

THE EADC PROGRAM DOE HELPING SMALL AND MEDIUM-SIZE MANUFACTURERS

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BACKGROUND

The Energy Analysis and Diagnostic Center (EADC) program serves small and medium-size manufacturers in 43 states by identifying in their plants specific energy-conserving and cost-saving measures. In addition, EADCs provide practical manufacturing experience for students of engineering and technology.

The Industrial Technology and Energy Management (ITEM) division of University City Science Center in Philadelphia has been managing the EADC program since its inception in 1976 as an outreach project of the U.S. Department of Commerce. ITEM continued its program management after the U.S. Department of Energy (DOE), created by legislation in 1978, became the program's sponsor. In 1992, DOE decided that the program's 30 EADCs ought to have a second field manager and awarded the western region of the nation to ITEM. Management of the eastern region is based at Rutgers University.

To understand an EADC better, it is essential to realize that all 30 of them were selected competitively, are located at universities, and are directed by professors of engineering or engineering technology and staffed by graduate and undergraduate students, but a faculty member must be on site during every energy audit. A list of their locations is provided at the end of this presentation.

To date EADCs have served more than 5,500 manufacturing plants in regions equivalent to a radius of about 150 miles. That enables them to reach 84% of the 124,000 eligible manufacturers in 43 states. (There are only about 1,600 eligible manufacturers in the 5 other contiguous states).

WHOM DOES THE PROGRAM SERVE

For a manufacturing plant to be served by an EADC, it has to meet three of the four following criteria:

- Maximum of \$1.75 million/year in energy costs.
- Maximum of \$75 million/year in gross sales.
- Maximum of 500 employees.
- Lack of in-house professional expertise in energy use and conservation.

Each EADC is allowed three exceptions per year, after prior approval by the field manager, for plants that meet only two criteria. Additionally, at least 70% of the plants audited in a given program year must have energy bills of at least \$100,000/year.

The small and medium-size manufacturers served most recently in the west averaged about \$31 million/year in gross sales, an employment of 178 persons, and about \$458,000 per year in energy costs. Average identified savings amounted to about 11% of cost and were 67% electric and 31% natural gas in the source affected.

Following an analysis of an energy audit performed by an EADC, the manufacturer receives a report that details specific energy-conserving and cost-saving recommendations and includes financial and technological justifications of each measure recommended. ITEM's engineers review and prepare a critique of every energy audit in the western region. In addition to recommending energy conservation opportunities, EADCs are required to report later on the implementation of their recommendations to each plant.

SUMMARY OF COST SAVING MEASURES AND INDUSTRIES SERVED

Recommendations for energy conservation and cost savings can be organized into eight broad classifications. These measures, along with their associated recommended cost savings (constant 1993 dollars) and percentages of achieved implementation are shown in Table 1 for plants served by an EADC between 1981 and 1993. It is evident from Table 1 that some types of measures contribute more to the total recommended cost savings than others. For example, four types of measures led the others and accounted for about 78% of the total recommended cost savings; they are (together with examples):

- Utility Supply
(Optimize plant power factors, restructure rate schedules, eliminate compressed air leaks.)
- Process Equipment and Changes
(Use energy efficient motors, belts, drives. Insulate equipment, modify refrigeration system. Exchange heat from hot process effluents. Replace inefficient equipment.)
- Buildings and Grounds
(Install more efficient lighting, improve space conditioning.)
- Alternate Sources
(Substitute more economical fuels.)

A similar analysis can be based on the types of manufacturers served. These data are presented in Table 2 and are organized by 2-digit SIC for plants served between 1981 and 1993. Eight industries that have historically led the others in recommended (and implemented) cost savings account for about 72% of the recommended amounts in Table 2; they are:

<u>SIC</u>	<u>Description</u>
20	Food and kindred products
22	Textile mill products
24	Lumber and wood products
30	Rubber and miscellaneous plastics products
32	Stone, clay, glass, and concrete products
33	Primary metal products
34	Fabricated metal products
35	Machinery, except electrical

VERIFICATION AND ANALYSIS OF SAVINGS

On a cumulative basis, EADCs have generated almost \$25 in implemented cost savings to manufacturers for every federal dollar invested in the program. We calculate that the federal government has received about \$6.25 for every federal dollar invested in the program. That return comes from taxes levied on the manufacturers' cost savings or incremental income.

How do we know those returns are correct? Recently we studied implementation results reported by EADCs from energy audits of 355 small and medium-size manufacturing plants. Then we interviewed all 355 manufacturers at their plants to learn more about their implementation.

Here is a summary of part of what we found:

- Over 92% of these plants had implemented some recommendations of EADCs and were indeed saving money, as well as conserving energy.
- About 90% agreed with all or most of the conclusions stated in their audit reports, and the other 10% agreed with some conclusions.
- Almost 60% of the recommendations had been implemented or would be within two years.
- A little more than 54% of the cost savings recommended had been implemented or would be within two years.
- The perception of principal benefits received and the reason for not implementing depend partially upon who sees the report.
- The largest perceived benefits are associated with a revelation or confirmation of energy inefficiencies and with a reduction of costs.
- Aiding decisions to install new equipment and convincing management of profitability are the two other most common benefits cited.
- The reason most responsible for not implementing an EADC's recommendations is financial risk, but unacceptable plant risk was a close second. Corporate officers and plant managers are more likely to reject recommendations for those reasons or because of schedule changes. (About 89% of EADCs' audit reports are seen by a corporate officer or plant manager or both.)
- An additional 14% of the recommended cost savings was in fact implemented more than two years after an energy audit.

Complete results of that study have been published as an ITEM report, and a summary was printed in the well-known periodical, "Plant Engineering"¹.

ILLUSTRATIVE EXAMPLES

A few specific examples illustrate what is found among plants recently served:

- A cement producer in Colorado saves over \$1.2 million/yr by converting a natural gas-burning kiln to coal. The plant realizes additional savings of nearly \$88,000/yr by reducing air infiltration to a preheater.
- An Oklahoma refiner and producer of natural and synthetic waxes saves nearly \$366,000/yr by improving the plant's steam system. Steam leaks and faulty steam traps were repaired; modifications were made to return condensate to the boiler; and steam and condensate lines were insulated. An additional \$5,200/yr in savings is also realized by replacing incandescent lamps with high-pressure sodium lamps.
- A manufacturer of pre-fabricated steel buildings and components in Texas saves \$24,000/yr by using capacitors to improve power factor. Implementation of a recommendation to change electric rate schedules produces another \$10,900/yr of savings. Repairing compressed air leaks yields \$1,000/yr in savings.

- A producer of dimensional lumber in Oregon saves over \$28,000/yr by reducing the air/fuel ratio of its wood-fired boiler. Controlling fan speeds to the dry kilns saves another \$22,000/yr. Improving lighting efficiency saves \$12,400/yr and repairing compressed air leaks saves another \$3,600/yr. Increasing the efficiency of selected motor systems by measures such as replacing standard motors with high-efficiency motors at burn-out, using notched V-belts, and installing high torque drive belts and sheaves leads to savings of nearly \$3,600/yr.
- A manufacturer of anodized and plated metal parts in Arizona saves \$60,000/yr by replacing electric resistance heating in plating and anodizing tanks with steam. Improving the lighting efficiency of the plant saves over \$1,100/yr. Installing shades over air conditioner condensers saves over \$400/yr and using synthetic lubricants adds \$360/yr in savings.

From first-hand experience we know that few if any of these energy-conserving or cost-saving recommendations would have been identified, analyzed, and implemented without the EADC. Small and medium-size manufacturers seldom have the time to do that work, and they are skeptical of those who offer to help for a fee or share of the savings. After an EADC has objectively done the initial work, they are willing --even anxious-- to hire contractors or equipment suppliers. But the EADC is the key ingredient.

SUMMARY

In summary, the profitability of investing in energy conservation by small and medium-size manufacturers, aided by the federal government's support through the EADCs, is very good. Of course, manufacturers must still have access to the funds to be invested and they must have confidence that other aspects of the business climate will continue to be favorable.

The relatively high implementation rates and excellent financial returns also provide a tribute to the manufacturers' confidence in the EADCs' recommendations and to their willingness to invest when the risks appear to be well-defined and manageable.

These results also demonstrate one means to improve the future competitiveness of the nation's small and medium-size manufacturers. Given practical and specific opportunities to lower costs without sacrificing output or quality, manufacturers as a group will take many of the actions needed to achieve the gains. When the federal government strengthens manufacturers' confidence by providing the information effectively, the results can be highly beneficial to the manufacturers, to the government, and to the nation as a whole.

REFERENCES

- 1 F. William Kirsch and William J. Clark III, "And the Survey Said: Energy Conservation Audits Help Most Manufacturers Save Money, Reduce Inefficiencies" Plant Engineering, September, 1994, p. 80.

Table 1
Cost Savings Recommended and Implemented in Broad Classifications (1981-1993)

<u>Measure</u>	<u>Cost Savings Recommended (\$/year)</u>	<u>% Implemented</u>
Combustion	24,417,165	49.3
Steam System	7,637,206	68.5
Utility Supply	29,269,946	60.6
Scheduling and Shipping/Handling	10,674,654	53.3
Process Equipment and Changes	48,945,438	48.2
Buildings and Grounds	45,445,014	59.6
Cost Savings Unrelated to Energy	1,478,570	21.8
Alternate Sources	36,771,243	24.4
T O T A L	204,639,236	49.2

Table 2
Cost Savings Recommended and Implemented by Each Industry (1981-93)

<u>SIC</u>	<u>Industry</u>	<u>No. Plants Served</u>	<u>Cost Savings Recommended (\$/year)</u>	<u>% Implemented</u>
20	Food and kindred products	546	26,389,138	45.3
22	Textile mill products	209	20,179,667	53.9
23	Apparel and other textile products	153	3,074,623	57.5
24	Lumber and wood products	214	13,588,321	42.9
25	Furniture and fixtures	110	3,515,249	57.5
26	Paper and allied products	222	11,622,864	42.0
27	Printing, publishing, and allied industries	192	5,056,949	51.8
28	Chemical and allied products	195	10,903,931	54.2
29	Petroleum and coal products	35	2,454,347	56.2
30	Rubber and miscellaneous plastics products	423	16,445,568	51.9
31	Leather and leather products	30	1,018,838	65.5
32	Stone, clay, glass, and concrete products	157	20,161,694	32.0
33	Primary metal products	257	15,384,450	50.3
34	Fabricated metal products	562	20,304,936	55.9
35	Machinery, except electrical	443	13,999,825	55.5
36	Electrical equipment and supplies	257	8,889,156	50.6
37	Transport equipment	174	5,900,974	59.5
38	Measuring, analyzing, and controlling instruments	117	3,122,938	49.8
39	Miscellaneous manufacturing industries	77	2,625,772	52.5

EADC Locations

Eastern Region

University of Dayton, Dayton, OH
University of Florida, Gainesville, FL
Georgia Institute of Technology, Atlanta, GA
Hofstra University, Hempstead, NY
University of Louisville, Louisville, KY
University of Maine, Orono, ME
University of Massachusetts, Amherst, MA
University of Michigan, Ann Arbor, MI
Mississippi State University, Starkville, MS
North Carolina State University, Raleigh, NC
University of Notre Dame, South Bend, IN
Old Dominion University, Norfolk, VA
University of Tennessee, Knoxville, TN
West Virginia University, Morgantown, WV
University of Wisconsin, Milwaukee, WI

Western Region

Arizona State University, Tempe, AZ
University of Arkansas, Little Rock, AR
Bradley University, Peoria, IL
Colorado State University, Fort Collins, CO
Iowa State University, Ames, IA
University of Kansas, Lawrence, KS
University of Missouri, Rolla, MO
University of Nevada, Reno, NV
Oklahoma State University, Stillwater, OK
Oregon State University, Corvallis, OR
San Diego State University, San Diego, CA
San Francisco State University, San Francisco, CA
South Dakota State University, Brookings, SD
Texas A&M University, College Station, TX
Texas A&M University-Kingsville, Kingsville, TX