Final Technical Report

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Recipient Organization:
Colorado State University
Sponsored Programs
Campus Delivery 2002
601 South Howes
Fort Collins, CO 80523-2002

Technical Contact:
Dr. Douglas C. Hittle
Colorado State University
Department of Mechanical Engineering
Campus Delivery 1374
Fort Collins, CO 80523-1374
Phone: (970) 491-1937
Facsimile: (970) 491-3827
hittle@engr.colostate.edu

Business Contact:
Ms. Mary Atella
Colorado State University
Sponsored Programs
Campus Delivery 2002
601 South Howes
Fort Collins, CO 80523-2002
Phone: (970) 491-2083
Facsimile: (970) 491-6147
mary.atella@research.colostate.edu

DOE Project Officer:
Mr. Bill Prymak
US Department of Energy
1617 Cole Blvd., Golden, CO 80401
Phone: 303-275-4931
Fax: 303-275-4758
Email: bill.prymak@go.doe.gov

Executive Summary

The Department of Energy's Industrial Assessment Center at Colorado State University (CSU IAC) has been helping manufacturers in Colorado and the Rocky Mountain region save energy, reduce waste, and save money while helping to produce highly-trained and highly-capable energy engineers since 1984. The most recent four-year contract continues that trend. This contract ran from September 1, 2002 through May 31, 2007 and included assessments conducted from September 1, 2002 through August 31, 2006. During this contract, he CSU IAC served 77 manufacturers in six Rocky Mountain States and recommended about 311,800 MMBtu/yr in energy savings, 12.6 million gallons of waste water reduction per year, nearly 650,000 pounds of solid waste reduction per year, and more than 5,600 gallons of hazardous solid waste per year, saving more than $9.54 million dollars per year in utility, waste disposal, raw material, and labor costs. Total expenditures for the period were about $814,000 for the period or about $203,500 per year. Thus, the CSU IAC generated almost 12 times more recommended cost savings than the project cost. In addition, the program employed 24 undergraduate mechanical and civil engineering students and seven graduate mechanical engineering students. Of these students, more than 75% have gone on to successful careers in energy engineering or manufacturing, where they continue to provide additional energy and cost savings for industry and the country.

Task Summary

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

During the four-year period from September 2002 through August 2006, the CSU IAC served 77 manufacturing plants in Colorado, Wyoming, Montana, North Dakota, South Dakota, and New Mexico, with the vast majority in Colorado (about 69%) and along the Colorado Front Range from about Fort Collins to Colorado Springs. About 16% of the plants 12 plants) were located in New Mexico, with 5 plants in North Dakota, 4 plants in Wyoming, 2 plants in Montana, and one plant in South Dakota. Of these, 20 assessments (about 26%) served food manufacturing plants (SIC 20XX), 8 assessments (about 10%) served manufacturers of transportation equipment (SIC 37XX), and 6 assessments each (about 8% each) were conducted at furniture and fixture manufacturers (SIC 25XX), stone/glass/clay manufacturers (SIC33XX), industrial machinery manufacturers (SIC35XX), and electronic equipment manufacturers (SIC36XX). Overall, 613 recommendations for energy efficiency, pollution prevention, and productivity were suggested at these plants.

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

For the four-year period considered, 613 ARs were recommended. Implementation reports are not yet complete for FY2006, but for the three-year period from FY2003 through FY2005, 480 AR were suggested at 61 plants. Of these, 213 ARs were implemented, a rate of 44.4%. From an energy basis, the total energy savings contained in the 480 ARs from FY2003 through FY2005 amounted to 311,806 MMBtu/yr. Of this, 84,320 MMBtu/yr were implemented, a rate of about 36.3% of the recommended energy savings.

During this four-year period, the CSU IAC acted to increase implementation rates as follows:

1. The assessment report format was changed to include an implementation summary form in the assessment report for clients to reference.
2. The implementation surveys were conducted in a more timely fashion
3. Various methods were used to collect implementation data, including email surveys
4. When possible, IAC personnel arranged for face-to-face implementation surveys to better characterize the implementation approach and progress.

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

The geographic coverage of the CSU IAC was expanded to include a few assessments in Montana, North Dakota, and South Dakota, in addition to regular assessments conducted in Colorado, Wyoming, and New Mexico. In doing so, the CSU IAC cultivated relationships with the following organizations:

1. Colorado Department of Public Health and Environment
2. Colorado Governor's Energy Office
3. North Dakota Department of Agricultural
4. Colorado Springs Utilities
5. Fort Collins Utilities
6. La Plata Electric Association
7. Montana-Dakota Utilities Company
8. Platte River Power Authority
9. Poudre Valley Rural Electric Association
10. Public Service Company of New Mexico
11. TriState Generation and Transmission
12. Xcel Energy – Public Service Company of Colorado
13. United Power
14. Colorado Center for Manufacturing and Technology
15. Montana Manufacturing Excellence Center
16. Northeast Metro Pollution Prevention Alliance
17. Wyoming Manufacturing Works

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

Several undergraduate and graduate level courses were taught in the Department of Mechanical Engineering during the four-year period considered that related to IAC activities and expertise. The courses included the following:

1. ME448: Pollution Prevention - taught by Dr. Harry W. Edwards (former CSU IAC Director)
2. ME463: Building Energy Systems - taught by Dr. Douglas C. Hittle, Director
3. ME563: Air Pollution Control - taught by Dr. Harry W. Edwards (former CSU IAC Director) and Mr. Michael Kostrzewa, P.E., Assistant Director
4. ME575: Solar and Alternative Energies – taught by Dr. Douglas C. Hittle, Director

Weekly training sessions were conducted on Thursdays during semesters when site visits were not being conducted. Typical topics included safety, equipment operation, datalogging, report

review and critique, and how-to sessions for ARs on common ARs. Local IAC alumnae also made presentations about their current jobs and tips for students.

In addition, CSU IAC students participated in several Best Practices training sessions for Fundamentals of Compressed Air, Steam Systems, and Distributed Generation. CSU IAC students also attended the DOE/SEN/IAC Webcast Lecture Series presentations on Energy Efficient Building Management Strategies, Measuring and Improving Boiler Efficiency, Combined Heat and Power, and Optimizing Combustion Systems.

During the four-year period considered, the program employed 24 undergraduate mechanical and civil engineering students and seven graduate mechanical engineering students. Of these students, more than 75% have gone on to successful careers in energy engineering or manufacturing. At least 12 of these students were awarded Certificates of Participation for their service and leadership to the CSU IAC.

Task 5: Coordinate and integrate Center activities with other Center and IAC Program activities, DOE's Industrial Technologies programs and other EERE programs.
The Assistant Director was very active in participating in the Best Practices trainings and using the Best Practices tools. During the four-year period considered, he became a Qualified Specialist in the AIRMaster+, Fan System Assessment Tool, and Pumping System Tool. He also became an instructor in the Pumping System Assessment Tool and conducted five PSAT End User Workshops in Colorado, Wyoming, and California.

The Assistant Director served on the Governor's Pollution Prevention Advisory Board, serving as Vice Chair the two years.

The Assistant Director also served in a limited role for about two years as a member of Steering Committee for the Intermountain Regional Combined Heat & Power Initiative.

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.
One technical paper was developed and presented during the four-year period considered. Dr. Harry W. Edwards, former CSU IAC Director presented a paper entitled "Pollution Prevention Through Energy Efficiency Improvement" at the 96th annual meeting of the Air & Waste Management Association in June 2003.

Several workshops were conducted during the four year period considered, including the following:

1. A PSAT End User Workshop was hosted by the CSU IAC in September 2004

2. CSU IAC was the Colorado host site for the NWFPA Industrial Efficiency Initiative: Save Energy, Maximize Profits satellite teleconference on March 6, 2006.

3. A Save Energy Now workshop was held in Denver on June 21, 2006 in cooperation with Xcel Energy.