

# Cutting C-store Costs: Energy Efficiency Upfits



## Welcome

### October 2 & 8, 2014

### 10 am – 1 pm



Waste Reduction Partners



# Today's Agenda

- Welcome & Introductions
- Energy Management at Convenience Stores
- Refrigeration Upgrades and Control Systems
- Duke Energy – Small Business Energy Saver Program
- Case Studies
- Lunch & Networking (Noon – 1 pm)



# Waste Reduction Partners Energy Management 101 at C-stores

## \$avings Opportunities

**Bake Garman PE, CEM  
Energy Assessor**



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# Why Save Energy?

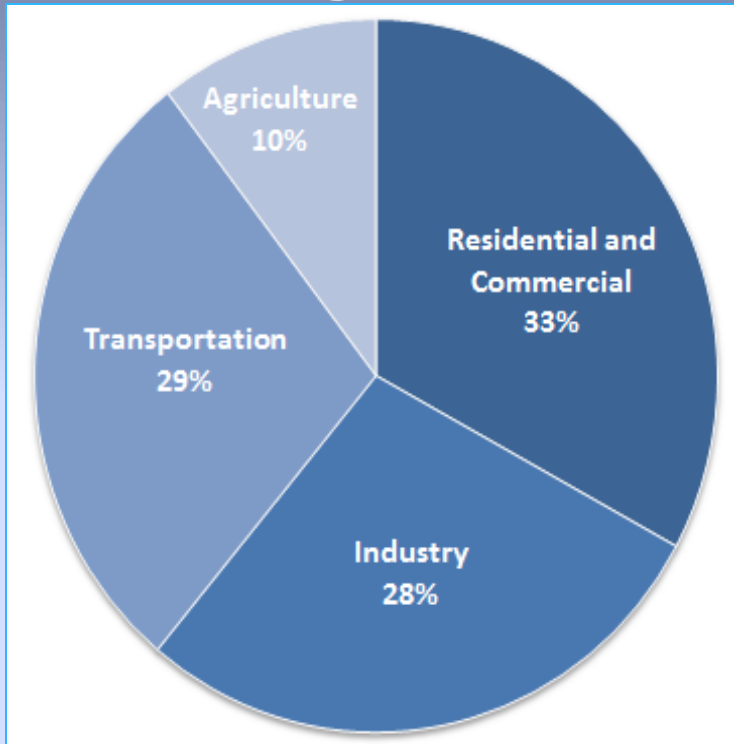


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# Why Save Energy?

## Commercial Buildings in the U.S

### Energy Use



Source: 2012 EPA U.S GHG Emissions by sector



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### Greenhouse Gas Emissions

Energy Use	Total CO <sub>2</sub> Million Tons	Percent
<b>Lighting</b>	<b>211.9</b>	<b>20.4%</b>
Space Heating	160.7	15.5%
Space Cooling	151.3	14.6%
Ventilation	95.2	9.2%
Refrigeration	69.1	6.7%
Electronics	46.4	4.5%
Water Heating	41.4	4.0%
Computers	37.7	3.6%
Cooking	13.6	1.3%
Other (4)	151.5	14.6%

Source: 2011 EIA Building Energy data book

# Environmental Improvements from Upgrades

## Example 400W Metal Halide vs. 109W LED

### Assumptions

- 12 hours per day
- 10 canopy light fixtures

### Annual Use Example

	400W Metal Halide Light	109 W LED Light
Operational Hours	4,380	4,380
Electricity (kWh/year)	20,150	4,774
CO <sub>2</sub> e Emissions (tons/yr)	10	2.6
NO <sub>x</sub> (pounds/year)	18	4.4
SO <sub>2</sub> (pounds/year)	44	11
Emissions - Car Equivalents	4.5	1.1



# What Does It Cost To Save Energy?

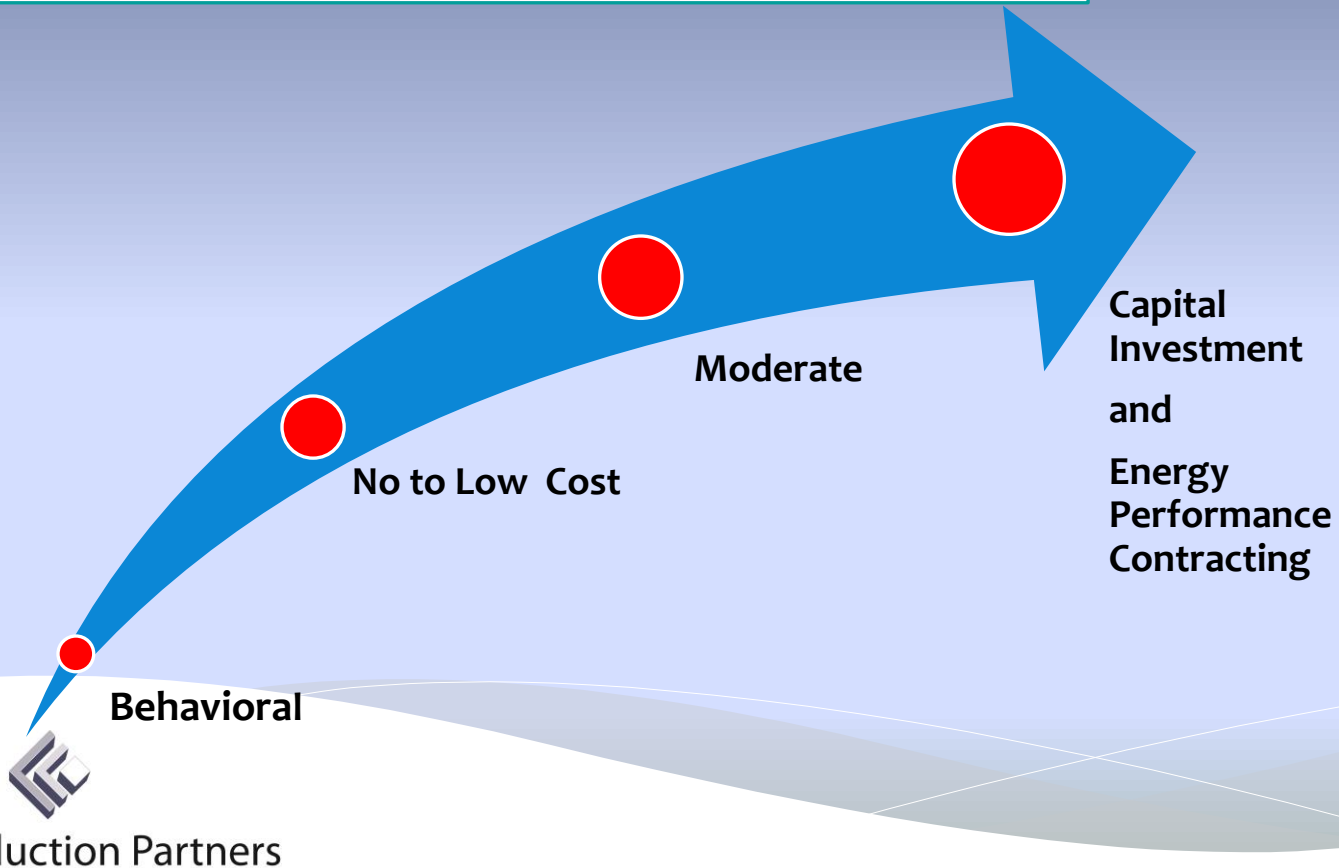
## Sustained Facility Energy Savings

5%

10%

15%

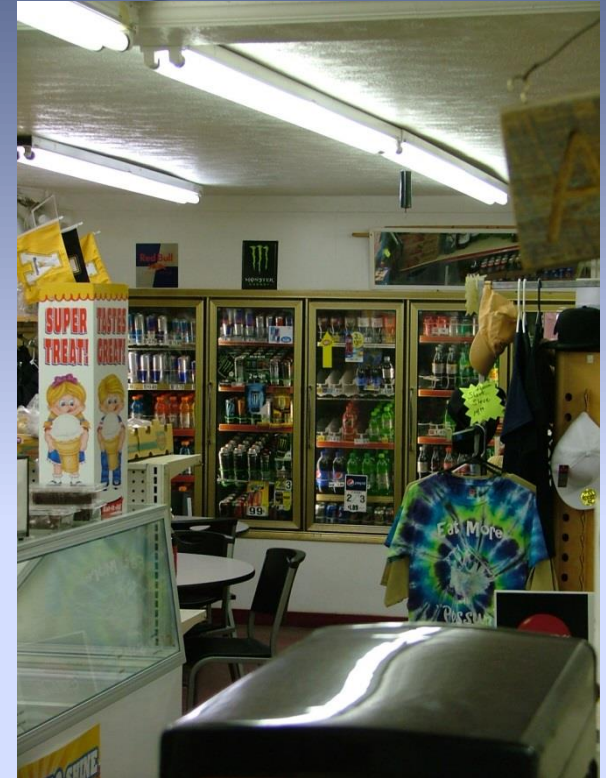
20%



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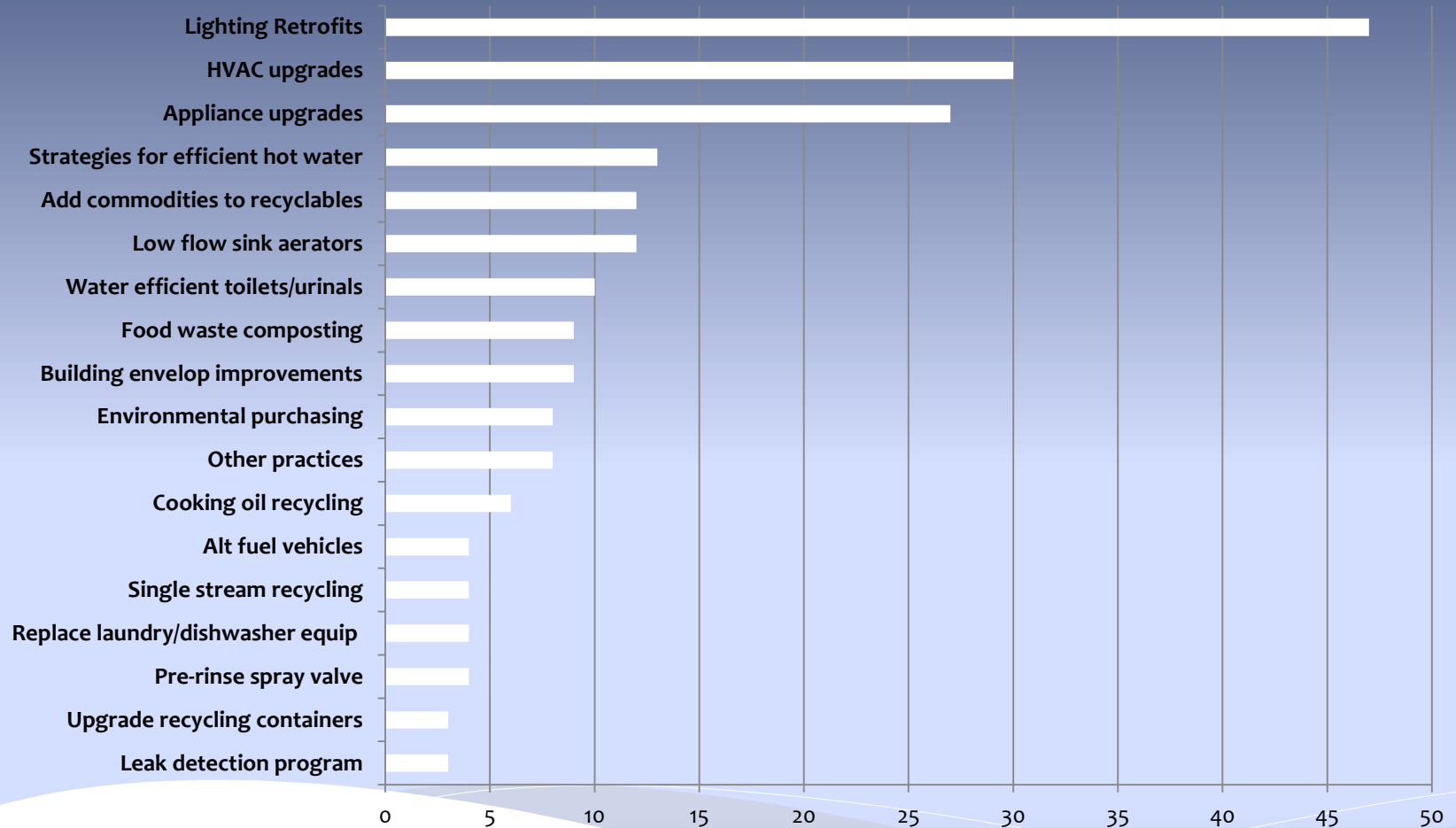
# Energy \$aving Opportunity Areas

- \* Utility Accounting (Your Bill)
- \* Lighting
- \* Heating, Cooling & Controls (HVAC)
- \* Refrigeration & Equipment
- \* Building Envelope Improvements
- \* Hot Water and Water Conservation





# Frequency

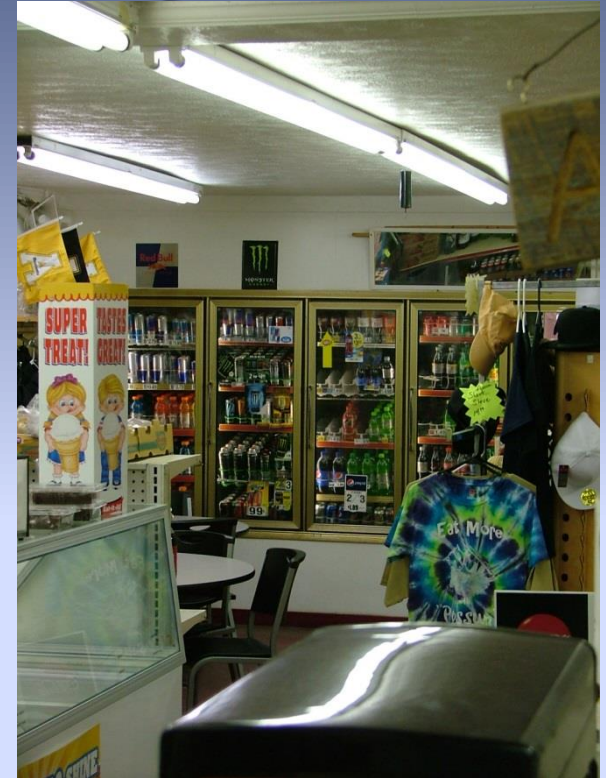


# 2010 Energy Efficiency Measure Implementation Study - WRP

Recommendations	Frequency Recommended	Simple Payback Range
Upgrade Lighting	24	2.7 – 5.0 years
Improve Envelope	17	0 – 20 years
Upgrade HVAC	15	Variable
De-lamp Vending	12	No cost
Improve HVAC Maintenance	12	Low cost
Reduce Lighting	10	No cost
Rate Reviews	9	No cost
Exit Light Upgrade	8	< 2.0 years
Occupancy Sensors	7	2.3-4.6
Compressed Air Leaks	7	0.1
Deactivate Equipment	6	No cost
Premium Efficiency Motors	6	2.0 year (20 HP)

# Energy \$aving Opportunity Areas

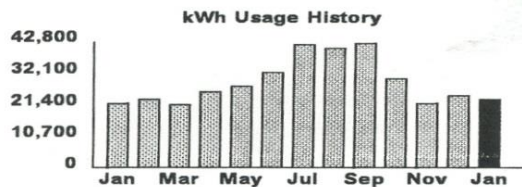
- ❖ Utility Accounting (Your Bill)
- ❖ Lighting
- ❖ Heating, Cooling & Controls (HVAC)
- ❖ Refrigeration & Equipment
- ❖ Building Envelope Improvements
- ❖ Hot Water and Water Conservation



# Example: Commercial Electric Bill

00045858 1 AV 0.278 00 \*\*AUTO \*\*C004

Customer Name  
Address  
ASHEVILLE NC 28801-3271



## Customer Bill

page 1 of 2

Account number 595 116 9860  
**Total due \$1,904.39**  
**Current charges past due after Feb 4**  
 Thank you for your payment Jan 2 \$2,113.30  
 Usage period Dec 18 - Jan 20  
 This bill was mailed on January 21, 2004

### Usage

Meter number TA3536  
 Readings: Jan 20 9787  
                   Dec 18 - 9588  
 Meter constant x 120  
**kWh usage 23880**  
 Days in period 33 Average kWh per day 724  
 Actual kW Demand 80.40

### Billing

MGS rate				33 Days
Basic customer charge				12.00
Energy charge	23,880 kwh	x	\$0.05132	1,225.5216
Demand charge				
(80% of 132.00 kw (09/03))	105.60 kw	x	\$4.89000	516.3840
Three phase service charge				9.00
ALS rate				33 Days
Metal halide light, 160 kwh, 40000 lumens, flood Area lighting	1 Light	x	\$25.63	25.63
Wood pole charge	1 Pole	x	\$2.16	2.16
ALS rate				33 Days
High Pressure Sodium light, 46 kwh, 9500 lumens, flood Area lighting	1 Light	x	\$11.15	11.15
ALS rate				33 Days
High Pressure Sodium lights, 109 kwh, 28500 lumens, flood Area lighting	3 Lights	x	\$15.69	47.07
3% North Carolina sales tax				55.47
<b>Total due</b>				<b>\$1,904.39</b>

Please detach here.

Turn over for helpful phone numbers and customer service tips.

PIN:



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Similarly, look at your other energy bills

# Optimize Temperature Controls

- ❖ Programmable 7-day Thermostats
  - Locked cover /password protected
- ❖ Low occupancy - nighttime setbacks
  - 6 degrees summer
  - 8 degrees winter
  - Commons savings > \$150/year
- ❖ Review summer/winter set points
  - 1 degree change saves 3%



# Vending Machines



## Background

- Typical refrigerated vending machine consumes 400 watts, \$225/year

## Opportunities

- Delamping – up to 180 watts reduction, \$100/yr savings
- Energy saving sensors – 30-50% savings, typical cost: \$170/unit, < 2 yr payback



## Future/Better Ideas

- Vendor requirement in new contracts – emphasis on saving energy especially when the vending area is well illuminated



# Hot Water and Water Conservation

- ❖ Hot Water Setting and Controls
  - Reduce water heater temperatures to 110°F if allowable (local codes vary)
  - Insulation blankets and pipe insulation save energy
  
- ❖ Use Low-flow Fixtures
  - Hand washing (0.5 gallons/minute)
    - Self actuating
  - Shower heads (1.5 gallons/minute)
  - High efficiency toilets (1.28 gpf) and urinals (0.125 gpf)
  
- ❖ These strategies save energy, water, and sewer charges



# Maintenance Saves Money

## Establish Maintenance Program Contracts

- Air Filters - Replace regularly - **4% savings**
- Heat Transfer Coils - Clean in heat pumps, air conditioners, and chillers - **1 to 4% savings**
- Ducts - Inspect ducts for leakage and missing insulation
- Obstructions - Remove obstructions to radiators, air diffusers, intakes, outdoor equipment
- Boilers - Have fuel-fired boilers inspected annually - **4% savings**





# Lighting

## Key Considerations

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**General Purpose**



**Flood/Spot**



**Downlight**



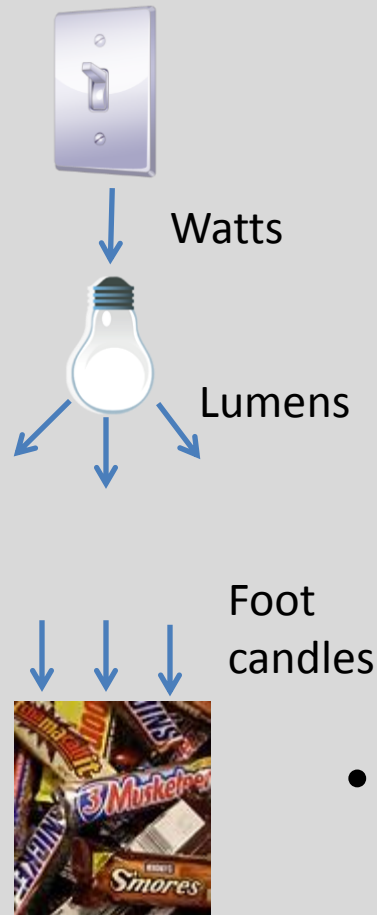
**Linear Fluorescent (Troffer)**



**Outdoor**

Key considerations will differ depending on lighting type

# STEP 1 - GET THE CORRECT QUANTITY OF LIGHT



## How much light is enough?

- Officially recognized standards measured in foot candles or lux. (<http://www.iesna.org/>)

Illumination Level for Space / Task	Foot candles, fc
Typical Offices	30-50
Retail	50-100
Canopy – Ordnance may limit to 32 lumens per square foot under canopy	20

- Uniformity of illumination is as important as amount of light. *The darkest areas should have at least 1/3 the illumination as brightest*

The goal is to provide sufficient illumination for people to do their activities comfortably and in a pleasing environment.

# STEP 2 - GET THE RIGHT QUALITY OF LIGHT

## Color Temperature, K (Kelvin)

- Indoor typically 3000 K to 4000 K
- Outdoor typically 4000 K and above



## Color Rendering Index (RCI)

- Measure of color accuracy relative to incandescent source (100)
- Target 80 or above for retail



T8 Linear Fluorescent

Photo: Cree



LED

Photo: Cree

Lighting is available in a range of color temperatures and with good color rendering

# INDOOR LIGHTING COMPARISON

## Bulb Comparison of Wattage and Annual Operating Costs

For 12 hours per day

\$0.116 per kWh Duke Energy Small General Service Schedule

Incandescent		Energy Star Average	
Tungsten	Halogen	CFL	LED
75 W	53 W	17.3 W	15.7 W
\$38.20	\$26.99	\$8.79	\$7.99

Replacing tungsten/halogen bulbs should be a top priority.

Cost analysis should include initial cost and rebates, labor, and replacement cost and labor.

Compare over 3 or 4 years to evaluate both initial and operating costs.

# CFLs & LEDs HAVE A WIDE RANGE OF EFFICIENCY

LED Type and Output		Lumens per Watt		
Application	Lumen Range	Average	Best	% Best over Avg.
<b>Bulbs and Lamps</b>				
General Purpose	700-1,100	69	94	36%
Directional	600-1,300	57	89	56%
MR16	400-600	55	77	40%
Decorative	400-700	58	77	33%

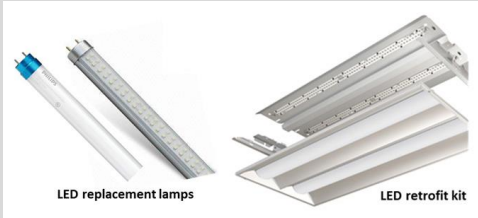
DOE Adoption of Light-Emitting Diodes in Common Lighting Applications

[http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/led-adoption-report\\_2013.pdf](http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/led-adoption-report_2013.pdf)

Variation in CFL efficiency is similar

Maximize benefits by selecting highest lumens per watt among options meeting other specs

# LINEAR FLUORESCENTS



## LED Lamp Replacement and LED retrofit kits

- T12 (1.5 inch diameter) should be replaced with T8 (1 inch diameter) and electronic ballast
- T8 linear fluorescent tubes are efficient and LED lamps may not offer significant energy savings
- Retrofitting LED lamps or kits into existing luminaires should be checked to insure safety certification (Underwriters Laboratory, etc.) is maintained

[Fact Sheet Upgrading Troffer Luminaires to LED](#)

[http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/led\\_troffer-upgrades\\_fs.pdf](http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/led_troffer-upgrades_fs.pdf)



## Complete Replacement

- LED replacements are available for the most common suspended ceiling sizes (2 x 2-ft, 1 x 4-ft, and 2 x 4-ft)
- T8 linear fluorescent tubes are efficient and LED lamps may not offer significant energy savings

Replace old 1.5 inch diameter fluorescent tubes.

Verify LED retrofits meet safety requirements

# OUTDOOR LIGHTING



- Under canopy light levels commonly are 2 or 3 times greater than 20 foot candles recommendation (<http://www.iesna.org/>)
- LEDs have exceptional ability to direct the light to where needed thereby reducing lumens per fixture

Search the web for guides and case studies. Examples:

- [http://www.usa.lighting.philips.com/pwc/li/us/en/application\\_areas/petrol/assets/Gas\\_Station\\_Brochure\\_A0112\\_Web.pdf](http://www.usa.lighting.philips.com/pwc/li/us/en/application_areas/petrol/assets/Gas_Station_Brochure_A0112_Web.pdf)
- <http://www.cree.com/lighting/applications/indoor-and-outdoor-applications/petroleum-convenience-store>

Uniformity of illumination is as important and peak light level

# CREDITS, INCENTIVES AND REBATES

Lime Energy is Duke Energy Progress' authorized contractor for the Small Business Energy Saver Program

<https://www.progress-energy.com/carolinas/business/save-energy-money/sbes/index.page?>

DSIRE is a comprehensive database of information on state, federal, local, and utility incentives and policies that support renewable energy and energy efficiency. <http://www.dsireusa.org/>

Duke Energy SmartSaver® Prescriptive Incentives

<http://www.duke-energy.com/pdfs/SS-Comprehensive-Prescriptive-NC.pdf>

Duke Energy Progress Incentive Program

[https://www.progress-energy.com/assets/www/docs/business/Progress\\_Lighting\\_Application\\_123113-FINAL.pdf](https://www.progress-energy.com/assets/www/docs/business/Progress_Lighting_Application_123113-FINAL.pdf)

Incentives and rebates offset the initial cost for lighting upgrades  
Verify upgrade equipment meets incentive criteria



## SUMMARY

### For all lighting upgrades:

- Determine illumination level needed and required lumens per fixture
- Specify color temperature and minimum color rendering index

### For replacing bulbs:

- Specify Energy Star and above average performance in terms of lumens per Watt
- Evaluate samples for acceptable spatial distribution and color
- Check compatibility of bulbs with dimmers, transformers, etc.

### For recessed fixtures:

- Complete fixture replacement is likely to provide greatest energy saving

### For outside lighting:

- Use directionality of LEDs to provide more uniform illumination with less lumens

LED upgrades can be cost competitive now.

Incentives and rebates expand types of viable projects.

LED performance is improving annually and prices will continue to fall.

# WRP Contacts

## WRP - Land of Sky Regional Council



339 New Leicester Hwy, Suite 140  
Asheville, NC 28806  
828-251-6622 wrp@landofsky.org  
Terry Albrecht, WRP Director

## WRP - Triangle J Council of Governments



PO Box 12276  
Research Triangle Park, NC 27703  
919-558-2702 wrp@tjcog.org  
Christal Sandifer, Program Administrator



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[www. WasteReductionPartners.org](http://www.WasteReductionPartners.org)



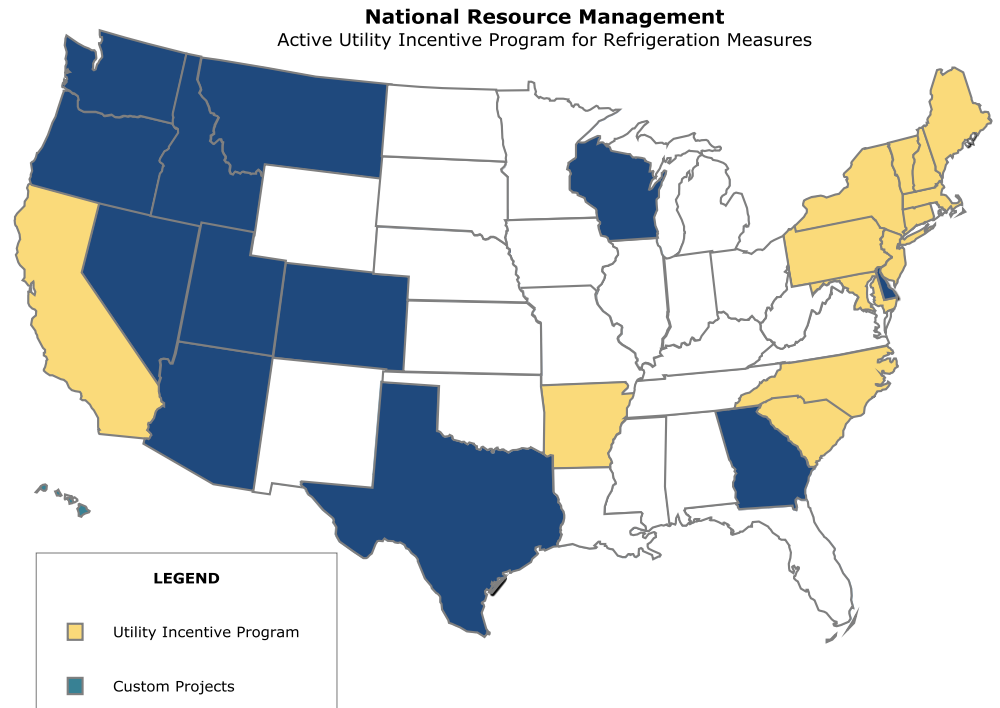
National Resource Management, Inc.

A Turn-key Solution to Permanently Reduce Demand  
for Electricity in Commercial Refrigeration

On Behalf of  
Waste Reduction Partners

# Who is National Resource Management?

- Manufacturing and Installing Refrigeration Controls since 1994.
- Installation base includes over 13,000 convenience and liquor stores; restaurants; grocery stores; fruit, floral and meat distributors; K-12 and Higher-Ed; Bio-Pharma.
- NRM's products have been accepted for rebates and incentives by over 25 utility and state run rebate programs in OH, NC, SC, AR, MA, VT, ME, NH, CT, RI, NY, NJ, MD, PA, WA, WI, OR & CA.



# Areas where Cooltrol and EC Motors can improve efficiency in a Convenience Store or Small Grocer

Cooltrol- our EMS system with multiple points of control.

Anti-sweat Door heater Controls



Evaporator Fan Motors

Novelty Cooler



- Cooltrol®-(EMS System) – Reduces Evaporator Fan Runtime by 35% to 50%
- Door Heater Controls – Reduces Cooler door heater runtime by up to 90% and Freezer door heater runtime by up to 50%
- Novelty Cooler Shut-Off's
- EC Motors in Walk-ins (ECM's) – 65% reduction in load
- EC Motors in Reach-ins (RIECM's) – 55% reduction in load



# CoolTrol™ Control System – CCS2

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## Feature / Functionality

- Tracks temperatures and equipment run time for statistical analysis of performance and energy use
- Provides historical usage patterns, which extend the life of the equipment and saves energy
- Optimized defrost cycles are based on coil temperature and run time
- **Alarm Light** notifies user of temperature problems

## Touch Pad Access

- Download information rather than clerk performed manual reads
- **Bypass** for equipment diagnostics using original thermostat
- Manual Defrost for unscheduled activation
- Set ups of temperatures, time/date, & dew point for operators

## Cooler Shutdown Button

- Store personnel can easily shut cooler off for comfort and to reduce cold air loss thereby improving employee productivity in coolers

Reduce Walk-in Energy Usage 40% to 50%.

# LED Lighting Retrofit

It's a win-win solution for both utility incentive programs and end-use customers



## Quanta ProStar SMD LED:

- 1.7 Watts per foot
  - 6 Foot Door = 20.7 Watts
  - 5 Foot Door = 17.2 Watts
- 50,000 hours
- Quick Disconnect Feature
- Retains high lumen output for the full life of the LED
- Significant glare reduction on marketplace floor



# What's the Bottom Line?

Refrigeration Retrofits can provide you a  
**Up to 25% reduction** in your electric bill.

Frank Dowling  
508-294-8514  
FDowling@nrminc.com



National Resource Management, Inc.





# Small Business Energy Saver PROGRAM OVERVIEW

Nate Lewis,  
Program Manager

855.776.4723

[www.duke-energy.com/sbes](http://www.duke-energy.com/sbes)

Small Business Energy Saver Program



# Program Overview

Lower your energy expenses with special discounts on energy efficiency improvements only available for small businesses

Turn-key energy equipment upgrades for qualified customers that have an average annual electric demand requirement of **100 kW or less**

## The program offers:

- A free, no obligation energy assessment
- Specific, energy-saving recommendations for your small business
- Complete, up-front coverage for **up to 80 percent** of all materials and installation costs
- Convenient installation scheduled around your business's needs
- Total turn-key satisfaction - we handle the assessment, installation and up to 80 percent of the cost

# Program Measures

## Measures

## Incentive

### Various Lighting

Up to 80%

- CFLs
- LEDs
- T5/T8 Fluorescents
- High Bay Lighting
- Occupancy Sensors
- Exterior Lighting

### Refrigeration

Up to 80%

- EC Motors
- Anti-Sweat Controls
- Vending Machine Controls
- Auto Door Closers for Freezers
- Evaporator Fan Controls

### HVAC

Up to 10%

- Packaged Unitary AC
- Split Systems
- Air Source Heat Pumps

# Program Key Benefits



Reduce ongoing operating and maintenance costs generated from inefficient energy consumption

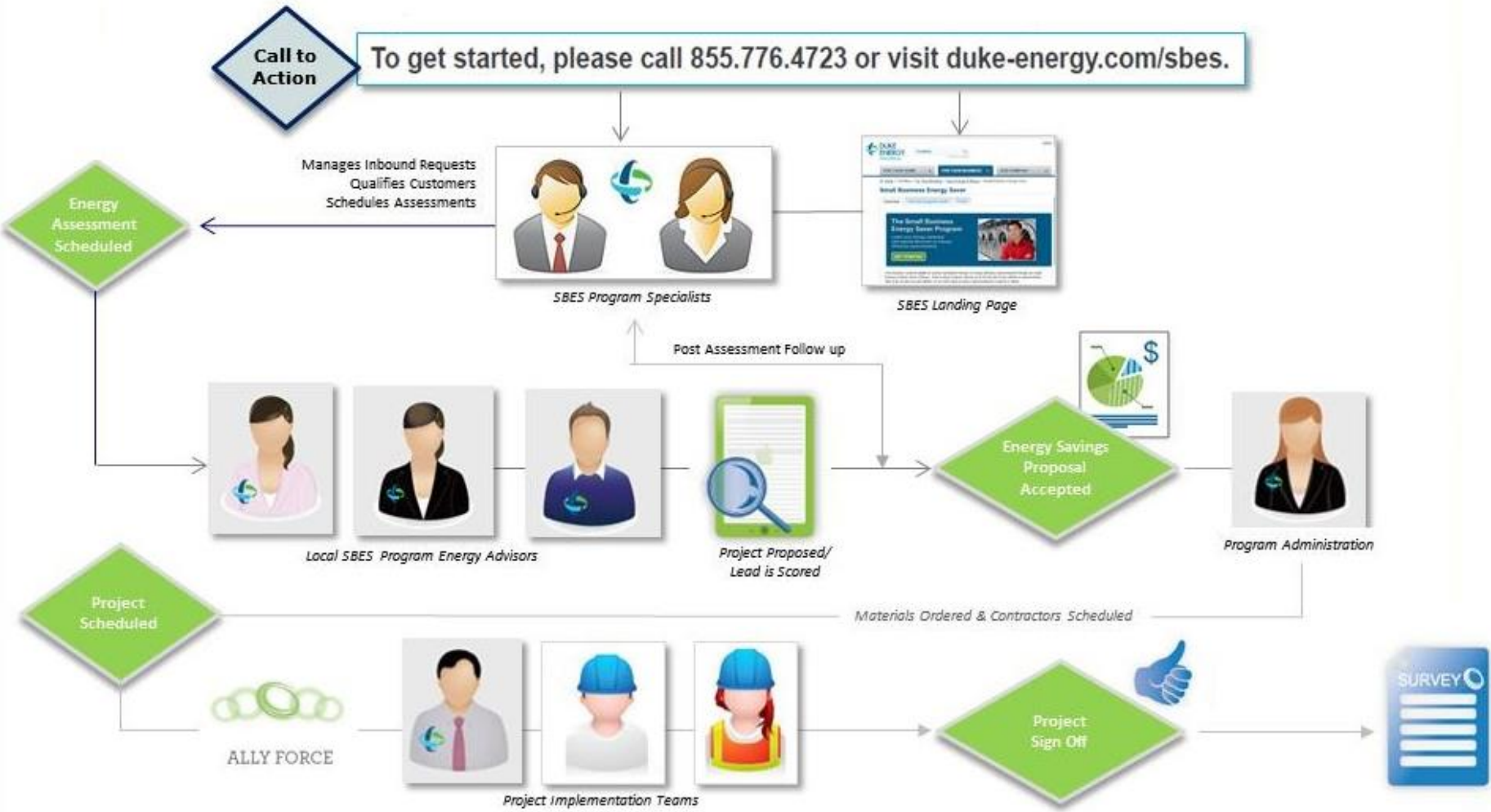


Improve your workplace environment while increasing productivity



Put more money back into your business

# Program Process



# SBES Program Administrator: Lime Energy



- Local Experts in Small Business Energy Efficiency
- North Carolina Based
- Ally Force: Local Installation Contractor Network

**Q:** Can businesses participate who rent their facilities?

**A:** Yes! The property owner/landlord must sign the SBES landlord agreement form and the property owner and tenant must agree to the terms and of the program.

**Q:** Will I get to choose the equipment for installation?

**A:** Yes, you may choose from the measures recommended to you by Lime Energy and make the final decisions on what to install.

**Q:** How can electrical contractors become involved in the program?

**A:** Lime Energy's Ally Force is our network of local installation contractors for the SBES program. Please contact Lime Energy at 1-855-232-1042 to learn more about joining the network.

# To Learn More

The screenshot shows the Duke Energy Progress website interface. At the top left is the Duke Energy Progress logo. To its right is a location dropdown menu set to "Carolinas" with a "change location" link. Further right are "Log In" and "YOUR ACCOUNT" links. Below these is a search bar. A navigation bar contains four tabs: "FOR YOUR HOME", "FOR YOUR BUSINESS" (which is selected), "OUR COMPANY", and "SUPPORT CENTER". The main content area has a breadcrumb trail: "Home > Carolinas > For Your Business > Save Energy & Money > Small Business Energy Saver". The page title is "Small Business Energy Saver". Below the title are utility icons for Font, Print, Rate, and Share. There are two tabs: "Overview" and "How the program works". The "Overview" tab is active, showing a large blue box with the text "The Small Business Energy Saver Program" and "Lower your energy expenses with special discounts on energy-efficiency improvements." Below this text is a green "GET STARTED" button and a photo of a man in a red shirt standing in front of laundry machines. To the right of the main content is a sidebar with the heading "Save Energy & Money" and a list of links: "Energy Efficiency for Business", "Residential New Construction Program for Builders", "Home Energy Improvement Program for Contractors", and "Small Business Energy Saver". At the bottom of the sidebar is a section titled "Update your profile!" with the text "Get exclusive emails about products and programs that can save you money."

**Website:**

[www.duke-energy.com/sbes](http://www.duke-energy.com/sbes)

**Program Inquires:**

855.776.4723.

**Construction / Warranty Inquires:**

855-232-1042

855.776.4723

[www.duke-energy.com/sbes](http://www.duke-energy.com/sbes)

Small Business Energy Saver Program

