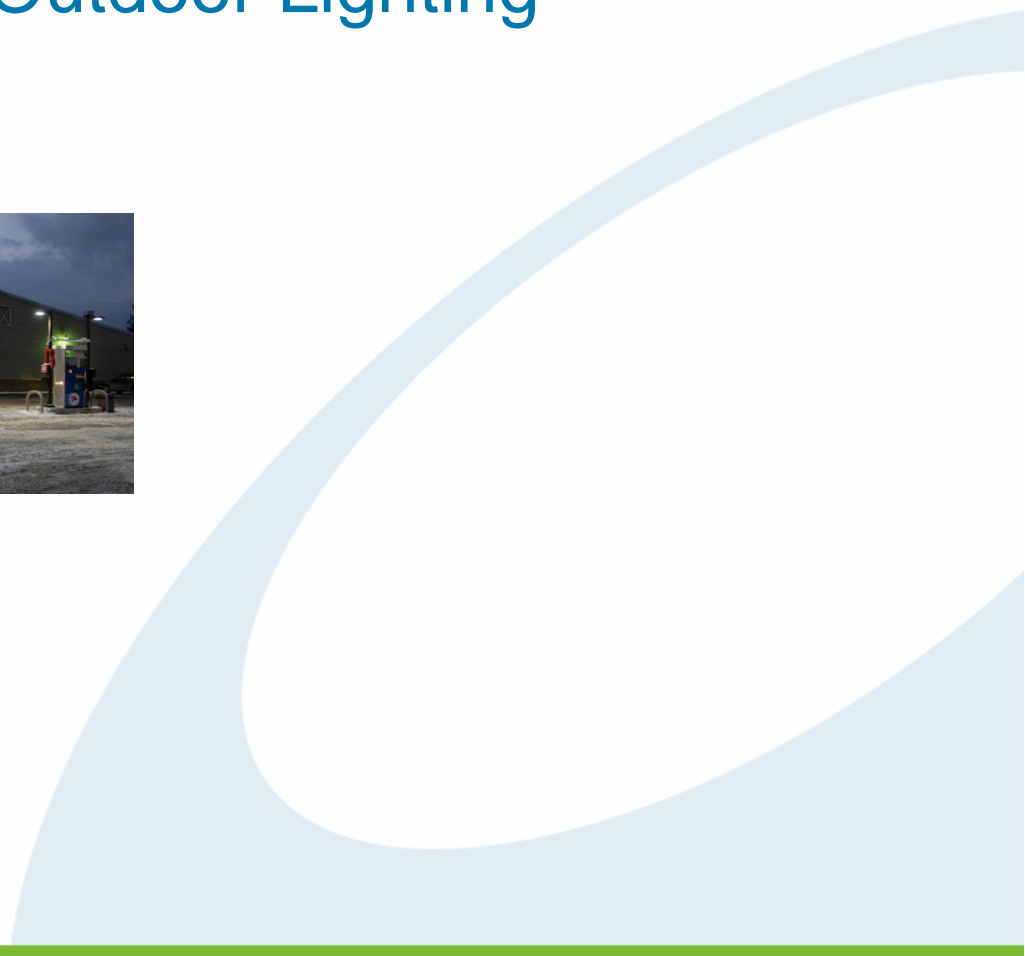


New Opportunities in Outdoor Lighting

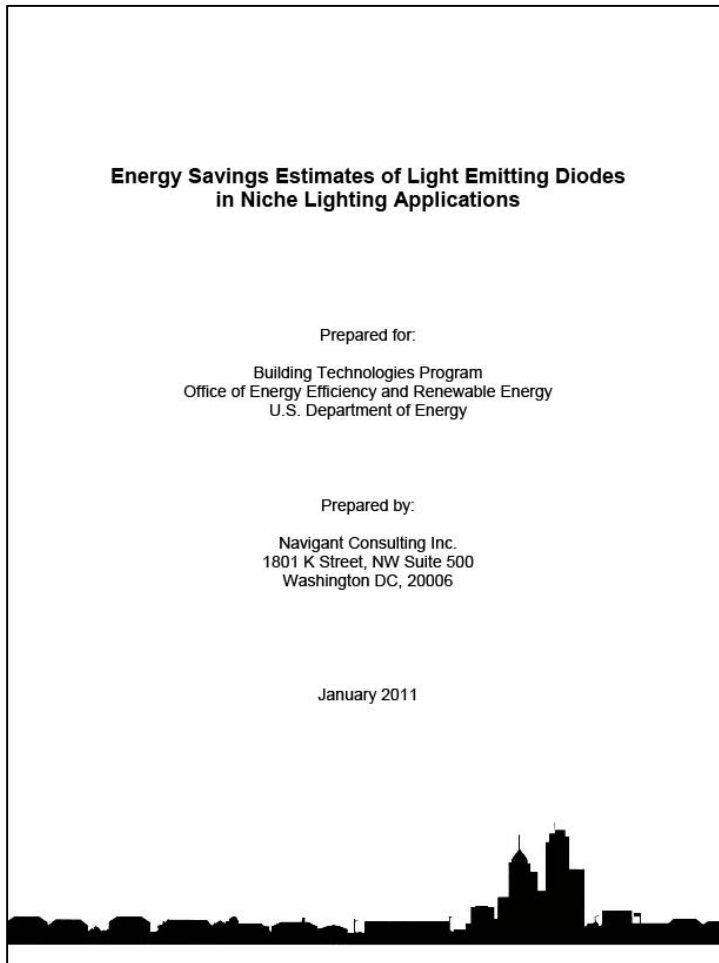


Agenda

- ▶ How big is the outdoor lighting opportunity?
- ▶ New Outdoor Lighting Technologies
- ▶ Outdoor Lighting Program Examples
- ▶ A focused look at Utility-Owned Street lights
- ▶ BUG Ratings and MLO
- ▶ DOE Municipal Solid-State Street Lighting Consortium
- ▶ DesignLights Consortium Qualified Products List

- ▶ Case Studies if there is time

How big is the Opportunity?



- ▶ IT'S HUGE!
- ▶ DOE/Navigant Report provides estimates
- ▶ 132.5 TWh/yr if all outdoor lighting is converted to more efficient LED

Roadway Lighting Inventory

Application	Lamp Type	Percentage	Number of Lights (000's)
Street Lighting	Incandescent	0.1%	18
	Mercury Vapor	15.9%	4,200
	Low Pressure Sodium	0.4%	100
	High Pressure Sodium	80.9%	21,500
	Metal Halide	2.5%	700
	LED	0.2%	60
	Total	100%	26,500
Highway Lighting	Induction	8.5%	2,200
	Low Pressure Sodium	0.4%	100
	High Pressure Sodium	86.1%	22,500
	Metal Halide	5.0%	1,300
	Total	100%	26,100

Source: "Energy Savings Estimates of Light Emitting Diodes in Niche Applications", Navigant, 2011

Roadway Lighting Average Wattage

Application	Lamp Type	Average System Wattage (W)	2010 LED Replacement Wattage (W)
Street Lighting	Incandescent	100	12
	Mercury Vapor	291	82
	High Pressure Sodium	178	118
	Low Pressure Sodium	90	84
	Metal Halide	310	183
	LED	74	n/a
Highway Lighting	Induction	176	104
	High Pressure Sodium	270	178
	Low Pressure Sodium	199	185
	Metal Halide	237	140

Source: "Energy Savings Estimates of Light Emitting Diodes in Niche Applications", Navigant, 2011

Parking Lighting Inventory

Application	Lamp Type	Percentage	Number of Lights (000's)
Garage Lighting	Incandescent	1.6%	600
	Halogen	2.2%	800
	Fluorescent	45.9%	16,600
	Induction	7.4%	2,700
	Mercury Vapor	0.1%	44
	High Pressure Sodium	23.2%	8,500
	Metal Halide	15.3%	5,600
	LED	4.1%	1,500
	Total	100%	36,400
Lot Lighting	Incandescent	2.6%	400
	Halogen	0.1%	16
	Mercury Vapor	2.4%	400
	High Pressure Sodium	36.0%	5,700
	Metal Halide	54.2%	8,600
	LED	4.6%	700
	Total	100%	15,800

Source: "Energy Savings Estimates of Light Emitting Diodes in Niche Applications", Navigant, 2011

Parking Lighting Average Wattage

Application	Lamp Type	Average System Wattage (W)	2010 LED Replacement Wattage (W)
Garage Lighting	Incandescent	86	18
	Halogen	107	27
	Fluorescent	82	68
	Induction	106	68
	Mercury Vapor	185	71
	High Pressure Sodium	183	138
	Metal Halide	152	91
	LED	54	n/a
Lot Lighting	Incandescent	150	22
	Halogen	150	26
	Mercury Vapor	421	119
	High Pressure Sodium	340	245
	Metal Halide	307	199
	LED	72	n/a

Source: "Energy Savings Estimates of Light Emitting Diodes in Niche Applications", Navigant, 2011

Area and Flood Lighting Inventory

Application	Lamp Type	Percentage	Number of Lamps (000's)
Area Lighting	Incandescent	2.3%	1,200
	Halogen	19.0%	8,600
	Fluorescent	5.8%	3,600
	Induction	0.3%	200
	Mercury Vapor	12.7%	6,700
	High Pressure Sodium	22.1%	10,700
	Metal Halide	36.9%	18,900
	LED	0.9%	600
	Total	100%	50,400
Flood Lighting	Incandescent	3.6%	1,600
	Halogen	18.6%	8,000
	Compact Fluorescent	0.2%	74
	Fluorescent	7.9%	3,400
	Mercury Vapor	8.4%	3,600
	High Pressure Sodium	21.4%	9,200
	Metal Halide	39.7%	17,100
	LED	0.2%	74
	Total	100%	43,200

Source: "Energy Savings Estimates of Light Emitting Diodes in Niche Applications", Navigant, 2011

Area and Flood Lighting Average Wattage

Application	Lamp Type	Average System Wattage (W)	2010 LED Replacement Wattage (W)
Area Lighting	Incandescent	202	23
	Halogen	150	26
	Fluorescent	160	61
	Induction	287	178
	Mercury Vapor	254	69
	High Pressure Sodium	285	183
	Metal Halide	451	255
	LED	67	n/a
Flood Lighting	Incandescent	202	23
	Halogen	150	26
	Compact Fluorescent	53	36
	Fluorescent	159	61
	Mercury Vapor	254	69
	High Pressure Sodium	294	194
	Metal Halide	460	264
	LED	67	n/a

Source: "Energy Savings Estimates of Light Emitting Diodes in Niche Applications", Navigant, 2011

Residential Outdoor Lighting Inventory

Lamp Type	Percentage	Number of Lamps (000's)
Compact Fluorescent	12.1%	46,000
Halogen Standard	10.6%	40,300
Halogen Quartz Tube	2.4%	9,200
Incandescent	75.2%	286,500
Total	100%	382,000

Source: "Energy Savings Estimates of Light Emitting Diodes in Niche Applications", Navigant, 2011

Residential Outdoor Average Wattage

Lamp Type	Average System Wattage (W)	2010 LED Replacement Wattage (W)
Compact Fluorescent	17	8
Halogen Standard	86	19
Halogen Quartz Tube	180	46
Incandescent	67	10

Source: "Energy Savings Estimates of Light Emitting Diodes in Niche Applications", Navigant, 2011

Outdoor Lighting Opportunity Summary

Type	Quantity (Millions)	Potential Savings (TWh/yr)
Street Lighting	26.5	10.0
Highway Lighting	26.1	10.2
Garage Lighting	36.4	8.3
Lot Lighting	15.8	8.6
Area Lighting	50.4	33.9
Flood Lighting	43.2	29.2
Residential Outdoor	0.4	30.3
Total	198.8	132.5

Source: "Energy Savings Estimates of Light Emitting Diodes in Niche Applications", Navigant, 2011

New Outdoor Lighting Technologies

- ▶ Improved Metal-Halide
- ▶ Induction Fluorescent
- ▶ Light Emitting Plasma
- ▶ LED

Improved Metal Halide

- ▶ Example: Philips Cosmopolis System
- ▶ Higher Efficacy (100+ Lumens per Watt)
- ▶ Improved Lamp Life (Up to 30,000 hrs)
- ▶ Compact Size (65% smaller than comparable HPS lamp)



Induction Fluorescent

- ▶ Example: Philips QL, Sylvania Icetron
- ▶ Not really new, but experiencing a resurgence
- ▶ Long, proven lifetime (100,000 hours)
- ▶ Good Efficiency (up to 73 LPW)
- ▶ White Light

- ▶ “Twice the life at half the price”?



Light Emitting Plasma

- ▶ Example: Luxim LiFi
- ▶ Just beginning to become available in outdoor lighting fixtures
- ▶ Long Lamp Life (50,000 hours)
- ▶ Good Efficacy (80+ lumens per watt)
- ▶ High Lumen Packages (23,000+ lumens)
- ▶ Small Size



LED

- ▶ Good to Excellent Efficacy (50 – 100 Lumens per Watt)
- ▶ Long Lamp Life (50,000 – 100,000 hours)
- ▶ Small Size
- ▶ Inherent directionality offers opportunities for improved optical control and efficiency



Source: PG&E Emerging Technologies Assessment

Outdoor Lighting Technology Comparison

Type	Initial Lamp Efficacy (lumens per watt)	Initial Delivered Efficacy (lumens per watt)*	Lamp Life (hours)	Other Benefits
Improved Metal Halide	105	79	15,000 – 30,000	Less Expensive?
Induction	70	53	100,000	Less Expensive?
Plasma	86	65	50,000	High Lumen Packages
LED	N/A	90+	60,000 – 100,000	Precise Distribution

*Delivered efficacy assumes 75% fixture efficiency. LED delivered efficacy from products on DesignLights Consortium Qualified Products List (April 2011)



Program Examples

5.7 LED Outdoor Pole-/Arm-Mounted Parking & Roadway Fixtures

Eligibility Requirements

- Product must be DesignLights approved.

Code	Watts	Rebate/ Fixture
5.7a	< 30W	\$100
5.7b	30W - 75W	\$200
5.7c	> 75W	\$300

5.8 LED Outdoor Pole-/Arm-Mounted Decorative Parking & Roadway Fixtures

Eligibility Requirements

- Eligible products include acorn and post-top decorative type outdoor light fixtures.
- Product must be DesignLights approved.

Code	Watts	Rebate/ Fixture
5.8a	< 30W	\$100
5.8b	30W - 75 W	\$200
5.8c	> 75W	\$300

5.9 LED Parking Garage & Canopy Fixtures

Eligibility Requirements

- Product must be DesignLights approved.

Code	Watts	Rebate/ Fixture
5.9a	< 30W	\$100
5.9b	30W - 75 W	\$200
5.9c	> 75W	\$300

5.10 LED Outdoor Wall-Mounted Area Fixtures (Wall Packs)


Eligibility Requirements

- Product must be DesignLights approved.

Code	Watts	Rebate/ Fixture
5.10a	< 30W	\$100
5.10b	≥ 30W	\$200



Program Examples

	LED Outdoor Area Fixture	S10	Outdoor Pole or Arm-Mounted LED Streetlight or Parking Lot Fixture	\$175 Per Fixture	<ul style="list-style-type: none"> • Must be approved by the DesignLights Consortium – see the following link for a complete list of qualified products: http://www.designlights.org/solidstate.about.QualifiedProductsList_Publicv2.php • Products not approved by the DesignLights Consortium must have: <ol style="list-style-type: none"> 1) Independent LM-79 Testing 2) LM-80 Testing, In-Situ LED Temperature Report, and a written explanation of how useful life was determined OR 5-Year Warranty that covers the product if light levels drop below 70% of the initial light output
	LED Wallpack	S12	Outdoor Wall-Mounted LED Area Fixture (Wallpack)	\$100 Per Fixture	<ul style="list-style-type: none"> • Must be approved by the DesignLights Consortium – see the following link for a complete list of qualified products: http://www.designlights.org/solidstate.about.QualifiedProductsList_Publicv2.php • Products not approved by the DesignLights Consortium must have: <ol style="list-style-type: none"> 1) Independent LM-79 Testing 2) LM-80 Testing, In-Situ LED Temperature Report, and a written explanation of how useful life was determined OR 5-Year Warranty that covers the product if light levels drop below 70% of the initial light output
	LED Parking Garage Fixture	S14	LED Parking Garage Fixture	\$175 Per Fixture	<ul style="list-style-type: none"> • Must be approved by the DesignLights Consortium – see the following link for a complete list of qualified products: http://www.designlights.org/solidstate.about.QualifiedProductsList_Publicv2.php • Products not approved by the DesignLights Consortium must have: <ol style="list-style-type: none"> 1) Independent LM-79 Testing 2) LM-80 Testing, In-Situ LED Temperature Report, and a written explanation of how useful life was determined OR 5-Year Warranty that covers the product if light levels drop below 70% of the initial light output

Program Examples



83	LED Low Bay Fixtures – Garage and Canopy Fixtures	\$100	Eligible LED Low Bay fixtures are required to be installed in 8,760 hour applications and be listed by Mass Save Interim LED Pre-Qualified list or Design Lights Consortium (for more information see www.masssave.com/business or www.designlights.org).	 An illustration of a rectangular LED low bay fixture and its corresponding circular mounting ring.
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- ▶ Some programs not able to move as quickly as others due to differences in cost-benefit analysis
- ▶ Methodology does not include O&M savings

Program Examples



*Pacific Gas and
Electric Company*[®]

Rebate/fixture	
Replace 70 watt fixture with new LED fixture	\$50
Replace 100 watt fixture with new LED fixture	\$75
Replace 150 watt fixture with new LED fixture	\$100
Replace 200 watt fixture with new LED fixture	\$125
Replace 250 watt fixture with new LED fixture	\$150
Replace 310 watt fixture with new LED fixture	\$175
Replace 400 watt fixture with new LED fixture	\$200



Program Examples

Custom LED Exterior Lighting Incentives

LED Exterior Lighting - Fixtures

- \$0.10/kWh
- Up to 20% of project cost or \$50,000, whichever is less

For this incentive, the existing wattage is used as a baseline.



[Download application](#)

- Notes -

Regarding streetlights: This program only applies to customer-owned / customer-maintained fixtures. SMUD is currently testing different LED products for other street lighting applications.

All projects require SMUD approval prior to installation. All projects are approved on a case-by-case basis.

For more information and eligibility requirements, call SMUD Commercial Services at 1-877-622-SMUD (7683).

Program Examples



Incentives and Savings

Oncor provides customers with the following incentives based on the estimated on-peak demand* and annual energy savings resulting from the installation of LED lighting and control measures:

- On-Peak Demand Savings: \$235 per kW
- Annual Energy Savings: \$0.15 per kWh

**The on-peak demand period is defined as the hours between 1:00 p.m. to 7:00 p.m., Central Standard Time, Monday through Friday, June through September, excluding weekends and federal holidays.*

Utility Owned Streetlights

- ▶ Many street, area, and flood lighting is owned by the utilities
- ▶ Paid for through special outdoor lighting rate tariffs
- ▶ Monthly or Daily Charge includes purchase, installation, maintenance

<u>Mercury Vapor*</u>			<u>Sodium Vapor</u>		
<u>Watts</u>	<u>Lumens</u>	<u>Price/Month</u>	<u>Watts</u>	<u>Lumens</u>	<u>Price/Month</u>
100	3,200	\$13.45	70	5,200	\$13.70
175	7,200	\$16.55	100	8,500	\$15.12
250	9,800	\$23.94	150	14,400	\$17.34
400	17,500	\$30.98	200	19,800	\$20.09
			250	24,700	\$22.13
<u>LED</u>					
20 LED	2070 Lumens	42 System Watts	\$12.99		
30 LED	3105 Lumens	60 System Watts	\$14.35		
40 LED	4140 Lumens	84 System Watts	\$16.44		
50 LED	5175 Lumens	99 System Watts	\$17.70		

Utility Owned Streetlights

- ▶ If a customer/municipality would like to upgrade to LED:
 - LED Rate must be offered by utility (rate case or tariff)
 - Customer may need to pay undepreciated costs of previous streetlight

- ▶ Challenges:
 - Utilities are cautious to move to new technology
 - Rate Cases take time
 - New LED Rates may not result in cost savings vs. older technology

Utility Owned Streetlights – Case Study

- ▶ Efficiency Vermont Municipal Street Light Initiative
- ▶ 4 Part Initiative

1. Step by Step Guide to Municipal Streetlight Conversions

2. Workshops offered to all Vermont Municipalities following Guide

3. Municipalities recruited to sign MOU with Efficiency Vermont

- Municipality agrees to develop project
- Efficiency Vermont offers 12 hours of engineering assistance from engineering firm free to municipality

4. Partnership with Utility Street Lighting Departments

Efficiency Vermont Municipal Street Light Initiative

- ▶ Over 50 municipalities attended the workshops
 - ▶ 20+ have signed MOU
 - ▶ Due to lack of LED rates or good economics, municipalities pressured utilities to offer economically attractive LED options
 - ▶ Some municipalities considered taking over ownership of fixtures (allowed through “customer-owned” rate tariff) – 2 followed through
-
- ▶ Concerned about losing some customers to ownership and negative PR, Utilities partnered with Efficiency Vermont on initiative

Efficiency Vermont Municipal Street Light Initiative Current Status

- ▶ Green Mountain Power and Central Vermont Public Service, Vermont's 2 largest utilities are primary partners in initiative
- ▶ New Rate Tariffs being submitted to regulatory bodies with LED rates lower than older technology rates
- ▶ Undepreciated Costs of fixtures upgraded to LED paid for by Efficiency Vermont (\$100 per fixture average)
- ▶ Municipalities will be able to convert street lights to LED for \$0 cost, and save \$ through the rate tariff
- ▶ Target: Nearly 2/3 of Vermont streetlights converted to LED in 3 years (20,000)

Utility Owned Streetlight Summary

- ▶ Utility owned street lights offer unique opportunities and unique barriers
- ▶ Working with utility critical to success
- ▶ Efficiency Program funding can reduce or eliminate undepreciated costs charged to municipality for upgrade

BUG Ratings (IES TM-15-07)

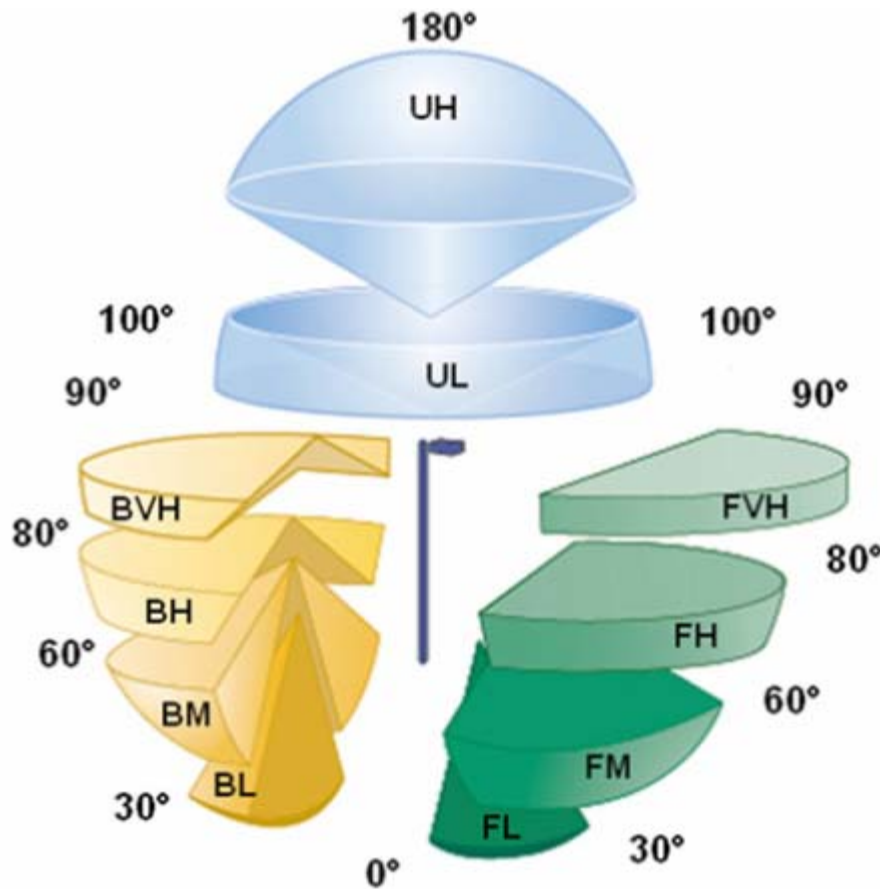


Table A-1: Backlight Ratings (maximum zonal lumens)

		Backlight Rating					
Secondary Solid Angle		B0	B1	B2	B3	B4	B5
Backlight / Trespass	BH	110	500	1000	2500	5000	>5000
	BM	220	1000	2500	5000	8500	>8500
	BL	110	500	1000	2500	5000	>5000

Table A-2: Uplight Ratings (maximum zonal lumens)

		Uplight Rating					
Secondary Solid Angle		U0	U1	U2	U3	U4	U5
Uplight / Skyglow	UH	0	10	100	500	1000	>1000
	UL	0	10	100	500	1000	>1000
	FVH	10	75	150	>150		
	BVH	10	75	150	>150		

Table A-3: Glare Ratings (maximum zonal lumens)

		Glare Rating for Asymmetrical Luminaire Types (Type I, Type II, Type III, Type IV)					
Secondary Solid Angle		G0	G1	G2	G3	G4	G5
Glare / Offensive Light	FVH	10	250	375	500	750	>750
	BVH	10	250	375	500	750	>750
	FH	660	1800	5000	7500	12000	>12000
	BH	110	500	1000	2500	5000	>5000

- Replaced “cut-off” classification system

IES/IDA Model Lighting Ordinance (MLO)

- ▶ Joint partnership between International Darksky Association and IESNA
- ▶ A uniform lighting ordinance that can be tailored to individual communities
- ▶ 10 years in the making – still not yet final
- ▶ Considerable controversy from darksky advocates
- ▶ Based on BUG classification system

IES/IDA Model Lighting Ordinance (MLO)

Lighting Zone Definitions: The Lighting Zone shall define the limitations for outdoor lighting as specified in this ordinance. The policymaking body is able to designate areas according to the following descriptions, thereby creating a custom lighting plan according to local needs, functions, and geography.

LZ0: No ambient lighting Areas where the natural environment will be seriously and adversely affected by lighting. Impacts include disturbing the biological cycles of flora and fauna and/or detracting from human enjoyment and appreciation of the natural environment. Little or no lighting is expected. When not needed, lighting should be extinguished.

LZ1: Low ambient lighting Areas where lighting might adversely affect flora and fauna or disturb the character of the area. The vision of human residents and users is adapted to low light levels. Lighting may be used for safety, security and/or convenience but it is not necessarily uniform or continuous. After curfew, most lighting should be extinguished or reduced as activity levels decline.

LZ2: Moderate ambient lighting Areas of human activity where the vision of human residents and users is adapted to moderate light levels. Lighting may typically be used for safety, security and/or convenience but

it is not necessarily uniform or continuous. After curfew, lighting may be extinguished or reduced as activity levels decline.

LZ3: Moderately high ambient lighting Areas of human activity where the vision of human residents and users is adapted to moderately high light levels. Lighting is generally desired for safety, security and/or convenience and it is often uniform and/or continuous. After curfew, lighting may be extinguished or reduced in most areas as activity levels decline.

LZ4: High ambient lighting Areas of human activity where the vision of human residents and users is adapted to high light levels. Lighting is generally considered necessary for safety, security and/or convenience and it is mostly uniform and/or continuous. After curfew, lighting may be extinguished or reduced in some areas as activity levels decline.

IES/IDA Model Lighting Ordinance (MLO)

- ▶ Offers prescriptive or performance path to compliance
- ▶ Sets maximum site lumens based on Lighting Zone
- ▶ Sets maximum BUG ratings based on Lighting Zone

▶ Example:

Table B - Allowed Total Initial Lumens per Site for Non-residential Outdoor Lighting, Hardscape Area Method

May be used for any project. When lighting intersections of site drives and public streets or road, a total of 600 square feet for each intersection may be added to the actual site hardscape area to provide for intersection lighting.

LZ-0	LZ-1	LZ-2	LZ-3	LZ-4
1.5 lumens per SF of hardscape	2.5 lumens per SF of hardscape	4.0 lumens per SF of hardscape	8.0 lumens per SF of hardscape	12.0 lumens per SF of hardscape

	Lighting Zone 0	Lighting Zone 1	Lighting Zone 2	Lighting Zone 3	Lighting Zone 4
Allowed Backlight Rating					
Greater than 2 mounting heights from property line	B1	B3	B4	B5	B5
1 to 2 mounting heights from property line and properly oriented*	B1	B2	B3	B4	B4
0.5 to 1 mounting heights from property line and properly oriented*	B0	B1	B2	B3	B3
Less than 0.5 mounting height to property line adjacent to a street and properly oriented* **	B0	B0	B1	B2	B3
Less than 0.5 mounting height to property line and properly oriented*	B0	B0	B0	B1	B2
Allowed Uplight Rating	U0	U0	U1	U2	U3
Allowed Glare Rating **	G0	G1	G2	G3	G4

DOE Municipal Solid-State Streetlight Consortium

- ▶ <http://www1.eere.energy.gov/buildings/ssl/consortium.html>
- ▶ Objective Resource
- ▶ Share experiences and technical information with LED municipal street lighting
- ▶ Consortium has developed flexible performance specification that can be used by municipality for LED street light purchase and/or upgrade projects – currently out for public review

Discussion Questions

- ▶ Do new lighting strategies include retrofit options or is full equipment replacement required?
- ▶ How are programs working with businesses and municipal governments to implement new guidelines for exterior lighting? How can utilities and other stakeholders work together to move more quickly?
- ▶ What can be done to address challenges with rate tariffs?
- ▶ What new outdoor lighting technologies should programs be pushing? When?
- ▶ How will new guidelines and standards such as the MLO impact programs?
- ▶ What are the barriers to moving forward with more efficient outdoor lighting? How can they be addressed?

Key Words

Case
Studies

Model
Lighting
Ordinance

High
Initial
Cost

Improved MH
Induction
Plasma
LED

Adaptive
Controls

Rate
Tariffs

Light
Color

Cautious
Utilities

Prescriptive
Custom

Utility-
Owned

BUG
Ratings

Cost
Benefit
Analysis

Street Light
Consortium

Privately-
Owned

DesignLights
Consortium

Burlington International Airport



- 113 LED Pole-Mount Parking/Street Lights
- 64 LED Wallpacks
- 762 LED Parking Garage Lights

Burlington International Airport

Measure	Quantity	Total Cost	Total Efficiency Vermont 2011 Incentive	Annual Energy Cost Savings	Annual Maintenance Savings	Payback (years)
Retrofit Portion	611	\$458,000	\$133,000	\$51,500	\$37,000	3.7
New Construction Portion	328	\$115,000	\$65,500	\$28,000	\$32,500	0.8
Project Total	939	\$573,000	\$198,500	\$79,500	\$69,500	2.5

Vermont LED Case Studies

▶ Fixture Type

- ▶ Exterior - Area Light
- ▶ Exterior - Street Light
- ▶ Exterior - Canopy Light

Location

Holiday Inn Express, Brattleboro

Founders Memorial, Essex

Short Stop Mobil, Derby

Applications – Area Light

▶ Fixture Type

▶ Exterior - Area Light

▶ Exterior - Street Light

▶ Exterior - Canopy Light

Location

Holiday Inn Express, Brattleboro

Founders Memorial, Essex

Short Stop Mobil, Derby





- ▶ Existing Equipment
- ▶ 250 watt metal halide
- ▶ (295 system watts)

▶ Brattleboro, VT

LED Solution

Beta LED EDGE Area Light

- 104 system watts (4-bar)
- 60 lumens per watt
- 75 CRI
- L₇₀ life 150,000 hours



► Brattleboro, VT





▶ Brattleboro, VT





▶ Brattleboro, VT



Example Economics

Replace 250W MH with Beta LED EDGE Area Light

- **Save 191 watts per fixture – 65%!**
- **Estimate installed cost \$885 per fixture**
- **\$100 Efficiency Vermont rebate**
- **5.9 year payback**
(includes maintenance savings, assumes 4380 hours and \$0.13/kWh)



River Bend Market - Townshend, VT



LYNDON
A *vermont* STATE COLLEGE

Lyndonville, VT

Applications – Street Light



► Fixture Type

- Exterior - Area Light
- **Exterior - Street Light**
- Exterior - Canopy Light
- Interior - Track Light
- Interior - Down Light

Location

Holiday Inn Express, Brattleboro

Founders Memorial, Essex

Short Stop Mobil, Derby

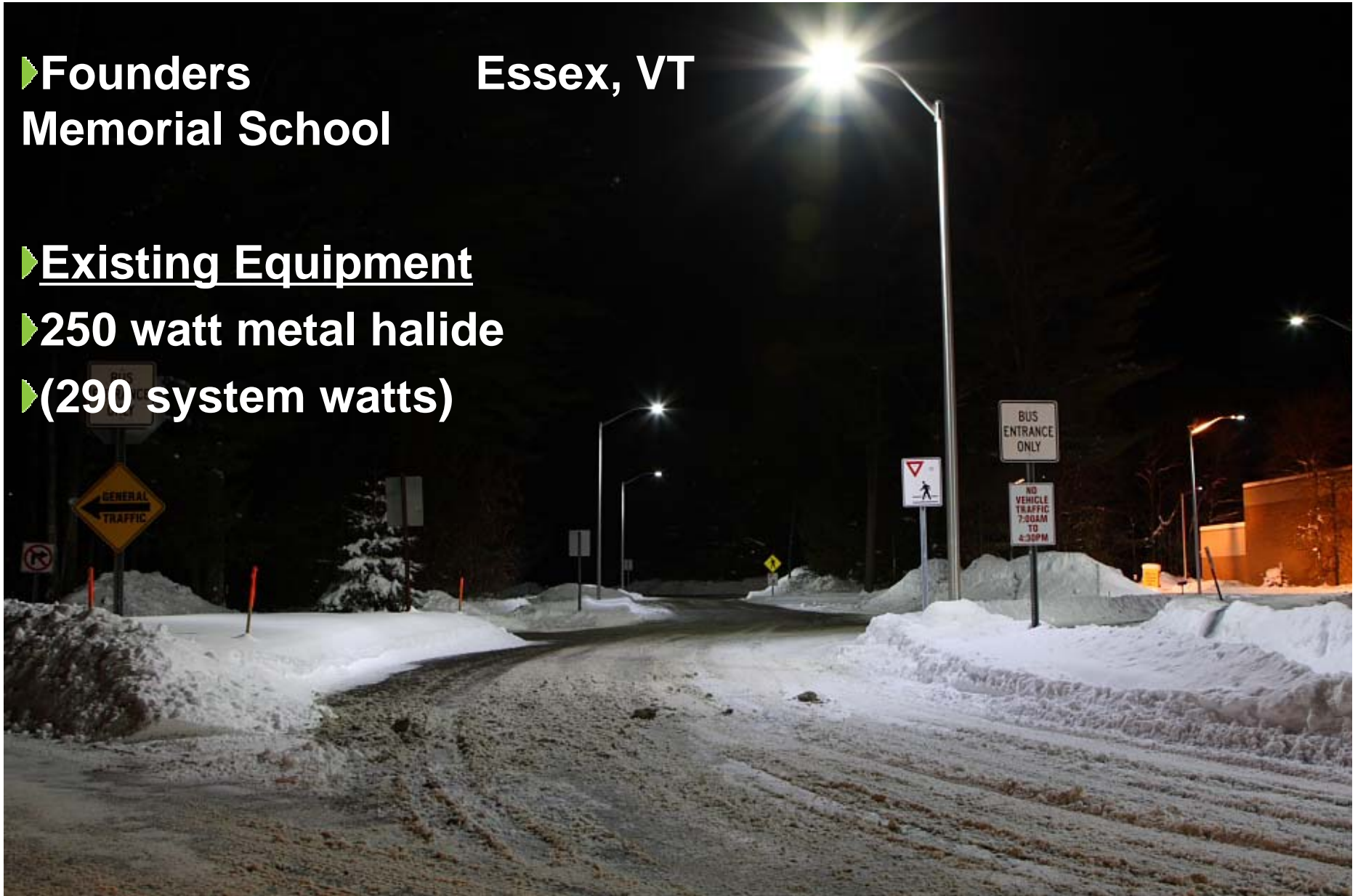
Orvis Outlet, Manchester

Denecker Chevrolet, Vergennes

► **Founders
Memorial School**

Essex, VT

- **Existing Equipment**
- **250 watt metal halide**
- **(290 system watts)**



► Founders
Memorial School

Essex, VT

LED Solution

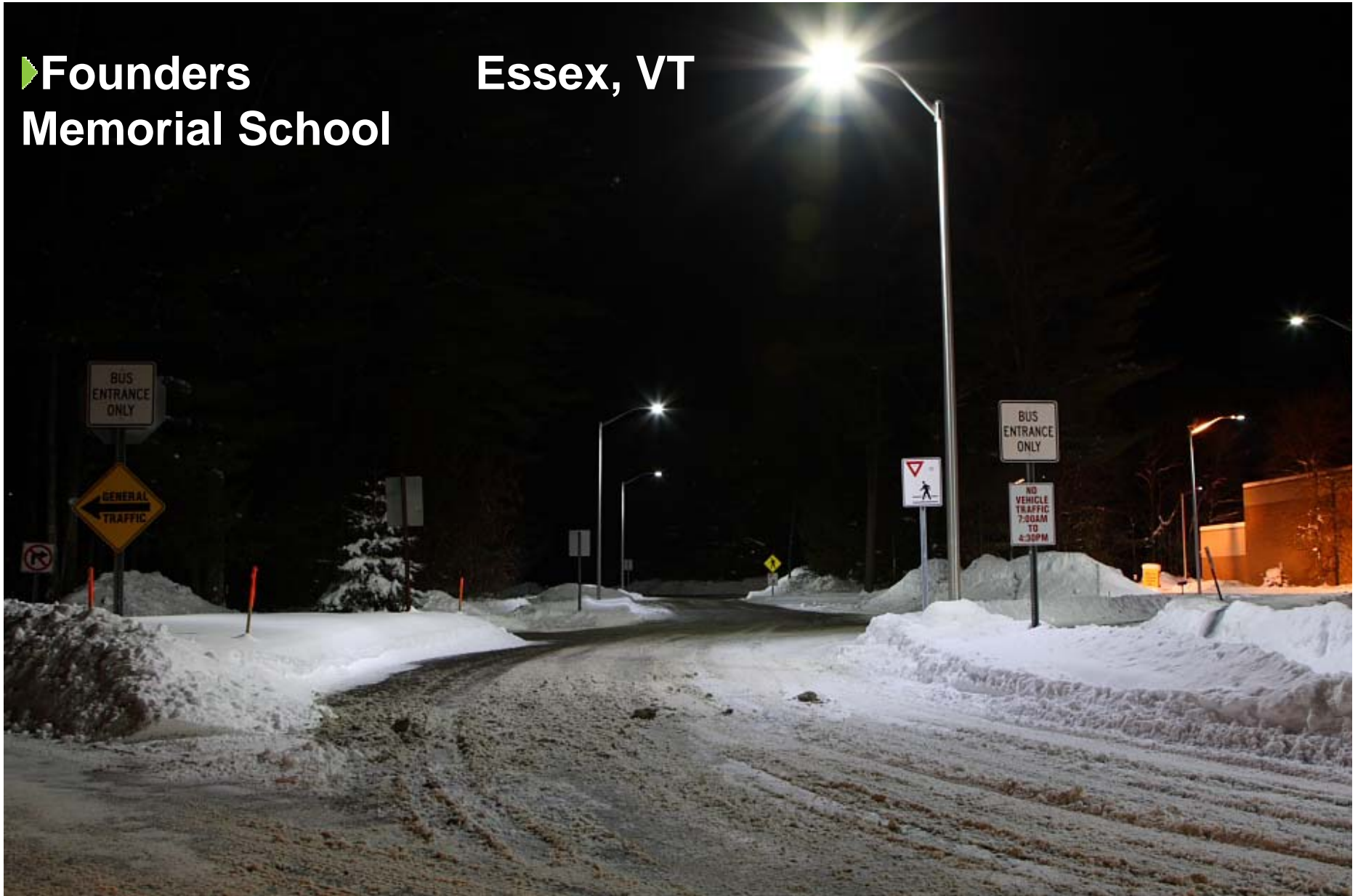
Beta LEDway Street Light

- 78 system watts
- 65 lumens per watt
- 75 CRI
- L₇₀ life 150,000 hours



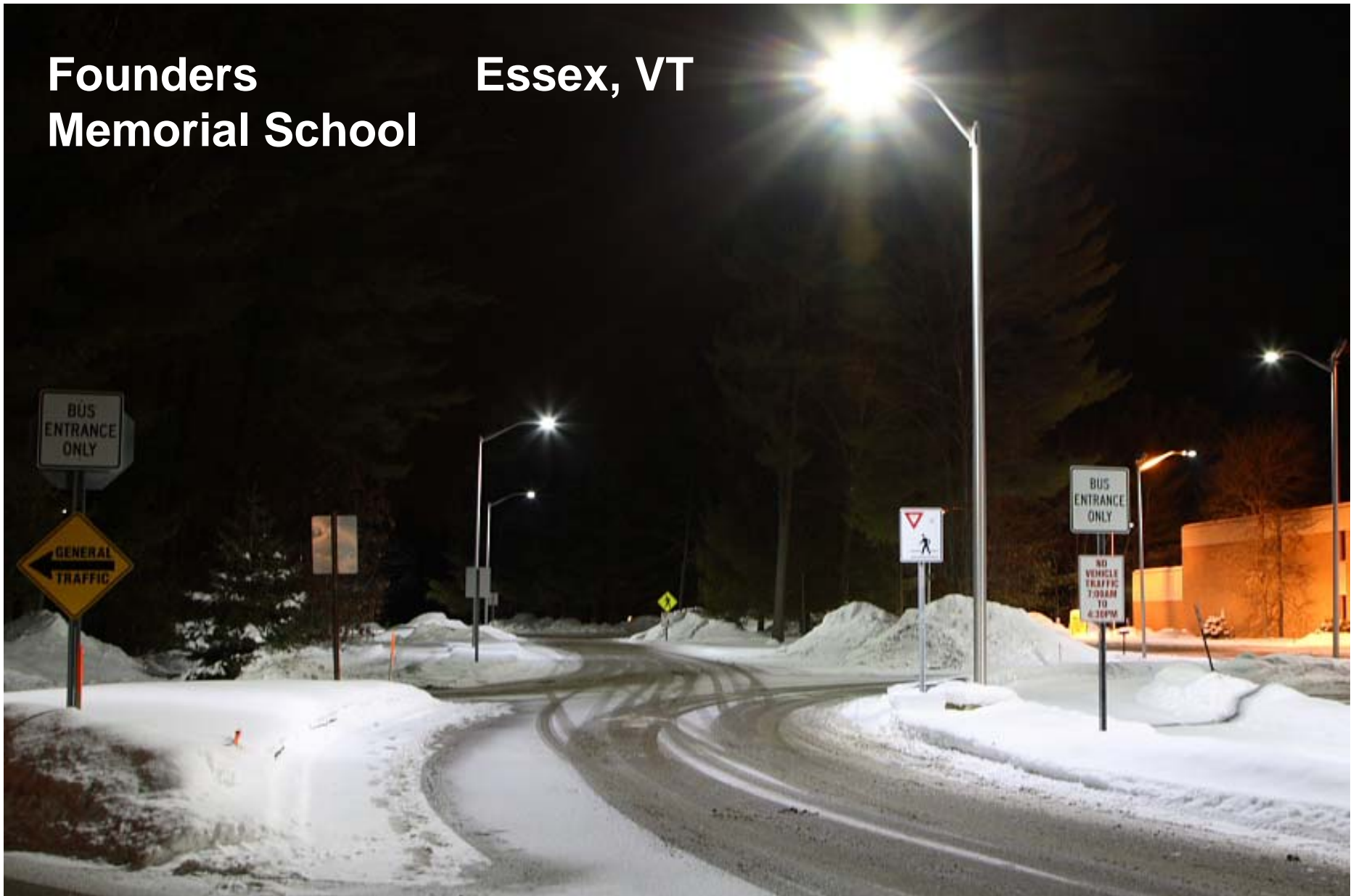
► Founders
Memorial School

Essex, VT



Founders Memorial School

Essex, VT



Example Economics

Replace 250W MH with Beta LEDway Steet Light

- Save 217 watts per fixture – 74%!
- Estimate installed cost \$800 per fixture
- \$100 Efficiency Vermont rebate
- 4.7 year payback
(includes maintenance savings, assumes 4380 hours and \$0.13/kWh)

Applications – Canopy Light

▶ **Fixture Type**

▶ Exterior - Area Light

▶ Exterior - Street Light

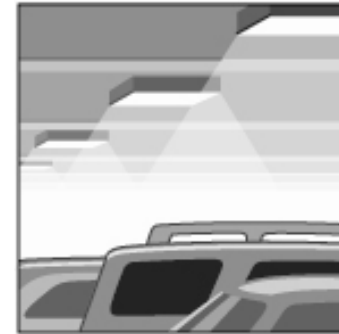
▶ **Exterior - Canopy Light**

Location

Holiday Inn Express, Brattleboro

Founders Memorial, Essex

Short Stop Mobil, Derby





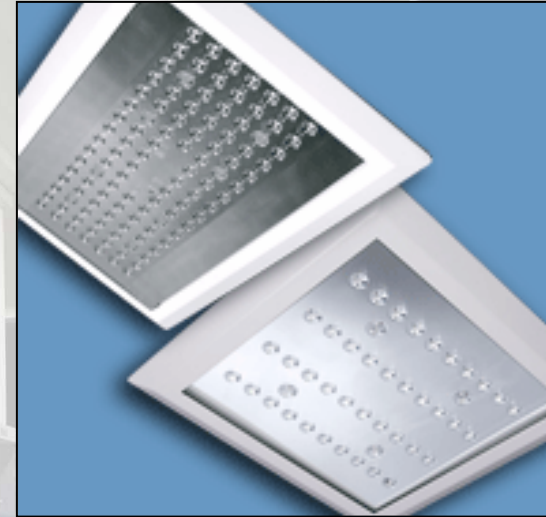
Short Stop Mobil - Derby, VT

Existing Equipment
400 watt metal halide
(455 system watts)

LED Solution

LSI Crossover Canopy Light

- 130 system watts (100 LED)
- 60 lumens per watt
- 75 CRI
- L₇₀ life 60,000 hours



Short Stop Mobil - Derby, VT



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Short Stop Mobil - Derby, VT

Example Economics

Replace 400W MH with LSI Crossover Canopy Light

- Save 325 watts per fixture – 71%!
- Estimate installed cost \$700 per fixture
- \$100 Efficiency Vermont rebate
- 2.9 year payback
(includes maintenance savings, assumes 4380 hours and \$0.13/kWh)



Derby, VT



Derby, VT



Thank you

Gabe Arnold

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