

PHILIPS

sense and simplicity

The Promise of LED Lighting

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LIGHT FROM SILICON VALLEY

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Philips Lumileds Profile

- Leader in LEDs since 1968
- Inventor of the power LED in 1999 – LUXEON I
- Continuous innovation ever since...
- Independent LED subsidiary of Philips Lighting, the largest lighting manufacturer in the world
- Headquarters, R&D, and all epi manufacturing in San Jose, California
- Approximately 2,300 employees worldwide.
- 1000s of customers worldwide. Leading vendor of power LEDs (1W+).
- Leading technology innovator for power LEDs, with 1000s of patents.

LUXEON®

never before possible

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What We Love About LEDs

TODAY

- Long Lifetime
- High Efficacy, Low Voltage
- Green – no toxic chemicals
- Directed Light
- Tiny
- Rugged
- Instant Start
- Infinite Dimmability
- Rich, saturated colors

TOMORROW

- CCT and Color control
- Networked Control
- Design
- Replaceable Modules

THE DAY AFTER TOMORROW

- Re-Design & Re-invention, affecting many aspects of everyday life

LED Lighting Today is like Personal Computers ca. 1980

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What is Efficacy, Really?

Concept: Narendran, LRC

- SOURCE efficacy: lumens *out of the source* per watt put into the source
- LUMINAIRE efficacy: lumens *out of the fixture* per watt input to the luminaire
- TASK efficacy: lumens *reaching the task surface* per watt of input
 - E.g. footcandles on the ground in the target area
- APPLICATION efficacy: lumens reaching the task area *and meeting the application lighting requirements* per watt of input
 - Has both spatial and temporal components – aim and control
 - Assumes you know the objective! New standards needed?

NOTE: It's not just about efficacy

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Application Efficacy – a simple example

- All the benefits of LEDs
 - Cold improves efficacy
 - Long life
 - Directed light
 - Less heat
- PLUS Application Engineering
 - Occupancy Sensing, with
 - Instant On and
 - Dimming
- Result in SMUD: 68% Savings in lighting energy over fluorescent, 20% additional energy savings in refrigeration and HVAC, lower maintenance cost



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Application Efficacy for Street Lighting

- Integrated Astronomical and Real-Time Clock – knows time and season
- Changing light levels at different times of the evening, night, morning
- Changing CCT depending on time of night and light level
- Amber mode for astronomical observation
- Color modes for turtles, birds, parades, festivals, or just plain fun!
- Occupancy and hazard sensing, with on/dim → directed lighting at target
- Remotely programmable and controllable over power line, wireless, etc.
- Able to monitor outages and meter electrical usage
- Able to tell operations team when it is time to clean or replace modules
- Let's not forget: **beautiful design** that is attractive in its own right, with accent colors on the luminaire, colored illumination of adjacent buildings, etc.
- And let's consider **alternatives to Blob Of Light** – curbs, railings, strings? Can we do a better job a different way, using these great new LEDs?

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The Day After Tomorrow...

What are the right specs? What are we trying to do, really?



- Light the pavement? Light the cars?
- Light pedestrians, dogs, deer, raccoons, squirrels & other hazards?
- Prevent muggings? Improve the perception of safety?
- Create beautiful cities? Increase evening commerce?
- Sell excess base load power generation capacity during off-peak hours?

Re-evaluating assumptions and redefining objectives and priorities is the most important job. We are wasting light and energy, destroying our planet and degrading rather than enhancing our quality of life, based on outmoded concepts dating back to fires and candles.

Engineers can and will solve the problem we ask them to solve. Let's ask the right questions and request the right solutions.

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