

Abstract

This report documents all activity of the University of Miami Industrial Assessment Center (MIIAC) grant awarded by the United States Department of Energy (USDOE) Office of Energy Efficiency and Renewable Energy (EERE) Industrial Technology Program (ITP). This grant was coordinated through a collaborative effort with the Center for Advanced Energy Systems (CAES) located at Rutgers University in New Jersey (www.caes.rutgers.edu) which acted as the program's Field Manager. The grant's duration included fiscal years 2003-2006 (September 2002 – August 2006), and operated under the direction of Dr. Shihab Asfour, Director (MIIAC). MIIAC's main goal was to provide energy assessments for local manufacturing firms. Energy consumption, productivity enhancement, and waste management were the focus of each assessment. Energy savings, cost savings, implementation costs, and simple payback periods were quantified using scientific methodologies and techniques. Over the four-year period of the grant, the total number of industrial assessments conducted was 91, resulting in 604 assessment recommendations and the following savings: 73,519,747 kWh, 435,722 MMBTU, and \$10,024,453 in cost savings. A total of 16 undergraduate and graduate students were trained on energy assessment. Companies in over 40 different zip codes were assessed.

The work conducted under the University of Miami Industrial Assessment Center (MIIAC) grant was issued by the Department of Energy (D.O.E.), included fiscal years 2003-2006 (September 2002 – August 2006), and operated under the direction of Dr. Shihab Asfour, Director (MIIAC). The Industrial Assessment Center (IAC) program began as a result of the 1970's energy crisis. Launched in 1976 with only four schools, the program during this most recent grant period included twenty-six centers located at colleges and universities throughout the country. All of the centers operated under the same grant which was funded by the United States Department of Energy (USDOE) Office of Energy Efficiency and Renewable Energy (EERE) Industrial Technology Program (ITP). Although each center was individually managed, the program coordinated through a collaborative effort with the Center for Advanced Energy Systems (CAES) located at Rutgers University in New Jersey (www.caes.rutgers.edu) which acted as the program's Field Manager.

The IAC program at University of Miami employed undergraduate and graduate engineering students to assess manufacturing plants and identify measures that saved energy through improved efficiency, waste minimization, pollution prevention, productivity enhancements, and overall reduction of operating costs. These students worked for the MIIAC on a part-time basis and under the direct supervision of Center's faculty and staff.

Plant eligibility depended on several factors. MIIAC concentrated on the geographic area represented by the southern half of the State of Florida (from Key West to the city of Orlando). Proprietary client data, as stipulated by grant guidelines, was always protected and all materials containing information identifying the plant was offered to the client for review. When needed, MIIAC asked for client permission to use their data for the development of case studies and promotion of industrial efficiency. Additionally, the following criteria had to be met by the plant:

1. Utility Costs between \$100,000 - \$2.5M/ year
2. Gross sales at maximum \$100M/year
3. Employees at maximum 500
4. Lack of in-house professional expertise in energy use and conservation non-existent

All assessments were expected to have a minimum of \$30,000 in energy cost savings and \$30,000 in combined cost savings from waste minimization and productivity improvement for a total savings of \$60,000. MIIAC continually strived to achieve savings per assessment day that were higher than \$60,000.

MIIAC delegated two students as Lead Student and Back-up Lead Student respectively. Lead Students assumed a managerial role; maintained the Center's student roster in the on-line IAC student registry, ensured departing students completed their exit interviews, and with the Director's approval interacted with the IAC student activities coordinator and Technical Field Manager. The Lead Student provided suggestions and feedback regarding the student experience to other students within the program, the Center's management, and to IAC program management. In addition, the Lead Student attended the IAC Student Meeting each February. When offered by the DOE, students attended professional conferences, meetings and technical training venues.

The first step in the IAC assessment process required a team of graduate students to perform a preliminary engineering analysis by examining the plant's energy, water and waste bills. After the information was analyzed, the team formulated a strategic plan for the site visit. Once on site, the team toured the plant, reviewed the plant layout, collected production and operating data, and tested and inspected the plant's equipment and procedures to identify efficiency recommendations. Additional data was collected through interviews or discussions with the plant's management and staff. The initial findings were then presented to the plant's management. MIIAC's recommendations were based upon observations and measurements made at the plant. Due to the scope of the grant,

focus was limited to general operations, energy consumption, and production processes. Specific and quantitative recommendations of cost savings, energy conservation, and waste minimization were then communicated to the client via a detailed report of findings.

While MIIAC shared fundamental goals with other university IACs; MIIAC's methodologies including data capture and analysis differed. The team utilized state-of-the-art measuring equipment such as: electrical data loggers, temperature and humidity loggers, pressure logging kit, power meters, combustion analyzer, ultrasonic leak detector, and infrared camera for conducting these assessments. With respect to the consumption of electrical power, the team implemented data logging sessions. During the grant, MIIAC acquired close to 600 electric current data loggers that were utilized in capturing electrical consumption data at the company being assessed in order to generate accurate estimates of the cost savings computed for each of the proposed Assessment Recommendations (ARs). The process of electrical data logging was unique to MIIAC. With the aid of these data loggers, MIIAC identified such things as: Program Power, i.e., isolating time-of-usage (on-peak/off peak); Alignment Power, transferring on-peak to off-peak usage; Ghost Power, identifying wasteful consumption of electrical energy when the plant is vacant; Effective Power, identifying motors with low efficiency ratings; and Re-Engineering Power, finding ways to streamline usage from manufacturing processes.

The MIIAC final report covered information regarding administrative, engineering, manufacturing, and logistics group habitual consumption of energy and other resources. Reports also included extensive detail regarding: (1) data, measurements and/or historical records information captured during the assessment; and (2) specific recommendations coupled with comprehensive calculations and any supporting assumptions. Within 60 days of the assessment date, the client and the field manager received a copy of the report for review. This report, in addition to assessment data, was also uploaded to the IAC database. Within six to nine months after an assessment report had been presented, MIIAC contacted the client for a discovery session to determine which recommendations had been implemented or scheduled for implementation and their respective associated costs and benefits. Findings were then reported to the Technical Field Management Organization (TFMO) and the IAC Database.

Under this grant, MIIAC completed 91 industrial assessments including several companies designated as "Industries of the Future": Aluminum, Chemicals, Forest Products, Glass, Metal Casting, and Mining. The variety of products and processes of the plants included areas such as: heat-treating and laminating glass, metal fabrication, plastics manufacturing, milk, soda, juice, and water bottling, aluminum extrusion, mining for cement and asphalt, cardboard manufacturing, pharmaceuticals, insulation, rubber manufacturing, and wood products. For a predominate number of these assessments, MIIAC employed DOE software including AIRMaster+, Motormaster 4.0+, and Steam System Tool Suite including 3E Plus. The total number of industrial assessments conducted under this grant was 91 including 604 assessment recommendations and the following savings¹: 73,519,747 kWh, 435,722 MMBTU, and \$10,024,453 in cost savings. A total of 16 undergraduate and graduate students were trained on energy assessment. Companies in over 40 different zip codes were assessed.

¹ For detailed assessment recommendation data, please see accompanying table.

Detailed Assessment Recommendation Data

Assessment Number	Total Number of AR's Generated	Amount of Energy Saved kWh	Electric Savings	Amount of Energy Saved MMBTU	Gas Savings	Zip Codes Covered
51	3	75,000.00	\$ 5,000.00			33142
52	5	1,000,000.00	\$ 233,064.00			33127
53	6	190,997.00	\$ 13,643.00			33169
54	8	515,416.00	\$ 27,867.00			33162
55	9	851,189.00	\$ 36,691.00			33137
56	8	147,333.00	\$ 10,592.00	23,174.00	155,492.00	33314
57	9	319,176.00	\$ 22,368.00	6,875.00	42,006.00	33314
58	6	215,186.00	\$ 15,063.00	312.00	1,906.00	33314
59	8	287,334.00	\$ 20,126.00			33166
60	7	27,335.00	\$ 1,914.00	9,915.00	59,186.00	33166
61	7	641,363.00	\$ 44,897.00			33166
62	7	2,445,415.00	\$ 143,824.00			33166
63	6	139,687.00	\$ 9,732.00			33142
64	6	961,251.00	\$ 67,288.00			33018
65	8	599,965.00	\$ 26,415.00			33157
66	9	594,960.00	\$ 29,772.00			33069
67	5	163,823.00	\$ 11,468.00			33069
68	5	141,621.00	\$ 9,947.00			33442
69	7	1,435,965.00	\$ 119,815.00			33178
70	5	416,950.00	\$ 24,487.00			33316
71	8	76,553.00	\$ 3,617.00			33010
72	5	103,217.00	\$ 4,892.00			33010
73	7	599,760.00	\$ 28,614.00			33142
74	7	784,323.00	\$ 43,790.00	3,159.00	18,447.00	33162
75	6	94,024.00	\$ 4,480.00			33014
76	6	69,497.00	\$ 3,315.00	153.00	1,535.00	33014
77	8	241,928.00	\$ 18,411.00			33142
78	9	602,965.00	\$ 29,681.00			33935
79	11	611,266.00	\$ 30,514.00			33935
80	5	229,123.00	\$ 11,482.00			33142
81	6	213,346.00	\$ 9,930.00			33014
82	7	429,466.00	\$ 22,438.00			33167
83	5	158,695.00	\$ 8,340.00	283.00	3,084.00	33178
84	5	124,302.00	\$ 7,007.00			33010
85	7	190,072.00	\$ 10,969.00	273.00	2,571.00	33442
86	8	557,081.00	\$ 31,352.00			33122
87	5	83,174.00	\$ 6,218.00	3,109.00	20,080.00	33147
88	8	516,524.00	\$ 29,162.00			33169
89	7	1,353,149.00	\$ 80,308.00			33152
90	7	1,860,742.00	\$ 92,410.00			33142
91	5	552,250.00	\$ 29,079.00			33137
92	6	697,110.00	\$ 36,678.00			33172
93	9	1,176,974.00	\$ 71,342.00			34104
94	9	457,226.00	\$ 26,587.00			33014
95	8	1,728,067.00	\$ 100,654.00	1,643.00	11,322.00	33166
96	7	286,651.00	\$ 15,955.00			33334
97	6	10,245,600.00	\$ 4,671,529.00	298,797.00	240,280.00	33014
98	6	422,282.00	\$ 25,032.00	89.00	901.00	33054
99	7	700,583.00	\$ 41,016.00	3,952.00	33,273.00	33138
100	5	232,967.00	\$ 14,594.00			33010
101	7	484,281.00	\$ 26,790.00	248.00	1,746.00	33405
102	5	3,392,143.00	\$ 115,569.00			33619
103	6	413,042.00	\$ 23,000.00	273.00	2,613.00	33404
104	6	1,302,459.00	\$ 64,465.00	37,105.00	293,130.00	33021
105	6	2,401,849.00	\$ 150,836.00	2,440.00	26,325.00	33132
106	7	297,232.00	\$ 23,167.00			33020
107	6	128,564.00	\$ 6,978.00	293.00	4,012.00	33186
108	6	227,922.00	\$ 12,381.00			33166
109	9	787,120.00	\$ 41,568.00			33020
110	5	62,260.00	\$ 4,521.00			33018
111	5	590,355.00	\$ 35,943.00			33014
112	5	514,564.00	\$ 30,000.00			33179
113	5	489,153.00	\$ 34,000.00	1,052.00	12,411.00	34950
114	9	445,530.00	\$ 23,973.00	12,350.00	80,610.00	33013
115	6	365,359.00	\$ 25,538.00	8,031.00	33,460.00	33442
116	7	852,553.00	\$ 58,917.00			33442
117	5	436,337.00	\$ 25,293.00			34243
118	7	464,664.00	\$ 30,570.00	1,352.00	8,966.00	34243
119	7	2,813,706.00	\$ 195,000.00			34240
120	5	50,010.00	\$ 9,200.00			33411
121	6	215,773.00	\$ 12,067.00			33404
122	9	455,103.00	\$ 50,000.00			33054
123	10	482,431.00	\$ 38,000.00			33325
124	10	482,431.00	\$ 38,000.00			33311
125	7	2,491,147.00	\$ 130,000.00	2,940.00	32,634.00	33442
126	6	118,222.00	\$ 6,672.00	1,782.00	27,437.00	33150
127	8	1,582,485.00	\$ 110,000.00			33069
128	7	1,066,749.00	\$ 58,641.00	7,595.00	88,486.00	33404
129	5	278,703.00	\$ 20,000.00			33069
130	7	191,599.00	\$ 10,908.00	427.00	4,791.00	33054
131	8	3,787,593.00	\$ 100,068.00	6,169.00	41,642.00	33321
132	5	1,076.00	\$ 6,500.00			33054
133	6	1,701,136.00	\$ 131,000.00			33054
134	6	2,816,947.00	\$ 223,423.00			33805
135	6	1,326,925.00	\$ 120,000.00			34787
136	5	833,418.00	\$ 50,000.00			32811
137	7	150,320.00	\$ 15,000.00			33054
138	8	1,354,118.00	\$ 119,000.00	1,931.00	18,750.00	32837
139	5	423,795.00	\$ 110,000.00			32955
140	5	234,790.00	\$ 52,000.00			33815
141	5	437,000.00	\$ 35,000.00			33167
91	604	73,519,747.00	\$ 8,757,357.00	435,722.00	1,267,096.00	