State Energy Program

Opportunities of Improving Industrial Environmental Control System Energy Performance in Nebraska

Save Energy Now: State Industrial Assessment Projects

Nebraska Energy Office
DOE Award Number: DE-FG36-08GO48020
CFDA Number 81.119
Period of Performance: March 6, 2008 – January 31, 2010

Project Partners:
Nebraska Energy Office
University of Nebraska-Lincoln
Omaha Public Power District

Project Overview

Nebraska is the home to eight Fortune 500 companies and the leading industries include food manufacturing, machinery manufacturing, and transportation equipment manufacturing. In 2003, the Nebraska industrial sector consumed 198.4 trillion Btu energy, including 38.4 trillion Btu natural gas according to EIA. The industrial sector consumed 29% of the total state energy usage.

Collaborating on the project were the Nebraska Energy Office (NEO), the University of Nebraska-Lincoln (UNL) and the Omaha Public Power District (OPPD). The project team has achieved significant results in the commercial sector under several projects awarded under the Rebuilding America Program by the U.S. Department of Energy (DOE). An advanced energy efficiency process, the Continuous Commissioning Leading Energy Project (CCLEP) process, was developed by Energy Systems Laboratory (ESL) at the University of Nebraska-Lincoln and implemented in several commercial buildings through those projects. The CCLEP process typically reduces the capital cost by up to 15 percent, reduces the energy utility cost from 15 to 50 percent and reduces comfort complaint calls by more than 90 percent.

The industrial facilities have environmental control systems, such as boiler and heating systems, chillers, cooling tower and refrigeration systems, air handling unit systems, and other fan and pump systems. These all have similar characteristics to commercial buildings. Therefore, the CCLEP process can be transferred to the Nebraska industrial sector to achieve the EPAct goals for reducing industrial energy intensity by 2.5 percent per year for the next 10 years. It is expected that similar savings, 10 to 25 percent, can be achieved if the CCLEP technologies are adapted to similar process controls in the industrial sector.

The objectives of the project were:

- Conduct preliminary assessments on six (6) Nebraska industrial facilities to identify potential energy efficiency opportunities through walkthrough visits and utility bill baseline analysis.
- Conduct detailed assessments on three (3) selected facilities, which have high energy improvement opportunities, through detailed on-site measurement and system performance analysis.
- Develop implementation plans for the selected facilities, including retrofit lists, system operation improvements, estimated cost and energy savings and verification methods.
- Deliver the Industrial Energy Efficiency assessments/ audits to the selected industrial facility owners.

Save Energy Now Goals Expected and Achieved

The NEO's Save Energy Now plan outlined the goals below, which were exceeded.

GOAL: Conduct 6 preliminary assessments

ACTUAL: 12 preliminary assessments were conducted.

GOAL: Conduct detailed assessments on 3 facilities.

ACTUAL: Detailed assessments were conducted on 4 facilities.

Project Implementation

The NEO welcomed the opportunity to partner with the University of Nebraska-Lincoln and Omaha Public Power District to maximize the impact of Save Energy Now funds into a program that would benefit our state long after the dollars were expended.

Project Responsibilities and Capabilities

The project team has a proven record of working together to achieve excellence, which is illustrated by high performance standards, producing documented results and meeting all grant and project requirements.

The project team includes a group of engineering and research experts form the Energy Systems Laboratory (ESL) at the University of Nebraska-Lincoln (UNL), technical and marketing staff from the Omaha Public Power District (OPPD) and the Nebraska Energy Office (NEO).

The University of Nebraska-Lincoln is the only state-chartered, land-grant university in Lincoln. ESL is housed in the Department of Architectural Engineering, a program in the College of Engineering at UNL. ESL focuses on developing energy efficient technology and improving building energy system performance. ESL has successfully conducted energy efficiency projects sponsored by several federal and state agencies, such as the California Energy Commission (CEC), American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) and the U.S. Department of Energy (DOE).

Omaha Public Power District (OPPD) serves more than 315,000 customers in 13 counties in southeastern Nebraska with retail electricity consumption of 8,772,000 Megawatt-hours in 2002. Though OPPD has a great existing energy efficiency partnership with their customers, it still has a strong desire to improve the way their customers utilize energy.

The Nebraska Energy Office (NEO) serves as the eligible state energy office applicant and the grant recipient and is responsible for all aspects of this program.

The ESL and OPPD have created a nationwide reputation on building energy systems and energy conservation using energy efficiency technologies. They will transfer these proven technologies into the industrial sector to improve industrial environmental control system energy performance through this project.

Project Roles

The Nebraska Energy Office serves as the eligible applicant; accepts the Notice of Financial Assistance Award; issues the contract/aid agreement to the University of Nebraska-Lincoln as the sub-recipient of funds; administers and oversees all aspects of the grant; monitors programmatic and financial expenditures; coordinates with project partners; assures all work is proceeding according to plan and is completed; monitors and assures programmatic and fiscal compliance; and prepares and submits all required reports.

The University of Nebraska-Lincoln serves as the contractor/recipient of aid and is responsible for the programmatic and fiscal reporting to the Nebraska Energy Office.

Omaha Public Power District is the project partner; is a sub-contractor/recipient to ESL UNL; coordinates specific tasks where staff are assigned leadership; coordinates task implementation and performance reporting; is responsible for program and fiscal management of federal funds designated to the project and is responsible for providing input to ESL UNL for reports.

The project director will be Dr. M. Liu, Ph. D., P.E., from UNL. Mrs. J. Wang from OPPD will lead plant identification and recruitment and facility information collection. Dr. G. Wang from UNL will lead preliminary walk-through evaluations, on-site measurements, and system performance analysis. Dr. M. Liu from UNL will lead the Assessment Report segment. The Rebuild America State Representative for Nebraska is Mr. Pete Davis, who will be the grant manager and project officer for the Nebraska Energy Office.

Energy Savings Validation

The project partner, OPPD, is the power provider to these facilities. It is easy to obtain the utility billing and usage through the provider. The utility bill is used to monitor system performance improvement and validate the energy savings after implementation. An 18-month baseline energy consumption profile will be developed before the implementation of energy savings opportunities. The utility bills after implementation will be calibrated with weather data and compared to the baseline data at a 6-month interval.

Grant Activities

The Nebraska Energy Office (NEO) developed its Save Energy Now funding plan based on the goals listed below and considered DOE's goals when developing the market titles to administer the program.

Seven goals were chosen to accomplish the objectives:

- Plant identification and recruitment
- Preliminary walk-through evaluations
- Collection of facility information
- On-site assessments and measurements
- System performance analysis
- Comprehensive assessment reports
- Project management and reporting

Project Timeline

The detailed time schedule and milestones for the project are presented in Table 1. The proposed project period was one year. (See Table 1 – attached)

Project Summary Table

Table 2 on page 4 summarizes the project information. A total of 12 plants were investigated. Goal 1 was to identify and recruit six (6) industrial facilities to join the project. The facility owners were contacted first by mail and then by telephone. Presentations were given to each to encourage participation.

The benefits of participation were addressed directly with facility owners: (1) they would receive a free facility energy assessment; and (2) they would receive a detailed system performance analysis report identifying the energy savings opportunities. (See Table 2 – Attached)

Actual Performance: 12 industrial facilities were identified and recruited, exceeding the requirement of six.

Goal 2, Preliminary Walk-through Evaluation, was achieved when the walk-throughs of all 12 industrial facilities were evaluated. Historical energy consumption data, utility bills and energy system information was collected. On-site investigations identified energy improvement opportunities. Twelve facilities were selected to join the project and agreements were signed by the facility owners for further investigation.

Actual Performance: Preliminary walk-throughs were completed on all 12 facilities, exceeding the proposed number of six.

Goal 3 provided for the collection of facility information. The selected facilities were required to provide facility mechanical and control system design information. An energy consumption baseline was developed based on historical energy consumption data and weather data. The building system design, control and energy consumption information was reviewed and a comprehensive, detailed assessment plan was provided to the facility.

Actual Performance: The required number of facilities that provided facility information was exceeded by 50 percent.

On-site measurements were a requirement under Goal 4. During this process, the project team interviewed the facility engineers to familiar themselves with routine system operations, to identify the current control sequences, to verify the system design information and to perform the system measurements.

Actual Performance: Detailed on-site measurements and interviews were conducted at 12 facilities.

System Performance Analysis was the focus of Goal 5. The annual Heating, Ventilation and Air-Conditioning (HVAC) system profile was constructed using the on-site measurement data and current control sequences. The energy savings opportunities were further identified and confirmed. Specific Continuous Commissioning (CC©) and CCLEP© were developed.

Actual Performance: The actual system load profiles and operation sequences were identified using the on-site measurement data and subsequent analysis in 4 facilities.

After many CC© technologies were identified, the total energy savings for these 4 facilities was calculated at over $2 million per year.

The Assessment Report for each participating facility was part of Goal 6. A simplified engineering model was calibrated using on-site measurement data and energy consumption date. The potential energy savings were then predicted based on this calibrated engineering model and compared with baseline model. A comprehensive energy assessment report was then developed.

Actual Performance: Detailed assessment reports were produced for 4 facilities, along with detailed engineering implementation plans.

Successes and Highlights

The project was successfully completed within the one-year period. As a result of this project, several other companies requested preliminary reviews and system performance analysis, with the goal of increasing energy efficiencies.

Pfizer decided to implement all of the recommendations. The total project, rolled out in five phases, had an up-front cost of $1.5 million, with a potential annual cost savings of $625,000. The project was partially contracted with a private company to implement the recommendations. Other similar projects are taking place at other Pfizer plants based on the proven results and success at the Nebraska plant, thanks to this project.

Connectivity Solutions has completed all recommended energy efficiency projects with OPPD. The project had an up-front cost of $490,000, with a measured energy cost savings of over $500,000 annually.

During the State Industrial Assessment project period, facility owners contributed a total of $200,000 to support the project, which is four times more than the DOE project award.

Cost Status

The program closed out the project on January 31, 2010 with the filing of the final Quarterly Performance Report and the Quarterly Financial Report.

Table 1: Project Schedule

Project Activities	Months					
	1-2	3-4	5-6	7-8	9-10	11-12
Goal 1: Plant identification and recruitment						
Goal 2: Preliminary walk-through evaluations						
Goal 3: Collection of facility information						
Goal 4: On-site assessments and measurements						
Goal 5: System performance analysis						
Goal 6: Comprehensive assessment reports						

Table 2: Project Summary Table

Name	Function	Annual Bill	Goal 1	Goal 2	Goal 3	Goal 4	Goal 5	Goal 6
PayPal	Call/Data Center	$500K	Y	Y	Y			
Roberts Dairy	Dairy Plant	$680K	Y	Y	Y			
Verizon Data Center	Data Center	$870K	Y	Y	Y	Y	Y	Y
Con Agra	Food Processing	$1.7M	Y	Y	Y			
D&D Food	Food Processing	$450K	Y	Y	Y			
Kellogg	Food processing	$9.5M	Y	Y	Y			
Phillips	Manufacturer	$150K	Y	Y	Y			
American Laboratory	Manufacturer	$588K	Y	Y	Y			
Connectivity Solutions	Manufacturer	$4.3M	Y	Y	Y	Y	Y	Y
Pfizer	Manufacturer	$4.7M	Y	Y	Y	Y	Y	Y
Greater Omaha Packing	Meat Processing	$2.5M	Y	Y	Y			
Bag and Save	Supermarket	$4.4M	Y	Y	Y	Y	Y	Y
TOTAL		$35M	12	12	12	4	4	4

Goal 1: Identify and recruit facilities
Goal 2: Preliminary walk-throughs
Goal 3: Collect facility information
Goal 4: On-site measurements
Goal 5: System performance analysis
Goal 6: Assessment Reports