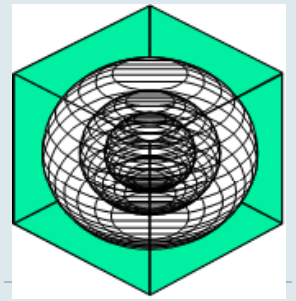
ABOVE CODE ENERGY ENHANCEMENT PROJECT
for
The City of Arlington

February 2012



ENERGY SYSTEMS LABORATORY

Texas Engineering Experiment Station
The Texas A&M University System

Project Goals

- Identify Energy Efficient Measure (EEM) combinations that acheive15% above current energy code requirements
- Examine the relationship between cost of the EEMs and simple return on investment
- Determine the impact on air quality through emission reduction
- Estimate consumer energy savings through the use of EEM combinations – lower utility bills
- Improve quality of construction

Types of Buildings Modeled

- Residential
  - 2,325 ft^2, square-shape, one-story, single-family detached house
  - 50% Energy Star permanent CFL or fluorescent lamps
  - HVAC and duct systems in unconditioned attic
- Small Office
  - 20,000 ft^2, square-shape, two-story, office building
  - Wood frame construction
  - 20% window-to-wall ratio
  - Packaged rooftop air conditioner (CAV, DX, gas furnace)

Types of Buildings Modeled

- Small Retail
  - 15,000 ft^2, one-story, strip mall building
  - Concrete tilt wall construction
  - 70% WWR for front wall only (28% WWR for an entire building)
  - Packaged rooftop air conditioner (CAV, DX, gas furnace)

- Restaurant
  - 5,500 ft^2, one-story, building – Dining space modeled (4,000 ft^2)
  - Steel frame construction
  - 35% WWR for front wall only (17% WWR for an entire building)
  - Packaged rooftop air conditioner (CAV, DX, gas furnace)
  - Dining space modeled for assessment of energy efficiency measures

Energy Efficiency Measures - Residential

- Envelope and Fenestration
  1. Radiant Barriers in Attics (with ducts in attics)
  2. Sealed (Unvented) Attic
  3. Window Shading (none to 2 ft. eaves on all sides)
  4. Window Shading and Distribution
  5. Decreased Window SHGC
  6. Decreased Window U Value
  7. Decreased Window SHGC & U Value
- HVAC System Measures
  8. Relocate Mechanical Systems within Conditioned Space
  9. Improved Air Conditioner SEER/Improved Heat Pump Efficiency
  10. Improved Furnace Efficiency
- Domestic Hot Water Measures
  11. Tankless Gas Water Heater
  12. Removal of Pilot Light from Domestic Hot Water System
  13. Solar Domestic Hot Water System (30 sq ft collector, 65 gal tank)
  14. Solar Domestic Hot Water System (64 sq ft collector, 80 gal tank)
- Lighting Measures
  15. 75% Energy Star Permanent CFL or Fluorescent Indoor Lamps
  16. 100& Energy Star Permanent CFL or Fluorescent Indoor Lamps
- Renewable Power Measures
  17. 4 kW Photovoltaic Array

Energy Efficiency Measures - Commercial

- Envelope
  1. Wall Insulation
  2. Roof Insulation
  3. Roof Exterior
  4. Window U-Value
  5. Window Re-Distribution
  6. Window Shading
  7. Window Shading and Re-Distribution
  8. Air Barrier
- Interior Lighting
  9. Lighting Power Density
  10. 24-Hour Lighting
  11. Daylighting Control (Sidelighting)
- Exterior Lighting
  12. Parking Lots
      Façade & Landscape Lighting
      Building Entrance (w/o canopy)
      Building Exit
      Extra Power Allowance
      Exterior Lighting Controls
- HVAC Systems
  13. HVAC System Efficiency
  14. Fan Efficiency
  15. Economizer
  16. Furnace Efficiency
  17. Demand Control Ventilation System
- Service Hot Water Systems
  18. Efficient Water Heaters

Residential

Energy Efficient Measures – Best Combination

- 100% Energy Star Permanent CFLs, or Fluorescent Indoor Lamps
- Decreased Window SHGC (from.3 to .2) and U-value (from .5 to .3)
- Radiant Barrier in attics (with ducts and AC equipment in the attic)

EEM Cost	% of project	ROI	Emissions Savings
$1,250 to $2,195	.75 to 1.3%	3.1-5.4 yrs	NOx = 5.8 lbs/year SO_2 = 3.9 lbs/year CO_2 = 2.4 tons/year

Estimated Energy Savings = $403 per year

Emission Savings equivalent to removing passenger vehicles/year[1]

- NOx = 0.16 vehicles
- CO_2 = 0.42 vehicles

Small Office

Energy Efficient Measures – Best Combination

- Daylight dimming control
- Decreased lighting power density (from 1.0 to 0.75 w/ft^2)
- Improved fan efficiency (from 55% to 65%)

EEM Cost	% of project	ROI	Emissions Savings
$28,644 to $42,966	.14 to 2.4%	8.4-12.7 yrs	NOx = 24.7 lbs/year SO_2 = 15.5 lbs/year CO_2 = 20.85 tons/year

Estimated Energy Savings = $2,812/yr; Estimated Demand Savings = $583/yr

Emission Savings equivalent to removing passenger vehicles/year[1]

- NOx = 0.65 vehicles
- CO_2 = 3.65 vehicles

Small Retail

Energy Efficient Measures – Best Combination

- Decreased lighting power density (from 1.5 to 1.25 w/ft^2)
- Daylight dimming control

EEM Cost	% of project	ROI	Emissions Savings
$18,872 to $28,307	1.3 to 1.9%	5.2-7.8 yrs	NOx = 27.3 lbs /year SO_2 = 32.2 lbs /year CO_2 = 43.3 tons/year

Estimated Energy Savings = $3,062/yr; Estimated Demand Savings = $580/year

Emission Savings equivalent to removing passenger vehicles/year[1]

- NOx = 0.71 vehicles
- CO_2 = 7.56 vehicles

Restaurant

Energy Efficient Measures – Best Combination

- Reduced lighting power density (from 1.6 to 0.89 w/ft^2)
- Exterior lighting power reduction (from 3.61 kw to 2 kw and reduction in usage to 25% of current usage from 12:00 AM to 6:00 AM)

EEM Cost	% of project	ROI	Emissions Savings
$8,480 to $12,720	.8 to 1.2%	2.4-3.5 yrs	NOx = 0.025 tons/year SO_2 = 0.014 tons/year CO_2 = 19.6 tons/year

Estimated Energy Savings = $3,362/yr; Estimated Demand Savings = $236

Emission Savings equivalent to removing passenger vehicles/year[1]

- NOx = 1.31 vehicles
- CO_2 = 3.42 vehicles

Final Reports Document Each Building Type

ESL-TR-11-10-08

COST-EFFECTIVE ENERGY EFFICIENCY MEASURES
FOR ABOVE CODE (ASHRAE 90.1-2001 and 2007):
FOR RESTAURANT BUILDINGS IN THE CITY OF ARLINGTON

A Research Project for the City of Arlington

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COST-EFFECTIVE ENERGY EFFICIENCY MEASURES
FOR ABOVE CODE (ASHRAE 90.1-2001 and 2007):
SMALL OFFICE BUILDINGS IN THE CITY OF ARLINGTON

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COST-EFFECTIVE ENERGY EFFICIENCY MEASURES
FOR ABOVE CODE (ASHRAE 90.1-2001 and 2007):
SMALL RETAIL BUILDINGS IN THE CITY OF ARLINGTON

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COST-EFFECTIVE ENERGY EFFICIENCY MEASURES
FOR ABOVE CODE (2003 AND 2009 IECC):
RESIDENTIAL BUILDINGS IN THE CITY OF ARLINGTON

A Research Project for the City of Arlington

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Questions?

Next Steps

- Marketing Plan Development
  - Web Page – Are you Above Code?
    - Energy Efficiency Information
  - Videos
    - Series that describes EEM's and possible ROI
  - Distribution to Contractors through professional organization
  - Press Release
  - Explore Partnership Opportunities
  - MyArlingtontx.com
    - Article
  - Social Media
    - Facebook/Twitter