



# Promoting Energy Efficiency at Commercial and Industrial facilities in North Carolina

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**2015 BEST PRACTICES AWARD**  
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# Outline

- Project Background / Objectives
- Planning / Marketing
- Project Implementation
- Results
- Conclusions / Challenges

# Why Energy Efficiency?

- Decreases Facility Operating Costs
- Low Cost, Multi-pollutant Control for Combustion Sources
- Decreases Demand for Electricity Generation
  - 1 unit of energy saved at the facility = 2 units of energy saved at power plant
  - Reduces demand at peaking units which have high emission rates
  - Reduces growth in demand over time

# Objectives

- **Target Audience**
  - Plant operators and management
  - No restriction on facility size or type
- **Program Goals**
  - Educate companies about benefits and independency between energy consumption, costs and air emissions
  - Encourage companies to take voluntary actions to reduce air pollution

## Energy Efficiency Program

- Voluntary
- Energy assessments
- Outreach activities
  - Workshops
  - Webinars

## Funding

- US EPA - \$360,000
- US DOE\*
- NC State Energy Office\*
- Nominal fees charged

\*In-kind contribution through our partners

### Project Timeline

2011 - 2015

# Marketing the Program

- Website <http://ncair.org/planning/iee/>
- Provided program information to target audiences
  - North Carolina Manufacturers Association and other industry meetings
  - Chamber of Commerce
  - Health and Safety and Environmental Meetings
  - Energy Efficiency Meetings and Classes
- Boiler MACT/GACT – letters to facilities subject to rule
- Regional Office Staff – recommended grant to specific companies
- Word of Mouth

# DAQ Energy Assessment Concept & Team

- Provide reduced-cost energy assessments
- No facility size or type restrictions
- Primary focus – reduce facility energy costs
- Identify cost-effective projects - **payback <2 years**
- Quantify emission benefits

## NC STATE UNIVERSITY



- Professors and students perform work
- Program has operated for 20 years
- Assisting facilities of all sizes
- Average saving of \$55,000 per assessment

Waste  
Reduction  
Partners



- Retired engineers perform the work
- Program has operated for 20 years
- Assist smaller facilities
- Estimated savings over program life

400,000 MWh  
1.2 million MMBtu

# Energy Assessment Process

## Pre Assessment

**Data Collection – bills, facility & equipment info**

**Site Visit** Conduct survey with facility personnel  
Long-term data collection  
Follow-up with questions and initial findings

## Written Reports

Recommendations for specific projects and O&M  
Estimate of cost savings/payback  
Information on rebate options  
Air quality benefits

**Follow-up Implementation Survey after a year**



# Pre- Assessment Form

**N.C. Division of Air Quality**

Planning >> Energy Efficiency Opportunities

### Energy Efficiency Opportunities

Technical Assistance to NC Businesses  
on GHG Reporting and Voluntary Reduction Strategies

EPA Greenhouse Gas Emissions Reporting Program	Voluntary Emissions Reduction Strategies
<a href="#">EPA Reporting Rule Website</a> <a href="#">Rule Fact Sheet</a> <a href="#">Resources by subpart</a> <a href="#">Applicability Tool</a>	<a href="#">Opportunity to Reduce Plant Energy Costs and Air Emissions</a>
<b>Reporting Assistance</b> <a href="#">Online Tutorial &amp; Training Presentations</a> <a href="#">Data Reporting System</a> <a href="#">Rule Help Center</a>	<a href="#">How can you get an energy assessment?</a>
<a href="#">Submit Request for Assistance on Reporting Requirements</a>	<a href="#">Information on Energy Assessment Partners</a>
<b>EPA GHG Data</b> <a href="#">EPA GHG Reporting Program Data</a> View NC facilities that reported under the rule.  <a href="#">EPA 2011 National GHG Emissions Inventory</a> View estimated emissions from all sectors for the entire USA.	<b>GHG Grant Case Study</b>  See our preliminary analysis of the energy assessments conducted under this grant. <ul style="list-style-type: none"> <li>Facility-wide</li> <li>Landfill Gas</li> <li>Wood Fired Boilers</li> </ul> <b>Cumulative Findings: Energy Efficiency Fact Sheet</b>
<b>New Reporting Information</b> <a href="#">Click</a> to learn about the latest development on the Confidential Business Information.  <b>Amended Global Warming Potentials (GWPs)</b> EPA published amendments to GWPs which will change the way total GHG emissions (as CO2e) are calculated. This change will impact both existing reporters of GHG and will cause facilities previously exempt from reporting to become subject to the rule. <a href="#">Click here for the Federal Register notice and rule summary: 78 FR 71904</a> .	<b>Webinar Resources</b>  <b>LED Lighting vs Fluorescents</b> <a href="#">Click</a> here for Resources for the February 2015 Webinar.  <b>Cutting Convenience Store Costs</b> <a href="#">Click</a> here for resources for the October 2014 workshops.  <b>NEWS</b>  2015 Award Recognition for energy efficient facilities and technical partners.  The NC DAQ Energy Efficiency Program funded by the EPA is one of the recipients of the 2014 ECOS State Program innovation Awards.

**DAQ CONTACTS**

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N.C. Division of Air Quality • Mailing Address: 1641 Mail Service Center, Raleigh, NC 27699-1641

### Application for Energy Assessment \*

**Facility/Organization Name** \_\_\_\_\_

**Type of facility** industrial, commercial, institutional \_\_\_\_\_

**Facility Identification Number (as shown on air permit, if applicable)** \_\_\_\_\_

**SIC Code or Product(s) Made** \_\_\_\_\_

**Facility Address** Street \_\_\_\_\_  
 City, State, Zip \_\_\_\_\_  
 County \_\_\_\_\_

**Contact Information Name** \_\_\_\_\_  
 Phone \_\_\_\_\_  
 Email \_\_\_\_\_

**Size of Facility (square feet of building space)** \_\_\_\_\_

**No. of Employees at Facility** \_\_\_\_\_

**Annual Energy Bill (include electricity, natural gas, coal, fuel oil, other)** \$ \_\_\_\_\_

**Annual Gross Plant Sales** \$ \_\_\_\_\_

**In-house Energy Engineer (full-time)** yes / no \_\_\_\_\_

**Types of Fuel (check all that apply)** coal\_\_ natural gas\_\_ fuel oil\_\_ propane\_\_ wood\_\_

**Process and Equipment of Interest**

Boilers	Motors & Pumps
Engines	Steam Systems & Steam Traps
Compressed Air	Process energy systems
HVAC Systems	Lighting
Chillers and Cooling Towers	Other

**Areas of Concern or Other Comments**

**Email form to:** [adey.olatosi@ncdenr.gov](mailto:adey.olatosi@ncdenr.gov)

\*Note energy assessments required by the GACT rule can no longer be scheduled. There is insufficient time remaining to complete any new audits prior to the compliance deadline, March 21, 2014.



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## Example -Targeted Assessment Summary

**Table 1. A Summary of Energy Assessment Recommendations**

Recommendation	Resource Savings (-/yr)	Dollar Savings (\$/yr)	Implement. Cost, \$	Simple Payback (years)
1. Recover Heat from Wastewater	11,079 MMBTU	\$52,036	\$15,000	0.25
2. Improve Boiler Turndown	3,939 MMBTU	\$17,607	\$1,000 - \$50,000	0.1 - 3
3. Reduce Stack Temperature in Boiler #1	2,351 MMBTU	\$11,043	\$0 - \$100,000	0 - 9
4. Install Blowdown Heat Recovery	2,187 MMBTU 79,920 gal water	\$10,670	\$35,000	3.3
5. Insulate Hot Water Tank	674 MMBTU	\$3,164	\$1,617	0.5
6. Insulate Steam and Condensate Return Lines	328 MMBTU	\$1,539	\$1,165	0.75
7. Repair Steam Leaks	278 MMBTU	\$1,306	\$1,750	1.3
Totals	20,836 MMBTU	\$97,365	\$55,532 - \$205,532	0.6 - 2

The results in Table 1 represent our best estimates of potential savings and implementation costs. Plant management should consult other sources and verify these estimates before taking action. Thank you for giving us the opportunity to visit your facility and to submit these recommendations. We welcome your inquiries and further discussions.

## Example - Facility-wide Assessment Summary

**Table 2. Summary of Energy Assessment Recommendations**

Recommendation	Conservation (-/yr)	Savings (\$/yr)	Implement Cost (\$)	Simple Payback (months)
1. Replace 100 hp Compressor with Smaller 75 hp VFD Compressor	127,417 kWh	\$8,551	\$44,599	63
2. Reduce Compressor Pressure	12,963 kWh	\$875	\$0	0
3. Repair Leaks in Compressed Air Lines	7,745 kWh	\$161	\$100	8
4. Install a Zero-Loss Compressed Air Condensate Drain Trap	11,629 kWh	\$782	\$300	5
5. Turn Off 125 hp Wood Waste Collection Hammer Unless Needed	172,513 kWh	\$9,319	\$1,000	1
6. Adjust Packing Schedules to Limit use of heat Shrink Oven	407 MMBTU	\$4,151	\$1,000	3
7. Conduct Burner Tune-up on the 500 HP Cleaver-Brooks Boiler to Reduce Excess Air and Improve Boiler Efficiency	32 MMBTU	\$349	\$800	28
8. Install Flowmeter in Makeup Water Line	42.35 MMBTU	\$462	\$600	16
9. Increase Water Temperature in Condensate Return Tank to Reduce Chemical Use and Potential Oxygen Pitting	45.87 MMBTU	\$1,800	\$1,000	7
10. Institute a Steam Trap Maintenance Program	171.5 MMBTU	\$1,119	\$1,000	11
11. Install High Efficiency Lamps and Electronic Ballasts	79,804 kWh	\$6,058	\$16,659	33
12. Convert Metal Halide Fixtures to Fluorescent	5,734 kWh	\$551	\$7,310	159
13. Replace Spray Booth Lights with More Efficient Fluorescent Lighting	8,586 kWh	\$659	\$5,880	107
14. Install Premium Efficiency Motors	17,584 kWh	\$1,335	\$7,920	71
15. Replace Electric Strip Heating	33,228 kWh	\$1,795	\$10,400	70
<b>Total</b>	477,203 kWh 699 MMBTU	<b>\$37,967</b>	<b>\$98,568</b>	<b>31</b>

# Example - Environmental Report

Table 2: Air Pollution Emission Offsets from Electricity Savings

Recommendations	Electricity Savings (kWh/yr)	Air Pollution Offsets (lb/yr)					
		GHG				Criteria Pollutants	
		CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	Total GHG (as CO <sub>2</sub> e)	SO <sub>2</sub>	NO <sub>x</sub>
1. Convert Metal Halide and High Pressure Sodium Fixtures to T8 Fluorescent High Bay Fixtures	195,746	202,767	4.2	3.4	203,909	415	133
2. Install High Efficiency Lamps and Electronic Ballasts	578,871	599,635	12.5	10.1	603,029	1,227	394
3. Convert Strip and U-Lamp Fixtures to High Efficiency Lamps and Electronic Ballasts	35,826	37,111	0.8	0.6	37,314	76	24
4. Replace 200-Watt and 150-Watt Incandescent Lamps with 40-Watt Compact Fluorescent Lamps	24,219	25,088	0.5	0.4	25,223	51	16
5. Convert 60-Watt Incandescent Lamps to 13.5-Watt LEDs	4,788	4,960	0.1	0.1	4,993	10	3
6. Convert from Incandescent to LED Exit Signs	1,690	1,751	0.0	0.0	1,751	4	1
7. Install Occupancy Sensor Controls	20,280	21,007	0.4	0.4	21,139	43	14
8. Repair Leaks in Compressed Air Lines	41,217	42,695	0.9	0.7	42,931	87	28
9. Reduce Compressor Discharge Pressure	37,437	38,780	0.8	0.7	39,014	79	25
10. Combine Router Vacuum System	247,300	256,171	5.3	4.3	257,615	524	168
11. Recover Conditioned Air from Dust Collection System	27,576	28,565	0.6	0.5	28,733	58	19
<b>Total</b>	<b>967,650 kWh</b>	<b>1,258,530</b>	<b>26.10</b>	<b>21.2</b>	<b>1,265,651</b>	<b>2,574</b>	<b>825</b>

Table 3b: Hazardous Air Pollution Emission Reductions from Wood Savings

Hazardous Air Pollutants*	Emissions Reduction (lb/yr)
Total Metals	9.6
Total Organics	98.2
Total Acid & Gases	112.9
<b>Total HAPs</b>	<b>221.2</b>

\*Appendix C presents a complete list of all HAP emissions

Table 3a: GHG and Criteria Pollutant Emission Reductions from Wood Savings

Recommendations	Fuel Savings (MMBtu/yr)	Air Pollution Reductions (lb/yr)								
		GHG				Criteria Pollutants				
		CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	Total GHG (as CO <sub>2</sub> e)	SO <sub>2</sub>	NO <sub>x</sub>	CO	VOC	PM <sub>10</sub>
11. Recover Conditioned Air from Dust Collection System	3,729	0*	253	33	15,601	93	1,827	2,237	63	1,070
12. Reduce Excess Air on the Hurst Wood Fired Boiler	1,125	0*	82	11	5,078	30	595	729	21	349
13. Increase the Amount of Condensate Returned to the Boiler	222	0*	15	2	937	6	109	133	4	64
14. Install a Flowmeter in Make-up Water Line	250	0*	17	2	1,037	6	122	150	4	72
15. Insulate Condensate Return Tank	283	0*	19	3	1,178	7	139	170	5	81
<b>Total</b>	<b>5,609</b>	<b>0*</b>	<b>386</b>	<b>51</b>	<b>23,831</b>	<b>143</b>	<b>2,792</b>	<b>3,419</b>	<b>97</b>	<b>1,635</b>

\* Actual biogenic emissions of CO<sub>2</sub> are 1,114,670 lb/yr, but are not reported (See Section 3).

# Workshops and Webinars

## Workshops

- Hands on wood-fired boiler workshop
- Improving Boiler Efficiency
- Cutting convenience store costs
- Compressed Air
- Steam Efficiency

## Webinars

- LED Lighting vs Fluorescents
- High grade lighting opportunities

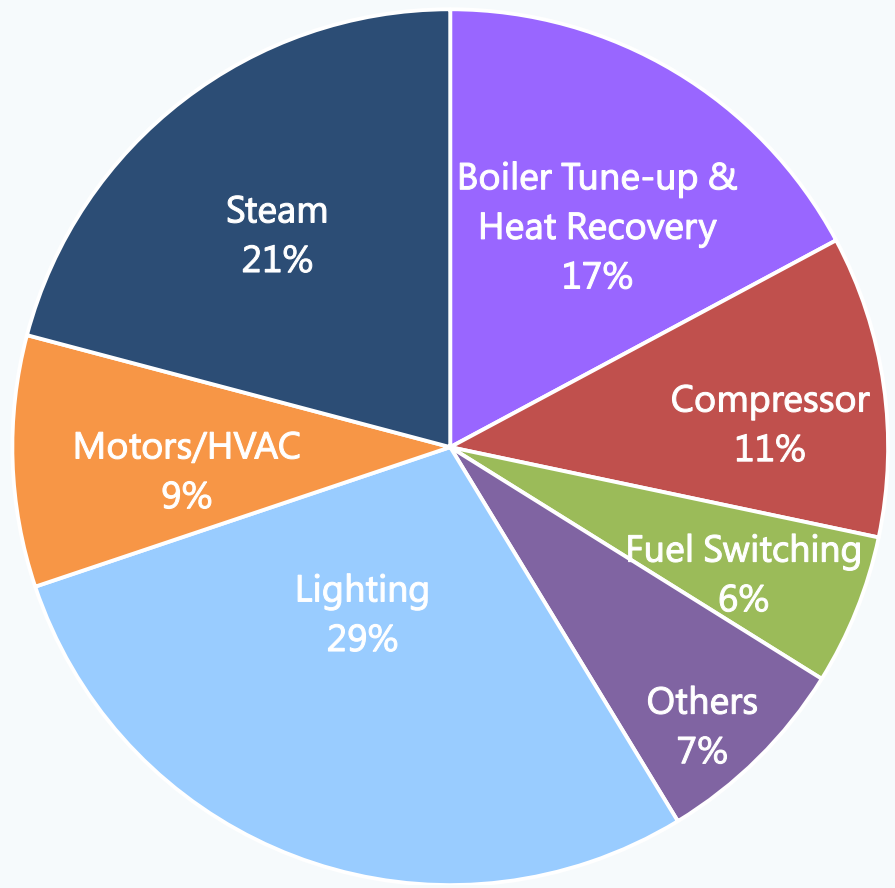
# Who received an Energy Assessment?

Industry	No. of Facilities
Furniture & Lumber	34
Manufacturing	14
Textiles	7
Food & Tobacco	6
Chemicals & Plastics	5
Others	11
Total	77



45 GACT Boilers

# Typical Energy Efficiency Recommendations





## Potential Energy Use and Emission Reductions Identified for 77 Energy Assessments

Total Reductions from ~500 Recommendations	
Electricity Savings	64,000 MWh/yr
Fuel Savings*	420,000 MMBtu/yr
CO <sub>2</sub> e	51,000 tons/yr
	16,000 tons/yr (biogenic)
SO <sub>2</sub>	131 tons/yr
NO <sub>x</sub>	92 tons/yr

\* Not all recommendations result in fuel use decrease



# Average Cost Savings & Capital Cost Per Recommendation

Top Recommendations	Average Cost Savings (\$/yr)	Average Capital Cost	Average Payback (Months)
Lighting	\$12,600	\$22,200	24
Steam	\$6,500	\$5,700	15
Boiler Tune-up	\$20,000	\$20,300	21
Compressor	\$5,400	\$3,500	8

Average total facility savings: \$100,000/yr

Average total facility capital cost: \$20,000

# Actual Energy Savings and Air Pollution Reductions

Type of Recommendation		Percentage Implemented	Total Cost Savings (\$/yr)	Energy Reductions		Air Pollution Reductions	
				Electricity Savings (kWh/yr)	Fuel Savings (MMBtu/yr)	NO <sub>x</sub> (ton/yr)	CO <sub>2</sub> e (ton/y)
Boilers	Boiler Tune-up	43%	\$249,000	0	137,000	22	11,500
	Steam	46%	\$332,000				
Electricity	Lighting	63%	\$768,000	22,700,000	5,000	11	13,000
	Compressor	58%	\$142,000				
	Motors/HVAC	44%	\$405,000				
	General- Electric	17%	\$160,000				
	Fuel Switching	10%	\$61,000				
Actual Savings Realized to Date			\$2,117,000	22,700,000	142,000	33	24,500

# Actual Savings and Reductions

	Potential Reductions 62 facilities	Implemented	Percent Reduction
Electricity Savings (MWh/yr)	46,000	22,500	49%
Fuel Savings (MMBtu/yr)	342,000	140,000	41%
CO <sub>2</sub> e (tons/yr)	41,000	17,000	41%
NO <sub>x</sub> (tons/yr)	80	32	40%

Average Implementation rate = 55%

## Air Quality Impacts from Energy Assessments in NC

Parameter	NO <sub>x</sub> (tons/year)	GHG (tons/year)
Statewide Emissions - EGUs & ICI Boilers*	63,950	58,234,000
Actual Reductions from 61 EAs	33	29,000
Percent Reduction	0.05%	0.04%
Possible Reduction in Emissions due to Statewide voluntary Implementation of Low Cost EE Measures	2.3%	1.9%

\* 2011 NEI and 2012 Point Source Inventory

# Conclusions

- **Energy Assessments**
  - Voluntary
  - Effective roadmap for the business community to implement EE
  - Significant savings in costs and air emissions can be realized
  - Direct interaction with energy professionals improves the outcome
- **Facility Barriers to EE**
  - Capital not available
  - Complexity of recommendation
  - Lack of management support, lack of time
  - Uncertainty in future of the business

# Program Challenges

- Initial lack of participation from certain industries
- Facility shutdowns
- Implementation reporting





# Acknowledgements

- U.S. EPA
- NCSU-MAE
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  - <http://www.mae.ncsu.edu/energy/>
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  - Terry Albrecht
  - Russell Jordan
  - <http://wastereductionpartners.org/>

# Project Team

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Thanks for the info . Again , It is very refreshing to meet with and work with such talented and helpful people.

**- Greenhouse facility**

The tips you provided on energy reduction and information on workshops/webinars will be helpful. Our company is putting together an Energy Council and as a member I will ensure we look into these opportunities. Our energy consumption for facilities in North and South Carolina is substantial so we are always looking for ways to reduce it. We also have a company goal to reduce greenhouse gas emissions through energy reduction. Many of our facilities are working on or considering lighting projects to achieve their goals

**- Bearings Manufacturing Company**

I have received the hard copy of the report. I appreciate Dr. Terry and his team inspecting our facility. This was very informative and very practical.

**- Tobacco Manufacturing Company**