



Total Resource Efficiency Education

Lamps & Ballasts

Training solutions brought to you by **ecovæ**

Meet Your Panelists

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Lamps and Ballasts*

Fluorescent

HID

Incandescent

LED

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Lighting Controls

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Image Source: LIGHTFAIR® International

*Source: DiLouie, C. and Wolfman, H. What's New in Lamps and Ballasts? 2011 LightFair International conference.

Increased Energy Efficiency of T8 Lamps

Drivers

Energy codes

LEED – US Green Building Council

Stimulus funds and efficiency grants

Utility rebates

Legislation

EPA Act 2005—Cannot manufacture replacement
T12 ballasts after July 2010

2009 DOE Energy Regulations—Effectively eliminate
most 4-ft T12, 8-ft (F96) T12 lamps, and 700 series
(1st generation) T8 lamps

Beginning July 14, 2012



Source: USGBC

T8 Types (Generations)

Type	Name	Watts	Lumens	CRI	Life (hrs, 000s)
1G	700 Series, Basic	32 W	2,800	75-78	15-20
2G	800 Series	32 W	2,850 - 3,000	82-86	24-30
3G	Super, HO	32 W	2,950 - 3,200	82-86	24-30
4G	Reduced Wattage, Energy Savers	23 W 25 W 28 W 30 W	2,000 2,400 2,750 2,850	82-86	Temp. sensitive, Instant start only

T8 Lamps

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

Dimmable Reduced Wattage T8 Lamps

Sylvania 25W, 28W, 30W Octron® SuperSaver® Ecologic®3 T8s



Image Source: Philips Lighting

Improved T8/T5 Lamp Life

Extended life 4-ft T8 lamps (XL, XLL, SXL) increase rated life to over 40,000 hours

Start Type/Cycle	T8 Rated Lamp Life (Hours)		
	Average		Extended
	3-Hr	12-Hr	12-hr
Instant-Start	20,000	24,000	30,000-40,000
Program-Start	24,000	30,000	36,000-46,000

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

Hybrid halogen from GE

Halogen center lamp

Surrounded by CFL lamp

Full-brightness starting



Image Source: GE

Cold Weather Fluorescent Lamps

Induction (electrodeless) Lighting

- Up to 100,000 hour rated lamp life

 - Lumen maintenance 70% at 60,000 hours

 - Efficacy of 70 to 75 lumens per watt

- Can operate at -20F

Cold Cathode Fluorescents

- Higher voltage (5X), lower current

 - No filament

 - Can operate at 5F to 122F

 - Long life (up to 100,000 hours)

Amalgam Mercury Fluorescents

 - Mercury alloy vs. pure mercury

 - Lower efficiency

 - 90% output at 40F



Image Source: Osram Sylvania Icetron™



Image Source: Osram DURA-ONE

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%)



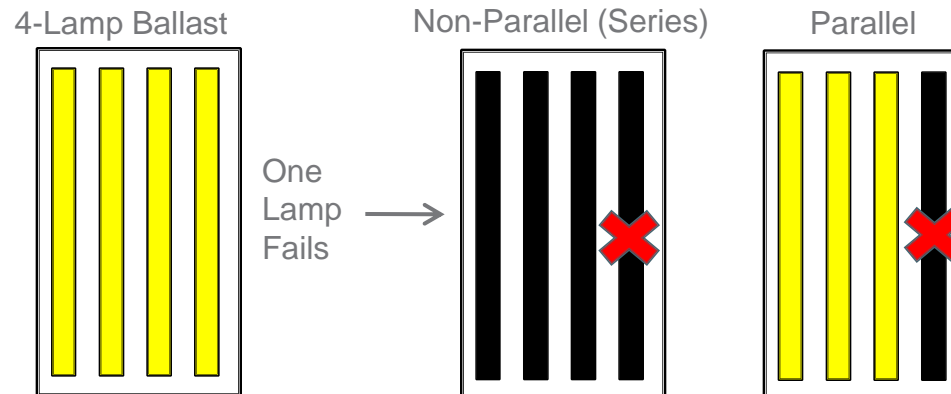
Increased Energy Efficiency

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



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



Image Source: Osram-Sylvania

Wal-Mart

T12 to T8 lighting upgrade

Upgraded 474 stores in just over 12 months

\$20 million in savings the first year

\$3 million in utility rebates

Lowered electric use 15 – 20% → 1.2 year payback



Facility Solutions Group Case Study

Reduced Wattage T5HO Lamps

Light output equal to standard 54W

Philips Energy Advantage (49W)

GE Watt Miser (51W)

Sylvania Pentron® SuperSaver® Ecologic® (51W)

Slightly less light output (%)

GE Watt Miser Plus 47W (4%)

Sylvania Pentron HO SuperSaver 47W (8%)

Higher Temperature Performance

Ballast temperatures in excess of 40°C (104°F)

- Reduces manufacturer's warranty

- Significantly shortens ballast life (50% lower every 10°C higher)

- T5HO light output degrades at ambient temperatures over 35°C

Holophane IntelliBay™ & IntelliVue™

- Operates in ambient environments up to 55°C (130°F)

- Uses heat pipe technology known as Passively Optimized Lumen output with Automated Regulation (P.O.L.A.R.)

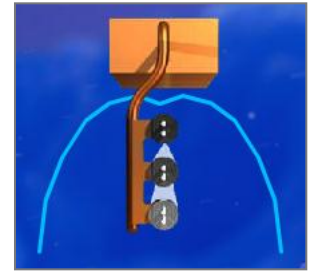


Image Source: Holophane

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

Warehouse lighting upgrade

T8 to T5HO in a 600,000 sqft warehouse

Lighting design study

4- and 6-lamp T5HO fluorescent high bays

Annual energy savings of \$93,000

20% decrease in lighting kWh

2.2 year payback



Acuity Brands Lighting Case Study

Induction Lamps

Hybrid Garage Fixture

Bi-level occupancy sensor

Amber LEDs on when induction off

Biologically friendly

Stepped-dimming induction lamp

83 to 118 watts high; dims to 40% level

Deco Lighting Two-Lamp Garage Fixture

Continuous security lighting from
20-watt lamp

Instant full-lighting by 60-watt lamp



Image Source: Everlast Biolume



Image Source: Deco Lighting

High Intensity Discharge

Sustained arc vs. fluorescent phosphor emission

Type	Watts	Lumens	Lumen Maintenance	LPW	CRI	Life (hrs)
Mercury Vapor*	1,000 W	47,500	65%	30	40	24,000
Low Pressure Sodium	135 W	22,000	>95%	150	10	18,000
High Pressure Sodium	400 W	45,000	75%	85	30	24,000+
Metal Halide**	452 W	40,000	70%	65	65	20,000

*Ballasts banned by EPA Act 2005

**Position dependent

Strike time (minutes)

	MV	LPS	HPS	MH Probe	MH Pulse
Warm up	4-7	7-15	1-4	2-15	1-4
Restrike	3-6	1	0.5-1	5-20	2-8

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

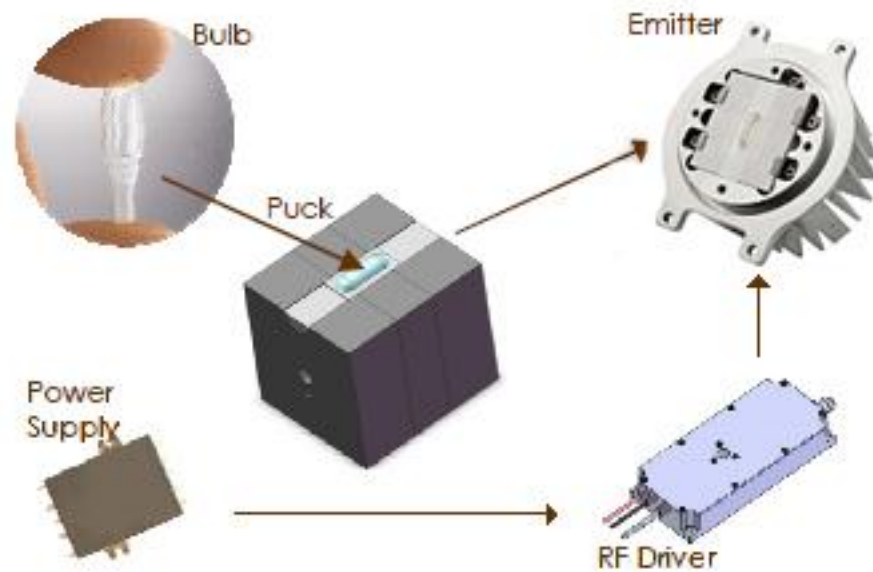
273 system watts

23,000 initial lumens

5,500K CCT/80 CRI

50,000 hour rated life

Dimmable to 20%



Source: Luxim

High-wattage HID Ballasts

Improved Efficiency >150W HID Ballasts (Pulse Start)

Brand Name	Type	Eff.	Glass	Watts	Other
Sylvania Quicktronic®	E	94%	MH, CMH	200-350	
GE UltraMax®	E	93%	MH, CMH	250-400	Dims to 50%
Philips PS XEE	M	90%	MH	250	
Metrolight SmartHID®	E	>90%	MH	175-450	HPS, Remote 50'

Low frequency square wave
Reduces lamp wear and tear



Source: Metrolight Ltd.

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)

e-ARC Keeper® (electronic)

Adds-on to existing ballast

Provides up to two minutes of ride-through



Image Source: Philips Lighting

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)



Image Source: Philips Lighting

Longer Rated Life LED Lamps

Comparison with traditional lighting

Type	Rated Life, hours	Lumens per Watt	CRI	Lumen Maintenance
LED	50,000	35-100	70-90	95-98%*
Incandescent	750-1,500	10-17	100	95%
Fluorescent	10,000-20,000	60-100	80-86	90-95%

*At 40% fluorescent rated life; 70% to 90% at 50,000 hours

DOE Commercially Available LED Product

Evaluation and Reporting (CALiPER) program benchmarks
LED products

LED Linear Fluorescent Replacement

CALiPER tested six different drop-in
4-foot retrofit LED products

Comparable LED lumens/watt output

Narrow LED light distribution

Over \$50 per LED lamp

Type	Watts	Lumens	LPW	CCT (K)	CRI
LED (Rd 9)	21	974	46	7,939	74
LED (Rd 11)	22	1,887	86	5,091	69
T8	32	3,300	100	3,300	82
Cree CR Series	44	4,000	90	3,500	90
LED 2X2 (Rd 13)	43	3,469	80	3,152	94

Source: Round 11, CALiPER



Image Source: Philips



Image Source: Cree

LED High-Bay Lighting

CALiPER tested seven different High-Bay LED products

Efficacy still lags fluorescent

Narrow light beam pattern

Life claims are suspect



Type	Watts	Lumens	LPW	CCT (K)	CRI
F32T8(4)	114	10,800	95	5,000	86
Pulse CMH	150	9,750	65	4,200	93
LED (Rd 11)	111	7,822	71	5,593	71
LED (Rd 13)	137	11,020	80	5,989	71

Source: DOE CALiPER

LED Outdoor Lighting

Lumen maintenance higher for LEDs versus HID lighting

CRI and uniformity for LEDs are better than HPS

Minimum illuminance levels equal to HPS (perceived as better)

LEDs are Dark Skies compliant

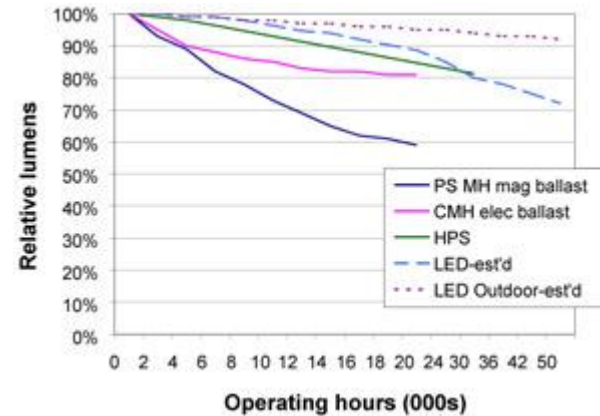
Simple payback of 3 to 10 years minimum

Capital cost of \$850 for LED versus \$250 for HPS
or CMH cobra head

Energy savings of 30% to 50%



LED (left) vs HPS (right)
Source: Beta Lighting &
EERE



Data Source: EERE

LED Omnidirectional Replacement Lamps

Brand Name	Wattage	Lumens	CCT	Life (Hrs)
LEDzworld Professional LED Bulb CTA	6.5W	250	2500K	35,000
GE Energy Smart™ LED	9W	450	3700K	25,000
Philips AmbientLED™	12.5W	800	2700K	25,000
Sylvania LED A-Line	12W	810	2700K	25,000
Switch 100	16W	1,700	4,200K	20,000



Source: Switch Bulb Co.



Source: GE Lighting



Source: LEDzworld

Philips Luminous Textile

Acoustic textile panels
Shows dynamic content
Softens sounds



Source: Philips

Daylight is BIG!

Foot-candles varies by 2X between summer and winter

Diffuse most of it

5% to 10% direct sunlight maximum

Do not try to match daylight to electric light (confuses people)

About 3% to 4% of roof area is optimal for energy savings

LightLouver™ Daylighting System

Mini-light shelves

- Extruded cellular plastic foam

- Coated with a reflective film

- Stacked together with vertical 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

Ace Hardware

Solar-tracking skylights

- Multiple reflectors to track the sun

- Directs outside light into the building through a diffuser

- Greater coverage through natural lighting

Light sensor in a skylight well turns on the electric lights when needed

65% energy savings for the 14,400 sqft facility

Projected annual energy savings estimates at 1.5 kWh/sqft per facility

Occupancy sensors

Passive infrared

- Require a line of sight
- Most sensitive to lateral movement
- Most suitable for smaller, enclosed spaces, such as hallways
- Maximum coverage area of 1,000 ft²

Ultrasonic sensors

- Can see around corners
- Most sensitive to movement to and from the sensor
- Most suitable for open spaces, spaces with obstacles, restrooms, and spaces with hard surfaces
- Maximum coverage area of 2,000 ft²

\$30 to \$150 cost

2-year payback is normal



Coverage Pattern

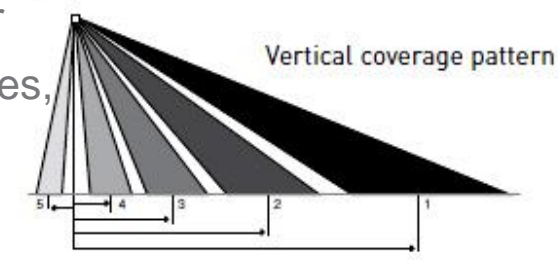
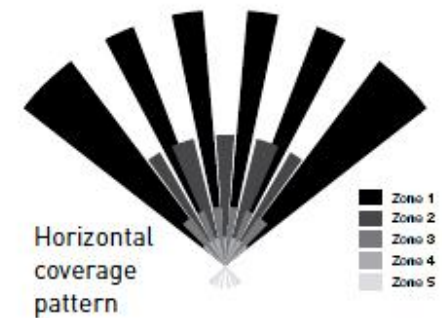


Image Source: Watt Stopper

Timers

Replace any indoor wall switch

Control indoor or outdoor loads up to 15 amps

Fit single- or multi-gang wall plates/junction boxes

Use in single and three-way switch applications

Provide internal battery backup to protect against power failure

The screen is blank during a power outage, but programmed times are permanently stored in system memory

Single/Multi-Channel Digital Timeclocks

SwitchPak™ Lighting Control Panel

Flexible time schedule control and override
for 4 to 8 lighting circuits

Standard relays switch 20A lighting loads

No need for external contactors or relays

Low voltage override switches

Motion sensor capable

Analog photocell capable



Source: Lithonia

The Blue Box™

8 or 16 relays

Manual override of individual relays,
zones or entire panel

Link up to 128 digital devices via
Cat 5 patch cable with RJ45 connectors



Source: Lighting Control & Design

Bonus

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NEEA Northwest Industrial Training

Provided by:

Northwest Regional Industrial Training Center:

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industrial-training@industrial.neea.org

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Utility incentives and programs:

Contact your local utility representative

Upcoming Trainings

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

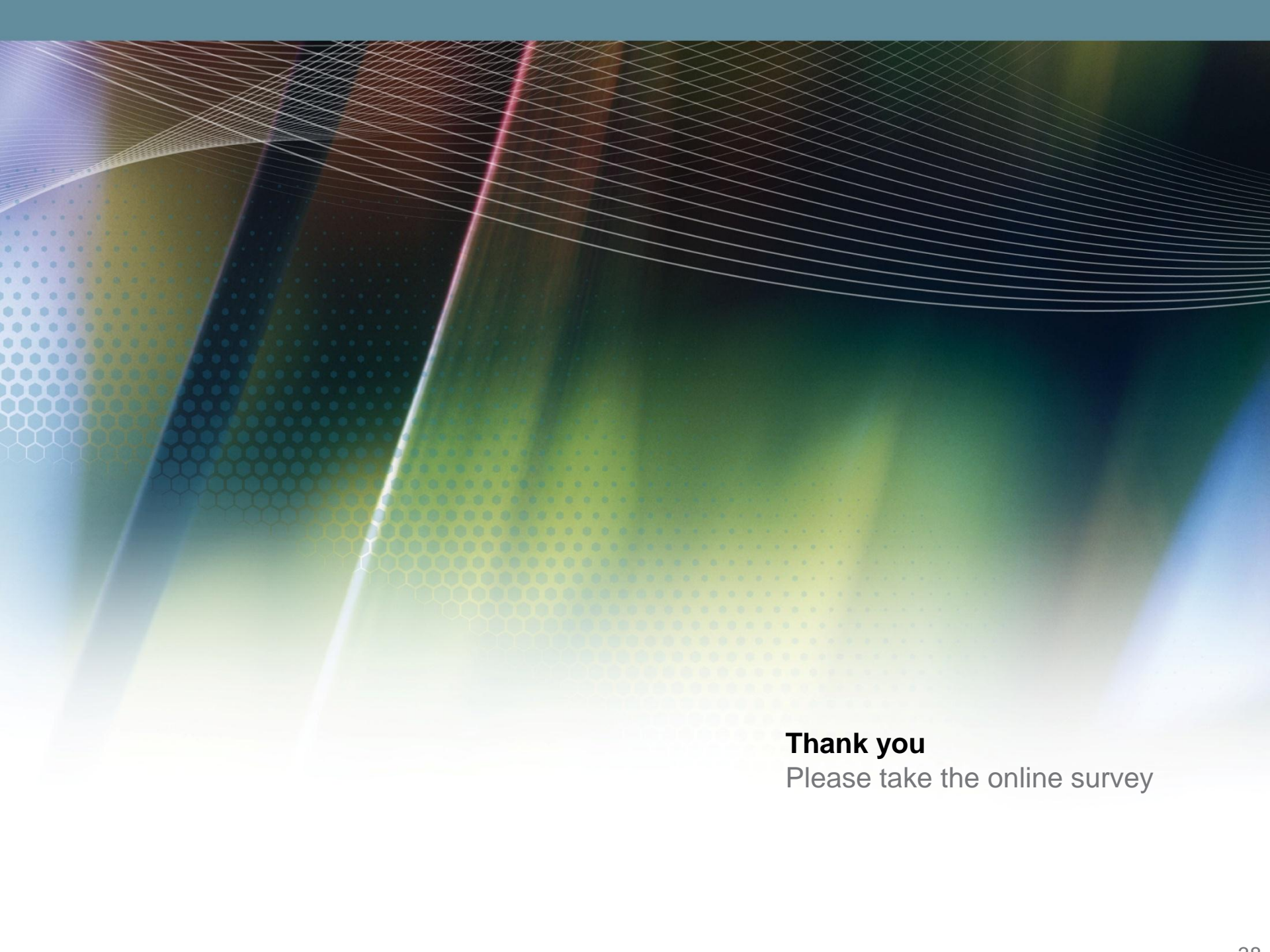
In-Class Trainings:

November 30, 2011: Energy Management: Introduction to Best Practices (Vancouver, WA)

<http://www.neea.org/participate/calendar.aspx?eventID=2974>

December 8, 2011: Energy Management: Introduction to Best Practices (Spokane, WA)

<http://www.neea.org/participate/calendar.aspx?eventID=3240>



Thank you
Please take the online survey