3680 PDF

Industrial Assessment Database for Energy Efficiency and P2

Michael Muller and Peter Polomski
Office of Industrial Productivity and Energy Assessment

Introduction

The Energy Analysis and Diagnostic Center / Industrial Assessment Center (EADC/IAC) Program, in existence since 1976, is a federally funded service provided to small to medium sized manufacturing firms. The program is funded out of the Office of Industrial Technology of the U.S. Department of Energy with support from the Pollution Prevention Research Branch of the U.S. Environmental Protection Agency. Over 5000 energy assessments have been performed by teams made up of faculty and students from engineering schools at universities throughout the United States. Normally the teams perform a one day site visit at a manufacturing plant which follows an extensive pre-assessment data gathering function. Following the site visit, the assessment team prepares a written report for the industrial client which includes information about the plant's resource use, processes, waste handling, and other operations. In addition, several assessment recommendations (ARs) are written up with sufficient engineering design to provide for anticipated savings, implementation costs and simple payback for each AR. Nearly 50% of the more than 35,000 recommendations have been reported implemented by the industrial clients.

The program has been highly successful since its inception with four schools. With 30 universities now active Centers, combined assessments encompassing both energy conservation and waste minimization began on a limited basis during the 1994 program year. Expansion of this effort to all participating schools is planned for 1996.

Program benefits are not limited to the manufacturers served, students educated and faculty enriched but also extend to the community at large through data generated by the program. Since 1980, the data has been compiled from the assessments performed under this program and since FY 93 has been made available to the public via internet links to the Office of Industrial Productivity and Energy Assessment (OIPEA) at Rutgers University. For FY 95, a major revision to the database and the accompanying Assessment Recommendation Coding (ARC) scheme was undertaken to bring the structure in line with the combined nature of the program.

The EADC/IAC Program Database

The EADC/IAC Program Database has evolved from a flat compendium of data issued annually to a fully relational dataset updated daily. Data provided from the EADC/IAC reports is uploaded in spreadsheet "boilerplates" via the internet to OIPEA where it is processed through various translation algorithms and ultimately appended to the database. Responsibility for the accuracy of the data rests with the uploading Center but consistency checks are included within the translation schemes.

The database consists of two separate datasets: the Assessment Database [ASSESSxxx.DBF] contains information pertaining to each individual assessment and the Recommendation Database [RECCxxx.DBF] where information pertinent to each recommendation arising from the site visit is logged (Table 1). The database relation exists via a derived common identifier field consisting of the EADC/IAC name and report number which together comprise the ID field in the assessment and a portion of the SUPERID field in the recommendation database. To speed data transfer, most derived fields such as the ID field in the recommendation data set have been left to the user.

TABLE 1. FIELDS IN THE EADC/IAC DATABASES

ASSESSMENT		RECOMMENDATION	
Field Name	Description	Field Name	Description
id	Unique identifying number given to all records based on EADC/IAC Name & Report # .	superid	The unique identifying number given to all records based on EADC/IAC Name, Report # & Recc #.
eadc/iac	The identifier assigned to each EADC /IAC.	ar_number	The recommendation number sequentially as it appears in the report
repnum	The number assigned by the EADC/IAC to the visit & report.	appcode	Application for recommendation (see ARC Manual).
visitdate	The date of the assessment.	arctype	Recommendation type (see ARC Manual).
sic	The Std. Industrial Code for the plant's principle product.	arc	The code representing the specific recommendation made (see ARC Manual).
sales	The annual sales in dollars for the site reported by the client.	impdate	Client reported date of implementation of this Assessment Recommendation.
employees	The total number of employees on the site.	impstatus	Client reported implementation status of this Assessment Recommendation.
plant_area	The total amount in square feet of area used for production and office support purposes.	impcost	Client reported implementation cost. This cost may be estimated.
products	Principle products of the plant (in words).	impconser	Client reported amount of energy conserved upon implementation of the Assessment Recommendation.
resources	The total number of resources tracked at the plant.	impsaved	Client reported amount of money saved upon implementation of the Assessment Recommendation.
produnits	The units of production for the principle product (coded).	psourccode	The Primary Resource [coded]. This resource may not necessarily be the most important resource involved in the Assessment Recommendation, but is usually chosen based on greatest usage before conservation measures are suggested (logic follows for secondary & tertiary).
prodlevel	The client reported total number of units produced annually.	pconserved	The amount of primary resource conserved.
prodhours	Client reported annual production hours.	psaved	The primary resource's dollar savings for this Assessment Recommendation.
numars	The total number of ARs recommended in this report.	ssourccode	The Secondary Resource involved in this Assessment Recommendation.
--------	The annual usage and cost of energy taken from actual bills.	sconserved	The amount of secondary resource conserved
nrgcosttot	Total energy cost for this client.	ssaved	The secondary resource's dollar savings.

--------	The annual production and cost of waste.		tsourccode	The Tertiary Resource involved in this Assessment Recommendation.
wstcosttot	Total waste cost for the client.		tconserved	The amount of Tertiary resource conserved.
comments	General comments about the assessment.		tsaved	The Tertiary resource's dollar savings.
fy	The fiscal year in which the assessment was performed.		rebate	Indicative of whether the Assessment Recommendation included a rebate.
			incremntal	Indicates if the AR is to be implemented on an incremental basis- included in the database for the first two years only.
			descript	Description in words of the AR.

Resource Stream Tracking in the Database

Program expansion into the waste reduction / pollution prevention arena necessitated a revamping in the way resources are thought of in the database. Spirited debate centered around which database modifications would expand the presented information without sacrificing understanding of the issues. Ultimately it became clear that any suggestions or considerations for change must represent a clear and unmistakable improvement over past practice. The judgments made often became a compromise between two or more equally valid points of view with the simpler argument holding sway.

Perhaps the easiest decision centered on the number of resource streams to track ("track or tracking" refer to information inclusion in the Assessment Database in terms of cost and usage and in the Recommendation Database where savings and reductions appear). Waste reduction recommendations tend to involve energy, resources, and waste. An increase from two to three streams allows recognition of tertiary detail which in the past would have been buried in the recommendation calculations. Recommendations have been calculated that involve more than three streams (even six or more!) but good database management precludes carrying so many as this burdens the database with a large number of empty fields acting merely as place holders.

The stream definition question focused debate on tracking issues important enough for inclusion without becoming bogged down in minutiae. Previously, the only items tracked involved energy sources, additional income, material costs and operating costs. Stream types now define four primary areas of interest:

- ◊ Energy
- ◊ Waste Reduction
- ◊ Resource Costs
- ◊ Production

The energy streams remain unaffected. Waste minimization and pollution prevention plays require the obvious consideration of liquid and solid waste (hazardous and non-hazardous) and gaseous waste in the waste reduction category. Water disposal is differentiated from other liquids conceding the importance of this shrinking resource. Resource costs break out detail from the old material and operating cost fields. Material is broken into primary raw material and ancillary material cost. Personnel changes and administrative costs cover the operating cost category. Water consumption costs become germane to many waste reduction recommendations as to warrant inclusion as a distinct heading. The production streams track one primary product and one byproduct only.

Waste Reduction Assessment Recommendation Coding

Concurrent with the inclusion of waste reduction efforts in the industrial assessment is the addition of a new coding scheme for the assessment recommendations. Older coding consisted primarily of Energy Conservation Opportunities (ECOs) and the need arose for a coding system for recommendations involving enhancements in energy efficiency, waste minimization and manufacturing productivity. Most recommendations can be collected into groups that focus either on the same system or on the same general strategy for enhancement. Attempts were made to develop a coding scheme which would be consistent along either one of those lines, but neither approach proved satisfactory. The resulting organization of recommendations has been done in an "expert system" fashion. Therefore, the code has been assembled to best collect recommendations which would be considered together by an experienced professional. For example, recommendations for energy savings for air compressors (a system) are grouped. In a similar fashion, waste heat recovery (a strategy) recommendations are collected together.

A coding system like this will change frequently as new technologies and strategies reach the manufacturing floor. The ARC consists of a code as follows:

X.YYYY.Z

The first number, "X" is the recommendation type. Examples are 2 for energy savings, 3 for waste reduction etc. The second four numbers, "Y1Y2Y3Y4", detail the strategy being employed. The final number, "Z" is the application of the strategy, indicating whether the recommendation impacts the process, the building and grounds, or other application (Table 2).

Database Strengths and Weaknesses

The EADC/IAC Program Database is a unique representation of over 15 years of manufacturing site visits by engineering faculty. Updated daily, the database reflects the latest in industrial assessment techniques, energy and waste costs for small to medium size industrial plants throughout the U.S., recommended / implementation costs and savings for a large number of recommendations involving a variety of resource streams, and other useful data. The database has been used successfully around the world for pre-assessment preparation, utility Demand Side Management planning, government policy recommendations, in conjunction with case studies to gain insights into the investment criteria required for successful recommendations, and many other applications.

The database must still be viewed for what it is: a collection of information generated by human beings. There can be errors made in almost any step of the data collection process. There are biases in the data and disagreements over what constitutes an acceptable technology. Earlier datasets do not provide the level of detail found after FY 94. Electricity data does not break out demand, etc. This should be remembered during any and all analysis of the data.

Database Location

The database access location for downloading purposes is the OIPEA Home Page on the World Wide Web (W3) at: "http://OIPEA-WWW.rutgers.edu".

FOR MORE INFORMATION

Michael R. Muller
Director, Office of Industrial Productivity and Energy Assessment
Rutgers, The State University of New Jersey
Piscataway, NJ 08855-1179
(908) 445-3655

TABLE 2. WASTE MINIMIZATION / POLLUTION PREVENTION ARC GROUPS

Major Group (Y1)	Sub Group (Y2)	Heading (Y3)
Operations	Procedures	Process Specific
		Material Application
		Stripping
		Scheduling
		Desulfurization/Slag Mgmnt
		Reduction / Elimination
		Product Specifications
		Byproduct Use
	WasteStream Contamination	Dragout Reduction
		Rinsing Strategies
		Miscellaneous
	CAD/CAM	General
Equipment	General	Fault Tolerance
		Painting Operations
		Process Specific Upgrades
		Tank Design
		Automation
		System Monitoring
Treatment / Minimization	General	Neutralization
		Removal of Contaminants
		Material Concentration
Water Use	General	Close Cycle Water Use
		Reduction
		Water Quality
		Chlorination

Recycling	Liquid Waste	Oil
		Ink
		White Water
	Solid Waste	Sand
		Metals
Waste Disposal	General	Sludge Maintenance
		Miscellaneous
Maintenance	Cleaning / Degreasing	Mechanical Cleaning
		Reduction of Cleaning
		Rag Use
		Preventive Maintenance
	Spillage	Operations
		Hardware
	Other	Leak Reduction
		Miscellaneous
Raw Materials	Solvents	Use Reduction
		Emission Reduction
		Material Replacement
		Solvent Recovery
	Other Solutions	Water-Based Substitutes
		Other Substitutes
	Solids	General