



## Common Lighting Retrofit Opportunities

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Better Buildings by Design  
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### Today's Presentation

Identify lighting retrofits in the following space types:

- Office environments
- Retail settings
- Industrial & warehouse

Within each space, we'll consider:

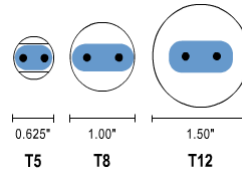
- Energy savings from the lighting retrofit
- Non-energy benefits
- Efficiency Vermont incentives



## Fluorescent Technology Refresher

### Lamps

- Fluorescent lamps (bulbs) come in a variety of shapes
- Typically denoted by the lamp diameter in 1/8" increments



### Ballasts

- A ballast is the electronic component required to start the lamp(s) and maintain the appropriate light output
- Available in a variety of *ballast factors*



## Office Environments

### Typical Lighting Requirements

- Uniform light level
- Long life
- Fixtures work with ceiling type and space layout

### Common Existing Lighting

- T8 and T12 fluorescent
- Recessed troffers



## Office Environments



### Retrofit Opportunities

- Replace T12 lamps and ballasts with High Performance T8



## Office Environments

### High Performance T8 (HPT8) – how it works

- Combination of a *high lumen lamp* and a *high efficiency low ballast factor ballast*
- Provides as much light as a standard T8 with normal ballast factor
- Saves **15-20%** vs. T8 and **30-50%** vs. T12
- Extends lamp life by **20-50%**
- Refer to the Efficiency Vermont HPT8 Fact Sheet for eligible lamps and ballasts



## Office Environments

### Various 3-lamp Linear Fluorescent Configurations

Technology	Total Mean Lumen Output	Input Watts	Lumens per Watt	Lamp Life (hours)
T12 (34 watt)	6,210	110	56	12,000 to 20,000
T8 (32 watt)	6,864 (+11%)	88	78	20,000
HPT8	6,815 (+10%)	74	92	24,000 to 30,000



## Office Environments



### Retrofit Opportunities

- Replace T12 lamps and ballasts with High Performance T8
- Retrofit or replace T8/T12 fixtures with high efficiency T5



## Office Environments

### High Efficiency T5: what does “High Efficiency” refer to?

- In many T5 fixtures, the *fixture efficiency* has been maximized by using superior lens & reflector designs
  - *Fixture efficiency* is the percentage of light produced by the lamps that leaves the fixture as usable light
- High Efficiency T5 fixtures deliver approximately 15% more usable light than a standard T8/T12 troffer fixtures
- More useable light → fewer lamps required



## Office Environments

### High Efficiency T5

Technology	Total Mean Lumen Output	Input Watts	Lumens per Watt	Lamp Life (hours)
3-lamp T12 (34 watt)	6,210	110	56	12,000 to 20,000
3-lamp T8 (32 watt)	6,864 (+11%)	88	78	20,000
3-lamp HPT8	6,815 (+10%)	74	92	24,000 to 30,000
<b>2-lamp T5</b>	<b>6,424 (+3%) *</b>	<b>64</b>	<b>100</b>	<b>30,000</b>

\* Includes 15% fixture efficiency bonus



## Office Environments



### Retrofit Opportunities

- Replace T12 lamps and ballasts with High Performance T8
- Retrofit or replace T8/T12 fixtures with high efficiency T5
- Reduce overall light levels and use task lighting

## Office Environments

### Task Lighting

- Many office areas are over lit, providing a bright light level throughout the entire space



### Task/Ambient Approach

- Reduce the ambient light level by using fewer lamps per fixture
- Supplement with compact fluorescent or LED task lights

## Office Environments



### Retrofit Opportunities

- Replace T12 lamps and ballasts with High Performance T8
- Retrofit or replace T8/T12 fixtures with high efficiency T5
- Reduce overall light levels and use task lighting
- Install occupancy sensor controls



## Office Environments

### Occupancy Sensor Controls

- Use automatic controls to shut off lights in low-use areas
- Typical good candidates:
  - Break rooms, bathrooms
  - Storage/utility rooms
  - Individual offices
- Simple wall-switch mounted sensors can be used for small spaces
- Larger spaces require remote/ceiling mounted sensors



## Office Environments



### Retrofit Opportunities

- Replace T12 lamps and ballasts with High Performance T8
- Retrofit or replace T8/T12 fixtures with high efficiency T5
- Reduce overall light levels and use task lighting
- Install occupancy sensor controls
- Replace incandescent lamps with compact fluorescent



## Office Environments

### Savings Example – Vermont Gas Offices

- Replace 3-lamp T12 parabolic office fixtures with 2-lamp high efficiency T5
- Replace T12 lamps and ballasts in troffer and wrap fixtures with HPT8
- Replace bathroom and kitchen incandescent with CFL



Total Annual Savings: \$4,000





## Retail Settings

### Typical Lighting Requirements

- Excellent color rendering
- Precise beam control
- Variety of light levels

### Common Existing Lighting

- Halogen track lighting
- Incandescent recessed cans
- T8 & T12 linear fluorescent



## Retail Settings




### Retrofit Opportunities


- Replace halogen track lights with halogen infrared (HIR) or integrated ceramic metal halide (CMH)

## Retail Settings

### Track Lighting

- Halogen track lights are often the workhorse of a retail lighting plan

 Excellent color properties

 Precise beam control

 Very energy inefficient




 Short life



## Retail Settings

### Track Lighting Options

- **Compact fluorescent**
- **Halogen InfraRed** – 15-20% more efficient and lasts up to twice as long
- **Ceramic metal halide** – high intensity discharge light source with good color rendering and 60-70% better efficiency

	Color	Beam	Energy	Life
Compact fluorescent				
Halogen InfraRed				
Ceramic metal halide				

## Retail Settings

### Track Lighting

Technology	Lumen Output	Lumens per Watt	Color Rendering	Lamp Life (hours)
75 watt halogen PAR38	1050	14	100	2,500
55 watt halogen IR PAR38	1120	20	100	4,200
25 watt ceramic metal halide PAR38 *	1220 init 850 mean	34-49	87	10,500

\* Will not work with dimming fixtures



## Retail Settings



### Retrofit Opportunities

- Replace halogen track lights with halogen infrared (HIR) or integrated ceramic metal halide (CMH)
- Replace incandescent bulbs used in recessed cans with compact fluorescent reflector bulbs



## Retail Settings

### Recessed Cans / Down Lights

- Down lights are often used for general/ambient lighting; there is typically no need for beam control
- In this situation, CFL reflector products excel
- A 65 watt BR30 lamp can be replaced 1-for-1 with a 15 watt CFL reflector



## Retail Settings



### Retrofit Opportunities

- Replace halogen track lights with halogen infrared (HIR) or integrated ceramic metal halide (CMH)
- Replace incandescent bulbs used in recessed cans with compact fluorescent reflector bulbs
- Replace T12 lamps and ballasts with High Performance T8 (HPT8)

## Retail Settings

### Savings Example – Von Bargaen’s Jewelry

- Replace 60 watt halogen track heads with 50 watt halogen IR
- Replace 65 watt incandescent recessed cans with 15 watt CFL
- Replace T12 lamps and ballasts with HPT8
- Install LED channel display case lighting



Total Annual Savings: \$1,700



## Industrial & Warehouse Spaces

### Typical Lighting Requirements

- High bay performance
- Long operating life
- Rough service

### Common Existing Lighting

- Metal Halide
- High Pressure Sodium
- T12 strip/industrial



## Industrial & Warehouse Spaces



### Retrofit Opportunities

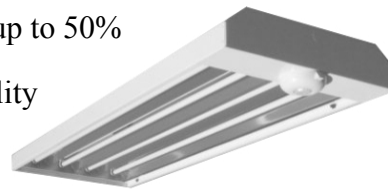
- Replace high-bay metal halide and high pressure sodium with T5HO (high output) or HPT8 high-bay fixtures



## Industrial & Warehouse Spaces

### T5HO and HPT8 Fluorescent High-Bay

- Replace 250-400 watt metal halide and high pressure sodium one-for-one
  - Cut operating wattage by up to 50%
  - Vastly improved light quality
  - Instant on/off
  - Minimal light output degradation over time



## Industrial & Warehouse Spaces

400 watt High Pressure Sodium

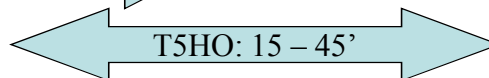
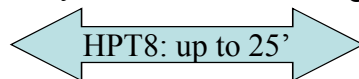
4-lamp T5HO



## Industrial & Warehouse Spaces

Which should you use: T5HO or HPT8?

- **Energy:** HPT8 is slightly more energy efficient
- **Cost:** HPT8 typically has a lower first cost
- **Maintenance:** HPT8 can use same lamp type as other areas  
→ T5HO performs better at higher **Mounting Heights**
- Why ever use T5HO? higher **Mounting Heights**



## Industrial & Warehouse Spaces



### Retrofit Opportunities

- Replace high-bay metal halide and high pressure sodium with T5HO (high output) or HPT8 high-bay fixtures
- Use remote-mounted or fixture-mounted occupancy sensors in aisles and low-use areas

## Industrial & Warehouse Spaces

### Occupancy Sensors

- With metal halide and high pressure sodium, the lights are often turned on and left on
- Fluorescent high bay fixtures allow the use of controls
  - Fixture mounted occupancy sensors control single fixtures and don't require additional wiring
  - Remote mounted occupancy sensors can control entire aisles/areas



## Industrial & Warehouse Spaces



### Retrofit Opportunities

- Replace high-bay metal halide and high pressure sodium with T5HO (high output) or HPT8 high-bay fixtures
- Use remote-mounted or fixture-mounted occupancy sensors in aisles and low-use areas
- Replace T12 lamps and ballasts with High Performance T8 (HPT8)



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## Industrial & Warehouse Spaces

### Savings Example – Gardener's Supply Warehouse

- 400 watt metal halide in main aisles
  - **Replace fixtures with 4-lamp T5HO**
- 400 watt metal halide in secondary aisles
  - **Replace with 2- and 3-lamp T5HO**
  - **Use fixture-mounted occ. sensors**



Total Annual Savings: \$33,000



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## What about LED Products?

### Good Applications

- Indicator lights, colored lighting, exit signs, traffic signals, task lighting (desk lamp, under cabinet, etc)

### General Lighting?

- Many overstated claims by manufacturers regarding life, color, light output, etc.
- Be skeptical, and try the product first if possible



## LED Products

### Efficiency Vermont Support

- Efficiency Vermont is only supporting products that perform well both in terms of energy efficiency and function (light output, color, life, etc)
- Incentives for LED products can be handled custom

### DOE Testing

- Commercially Available LED Product Evaluation and Reporting (CALiPER) Program
- <http://www.netl.doe.gov/ssl/>

## Efficiency Vermont Incentives

### Prescriptive Lighting Track

- Designed for projects less than 10,000 square feet and fewer than 100 fixtures
- Incentive amounts are predefined



### Custom Lighting Track

- Designed for large projects or those with non-standard lighting measures
- Efficiency Vermont Project Managers assist with custom incentive calculations



## Efficiency Vermont Incentives

### Prescriptive Incentives

Lighting Technology	Incentive Amount
HPT8	\$10/fixture
High Efficiency T5	\$25/fixture
T5HO / HPT8 Highbay	\$50/fixture
Halogen InfraRed	\$3/lamp
Integrated Ceramic Metal Halide	\$20/lamp
Wall-switch Occupancy Sensor	\$30/sensor
Remote Occupancy Sensor	\$75/sensor



## Efficiency Vermont Incentives

### Custom Projects

- Incentives are calculated based on the project cost, energy savings, and equipment type
- Equipment types not limited to the prescriptive form
  - Example: LED technologies, task/ambient, etc.
- Efficiency Vermont Project Managers can work with owners, managers, contractors, and designers to maximize energy savings



## Selling the Project

### Energy Savings

- Typical savings levels reach 25-50% of baseline lighting

### Non-energy Benefits

- Improved light quality (safety, comfort, performance, sales)
- Longer equipment life
- Quiet operation
- Air conditioning savings



## Promoting Broader Energy Savings

Use Efficiency Vermont as a resource to maximize your savings potential

Look beyond lighting! Leverage good lighting retrofits to encourage further energy saving projects



Keep an eye on technology – future lighting products hold even more promise for delivering energy savings and quality lighting



## Contact Info

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