR certified
  - **4%** of outdoor fixtures were ENERGY STAR ified



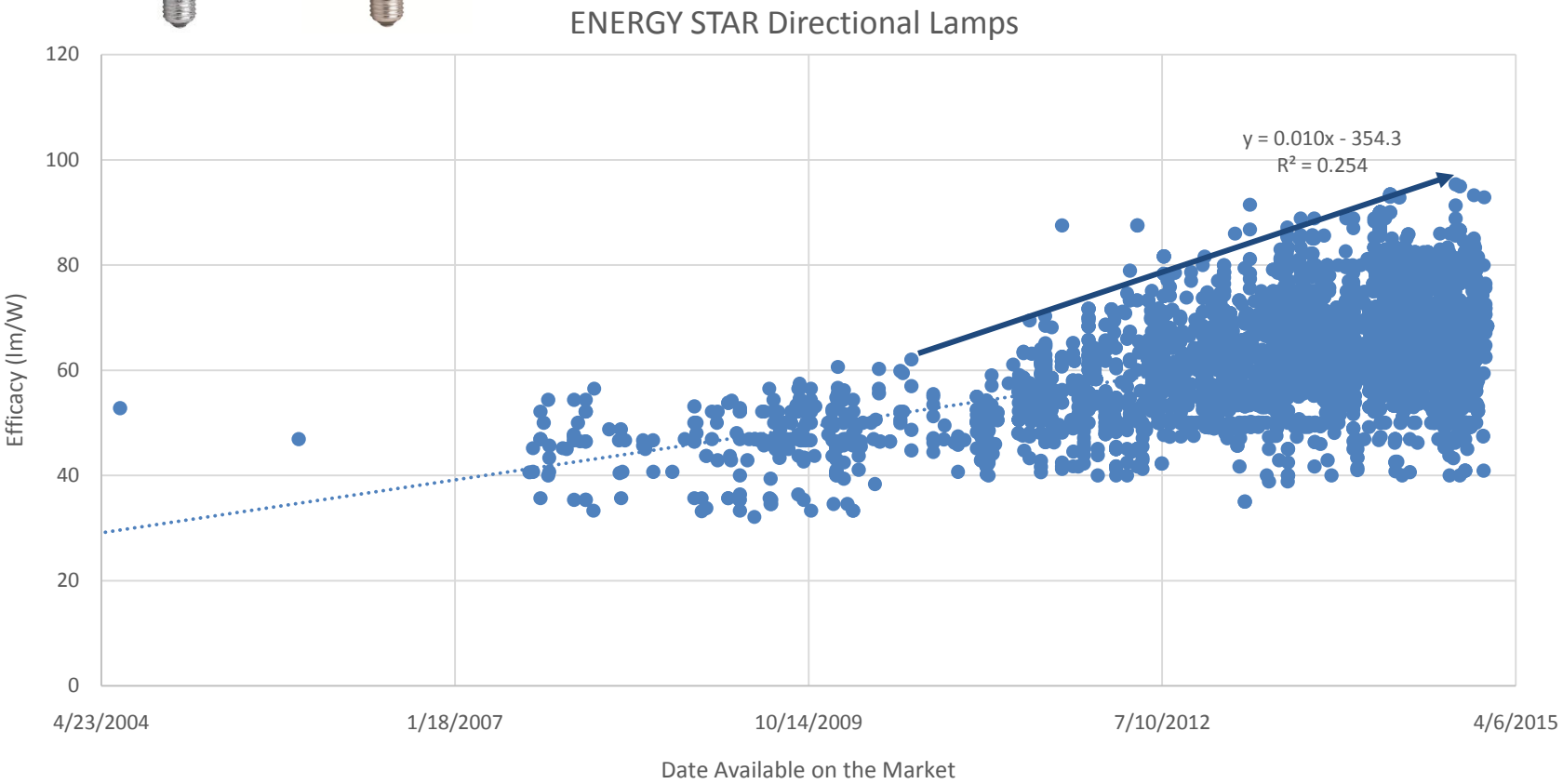


ENERGY STAR Fixture Shipments

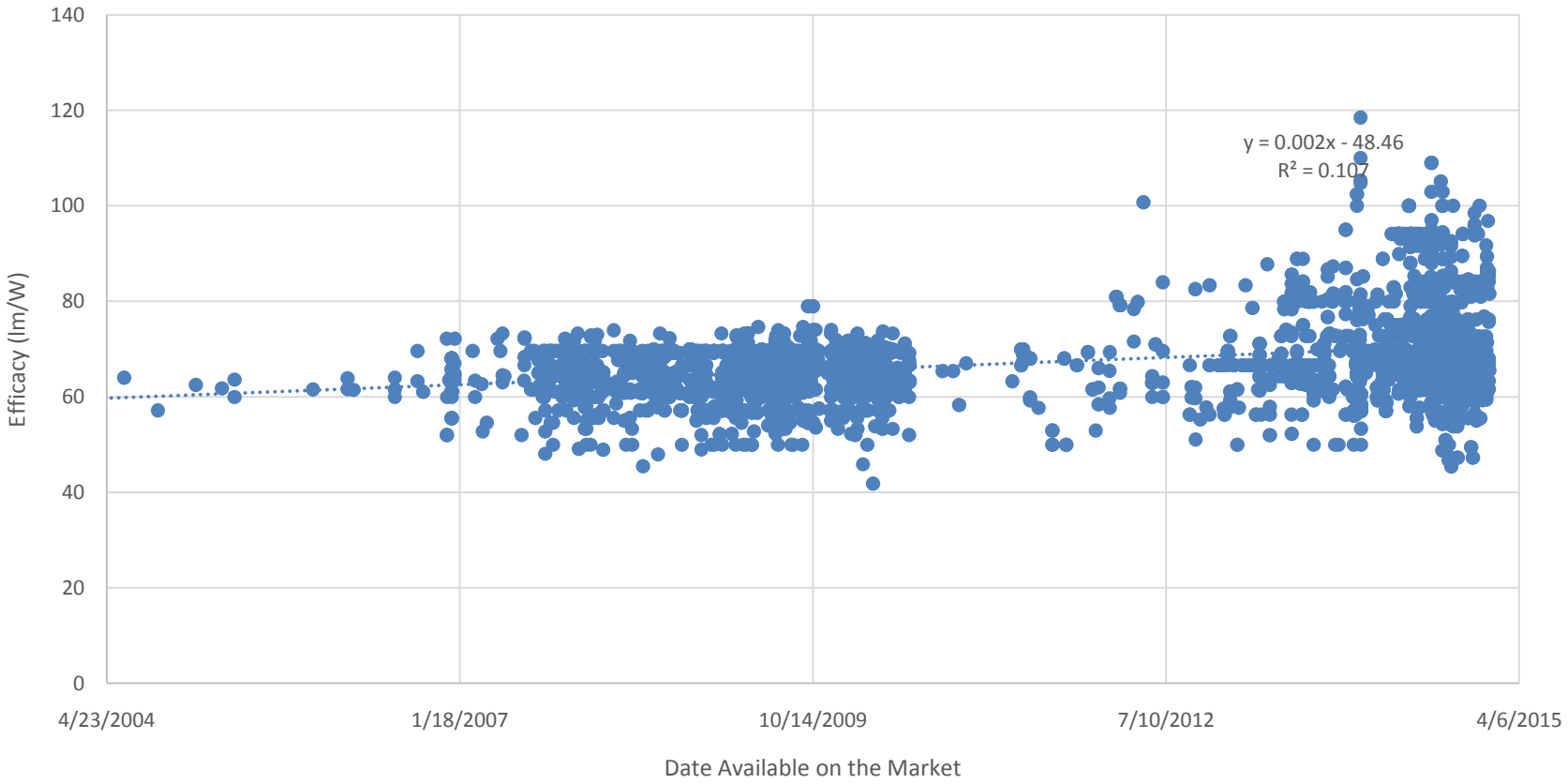




- Average increase of 2.117 lm/W per year.

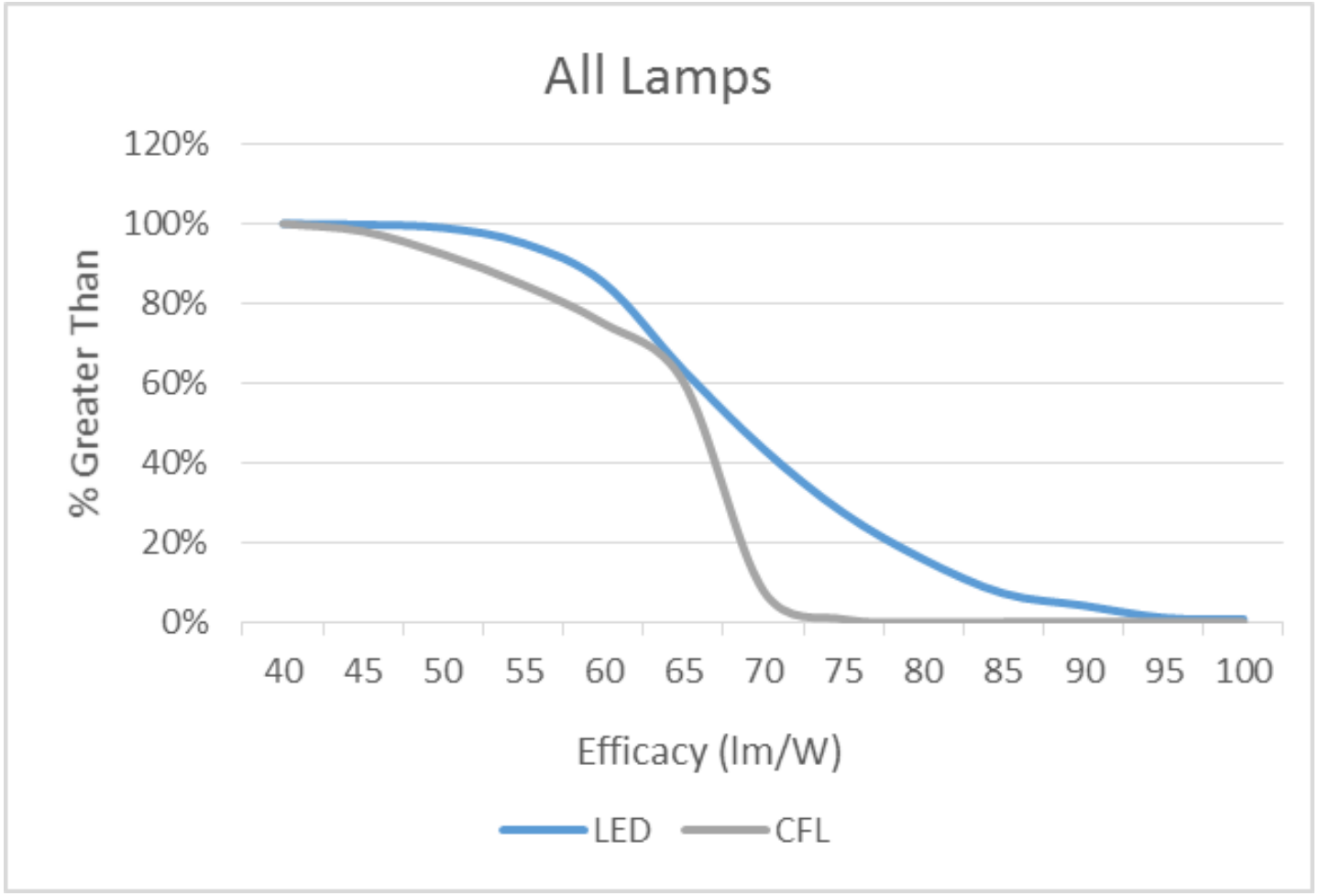


- Overall trend, 3.65 lm/W per year.
- Recent trend in maximum efficacy, increasing by close to 10 lm/W per year since 2011.

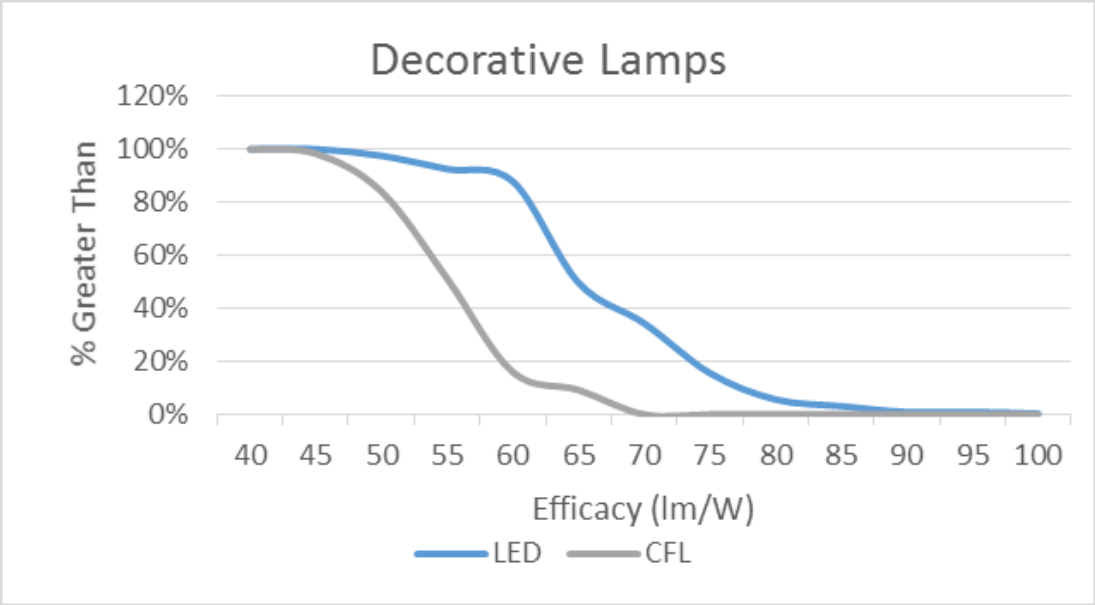


- Average increase of 1.022 lm/W per year.

Today's ENERGY STAR Bulb Efficacy Levels



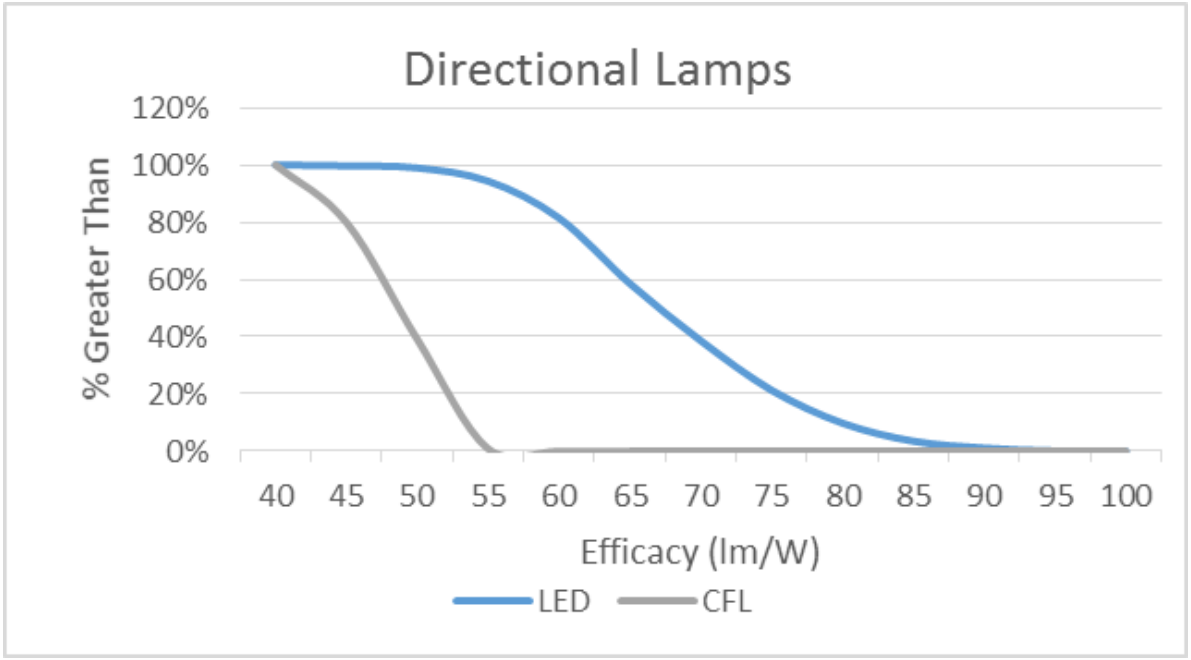
ENERGY STAR Decorative Bulbs



Decorative

- **27% of sockets**
- Baseline Efficacy: 6-12 lm/w
- **No federal standard**
- Current ENERGY STAR min: 45, 50, 60 depending on wattage lm/w
- Proposed for 2016: 65 lm/w

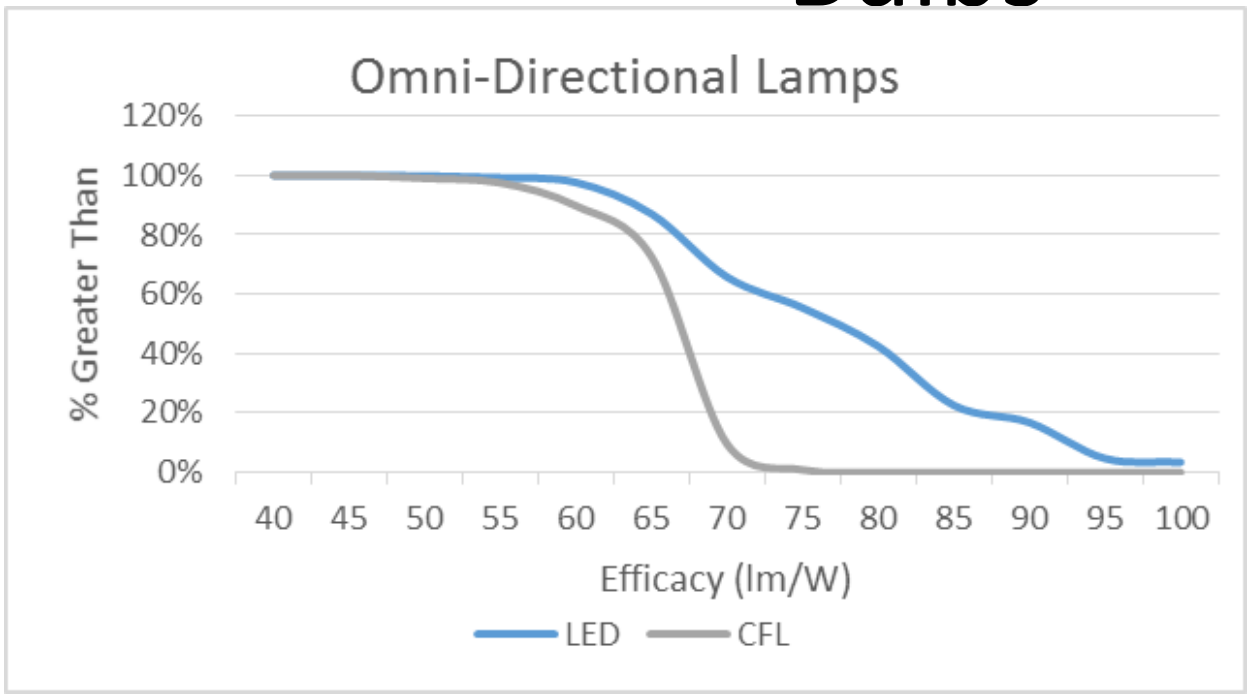
ENERGY STAR Directional Bulbs



Directional

- Baseline Efficacy : **6 – 32lm/w**
- **Some federal standards exist**
- **Popular exemptions e.g. BR30**
- **6% of sockets**
- **Current ENERGY STAR: 40 lm/w**
- **2016 Proposed : 65 lm/w**

Omni-directional ENERGY STAR Bulbs



Omni/A lamp/General Purpose

- **67% of sockets**
- Baseline (EISA) Efficacy: 6 – 23lm/w
- **Federal standards exist for most**
- **Federal standards in 2017 for all technologies**
- **Federal standard backstop 45 lm/w 2020**
- Current ENERGY STAR: 55 or 65lm/w (15W break)
- 2016 Proposed: 70 Lm/w

127 LPW Products

AXP Lighting Inc.

Home Shop Product Line Energy Savings About Us Contact Us

Shop

Shop > Standard A Bulbs > AXP A19 (Warm White)

AXP A19 (Warm White)

$11.99–$13.99

AXP Lighting's A19 Series offers advanced Filament LED™ technology, with superior brightness, efficiency, longevity, and the classic look of an incandescent light bulb, but without the burning heat!

Equivalent Chart:
4 Watts (35W Equivalent)
5 Watts (45W Equivalent) – Dimmable bulb
6 Watts (50W Equivalent)
7 Watts (65W Equivalent)

Wattage

Choose an option...

Base Color

plighting.com/wp-content/uploads/A19-white-base.jpg

118.5 Lm/W Product

$19.20 on
Amazon.com
1600 Lm
13.5 Watts
5000K

$20.97
3000K
1100 Lumen
10W
110lpw

What are industry Leaders doing to Advance market adoption?

ENERGY STAR LED Bulb Challenge

- More than **20 million** ENERGY STAR certified LED bulbs sold
- Educated consumers on the benefits of ENERGY STAR LED bulbs
- Increased visibility of ENERGY STAR certified LED bulbs, both in stores and online!

Collaboration: EPA, Philips, The Home Depot

Collaboration: EPA, Walmart, TCP Inc.

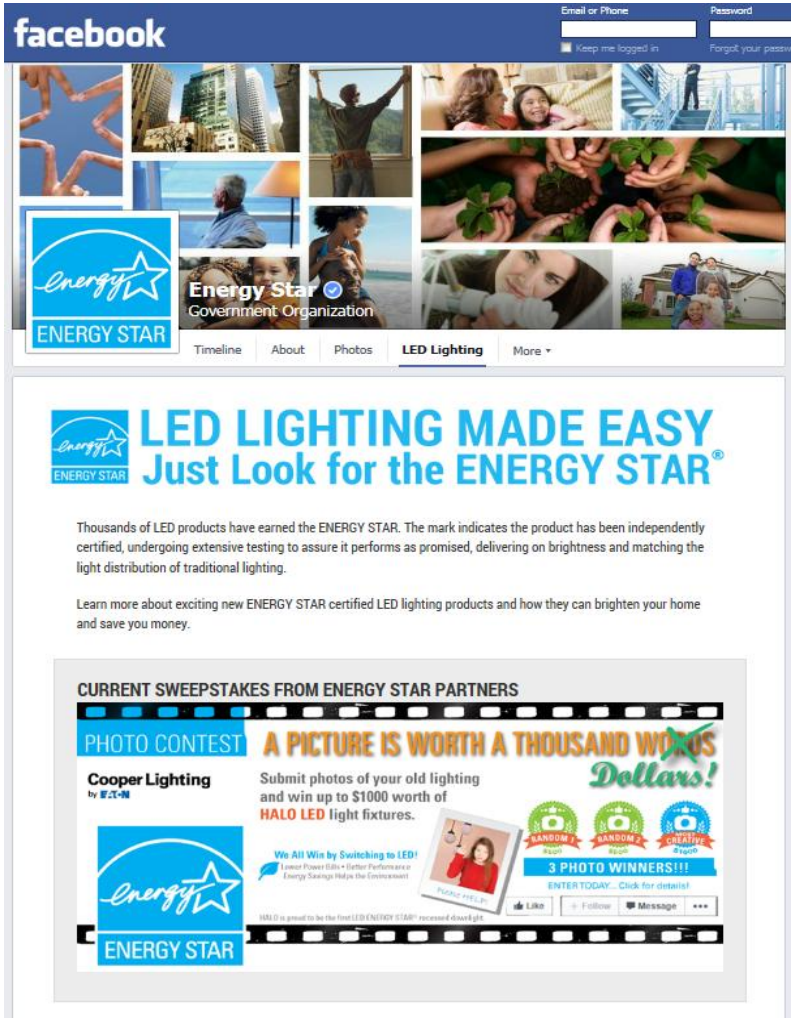
EPA ENERGY STAR Promotions

- Fall 2014 EPA launched a new LED bulb promotion, featuring exciting new social media tools
- Check out our three quirky, irreverent new video vignettes that highlight the benefits of ENERGY STAR certified LED bulbs.
- Facebook tab

Madame Helga - Margaret the Zombie - Floyd's Explosive Surprise

ENERGY STAR LED Lighting Facebook tab!

- Latest in ENERGY STAR Lighting
  - Sweepstakes
  - Showcasing certified products, videos, reviews and tools to help consumers
  - Add this tab to your Facebook page!



Energystar.gov/LED

Video to Help Consumer Choose Bulbs

Two Part Lighting Podcast!

Available on iTunes and www.energystar.gov/podcasts

Taylor Jantz-Sell
ENERGY STAR

Naomi Miller
Lighting Designer
PNNL

Noah Horowitz
NRDC

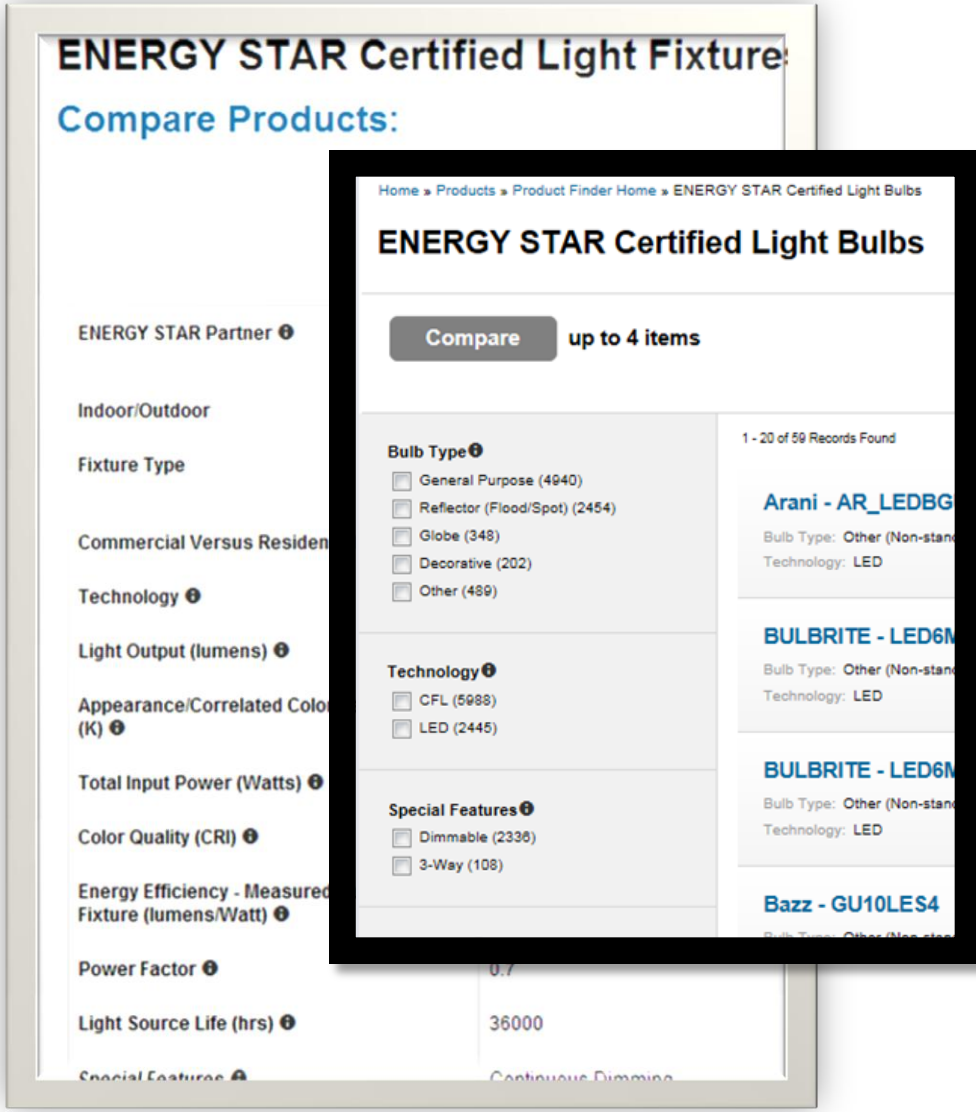
Mark Voykovic
The Home Depot

ENERGY STAR Resources

- **Stakeholder resources:**
  - www.energystar.gov/Lightingresources
- **Consumer Info:**
  - www.energystar.gov/lighting or www.energystar.gov/LED
- **Rebate Information:**
  - www.energystar.gov/DIME

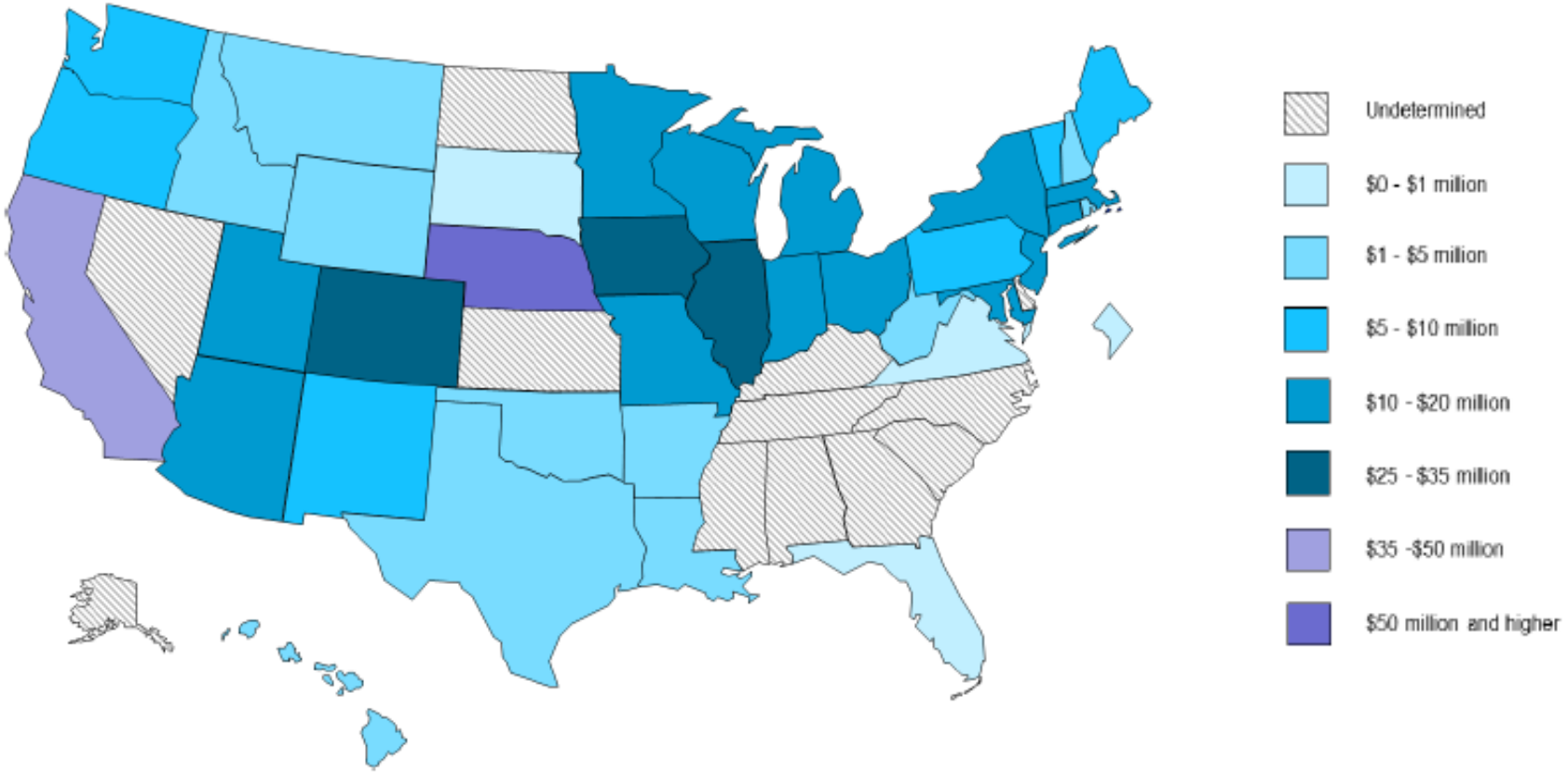
How to Find ENERGY STAR Certified Products

- Look for the label
- Find & compare ENERGY STAR certified product details
- www.energystar.gov/productfinder
  - Light Bulbs
  - Light Fixtures
- Filter based on product type, features, technology, etc.
- Compare up to 4 products side by side



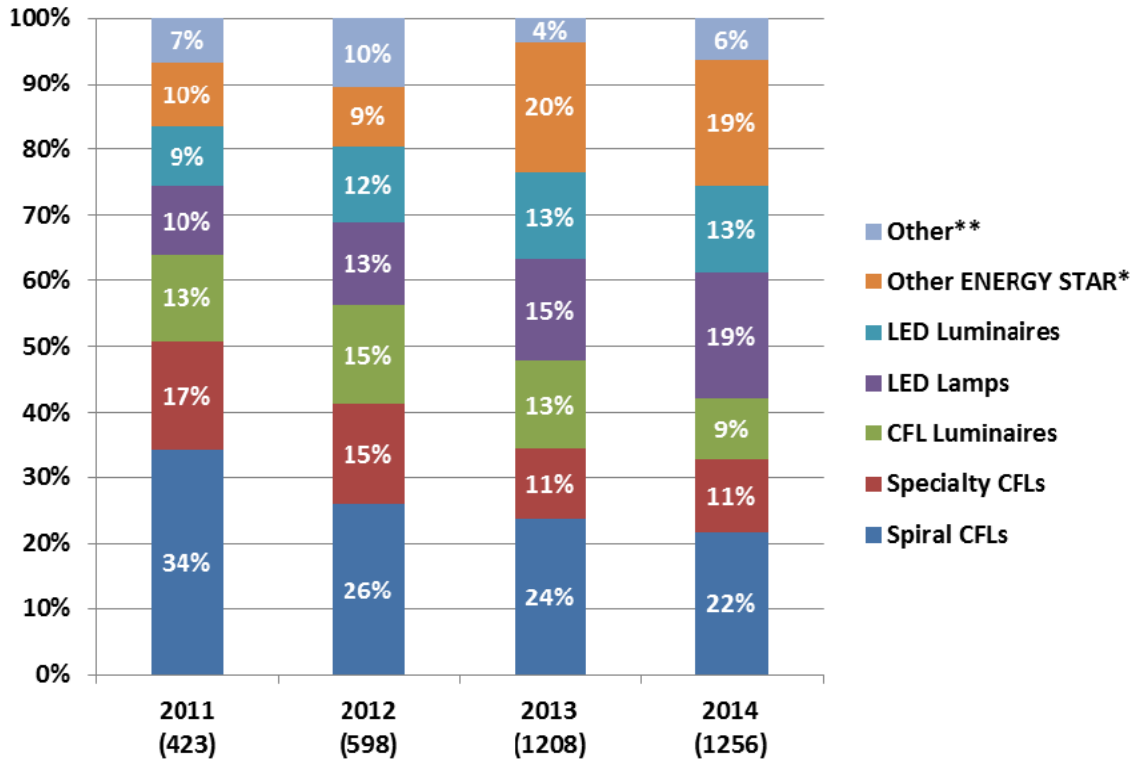
Utility Promotions

- The map below shows program budgets for lighting programs by state as reported by the energy efficiency program sponsors.



Utility Promotions: Product Types

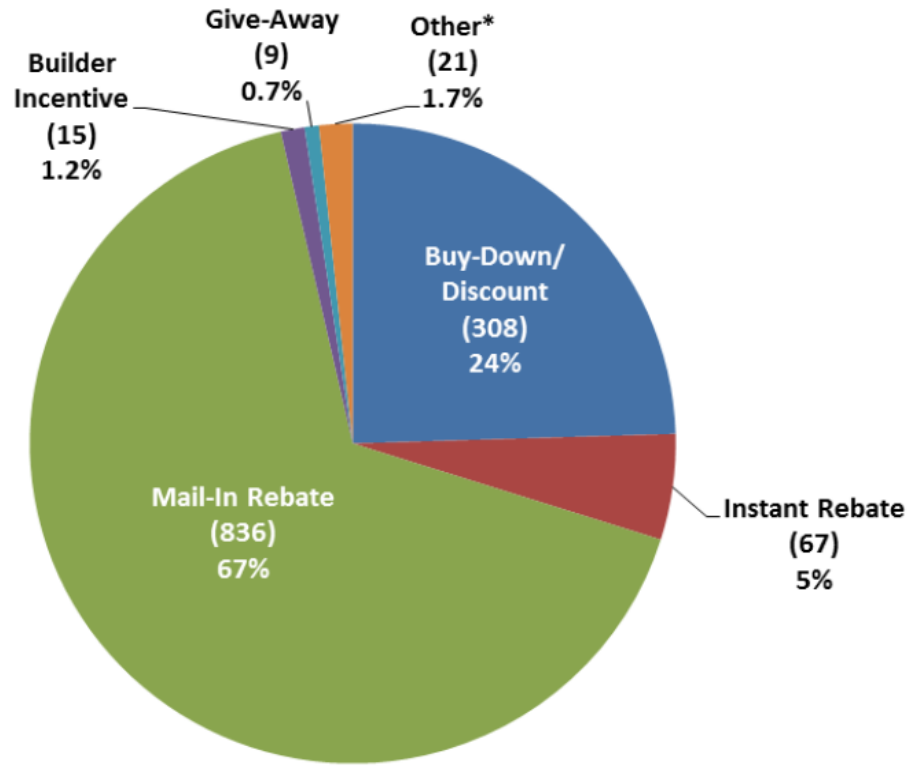
ENERGY STAR and Energy-Efficient Lighting Promotions by Product Type 2011-2014
(Annual totals listed in parentheses)



* The “Other ENERGY STAR” category is comprised of ENERGY STAR decorative light strings, CFLs w/pin base, ceiling and vent fans, and new construction programs. See the “Lighting Programs at a Glance” for individual partner details.
** The “Other” category is comprised primarily of commercial lighting products, such as LED exit sigs, fluorescent T-8 or T-5, High Bay lighting, and occupancy sensors.

Utility Promotions: Incentive Type

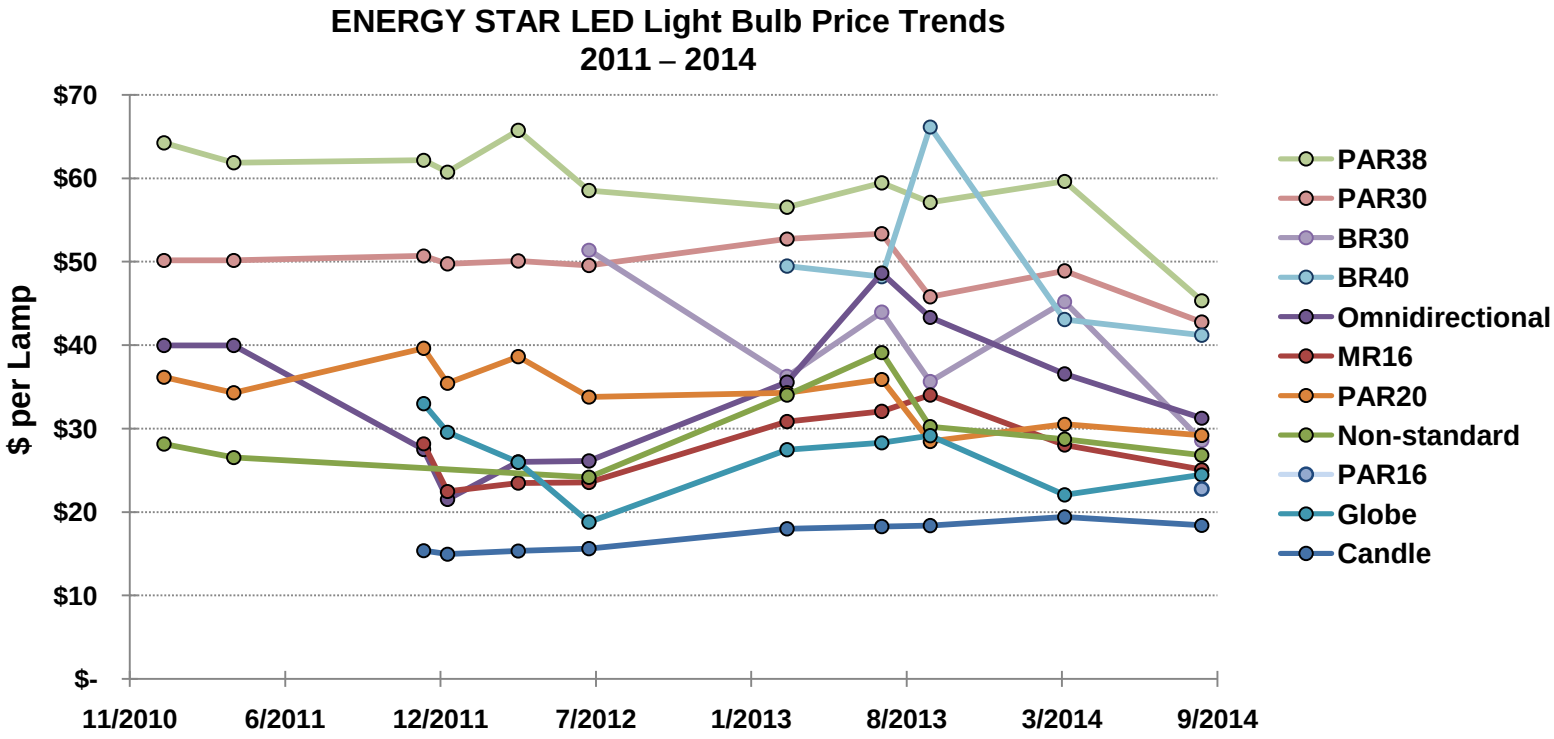
2014 ENERGY STAR and Energy-Efficient Lighting Promotions by Incentive Type
(Totals listed in parentheses)



* The “Other” category is comprised of low-interest loans, bill credits, and other miscellaneous promotion types. See the “Lighting Programs at a Glance” for individual partner details.

Price Trends for ENERGY STAR certified LED bulbs

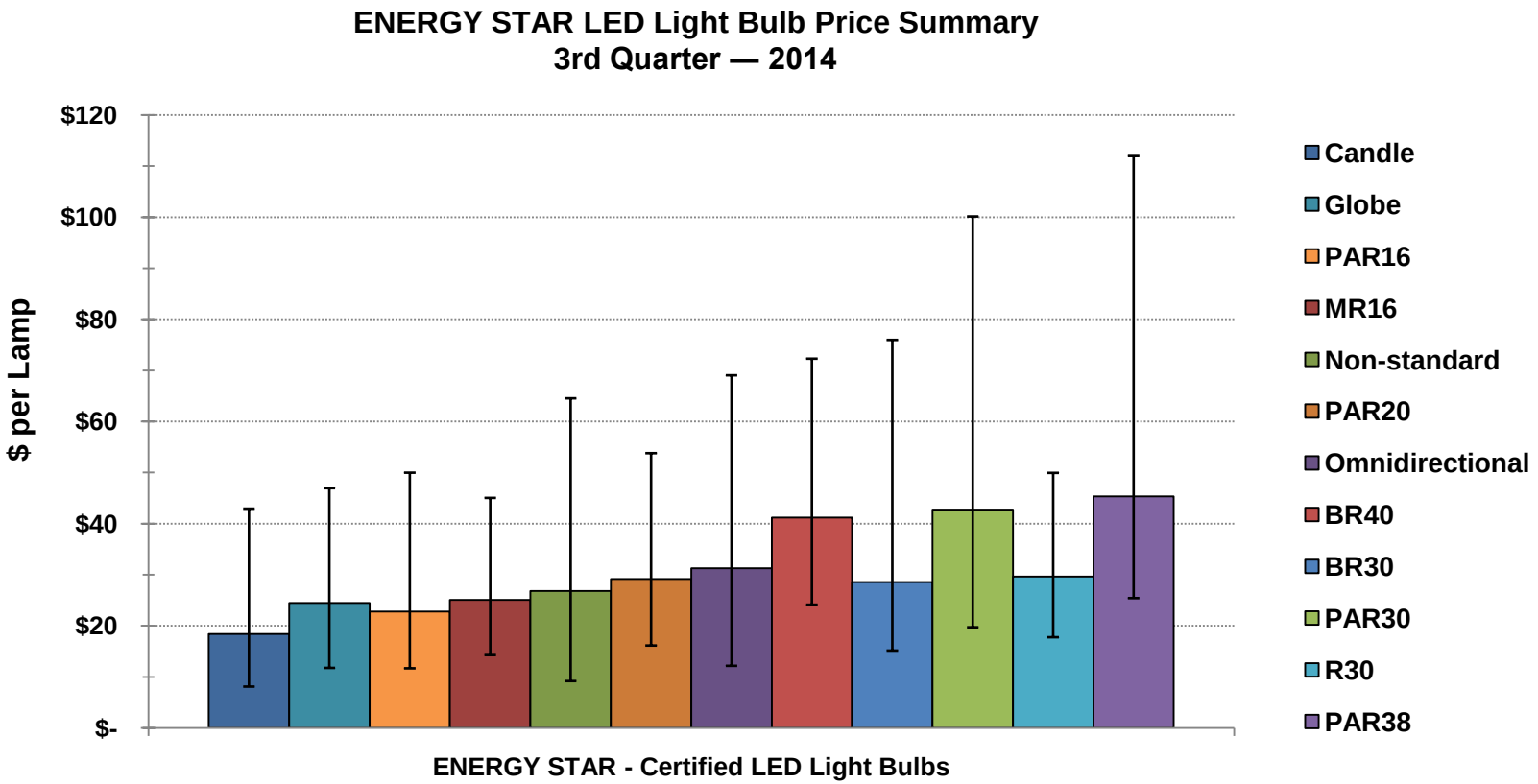
ENERGY STAR LED Bulb Price Trends from 2011-2014



** Note: Upward price swings largely due to additional products added to tracking scope*

Source: Bulb Price Trend Tracker

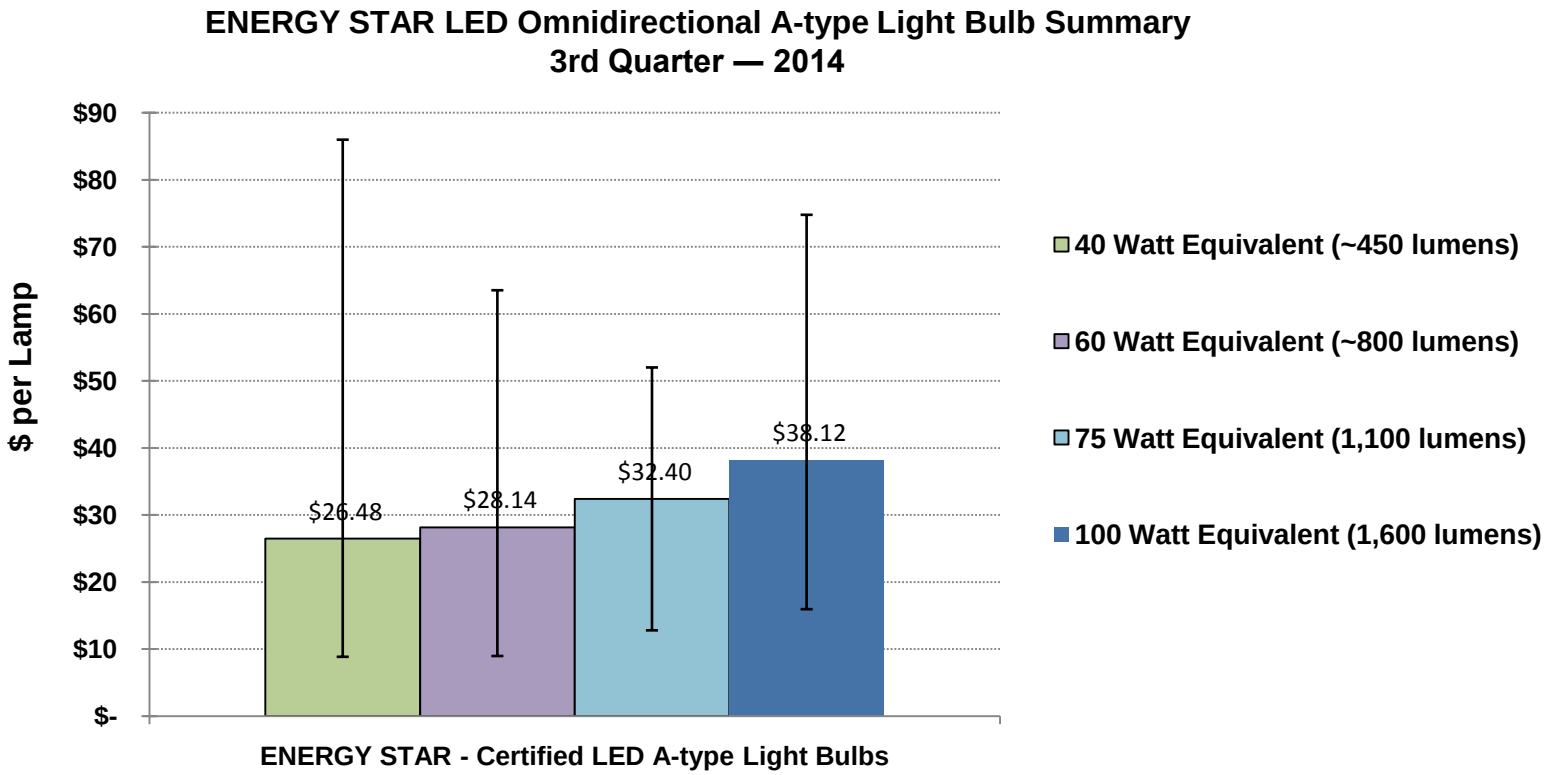
ENERGY STAR Certified LED Light Bulb Prices



** Note: Range reflects absolute minimum and maximum prices collected per light bulb type*

Source: Bulb Price Trend Tracker

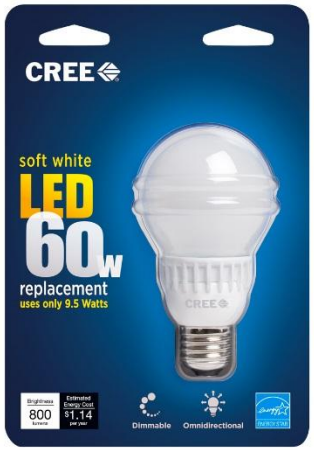
ENERGY STAR Omnidirectional LED Light Bulb Prices

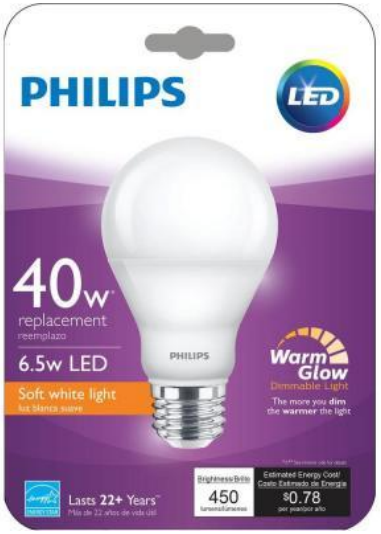


** Note: Range reflects absolute minimum and maximum prices collected per light bulb type*

Sub $10 ENERGY STAR 60W Replacements

- $9.97/9.98
- $8.97 leading major retail price for an ENERGY STAR certified, Omnidirectional, 60W replacement
  - –Rebates and deals bring them to $3.98





What happens when LED bulbs are $1.97?

- October 2014
- **Partners: Philips, The Home Depot & 15 utilities** (198 stores).
- 64 locations offered this product at $1.97
- Ran out of inventory week 2
- **185,182 Units Sold**
  - Of the total units sold, 82% of these sales came from the 64 stores offering this product at $1.97 (reg. retail $8.97)

Warehouse + Re

- Multi-packs with rebates
- 2 pk BR30 - $4.99 per bulb
- 3 pk Chandelier bulb - $3.99 per bulb
- 3 pk A19 - $3.99

Taylor Jantz-Sell
ENERGY STAR Lighting Program Manager
Jantz-Sell.Taylor@epa.gov

www.energystar.gov/lighting
www.energystar.gov/lightingresources

This concludes The American Institute of Architects Continuing Education Systems Course

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