Sustainable Development
Sustainable Lighting

May 2003
Sustainable Development

- Corporate environmental attention and compliance is growing at a very fast pace
- Environmental decision making is made at a higher level in most organizations
  - Top down directive to “buy green”
  - Value Creation
  - Long term enduring customer relationships

The world in general and businesses in particular are graduating from environmental awareness to ‘sustainable development’.
Sustainable Development ..... 

Growth that meets economic, social, and environmental needs without compromising the future of any one of them.

Why are Companies turning to Sustainable Practices ?

Business owes it to society to improve people’s lives and the environment in exchange for the privilege to operate.

The value of SD as a driver of innovation, new market development, and new technology is just emerging.

Legal requirements will remain a major driver of business investment in the environment for years to come.
Our Commitment to Sustainable Development

“We recognize the need to perform not only against a single, financial bottom line, but against the triple bottom line. This involves the simultaneous pursuit not only of economic prosperity and environmental quality, but of social equity as well. It’s about living up to our brand promise, *Let’s make things better.*”

- Gerard Kleisterlee,
  *President, Royal Philips Electronics*
Sustainable Lighting

“Sustainable lighting design meets the qualitative needs of visual environment with the least impact on the physical environment.”

- IALD Sustainability Committee
Elements of Sustainable Lighting

Most efforts in Lighting are starting off with the need to comply

☆ **Energy efficiency**
  - Meeting or exceeding visual performance while optimizing energy utilization (i.e., Lumens/watt)

❖ **Impact on the Physical Environment - Life Cycle Assessment (LCA)**
  - Lighting products have the least impact on the physical environment at optimum performance levels.
    (Resource depletion, environmental toxicity, source reduction, etc.)

❖ **Light Pollution -**
  - Encroachment/Negative impact of lighting on night skies

Sustainability is just beginning to emerge as a key issue in the lighting industry and we expect these elements to evolve further.
A Comprehensive response to Sustainability

- **Energy Efficiency**
  - Daylight harvesting - Dimming
  - System Solutions

- **Impact on Environment**
  - Acid rain
  - Global warming
  - Acidification
  - Resource depletion
  - Environmental toxicity (mercury, lead, etc..)
  - Source Reduction - Long Life - Packaging
  - Lamp recycling

- **Light Pollution**
  - Dark Sky Initiatives

Most of the efforts of the Lighting Industry have been focused on Energy Efficiency
SUSTAINABLE LIGHTING
Energy Efficiency

- Lighting consumes approximately 20% of US energy requirements
- Lighting consumes about 40-50% of energy use in a typical building
- Sustainable energy efficient lighting reduces global warming by reducing energy requirements

Top Energy Offenders For The Home

- Water Heating: 14%
- Heating and Cooling: 44%
- Lighting, Cooking and Other Appliances: 33%
- Refrigerator: 9%

Energy Offenders For Businesses

- Space Heating, Cooling and Ventilation: 36%
- Lighting: 17%
- Water Heating: 12%
- Other: 30%
- Office Equipment: 5%

Lighting Falls into the Second Largest Energy Offender Category

* Source: Energy Star

Source: Department of Energy
## SUSTAINABLE LIGHTING

### Energy Efficiency

<table>
<thead>
<tr>
<th>Lamp Technology</th>
<th>Efficiency (L/W)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incandescent Lamps</td>
<td>10-15</td>
</tr>
<tr>
<td>Halogen Lamps</td>
<td>15-20</td>
</tr>
<tr>
<td>Fluorescent Lamps</td>
<td>70-100</td>
</tr>
<tr>
<td>Mercury Vapor</td>
<td>60-70</td>
</tr>
<tr>
<td>High Pressure Sodium &amp; Metal Halide</td>
<td>80-110</td>
</tr>
<tr>
<td>Low Pressure Sodium</td>
<td>200</td>
</tr>
</tbody>
</table>

Lamp Technologies vary in efficacy.
Family of low mercury, energy efficient lamps

- High Performance, Long Life, Environmentally - Responsible Lamps
SUSTAINABLE LIGHTING
Energy Efficiency

- Use most energy efficient light source consistent with application
- Halogen, Compact Fluorescent for incandescent
- T-5 & T-8 lamps for T-12 (electronic ballasts for electro-mechanical)
- Metal Halide or QL or other induction lighting for mercury vapor

Matching Light sources with application is critical for energy efficiency
SUSTAINABLE LIGHTING
Lamp Performance - Longer Life

- Fluorescent extended rated life
  - Universal T8 20,000 hrs (all ballast types)
  - Advantage - Plus T8 24,000 hrs
- Induction Lighting 100,000 hrs
- Halogen longer life of 2-3 versus incandescent
- Longer life products reduce
  - Lamps to landfills
  - Packaging
  - Transportation emissions

High performance longer life lamps are a key element in source reduction!
Induction System (QL)

- 55W - 3500 lm
- 85W - 6000 lm
- 165W - 12000 lm

100,000 hours life
What is the largest contributor of mercury into the environment?

Coal fired energy plants contribute the greatest amount of mercury into the air!

Energy Efficient - Alto® Low mercury lamps and other low mercury lamps have the least amount of impact on the Environment!
Lifetime Mercury Emissions

* Based on 20K burning hours, Hg content of 23 mg per T12 lamp, and 8 mg per T8 lamp.

Hg content of fuels is the US weighted average for fossil and non-fossil fuels, calculated from "Environmental and Health Aspects of Lighting: Mercury" J.IES 1994.

Disposal emissions assume 3% in residuals of recycling, 90% from incinerators.
CONCLUSIONS:

- Mercury (Hg) from lamp disposal is small compared to Hg released from power generation required to operate lamp.

- Incandescent lamps contain no mercury but result in the highest Hg emissions.

- Energy Efficiency combined with reduced toxicity creates optimal solution for sustainable lighting.
THE MAD HATTER, H. McLACHLAN & COMPANY, BRIM STRETCHING. Mercury nitrate had been applied to fur for centuries to aid in the felting process. Steam produced at various stages was inhaled by the hatters and this affected their neurological systems. “Hatters’ shakes,” a palsy resembling a symptom of Parkinson’s disease, and recessed gums were some of the effects of the mercury poisoning. In the 1930s, a patent for a nonmercuric substance was issued and in 1941, mercury was outlawed in 26 states.
Fish Advisories For The State of Minnesota

- Ada Lake
- Adams Lake
- Adley Lake
- Agate Lake
- Agnes Lake
- Atkin Lake
- Albert Lea Lake
- TOTAL LISTINGS 118 PAGES
- http://map1.epa.gov
Source Reduction In Lamps
Solution - Low Mercury Fluorescent Lamps

Philips Lighting Company and the National Electrical Manufacturers Association, based on the study of standard four-foot, 40-watt T-12 fluorescent lamps.
To make a fluorescent lamp, we start with a clear glass tube....
The inside of the glass is then coated with a “barrier mechanism” to keep mercury from binding with the glass in the lamp.
Next, we coat the inside of the glass with the phosphors.
The lamp mount assembly starts with the flare & the exhaust tube, the lead wires, the center wire, and the electrode.
To operate a fluorescent lamp, the electrode must be coated with “emitter” material. Without emitter, the lamp won’t start.
Fluorescent Lamp Basics

- The cathode guard is attached to the center wire.

- The cathode guard reduces “end-blackening” and provides a mount for the “dosing capsule”.

[Diagram of a fluorescent lamp showing the cathode guard and its attachment to the center wire]
The mercury “dosing capsule” is mounted to the cathode guard.

The “cut wire” stretches over the “dosing capsule”. When heated it opens the capsule.
The completed mount is flame-sealed to the glass tube previously coated with the “barrier mechanism” and the phosphors.
All of the atmosphere in the lamp is exhausted, creating a virtual vacuum.

Current is applied to the cathode to treat & drive off CO₂
The appropriate “fill gases” (neon, argon, krypton) are added while maintaining a certain vacuum.
The exhaust tubes are then "tipped off". That is, the exhaust tubes are sealed and cut in one operation.
A high frequency induction current heats up the “cut wire” opening the dosing capsule and releasing the mercury into the lamp.
The basing cement is applied to the end-cap, the lead wires are threaded through the bi-pins and the end-caps are put on the lamp.
When current is applied to the lamp, an electrical arc stream is formed.
The electrical arc stream moves mercury to a higher energy state and as it settles back down it gives off ultra violet energy.
The ultra-violet energy excites the phosphors on the bulb wall and the lamp gives off visible light.
Light Pollution (as shown in the following chart) is becoming a key concern around the world - with efforts to counter through organizations like DSO.

Top targets of ‘Dark Skies Organization’ (DSO) are:

- Parking lots
- Car lots
- Service Stations

Various Counties in the US have reacted with:

- Pole height requirements
- On extreme-end, specified SOX lamps

Light encroachment into night skies is receiving more attention!
Sustainable Lighting Benefits

- Improved benefits throughout the product life cycle to all value chain partners
  - End user (reduced cost)
  - Channel
  - Contractor
  - Manufacturer

- Government and legislative advantages
- Promotes social and economic goodwill
- Global leadership
Sustainable Lighting Benefits

- Improved product market position, share and goodwill
- Increased brand and product value
- Reduced environmental and social liability, and associated cost for transactions, regulatory compliance, raw materials extraction, and manufacturing
- Improved product design
- First to market opportunity
Leadership in Energy & Environmental Design (LEED™)

A leading-edge system for designing, constructing, and certifying the world’s greenest buildings.
Why Was LEED™ Created?

- Facilitate positive results for the environment, occupant health and financial return
- Define “green” by providing a standard for measurement
- Prevent “greenwashing” (false or exaggerated claims)
- Promote whole-building, integrated design processes
Why Was LEED™ Created?

- Use as a design guideline
- Recognize leaders
- Stimulate green competition
- Establish market value with recognizable national “brand”
- Raise consumer awareness
- Transform the marketplace!
Technical Overview of LEED™

- Green building rating system, currently for commercial, institutional, and high-rise residential new construction and major renovation.
- Existing, proven technologies
- Evaluates and recognizes performance in accepted green design categories
- LEED 3.0 product development includes existing buildings, multiple buildings, core & shell, interiors, and residential
Technical Overview of LEED™ (continued)

- Whole-building approach encourages and guides a collaborative, integrated design and construction process
- Optimizes environmental and economic factors
- Four levels of certification
  - LEED Certified: 26 - 32 points
  - Silver Level: 33 - 38 points
  - Gold Level: 39 - 51 points
  - Platinum Level: 52+ points (69 possible)
LEED™ Point Distribution

Five LEED credit categories

- Indoor Environmental Quality: 23%
- Sustainable Sites: 22%
- Water Efficiency: 8%
- Energy & Atmosphere: 27%
- Materials & Resources: 20%
- Indoor Environmental Quality: 23%
LEED - Existing Building Pilot

- LEED Existing Building design - to operate “LEED” certified throughout the life of the building
- 65 Companies have signed on as pilot
- Pilot specifications designate low mercury component to the weight of all lamps used divided my mercury content of each lamp
  - 25 ppm mercury threshold
- 2003/2004: LEED Existing Building Pilot to become standard
Sustainable Development

- Corporate environmental attention and compliance is growing at a very fast pace
- Environmental decision making is made at a higher level in most organizations
  - Top down directive to “buy green”
  - Value Creation
  - Long term enduring customer relationships
- Educating end users and trading partners is a must

The world in general and businesses in particular are graduating from environmental awareness to ‘sustainable development’……….
End of AIA/CES presentation
Philips Eco-Vision Program

- Eco Design - Product design methodology takes into account environmental effect in product creation
  - Creates Green Flagships
- Eco Vision - Manufacturing Process
  - Reduces
    - Energy
    - Waste
    - Water use
    - Packaging
    - Emissions
- Environmental Management Systems Certification - ISO 14001

Philips has strong environmental processes and position!
• Life Cycle Analysis (LCA) Takes into account
  – Extraction of raw materials
  – Manufacturing / Assembly of product
  – Operation of Product
  – Disposal / Reuse

• Eindhoven has compiled extensive information regarding LCA on Philips Lamps

• LCA conclusion:
  – Operation / Energy efficiency dominates LCA
  – Smaller the better
  – Toxicity next important factor
SUSTAINABLE LIGHTING

Raw Materials Acquisition → Manufacture & Transport → Installation, Maintenance & Use → Disposal & Recycle

Inputs  Inputs  Inputs  Inputs

Outputs  Outputs  Outputs  Outputs
Energy & Environmental Leadership

- First - ISO 14000 Lighting Company
- First - Green Lights Ally
- First - Energy Star Building Ally
- First - TCLP Compliant Lamps
- First - Lighting MFG - US Green Building Council Member
- 2002 State of California “Flex Your Power” Award winner
- 2002 Energy Star Lighting Partner of the Year!
Participating with 3rd party agencies has given us a voice in the Sustainability World
LEED - Existing Building Pilot

- LEED Existing Building design - to operate “LEED” certified throughout the life of the building
- 65 Companies have signed on as pilot
- Pilot specifications designate low mercury component to the weight of all lamps used divided by mercury content of each lamp
  - 25 ppm mercury threshold
  - Alto lamp qualifies building under 25 ppm threshold
  - Advantage Alto!
- 2003: LEED Existing Building Pilot to become standard after vote this summer
$13 Billion allocated for schools over next 5 years
- New Construction
- Retrofit / remodel

Governor signed legislation that all schools will be LEED certified

NJ sustainable business council (Philips & other companies)
- Submitted LEED standards and changed specification criteria with State

Outcome: Alto specification will be adopted in many of the schools
- First 3 schools in Howell Township -
- Willow School to use ALTO-T-5 lamps
Example:

The Philips Lighting Formula
An Energy Blueprint for the Nation

- Relamp a city block in Berkeley California with energy efficient lighting
- Residential and Business
- Demonstrate how easy it is to improve efficiency with changing a light bulb
- Create a “Blueprint “ for others to emulate
- Demonstrate Philips social responsibility
- Partner with Department of Energy, State of California, and City of Berkeley
# Case Study

The Philips Lighting Formula

How One Block in Berkeley Will Impact the Energy Crisis

<table>
<thead>
<tr>
<th>Current Energy Consumption</th>
<th>Post-Retrofit Consumption</th>
<th>Energy Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>45 kW</td>
<td>25 kW</td>
<td>20 kW</td>
</tr>
<tr>
<td>147,800 kWh/yr</td>
<td>85,142 kWh/yr</td>
<td>62,712 kWh/yr</td>
</tr>
<tr>
<td>$20,692 Annually</td>
<td>$11,920 Annually</td>
<td>$8,772 Annually</td>
</tr>
</tbody>
</table>
One Block In Berkeley

45

PRE-RETROFIT

25

POST-RETROFIT

45%

Power Saved
Sustainable Development

- Corporate environmental attention and compliance is growing at a very fast pace
- Environmental decision making is made at a higher level in most organizations
  - Top down directive to “buy green”
  - Value Creation
  - Long term enduring customer relationships
- In most cases we are leading the efforts in educating end users and our trading partners

The world in general and businesses in particular are graduating from environmental awareness to ‘sustainable development’………..
What Next ..... 

- Build the framework for all our stakeholders to aspire to our vision of SD
- Educate, Educate, Educate!

- Lead & shape sustainable lighting vision & practices for the industry
- Create and participate in global sustainable business forums
- Leverage our technology and environmental leadership to create new markets and to grow share at existing customers

- Build partnerships with Govt. & other regulatory agencies to demonstrate our commitment to SD
- Analyze & understand the impact of our products & technology on the environment (LCA’s etc.)

A little less conversation, A little more action!
Thank You