Meet Your Panelists

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NEEA Northwest Industrial Training

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Upcoming In-Class Trainings

- Go to the NEEA calendar at www.neea.org/industrial-events for other trainings and events scheduled around the Northwest region.

- Compressed Air Systems
  - Conveyance Systems Energy Management

- Data Centers
  - Data Centers Data Center Energy Efficiency

- Energy Management
  - Energy Management: Introduction to Best Practices
  - November: Moses Lake, WA
    http://www.neea.org/participate/calendar.aspx?eventID=3459

- Fans
  - Fan System Assessment Tool (FSAT)
  - September 20: Spokane, WA
    http://www.neea.org/participate/calendar.aspx?eventID=3333
Upcoming In-Class Trainings continued

Motor Systems
  ◦ Adjustable Speed Drive Applications and Energy Efficiency
    • July 31: Redmond, OR  http://www.neea.org/participate/calendar.aspx?eventID=3416
    • August 21: Pocatello, ID  
      http://www.neea.org/participate/calendar.aspx?eventID=3453
    • October 4: Roseburg, OR  
      http://www.neea.org/participate/calendar.aspx?eventID=3454
    • November 15: Yakima, WA  
      http://www.neea.org/participate/calendar.aspx?eventID=3431

Refrigeration
  ◦ Industrial Refrigeration Energy Management
    • June 5: Bellevue, WA (Check NEEA calendar for registration information)
    • October 23: Hermiston, OR  
      http://www.neea.org/participate/calendar.aspx?eventID=3475
    • October 24: Caldwell, ID (Check NEEA calendar for registration information)
Upcoming Webinars

- Adjustable Speed Drives
  - June 8, 2012 - 1pm until 2pm (PST) http://www.neea.org/participate/calendar.aspx?eventID=3411
  - October 4, 2012 - 10am until 11am (PST)
- Developing an Energy Plan
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- Energy Management Opportunities for Industrial Customers
  - July 9, 2012 - 10am until 11am (PST) http://www.neea.org/participate/calendar.aspx?eventID=3408
  - September 25, 2012 - 8am until 9am (PST)
- To register for multiple webinars at once, use this landing page

6
Contents

- Basics
- T8 Ballasts
- T8 Lamps
- HID Ballasts
- HID Lamps
- Incandescent Bulbs
- CFL Lamps
- Bonus

Basics

- Ballast: Starts the lamp and regulates current
- Ballast Factor: Ratio of the light output of a fluorescent lamp to the light output of the same lamp operated on a standard (reference) ballast
  - Ranges from 0.6 to 1.3, typically 0.88
  - Is not a measure of efficiency
  - For electronic ballasts, affects system watts proportionally
- Ballast Efficiency Factors (BEF): Equals the ballast factor divided by the input power of the ballast
  \[ \text{BEF} = \frac{\text{BF}}{\text{watts}} \]
- Ballast Luminous Efficiency (BLE): the ratio of total lamp arc power to ballast input power.
  \[ \text{BLE} = \frac{\text{output power}}{\text{input power}} \]
T8 Ballasts

- TREND: T8 Instant-Start Holds 50% Share
  - T5 ballast sales increased 26% in 2010
  - Magnetic ballast share was 27% in 2005

2010 Fluorescent Ballast Shipments

Source: NEMA
T8 Ballasts

- TREND: Increased Energy Efficiency
  - NEMA Premium® Ballasts
    - Generally a 5% to 7% efficiency improvement (2 to 5 watts) and anti-striation control
    - Meets or exceeds the Ballast Efficiency Factors (BEF) established by the CEE (Consortium for Energy Efficiency)
  - Examples
    - Universal Ultim8®
    - Sylvania PROStart®
    - Philips Optanium®
    - GE UltraStart™ (with dimming down to 3%)
T8 Ballasts

- **TREND: Increased Energy Efficiency**
  - **Sylvania 1.0 BF**
    - 2-lamp fixture delivers light output comparable to a standard 3-lamp fixture but with 20% energy savings
  - **Programmed-start parallel lamp operation ballasts**
    - Typically wired in series, these new parallel wired ballasts keep remaining lamps burning when one fails

![Diagram of 4-Lamp Ballast, Non-Parallel (Series), and Parallel configurations](image-url)
T8 Ballasts

- **TREND: Controllable T8 Ballasts**
  - Dimming Ballasts
    - Philips EssentiaLine™ (down to 20%)
    - GE UltraStart™ (3%)
    - GE UltraMax™ (60%) load-shed
  - Bi-Level (A/B) Switching Ballasts
    - Sylvania Quickstep® (55W at 100% and 27W at 50%)
    - GE UltraMax™ (100%; 60%) Hi/Lo
  - Emergency battery backup

Source: Osram–Sylvania

Source: Fulham FireHorse
T5HO Ballasts

- **TREND: Higher temperature performance**
  - Ballast temperatures in excess of 40°C (104°F) reduces manufacturer’s warranty and significantly shortens ballast life (50% lower every 10°C/18°F higher than 35°C/95°F)
    - T5HO light output degrades at ambient temperatures over 35°C
  - **Holophane IntelliBay™ & IntelliVue™**
    - Operates in ambient environments up to 55°C (130°F)
    - Maintains optimum lamp cold spot temperature at 47°C (117°F)
    - Uses heat pipe technology known as Passively Optimized Lumen output with Automated Regulation (P.O.L.A.R.)
  - **Lithonia I-BEAM™ System**
    - Operates in ambient environments up to 55°C-65°C (130°F-150°F)
    - T5HO Cool Running™ Technology involves increased ballast package conductivity, efficiency, and air convection

Source: Holophane
T8 Lamps

- **TREND: Slowed Market Penetration**
  - T5 sales increased 31% in 2010

![Graph showing T5/T8/T12 four foot lamp sales indexes and market penetration from 2003 to 2011.](source: NEMA)

![Pie chart showing 2010 lamp shipments with T8 at 63.3%, T12 at 27.9%, and T5 at 8.8%.](source: NEMA)
T8 Lamps

- **TREND: Increased Energy Efficiency of T8 Lamps**
  - **Drivers**
    - Energy codes
    - LEED – US Green Building Council
    - Stimulus funds and efficiency grants
    - Utility rebates
  
- **Legislation**
  - The 2000 *Ballast* Rule
    - No magnetic ballasts manufactured for replacement after June 2010.
  - New electronic *ballast* luminous efficiency (BLE) standards.
    - Effective July 1, 2014
  - Energy Conservation Program (ECP) 2009 *Lamp* Rule
    - Effectively eliminate most 4-ft T12 and 8-ft (F96) T12 lamps
      - 700 series (1st generation) T8 lamps have 2-year exemption
T8 Lamps

**TREND: Increased Energy Efficiency of T8 Lamps**
- Sylvania 23W Octron® XP® SuperSaver® (2,000 lumens)
  - T8 lamp is a direct replacement for full-wattage F32T8 lamps with 28% energy savings
- Reduced wattage T5HO lamps are also available
  - Light output equal to standard 54W
    - Philips Energy Advantage (49W)
    - GE Starcoat® Ecolux® (51W)
    - Sylvania Pentron® SuperSaver® Ecologic® (51W)

**TREND: Dimmable Reduced Wattage T8 Lamps**
- Sylvania 25W, 28W, 30W Octron® SuperSaver® Ecologic®
T8 Lamps

- TREND: Improved T8/T5 Lamp Life
  - Extended life 4-ft T8 lamps (XL, XLL, SXL) increase rated life to over 40,000 hours

<table>
<thead>
<tr>
<th>Start Type/Cycle</th>
<th>Average</th>
<th>Extended</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3-Hr</td>
<td>12-Hr</td>
</tr>
<tr>
<td>Instant-Start</td>
<td>20,000</td>
<td>25,000</td>
</tr>
<tr>
<td>Program-Start</td>
<td>24,000</td>
<td>30,000</td>
</tr>
</tbody>
</table>

- New Sylvania 54W T5HO lamps are supposedly rated at 40,000 hours at 12 hours/start
HID Ballasts


2009 HID Ballast Shipments

Source: NEMA
**HID Ballasts**

- **TREND: Improved Efficiency >150W HID Ballasts (Pulse Start)**

<table>
<thead>
<tr>
<th>Brand Name</th>
<th>Type</th>
<th>Eff.</th>
<th>Glass</th>
<th>Watts</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sylvania Quicktronic</td>
<td>E</td>
<td>94%</td>
<td>MH, CMH</td>
<td>200–350</td>
<td></td>
</tr>
<tr>
<td>GE UltraMax®</td>
<td>E</td>
<td>93%</td>
<td>MH, CMH</td>
<td>250–400</td>
<td>Dims to 50%</td>
</tr>
<tr>
<td>Philips PS XEE</td>
<td>M</td>
<td>90%</td>
<td>MH</td>
<td>250</td>
<td></td>
</tr>
<tr>
<td>Metrolight SmartHID®</td>
<td>E</td>
<td>&gt;90%</td>
<td>MH</td>
<td>175–450</td>
<td>HPS, Remote 50'</td>
</tr>
</tbody>
</table>

Source: Metrolight Ltd.
HID Ballasts

- **TREND: Smarter HID Ballasts**
  - DALI Compliant
    - GreenTek Ceramivision eHID
      - Micro-Start™, dimming to 35% (CMH), 200W to 400W CMH
      - SmartLot Solution™ preprogrammed dimming
  - Power Disturbance Ride-Through
    - Philips Bodine ARC Keeper® (magnetic) and e-ARC Keeper® (electronic) HID backup ballasts
      - Adds-on to existing ballast
      - Provides up to two minutes of ride-through

Source: Philips Lighting
HID Ballasts

- TREND: Smaller Size <150W HID Ballasts
  - Generally 50% smaller in size (3" x 1.3" x 1.1") and lighter weight than standard magnetic ballasts

<table>
<thead>
<tr>
<th>Brand Name</th>
<th>Lamp Watts</th>
<th>System Watts</th>
<th>Replaces</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sylvania Quicktronic® eHID Super Mini</td>
<td>15W, 20W, 39W</td>
<td>17.5W, 23W, 44W</td>
<td>50W MR16; 20W CMH</td>
</tr>
<tr>
<td>GE UltraMax® micro eHID</td>
<td>20W, 39W</td>
<td>23W, 43W</td>
<td>75–100W halogen</td>
</tr>
<tr>
<td>Universal Micro Series</td>
<td>20W, 22W, 39W</td>
<td>24.5W, 26.5W, 45W</td>
<td>75–100W halogen</td>
</tr>
<tr>
<td>Philips e-Vision® Mini MasterColor®</td>
<td>20W</td>
<td>&lt;26W</td>
<td>60W+ halogen</td>
</tr>
</tbody>
</table>

Source: GE Lighting
HID Lamps

- TREND: Metal Halide Share Remains Steady
  - Metal halide holds 60% share, up from 40% in 1995

Source: NEMA
HID Lamps

- TREND: Innovation in CMH Lamps
  - Saturated Color Rendering (R9)
    - EYE Lighting's Cera Arc® 39W Natural Red (90+CRI, R9=80)
  - Self-Ballasted CMH Lamps
    - PAR30LN and PAR38
      - 1,200 initial lumens @ 23W CMH lamps
      - Replaces 74W and 120W halogen bulbs.
    - Sylvania's Metalarc® Powerball® self-ballasted CMH (also provides good red R9 rendering)

Source: Osram–Sylvania
Source: DOE
TREND: Improved Incandescent Bulbs

- New halogen bulbs
  - Up to 30% energy savings
  - Instant on
  - No mercury
  - 100 CRI
  - Compliance with EISA 2007
    - Philips Halogena® Energy Saver/Energy Advantage (3,000 hrs)
    - Sylvania Halogen SuperSaver® (1,000 hrs)
    - GE Edison™ (2,500 hrs)

Source: Philips Lighting
CFL Lamps

- **TREND: Level CFL Market Growth**
  - CFL share is 24%
  - Incandescent sales at lowest historic level

Source: NEMA
CFL Lamps

- TREND: Lower Dimming Levels
  - Technical Consumer Products (TCP) TruDim™ CFL
    - Smoother, full-range, dimming performance, from 100% down to 1%
      - NXP GreenChip digital/analog integrated circuit (IC) chip
      - InstaBright™ technology temporarily boosts power
      - "Quad\Phosphor” technology increases red spectrum performance (CIE-R9)
  - Philips Energy Saver Twister Dimmable
    - Dimmable 100% to 10%
CFL Lamps

- **TREND: Built-In Dimming Control**
  - Sylvania DULUX EL Twist-n-Dim™
    - Dimmable 100% to 20%
      - 23 watt
      - 1,500 lumens
      - 8,000 hour life
      - 82 CRI
    - Eliminates lamp dimmer compatibility issues

- **TREND: Hybrid halogen**
Bonus

TREND: LED Omnidirectional Replacement Lamps

<table>
<thead>
<tr>
<th>Brand Name</th>
<th>Wattage</th>
<th>Lumens</th>
<th>CCT</th>
<th>Life (Hrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEDzworld Professional LED Bulb CTA</td>
<td>6.5W</td>
<td>250</td>
<td>2500K</td>
<td>35,000</td>
</tr>
<tr>
<td>GE Energy Smart™ LED</td>
<td>9W</td>
<td>450</td>
<td>3700K</td>
<td>25,000</td>
</tr>
<tr>
<td>Philips AmbientLED™</td>
<td>12.5W</td>
<td>800</td>
<td>2700K</td>
<td>25,000</td>
</tr>
<tr>
<td>Sylvania LED A–Line</td>
<td>12W</td>
<td>810</td>
<td>2700K</td>
<td>25,000</td>
</tr>
</tbody>
</table>
TREND: Daylighting Window Treatment

- LightLouver™ Daylighting System
  - Mini-light shelves
  - Louvers made from extruded cellular plastic foam that is coated with a reflective film and stacked together with vertical support rods.
  - Redirects sunlight onto the ceiling from overhead windows.
  - Creates an ambient source of natural light that reaches deep inside the building.

Source: LightLouver LLC
Bonus

- TREND: Aftermarket Decorating of Recessed Downlights
  - recesso Lights
    - Transform recessed downlights into works of art
    - Art glass or hand-formed resin pieces
    - Uses a simple locking ring that is attached to the ceiling and secured to the globe/arc/square
TREND: Radio Frequency Lighting

- Luxim LiFi™ or Light Emitting Plasma™ (LEP)
  - An ac/dc converter generates an RF signal that is transmitted by a special cable to a quartz lamp embedded in a dielectric material.
  - Pemco Lighting Products STA-41-01 luminaire
    - 273/450 system watts
    - 23,000/45,000 initial lumens
    - 5,500K CCT/80 CRI
    - 50,000 hour rated life
    - Dimmable to 20%

Source: Luxim
Bonus

- **TREND: Light-Emitting Diodes (LED)**
  - Lower CCT and higher CRI color quality
  - Higher wattage omnidirectional lamps
  - Purpose-built Linear LED Troffers
  - Light guide products
**Bonus**

- **TREND: Light-Emitting Diodes (LED)**
  - Higher lumen output high-bay lighting
  - Hybrid parking garage lighting
  - Organic Light-Emitting Diodes (OLEDs)

Source: Albeo

Source: Acuity Revel

Source: Everlast Biolume
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