

## Final Technical Report

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## **Executive Summary**

We have completed 83 assessments in this project period, covering all states in New England and the eastern part of New York. The combined energy consumption for these facilities was more than 750,000,000 kWh costing approximately \$77,000,000 for electricity and close to 5,600,000 MMBtu for all fossil fuels combined, totaling almost \$37,000,000. The average annual energy costs per plant were \$1,372,600. We had almost eight recommendations per assessment, and the implemented recommendations alone are saving these facilities on an average \$66,500 or almost 5% of their total energy bill.

We have organized and participated in sixteen seminars and presentations promoting energy efficiency practices and other DOE tools and programs. Our center developed the Chilled Water System Assessment tool that is part of DOE's BestPractices Suite of Tools.

During this period we had nineteen students in the program. Fifteen were graduate students, and four were undergraduate students. Eleven of them graduated with the Masters of Science degree in mechanical engineering and are working in the energy field, and three are currently in the program. Two undergraduate students were hired by engineering firms that perform energy efficiency services, and one continued his education and is pursuing an advanced engineering degree.

We cooperate with the Manufacturing Extension Partnerships and state Energy Offices to provide energy efficiency services to their constituents. As a result of our activities, all our clients requested assessments or were referred to us by one of the state energy offices, the MEP's or DOE.

Our current and former staff members hold 16 Qualified Specialist certificates. Seven of those were awarded to our students while participating in the IAC program. Currently we have three staff members with nine QS certificates and two students with four.

Three people from our staff were involved in the DOE's Save Energy Now program during the first year of program as steam and process heating qualified specialists. We completed eleven ESAs during 2006.

## **Task Summary**

### **Task 1: Conduct Industrial Assessments, to include a variety of plant types and sizes as well as coverage of the geographic area defined in the Annual Workplan Industrial Assessments:**

Our program is well established in the Northeast. We cooperate closely with the energy offices in all states in the Northeast, especially New Hampshire, Connecticut and Massachusetts. Due in part to the recent increased energy prices the Northeast has experienced, we have been deluged with requests for audits. We have responded to all of them promptly. We have completed 83 assessments in the period September 1, 2002 – August 31, 2006, and covered all states in our region. Our assessments were balanced among the states. We have completed 14 assessments in Connecticut, 34 in Massachusetts, 4 in Maine, 21 in New Hampshire, 4 in New York, 3 in Rhode Island and 3 in Vermont. We had 645 recommendations or almost eight recommendations per assessment. The total energy savings for those assessments were almost 150,000,000 kWh, 260,000 MMBtu for a total of close to \$19,000,000. Of those recommendations 335 were implemented saving approximately 33,500,000 kWh, 254,000

MMBtu for a total cost savings of over \$5,500,000. The average savings per assessment were \$66,500 or almost 5% of the overall plant's energy cost.

We have served diverse industries and had 56 different Standard Industrial Classification Code clients in 83 assessments. The largest number of plants was in the pulp and paper industry (14) including seven paper mills, followed by metal plating and finishing with seven plants.

**Task 2: Promote and increase the adoption of assessment recommendations and employ innovative methods to assist in accomplishing these goals.**

Our standard practice is to call all our clients two weeks after delivery of the report to discuss any problems that clients might have with it. We have also worked with the state of New Hampshire, which on several occasions went on plant visits with us to promote adoption of our recommendations to clients.

We have been working with the local electric utilities in an effort to implement recommendations with their assistance. The effort is supported by Massachusetts Energy Efficiency Partnership. We contact clients and request their permission to provide a copy of our report to the local electric utility; the goal is to take advantage of the utility's rebate programs.

**Task 3: Promote the IAC Program and enhance recruitment efforts for new clients and expanded geographic coverage.**

The students and professional staff at our IAC have been active participants in industrial outreach. Our IAC collaborates with the region's State Energy Offices, with its electric and natural gas utilities, with the New York State Energy Research and Development Authority, and with various Manufacturing Extension Partnerships. The IAC has been associated with CEERE, the Center for Energy Efficiency and Renewable Energy within the Mechanical and Industrial Engineering Department at the University of Massachusetts. CEERE promotes energy efficient technologies and renewable energy resources. CEERE allows us to extend our outreach to industry, government and the community in ways we are not able to within the IAC contract. CEERE has acted as host to conferences, workshops and meetings that bring energy efficiency issues to the industrial, governmental and commercial community. In the past year we have offered workshops on Building Commissioning and Building Fenestration Systems, and hosted an IOF Forest Products Roadmapping Conference. CEERE also works with the Massachusetts Division of Energy Resources to provide energy technology assistance for policy issues. This effort is intended to coordinate and plan industrial outreach activities, including various DOE Conferences, Training Workshops and other Integrated Delivery activities throughout the Northeast. Below is a list of workshops and events in which we participated in an effort to promote IAC program and expand the reach of our center.

- “Steam System Operation and Improvements – Case Study” at the Optimizing Steam System Performance workshop, Boston, MA, April 1, 2003
- “Chiller System Optimization and Energy Efficiency Workshops” Waltham, MA September 16, 2003
- “Chiller System Optimization and Energy Efficiency Workshops” Springfield, MA September 17, 2003

- “Chiller System Optimization and Energy Efficiency Workshops” Westborough, MA September 18, 2003
- The Northeast Energy & Technology EXPO, USDOE and State Industrial Efficiency Partnerships of CT, MA, ME, NH Worcester, MA November 6, 2003.
- “Increasing Energy Efficiency Through Gas Technologies”, Manchester NH December 1, 2004.
- “Energy Efficiency Improvements for the Plastic Industry” Pittsfield, MA October 28, 2004. Molding”.
- “The energy saving opportunities in plastic injection molding industry” Berlin, CT; March 25, 2004.
- Steam Best Practices workshop - “Steam System Operation and Improvements – Case Study” Boston, MA; April 1, 2004.
- “Energy Efficiency Improvements for the Plastic Injection Molding Industry”, Fitchburg, MA March 30, 2005.
- “Electric Load Management Best Practices in Energy Use for Commercial and Industrial Facilities” Westborough, MA April 28, 2005.
- Chiller Systems Optimization Workshop held in Berlin CT on November 9, 2005.
- Visited American Saw Co. in East Longmeadow. The purpose of this visit was to assess American Saw’s energy consumption and encourage the company to participate in DOE’s Best Practices training program. October 14, 2005.
- “Peer Exchange Forum on Best Practices in Energy Auditing”, a full-day roundtable for industrial energy stakeholders from New England’s industry, government, utility, and non-profit organizations. The roundtable goal was to allow participants to compare regional agendas and develop collaborative activities in a “post-federal” energy program environment. Our IAC was recognized as a valuable resource for industrial customers in the Northeast. February 16, 2006.
- EASTEC 2006 Exposition and Conference in Springfield, MA. We had booth there and used this opportunity to promote IAC and DOE programs and best practices tools. May 26, 2006.
- “Chilled Water Systems Performance Workshop”. The workshop was attended by 44 people from industrial and commercial facilities and engineering consultants. It included plant and facility managers, energy, maintenance and mechanical engineering staff, and energy professionals. This Chiller Tool Training workshop was the first to be offered since the DOE recognized CWSAT as a Best Practices tool in 2005. This training provided attendees with the background, methodology, and skills needed to begin utilizing this valuable tool. It helped them understand how to determine energy consumption and costs of operating the chillers, pumps, and towers in a chilled water system. It provided a background in determining how to quantify potential cost and energy savings and examine the energy and economic impact of varying operating scenarios. Northborough, MA; May 26, 2006

**Task 4: Provide educational opportunities, training, and other related activities for IAC students.**

An important component of this program is the training of future professionals in the energy field. Our philosophy is that every student in the IAC Program should be able to perform the highest quality assessment on their own by the time he or she leaves the program, so we create a training

environment in which each student must “reinvent the wheel” in order to thoroughly understand every aspect of industrial energy assessments. Consequently, most of the graduate students who have completed our program – 11 of 14 in the past four years – are successful energy and consulting engineers (see list below).

We provide students with the skills they need to be successful engineers, including report writing, analysis and communication. From time to time, students are sent to professional training conferences and courses such as those offered by the DOE Tool Workshops or the Boiler Efficiency Institute, to expand their understanding of industrial energy efficiency. New software products, new or revised equipment procedures and new techniques all require additional training for IAC Professional Staff and students.

During this period we had nineteen students in the program. Fifteen were graduate students and four were undergraduate students. Eleven graduated with a Masters of Science degree in mechanical engineering and are working in the energy field, and three are still in the program. Two undergraduate students were hired by engineering firms that perform energy efficiency services, and one student continued his education and is pursuing an advanced engineering degree.

In addition to training received through the IAC program, all students participate in an end-user program, and many participate in DOE’s Qualified Specialist program. Two undergraduate students and eleven graduate students went through the following end-user trainings: Fundamentals of Compressed Air Systems (September 15, 2005), Process Heating Assessment Tool End User Training (October 13, 2005), Compressed Air Systems Level II training (March 16-17, 2006), and Pump Systems Assessment Training (March 29, 2006).

Since the BestPractices training started, we had a number of students and staff participating in this program. All together, IAC and CEERE staff members hold 16 Qualified Specialist certificates. Seven of those were awarded to our students while participating in the IAC program.

In addition to these activities some our students attended the following events:

- The World Energy Engineering Congress (WEEC) 2003 organized by the Association of Energy Engineers, Atlanta, GA, November 12-14, 2003.
- US Combined Heat and Power Association Annual Policy Day- May 3-5, 2005 (Washington DC)
- Industrial Energy Technology Conference in New Orleans, LA, May 11-12, 2005.
- The 5<sup>th</sup> Annual CHP Roadmapping Workshop, September 20-21, 2005 and the Association of Energy Engineers (AEE) World Energy Engineering Congress (WEEC), September 22-24, 2005.

#### **Task 5: Coordinate and integrate Center activities with other Center and IAC Program activities, DOE’s Industrial Technologies programs and other EERE programs.**

Early in the program, we worked with IOF teams from New Hampshire (through the WasteCap Resource Conservation Network), Massachusetts and Connecticut to promote IAC to industries participating in state IOF programs. More recently we have been working with Manufacturing Extension Partnerships and state Energy Offices to provide energy efficiency services to their constituents. As a result of our activities, all our clients requested assessments or were referred to us by one of the state energy offices, the MEP’s, or DOE.

Three people from our staff were involved in the DOE's Save Energy Now program during the first year of the program as steam and process-heating Qualified Specialists. We completed eleven ESAs during 2006.

**Task 6: Other tasks or special projects, as needed, and as determined by DOE to be advantageous to the program and in furtherance of IAC Program goals.**

We developed the Chilled Water System Assessment tool that is now part of DOE's BestPractices suite of tools. Since 2003 when we started development of this tool, we have organized five workshops to promote this tool to end users in the Northeast.

We were contracted by the Oak Ridge National Laboratory to perform an energy assessment at the Philadelphia Mint facility. The assessment was performed on January 8 and 9, 2003.

We have worked with the Alliance to Save Energy on a pilot program to: (1) better utilize Best Practices Steam materials during plant assessments, and (2) develop a protocol for collecting data and reporting information back to DOE that describes the energy impacts of assessment activities. We performed two assessments during which we spent additional time explaining DOE's Steam BestPractices program to our client. At the time of our visit, we also gave them the brochure "Improving Steam System Performance". During those assessments, James Moore from TA Engineering accompanied us. The reports have been submitted to the client, and results were presented at the annual IAC director's meeting.