

Energy Efficient Lighting Programs

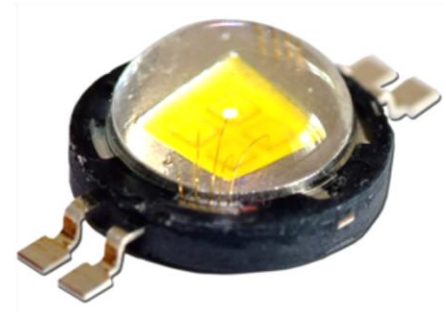
Key elements to maintaining quality,
accessibility and competition

Steve Coyne
Light Naturally



The Transformation of Lighting

- Greatest advance in the source of lighting since the incandescent lamp
- The Light Emitting Diode: LED



Hugely Disruptive Technology

- Highly responsive, (colour and light output)
- Excellent opportunity for optical control
- Comparatively very long life
- Introduces new industry sectors to the lighting industry
 - Potentially without understanding or experience of lighting concepts



Unmatched Energy Savings

- Moving towards an energy efficiency gain of almost 10:1. That is a 90% energy saving!
- Particularly significant for governments in terms of energy security and economic development of emerging economies.



Shift Required in Consumer Thinking

- Light sources becoming assets rather than consumables
- Product pricing reflects this concept
- Need to shift mind set
 - No longer are lamps cheap, and purchased without thought
 - Consider longer term investment and return



Quick Look at Economics

□ Compare:

	Incandescent	LED
Power	60 W	9 W
Lifetime	1,000 h	15,000 h
Price	0.50 USD	10 USD

- Average 3 hours operating per day
- Electricity cost 0.20 USD per kWh
- 20 year analysis

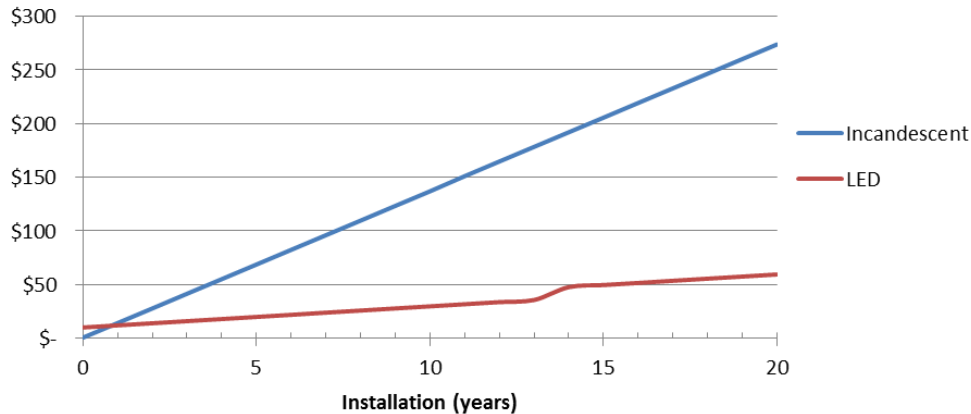


Finance Make Sense

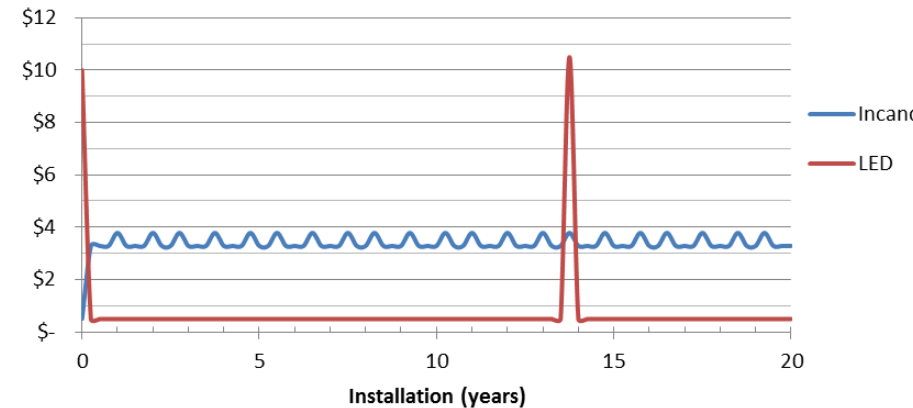
- Obvious monetary benefits

- But it's the initial outlay per lamp that is a disincentive or barrier

Cummulative Cost (operating at 3 hours average per day)



Quarterly Cost (operating at 3 hours average per day)

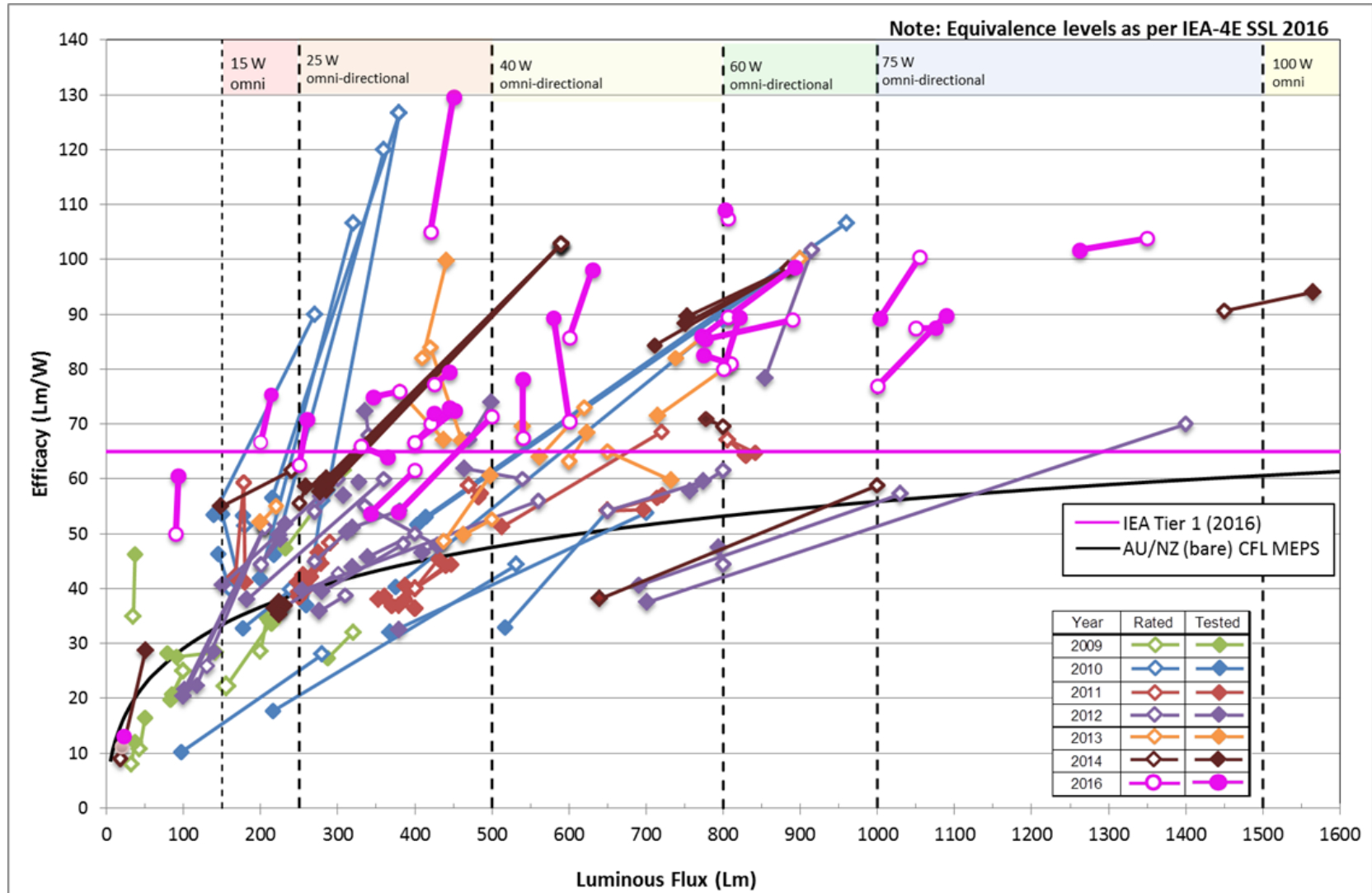


Key consumer concerns

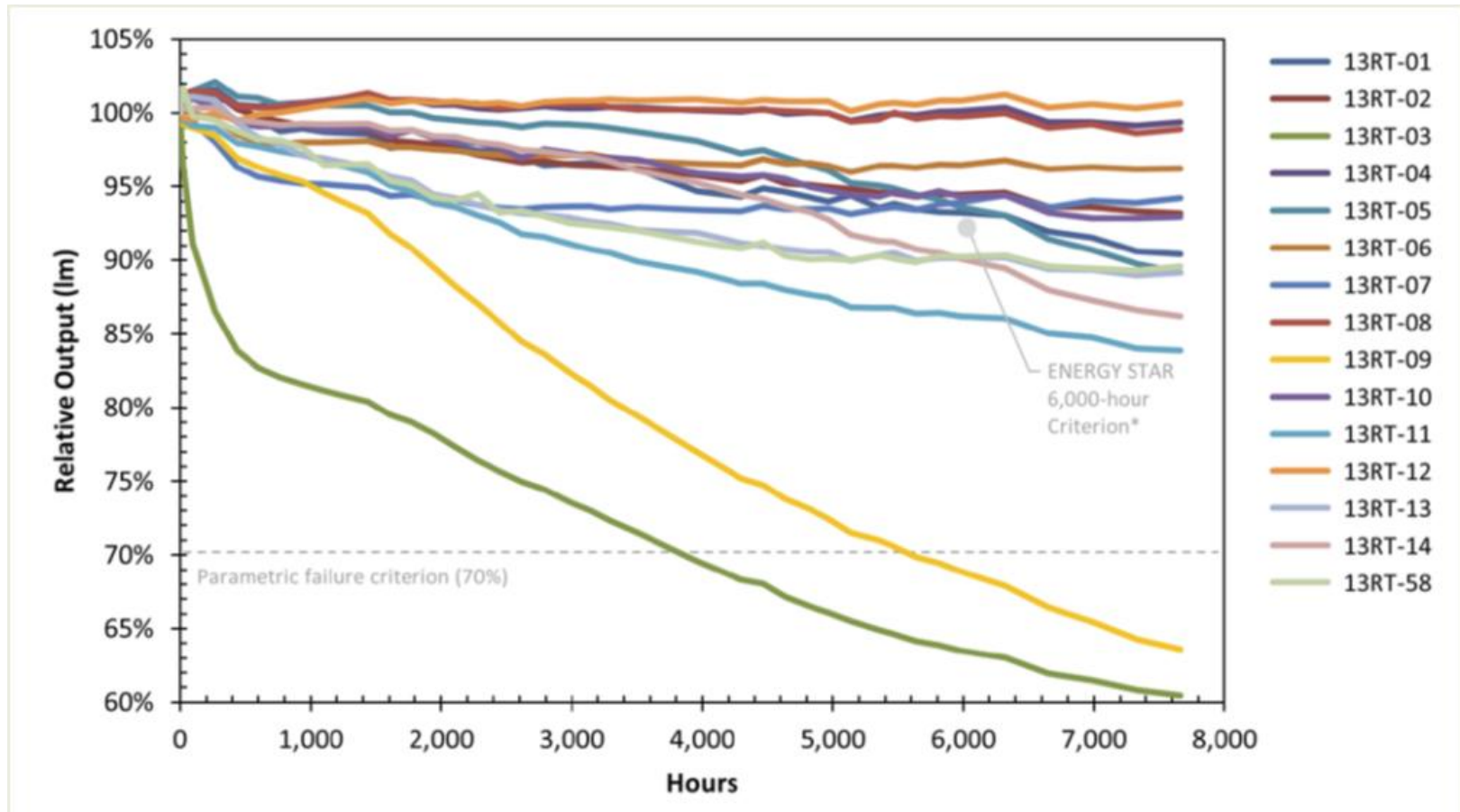
- Like-for-like replacement in light output
- Energy reduction achieved
- Lamp life achieved



Performance of lamps (light output and energy consumption)



Lumen Depreciation (lifetime)



Average lumen maintenance for each of the 15 LED lamp models tested for CALiPER (US DOE Dec 2014)



Government regulation

- To deal with market failure or impediments to transformation of the market
- Protect the consumer who also struggles with:
 - Transition from lost-cost consumable to investing in an asset
 - Build confidence in new technology (awareness/education programs)
- Regulation also requires a compliance program of Monitoring, Verification and Enforcement



Supplier Motivation for Compliance

Market participants will be motivated to comply when non-compliance brings

Cost
Benefit

- Potential consequences (financial and/or reputational) are greater than the benefits to be gained

Low

Risk of
Capture

- Chance of capture for non-compliance is relatively high

High

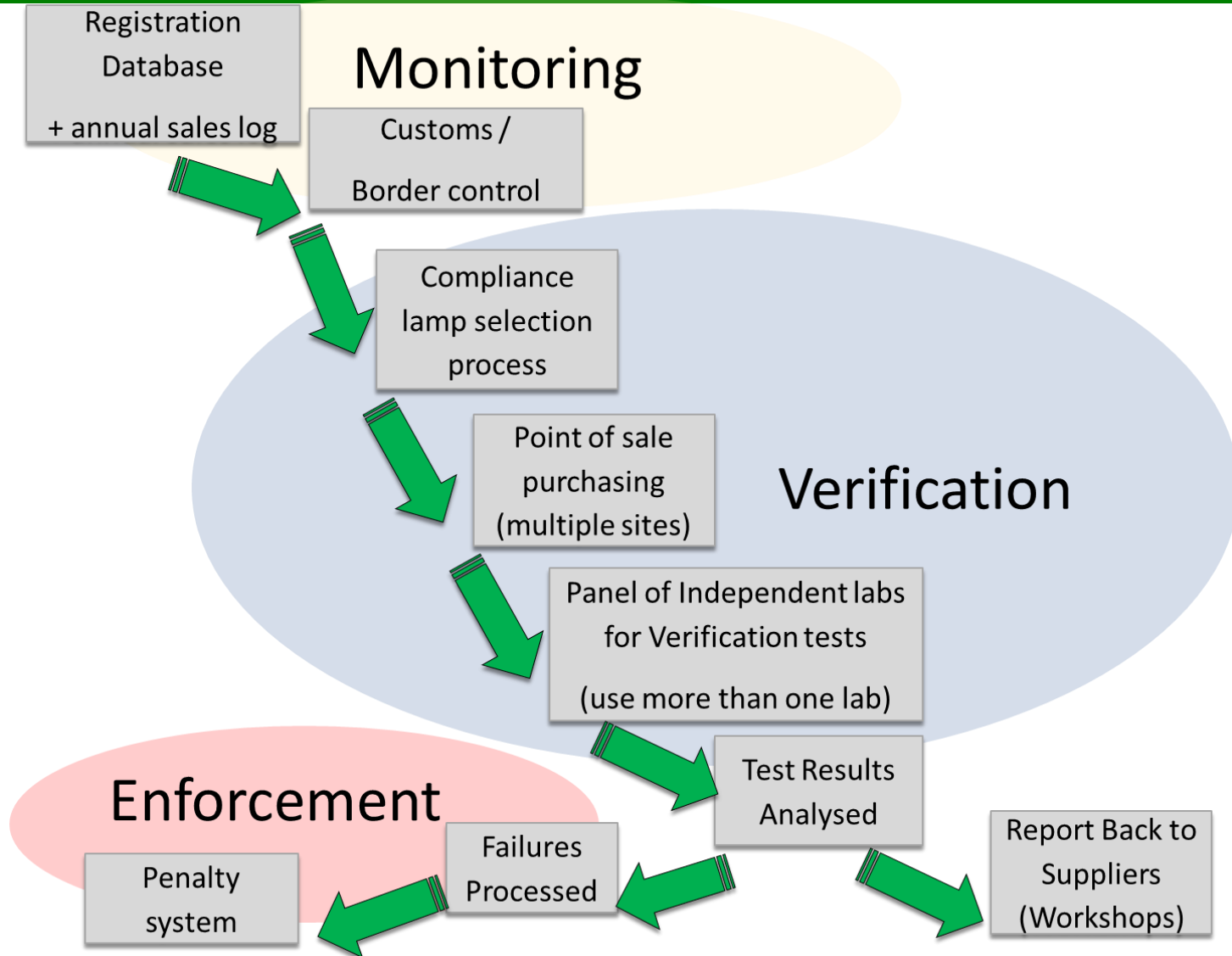
Enforcement
Response

- Action is prompt

Imminent



Full Monitoring Cycle



Country

Government Regulation



Verification program



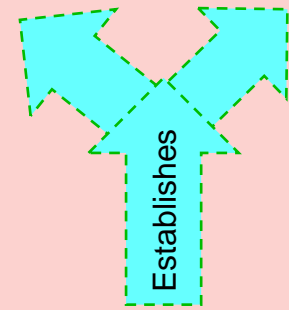
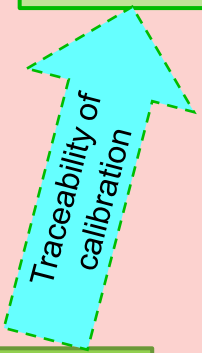
Accredited Laboratories



Test methods



Performance requirements



National Measurement Institute (NMI)

National Accreditation Body (AB)

National Standards Body (SB)



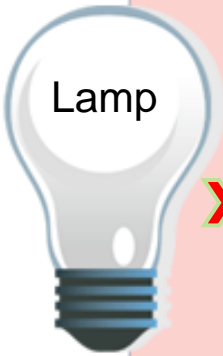
Global Harmonisation of Product Quality

Requires governments to agree on performance levels and test methods

Country

Government Regulation

Regulation requires set performance levels, relevant test methods, and competent laboratories



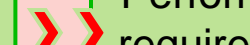
Lamp



Accredited Laboratories



Test methods



Performance requirements



Approved lamp

Can be registered for sale

Verification program

Traceability of calibration

Accreditation to perform test

Establishes

National Measurement Institute (NMI)

National Accreditation Body (AB)

National Standards Body (SB)

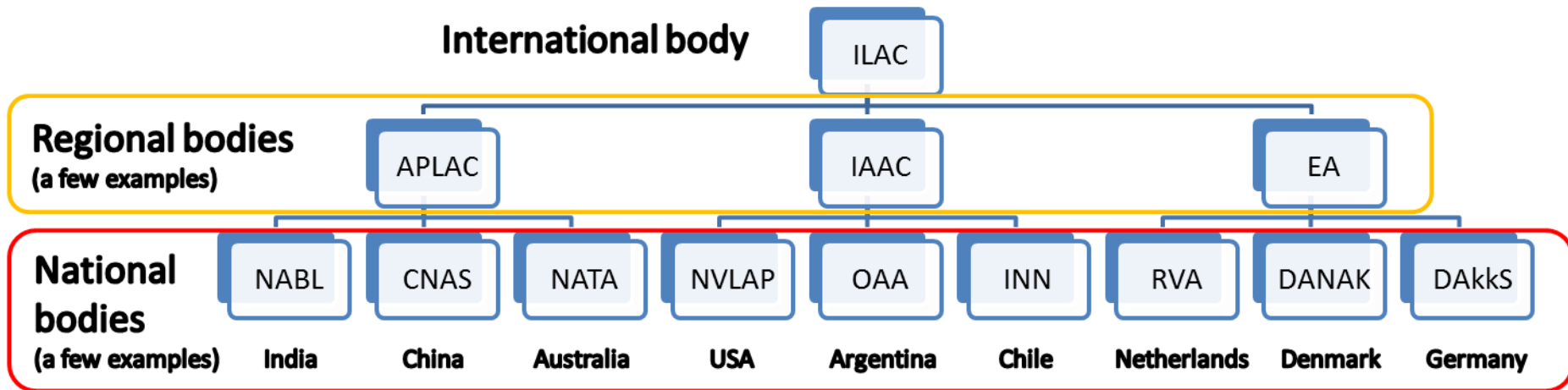
International Bureau of Weights & Measures (BIPM)

International Laboratory Accreditation Schemes (ILAC)

International Commission on Illumination (CIE)

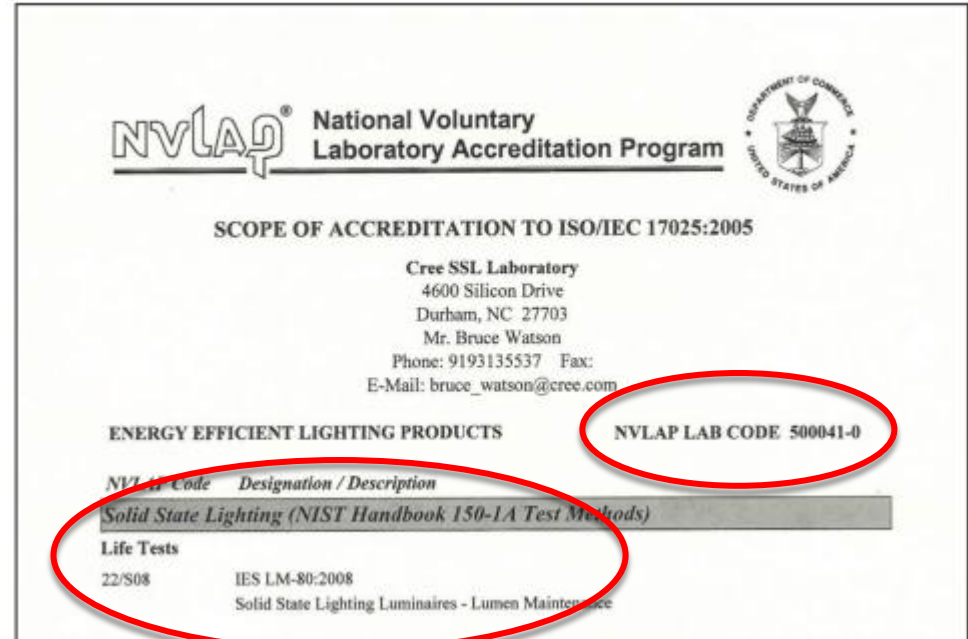
International Electrotechnical Commission (IEC)

International Accreditation System



Authenticity of Test Reports

- Confirm accreditation status
- If in doubt contact AB
- Check scope of lab



Authenticity of Test Reports



APPLICATION NOTE

CLD-AP57 REV 3

Cree® XLamp® LED IES LM-80-2008 Testing Results

Revision: 3 (November 22, 2011)



INTRODUCTION

This document provides the results of Cree's IES LM-80-2008 ("LM-80") testing on XLamp LEDs. Cree is providing this data so that the public can verify the reliability of Cree LEDs as part of a complete LED lighting system.

Note that this document only provides the end results of the LM-80 tests. This is not a complete LM-80 report. Do not use this document to submit luminaires or lamps to an agency. Cree customers who need the full LM-80 reports should contact their Cree sales representative.

Cree's customers who wish to share LM-80 results with their customers have permission to link to this document from their websites. For more information, contact:

TABLE OF CONTENTS

NVLAP Accreditation for LM-80-2008 Testing	2
XLamp MC-E White LEDs (Rev 1)	3
XLamp ML-B White LEDs (Rev 0)	4
XLamp ML-E White LEDs (Rev 0).....	5
XLamp MP-L EasyWhite LEDs (Rev 0).....	6
XLamp MT-G EasyWhite LEDs (Rev 0).....	7
XLamp MX-3 White LEDs (Rev 0)	8
XLamp MX-6 White LEDs (Rev 2)	9
XLamp XM-L EasyWhite LEDs (Rev 0).....	10
XLamp XM-L White LEDs (Rev 0)	11
XLamp XP-E White LEDs (Rev 3).....	12
XLamp XP-E High Efficiency White LEDs (Rev 2)	13
XLamp XP-G White LEDs (Rev 4)	14
XLamp XR-E White LEDs (Rev 1)	15



Light Naturally
for generations to come

Market Transformation Monitoring

- Data critical to monitoring and evaluation of regulatory programs

- World Customs Codes – Harmonised System
 - HS Nomenclature 2017 Edition
 - 85.39
 - Electric filament or discharge lamps, including sealed beam lamp units and ultra-violet or infra-red lamps; arc-lamps; **light-emitting diode (LED) lamps.**
 - 8539.50 – Light-emitting diode (LED) lamps

