Partners Role in LED value chain

A Consultant's Perspective

By

Anil Valia

January 5-6 2012 | Mumbai

ELCOMA

LED and off-grid Lighting Conclave

Acknowledgement

- ELCOMA - Electrical Lamp & Component Manufacturer Association
- Data & Photographs shown here are only for education purpose.

Anil Valia

Lighting Designer & Educator

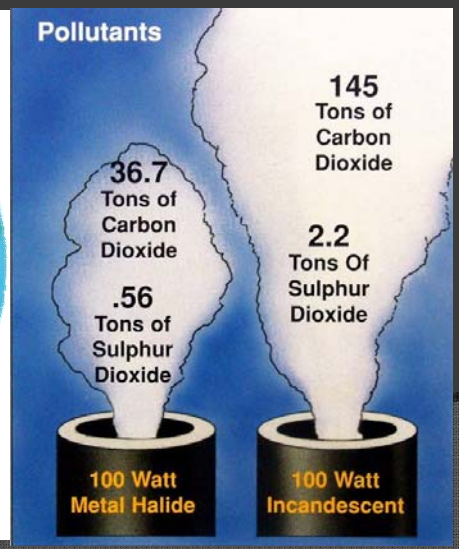
BE Elect (Hons.), Chartered engineer,
MIE (India), FISLE, MIES Emeritus (USA),
FILE (U.K.), MIES (Australia),
Educator - IALD (USA); CIE. EDU,
Ex-Vice President & Founder Member ISLE, Fellow & Founder Member CEEAMA,
Course Director – ILA

Lighting Systems Consultant

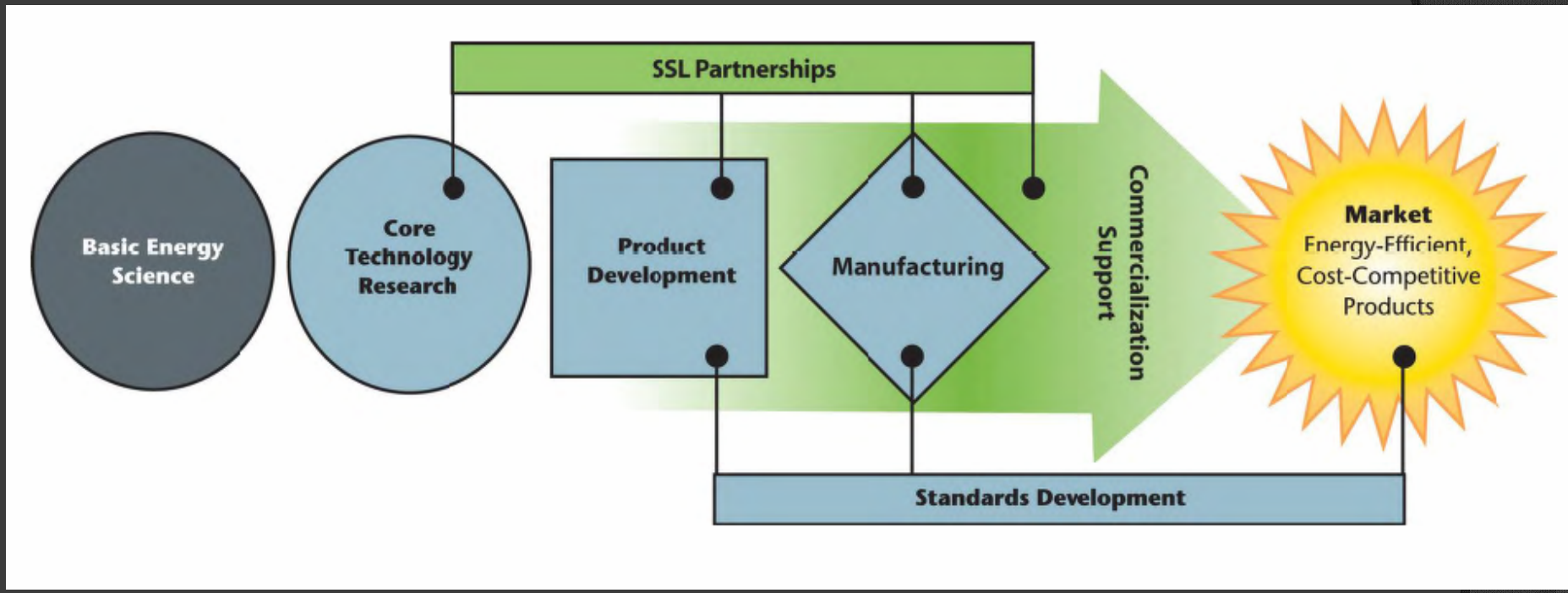
Shop No.9, Omex Apt, 64, Sahar Road, Koldongri,
Andheri (East), Mumbai-400069, India
Tel.: 91-22-26838413, 66922443, Email: atvalia@gmail.com

International Overview

- Lighting standards driven by national goals to reduce energy consumption for greener world –India is also committed.

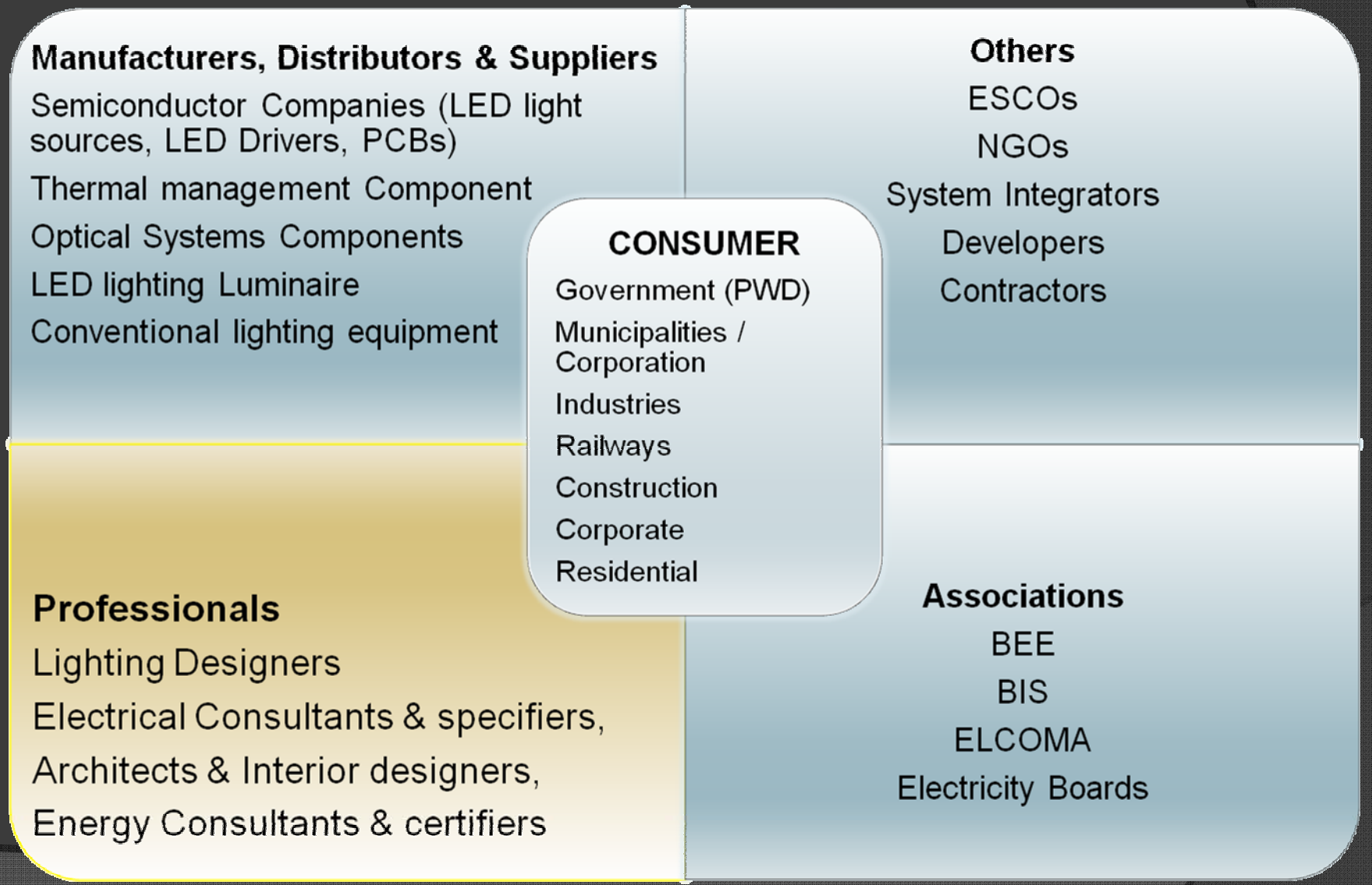


DOE Solid-State Lighting Program Strategy

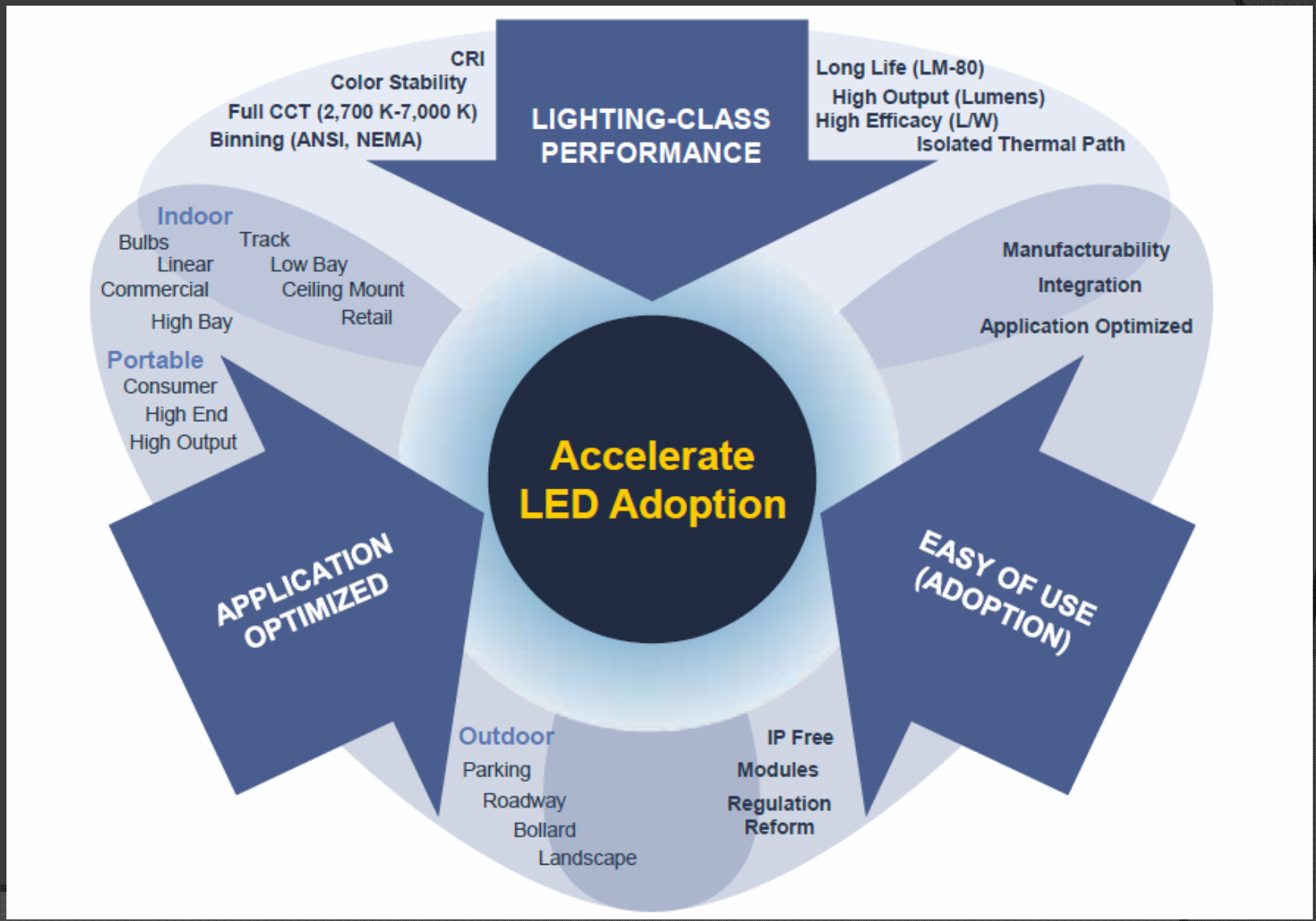


Guiding technology advances from laboratory to marketplace

Value Chain Partners

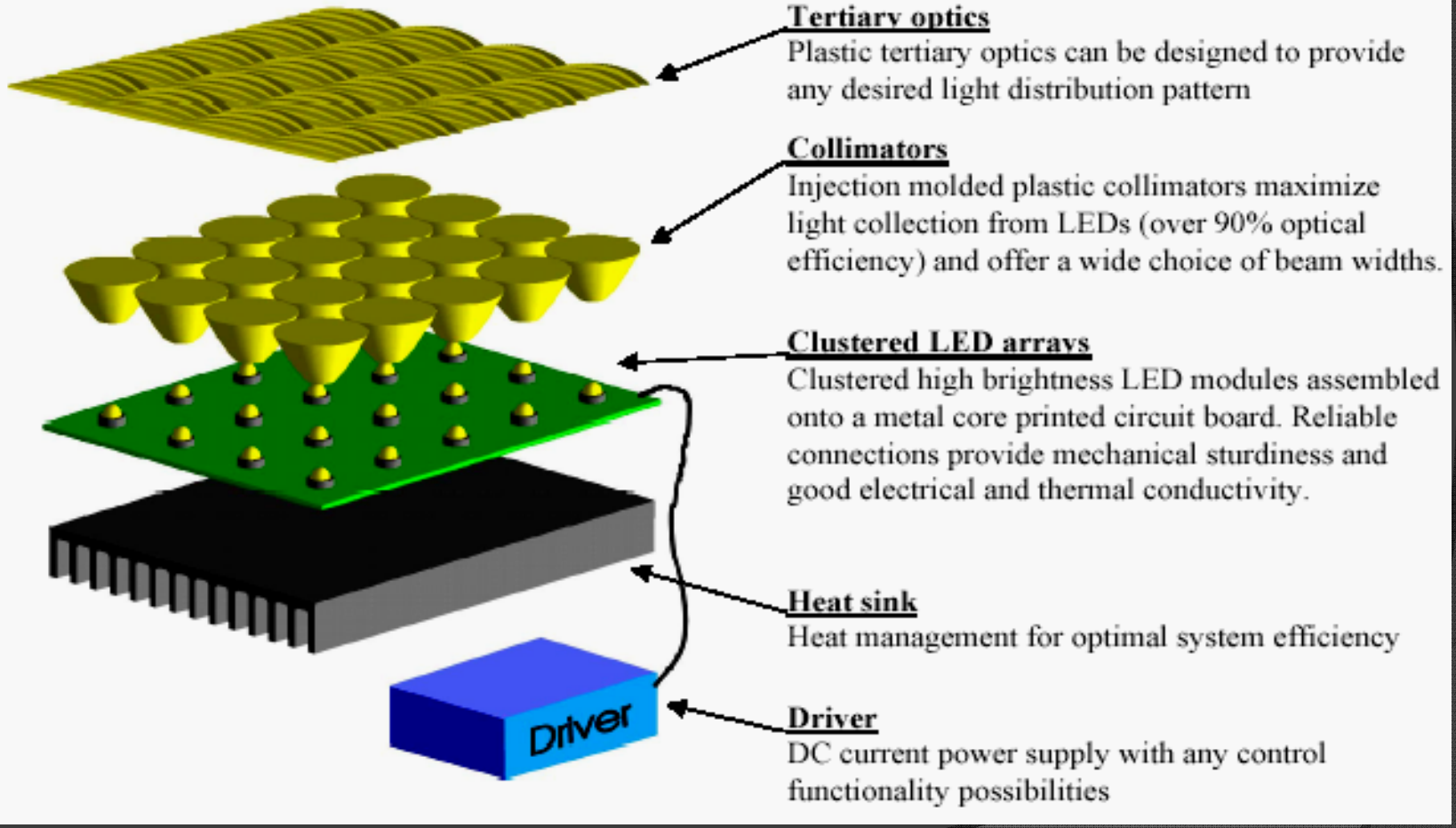


Dimensions of Acceleration



CONSULTANT'S PERSPECTIVE

OEMs v/s.LED Technology
LED – A System Criteria



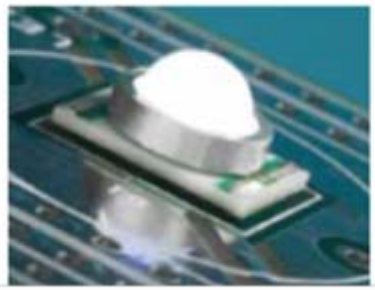
LED is not a stand alone lamp like any other lamp for using in a standard luminaire

OEMs v/s.LED Technology

- LED Luminaire Manufacturers have to understand entire gamut of LED System manufacturing which is not possible for most of them as they are not that literate /equipped in all the fields.
- Most also claim using reputed Make of LEDs but what about its integration and who certifies that ?

OEMs v/s.LED Technology

- Baffled by endless choice of LEDs and changing specifications
- Do not always understand thermal / optical challenges
- Quality of driver and resulting LED life
- Their chosen LED is often obsolete after a year of production!
- Blindly substituting conventional lighting with LED, irrespective of their suitability



OEMs v/s.LED Technology

- Two Groups of industry involved
  - Traditionally lighting
  - electronics (non lighting)
- Large Gap between LED manufacturers and Lighting Industry

Negative impact on rate of LED penetration

OEMs v/s.LED Technology

- LED products rapidly coming to market. Some LED products perform well, meet manufacturer claims, beat existing alternatives
  - Many do not perform as claimed …
    - Bad Colour Appearance
    - Poor Colour Rendering
    - Efficacy V/s.Efficiency
    - Short Life,
    - Diming & Flicker Issues
    - Cost V/S. Quality Variation

- Significant learning curve for manufacturers, Consultants, buyers & Users

Lots of hype and misinformation

MISCONCEPTION

“LEDs are going to supersede all other light sources”

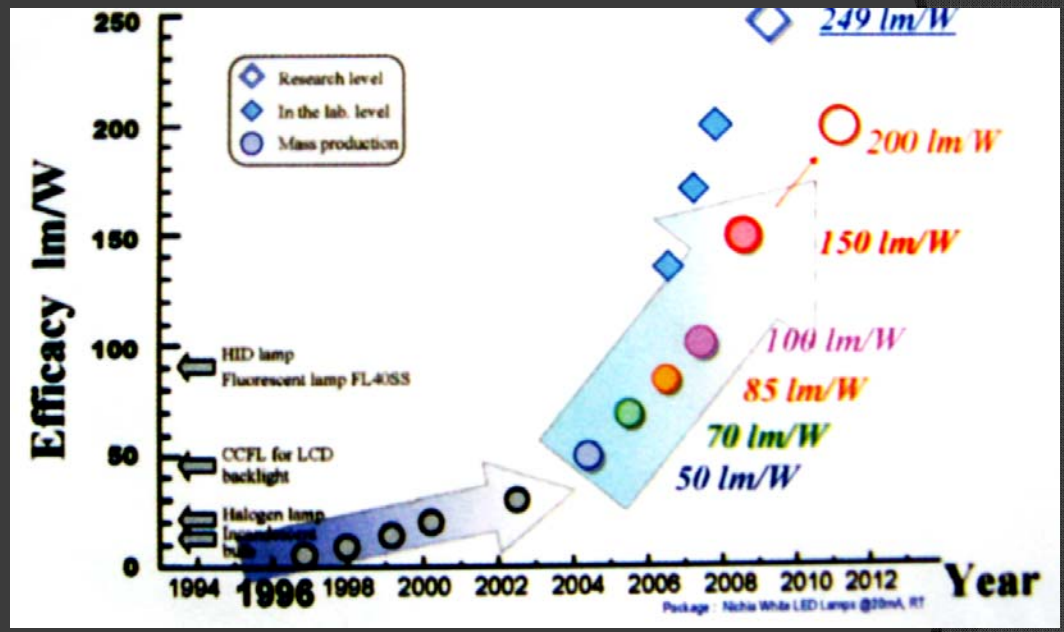
“LEDs out-perform all other lamps on every criteria in each & every applications!”

FACT

- LEDs can excel in lifetime and efficacy for incandescent & CFL lamps, but this is not always enough as other parameters are of importance
- No single light source technology achieves leadership in every category
  - That is why we still manufacture so many different types of lamps
  - There is always an optimum light source for each given application

Understanding of Efficacy

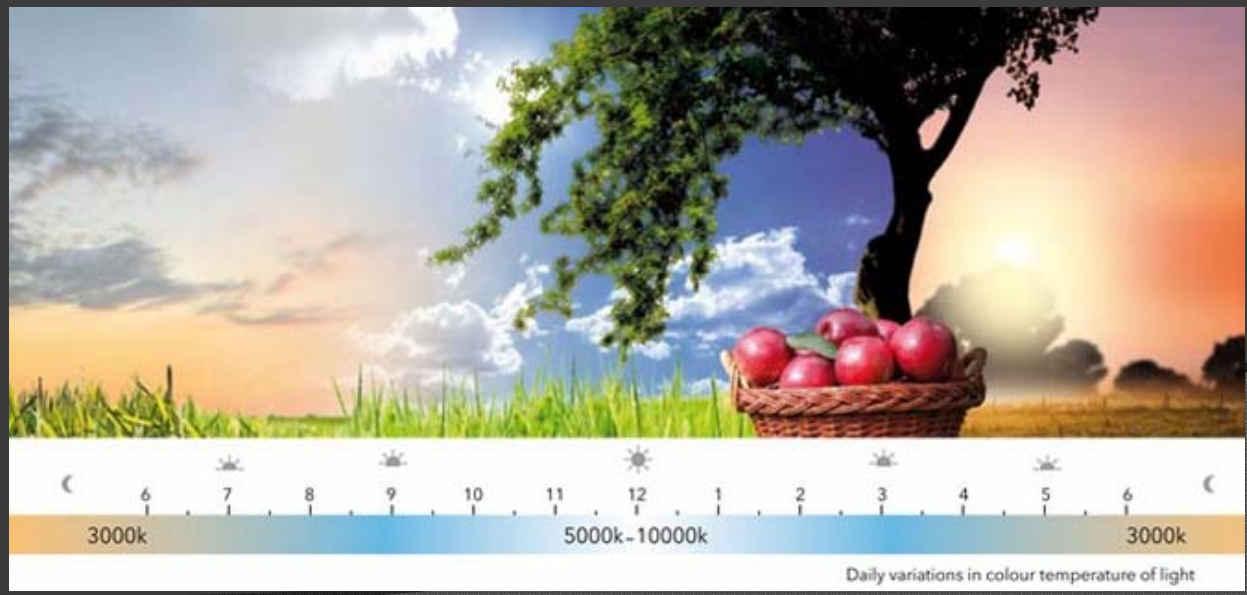
- White LEDs are > 160 lm/W but in practice Efficacy of White LED Lamp/Luminaire in Year 2011 is 70 -90 lm/W
- LED efficacy decreases in Practical Installations
  - at real operating temperatures (droop effect)
  - when used with lens, diffuser, reflector elements
  - when used with Electronic Drivers



White LEDs – Luminous Efficacy

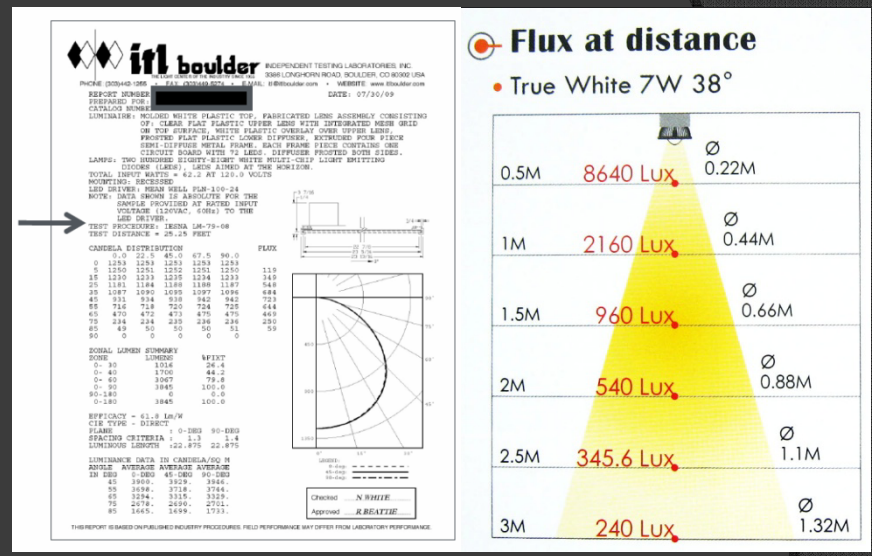
Understanding of Colour Characteristics

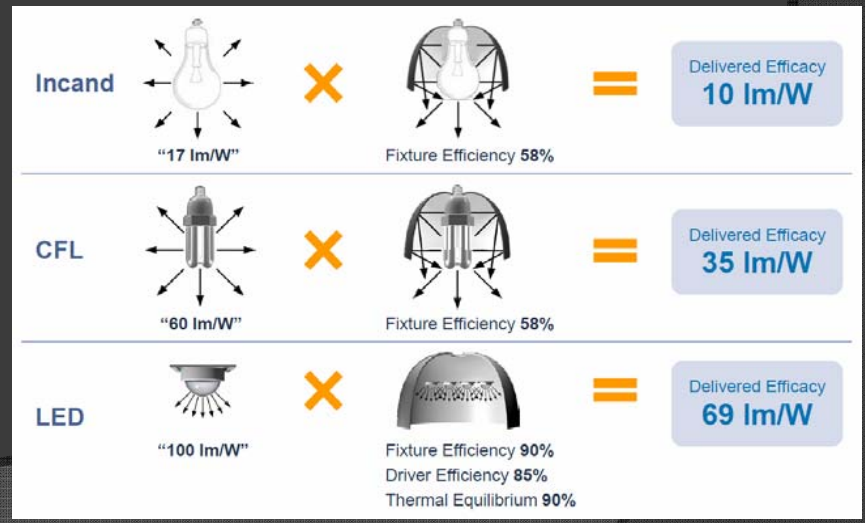
- Spectral Distribution (SPD)
- Co related Colour Temperature (CCT)
- Colour Rendering Index (CRI)



Understanding of Photometry

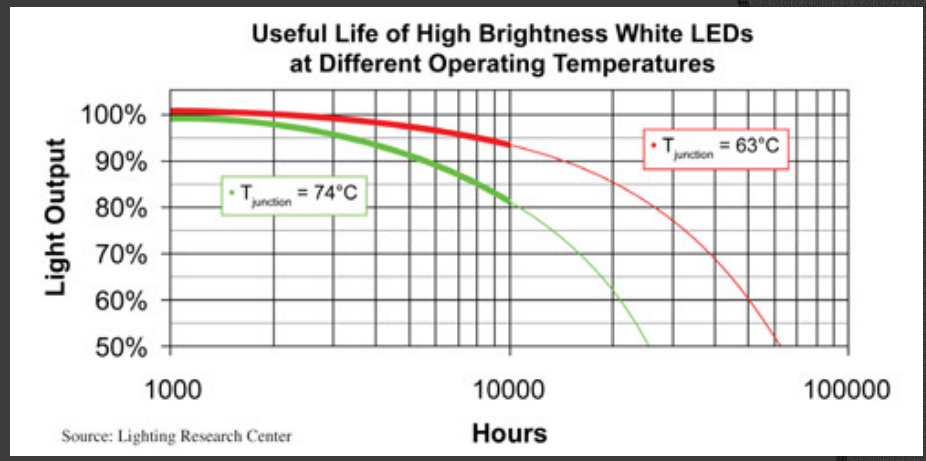
- Understanding of Lamp Beam Characteristics
- Understanding of Photometric data & Delivered Light





Understanding of Life

- Life of LEDs & Drivers
  - Rated lumens in datasheet at $T_{junction}$ (T_j) = 25°C but LEDs in luminaires are hot (T_j= 60°C - 100°C)
  - As T_j rises Temporary decrease in flux & efficacy
  - Colour shift over life (increase in CCT)



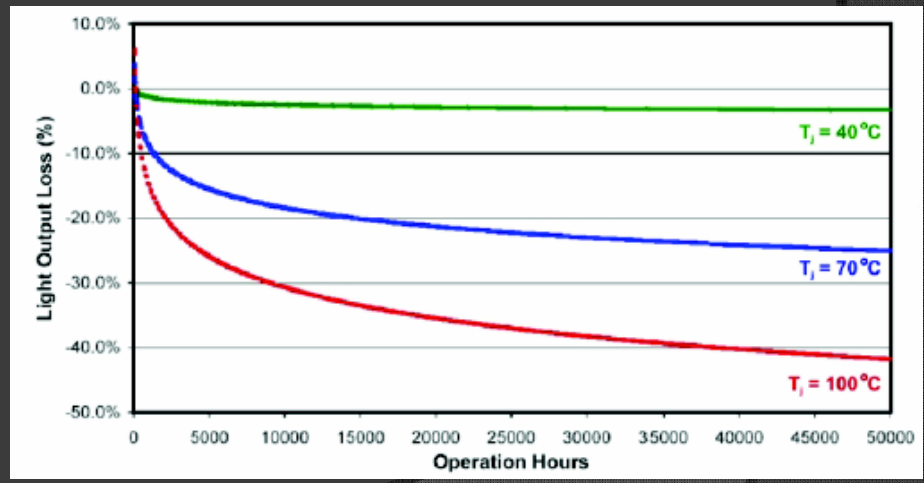
50,000 hours Lifetime to 70% Lumens

Drivers do not have the same Life

Understanding of Thermal Behavior

- Rated datasheet lumens are always at $T_{junction}$ (T_j) = 25°C
- LEDs in luminaires are hot (T_j= 60°C - 100°C)
- Above T_j ~ 120°C irreversible and permanent damage will occur
- Higher the T_j Lower the light Output & Life


Heat Sinks on SSL Products



T_j is a key metric for evaluating an LED's quality & Life.

Understanding of Wiring

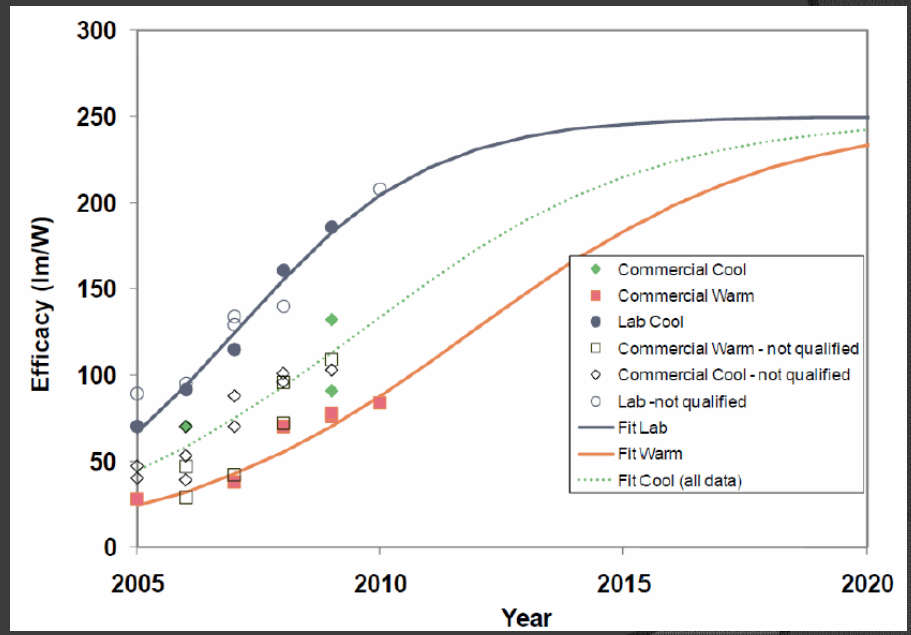
- Installation, Commissioning & Integration by Contractors
- DC wiring & Polarity issues
- Driver, Dimmer & Controller

The Challenges …
A Time to Interact

- We all Channel Partners must
  - Learn about New Products & Systems
  - Learn about Applications
  - Interact & Share
  - Do justice to our Role

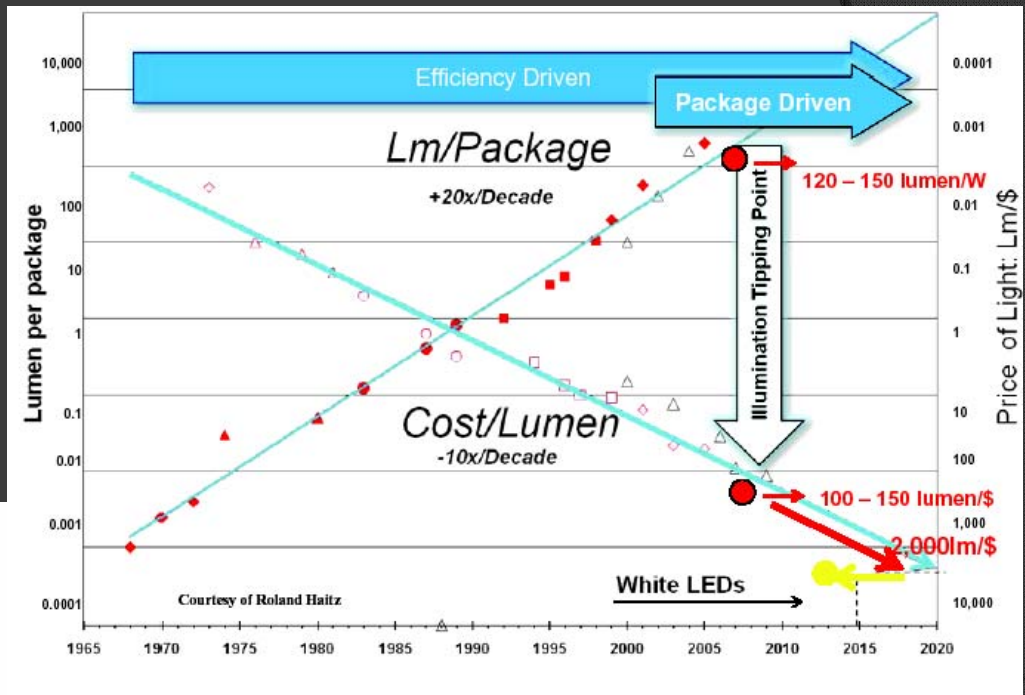
How OEMs Accelerate Adoption?

- Continue to innovate in LEDs & components
- Develop a kilo-lumen high power White LED package with Small footprint
- Optimize LED system elements to provide solutions that are better than traditional lighting
- Good colour performance
- Staying ahead of DOE SSL MYPP in terms of $/lm and lm/W
- Reduce cost of LED lighting



White LEDs – Price v/s Light Output

- Cost of lumen package falls by a factor of 10 and the Lumen generated per LED package increases by a factor of 20 every decade



Haitz Law – LED Performance, lm/$

2007

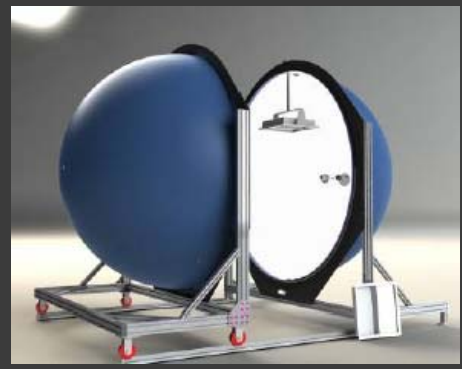
- 42 LEDs
- 650 lm
- 12W
- **>$100 Commercial Wholesale**

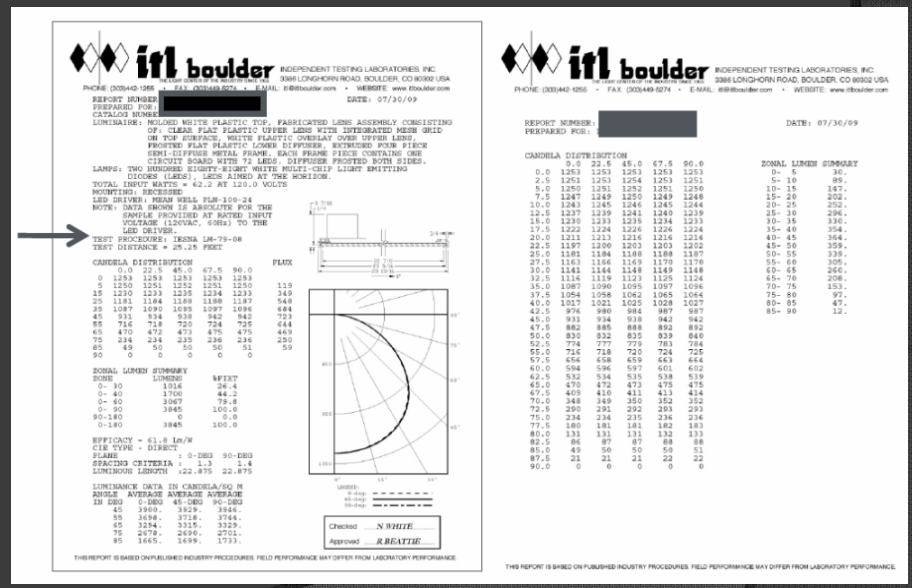
2010

- 8 LEDs
- 560 lm
- 10W
- **<$50 Retail**

Standards & Measurement v/s. LED Technology

- LED Technology is evolving fast and will continue to develop at a very fast pace
- Need to establish standards for LED Lighting at same pace
- **Test method and measurement**
  - IESNA LM-79
- **Chromaticity specification**
  - ANSI C78.377
- **Test method for lifetime of LEDs**
  - IESNA LM-80





itl boulder

INDEPENDENT TESTING LABORATORIES, INC.

3086 LONGHORN ROAD, BOULDER, CO 80302 USA

PHONE (303)440-1255 • FAX (303)449-5274 • E-MAIL: it@itlboulder.com • WEBSITE: www.itlboulder.com

REPORT NUMBER: [redacted]

PREPARED FOR: [redacted]

DATE: 07/30/09

CATALOG NUMBER: [redacted]

LUMINAIRE: MOLDED WHITE PLASTIC TOP, FABRICATED LENS ASSEMBLY CONSISTING OF: CLEAR FLAT PLASTIC UPPER LENS WITH INTEGRATED MESH GRID ON TOP SURFACE, WHITE PLASTIC OVERLAY OVER UPPER LENS, FROSTED FLAT PLASTIC LOWER DIFFUSER, EXTRUDED FOUR PIECE SEMI-DIFFUSE METAL FRAME. EACH FRAME PIECE CONTAINS ONE CIRCUIT BOARD WITH 72 LEDS. DIFFUSER FROSTED BOTH SIDES.

LAMPS: TWO HUNDRED EIGHTY-EIGHT WHITE MULTI-CHIP LIGHT EMITTING DIODES (LEDS). LEDS AIMED AT THE HORIZON.

TOTAL INPUT WATTS = 62.2 AT 120.0 VOLTS

MOUNTING: RECESSED

LED DRIVER: MEAN WELL PLN-100-24

NOTE: DATA SHOWN IS ABSOLUTE FOR THE SAMPLE PROVIDED AT RATED INPUT VOLTAGE (120VAC, 60Hz) TO THE LED DRIVER.

TEST PROCEDURE: IESNA LM-79-08

TEST DISTANCE = 25.25 FEET

CANDELA DISTRIBUTION

	0.0	22.5	45.0	67.5	90.0	
0	1253	1253	1253	1253	1253	
5	1250	1251	1252	1251	1250	119
15	1230	1233	1235	1234	1233	349
25	1181	1184	1188	1188	1187	548
35	1087	1090	1095	1097	1096	684
45	931	934	938	942	942	723
55	716	718	720	724	725	644
65	470	472	473	475	475	469
75	234	234	235	236	236	250
85	49	50	50	50	51	59
90	0	0	0	0	0	

FLUX

ZONAL LUMEN SUMMARY

ZONE	LUMENS	%FIXT
0- 10	1014	26.4
0- 40	1700	44.2
0- 60	3067	79.8
0- 90	3845	100.0
90-180	0	0.0
0-180	3845	100.0

EFFICACY = 61.8 lm/W

CIE TYPE - DIRECT

FLAME	:	0-DEG	90-DEG
SPACING CRITERIA	:	1.3	1.4
LUMINOUS LENGTH	:	22.875	22.875

LUMINANCE DATA IN CANDELA/SQ M

ANGLE IN DEG	AVERAGE 0-DEG	AVERAGE 45-DEG	AVERAGE 90-DEG
45	3900.	3929.	3946.
55	3698.	3718.	3744.
65	3294.	3315.	3329.
75	2678.	2690.	2701.
85	1665.	1699.	1733.

Checked: N WHITE

Approved: R BEATTIE

THIS REPORT IS BASED ON PUBLISHED INDUSTRY PROCEDURES. FIELD PERFORMANCE MAY DIFFER FROM LABORATORY PERFORMANCE.

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CANDELA DISTRIBUTION

	0.0	22.5	45.0	67.5	90.0
0.0	1253	1253	1253	1253	1253
2.5	1251	1253	1254	1253	1251
5.0	1250	1251	1252	1251	1250
7.5	1247	1249	1250	1249	1248
10.0	1243	1245	1246	1245	1244
12.5	1237	1239	1241	1240	1239
15.0	1230	1233	1235	1234	1233
17.5	1222	1224	1226	1226	1224
20.0	1213	1213	1216	1216	1214
22.5	1197	1200	1203	1203	1202
25.0	1181	1184	1188	1188	1187
27.5	1163	1166	1169	1170	1170
30.0	1141	1144	1148	1149	1148
32.5	1116	1119	1123	1125	1124
35.0	1087	1090	1095	1097	1096
37.5	1054	1058	1062	1065	1064
40.0	1017	1021	1025	1028	1027
42.5	976	980	984	987	987
45.0	931	934	938	942	942
47.5	882	885	888	892	892
50.0	830	832	835	839	840
52.5	774	777	779	783	784
55.0	716	718	720	724	725
57.5	656	658	659	663	664
60.0	594	596	597	601	602
62.5	532	534	535	538	539
65.0	470	472	473	475	475
67.5	409	410	411	413	414
70.0	348	349	350	352	352
72.5	290	291	292	293	293
75.0	234	234	235	236	236
77.5	180	181	181	182	183
80.0	131	131	131	132	133
82.5	86	87	87	88	88
85.0	49	50	50	50	51
87.5	21	21	21	22	22
90.0	0	0	0	0	0

ZONAL LUMEN SUMMARY

0- 5	30.
5- 10	89.
10- 15	147.
15- 20	202.
20- 25	252.
25- 30	296.
30- 35	330.
35- 40	354.
40- 45	364.
45- 50	359.
50- 55	339.
55- 60	305.
60- 65	260.
65- 70	208.
70- 75	153.
75- 80	97.
80- 85	47.
85- 90	12.

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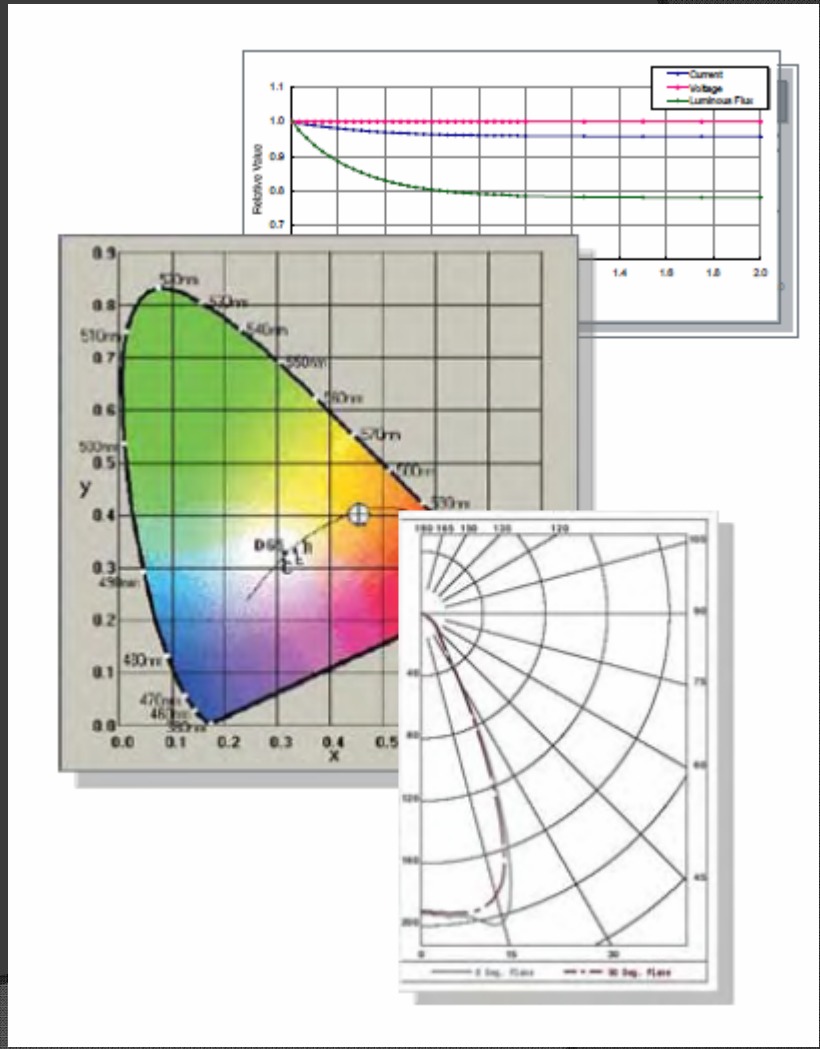
Performance and reliability issues in actual field conditions

How Standards Accelerate Adoption?

- LED Standards in India
  - BEE – Bureau of Energy Efficiency
  - ELCOMA – Electrical Lamp & Component Manufacturer Association
  - BIS - Bureau of Indian Standards
    - 10 Standards on LED approved for printing
- Measurement and quantification for quality is critical
  - 3 LED Testing Laboratories

Need for ENERGY STAR Program



How Quality Accelerate Adoption?

- Product performance reporting
  - Five key parameters: lumens, watts, efficacy, CRI, CCT
  - Reliability & lifetime
- ENERGY STAR® qualified products

L Prize winner

How Consultants Accelerate Adoption?

- Recommend right LED Products & Systems for each application
- Critically evaluate suppliers as well as products & systems
- Users to adopt LED Lighting solutions after due evaluation of the performance of the products on comparable conditions.
- User and Contractor to understand additional efforts and cost
- Trust is essential

APPLICATIONS

Applications

- **Architectural Lighting**
  RGB LED Lighting
  - Well established since last Ten Years
- **General Lighting**
  White LED Lighting
  - Technology Is Still Evolving

Application – RGB LED Lighting

- Well established since last Ten Years

Abbeey's Palace, Pune

Rang Mandap

Farm House at Panvel

COLOUR Asian Paints Signature store, Mumbai

Projects

COLOUR Asian Paints Signature store, Mumbai

Projects

YAZOO PARK, Virar

Application
White LED for General Lighting

- Technology Is Still Evolving

API Signature Store, Bandra

3000 Kelvin 3500 Kelvin 6500 Kelvin

Ideal Applications

- Residential
  - Ambient Lighting with LED Lamps

Ideal Applications

- Residential
  - Accent Lighting
  - Furniture Lighting

Ideal Applications

- Hospitality
  - Accent Lighting
  - PAR38 LED Lamp
  - MR16 LED Lamp

Ideal Applications

- Hospitality
  - Ambience creation
  - Chandeliers and sparkling lights

Ideal Applications

- Retail Lighting
  - All accent applications
  - Small display units like jewelry, art, shelves

Ideal Applications

- Down Lights in Offices & Mall Passages

Philips

Cree

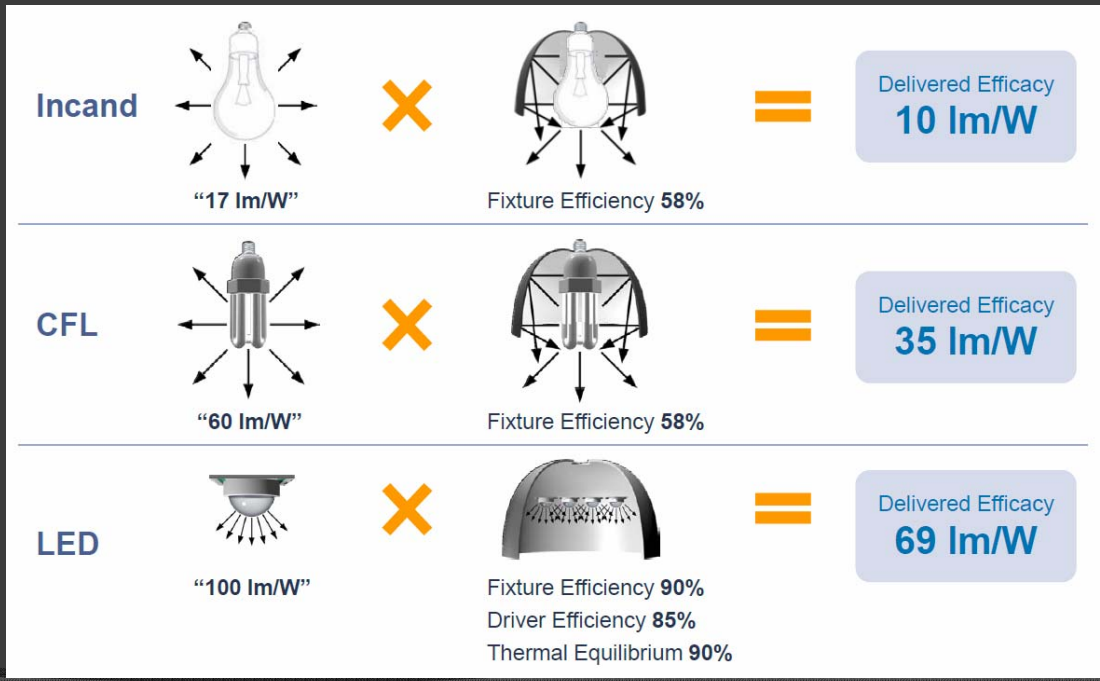
Sylvania

Ideal Applications

- Retail Lighting – Super Market
  - Parking lot LED lighting
  - Refrigerated display case LED lighting

Ideal Applications

- Offices
  - Combine LED performance with flexibility of a lamp like CFLs



Philips

Cree

Sylvania

LED Tube Lights

- Good Quality Can Replace first Generation T12 Tubes but at much higher price.

Long way to go to replace T8 & T5 with Class A electronic Ballast.

Ideal Applications

- 24/7 operation
  - corridors, lobbies
- hard to maintain or replace
  - escalators, elevators, high ceilings

Municipalities –Road Lighting

- 2nd largest City in the USA
- 4 Million Residents
- 472 Sq. Mi.
- 6500 Miles of streets
- $6.7 Bi. City Budget for 2011

Municipal Solid-State STREET LIGHTING CONSORTIUM

Main Roads Type A1 & A2 – Key issue is Pay Back Period

Ideal Applications

- Road Lighting
  - Residential area Roads Type B1 & B2
  - Public Plazas

LED Streetlight with Solar Panel is getting popular

Ideal Applications

- Area Lighting
  - Outdoor Car Park

Education

CERTIFICATE OF MERIT

This certificate is awarded to Dolly Valia

for completing the Training Course on Practical Aspects of Light & Interior Lighting conducted by Mr. Anil Valia for the duration of six weekends (48 hours) from December 1999 to February 2000.

Anil Valia
Course director

10th March 2000
Date

ILA
INTERNATIONAL LIGHTING ACADEMY

INTERNATIONAL LIGHTING ACADEMY
201 Classic, Dr.Manjarekar's Compound, Off M.V. Road,
Andheri (E), Mumbai-400 069. Tel. 8208413 Fax. 8384752
Email: atvalia@vsnl.com

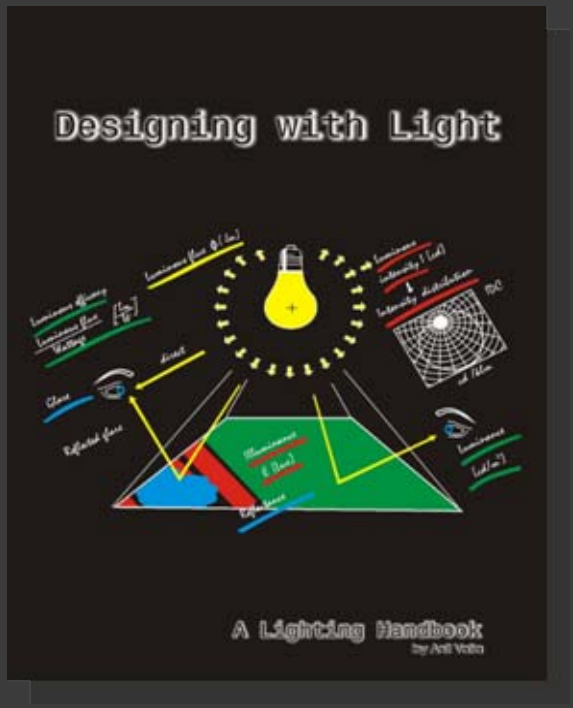
Specially Structured Courses By ILA

- in India & Abroad
- Practical Aspects of Light & Lighting
- LED Lighting Systems

Course Director – Anil Valia
Course Co ordinator – Dolly Chitalia

International Lighting Academy
9, Omex Apartment, 64, Sahar Road,
Koldongri, Andheri (East), Mumbai-400069, India
Tel.:91-22-26838413; 91-22-66922443
email: internationallightingacademy@gmail.com

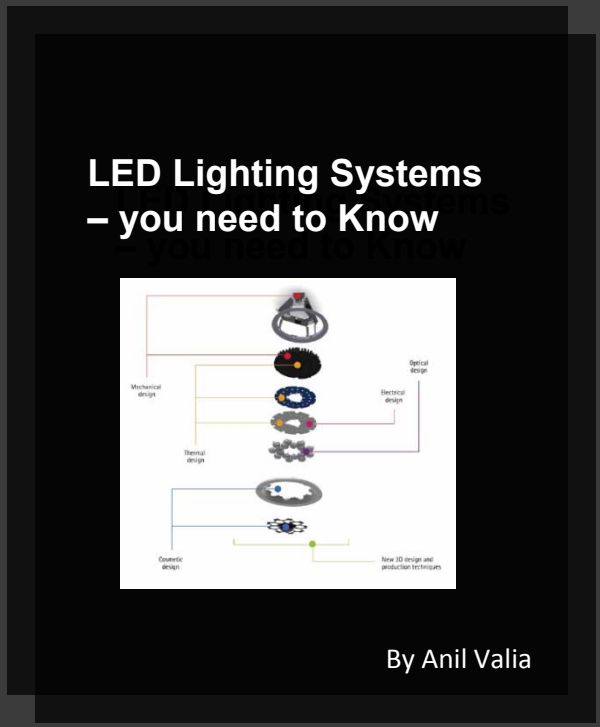
Books By Anil Valia



Designing With Light – A Lighting Handbook By

Anil Valia

Published by International Lighting Academy (ILA) January 2002



LED Lighting Systems – you need to Know By

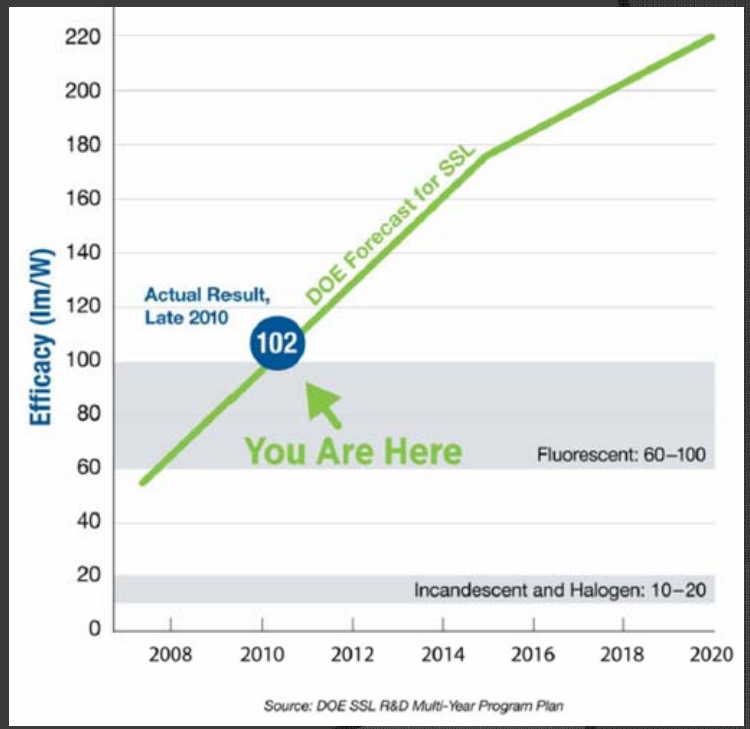
Anil Valia

Published by International Lighting Academy (ILA) January 2012

The promises of white LEDs is AMAZING! But …….with word of caution for all!!!

The Challenges …
A Time to Educate

- Education needs to follow the SSL technology & advances steep slope
- Need to educate everyone - designers, professionals, developers, contractors, users, representatives and manufacturers - about solid-state lighting
- Will bridge the gap between the lighting and electronics (non lighting) industry professionals



Education > Adoption ≥ Market Growth

LED Lighting Adoption

- LED technology continues to improve rapidly – next generation devices introduced every six months
- LED products can save energy and provide high-quality lighting in a growing number of applications

Momentum is building, but we have to go a long way

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Shop No.9, Omex Apt, 64, Sahar Road, Koldongri,
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Email: atvalia@gmail.com