

NC DEPARTMENT OF TRANSPORTATION



GUARANTEED ENERGY SAVINGS PERFORMANCE CONTRACTS

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Guaranteed Energy Savings Performance Contracts

Objectives

- A. Overview of NCDOT Energy Management Program
 - Energy & Water Reductions
 - Environmental Impact
- B. Summary of Performance Contracting
- C. Considerations & Recommendations
- D. Backup Information

Need for Performance Contracts

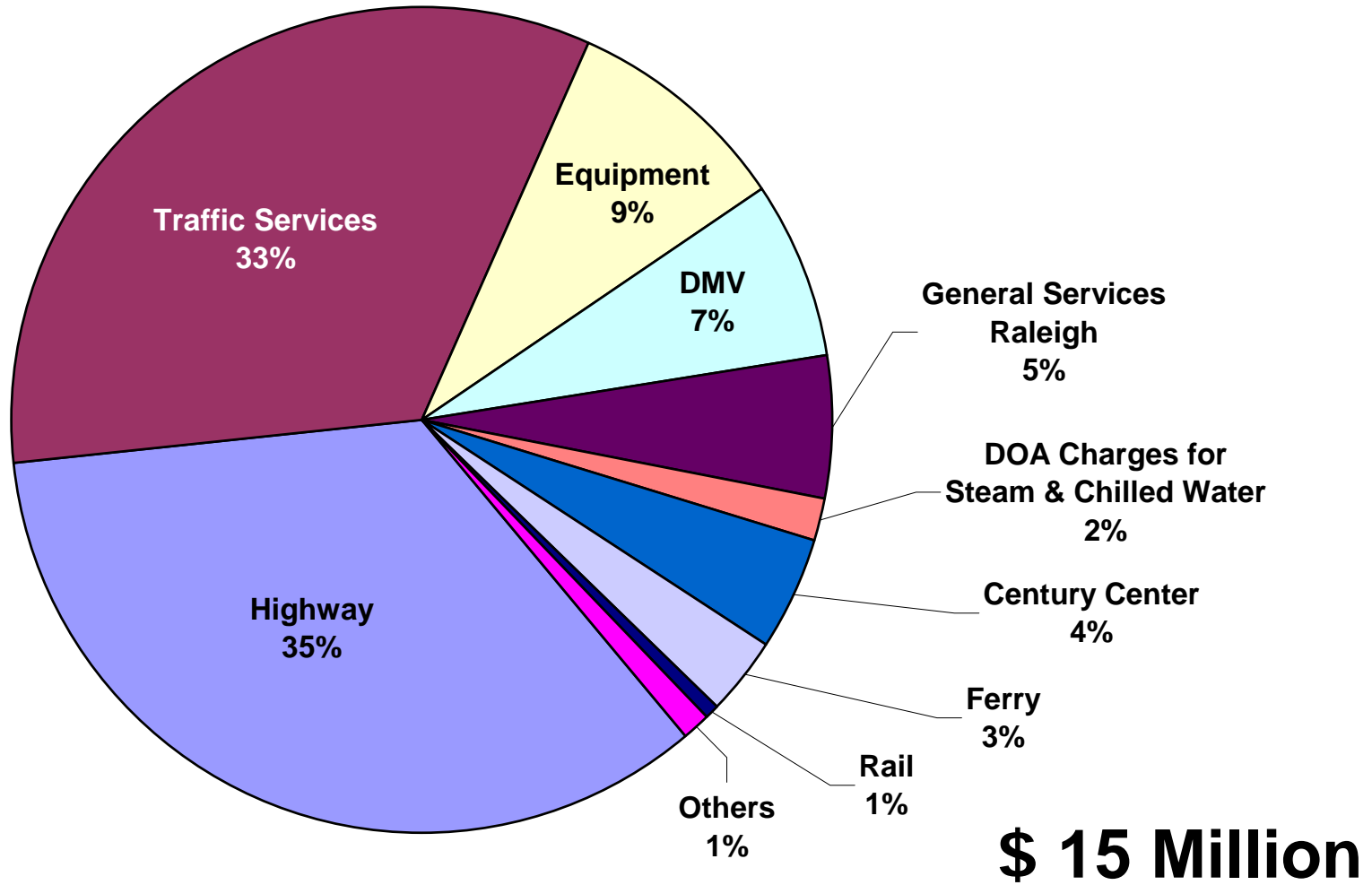
NC Department of Transportation

NCDOT Employees occupy approximately 2,250 buildings statewide.

- ❑ Over 6 million square feet {building footprint}
 - ❑ \$15 Million per year for energy and water/sewer in FY 07-08
 - ❑ @14,000 NCDOT employees
 - ❑ approximately \$1,100 per employee
 - ❑ More than half of total building space is over 35 years old.
-
- Significant building improvements and replacement projects are needed in order to repair, upgrade, and avoid critical failures in mechanical systems that are nearing or have already surpassed expected service life.

Total Electric, Natural Gas, & Water/Sewer Expenditures

NCDOT Utility Costs for FY 2007-08



Mandate for Comprehensive Energy Management Program

The Strategic Energy and Water Plan (SEP) for the NCDOT was developed in accordance with General Statute 143-64.10-12;

[Energy Conservation in Public Facilities](#), which mandates a comprehensive energy management program for State government.

The SEP meets the objectives of the [State Utility Savings Initiative](#) for state facilities established in June 2002 by the Governor's Efficiency Commission.

The goal of the program is to reduce energy consumption by 20%, and reduce water consumption by 10%.

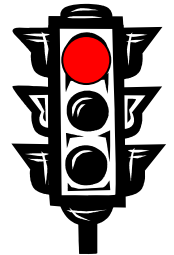
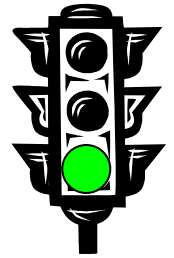
Session Law 2007-546, Senate Bill 668 was ratified August 2007 and establishes a deadline of:

- ❑ **20% energy reduction by 2010**
- ❑ **30% energy reduction by 2015**

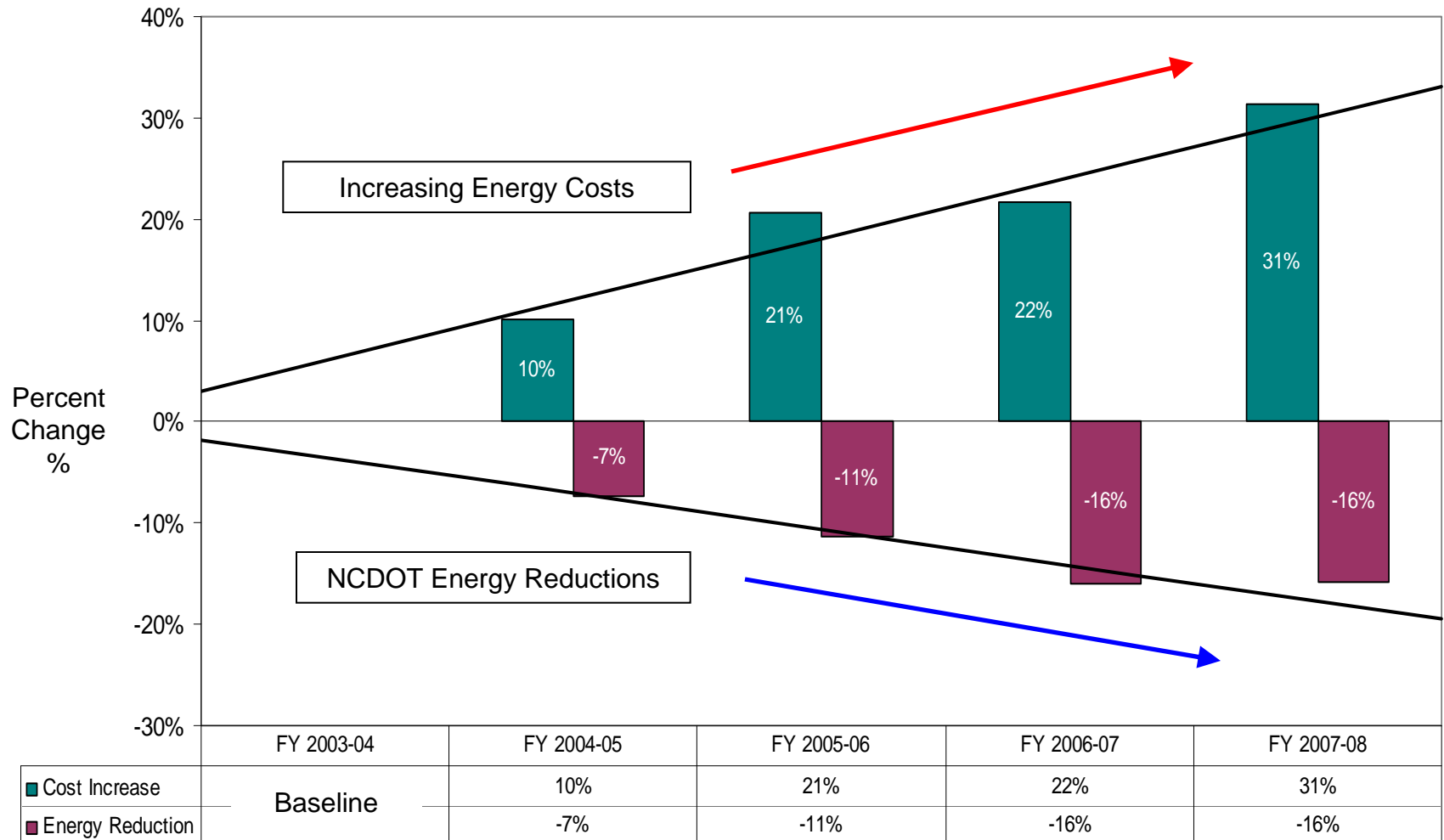
Plan of Action “Thus Far”: 3-Way Approach

Progress?

- **Accounting: 1-2% Cost Reduction**
 - Utility bills matched to building data
 - Benchmarks, Metrics
- **Buildings: 12-15% Usage Reduction**
 - Operations, Maintenance, Design
- **Employee Awareness: 5-10% Usage Reduction**
 - Communication, Education, Organizational Culture



Avoided Energy

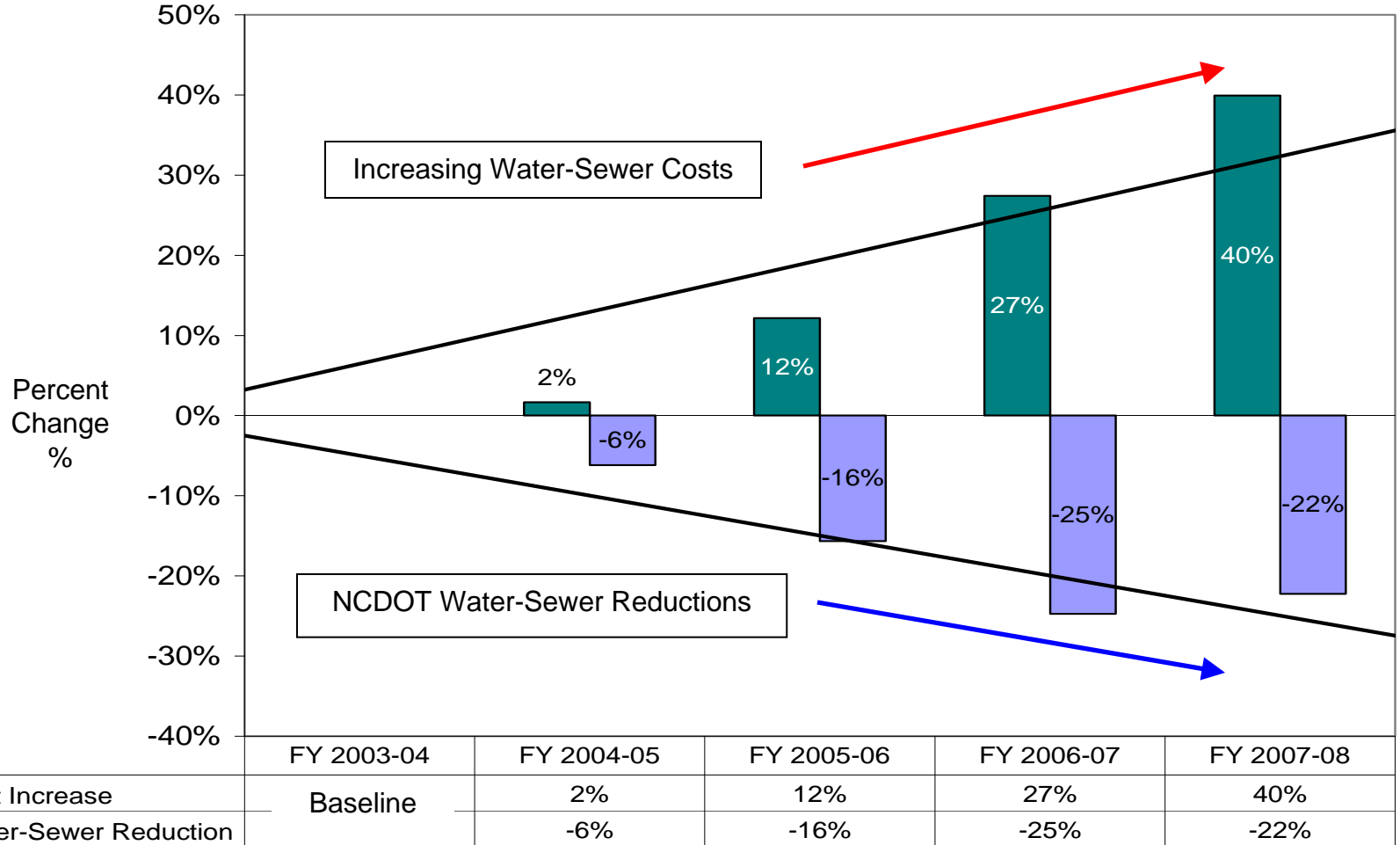


* Baseline year of SFY 2003-04

* Cost Increase = percent change of US dollars per million British Thermal Units of total energy used (\$ / MMBTU)

* Energy Reduction = percent change of total British Thermal Units per total gross building square footage (BTU / sf)

Avoided Water

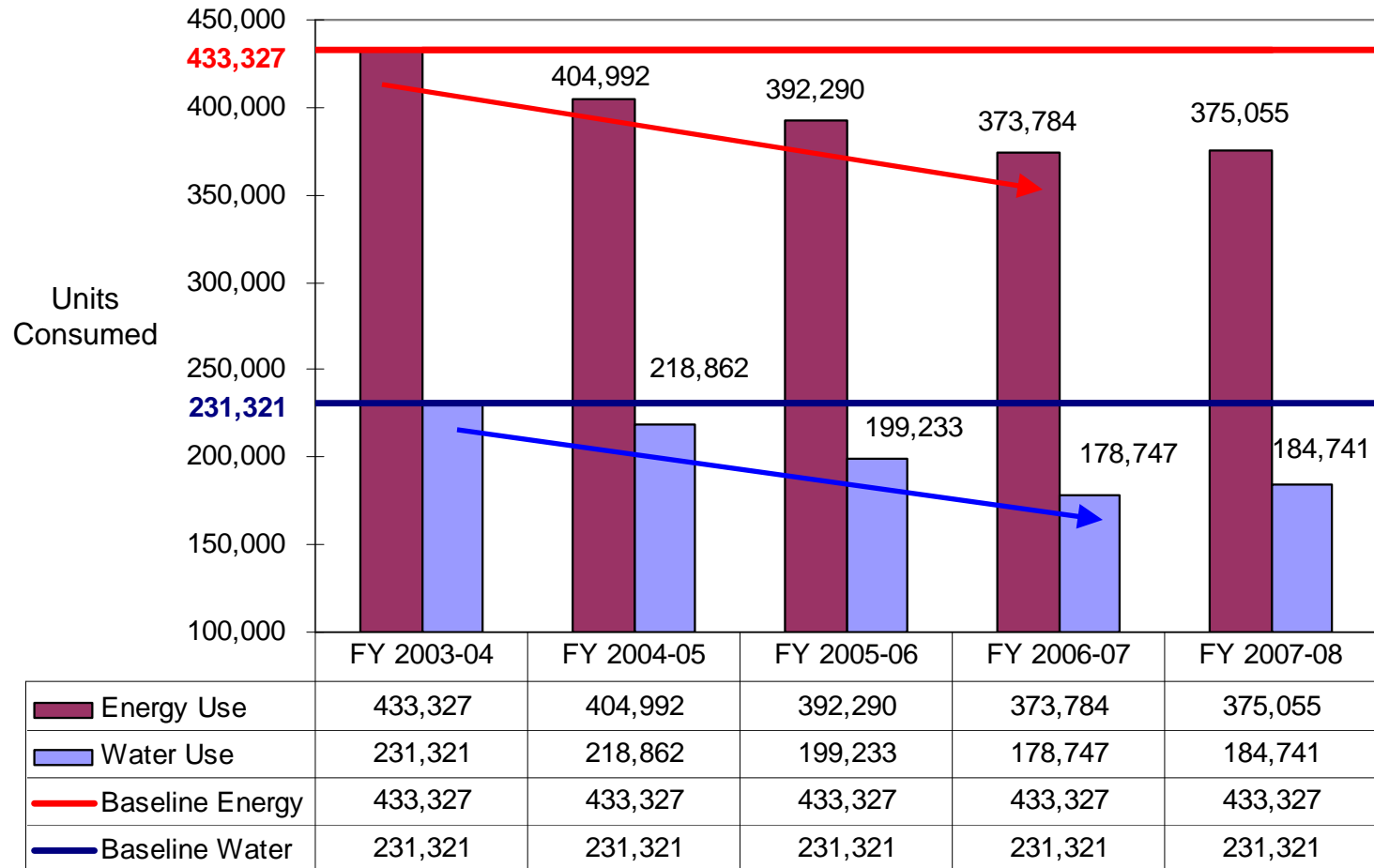


* Baseline year of SFY 2003-04

* Cost Increase = percent change of US dollars per thousands of gallons of total water used (\$ / mgal)

* Water-Sewer Reduction = percent change of gallons of water used per gross building square footage (gal / sf)

NCDOT Energy and Water Usage



* Baseline Use – SFY 2003-04

1. Usage reported in standard units of energy and water consumption.
2. Energy units reported in millions of British Thermal Unit (MMBTU).
3. Water units reported in thousand gallons (mgal).

Has NCDOT met 20% goal yet?

Since July 2003, FY 2007-08 reports overall

- | | <u>Goal</u> |
|---|-------------|
| ■ decrease in building energy use of 16% | 20% |
| ■ decrease in water use of 22% | 10% |
- from the initial year FY 2003-04.
- Estimated to have reduced FY 2007-08 Building Operating Costs by \$2 million.

Initial Goal (Avoided Costs) = @ **\$400,000** annually

Estimated 4-Year Avoided Costs:

Buildings – **\$5.7 Million**

Traffic Services – **\$4.7 Million**

 **\$10.4M**

Overall Impact * NC's Economy *

- Total Cost Avoidance {cumulative four-year period}
 - \$10.4 Million
 - Same As – 204 NCDOT Full-time Employees
 - \$51,000 for average DOT employee including salary, retirement, and benefits

- Water Usage Reduction {4-year}
 - 143,701 Thousands of Gallons (mgal)
 - Same As – Annual water use for 984 NC Homes
 - “Family of Four” uses 400 gallons of water daily.

- Electricity Usage Reduction {4-year}
 - 11,595,772 Kilowatt-Hours (kWh) Buildings
 - 73,750,135 Kilowatt-Hours (kWh) Traffic Services
 - Same As – Annual electric use for 8,009 NC Homes
 - Average household consumes 10,656 kilowatt-hours yearly.

Energy Reduction Impact * Carbon Emissions *

Greenhouse Gas Equivalencies		
Total Energy Avoided {cumulative 4-year}	438,896 MMBTU	95,353 metric-tons CO₂
Same As		
Annual Greenhouse Gas Emissions from	16,914	Passenger Vehicles
CO ₂ Emissions from	10,482,699	Gallons of Gasoline Consumed
CO ₂ Emissions from	214,773	Barrels of Oil Consumed
CO ₂ Emissions from	1,233	Tanker Trucks' Worth of Gasoline
CO ₂ Emissions from Electricity Use of	12,809	Homes for One Year
CO ₂ Emissions from Energy Use of	8,403	Homes for One Year
Carbon sequestered by	2,368,015	Tree Seedlings grown for Ten Years
Carbon sequestered annually by	20,989	Acres of Pine or Fir Forests
Carbon sequestered annually by	644	Acres of Forest Preserved from Deforestation
CO ₂ Emissions from	3,848,024	Propane Cylinders Used for Home BBQs
CO ₂ Emissions from burning	482	Railcars' Worth of Coal
Greenhouse Gas Emissions Avoided by Recycling	31,846	Tons of Waste instead of sending it to the Landfill
Annual CO ₂ Emissions of	0.02	Coal Fired Power Plants

- <http://www.epa.gov/solar/energy-resources/calculator.html>

Guaranteed Energy Savings Performance Contracts

“Performance Contracting” was approved in 2003 for state buildings in General Statute 143-64.17 for funding of major building energy-related improvements from the energy savings.

Guaranteed Energy Savings Performance Contracts are:

- ❑ design-build projects
- ❑ implements energy cost reduction measures
- ❑ performed at “no initial cost to owner”
- ❑ guaranteed for reduced consumption and cost savings
- ❑ paid for by the issuer over time.

The performance contractor is paid based on:

- ❑ energy savings measured and verified
- ❑ revenue provided by the energy reduction measures.

Concerted Effort Required

- Team Effort: Secretary's staff, Board Members, Divisions, DMV, Operations & Maintenance, General Services, Public Information, Finance, IT, and "*Cooperation from All Employees*"
- Proceed with Performance Contracting ***MUST***
 - Submitted 1st Application to State Energy Office – Feb 18th
 - Includes facilities within Raleigh Capital area
 - Waiting approval from State Energy Office
 - ON HOLD until General Assembly raises budget cap above \$100M
- Project Identification Elsewhere {statewide}
 - Need assistance and coordination from each division to identify where significant energy and water reductions can be achieved.
- Energy Service Company (contractor) is not responsible for Asbestos Abatement or Hazardous Waste Removal.

Guaranteed Energy Savings Performance Contracts

Backup Information

Energy Conservation Measures For Consideration



- Potential Energy Savings Strategies for Transportation Building Complex
 1. Highway Building
 2. Annex
 3. Old Art Museum

Expected Service Life

Item #	Description	Year Installed	Service Life	Maintenance Status	Critical Date
1	500 Ton Chiller – HWY Bldg.	1997	20 years	Good Condition	2017
2	Cooling Tower – HWY	1994	14-15	Manufacturer recommends Replacement	NOW
3	Pumps – HWY	1997	@ 20	No Redundancy	2017
4	325 Ton Chiller – Annex	2005	20	Excellent Condition	2025
5	Cooling Tower – Annex	1994	14-15	Manufacturer recommends Replacement	NOW
6	Pumps – Annex	1997	@ 20	No Redundancy	2017
7	Air Handling Units	Original	20	Needs upgrades on motors	NOW
8	Variable Air Volume (VAV) Units	Original	20	Needs upgrades on motors	NOW
9	Exhaust Fans	Original	20	Fair Condition	2012
10	Pneumatic Controls for T-stats & Valves	Original	Obsolete	Replacement Parts - Scarce	NOW
11	Converters – Steam to Hot Water	Original	5 more	Nearing Replacement	2012
12	Radiators	Original	40-50	Need new controls & piping	NOW
13	Transformers	Original	Life of Bldg.	No replacement parts	UPGRADE
14	Electrical Switchgear – Hwy Bldg.	1999	30-40	Good Condition	2030
15	Electrical Switchgear – Annex	1967	30-40	Good Condition	@ 2015
16	Fire Alarm Panels	1970s	20-30	Parts not readily available	UPGRADE
17	Windows – 1,300 units	Original	Life of Bldg.	Extremely Inefficient	UPGRADE

- Major Equipment & Components, Transportation Building Complex

Energy Conservation Measures For Consideration

- Air Infiltration Control and Improved Thermal Resistance of Building Envelope
 - New Efficient Windows
 - double pane, tinted, fixed
 - Install Windows in all Stairwells
 - Re-Seal all Roof Penetrations
 - Weather-Stripping for Doors
- Resists heat loss and controls heat gain.



Energy Conservation Measures For Consideration

- Replace and Upgrade Building System Components
 - ❑ Cooling Towers
 - ❑ Air-Handling Units or Roof-Top Units
 - ❑ Motors for Pumps & Fans
 - ❑ Transformers



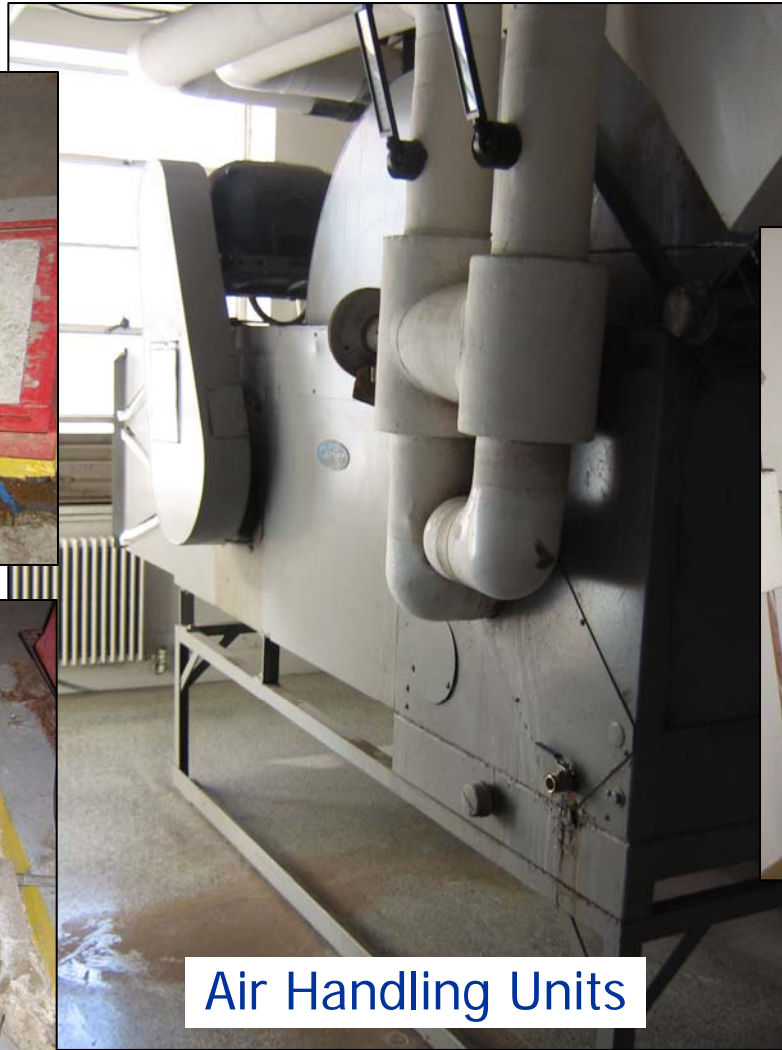
- Avoid critical failures in mechanical systems that are nearing or have already surpassed expected service life.

Other Equipment Surpassing Expected Service Life

Pumps



Leaks

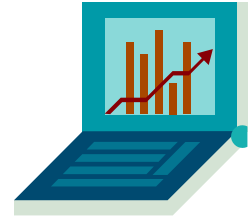


Air Handling Units

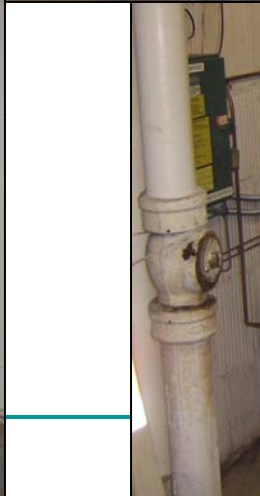
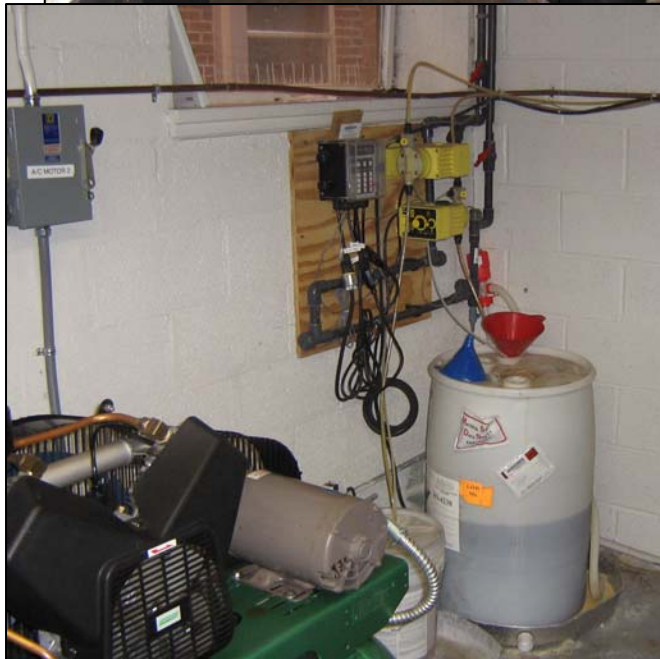


Transformers

Energy Conservation Measures For Consideration



- Whole Building Automation System
 - Direct Digital Controls – for monitoring equipment operations
 - Economizer Controls
- Modernizes building infrastructure.



Energy Conservation Measures For Consideration

- Install New Stand-Alone Boiler and Hot Water Coils in Highway Building
 - Eliminates dependence for purchasing steam and chilled water from the Department of Administration by square foot cost; currently an un-metered, fixed expense.



- Re-Calculate Building Loads and System Balance
- Automatic Lighting Controls and Occupancy Sensors

Results of Energy Study

- performed by Padia Consulting, July 2007, Transportation Building Complex

ECM #	Description	Individual ECM			Cumulative		
		Yearly Savings \$	Capital Cost \$	Simple Payback {years}	Yearly Savings \$	Capital Cost \$	Simple Payback {years}
1	Automatic Lighting and Fans Night-time Shut-off	48,000	58,000	1.2	48,000	58,000	1.2
2	Museum Day-lighting	1,100	6,500	5.9	49,100	64,500	1.3
3	Thermostatic Control of Radiant Heating	26,000	45,000	1.7	75,100	109,500	1.5
4	Install New Boiler & HW Coils at Air Handlers *	13,400	50,000	3.7	88,500	159,500	1.8
5	Install New Boiler & HW Coils at Air Handlers	145,000	90,000	0.6	233,500	249,500	1.1
6	New Windows [1300]	14,800	297,600	20.11	248,300	547,100	2.2
7	Replace all Air Handlers over 20 years old **	14,400	480,000	33.33	262,700	1,027,100	3.9
8	Whole Building Systems Automation	23,000	240,000	10.4	285,700	1,267,100	4.4

* Cost includes a credit for Energy Conservation Measure (ECM) 3 which will not be necessary if ECM 5 is completed.

** Cost includes a credit for ECM 4 and the hot water coil portion of ECM 5 which will done as part of ECM 7.

Guaranteed Energy Savings Performance Contracts

Summary

“Performance Contracting” was approved in 2003 for state buildings in General Statute 143-64.17 for funding of major building energy-related improvements from the energy savings.

Guaranteed Energy Savings Performance Contracts are design-build projects performed at “no initial cost to owner” and guaranteed for reduced consumption and cost savings.

Before contract implementation, a fixed set of conditions are established in agreement between the owner and contractor on a baseline year energy and water usage experienced at the facility.

The performance contractor is paid based on the savings measured and verified during post-retrofit period operating conditions as compared to the normalized baseline usage. The energy or demand savings are determined by comparing measured energy use or demand before and after implementation of the energy savings program.

Process for Implementing Performance Contracting

1. Project Identification with assistance from State Energy Office (SEO)
2. Submit application to SEO for approval to proceed with Performance Contracting (PC).
3. NCDOT has the option to post RFP for Third-Party Owner's Representative to help with PC {approximately \$35k cost}
4. RFP preparation & solicitation
5. Hold Mandatory Pre-Bid Meeting with Energy Service Companies (ESCO), Pre-Certified by the State of North Carolina. Currently 12 companies are pre-certified.
6. Each ESCO prepares and submits a Preliminary Technical and Cost Proposal for a guaranteed energy savings performance contract.
7. ESCO is selected after proposal evaluation and interview.
8. Negotiate Investment Grade Energy Audit (IGA) with ESCO.

Process for Implementing Performance Contracting

9. Post RFP for Third-Party Measurement & Verification.
10. Perform IGA.
11. Owner (NCDOT) selects Energy Conservation Measures (ECMs) from IGA.
12. ESCO consults State Construction Office (SCO) and Department of Insurance (DOI) as needed for IGA.
13. Technical review of IGA performed and acceptance.
14. Negotiate and prepare Energy Services Agreement (ESA) and financial contracts.
15. Request for approval through OSBM or State Treasurer.
16. Conduct Kick-Off Meeting with NCDOT, ESCO, SEO, SCO, and DOI to start.

Reference:

State Energy Office Website, Utility Savings Initiative (USI)

<http://www.energync.net/programs/usi.html>

Employee Awareness

- Look for “WastEnders” stickers and posters
- Log on to NCDOT portal and click on [Employee Information > Energy & Water Conservation](#)
 - For energy information & tips
 - Post Annual Strategic Energy Plan
 - What DOT employees can do...
 - Promote CPI Awards and Best Practices



Contact Information



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