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Pilot Project for a Commercial Buildings
Energy Analysis and Diagnostic Center
(EADC) Program

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Executive Summary

Commercial energy use costs businesses around \$70 billion annually. Many of these businesses are small and medium sized organizations that do not have the resources to help themselves, or to pay for professional engineering services to help reduce their energy costs and improve their economic competitiveness. Energy cost reduction actions with payback times of around two years could save the commercial sector 15 - 20%, or \$10 - \$15 billion per year.

This project was initially intended to evaluate the feasibility of performing commercial energy audits as an adjunct to the industrial audit program run by the U.S. Department of Energy Industrial Office. This program is housed in 30 universities throughout the United States. Formerly known as Energy Analysis and Diagnostic Centers (EADC's), the university programs are now called Industrial Assessment Centers (IAC's) to reflect their expansion from energy use analyses to include waste and productivity analyses.

The success of the EADC/IAC program in helping the manufacturing sector provides an excellent model for a similar program in the commercial buildings sector. This project has investigated using the EADC/IAC approach to performing energy audits for the commercial sector, and has determined that such an approach is feasible and cost effective.

When this commercial EADC/IAC project was initially proposed, there appeared to be substantial support in Washington for funding energy efficiency programs. Shortly after this project was started, the elections in November 1994 dramatically changed the spending policies of the country and the likelihood of major funding for a program like this seems low. As a result, in addition to completing the original proposal to evaluate commercial energy audits performed by an IAC team, this project has studied a lower-cost alternative program for performing commercial energy audits. This alternative would still require some funding depending on the level of coverage desired, but the program costs would be significantly less.

Overall conclusions and recommendations for this study are as follows:

Conclusions

- Significant opportunities exist in the commercial sector to reduce energy operating costs and improve business profitability;
- Many commercial facilities recognize the need to reduce their energy operating costs, but do not have the time or resources to identify and determine the cost effectiveness of these opportunities;
- Utility audit services offered to commercial customers are often inadequate and generally consist of quick walk-through audits with emphasis only on the lighting system;

- Using university faculty and students to conduct commercial energy audits and prepare high quality, technically competent reports and recommendations provides a highly cost effective program to assist the commercial buildings sector;

- A low-cost commercial assistance program can be conducted in those universities and colleges that already teach an energy management course - and the commercial audits can be conducted as part of the course requirements;

- A formal commercial energy assistance program based on the EADC/IAC model offers the greatest potential to help the commercial sector, and can provide the greatest range of opportunities to commercial businesses to reduce energy costs, improve profitability and productivity, and also to reduce waste.

Final Recommendations

- The US DOE Office of Buildings Technologies should initiate a Commercial Buildings Assessment Center (CBAC) program modeled after the EADC/IAC program run by the Office of Industrial Technologies. The goal for this CBAC program should be to have at least one Center in each state, and to have one additional center in each state for each five million population.

However, the present political and federal funding climate does not appear likely to allow this recommendation to be implemented in the near future. With this realization, this project is recommending an alternative program that achieves many of the same goals as a full CBAC program at minimal cost.

- DOE/OBT should encourage universities with EADC/IAC programs to incorporate commercial energy audits into their energy management classes. The energy audit report template developed in this project is available for use by these universities.

- If some limited amount of funding is available from DOE/OBT, then an expanded commercial auditing program could be supported using an EADC/IAC trained teaching assistant to participate in the facility visits and to serve as a technical consultant during the preparation of the final commercial energy audit reports.

**PILOT PROJECT FOR A COMMERCIAL BUILDINGS ENERGY ANALYSIS AND
DIAGNOSTIC CENTER (EADC) PROGRAM
Grant No. DE-FG44-94R10625**

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I. Introduction

The need for commercial energy efficiency

In 1994, the commercial sector accounted for about 16 percent of the energy used in the United States at a cost of approximately \$70 billion. Energy efficiency gains in this sector can help reduce the reliance on imported oil, reduce CO₂ and SO_x emissions and improve the U.S. economy by increasing commercial profits and/or reducing commercial costs. In some states, such as Florida, the commercial sector is much larger than the industrial sector. Consequently, in some areas of the U.S. successful commercial energy efficiency programs could have a greater impact on reducing energy use than industrial programs.

The need for a commercial energy audit program

Most small businesses do not believe they can afford to spend money on energy audits. Even though an energy audit could result in significant dollar savings for the business, most businessmen want to know for sure that the energy audit will save them money before they are willing to make an investment in the audit itself.

Many utilities have been performing free or low-cost energy audits for their commercial customers for some time. However, these programs may come to a halt in the future; utilities are cutting their own costs as they anticipate deregulation and competition for customers. Energy audits are not a money making venture for a utility company. In addition, utilities have often been somewhat reluctant to help their customers save significant amounts of energy because that reduces the utility company's profit. Utilities like to find ways that a customer can reduce demand, but not ways that the customer can reduce its energy consumption. An independent energy audit would show the customers way to save both energy and demand.

II. The Commercial IAC Project

As initially proposed

This project was initially intended to evaluate the feasibility of performing commercial energy audits as an adjunct to the industrial audit program run by the U.S. Department of Energy Industrial Office. This program is housed in 30 universities throughout the United States. Formerly known as Energy Analysis and Diagnostic Centers (EADC's), the university programs are now called Industrial Assessment Centers (IAC's) to reflect their expansion from energy use analyses to include waste and productivity analyses.

Adding a commercial program as an incremental component of the industrial program would avoid much of the startup cost normally associated with a new program because the IAC's are already established with space, equipment, training programs, and staff. Therefore, the cost of running a commercial audit program through existing IAC's would only involve funding the audits themselves. This cost would depend heavily on the size of commercial facilities which

would be audited and the size of the service territory, but would probably cost about \$2,000 per audit (see cost analysis in Section III A below). The IAC's currently perform 30 industrial audits per year. The cost of funding the same number of commercial audits would be \$60,000 per year per IAC. If all 30 IACs were funded to add this commercial component to their industrial program, it would cost DOE at least \$1.8 million per year to implement. This does not include the cost of hiring a project manager like Rutgers University or the University City Science Center to maintain program quality and consistency.

When this commercial EADC/IAC project was initially proposed, there appeared to be substantial support in Washington for funding energy efficiency programs. Shortly after this project was started, the elections in November 1994 dramatically changed the spending policies of the country and the likelihood of major funding for a program like this seems low.

As a result, we have revised our project direction somewhat. In addition to completing the original proposal to evaluate commercial energy audits performed by an IAC team, we have studied a lower-cost alternative program for performing commercial energy audits. This alternative would still require some funding depending on the level of coverage desired, but the program costs would be significantly less.

III. Description of Work

A. The IAC Audits

We performed five commercial energy audits using a team of three IAC students. All three were graduate engineering students. The student with the most IAC experience was the team leader and was responsible for locating audits, supervising the work of the other two students, and putting together the final report. Unlike the IAC audits, no faculty member accompanied the audit team to the commercial facilities. This was deemed unnecessary for two reasons. One, the commercial facilities do not have production lines and the safety concerns associated with industrial facilities are not as critical. Second, the variety of activities is greater in the industrial audits and the faculty member's experience in identifying savings opportunities is needed more. Third, none of the audits was performed outside of Gainesville and therefore, there was no official university travel.

The facilities that were audited were selected to represent a range of commercial facilities. We audited one large facility (a combination grocery store/department store), three medium-sized facilities (a large restaurant, an office supply store and a bank), and one small facility (a video rental store). The size of these facilities does not correspond directly to the size of their energy bills.

Two of the facilities (the grocery store and the video store) were repeat visits to facilities audited by student audit teams (described in Section B below). We repeated these two audits to check the quality of the student reports and to see whether the IAC team identified additional savings

that the students had missed. Complete copies of all five IAC audit reports are provided in Appendix E.

Table I shows the time and costs involved in each of the IAC audits, as well as the size of the electric bills and the savings achieved by the IAC team. The team spent the most time on the audit for the office supply store. This happened because the metering system for this store was complex and the students were trying to locate all energy uses in order to develop a correct energy balance for the facility. The facility was spread through a strip mall shopping center and it was difficult to establish exactly which meters belonged to which facility. Otherwise, the large grocery store would have required the most time for the audit.

Table I. IAC Audits

Type of audit	Students/ Hours spent on audit	Cost of audit		Electric Energy bill	Energy Cost Savings	Savings as % of Energy Use
		Student team only	Incl. support costs			
1. Grocery store	3/31	\$226.75	\$453.50	\$200,779	\$28,700	14%
2. Restaurant	3/23.1	\$194.75	\$389.50	\$39,967	\$7,121	18%
3. Office supply	3/31.5	\$242.75	\$485.50	\$34,900	\$8,200	23%
4. Bank	2/15	\$124.50	\$249.00	\$13,300	\$5,400	39%
5. Video store	3/26	\$190.50	\$381.00	\$12,060	\$3,711	29%
Totals		\$979.25	\$1,958.50	\$301,006	\$53,132	

The costs shown in Table I include the student time spent on the on-site visit (2 or 3 students per audit), the analysis of the potential energy management opportunities, the compilation of the report (using the boilerplate format developed for the student program described below), a review of the audits by the IAC staff person who reviews the IAC reports; consultation with the principal investigator on problem areas as needed; and the copying and mailing costs for the reports. An average cost of \$650 per audit (including overhead) would probably fund similar audits for facilities with energy bills in the range of \$30,000-\$100,000 per year. This assumes a cost of \$5/hour for student team members and \$10/hour for the team leader. It also assumes that all audits would be performed locally with no travel costs.

If this program were to be extended comparable to the IAC assessment program, the costs would be higher than shown above. All five of these audits were performed in Gainesville, so there was no travel expense. With a 150-mile radius to the IAC service territory, the IAC teams have a maximum travel time of approximately 3 1/2 hours each way for some audits. This involves

the expense of a vehicle as well as paying the team members for their travel time. Assuming an average travel time of 2 hours each way, and three team members per audit, the average cost for student travel would be \$50 for car rental and \$80 for student time (\$10/hr for the team leader and \$5/hr for the team members). With 45 percent overhead, the average cost for this program with minimal faculty participation would be approximately \$850.

The IAC program requires the presence of a faculty member at the facility visit. If a commercial program had the same requirement, the cost would increase by approximately one day of faculty time per audit. Assuming a faculty cost of \$375 per day (including fringe benefits), the audit cost with overhead would be approximately \$1400 per audit. Because the faculty member often identifies ECOs that the students would not normally consider, the time needed for analysis of ECOs would also increase. This additional time would probably be the equivalent of 10 hours of student time and 4 hours of team leader time for an additional \$90 per audit, or \$130 with overhead. Therefore, the total average audit cost for an IAC program including full faculty participation would be a little over \$1500 per audit.

Audit Savings:

As Table II shows, all five IAC audits paid for themselves in savings to the customer. The cost savings for each is more than the actual cost of the audit. In addition, the savings for each is higher than the estimated cost of an IAC-type program (\$1500/audit). Furthermore, the cost savings for only one facility (the video store) is less than the \$4,000 cost per audit allocated to industrial IAC audits. If the commercial program followed the IAC program guidelines of setting a lower limit of \$30,000 on annual electric bills, this audit would not have been performed. However, because of the lower cost associated with commercial audits, even the smaller facilities can save the cost of the audit. In fact, the percentage savings for the video store was the second highest percentage savings of the five audits. This indicates that a program that assists smaller energy users could be very cost effective.

Table II. IAC Audit Costs and Savings

Type of facility	Electric Energy bill	Basic Cost of audit	Average cost of program	Savings	Savings as % of electric bill	Cost of audit as % of savings
1. Grocery store	\$200,779	\$453.50	\$1,400	\$28,700	14.3	1.6
2. Restaurant	\$39,967	\$389.50	\$1,400	\$7,121	17.8	5.5
3. Office supply	\$34,900	\$485.50	\$1,400	\$8,208	23.5	5.9
4. Bank	\$13,300	\$249.00	\$1,400	\$5,406	40.7	4.6
5. Video store	\$12,060	\$381.00	\$1,400	\$3,711	30.8	10.3
Totals					Averages	
	\$301,006	\$1,958.50	\$7,000	\$53,146	17.7	3.7

B. The Student Audit Program

How the Program Worked

Students in the Spring 1995 Energy Management course at the University of Florida participated in another part of this project. They were divided into teams of three or four, and each team was assigned the task of locating a commercial facility that would be interested in having an energy audit performed as part of a class project. Students were given certain guidelines for selecting facilities. The facility should have combined energy bills (gas and electric) no higher than \$100,000 per year and the building size should be under 100,000 square feet. Not all student teams followed these guidelines.

The students started on their audits after spring break. This allowed them to have completed enough of the course that they understood what was required of them for most of the audit. Twelve separate audits were performed. These audits are discussed below.

The teaching assistant accompanied seven of the twelve student teams on their audit trips. He was available to go with the other five teams, but they either decided to go by themselves or they waited too long to schedule the trip and by then the TA could not go. He was not present at the two poorest student audits. However, he also did not go on several audits in which the students did very good work.

After the students completed their audit visits, they completed their ECO analyses and then wrote their reports using the template that we had developed. The template was used to make sure that the reports the students gave to the clients they audited were clear and intelligible. Several students failed to use the template and their reports illustrate why the template is necessary. The template and a Help document explaining how to use the template were on a floppy disk available for the students to copy. (A hard copy of the template and the Help document is in Appendix D.)

Even with the template and the Help document many student did not fill out the report form correctly. We have rewritten the Help document to address these problems. We have also added a sample report to the template disk so students can see what the finished product should look like.

The Student Audits

The student teams performed twelve energy audits. A summary of these audits is shown in Appendix A and copies of two of the reports are in Appendix F. The size of the facilities varied from just over \$8,000 per year in energy bills to more than \$172,000 per year. Seven of the twelve audits were of facilities with bills less than \$20,000/year. Two were between \$30,000 and \$60,000/year, and two were between \$60,000 and \$175,000 per year. One student did not include annual energy bills with his report.

Although we recommend limiting the size of the audits performed by student teams, the worst reports were of small facilities. Therefore, we cannot conclude that quality is necessarily a function of size.

One problem we found with the student audits was that some of the student teams did not send their final reports to the facility. As part of this research project, we contacted the facilities and sent them a copy if they had not received one. Then we conducted a telephone survey of the facilities to determine how they liked the student audits. Table IV shows the results of that survey. For various reasons, we were only able to get full responses from 7 of the facilities. All of those were enthusiastic in their support of the student teams and the reports. One other person responded favorably about the audit but refused to take time to read the report. Six of the seven said they were planning to implement at least some of the student's suggestions.

We also asked if any of the facilities would be willing to help pay some of the cost of the audit. Two places said they might pay as much as \$100. The others all said no, with some of them explaining that the local utility offered a free audit service so they would ask for that before paying for an audit. Copies of the appropriate questionnaires are included with the copies of the student audits in Appendix F.

The average savings for the student reports was 18% of the facility's energy bills. This percent savings includes the two poorest reports, one of which found no savings possible (0%) and the other found a 53% savings. Discounting these two audits, the average savings is 16%. Furthermore, the savings for the two largest facilities was very small (2.3% and 4%). These facilities exceeded the size limits the students were given. If they too are excluded from the total, the average savings is over 19%. This is a very respectable savings for this type of program.

C. Comparison of the IAC and Class Audit Results

The IAC team revisited two of the commercial facilities that were audited by the energy management class in order to determine the effect of having a more experienced team perform the audit. The comparisons are shown in tabular form below. Several points should be made about the comparisons.

Annual Energy Costs: Each student team showed different annual energy costs than the IAC team. This was because the time periods for which the energy costs were examined were different. Each team looked at the bills for the preceding 12 months, but the student audits were in the spring and the IAC audits were in the summer so the 12-month period was not the same.

Annual Energy Savings: The IAC team achieved higher savings than the student teams primarily because the IAC team recommended the use of reflectors in the lighting fixtures. This recommendation saves a great deal of energy because it includes delamping half the lamps. In our IAC experience however, very few facilities actually install reflectors. Furthermore, a 50%

delamping rate with reflectors may be very optimistic. Therefore, the savings for the IAC team are shown both with and without the savings from reflectors.

Audit 1: The first comparison audit performed by the IAC team was for a video store. The students had done a nice report for this facility and had made some innovative recommendations about changing the lighting layout. When the IAC team discussed these recommendations with the store manager, he was not receptive to making major changes to the layout. In addition, the IAC team felt that the student recommendations would adversely change the lighting effects that the store was trying to achieve.

The students missed the 110-watt fluorescent lamps in their audit. Either they did not realize the lamps were that size, or they did not know there was a high-efficiency replacement for that size. In any case, this mistake contributed to the large difference in savings for the high-efficiency lighting ECO.

The IAC team recommended using reflectors to cut lighting costs. This saves \$2189, almost 67% of the entire savings. The student report did not include an analysis of reflectors.

The teaching assistant accompanied this audit team on the audit visit.

Conclusion: The student audit of this facility was almost as good as the IAC audit. The total savings without reflectors is approximately the same. If reflectors are desirable and are stressed in an energy management class, most students will probably include them in the report. Although the students missed one significant block of lighting, they did identify high efficiency lighting as an opportunity for the facility. This provided the manager with the information he needed to look at lighting opportunities. In addition, the manager had planned to implement the lighting recommendation prior to the IAC audit; therefore, most of the energy savings would have been realized without the IAC audit.

Table III. Comparison of audits for video store

Audit 1: Video store	Student report	IAC report
Energy use	\$13,939	\$12,060
Energy Savings	29,859 KWH	53,723 KWH
Dollar Savings	\$1907	\$3,711 (\$1,522)*
Implementation Cost	\$1233	\$1,809 (\$784)*

Audit 1: Video store	Student report	IAC report
Payback Period	0.65 years	0.5 years (0.5 years)
Percent savings	14%	29% (13%)*
Number of ECOs	5	3
Common ECOs	High-efficiency Lighting (40W to 34W)	
Savings-\$	\$472	\$1,169
Savings-KWH	8117	19,154
	Photosensor	
Savings - \$	\$235	\$353
Savings - KWH	4256	5975

* Savings without reflectors

Audit 2: The second comparison audit was for a large grocery store/variety store combination. The students who performed this audit were excellent students. In addition, the teaching assistant accompanied this audit team. However, a number of mistakes were found in the student report.

Off-peak recommendations: The students counted off-peak testing of backup power generators in their savings. Backup power generators are not electrically-powered, so even if tested on-peak, they do not contribute to the peak demand. Furthermore, the store did not have a demand component to its bill so shifting uses off-peak would not affect the cost of electricity.

High-efficiency Lighting: The students apparently miscounted lights. The IAC team counted 64 40-watt lamps while the students counted 284. In contrast, the IAC team found 2424 60-watt lamps while the students counted 2218.

Insulate Water Heater: Unfortunately, the students did not notice that the water heater was gas instead of electricity. Therefore, their energy savings is attributed to the wrong energy source. This should have been caught by the teaching assistant since it does not help the credibility of the student report.

Conclusion:

This grocery store covers a large area, has very high energy bills, and has some complex energy uses and energy use patterns. With energy bills at about \$170,000 per year, this facility is the size of (and larger than many of) the facilities audited by the IAC.

Students should not audit commercial facilities this large. The amount of time required to gather and analyze data can overwhelm a student team and prevent it from being able to do a thorough job. The complexity of energy uses also suggests that students would not be likely to have the experience needed to consider a number of alternatives.

Audit 2: Large grocery store	Student report	IAC report
Annual energy cost	\$170,304	\$198,181
Energy Savings	90,764 KWH/yr	376,024 KWH/yr (24,247 KWH/yr)*
Dollar Savings	\$7,964 (\$3,449)**	\$28,691 (\$2,240)*
Implementation Cost	\$2,648	\$19,686 (\$1,626)*
Payback Period	0.3 yr (0.8 yr)**	0.7 yr (0.7)*
Percent savings	4% (2%)	14% (1%)*
Number of ECOs	5	4
Repeated ECOs	High-efficiency Lighting	
Savings-\$	\$845	\$266
Savings-KWH	11,005	3,867
	High-efficiency Motors	
Savings-\$	\$3,424	\$1,447
Savings-KWH	46,178	20,380
	Insulate Water Heater	
Savings-\$	\$401	\$527
Savings-KWH	21,770	958 therms

* Excludes savings from reflectors

** Excludes incorrect savings from peak shifting

D. The Alternative Program

As stated in the introduction, we propose that DOE develop and sponsor a low-cost commercial audit program at universities throughout the country. We have considered a number of ways to run such a program. In order to incorporate some of the best features of the IAC program into a commercial audit program at very little cost, we suggest the following type of program.

As an alternative to a program run out of an Industrial Assessment Center, we believe that a reasonably low-cost program could be set up to perform commercial energy audits through universities that teach energy management classes. Student teams could do energy audits as a class project. With good controls on the quality of the students' work, this program could have similar benefits to the IAC program at extremely low-cost.

For example, auditing local facilities would help increase the awareness of energy conservation opportunities in the commercial sector of that community. It would foster "town and gown" relations. And it would train a large number of students in hands-on principles of energy management. At the University of Florida, the IAC trains approximately 15 new students each year. The energy management class generally has an enrollment of at least sixty students. The proposed commercial audit program would train almost 4 times as many students in energy management as the IAC program does.

In contrasting the student training in each program, there are benefits to each. The IAC students perform more than one audit during their tenure at the IAC; the students in the class would only perform one. The IAC students are exposed to a variety of industrial facilities; the class students would only see one type of commercial facility (although they would hear the reports given by the other teams on other facilities). The audit reports at the IAC are given a thorough review by several members of the technical staff; the class reports may only be reviewed by the TA. Finally, the class students may learn more about the technical details of energy auditing since they will have to develop their own calculations; the IAC students use a boilerplate template which contains calculation tables. They can fill out the forms with very little understanding of the technical background for the report.

Recommendations:

For the alternative program, we strongly recommend that the TA be a required member of the audit team. This will provide several checks. It will insure that the students actually make the on-site visit instead of fabricating the data. It will also provide the students with some guidance on potential recommendations they might overlook.

To maintain quality, a boilerplate report form should be provided to the students. In addition, there should be a teaching assistant knowledgeable in energy management who reviews the first drafts to reduce the number of student errors in the reports to the companies. The students could be assigned their primary grade for the first draft and a second grade for their revised final report.

If the program is implemented at schools which also have DOE Industrial Assessment Centers (IACs), teaching assistants could be drawn from experienced IAC team members. The minimum cost to DOE for this alternative would be the cost of copying and distributing computer disks with the boilerplate form and sending a course supplement to universities with energy management programs. If the program is limited to universities which also have IACs, the cost would be fairly small since there are only 14 of these schools. (See list in Appendix B.)

Making the program available to schools without IACs is also a possibility. The school would need to offer a graduate course/program in energy management or have some other source from which to draw an experienced teaching assistant. Otherwise, this program would require a substantial amount of time from the instructor in supervising the audits and reviewing the students' drafts.

If DOE decided to make the program available to anyone, the report template, sample report form, and guidelines for integrating the audits into an energy management course could be placed on the World-Wide Web. (See Appendix D.) This would allow DOE to distribute the program at a very low cost.

To help the TA be more effective, an audit manual should be prepared providing information on various types of commercial facilities and a list of potential energy conservation opportunities (ECOs). It should also include a checklist of areas where students typically have problems so the TA is on the lookout for such problems and does not miss them in his/her review of the report.

IV. Conclusion and Recommendations

Commercial energy use costs businesses around \$70 billion annually. Many of these businesses are small and medium sized organizations that do not have the resources to help themselves, or to pay for professional engineering services to help reduce their energy costs and improve their economic competitiveness. Energy cost reduction actions with payback times of around two years could save the commercial sector 15 - 20%, or \$10 - \$15 billion per year.

The success of the EADC/IAC program in helping the manufacturing sector provides an excellent model for a similar program in the commercial buildings sector. This project has investigated using the EADC/IAC approach, as well as an alternative approach, to performing energy audits for the commercial sector, and has determined that such approaches are feasible and cost effective.

Overall conclusions and recommendations for this study are as follows:

Conclusions

- Significant opportunities exist in the commercial sector to reduce energy operating costs and improve business profitability;

Appendices A, B, and C

Appendix C. Summary/Comparison of Alternative Commercial Audit Programs

Type of Program	Estimated Cost	Faculty Involvement	Number of Students Trained/yr	Targeted Facilities	
				Size (energy bills)	Location
1. Full IAC-type program	\$2000/audit	Full	10-15	\$100,000-\$1.5 million/yr	150 mile radius of IAC
2. Limited IAC-type program	\$1000/audit	Limited	10	\$30,000-\$300,000/yr	75-mile radius of IAC
3. Student audits through energy management course	Minimal, but could include DOE funding of Teaching Assistant	Limited (but better training in principles of energy management than through IAC)	Depends on class size	<\$100,000/yr	In same town or city as university

Appendix A. Student audit summary table

Facility information					Audit Reports			Questionnaire responses		
Type of facility	Energy bills* (annual)	Energy Cost Savings	Percent savings (IAC)		Quality	# of ECOs	TA on audit?	Liked audit/ report?	Will implement?	Would pay?
1. Boarding house	--	0	0		Poor	-	No	NR/NR	NR	NR
2. Small video store	\$8280	\$954	9		Good	2	No	Yes/Yes	Yes	Prob. not
3. Small video store	\$13,939	\$1907	13.7	29	Good	5	Yes	Yes/Yes	Yes	No (GRU)
4. Large grocery store	\$170,304 (electric) \$2,568 (natural gas)	\$8000	4	14	Good**	5	Yes	Yes/Yes	Yes	No
5. Lumber store	\$56,803	\$8100	14		Good	6	No	NR/NR	NR	NR
6. Restaurant/bar	\$28,452 (electric) \$4,125 (natural gas)	\$5700	17.3		Good	11	Yes	Yes/Yes	Yes	Maybe \$100
7. Small retail store	\$10,864	\$3000	27.4		Good	8	Yes	Yes/Yes	No	\$100
8. Hotel	\$12,173	\$8000	53		Poor	4	No	Yes/NR	NR	NR
9. Large hotel (1st floor)	\$155,372 (electric) \$16,708 (nat. gas)	\$4100	2.3		Good	3	Yes	Yes/Yes	Yes	No (GRU)
10. Apt complex (club house)	\$16,868	\$3200	20		Good	7	No	NR/NR	NR	NR
11. Lumber store	\$12,875	\$4700	37		Good	8	Yes	Yes/Yes	Yes	No (GRU)
12. Retail store	\$8221	\$1470	18		Fair	8	Yes	NR/NR	NR	NR
		49,131								

* Unless otherwise noted, energy bills are for electric use.

** Audit was good considering the complexity of the facility.

Appendix B - List of EADC/IAC Schools that teach Energy Management

Twenty-four (24) of the thirty (30) universities that have DOE Industrial Assessment Centers responded to our survey asking whether energy management courses were taught at their university. Of those universities responding, 10 teach a specific course in energy management, 3 teach energy management as part of another course, and 11 do not teach any course in energy management. The following table summarizes the survey results.

Universities that teach energy management as a complete course	Universities that teach energy management as part of another course	Universities that do not offer a course in energy management
Arizona State University	Mississippi State University	Hofstra University
Bradley University	University of Missouri-Rolla	Iowa State University
Colorado State University	West Virginia University	University of Louisville
South Dakota State University		Old Dominion University
University of Notre Dame		Oregon State University
Oklahoma State University		San Diego State University
Texas A&M University		San Francisco State University
University of Arkansas-Little Rock		University of Dayton
University of Florida		University of Tennessee
University of Massachusetts		University of Maine
		University of Wisconsin-Madison

Appendix D

Sample report form
HELP documentation
Sample audit report
Teaching guidelines

COMMERCIAL ENERGY USE ANALYSIS

Summary of Results	
Dollar Savings:	\$(xxxx.zz)/yr
Energy Savings:	[xxxx] KWH/yr
Cost to Implement:	\$(xxxx.zz)
Payback Period	[x.x] yrs

INTRODUCTION:

On [date], our team from the University of Florida Energy Management Class performed an energy use survey at your facility. We have reviewed and analyzed the data gathered, and have identified [number] Energy Conservation Opportunities that could save money for your company.

If you implement all of the ECOs, you should save approximately \$[amount--rounded to 100] per year on your [electric/energy] bills. This is a savings of [#] percent of your present cost. It will cost you about \$[amount--rounded to 100] to make these changes. As a result, if you install all of these ECOs at one time, you will recover your full investment in these energy savings measures in about [number] years.

Some of the ECOs can be implemented over a period of the time because you only install the new high-efficiency equipment when the old equipment wears out or fails. You save the additional labor cost associated with immediate replacement and the cost of any useful life remaining with the existing equipment. However, using this method means that you will not realize the total energy and cost savings for that ECO until all equipment has been replaced.

Our team has recommended ECOs in a number of areas including [lighting, air conditioning, and motors]. We have provided descriptive information about each ECO to explain what you need to do. The table following the text summarizes the savings from these ECOs. Next, we

describe some financing options available to help you pay the capital costs of implementing some of the ECOs. These can be very helpful if you do not have enough capital on hand to implement these energy efficiency improvements. Finally, we give you a short explanation of your electric bills and we use a graph to summarize your annual [electric/energy] bills for you. This graph provides a useful picture of your annual energy consumption pattern.

DESCRIPTION OF ENERGY CONSERVATION OPPORTUNITIES

LIGHTING RECOMMENDATIONS

ECO #X	[Fill in appropriate ECO information here]
ECO #X	[Fill in appropriate ECO information here]
	[Delete this row if not needed for report. Insert more rows if you have more than two lighting ECOs.]

HVAC RECOMMENDATIONS

ECO #X	[Fill in appropriate ECO information here]
ECO #X	[Fill in appropriate ECO information here]
	[Delete this row if not needed for report. Insert more rows if you have more than two HVAC ECOs.]

MOTORS RECOMMENDATIONS

ECO #X	[Fill in appropriate ECO information here]
ECO #X	[Fill in appropriate ECO information here]
	[Delete this row if not needed for report. Insert more rows if you have more than two motors ECOs.]

BUILDING ENVELOPE RECOMMENDATIONS

ECO #X	[Fill in appropriate ECO information here]
ECO #X	[Fill in appropriate ECO information here]
	[Delete this row if not needed for report. Insert more rows if you have more than two building envelope ECOs.]

OTHER RECOMMENDATIONS

ECO #X	[Fill in appropriate ECO information here]
--------	--

ECO #X	[Fill in appropriate ECO information here]
	[Delete this row if not needed for report. Insert more rows if you have more than two ECOs in this category.]

**ENERGY CONSERVATION OPPORTUNITIES (ECOs)
SUMMARY OF SAVINGS AND COSTS**

ECO Number and Description	Potential Savings (\$/yr)	Cost to Implement (\$)	Payback Period (yrs)	Energy Savings (KWH/yr)	Demand Reduction (KW)
1.					
2.					
3.					
4.					
5.					
6.					
7.					
Totals	\$	\$			

How to Pay for Your Energy Conservation Measures

In-house capital

In-house capital or internal financing is the most common way that companies pay for their energy efficiency measures. Under this method, you use funds available within your organization to finance a project or purchase the equipment under consideration. The cost of using these funds is what they could have produced if invested somewhere else or used for another project.

Develop an energy management account

Most businesses do not have sufficient funds on hand to implement all of the cost-effective ECOs at one time. However, developing an energy management account allows you to accumulate the funds necessary to implement energy conservation measures. If you take the energy cost savings you realize from implementing one ECO and apply all or part of those dollars toward paying for another ECO, you can use money that was budgeted for energy bills to pay for installing other energy-saving measures. If you want to use some of the savings for other business purposes, you can reduce the amount of the savings you put into this energy management account.

The energy management account can be especially valuable when it is used to accumulate the dollar savings from any ECOs which have little or no implementation cost. If you "deposit" the savings from these low or no-cost ECOs in your energy management account, you can often pay for the other ECOs out of that account with no supplemental funding.

Other Financing Programs

Even with an energy management account, you may find it difficult to finance some of the ECOs. However, there are a number of methods available for paying for energy efficiency improvements.

○ Utility incentives

Some utilities offer rebates or financial incentives to help their customers reduce the initial cost of certain energy efficiency improvements. These utility programs will often reimburse you for a portion of the cost of the energy efficiency measure.

○ Commercial loans

Commercial lending institutions often loan money for energy efficiency projects. Although you are charged interest on the loan, the monthly payments are generally less than the monthly savings on your energy bill.

○ Government loans

The State of Florida loans money to small businesses to help them reduce their energy consumption. To qualify for the Florida

Energy Loan Program (FELP), a company must have 200 employees or less, and must have made a profit for the past two consecutive years. Eligible conservation measures include replacing equipment with more energy efficient models; renovation of the business (air conditioning ducts, relocation of thermostats, etc.) for the purpose of energy conservation; and building retrofits including replacement of windows and heating, ventilation, and air conditioning units. The term of the loan is for a maximum of 7 years. The monthly payment is approximately 75% of the average monthly energy savings. The interest rate varies: it is 5% for loans up to \$5,000; 7% for \$5,001 to \$10,000; and 9% for \$11,000 to \$25,000.

○ **Performance contracts**

Performance contracts (Shared Savings, ESCO, Guaranteed Savings) are attractive financing options. The basis for this type of financing is quite simple; the avoided energy cost resulting from the increased energy efficiency of the new equipment pays for the equipment. However, you must be sure the cost-benefit analysis has been done correctly, and you must check to see that the new equipment is being used correctly.

Performance contracting can be simple if the project involves something like a straight-forward lighting change-out where the cost savings can easily be calculated. In most cases, the cost and risk of the project is largely taken by the contractor, but the user must relinquish a certain amount of control. Also many of the factors to be considered will require in-house expertise. Nevertheless, performance contracting is an option that you should consider carefully because of the benefits it can bring if done right.

Shared savings is a particularly useful option for businesses that do not have the capital to pursue needed energy projects. This option is based on using the energy cost savings in the existing energy budget to pay for the project. The shared savings company is usually responsible for the engineering study, energy and economic evaluation, purchase and installation, and maintenance. The customer pays some percentage of the savings (usually around 50%) to the shared savings company for a specified period of time (normally 5-10 years).

Performance contract for energy services is a variation of a shared savings program. An energy service company (ESCO) contracts with the customer to provide certain energy services such as providing specific levels of heating, cooling, illumination, or the use of equipment for other purposes. The ESCO then takes over the payment of the utility bills that are directly related to the energy services provided.

ENERGY BILLS

Evaluating the energy and cost records for your company is an important step in an energy use assessment. These figures can reveal trends and irregularities in energy usage and costs.

Electric Use

Your company receives its electric utility service from [*Name of the utility company*].

○ **Annual Cost of Electricity**

Your company paid a total of \$[] for [] KWH of electricity for the year.

○ **Graph**

The following graph shows the electric energy usage and costs incurred over the period of [month 199_ to month 199_].

Paste your Harvard Graphics chart
with the analysis of the electric bills
here.

○ **Explanation of Electric Bills**

[Your energy and demand charts show a consistent pattern of use. Your electric energy use is higher in the summer months than the winter months because of your air conditioning load.] [Or put in some other note about any inconsistencies.]

Natural Gas Use

Your company receives its gas service from [Name of the company].

○ **Annual Cost of Natural Gas**

Your company paid \$[] for [] therms, an average cost of \$[] per therm.

○ **Graph**

The following graph shows the natural gas use and costs incurred for the twelve-month period from [].

Paste your Harvard Graphics chart with the analysis of the natural gas bills here.

○ **Explanation of Natural Gas Bills**

[The graph of your natural gas use shows a consistent pattern. You use more natural gas during the winter months--November through March--than the rest of the year.]

The work and recommendations described in this report are a service provided by students in the Energy Management class at the University of Florida as part of a pilot project funded by the U.S. Department of Energy.

The primary objective of the commercial energy audit program is to identify and evaluate opportunities for energy conservation and demand reduction through visits to commercial facilities. Data are gathered during a one-day site visit and opportunities for saving energy and reducing demand are identified. Since the site visits are brief, they are necessarily limited in scope. Therefore, if you are interested in pursuing an Energy Conservation Opportunity (ECO) which involves engineering design and significant capital investment, you need to engage a consulting engineering firm to perform the detailed engineering design and cost estimations for implementing the ECO.

OFFICIAL DISCLAIMER

The University of Florida (a) does not make any warranty or representation, expressed or implied, with respect to the accuracy or completeness of the information contained in this report; (b) does not warrant that the use of any information, apparatus, method or process described in this report may not infringe on privately owned rights; or (c) does not assume any liabilities with respect to the use of, or for damages resulting from the use of, any information, apparatus, method or process described in this report. This report does not reflect official views or policies of the previously mentioned institutions.

EIN 4321: ENERGY MANAGEMENT
Spring 1995

Directions Pertaining to the Files and Audits

Included on your disc are seven files:

1. HELP.DOC: This document is the HELP.DOC. This file will tell you how to use the other files on your disc.
2. ECOLIGHT.ECO is a file containing summaries for some of the most common potential audit recommendations in the area of lighting.
3. ECOBOILR.ECO is a file containing summaries for some of the most common possible ECOs in the area of boilers and heat recovery.
4. ECOHVAC.ECO is a file containing summaries for some of the most common possible ECOs in the areas of air conditioning, chillers, and insulation.
5. ECOMOTOR.ECO is a file containing summaries for some of the most common possible ECOs in the area of motors.
6. MISC.ECO is a file containing summaries for some additional potential ECOs which do not fit under the other headings. Also in this file is a template to follow for writing your own ECO.
7. REPORT.FRM is the document that will be turned in, graded, and given to the facility for whom you performed the audit.

To start your audit, we suggest several steps. First, read the summaries of all of the potential ECOs to get some idea of what you should be looking for. Remember, however, that this is not an all-encompassing list of ECOs, just a list of the most common ones. So, do not limit your analysis to these ECOs alone.

Next, you will want to collect any necessary information during your audit (including energy bills). Determine which ECOs apply to your case and calculate implementation costs, cost savings per year, and ECO payback periods. This is where the bulk of your work will come since you must locate the ECO information on your own.

After you have completed all of your ECOs, you will then have to complete REPORT.FRM by filling in all of the appropriate spaces in the file. To complete the "Description of Energy Conservation Opportunities" Table, you will first fill in the blanks in the appropriate *.ECO files and then copy those files to the correct sections of the table. Therefore, you need to be proficient in using table commands and importing information from one file to another. (Note: we gave you the ECO files for a reason, so use them in the table. If this is not done, your audit will not be considered complete).

After completing the REPORT.FRM file, you must include a technical analysis at the end of the report showing your analysis of the company's energy consumption and the calculations you used in

analyzing each ECO. This section of the report must be typed in a standard report format, clearly showing all of the collected data and the analyses. Be as thorough as possible.

Light meters are available for you to take on your audits. Contact Michael (336-6586), the class TA, at least one day in advance. Also, we encourage you to consult with Michael, Susanna, or Sanjay concerning your audit. Michael is also available to attend team audits. This is a good idea since he is grading all of the papers. GOOD LUCK!!!!

Install High-Efficiency Lighting

Efficiency of lighting has improved dramatically in recent years. The [list areas for replacement] are currently lighted with less efficient lamps. Replacing many of your present lamps with high-efficiency lamps as they burn out, will allow you to implement this ECO without incurring an appreciable implementation cost.

- Replace []-watt [lamp type] lamps with a high-efficiency []-watt [lamp type] lamps.
- [Continue previous sentence for each type of lamp.]

The implementation cost for this ECO [including \$\$\$ in labor costs] is [\$\$\$\$\$], and the associated cost savings is [\$\$\$\$\$]. This results in a payback period of [] years.

Replace Existing Ballasts with High-Efficiency Ballasts

The fluorescent lighting fixtures at your facility are currently equipped with standard induction coil ballasts. More efficient ballasts are now available. Replacing the existing fluorescent lamp ballasts with high-efficiency ballasts as they burn out is a simple way to save energy.

The implementation cost for this ECO is [\$\$\$\$\$] [which includes a labor cost of \$\$\$]. The associated annual cost savings is [\$\$\$\$\$]. Therefore, this project has a payback period of [] years.

Reduce Lighting in [facility, or specific area]

[List the areas] [is] [are] significantly over-lighted. The light levels in this/these area[s] is []. However, the suggested light level is []. To reduce energy costs, you should disconnect [half or some other fraction] of the light fixtures in [these areas] [this area].

The implementation cost for this ECO is [\$\$\$\$\$] [which includes \$\$\$ in labor costs]. The associated annual savings comes to [\$\$\$\$\$]. Therefore, the payback period on this project is [] months.

Install Occupancy Sensors

[Locations] is/are seldom used and has/have little traffic flow. Install occupancy sensing devices to control lighting during periods when no one is using this area/these areas.

The implementation cost for this ECO is [\$\$\$\$\$] [including \$\$\$ in labor costs]. The annual cost savings is [\$\$\$\$\$]. Installing occupancy sensors returns a payback period of [] years.

[Relocate and]Disconnect Lighting

The light level in the [area] is []. The recommended light level for this type of work is []. If you change the lighting layout in this area, you will reduce your energy costs. [Fill in with your recommendation such as: You should lower some of the lighting fixtures in the [area] and disconnect the rest. In the [area], you should disconnect half of the lights and realign the others parallel to the direction of the aisles.]

The implementation cost for this ECO is [\$\$\$\$] [which includes a \$\$\$ labor cost]. The annual cost savings comes to [\$\$\$]. Therefore [relocating and] disconnecting lighting has a payback period of [] years.

Install High-Efficiency T-8 Lighting System

[locations] are lighted by low-efficiency fluorescent lamps. However, efficiency of lighting has improved dramatically in recent years. You can retrofit a new, energy-efficient lighting system using high-efficiency T-8, 32-watt lamps and electronic ballasts.

Implementation of this ECO will cost [\$\$\$\$] [which includes a \$\$\$ labor charge]. This ECO will save [\$\$\$\$\$] in annual energy costs. You will begin to see a savings in electric bills that will repay your additional cost of implementation within [] years.

Adjust and Maintain Optimum Boiler Air-Fuel Ratio

Your boiler is not operating at its optimum air-fuel ratio. You should adjust the boiler air-fuel ratio for optimum combustion efficiency and fuel savings. The stack temperature will usually drop after the air/fuel ratio is adjusted; this will also increase the efficiency of the boiler. To maintain the optimum air-fuel ratio, you should purchase a flue gas analysis kit and set up a regular schedule for analyzing and adjusting the air-fuel ratio.

The implementation cost of this ECO [including a labor cost of \$\$\$] is [?????]. Anticipated annual cost savings are [?????] and the payback period is [????] years.

Install Heat Recuperator on the [equipment]

You should install a heat recuperator on the [equipment]. Heat recuperators save energy by using the heat of the waste exhaust gases to preheat the air used for combustion in the same equipment.

The implementation cost of this ECO is [?????] [which includes a labor cost of \$\$\$\$]. The associated annual cost savings is [?????]. This gives a payback period of [?????] years.

Reduce Boiler Stand-By Time

The boiler is on during plant operating hours, [**] hr/day. The steam produced is used for only [**] of that time, [**] hr/day. There is considerable loss through stand-by running time.

The start-up time required for this boiler is approximately [30-45] minutes. Instead of running the boiler for [**] hr/day, set a specific time of day for [insert activity the boiler is used for], and turn on the boiler only for that time. Running the boiler for only [**] hours in either the morning or the afternoon would cut fuel consumption by [**].

The implementation cost of this ECO [including \$\$\$ for labor] is [?????]. The anticipated annual cost savings is [?????]. The payback period is [?????] years.

Install Stack Heat Exchanger

You will save energy if you install a stack heat exchanger in the stack of your boiler to utilize heat from the boiler stack for preheating the boiler feed water.

The implementation cost of this ECO is [?????] [which includes a \$\$\$ labor cost], and its associated annual cost savings is [?????]. The payback period is [?????] years.

Repair Steam Leaks

During the site visit, the project team found [fill in number] leaks in the steam lines and condensate return lines. You will save energy and money if you repair these leaks.

The implementation cost associated with this ECO is [?????] [(including \$\$\$\$ for labor expenses)], and the anticipated annual cost savings is [?????]. The payback period is [?????] years.

Install Air Preheater on the [equipment]

You should install a heat recuperator on the [equipment]. Heat recuperators save energy by using the heat of the waste exhaust gases to preheat the air used for combustion in the same equipment.

The implementation cost for this ECO [including \$\$\$ in labor costs] is [?????]. The anticipated annual cost savings is [?????], giving a payback period of [?????] years.

Install Vinyl Strip Doors

Open doorways between air-conditioned spaces and non-air-conditioned spaces allow cool air to escape and hot air to infiltrate the air-conditioned space. Install vinyl strip doors between the [] [and between doorway].

The implementation cost for such a project is [\$\$\$\$] [including \$\$\$ for labor], and its anticipated cost savings comes to [\$\$\$\$]. Therefore this ECO has a payback period of [] months.

Install High-Efficiency Air Conditioners

Your facility has about [] tons of air-conditioning. The units producing this air-conditioning range in size from [] to [] tons. These air-conditioning units have been operating for about [] years. Large air-conditioning units often operate for 15 to 20 years. However, by the time they are about 15 years old, they will need substantial maintenance. Therefore, when an older unit fails, you should examine the potential savings available from replacing it with a high-efficiency model. This savings will include an energy savings and a reduced maintenance cost.

The expense for this ECO is [\$\$\$\$] [including \$\$\$\$ in labor costs], and the annual savings is [\$\$\$\$]. Therefore the payback period for this ECO is [] years.

Install High-Efficiency Chiller

You have [] tons of chiller capacity in your facility. [describe the number, size, age and efficiency of these units.] A new high-efficiency chiller has an efficiency rating of [] KW/ton. [The current model uses CFCs which must be eliminated soon. The new model does not use CFCs and will thus meet federal requirements.] When your present chiller fails, you should replace it with a new high-efficiency chiller. A high-efficiency chiller will produce more chilled water for a given number of kilowatt-hours than your current unit.

The implementation cost for this ECO [including a \$\$\$ labor expense] is [\$\$\$\$], while its annual cost savings is [\$\$\$\$]. Therefore, the resulting payback period is [] years.

Insulate [location] to Reduce Energy Loss

You currently have the following insulation levels: the ceilings are insulated with R-[] and the walls with R-[]. The ceiling height is approximately [] feet in [location]. The roofs and walls are [type of materials and type and amount of insulation, if any]. Adding insulation to the [walls and ceiling] in the [location] will reduce the air-conditioning load and save energy.

The implementation cost for this ECO [including a \$\$\$ labor expense] is [\$\$\$\$], and it has an anticipated annual cost savings of [\$\$\$\$]. Therefore, this ECO has a payback period of [] years.

Install Timers for Air Conditioners

You currently have [X window type and X central] A/C units (a total capacity of [] tons) in operation at this facility. Presently your facility operates on [shifts and days] days of the week. You will save energy if you install timers on all the air conditioning units to switch off the units when the plant is not in operation.

Installing timers will cost you [\$\$\$\$\$] [including \$\$\$ for labor], and you will save [\$\$\$\$] annually in energy costs. The payback period for this project is [] years.

Weatherstrip [give area for change]

Wind pressure will cause an infiltration of air between door and door-frames which increases the chiller load. However, if the space is weather-stripped, the airflow rate is decreased and the quantity of air which can infiltrate is also decreased. Weatherstrip the doors in the [give locations] to reduce your cooling load.

The annual savings for this ECO [including \$\$\$ in labor costs] is [\$\$\$\$], while its implementation cost is [\$\$\$\$\$]. Therefore, this ECO has a payback period of [] years.

Install [an] Adjustable Speed Drive[s] on [name of equipment]

Install [an] adjustable speed drive[s] (ASD) on the []-hp [description of motor] motor to control the [airflow, flow of water, flow of (process material)]. With an adjustable speed drive, the system flow rate can be varied by controlling the speed of the motor. Energy is saved because the motor consumes significantly less power.

The implementation cost is for this ECO is [?????] [which includes a \$\$\$ labor cost]. The annual cost savings from reduced energy costs is [?????]. This gives a payback period of [?????] years.

Retrofit V-Belts With Cogged V-Belts

You should retrofit the standard V-belts on some of the motors in your facility with cogged V-belts, which are more energy-efficient. The use of cogged V-belts provides energy savings by reducing flexing losses. [List motors to be considered for this ECO]

The implementation costs associated with this ECO [(including \$\$\$ for labor costs)] is [?????]. The anticipated annual energy cost savings is [?????]. The payback period for this ECO is [?????].

Install High-Efficiency Motors

Install high-efficiency electric motors to replace the existing standard motors currently used at this facility. The most cost-effective method of implementing this recommendation is to install the more efficient motors only as the existing motors wear out. [List the motors under consideration.]

This ECO has an implementation cost of [?????] [including \$\$\$ for labor]. The corresponding annual energy cost savings is [?????]. This gives a payback period of [?????] years.

Use Synthetic Lubricants in Motors

Lubricating your motors with synthetic lubricants can save money. These lubricants decrease wear and friction on your motors, thereby saving energy and increasing motor life. However, you cannot mix synthetic lubricants with standard lubricants. Therefore, you must be careful when using these new lubricants.

The implementation cost of this ECO [including \$\$\$ for labor] is [?????]. The annual cost savings is [?????]. Therefore, the payback period is [?????].

Retrofit Motors With Synchronous Drives

The standard V-belts on some of the motors in your facility should be retrofitted with synchronous belts and drives, which are more energy-efficient.

The implementation cost associated with this ECO is [?????] [which includes \$\$\$ in labor costs]. The anticipated annual cost savings is [?????], giving a payback period of [?????] years.

Install Variable-Voltage Motor Controller[s]

Install [an] electronic variable-voltage control[s] on the [describe piece[s] of equipment] that frequently idle in your facility. Electronic variable-voltage controls, or power-factor controllers (PFCs), improve the efficiency of lightly loaded (idling) induction motors by controlling the applied voltage.

The implementation cost associated with this ECO is [?????] [including \$\$\$ in labor costs]. The anticipated annual cost savings is [?????], giving a payback period of [?????] years.

Reduce Peak Electrical Usage

You can lower your total electric bill by shifting some of your electrical usage from the peak hours of [** a.m. to ** p.m.] to the off-peak hours. The following areas are good possibilities for peak load reduction.

- [Summary of peak reduction recommendations]
-

The implementation cost of this ECO is [?????] [including \$\$\$ for labor]. The anticipated annual cost savings is [?????], and the payback period is [?????] [months/years].

Install Timer on Water Heater

Your water heater is currently operating between [specific hours of the day/ 24 hours per day]. However, hot water is needed only during [???] hours. If you install a timer on the water heater, it will operate only when needed.

The implementation cost of this ECO is [???] [which includes \$\$\$ for labor]. The anticipated annual cost savings is [????], and the resulting payback period is [???] [months/years].

Insulate Water Heater

You currently have your water insulated with [list types of material] which provides you with an insulation level of R-[] . To increase the water heater's efficiency, you should place an additional R-[] of insulation around the water heater.

Adding insulation will cost you [\$\$\$\$] [including \$\$\$ for labor], and you will save [\$\$\$\$] annually in energy costs. The payback period for this project is [] [years/months].

Improve Refrigeration Efficiency

New refrigeration systems are more energy efficient. You will save energy if you replace your inefficient refrigeration system. [Recommend replacement of outdated refrigeration equipment and investigate what systems are available.]

The estimated implementation costs associated with this ECO [including labor costs] is [????]. The annual cost savings is [?????], resulting in a payback period of [???] years.

[Include this section even if you don't recommend replacement]
[In addition,] you can improve the efficiency of your refrigeration system by doing the following preventive maintenance:
[List maintenance tips]

TEMPLATE FOR ANY ADDITIONAL ECOS

Recommendation Name

Give one sentence of background information. Give a concise description of the current problem and the proposed solution.

State the implementation costs (including labor if applicable), the annual cost savings and the payback period.

COMMERCIAL ENERGY USE ANALYSIS

SAMPLE REPORT

Summary of Results	
Dollar Savings:	\$8,128/yr
Energy Savings:	120,334 KWH/yr
Cost to Implement:	\$3,651
Payback Period	0.4 yrs

INTRODUCTION:

On March 30, 1995, our team from the University of Florida Energy Management Class performed an energy use survey at your facility. We have reviewed and analyzed the data gathered, and have identified six (6) Energy Conservation Opportunities that could save money for your company.

If you implement all of the ECOs, you should save approximately \$8,100 per year on your electric bills. This is a savings of 14 percent of your present cost. It will cost you about \$3,700 to make these changes. As a result, if you install all of these ECOs at one time, you will recover your full investment in these energy savings measures in about 0.4 years, or less than five months.

Our team has recommended ECOs in the areas of lighting and motors. We have provided descriptive information about each ECO to explain what you need to do. The table following the text summarizes the savings from these ECOs. Next, we describe some financing options available to help you pay the capital costs of implementing some of the ECOs. These can be very helpful if you do not have enough capital on hand to implement these energy efficiency improvements. Finally, we give you a short explanation of your electric bills and we use a graph to summarize your annual electric bills for you. This graph provides a useful picture of your annual energy consumption pattern.

DESCRIPTION OF ENERGY CONSERVATION OPPORTUNITIES

LIGHTING RECOMMENDATIONS

ECO #1	Install High-Efficiency Lighting <p>Efficiency of lighting has improved dramatically in recent years. Your facility is currently lighted with less efficient fluorescent lamps than are now available. Replacing all of your present lamps (648 lamps) as they burn out with high-efficiency lamps will allow you to implement this ECO without incurring an appreciable implementation cost.</p> <p>○ Replace 75-watt fluorescent lamps with high-efficiency 60-watt fluorescent lamps.</p> <p>The implementation cost for this ECO is \$590; this represents the difference between the cost of the standard lamp and the cost of the high-efficiency lamp. The associated cost savings is \$4,946. This results in a payback period of 0.12 years or 1 1/2 months.</p>
ECO #2	Install Photosensors in Warehouse Area <p>The warehouse area of your facility has adequate daylighting for a large part of the day. Furthermore, your lamps in this area are placed 25-30 high and do not provide additional light during daylight hours. You should install four (4) photosensors to control lighting during periods when daylight is adequate in this area.</p> <p>The implementation cost for this ECO is \$2,400 including \$300/sensor in labor costs. The annual cost savings is \$1,617. The cost of installing occupancy sensors will pay back in energy savings in 1.5 years.</p>
ECO #3	Retrofit Existing Exit Sign Lamps with High-efficiency LED Lamps <p>You have 8 Exit signs in your store; these signs currently use 40 watt lamps. LED lamps are now available for Exit signs. These lamps use very little energy and last for at least 25 years so they also save maintenance costs.</p> <p>The total cost of retrofitting the Exit signs with LED lamps in your facility is \$320 (excluding labor). You will save \$144 per year in energy costs and \$32 per year in lamp replacement costs (excluding the labor cost savings). This ECO will pay back in 1.8 years.</p>

ECO #4	Install Occupancy Sensors in Lunchroom and Restrooms The lights in your restrooms and lunchroom are left on even when these areas are not occupied. You should install occupancy sensors to control lighting during periods when no one is using these areas. The implementation cost for this ECO is \$192 not including labor costs. The annual cost savings is \$294. Installing occupancy sensors will pay back in less than eight (8) months.
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MOTORS RECOMMENDATIONS

ECO #5	Install a High-Efficiency Motor in Your Air Handler Unit When the motor in your air handler unit wears out, replace it with a high-efficiency motor. This ECO has an implementation cost of \$149—the cost premium for the high-efficiency motor. The annual energy cost savings is \$64.30/year. This ECO has a payback period of 2.3 years.
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OTHER RECOMMENDATIONS

ECO #6	Reduce Peak Electrical Use Shift your use of the baler and the compactor to off-peak hours so that they do not contribute to your peak and increase your electric bill. There is no additional cost to using this equipment off-peak. The annual savings on your electric bill will be \$1,030 per year. Since there is no implementation cost, the ECO pays back immediately.
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**ENERGY CONSERVATION OPPORTUNITIES (ECOs)
SUMMARY OF SAVINGS AND COSTS**

ECO Number and Description	Potential Savings (\$/yr)	Cost to Implement (\$)	Payback Period (yrs)	Energy Savings (KWH/yr)	Demand Reduction (KW)
1. Install high-efficiency lighting	\$4,946	\$590	0.1	81,080	10
2. Install photosensors in warehouse	\$1,617	\$2,400	1.5	29,952	0
3. Install high-efficiency LED exit signs	\$176	\$320	1.8	2,663	0
4. Install occupancy sensors	\$294	\$192	0.7	5,448	0
5. Install high-efficiency motor in air handler	\$64	\$149	2.3	1191	0
6. Use baler and compactor during off-peak hours	\$1,031	0	0.0	0	18
Totals	\$8,128	\$3,651	0.4	120,334	28

How to Pay for Your Energy Conservation Measures

In-house capital

In-house capital or internal financing is the most common way that companies pay for their energy efficiency measures. Under this method, you use funds available within your organization to finance a project or purchase the equipment under consideration. The cost of using these funds is what they could have produced if invested somewhere else or used for another project.

Develop an energy management account

Most businesses do not have sufficient funds on hand to implement all of the cost-effective ECOs at one time. However, developing an energy management account allows you to accumulate the funds necessary to implement energy conservation measures. If you take the energy cost savings you realize from implementing one ECO and apply all or part of those dollars toward paying for another ECO, you can use money that was budgeted for energy bills to pay for installing other energy-saving measures. If you want to use some of the savings for other business purposes, you can reduce the amount of the savings you put into this energy management account.

The energy management account can be especially valuable when it is used to accumulate the dollar savings from any ECOs which have little or no implementation cost. If you "deposit" the savings from these low or no-cost ECOs in your energy management account, you can often pay for the other ECOs out of that account with no supplemental funding.

Other Financing Programs

Even with an energy management account, you may find it difficult to finance some of the ECOs. However, there are a number of methods available for paying for energy efficiency improvements.

○ Utility incentives

Some utilities offer rebates or financial incentives to help their customers reduce the initial cost of certain energy efficiency improvements. These utility programs will often reimburse you for a portion of the cost of the energy efficiency measure.

○ Commercial loans

Commercial lending institutions often loan money for energy efficiency projects. Although you are charged interest on the loan, the monthly payments are generally less than the monthly savings on your energy bill.

○ Government loans

The State of Florida loans money to small businesses to help them reduce their energy consumption. To qualify for the Florida

Energy Loan Program (FELP), a company must have 200 employees or less, and must have made a profit for the past two consecutive years. Eligible conservation measures include replacing equipment with more energy efficient models; renovation of the business (air conditioning ducts, relocation of thermostats, etc.) for the purpose of energy conservation; and building retrofits including replacement of windows and heating, ventilation, and air conditioning units. The term of the loan is for a maximum of 7 years. The monthly payment is approximately 75% of the average monthly energy savings. The interest rate varies: it is 5% for loans up to \$5,000; 7% for \$5,001 to \$10,000; and 9% for \$11,000 to \$25,000.

○ **Performance contracts**

Performance contracts (Shared Savings, ESCO, Guaranteed Savings) are attractive financing options. The basis for this type of financing is quite simple; the avoided energy cost resulting from the increased energy efficiency of the new equipment pays for the equipment. However, you must be sure the cost-benefit analysis has been done correctly, and you must check to see that the new equipment is being used correctly.

Performance contracting can be simple if the project involves something like a straight-forward lighting change-out where the cost savings can easily be calculated. In most cases, the cost and risk of the project is largely taken by the contractor, but the user must relinquish a certain amount of control. Also many of the factors to be considered will require in-house expertise. Nevertheless, performance contracting is an option that you should consider carefully because of the benefits it can bring if done right.

Shared savings is a particularly useful option for businesses that do not have the capital to pursue needed energy projects. This option is based on using the energy cost savings in the existing energy budget to pay for the project. The shared savings company is usually responsible for the engineering study, energy and economic evaluation, purchase and installation, and maintenance. The customer pays some percentage of the savings (usually around 50%) to the shared savings company for a specified period of time (normally 5-10 years).

Performance contract for energy services is a variation of a shared savings program. An energy service company (ESCO) contracts with the customer to provide certain energy services such as providing specific levels of heating, cooling, illumination, or the use of equipment for other purposes. The ESCO then takes over the payment of the utility bills that are directly related to the energy services provided.

ENERGY BILLS

Evaluating the energy and cost records for your company is an important step in an energy use assessment. These figures can reveal trends and irregularities in energy usage and costs.

Electric Use

Your company receives its electric utility service from Gainesville Regional Utilities.

- Annual Cost of Electricity

Your company paid a total of \$56,803 for 844,100 KWH of electricity for the year.

- Graph

The following graph shows the electric energy usage and costs incurred over the period of February 1994 to January 1995.

Total Electric Cost (\$) Feb 1994 - Jan 1995

Electrical Consumption (KWh) Feb 1994 - Jan 1995

Peak Demand Usage (KW) Feb 1994 - Jan 1995

The work and recommendations described in this report are a service provided by students in the Energy Management class at the University of Florida.

The primary objective of the commercial energy audit program is to identify and evaluate opportunities for energy conservation and demand reduction through visits to commercial facilities. Data are gathered during a one-day site visit and opportunities for saving energy and reducing demand are identified. Since the site visits are brief, they are necessarily limited in scope. Therefore, if you are interested in pursuing an Energy Conservation Opportunity (ECO) which involves engineering design and significant capital investment, you need to engage a consulting engineering firm to perform the detailed engineering design and cost estimations for implementing the ECO.

OFFICIAL DISCLAIMER

The University of Florida (a) does not make any warranty or representation, expressed or implied, with respect to the accuracy or completeness of the information contained in this report; (b) does not warrant that the use of any information, apparatus, method or process described in this report may not infringe on privately owned rights; or (c) does not assume any liabilities with respect to the use of, or for damages resulting from the use of, any information, apparatus, method or process described in this report. This report does not reflect official views or policies of the previously mentioned institutions.

Teaching Guidelines--Commercial Project

1. Basic topics that need to be covered in class to prepare students for performing a commercial energy audit

- How to:
 - conduct an energy audit
 - write an audit report
- Lighting
- Motors
- Heating/airconditioning

Possibly:

- Heat recovery
- Energy management controls

2. Guidelines for choosing a facility to audit

Square footage--20,000-100,000 sq. ft.

Energy bills--\$24,000-\$100,000

No manufacturing processes at the facility

Types of facilities that would be appropriate for a student audit team:

- small to medium-sized restaurants
- small grocery stores
- retail shops (video stores, pet stores, hobby stores, office supply stores, etc.)

3. Provided by DOE

Computer disk with

- brief description of commercial audit program
- template for report
- instructions on how to use template
- sample report

Appendix E

Five IAC Audit Reports

**UNIVERSITY OF
FLORIDA**
**Energy Analysis and
Diagnostic Center**

COMMERCIAL ENERGY USE ANALYSIS

Summary of Results	
Dollar Savings:	\$28,691/yr
Energy Savings:	376,024 KWH/yr and 958 therms/yr
Cost to Implement:	\$19,686
Payback Period:	0.7 yrs

INTRODUCTION:

On June 15, 1995, our team from the Energy Analysis and Diagnostic Center at the University of Florida performed an energy use survey at your facility. We have reviewed and analyzed the data gathered, and have identified 4 Energy Conservation Opportunities that could save money for your company.

If you implement all of the ECOs, you should save approximately \$28,700 per year on your electric bills. This is a savings of 14 percent of your present cost. It will cost you about \$19,700 to make these changes. As a result, if you install all of these ECOs at one time, you will recover your full investment in these energy savings measures in about 0.7 years.

Some of the ECOs can be implemented over a period of the time because you only install the new high-efficiency equipment when the old equipment wears out or fails. You save the additional labor cost associated with immediate replacement and the cost of any useful life remaining with the existing equipment. However, using this method means that you will not realize the total energy and cost savings for that ECO until all equipment has been replaced.

Our team has recommended ECOs in a number of areas including lighting and motors. We have provided descriptive information about each ECO to explain what you need to do. The table

following the text summarizes the savings from these ECOs. Next, we describe some financing options available to help you pay the capital costs of implementing some of the ECOs. These can be very helpful if you do not have enough capital on hand to implement these energy efficiency improvements. Finally, we give you a short explanation of your electric bills and we use a graph to summarize your annual energy bills for you. This graph provides a useful picture of your annual energy consumption pattern.

DESCRIPTION OF ENERGY CONSERVATION OPPORTUNITIES

LIGHTING RECOMMENDATIONS

ECO #1	<p>Install High-efficiency Lighting</p> <p>Efficiency of lighting has improved dramatically in recent years. Your facility has already replaced all of its 75-watt fluorescent lamps with high-efficiency 60-watt lamps. You should also replace all your 40-watt fluorescent lamps with high-efficiency 34-watt lamps. Replacing your present 40-watt lamps with high-efficiency 34-watt lamps as they burn out, will allow you to implement this ECO without incurring an appreciable implementation cost.</p> <p>The implementation cost for this ECO is \$32, and the associated annual cost savings is \$266. This results in a payback period of 0.1 years.</p>
ECO #2	<p>Install Reflectors</p> <p>Special reflectors are available for both fluorescent lamp fixtures and high-intensity discharge fixtures. These reflectors approximately double the light output of the lamp fixture. We recommend that you install reflectors and disconnect one quarter of the ballasts and lamps.</p> <p>You presently use about 2,414 60-watt lamps and 1,207 ballasts in the store. We recommend that you install reflectors on all of these fixtures and disconnect a quarter of the lamps uniformly. Since the fixtures are located close to each other, you can then disconnect a quarter of the ballasts and re-wire the rest. The labor-inclusive implementation cost for this ECO is \$18,060 and the associated annual cost savings is \$26,451. This results in a payback period of 0.7 years, or 9 months.</p>

MOTORS RECOMMENDATIONS

ECO #3	Install High-efficiency Motors
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Install high-efficiency electric motors to replace the existing standard motors currently used at this facility. The most cost-effective method of implementing this recommendation is to install the more efficient motors only as the existing motors wear out.

- Replace all compressor motors (six 5-hp motors, two 3-hp motors and eight 7.5-hp motors) and the two 5-hp exhaust fan motors with high-efficiency motors as they fail.

This ECO has an implementation cost of \$1,474. The corresponding annual energy cost savings is \$1,447. This gives a payback period of 1.0 years.

OTHER RECOMMENDATIONS

ECO #4	Insulate Water Heater
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Currently, your two water heaters have no insulation on the surface. We recommend that you put an insulation jacket around each heater. The labor inclusive implementation cost for this recommendation is \$120. The total annual cost savings is \$527. This gives a payback period of 0.2 years, or 3 months.

**ENERGY CONSERVATION OPPORTUNITIES (ECOs)
SUMMARY OF SAVINGS AND COSTS**

ECO Number and Description	Potential Savings (\$/yr)	Cost to Implement (\$)	Payback Period (yrs)	Energy Savings (KWH/yr)	Demand Reduction (KW)
1. Install High-efficiency Lighting	266	32	0.1	3,867	0.5
2. Install Reflectors	26,451	18,060	0.7	351,777	42.0
3. Install High-efficiency Motors	1,447	1,474	1.0	20,380	3.7
4. Insulate Water Heater	527	120		958 therms	0.0
Totals	\$28,691	\$19,686	0.7	376,024 KWH/yr	46.2

How to Pay for Your Energy Conservation Measures

In-house capital

In-house capital or internal financing is the most common way that companies pay for their energy efficiency measures. Under this method, you use funds available within your organization to finance a project or purchase the equipment under consideration. The cost of using these funds is what they could have produced if invested somewhere else or used for another project.

Develop an energy management account

Most businesses do not have sufficient funds on hand to implement all of the cost-effective ECOs at one time. However, developing an energy management account allows you to accumulate the funds necessary to implement energy conservation measures. If you take the energy cost savings you realize from implementing one ECO and apply all or part of those dollars toward paying for another ECO, you can use money that was budgeted for energy bills to pay for installing other energy-saving measures. If you want to use some of the savings for other business purposes, you can reduce the amount of the savings you put into this energy management account.

The energy management account can be especially valuable when it is used to accumulate the dollar savings from any ECOs which have little or no implementation cost. If you "deposit" the savings from these low or no-cost ECOs in your energy management account, you can often pay for the other ECOs out of that account with no supplemental funding.

Other Financing Programs

Even with an energy management account, you may find it difficult to finance some of the ECOs. However, there are a number of methods available for paying for energy efficiency improvements.

○ Utility incentives

GRU has a low interest loan for customers who make lighting system improvements

○ Commercial loans

Commercial lending institutions often loan money for energy efficiency projects. Although you are charged interest on the loan, the monthly payments are generally less than the monthly savings on your energy bill.

○ **Government
loans**

The State of Florida loans money to small businesses to help them reduce their energy consumption. To qualify for the **Florida Energy Loan Program (FELP)**, a company must have 200 employees or less, and must have made a profit for the past two consecutive years. Eligible conservation measures include replacing equipment with more energy efficient models; renovation of the business (air conditioning ducts, relocation of thermostats, etc.) for the purpose of energy conservation; and building retrofits including replacement of windows and heating, ventilation, and air conditioning units. The term of the loan is for a maximum of 7 years. The monthly payment is approximately 75% of the average monthly energy savings. The interest rate varies: it is 5% for loans up to \$5,000; 7% for \$5,001 to \$10,000; and 9% for \$11,000 to \$25,000.

○ **Performance
contracts**

Performance contracts (Shared Savings, ESCO, Guaranteed Savings) are attractive financing options. With this type of financing, the avoided energy cost resulting from the increased energy efficiency of the new equipment pays for the equipment. However, you must be sure the cost-benefit analysis is correct, and you must check to see that the new equipment is being used correctly.

Performance contracting can be simple if the project involves something like a straight-forward lighting change-out where the cost savings can easily be calculated. In most cases, the cost and risk of the project is largely taken by the contractor, but the user must relinquish a certain amount of control. Also many of the factors to be considered will require in-house expertise. Nevertheless, performance contracting is an option that you should consider carefully because of the benefits it can bring if done right.

Shared savings is a particularly useful option for businesses that do not have the capital to pursue needed energy projects. This option is based on using the energy cost savings in the existing energy budget to pay for the project. The shared savings company is usually responsible for the engineering study, energy and economic evaluation, purchase and installation, and maintenance. The customer pays some percentage of the savings (usually around 50%) to the shared savings company for a specified period of time (normally 5-10 years).

Performance contract for energy services is a variation of a shared savings program. An energy service company (ESCO) contracts with the customer to provide certain energy services such as providing specific levels of heating, cooling, illumination, or the use of equipment for other purposes. The ESCO then takes over the payment of the utility bills that are directly related to the energy services provided.

ENERGY BILLS

Evaluating the energy and cost records for your company is an important step in an energy use assessment. These figures can reveal trends and irregularities in energy usage and costs.

Electric Use

Your company receives its electric utility service from the Gainesville Regional Utilities.

- **Annual Cost of Electricity**

Your company paid a total of \$198,181 for 2,928,960 KWH of electricity for the year.

- **Graph**

The following graph shows the electric energy usage and costs incurred over the period of July 1994 to June 1995.

- **Explanation of Electric Bills**

Your electric energy use is higher in the summer months than the winter months because of your air conditioning load.

Natural Gas Use

Your company receives its gas service from the Gainesville Regional Utilities.

○ **Annual Cost of Natural Gas**

Your company paid \$2,598 for 4,790 therms, an average cost of \$0.55 per therm.

○ **Graph**

The following graph shows the natural gas use and costs incurred for the twelve-month period from July 1994 to June 1995.

The graph of your natural gas use shows a consistent pattern.

○ **Explanation of Natural Gas Bills**

The work and recommendations described in this report are a service provided by the Energy Analysis and Diagnostic Center at the University of Florida as part of a pilot project funded by the U.S. Department of Energy.

The primary objective of the commercial energy audit program is to identify and evaluate opportunities for energy conservation and demand reduction through visits to commercial facilities. Data are gathered during a one-day site visit and opportunities for saving energy and reducing demand are identified. Since the site visits are brief, they are necessarily limited in scope. Therefore, if you are interested in pursuing an Energy Conservation Opportunity (ECO) which involves engineering design and significant capital investment, you need to engage a consulting engineering firm to perform the detailed engineering design and cost estimations for implementing the ECO.

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**UNIVERSITY OF
FLORIDA**

**Energy Analysis and
Diagnostic Center**

COMMERCIAL ENERGY USE ANALYSIS

Summary of Results	
Dollar Savings:	\$7,121/yr
Energy Savings:	76,329 KWH/yr
Cost to Implement:	\$5,671
Payback Period	0.8 yrs

INTRODUCTION:

On August 11, 1995, our team from the Energy Analysis and Diagnostic Center at the University of Florida performed an energy use survey at your facility. We have reviewed and analyzed the data gathered, and have identified 4 Energy Conservation Opportunities that could save money for your company.

If you implement all of the ECOs, you should save approximately \$7,100 per year on your electric bills. This is a savings of 18 percent of your present cost. It will cost you about \$5,700 to make these changes. As a result, if you install all of these ECOs at one time, you will recover your full investment in these energy savings measures in about 0.8 years.

Some of the ECOs can be implemented over a period of the time because you only install the new high-efficiency equipment when the old equipment wears out or fails. You save the additional labor cost associated with immediate replacement and the cost of any useful life remaining with the existing equipment. However, using this method means that you will not realize the total energy and cost savings for that ECO until all equipment has been replaced.

Our team has recommended ECOs in a number of areas including lighting and HVAC. We have provided descriptive information about each ECO to explain what you need to do. The table following the text summarizes the savings from these ECOs. Next, we describe some

financing options available to help you pay the capital costs of implementing some of the ECOs. These can be very helpful if you do not have enough capital on hand to implement these energy efficiency improvements. Finally, we give you a short explanation of your electric bills and we use a graph to summarize your annual energy bills for you. This graph provides a useful picture of your annual energy consumption pattern.

DESCRIPTION OF ENERGY CONSERVATION OPPORTUNITIES

LIGHTING RECOMMENDATIONS

ECO #1	<p>Install High-efficiency Lighting</p> <p>Efficiency of lighting has improved dramatically in recent years. Currently, you use low efficiency 40-watt lamps in your kitchen. Replacing your present 40-watt lamps with high-efficiency 34-watt lamps, as they burn out, will allow you to implement this ECO without incurring an appreciable implementation cost.</p> <ul style="list-style-type: none"> ○ Replace all 40-watt fluorescent lamps with high-efficiency 34-watt lamps. <p>The implementation cost for this ECO is \$32, and the associated annual cost savings is \$266. This results in a payback period of 0.1 years, or one month.</p>
ECO #2	<p>Retrofit 75-watt incandescent lamps with compact fluorescent Lamps</p> <p>Currently you use 75-watt incandescent lamps in the main dining area. A 17-watt compact fluorescent lamp produces a diffused low-glare lighting that closely resembles the light output of a 75-watt incandescent lamp. Compact fluorescent lamps can be retrofitted in a regular incandescent lamp holder without any adaptor. For your facility, we recommend that you replace all the 75-watt incandescent lamps with 17-watt compact fluorescent lamps at the same time.</p> <p>The implementation cost for this ECO is \$4,139 and the associated annual cost savings is \$4,551. This results in a payback period of 0.9 years, or 11 months.</p>

HVAC RECOMMENDATIONS	
ECO #3	<p>Set AC thermostat temperature to 75 °F</p> <p>Currently the dining area thermostat is set to 72 °F. We recommend that you avoid excess cooling and set the thermostat to 75 °F during the restaurant off-peak hours (9 AM - noon and 2 PM - 6 PM)</p> <p>You already have a programmable thermostat that is currently used to "set-back" the temperature at night. You can use this thermostat to make these changes. Therefore, this ECO has no implementation cost. The corresponding annual energy cost savings is \$989. This ECO has an immediate payback period.</p>

OTHER RECOMMENDATIONS	
ECO #4	<p>Install a load manager</p> <p>You currently operate 6 4-ton air conditioners for cooling the restaurant and the kitchen and 3 5-ton air conditioners for the cold storage and the beer cooler. Install a load manager on these units so that at any time, at least two of the 4-ton air conditioners and one of the 5-ton air conditioners are off-cycle.</p> <p>Installing a load manager will eliminate the demand costs associated with the operation of two 4-ton units and one 5-ton unit. This ECO has an implementation cost of about \$1,500 and annual savings are \$1,355. This results in a payback period of 1.1 years.</p>

**ENERGY CONSERVATION OPPORTUNITIES (ECOs)
SUMMARY OF SAVINGS AND COSTS**

ECO Number and Description	Potential Savings (\$/yr)	Cost to Implement (\$)	Payback Period (yrs)	Energy Savings (KWH/yr)	Demand Reduction (KW)
1. Install High-efficiency Lighting	266	32	0.1	3,130	0.5
2. Install Compact Fluorescent lamps	4,511	4,139	0.9	60,149	8.6
3. Set AC thermostat to 75 °F	989	0	0.0	13,050	0.0
4. Install Load Manager	1,355	1,500	1.1	0	19.37
Totals	\$7,121	\$5,671	0.8	76,329	28.5

How to Pay for Your Energy Conservation Measures

In-house capital

In-house capital or internal financing is the most common way that companies pay for their energy efficiency measures. Under this method, you use funds available within your organization to finance a project or purchase the equipment under consideration. The cost of using these funds is what they could have produced if invested somewhere else or used for another project.

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The energy management account can be especially valuable when it is used to accumulate the dollar savings from any ECOs which have little or no implementation cost. If you "deposit" the savings from these low or no-cost ECOs in your energy management account, you can often pay for the other ECOs out of that account with no supplemental funding.

Other Financing Programs

Even with an energy management account, you may find it difficult to finance some of the ECOs. However, there are a number of methods available for paying for energy efficiency improvements.

○ Utility incentives

GRU has a low interest loan for customers who make lighting system improvements

○ Commercial loans

Commercial lending institutions often loan money for energy efficiency projects. Although you are charged interest on the loan, the monthly payments are generally less than the monthly savings on your energy bill.

- **Government loans**

The State of Florida loans money to small businesses to help them reduce their energy consumption. To qualify for the Florida Energy Loan Program (FELP), a company must have 200 employees or less, and must have made a profit for the past two consecutive years. Eligible conservation measures include replacing equipment with more energy efficient models; renovation of the business (air conditioning ducts, relocation of thermostats, etc.) for the purpose of energy conservation; and building retrofits including replacement of windows and heating, ventilation, and air conditioning units. The term of the loan is for a maximum of 7 years. The monthly payment is approximately 75% of the average monthly energy savings. The interest rate varies: it is 5% for loans up to \$5,000; 7% for \$5,001 to \$10,000; and 9% for \$11,000 to \$25,000.

- **Performance contracts**

Performance contracts (Shared Savings, ESCO, Guaranteed Savings) are attractive financing options. With this type of financing, the avoided energy cost resulting from the increased energy efficiency of the new equipment pays for the equipment. However, you must be sure the cost-benefit analysis is correct, and you must check to see that the new equipment is being used correctly.

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Performance contract for energy services is a variation of a shared savings program. An energy service company (ESCO) contracts with the customer to provide certain energy services such as providing specific levels of heating, cooling, illumination, or the use of equipment for other purposes. The ESCO then takes over the payment of the utility bills that are directly related to the energy services provided.

ENERGY BILLS

Evaluating the energy and cost records for your company is an important step in an energy use assessment. These figures can reveal trends and irregularities in energy usage and costs.

Electric Use

Your company receives its electric utility service from the Gainesville Regional Utilities.

- Annual Cost of Electricity

Your company paid a total of \$39,967 for 567,600 KWH of electricity for the year.

- Graph

The following graph shows the electric energy usage and costs incurred over the period of August 1994 to July 1995.

Your electric energy use is higher in the summer months than the winter months because of your air conditioning load.

Natural Gas Use

Your company receives its gas service from the Gainesville Regional Utilities.

- Annual Cost of Natural Gas

Your company paid \$5,397 for 14,612 therms, an average cost of \$0.37 per therm.

- Graph

The following graph shows the natural gas use and costs incurred for the twelve-month period from August 1994 to July 1995.

The graph of your natural gas use shows a consistent pattern.

The work and recommendations described in this report are a service provided by the Energy Analysis and Diagnostic Center at the University of Florida as part of a pilot project funded by the U.S. Department of Energy.

The primary objective of the commercial energy audit program is to identify and evaluate opportunities for energy conservation and demand reduction through visits to commercial facilities. Data are gathered during a one-day site visit and opportunities for saving energy and reducing demand are identified. Since the site visits are brief, they are necessarily limited in scope. Therefore, if you are interested in pursuing an Energy Conservation Opportunity (ECO) which involves engineering design and significant capital investment, you need to engage a consulting engineering firm to perform the detailed engineering design and cost estimations for implementing the ECO.

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UNIVERSITY OF FLORIDA

Energy Analysis and Diagnostic Center

COMMERCIAL ENERGY USE ANALYSIS

Summary of Results	
Dollar Savings:	\$8,208/yr
Energy Savings:	84,647 KWH/yr
Cost to Implement:	\$486
Payback Period	0.1 yrs

INTRODUCTION:

On June 22, 1995, our team from the Energy Analysis and Diagnostic Center at the University of Florida performed an energy use survey at your facility. We have reviewed and analyzed the data gathered, and have identified 4 Energy Conservation Opportunities that could save money for your company.

If you implement all of the ECOs, you should save approximately \$8,200 per year on your electric bills. This is a savings of 23 percent of your present electric cost. It will cost you about \$490 to make these changes. As a result, if you install all of these ECOs at one time, you will recover your full investment in these energy savings measures in about 0.1 years.

One ECO can be implemented over a period of the time because you only install the new high-efficiency lamps when the old lamps burn out. You save the additional labor cost associated with immediate replacement and the cost of any useful life remaining with the existing lamps. However, using this method means that you will not realize the total energy and cost savings for that ECO until all equipment has been replaced.

Our team has recommended ECOs in the area of lighting and air-conditioning. We have provided descriptive information about each ECO to explain what you need to do. The table following the text summarizes the savings from these ECOs. Next, we describe some

financing options available to help you pay the capital costs of implementing some of the ECOs. These can be very helpful if you do not have enough capital on hand to implement these energy efficiency improvements. Finally, we give you a short explanation of your electric bills and we use a graph to summarize your annual electric bills for you. This graph provides a useful picture of your annual energy consumption pattern.

DESCRIPTION OF ENERGY CONSERVATION OPPORTUNITIES

LIGHTING RECOMMENDATIONS

ECO #1	<p>Install High-Efficiency Lighting</p> <p>Efficiency of lighting has improved dramatically in recent years. Your facility has a few high-efficiency 34-watt and 60-watt fluorescent lamps but most of the lighting is accomplished by the lower efficiency 40-watt and 75-watt lamps. Replacing many of your present lamps with high-efficiency lamps as they burn out, will allow you to implement this ECO without incurring an appreciable implementation cost.</p> <ul style="list-style-type: none"> ○ Replace all 40-watt fluorescent lamps with high-efficiency 34-watt lamps. ○ Replace all 75-watt fluorescent lamps with high-efficiency 60-watt lamps. <p>The implementation cost for this ECO is \$322, and the associated annual cost savings is \$1,875. This results in a payback period of 0.2 years, or 2 months.</p>
ECO #2	<p>Disconnect Lights</p> <p>The storage areas in the first and second floors of your facility are currently overlighted. Light levels of up to 80 footcandles were observed in some parts of these storage areas. We recommend that you</p> <ul style="list-style-type: none"> ○ Disconnect a quarter of the lamp fixtures in the storage area in the first and second floors. <p>Moreover, some of the lights in these areas are blocked by cardboard boxes in such a way that disconnecting these will not reduce the overall lighting.</p> <p>Disconnecting a quarter of these lamps will result in cost savings of \$819. There is no implementation cost for this AR as your maintenance personnel can easily disconnect the fixtures in these storage areas. The payback period for this recommendation is immediate.</p>

ECO #3	<p>Install Occupancy Sensors</p> <p>Although the conference room in your facility is seldom used and has little traffic flow, the lights are left on during working hours. You can install occupancy sensing devices to control lighting during periods when no one is using this area.</p> <p>The implementation cost for this ECO is \$164 including \$100 in labor costs. The annual cost savings is \$177. Installing occupancy sensors has a payback period of 0.9 years, or 11 months.</p>
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HVAC RECOMMENDATIONS

ECO #4	<p>Install high-efficiency AC units</p> <p>Your facility currently uses an 80-ton chiller to cool the store and the office areas. This unit is about 25 years old and is due for replacement. We recommend that you replace this unit with 8 high-efficiency individual 10-ton units.</p> <p>These high-efficiency units will be about 30% more efficient than your existing chiller and will save you \$5,387 annually. Since you are already considering replacing this unit with new 10-ton units, there is no implementation cost for this ECO. The payback period, therefore, is immediate.</p>
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**ENERGY CONSERVATION OPPORTUNITIES (ECOs)
SUMMARY OF SAVINGS AND COSTS**

ECO Number and Description	Potential Savings (\$/yr)	Cost to Implement (\$)	Payback Period (yrs)	Energy Savings (KWH/yr)	Demand Reduction (KW)
1. Install High-efficiency Lighting	1,825	322	0.2	22,633	5.4
2. Disconnect Lamps	819	0	0.0	10,164	2.4
3. Install Occupancy Sensors	177	164	0.9	2,760	0.0
4. Install high-efficiency AC units	5,387	0	--	49,090	32.7
Totals	\$8,208	\$486	0.1	84,647	40.5

How to Pay for Your Energy Conservation Measures

In-house capital

In-house capital or internal financing is the most common way that companies pay for their energy efficiency measures. Under this method, you use funds available within your organization to finance a project or purchase the equipment under consideration. The cost of using these funds is what they could have produced if invested somewhere else or used for another project.

Develop an energy management account

Most businesses do not have sufficient funds on hand to implement all of the cost-effective ECOs at one time. However, developing an energy management account allows you to accumulate the funds necessary to implement energy conservation measures. If you take the energy cost savings you realize from implementing one ECO and apply all or part of those dollars toward paying for another ECO, you can use money that was budgeted for energy bills to pay for installing other energy-saving measures. If you want to use some of the savings for other business purposes, you can reduce the amount of the savings you put into this energy management account.

The energy management account can be especially valuable when it is used to accumulate the dollar savings from any ECOs which have little or no implementation cost. If you "deposit" the savings from these low or no-cost ECOs in your energy management account, you can often pay for the other ECOs out of that account with no supplemental funding.

Other Financing Programs

Even with an energy management account, you may find it difficult to finance some of the ECOs. However, there are a number of methods available for paying for energy efficiency improvements.

○ Utility incentives

GRU has a low interest loan for customers who make lighting system improvements

○ Commercial loans

Commercial lending institutions often loan money for energy efficiency projects. Although you are charged interest on the loan, the monthly payments are generally less than the monthly savings on your energy bill.

- Government loans

The State of Florida loans money to small businesses to help them reduce their energy consumption. To qualify for the Florida Energy Loan Program (FELP), a company must have 200 employees or less, and must have made a profit for the past two consecutive years. Eligible conservation measures include replacing equipment with more energy efficient models; renovation of the business (air conditioning ducts, relocation of thermostats, etc.) for the purpose of energy conservation; and building retrofits including replacement of windows and heating, ventilation, and air conditioning units. The term of the loan is for a maximum of 7 years. The monthly payment is approximately 75% of the average monthly energy savings. The interest rate varies: it is 5% for loans up to \$5,000; 7% for \$5,001 to \$10,000; and 9% for \$11,000 to \$25,000.

- Performance contracts

Performance contracts (Shared Savings, ESCO, Guaranteed Savings) are attractive financing options. With this type of financing, the avoided energy cost resulting from the increased energy efficiency of the new equipment pays for the equipment. However, you must be sure the cost-benefit analysis is correct, and you must check to see that the new equipment is being used correctly.

Performance contracting can be simple if the project involves something like a straight-forward lighting change-out where the cost savings can easily be calculated. In most cases, the cost and risk of the project is largely taken by the contractor, but the user must relinquish a certain amount of control. Also many of the factors to be considered will require in-house expertise. Nevertheless, performance contracting is an option that you should consider carefully because of the benefits it can bring if done right.

Shared savings is a particularly useful option for businesses that do not have the capital to pursue needed energy projects. This option is based on using the energy cost savings in the existing energy budget to pay for the project. The shared savings company is usually responsible for the engineering study, energy and economic evaluation, purchase and installation, and maintenance. The customer pays some percentage of the savings (usually around 50%) to the shared savings company for a specified period of time (normally 5-10 years).

Performance contract for energy services is a variation of a shared savings program. An energy service company (ESCO) contracts with the customer to provide certain energy services such as providing specific levels of heating, cooling, illumination, or the use of equipment for other purposes. The ESCO then takes over the payment of the utility bills that are directly related to the energy services provided.

ENERGY BILLS

Evaluating the energy and cost records for your company is an important step in an energy use assessment. These figures can reveal trends and irregularities in energy usage and costs.

Electric Use

Your company receives its electric utility service from the Gainesville Regional Utilities.

- **Annual Cost of Electricity**

Your company paid a total of \$34,900 for 439,380 KWH of electricity for the year.

- **Graph**

The following graph shows the electric energy usage and costs incurred over the period of August 1994 to July 1995.

Your electric energy use is higher in the summer months than the winter months because of your air conditioning load.

Natural Gas Use

Your company receives its gas service from the Gainesville Regional Utilities.

- Annual Cost of Natural Gas

Your company paid \$1,192 for 2,371 therms, an average cost of \$0.50 per therm.

- Graph

The following graph shows the natural gas use and costs incurred for the twelve-month period from August 1994 to July 1995.

You use more natural gas in the winter months than in the summer months due to your heating load.

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UNIVERSITY OF FLORIDA

Energy Analysis and Diagnostic Center

COMMERCIAL ENERGY USE ANALYSIS

Summary of Results	
Dollar Savings:	\$5,406/yr
Energy Savings:	55,358 KWH/yr
Cost to Implement:	\$2,780
Payback Period	0.5 yrs

INTRODUCTION:

On July 26, 1995, our team from the Energy Analysis and Diagnostic Center at the University of Florida performed an energy use survey at your facility. We have reviewed and analyzed the data gathered, and have identified 4 Energy Conservation Opportunities that could save money for your company.

If you implement all of the ECOs, you should save approximately \$5,400 per year on your electric bills. This is a savings of 39 percent of your present cost. It will cost you about \$2,800 to make these changes. As a result, if you install all of these ECOs at one time, you will recover your full investment in these energy savings measures in about 0.5 years.

Some of the ECOs can be implemented over a period of the time because you only install the new high-efficiency equipment when the old equipment wears out or fails. You save the additional labor cost associated with immediate replacement and the cost of any useful life remaining with the existing equipment. However, using this method means that you will not realize the total energy and cost savings for that ECO until all equipment has been replaced.

Our team has recommended ECOs in the area of lighting. We have provided descriptive information about each ECO to explain what you need to do. The table following the text summarizes the savings from these ECOs. Next, we describe some financing options available

to help you pay the capital costs of implementing some of the ECOs. These can be very helpful if you do not have enough capital on hand to implement these energy efficiency improvements. Finally, we give you a short explanation of your electric bills and we use a graph to summarize your annual electric bills for you. This graph provides a useful picture of your annual energy consumption pattern.

DESCRIPTION OF ENERGY CONSERVATION OPPORTUNITIES

LIGHTING RECOMMENDATIONS

<p>ECO #1</p>	<p>Install High-Efficiency Lighting</p> <p>Efficiency of lighting has improved dramatically in recent years. Your facility is currently lighted with less efficient lamps. Replacing many of your present lamps with high-efficiency lamps as they burn out, will allow you to implement this ECO without incurring an appreciable implementation cost.</p> <ul style="list-style-type: none"> ○ Replace 40-watt fluorescent lamps with high-efficiency 34-watt lamps. <p>The implementation cost for this ECO is \$102, and the associated annual cost savings is \$688. This results in a payback period of 0.2 years.</p>
<p>ECO #2</p>	<p>Install Reflectors</p> <p>Special reflectors are available for both fluorescent lamp fixtures and high-intensity discharge fixtures. These reflectors approximately double the light output of the lamp fixture. But since your operations require a high light output, we recommend that you disconnect only one quarter of the ballasts and lamps.</p> <p>You presently use about 220 40-watt lamps and 110 ballasts. We recommend that you install reflectors on all of these fixtures and disconnect a quarter of the lamps uniformly. Since the fixtures are located close to each other, you can then disconnect a quarter of the ballasts and re-wire the rest. The savings for this ECO are calculated with the assumption that you have implemented ECO #1 and have replaced all 40 watt lamps with 34 watt lamps. The labor-inclusive implementation cost for this ECO is \$2,750, and the associated annual cost savings is \$1,145. This results in a payback period of 2.4 years.</p>

<p>ECO #3</p>	<p>Replace Incandescent lamps with Compact Fluorescent lamps</p> <p>All the outside lamps in your facility are 100-watt incandescent lamps. An 18-watt compact fluorescent lamp produces diffused low-glare lighting that closely resembles the light output of a 100-watt incandescent lamp. Compact fluorescent lamps can be retrofitted in a regular incandescent lamp holder without an adaptor. For your facility, we recommend that you replace all the 100-watt incandescent lamps with 17-watt compact fluorescent lamps as they fail.</p> <p>The implementation cost for this ECO is \$1,425. The annual cost savings is \$2,150. This results in a payback period of 0.7 years, or 8 months.</p>
<p>ECO #4</p>	<p>Install Occupancy Sensors</p> <p>The main conference room and the Trust Department conference room are seldom used and have little traffic flow. Install occupancy sensing devices to control lighting during periods when no one is using this area/these areas.</p> <p>The implementation cost for this ECO is \$228 including \$100 in labor costs. The annual cost savings is \$379. Installing occupancy sensors has a payback period of 0.6 years, or 7 months.</p>

**ENERGY CONSERVATION OPPORTUNITIES (ECOs)
SUMMARY OF SAVINGS AND COSTS**

ECO Number and Description	Potential Savings (\$/yr)	Cost to Implement (\$)	Payback Period (yrs)	Energy Savings (KWH/yr)	Demand Reduction (KW)
1. Install High-efficiency Lighting	688	102	0.2	8,931	1.5
2. Install Reflectors	1,145	2,750	2.4	12,563	2.2
3. Replace Incandescent Lamps	2,150	1,425	0.7	28,044	4.7
3. Install Occupancy Sensors	379	228	0.6	5,820	0.0
Totals	\$5,406	\$2,780	0.5	55,358	8.4

How to Pay for Your Energy Conservation Measures

In-house capital

In-house capital or internal financing is the most common way that companies pay for their energy efficiency measures. Under this method, you use funds available within your organization to finance a project or purchase the equipment under consideration. The cost of using these funds is what they could have produced if invested somewhere else or used for another project.

Develop an energy management account

Most businesses do not have sufficient funds on hand to implement all of the cost-effective ECOs at one time. However, developing an energy management account allows you to accumulate the funds necessary to implement energy conservation measures. If you take the energy cost savings you realize from implementing one ECO and apply all or part of those dollars toward paying for another ECO, you can use money that was budgeted for energy bills to pay for installing other energy-saving measures. If you want to use some of the savings for other business purposes, you can reduce the amount of the savings you put into this energy management account.

The energy management account can be especially valuable when it is used to accumulate the dollar savings from any ECOs which have little or no implementation cost. If you "deposit" the savings from these low or no-cost ECOs in your energy management account, you can often pay for the other ECOs out of that account with no supplemental funding.

Other Financing Programs

Even with an energy management account, you may find it difficult to finance some of the ECOs. However, there are a number of methods available for paying for energy efficiency improvements.

○ Utility incentives

GRU has a low interest loan for customers who make lighting system improvements

○ Commercial loans

Commercial lending institutions often loan money for energy efficiency projects. Although you are charged interest on the loan, the monthly payments are generally less than the monthly savings on your energy bill.

○ **Government loans**

The State of Florida loans money to small businesses to help them reduce their energy consumption. To qualify for the Florida Energy Loan Program (FELP), a company must have 200 employees or less, and must have made a profit for the past two consecutive years. Eligible conservation measures include replacing equipment with more energy efficient models; renovation of the business (air conditioning ducts, relocation of thermostats, etc.) for the purpose of energy conservation; and building retrofits including replacement of windows and heating, ventilation, and air conditioning units. The term of the loan is for a maximum of 7 years. The monthly payment is approximately 75% of the average monthly energy savings. The interest rate varies: it is 5% for loans up to \$5,000; 7% for \$5,001 to \$10,000; and 9% for \$11,000 to \$25,000.

○ **Performance contracts**

Performance contracts (Shared Savings, ESCO, Guaranteed Savings) are attractive financing options. With this type of financing, the avoided energy cost resulting from the increased energy efficiency of the new equipment pays for the equipment. However, you must be sure the cost-benefit analysis is correct, and you must check to see that the new equipment is being used correctly.

Performance contracting can be simple if the project involves something like a straight-forward lighting change-out where the cost savings can easily be calculated. In most cases, the cost and risk of the project is largely taken by the contractor, but the user must relinquish a certain amount of control. Also many of the factors to be considered will require in-house expertise. Nevertheless, performance contracting is an option that you should consider carefully because of the benefits it can bring if done right.

Shared savings is a particularly useful option for businesses that do not have the capital to pursue needed energy projects. This option is based on using the energy cost savings in the existing energy budget to pay for the project. The shared savings company is usually responsible for the engineering study, energy and economic evaluation, purchase and installation, and maintenance. The customer pays some percentage of the savings (usually around 50%) to the shared savings company for a specified period of time (normally 5-10 years).

Performance contract for energy services is a variation of a shared savings program. An energy service company (ESCO) contracts with the customer to provide certain energy services such as providing specific levels of heating, cooling, illumination, or the use of equipment for other purposes. The ESCO then takes over the payment of the utility bills that are directly related to the energy services provided.

ENERGY BILLS

Evaluating the energy and cost records for your company is an important step in an energy use assessment. These figures can reveal trends and irregularities in energy usage and costs.

Electric Use

Your company receives its electric utility service from The Gainesville Regional Utilities.

- Annual Cost of Electricity

Your company paid a total of \$13,300 for 168,400 KWH of electricity for the year.

- Graph

The following graph shows the electric energy usage and costs incurred over the period of August 1994 to July 1995.

- Explanation of Electric Bills

Your electric energy use is higher in the summer months than the winter months because of your air conditioning load.

The work and recommendations described in this report are a service provided by the Energy Analysis and Diagnostic Center at the University of Florida as part of a pilot project funded by the U.S. Department of Energy.

The primary objective of the commercial energy audit program is to identify and evaluate opportunities for energy conservation and demand reduction through visits to commercial facilities. Data are gathered during a one-day site visit and opportunities for saving energy and reducing demand are identified. Since the site visits are brief, they are necessarily limited in scope. Therefore, if you are interested in pursuing an Energy Conservation Opportunity (ECO) which involves engineering design and significant capital investment, you need to engage a consulting engineering firm to perform the detailed engineering design and cost estimations for implementing the ECO.

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**UNIVERSITY OF
FLORIDA**

**Energy Analysis and
Diagnostic Center**

COMMERCIAL ENERGY USE ANALYSIS

Summary of Results	
Dollar Savings:	\$3,711/yr
Energy Savings:	53,723 KWH/yr
Cost to Implement:	\$1,809
Payback Period	0.5 yrs

INTRODUCTION:

On June 8, 1995, our team from the Energy Analysis and Diagnostic Center at the University of Florida performed an energy use survey at your facility. We have reviewed and analyzed the data gathered, and have identified 3 Energy Conservation Opportunities that could save money for your company.

If you implement all of the ECOs, you should save approximately \$3,700 per year on your electric bills. This is a savings of 29 percent of your present cost. It will cost you about \$1,809 to make these changes. As a result, if you install all of these ECOs at one time, you will recover your full investment in these energy savings measures in about 0.5 years.

Some of the ECOs can be implemented over a period of the time because you only install the new high-efficiency equipment when the old equipment wears out or fails. You save the additional labor cost associated with immediate replacement and the cost of any useful life remaining with the existing equipment. However, using this method means that you will not realize the total energy and cost savings for that ECO until all equipment has been replaced.

Our team has recommended ECOs in the area of lighting. We have provided descriptive information about each ECO to explain what you need to do. The table following the text summarizes the savings from these ECOs. Next, we describe some financing options available

to help you pay the capital costs of implementing some of the ECOs. These can be very helpful if you do not have enough capital on hand to implement these energy efficiency improvements. Finally, we give you a short explanation of your electric bills and we use a graph to summarize your annual electric bills for you. This graph provides a useful picture of your annual energy consumption pattern.

DESCRIPTION OF ENERGY CONSERVATION OPPORTUNITIES

LIGHTING RECOMMENDATIONS

ECO #1	<p>Install High-Efficiency Lighting</p> <p>Efficiency of lighting has improved dramatically in recent years. Your facility is currently lighted with less efficient lamps. Replacing many of your present lamps with high-efficiency lamps as they burn out, will allow you to implement this ECO without incurring an appreciable implementation cost.</p> <ul style="list-style-type: none"> ○ Replace all of your 40-watt fluorescent lamps with high-efficiency 34-watt lamps. ○ Replace all of your 110-watt fluorescent lamps with high-efficiency 95-watt lamps. <p>The implementation cost for this ECO is \$184, and the associated annual cost savings is \$1,169. This results in a payback period of 0.2 years, or 3 months.</p>
ECO #2	<p>Install Reflectors</p> <p>Special reflectors are available for both fluorescent lamp fixtures and high-intensity discharge fixtures. These reflectors approximately double the light output of the lamp fixture. But since your operations require a high light output, we recommend that you disconnect only one quarter of the ballasts and lamps.</p> <p>You presently use about 324 40/34-watt lamps and 162 ballasts. We recommend that you install reflectors on all of these fixtures and disconnect a quarter of the lamps uniformly. Since the fixtures are located close to each other, you can then disconnect a quarter of the ballasts and re-wire the rest. The labor-inclusive implementation cost for this ECO is \$1,025, and the associated annual cost savings is \$2,189. This results in a payback period of 0.5 years, or six months.</p>

ECO #3

Utilize Sunlight

Your facility has windows on the South and the East. These areas can use natural lighting during the day time. Install a photosensor to utilize sunlight in the areas bordering these windows.

The implementation cost for this ECO is \$600, which includes a installation and re-wiring cost of \$300, and the associated annual cost savings is \$353. This results in a payback period of 1.7 years.

**ENERGY CONSERVATION OPPORTUNITIES (ECOs)
SUMMARY OF SAVINGS AND COSTS**

ECO Number and Description	Potential Savings (\$/yr)	Cost to Implement (\$)	Payback Period (yrs)	Energy Savings (KWH/yr)	Demand Reduction (KW)
1. Install High-efficiency Lighting	1,169	184	0.2	19,154	2.7
2. Install Reflectors	2,189	1,025	0.5	28,594	2.6
3. Utilize Sunlight	353	600	1.7	5,975	0.0
Totals	\$3,711	\$1,809	0.5	53,723	5.3

How to Pay for Your Energy Conservation Measures

In-house capital

In-house capital or internal financing is the most common way that companies pay for their energy efficiency measures. Under this method, you use funds available within your organization to finance a project or purchase the equipment under consideration. The cost of using these funds is what they could have produced if invested somewhere else or used for another project.

Develop an energy management account

Most businesses do not have sufficient funds on hand to implement all of the cost-effective ECOs at one time. However, developing an energy management account allows you to accumulate the funds necessary to implement energy conservation measures. If you take the energy cost savings you realize from implementing one ECO and apply all or part of those dollars toward paying for another ECO, you can use money that was budgeted for energy bills to pay for installing other energy-saving measures. If you want to use some of the savings for other business purposes, you can reduce the amount of the savings you put into this energy management account.

The energy management account can be especially valuable when it is used to accumulate the dollar savings from any ECOs which have little or no implementation cost. If you "deposit" the savings from these low or no-cost ECOs in your energy management account, you can often pay for the other ECOs out of that account with no supplemental funding.

Other Financing Programs

Even with an energy management account, you may find it difficult to finance some of the ECOs. However, there are a number of methods available for paying for energy efficiency improvements.

○ Utility incentives

GRU has a low interest loan for customers who make lighting system improvements

○ Commercial loans

Commercial lending institutions often loan money for energy efficiency projects. Although you are charged interest on the loan, the monthly payments are generally less than the monthly savings on your energy bill.

○ **Government loans**

The State of Florida loans money to small businesses to help them reduce their energy consumption. To qualify for the Florida Energy Loan Program (FELP), a company must have 200 employees or less, and must have made a profit for the past two consecutive years. Eligible conservation measures include replacing equipment with more energy efficient models; renovation of the business (air conditioning ducts, relocation of thermostats, etc.) for the purpose of energy conservation; and building retrofits including replacement of windows and heating, ventilation, and air conditioning units. The term of the loan is for a maximum of 7 years. The monthly payment is approximately 75% of the average monthly energy savings. The interest rate varies: it is 5% for loans up to \$5,000; 7% for \$5,001 to \$10,000; and 9% for \$11,000 to \$25,000.

○ **Performance contracts**

Performance contracts (Shared Savings, ESCO, Guaranteed Savings) are attractive financing options. With this type of financing, the avoided energy cost resulting from the increased energy efficiency of the new equipment pays for the equipment. However, you must be sure the cost-benefit analysis is correct, and you must check to see that the new equipment is being used correctly.

Performance contracting can be simple if the project involves something like a straight-forward lighting change-out where the cost savings can easily be calculated. In most cases, the cost and risk of the project is largely taken by the contractor, but the user must relinquish a certain amount of control. Also many of the factors to be considered will require in-house expertise. Nevertheless, performance contracting is an option that you should consider carefully because of the benefits it can bring if done right.

Shared savings is a particularly useful option for businesses that do not have the capital to pursue needed energy projects. This option is based on using the energy cost savings in the existing energy budget to pay for the project. The shared savings company is usually responsible for the engineering study, energy and economic evaluation, purchase and installation, and maintenance. The customer pays some percentage of the savings (usually around 50%) to the shared savings company for a specified period of time (normally 5-10 years).

Performance contract for energy services is a variation of a shared savings program. An energy service company (ESCO) contracts with the customer to provide certain energy services such as providing specific levels of heating, cooling, illumination, or the use of equipment for other purposes. The ESCO then takes over the payment of the utility bills that are directly related to the energy services provided.

ENERGY BILLS

Evaluating the energy and cost records for your company is an important step in an energy use assessment. These figures can reveal trends and irregularities in energy usage and costs.

Electric Use

Your company receives its electric utility service from THE Gainesville Regional Utilities.

- **Annual Cost of Electricity**

Your company paid a total of \$12,060 for 156,460 KWH of electricity for the year.

- **Graph**

The following graph shows the electric energy usage and costs incurred over the period of July 1994 to June 1995.

- **Explanation of Electric Bills**

Your electric energy use is higher in the summer months than the winter months because of your air conditioning load.

The work and recommendations described in this report are a service provided by the Energy Analysis and Diagnostic Center at the University of Florida as part of a pilot project funded by the U.S. Department of Energy.

The primary objective of the commercial energy audit program is to identify and evaluate opportunities for energy conservation and demand reduction through visits to commercial facilities. Data are gathered during a one-day site visit and opportunities for saving energy and reducing demand are identified. Since the site visits are brief, they are necessarily limited in scope. Therefore, if you are interested in pursuing an Energy Conservation Opportunity (ECO) which involves engineering design and significant capital investment, you need to engage a consulting engineering firm to perform the detailed engineering design and cost estimations for implementing the ECO.

OFFICIAL DISCLAIMER

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Two Audits from Energy Management Class

Appendix F

**UNIVERSITY OF
FLORIDA**
**Student Energy
Management Team**

COMMERCIAL ENERGY USE ANALYSIS

SUMMARY OF RESULTS	
DOLLAR SAVINGS:	\$5744.85/YR
ENERGY SAVINGS:	26,647 KWH/YR
COST TO IMPLEMENT:	\$2117
PAYBACK PERIOD	0.4 YRS

INTRODUCTION:

ON MARCH 15, 1995, OUR TEAM FROM THE UNIVERSITY OF FLORIDA ENERGY MANAGEMENT CLASS PERFORMED AN ENERGY USE SURVEY AT YOUR FACILITY. WE HAVE REVIEWED AND ANALYZED THE DATA GATHERED, AND HAVE IDENTIFIED *ELEVEN* ENERGY CONSERVATION OPPORTUNITIES THAT COULD SAVE MONEY FOR YOUR COMPANY.

IF YOU IMPLEMENT ALL OF THE ECOs, YOU SHOULD SAVE APPROXIMATELY \$5700 PER YEAR ON YOUR *ELECTRIC* BILLS. THIS IS A SAVINGS OF 17.3 PERCENT OF YOUR PRESENT COST. IT WILL COST YOU ABOUT \$2200 TO MAKE THESE CHANGES. AS A RESULT, IF YOU INSTALL ALL OF THESE ECOs AT ONE TIME, YOU WILL RECOVER YOUR FULL INVESTMENT IN THESE ENERGY SAVINGS MEASURES IN ABOUT 0.4 YEARS.

SOME OF THE ECOs CAN BE IMPLEMENTED OVER A PERIOD OF THE TIME BECAUSE YOU ONLY INSTALL THE NEW HIGH-EFFICIENCY EQUIPMENT WHEN THE OLD EQUIPMENT WEARS OUT OR FAILS. YOU SAVE THE ADDITIONAL LABOR COST ASSOCIATED WITH IMMEDIATE REPLACEMENT AND THE COST OF ANY USEFUL LIFE REMAINING WITH THE EXISTING EQUIPMENT. HOWEVER, USING THIS METHOD MEANS THAT YOU WILL NOT REALIZE THE TOTAL ENERGY AND COST SAVINGS FOR THAT ECO UNTIL ALL EQUIPMENT HAS BEEN REPLACED.

OUR TEAM HAS RECOMMENDED ECOS IN A NUMBER OF AREAS INCLUDING LIGHTING, AIR CONDITIONING, INSULATION AND WASTE HEAT RECOVERY. WE HAVE PROVIDED DESCRIPTIVE INFORMATION ABOUT EACH ECO TO EXPLAIN WHAT YOU NEED TO DO. THE TABLE FOLLOWING THE TEXT SUMMARIZES THE SAVINGS FROM THESE ECOS. NEXT, WE DESCRIBE SOME FINANCING OPTIONS AVAILABLE TO HELP YOU PAY THE CAPITAL COSTS OF IMPLEMENTING SOME OF THE ECOS. THESE CAN BE VERY HELPFUL IF YOU DO NOT HAVE ENOUGH CAPITAL ON HAND TO IMPLEMENT THESE ENERGY EFFICIENCY IMPROVEMENTS. FINALLY, WE GIVE YOU A SHORT EXPLANATION OF YOUR ELECTRIC BILLS AND WE USE A GRAPH TO SUMMARIZE YOUR ANNUAL ELECTRIC BILLS FOR YOU. THIS GRAPH PROVIDES A USEFUL PICTURE OF YOUR ANNUAL ENERGY CONSUMPTION PATTERN.

DESCRIPTION OF ENERGY CONSERVATION OPPORTUNITIES

LIGHTING RECOMMENDATIONS

ECO #1	REPLACE FOUR 150W FLOODLIGHTS ABOVE DART BOARDS WITH FOUR 16W FLOURESCENT FLOODLIGHTS AND REPLACE ONE 120W FLOODLIGHT ABOVE BASKETBALL GAME WITH 16W FLOURESCENT FLOODLIGHT.
ECO #2	REPLACE ALL 55W FAN LIGHTS AND FRONT FOYER LIGHT WITH 15W COMPACT FLOURESCENT LIGHTS
ECO #3	LOWER FOUR FOOT FLOURESCENT FIXTURES IN HALLWAY 1.5 FEET AND REMOVE ONE FLOURESCENT BULB IN EACH FIXTURE.
ECO #4	REMOVE ONE FOUR FOOT FLOURESCENT BULB IN KEG COOLER FIXTURE, IN MEN'S AND WOMEN'S BATHROOM IN MULLET, IN MEN'S BATHROOM IN PORPOISE, AND REMOVE ONE FIXTURE IN FOOD PREPARATION KITCHEN.

HVAC RECOMMENDATIONS

ECO #5	INCREASE AIR TEMPERATURE TO 74 FROM OPENING UNTIL 9:30 P.M. INSTEAD OF 68.
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BUILDING ENVELOPE RECOMMENDATIONS

ECO #6	ADD WEATHER STRIPPING AND METAL SIL TO BACK DOOR
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OTHER RECOMMENDATIONS

ECO #7	ADD VINYL STRIPS TO DOORWAY IN ALL WALK-IN COOLERS
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ECO #8	ADD WATER HEATER INSULATING BLANKET TO WATER HEATER
ECO #9	ADD HEAT EXCHANGER TO GRILL EXHAUST NETWORK TO PREHEAT WATER FOR WATER HEATER
ECO #10	CLEAN ALL LENSES AND LIGHT FIXTURES
ECO #11	ADD INSULATION BOARD BETWEEN CONDIMENT COOLER AND GRILL

HOW TO PAY FOR YOUR ENERGY CONSERVATION MEASURES

IN-HOUSE CAPITAL

IN-HOUSE CAPITAL OR INTERNAL FINANCING IS THE MOST COMMON WAY THAT COMPANIES PAY FOR THEIR ENERGY EFFICIENCY MEASURES. UNDER THIS METHOD, YOU USE FUNDS AVAILABLE WITHIN YOUR ORGANIZATION TO FINANCE A PROJECT OR PURCHASE THE EQUIPMENT UNDER CONSIDERATION. THE COST OF USING THESE FUNDS IS WHAT THEY COULD HAVE PRODUCED IF INVESTED SOMEWHERE ELSE OR USED FOR ANOTHER PROJECT.

DEVELOP AN ENERGY MANAGEMENT ACCOUNT

MOST BUSINESSES DO NOT HAVE SUFFICIENT FUNDS ON HAND TO IMPLEMENT ALL OF THE COST-EFFECTIVE ECOs AT ONE TIME. HOWEVER, DEVELOPING AN ENERGY MANAGEMENT ACCOUNT ALLOWS YOU TO ACCUMULATE THE FUNDS NECESSARY TO IMPLEMENT ENERGY CONSERVATION MEASURES. IF YOU TAKE THE ENERGY COST SAVINGS YOU REALIZE FROM IMPLEMENTING ONE ECO AND APPLY ALL OR PART OF THOSE DOLLARS TOWARD PAYING FOR ANOTHER ECO, YOU CAN USE MONEY THAT WAS BUDGETED FOR ENERGY BILLS TO PAY FOR INSTALLING OTHER ENERGY-SAVING MEASURES. IF YOU WANT TO USE SOME OF THE SAVINGS FOR OTHER BUSINESS PURPOSES, YOU CAN REDUCE THE AMOUNT OF THE SAVINGS YOU PUT INTO THIS ENERGY MANAGEMENT ACCOUNT.

THE ENERGY MANAGEMENT ACCOUNT CAN BE ESPECIALLY VALUABLE WHEN IT IS USED TO ACCUMULATE THE DOLLAR SAVINGS FROM ANY ECOs WHICH HAVE LITTLE OR NO IMPLEMENTATION COST. IF YOU "DEPOSIT" THE SAVINGS FROM THESE LOW OR NO-COST ECOs IN YOUR ENERGY MANAGEMENT ACCOUNT, YOU CAN OFTEN PAY FOR THE OTHER ECOs OUT OF THAT ACCOUNT WITH NO SUPPLEMENTAL FUNDING.

OTHER FINANCING PROGRAMS

◦ UTILITY INCENTIVES

EVEN WITH AN ENERGY MANAGEMENT ACCOUNT, YOU MAY FIND IT DIFFICULT TO FINANCE SOME OF THE ECOs. HOWEVER, THERE ARE A NUMBER OF METHODS AVAILABLE FOR PAYING FOR ENERGY EFFICIENCY IMPROVEMENTS.

SOME UTILITIES OFFER REBATES OR FINANCIAL INCENTIVES TO HELP THEIR CUSTOMERS REDUCE THE INITIAL COST OF CERTAIN ENERGY EFFICIENCY IMPROVEMENTS. THESE UTILITY PROGRAMS WILL OFTEN REIMBURSE YOU FOR A PORTION OF THE COST OF THE ENERGY EFFICIENCY MEASURE.

◦ COMMERCIAL LOANS

COMMERCIAL LENDING INSTITUTIONS OFTEN LOAN MONEY FOR

◦ **GOVERNMENT
LOANS**

ENERGY EFFICIENCY PROJECTS. ALTHOUGH YOU ARE CHARGED INTEREST ON THE LOAN, THE MONTHLY PAYMENTS ARE GENERALLY LESS THAN THE MONTHLY SAVINGS ON YOUR ENERGY BILL.

THE STATE OF FLORIDA LOANS MONEY TO SMALL BUSINESSES TO HELP THEM REDUCE THEIR ENERGY CONSUMPTION. TO QUALIFY FOR THE **FLORIDA ENERGY LOAN PROGRAM (FELP)**, A COMPANY MUST HAVE 200 EMPLOYEES OR LESS, AND MUST HAVE MADE A PROFIT FOR THE PAST TWO CONSECUTIVE YEARS. ELIGIBLE CONSERVATION MEASURES INCLUDE REPLACING EQUIPMENT WITH MORE ENERGY EFFICIENT MODELS; RENOVATION OF THE BUSINESS (AIR CONDITIONING DUCTS, RELOCATION OF THERMOSTATS, ETC.) FOR THE PURPOSE OF ENERGY CONSERVATION; AND BUILDING RETROFITS INCLUDING REPLACEMENT OF WINDOWS AND HEATING, VENTILATION, AND AIR CONDITIONING UNITS. THE TERM OF THE LOAN IS FOR A MAXIMUM OF 7 YEARS. THE MONTHLY PAYMENT IS APPROXIMATELY 75% OF THE AVERAGE MONTHLY ENERGY SAVINGS. THE INTEREST RATE VARIES: IT IS 5% FOR LOANS UP TO \$5,000; 7% FOR \$5,001 TO \$10,000; AND 9% FOR \$11,000 TO \$25,000.

◦ **PERFORMANCE
CONTRACTS**

PERFORMANCE CONTRACTS (SHARED SAVINGS, ESCO, GUARANTEED SAVINGS) ARE ATTRACTIVE FINANCING OPTIONS. THE BASIS FOR THIS TYPE OF FINANCING IS QUITE SIMPLE; THE AVOIDED ENERGY COST RESULTING FROM THE INCREASED ENERGY EFFICIENCY OF THE NEW EQUIPMENT PAYS FOR THE EQUIPMENT. HOWEVER, YOU MUST BE SURE THE COST-BENEFIT ANALYSIS HAS BEEN DONE CORRECTLY, AND YOU MUST CHECK TO SEE THAT THE NEW EQUIPMENT IS BEING USED CORRECTLY.

PERFORMANCE CONTRACTING CAN BE SIMPLE IF THE PROJECT INVOLVES SOMETHING LIKE A STRAIGHT-FORWARD LIGHTING CHANGE-OUT WHERE THE COST SAVINGS CAN EASILY BE CALCULATED. IN MOST CASES, THE COST AND RISK OF THE PROJECT IS LARGELY TAKEN BY THE CONTRACTOR, BUT THE USER MUST RELINQUISH A CERTAIN AMOUNT OF CONTROL. ALSO MANY OF THE FACTORS TO BE CONSIDERED WILL REQUIRE IN-HOUSE EXPERTISE. NEVERTHELESS, PERFORMANCE CONTRACTING IS AN OPTION THAT YOU SHOULD CONSIDER CAREFULLY BECAUSE OF THE BENEFITS IT CAN BRING IF DONE RIGHT.

SHARED SAVINGS IS A PARTICULARLY USEFUL OPTION FOR BUSINESSES THAT DO NOT HAVE THE CAPITAL TO PURSUE NEEDED ENERGY PROJECTS. THIS OPTION IS BASED ON USING THE ENERGY COST SAVINGS IN THE EXISTING ENERGY BUDGET TO PAY FOR THE PROJECT. THE SHARED SAVINGS COMPANY IS USUALLY RESPONSIBLE

FOR THE ENGINEERING STUDY, ENERGY AND ECONOMIC EVALUATION, PURCHASE AND INSTALLATION, AND MAINTENANCE. THE CUSTOMER PAYS SOME PERCENTAGE OF THE SAVINGS (USUALLY AROUND 50%) TO THE SHARED SAVINGS COMPANY FOR A SPECIFIED PERIOD OF TIME (NORMALLY 5-10 YEARS).

PERFORMANCE CONTRACT FOR ENERGY SERVICES IS A VARIATION OF A SHARED SAVINGS PROGRAM. AN ENERGY SERVICE COMPANY (ESCO) CONTRACTS WITH THE CUSTOMER TO PROVIDE CERTAIN ENERGY SERVICES SUCH AS PROVIDING SPECIFIC LEVELS OF HEATING, COOLING, ILLUMINATION, OR THE USE OF EQUIPMENT FOR OTHER PURPOSES. THE ESCO THEN TAKES OVER THE PAYMENT OF THE UTILITY BILLS THAT ARE DIRECTLY RELATED TO THE ENERGY SERVICES PROVIDED.

ENERGY BILLS

EVALUATING THE ENERGY AND COST RECORDS FOR YOUR COMPANY IS AN IMPORTANT STEP IN AN ENERGY USE ASSESSMENT. THESE FIGURES CAN REVEAL TRENDS AND IRREGULARITIES IN ENERGY USAGE AND COSTS.

ELECTRIC USE

YOUR COMPANY RECEIVES ITS ELECTRIC UTILITY SERVICE FROM GAINESVILLE REGIONAL UTILITIES.

◦ ANNUAL COST OF ELECTRICITY

YOUR COMPANY PAID A TOTAL OF \$28,451.69 FOR 489,273 KWH OF ELECTRICITY FOR THE YEAR. THE FOLLOWING GRAPH SHOWS THE ELECTRIC ENERGY USAGE AND COSTS INCURRED OVER THE PERIOD OF

◦ GRAPH

THE FOLLOWING GRAPH SHOWS THE ENERGY USE AND COSTS INCURRED FOR THE TWELVE-MONTH PERIOD FROM JAN. 1994 TO FEB. 1995.

◦ EXPLANATION OF ELECTRIC BILLS

YOUR ENERGY AND DEMAND CHARTS SHOW A CONSISTENT PATTERN OF USE. YOUR ELECTRIC ENERGY USE IS HIGHER IN THE SUMMER MONTHS THAN THE WINTER MONTHS BECAUSE OF YOUR AIR CONDITIONING LOAD.

NATURAL GAS USE

YOUR COMPANY RECEIVES ITS GAS SERVICE FROM GAINESVILLE REGIONAL UTILITIES.

- **ANNUAL COST OF NATURAL GAS**

YOUR COMPANY PAID \$4,124.55 FOR 10,299 THERMS, AN AVERAGE COST OF \$0.40 PER THERM.

- **GRAPH**

THE FOLLOWING GRAPH SHOWS THE NATURAL GAS USE AND COSTS INCURRED FOR THE TWELVE-MONTH PERIOD FROM FEB. 1994 TO JAN. 1995.

- **EXPLANATION OF NATURAL GAS BILLS**

THE GRAPH OF YOUR NATURAL GAS USE SHOWS A CONSISTENT PATTERN. YOU USE MORE NATURAL GAS DURING THE WINTER MONTHS—NOVEMBER THROUGH MARCH—THAN THE REST OF THE YEAR.

THE WORK AND RECOMMENDATIONS DESCRIBED IN THIS REPORT ARE A SERVICE PROVIDED BY STUDENTS IN THE ENERGY MANAGEMENT CLASS AT THE UNIVERSITY OF FLORIDA AS PART OF A PILOT PROJECT FUNDED BY THE U.S. DEPARTMENT OF ENERGY.

THE PRIMARY OBJECTIVE OF THE COMMERCIAL ENERGY AUDIT PROGRAM IS TO IDENTIFY AND EVALUATE OPPORTUNITIES FOR ENERGY CONSERVATION AND DEMAND REDUCTION THROUGH VISITS TO COMMERCIAL FACILITIES. DATA ARE GATHERED DURING A ONE-DAY SITE VISIT AND OPPORTUNITIES FOR SAVING ENERGY AND REDUCING DEMAND ARE IDENTIFIED. SINCE THE SITE VISITS ARE BRIEF, THEY ARE NECESSARILY LIMITED IN SCOPE. THEREFORE, IF YOU ARE INTERESTED IN PURSUING AN ENERGY CONSERVATION OPPORTUNITY (ECO) WHICH INVOLVES ENGINEERING DESIGN AND SIGNIFICANT CAPITAL INVESTMENT, YOU NEED TO ENGAGE A CONSULTING ENGINEERING FIRM TO PERFORM THE DETAILED ENGINEERING DESIGN AND COST ESTIMATIONS FOR IMPLEMENTING THE ECO.

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DETAILS:

LIGHTING

The problems we encountered at the Purple Porpoise and the Lavender Mullet involving the lighting mainly included using higher efficiency bulbs and removing unnecessary lights where there was too much light originally. Also, cleaning all of the lenses and fixtures would greatly improve the output of all the existing fixtures.

HVAC

We noticed almost immediately the misuse of the cooling system. During the day the temperature of the facility was kept at a level of 68 degrees, which made it too cool for comfort in the daytime when business was the slowest. Seeing this, we recommended that the temperature be raised to 74 degrees from opening until 9:30 p.m., at which time it should be dropped to 68 degrees to handle the larger crowd comfortably.

INSULATION

The only problems that we found with the insulation was the hot water heater remained uninsulated. By adding a layer of insulation we could raise the efficiency of the heater and also help lower the amount of waste heat that being given off in the already overheated kitchen.

HEAT EXCHANGER

To recover a lot of the waste heat in the kitchen area and utilize it we decided that a heat exchanger would be the best bet. We could use the heat that was otherwise being blown out through the exhaust ducts to the outside and preheat the cold water that was going to the hot water heater. This increases the efficiency of the hot water heater because the temperature of the water would not need to be raised so much in the hot water heater itself. We found this to be a very cost effective measure even though the initial cost seems quite high.

MISCELLANEOUS

Other improvements that we would make are as follows:

1. Vinyl strips should be added to all of the walk-in coolers and freezers to reduce the amount of cold air being lost. This saves the amount of work the refrigeration unit has to do.

2. Weather stripping should be added to the rear doors as well as metal sails. These are meant to keep heat or cooling from being lost to the outside around the doors and saves the work done by the HVAC system.
3. Adding insulation board to area between the condiment cooler and the grills would save a lot of cooling work being done by the cooler itself by blocking off the amount of heat that the cooler is exposed to. It would also help keep the food a little fresher.

Purple Porpoise

376-1661

Sharon

UF EADC COMMERCIAL AUDIT PILOT PROGRAM

CLIENT QUESTIONNAIRE

During the Spring semester, you participated in a pilot program in which engineering students from the Energy Management Class at the University of Florida performed an energy audit at your business/facility. As part of the project, we need to evaluate the students' performance and determine whether this program is satisfactory to the companies who received the audits.

I would like to ask you a few questions about the audit if you have time. If you would rather, I can send you a questionnaire to fill out and return to us:

1. Did you get a copy of the students' audit report? Yes.

2. Were you happy with the student audit? Yes

Were the students efficient and courteous? Yes

Would you be willing to participate in another similar student project? Maybe (lot of time)

Would you recommend the student energy audits to someone else? Yes

What change(s) in our student energy audit process (initial contact, audit visit, audit report, etc.) would improve this program the most? Not really - utility bills

3. Were you pleased with the students' audit report?

Was it easy to understand? Yes

Do you have any suggestions for changing the report to make it easier to read and understand? No.

Would you want to see the students' calculations?

4. Are you planning to implement/follow any of the students' suggestions?

If so, which ones? (Please list them here)

(1) Lighting done
(2) Room Temp. - thinking

5. Do you think we should continue this program?

Ar Yes.

6. Do you have any suggestions for improving the program?

No

7. Would you be willing to pay a fee for the audit to help defray the costs of running this program?

Probably

If so, how much do you think would be a reasonable fee?

\$50? \$100? \$150? \$200? Other?

Ms Sharon

Student Energy Management Team

COMMERCIAL ENERGY USE ANALYSIS

Summary of Results	
Dollar Savings:	\$4,736.00/yr
Energy Savings:	53,741 KWH/yr
Cost to Implement:	\$5,921.00
Payback Period:	1.2 yrs

INTRODUCTION:

ON MARCH 27, 1995, OUR TEAM FROM THE UNIVERSITY OF FLORIDA ENERGY MANAGEMENT CLASS PERFORMED AN ENERGY USE SURVEY AT YOUR FACILITY. WE HAVE REVIEWED AND ANALYZED THE DATA GATHERED, AND HAVE IDENTIFIED 8 ENERGY CONSERVATION OPPORTUNITIES THAT COULD SAVE MONEY FOR YOUR COMPANY.

IF YOU IMPLEMENT ALL OF THE ECOS, YOU SHOULD SAVE APPROXIMATELY \$4,700 PER YEAR ON YOUR ELECTRIC BILLS. THIS IS A SAVINGS OF NEARLY 37 PERCENT OF YOUR PRESENT COST. IT WILL COST YOU ABOUT \$5,900 TO MAKE THESE CHANGES. AS A RESULT, IF YOU INSTALL ALL OF THESE ECOS AT ONE TIME, YOU WILL RECOVER YOUR FULL INVESTMENT IN THESE ENERGY SAVINGS MEASURES IN ABOUT 1.2 YEARS.

SOME OF THE ECOS CAN BE IMPLEMENTED OVER A PERIOD OF THE TIME BECAUSE YOU ONLY INSTALL THE NEW HIGH-EFFICIENCY EQUIPMENT WHEN THE OLD EQUIPMENT WEARS OUT OR FAILS. YOU SAVE THE ADDITIONAL LABOR COST ASSOCIATED WITH IMMEDIATE REPLACEMENT AND THE COST OF ANY USEFUL LIFE REMAINING WITH THE EXISTING EQUIPMENT. HOWEVER, USING THIS METHOD MEANS THAT YOU WILL NOT REALIZE THE TOTAL ENERGY AND COST SAVINGS FOR THAT ECO UNTIL ALL EQUIPMENT HAS BEEN REPLACED.

OUR TEAM HAS RECOMMENDED ECOS IN A NUMBER OF AREAS INCLUDING LIGHTING AND AIR CONDITIONING. WE HAVE PROVIDED DESCRIPTIVE INFORMATION ABOUT EACH ECO TO EXPLAIN WHAT YOU NEED TO DO. THE TABLE FOLLOWING THE TEXT SUMMARIZES THE SAVINGS FROM THESE ECOS. NEXT, WE DESCRIBE SOME FINANCING OPTIONS AVAILABLE TO HELP YOU PAY THE CAPITAL COSTS OF IMPLEMENTING SOME OF THE ECOS. THESE CAN BE VERY HELPFUL IF YOU DO NOT HAVE ENOUGH CAPITAL ON HAND TO IMPLEMENT THESE ENERGY EFFICIENCY IMPROVEMENTS. FINALLY, WE GIVE YOU A SHORT EXPLANATION OF YOUR ELECTRIC BILLS AND WE USE A GRAPH TO SUMMARIZE YOUR ANNUAL ELECTRIC BILLS FOR YOU. THIS GRAPH PROVIDES A USEFUL PICTURE OF YOUR ANNUAL ENERGY CONSUMPTION PATTERN.

DESCRIPTION OF ENERGY CONSERVATION OPPORTUNITIES

LIGHTING RECOMMENDATIONS

ECO #1	<p>INSTALL HIGH-EFFICIENCY T-8 LIGHTING SYSTEM IN SHOWROOM</p> <p>THE SHOWROOM, EMPLOYEE LOUNGE AND CUSTOMER REST ROOMS ARE LIGHTED BY LOW-EFFICIENCY FLUORESCENT LAMPS. THE NORTHWEST CORNER OF THE SHOWROOM ALSO CONTAINS FOUR FIXTURES THAT ARE OBSTRUCTED AND DO NOT CONTRIBUTE TO THE LIGHTING IN THAT AREA. HOWEVER, EFFICIENCY OF LIGHTING HAS IMPROVED DRAMATICALLY IN RECENT YEARS. YOU CAN RETROFIT A NEW, ENERGY-EFFICIENT LIGHTING SYSTEM USING HIGH-EFFICIENCY T-8, 32-WATT LAMPS AND ELECTRONIC BALLASTS AS WELL AS DISCONNECT THE FOUR USELESS FIXTURES.</p> <p>IMPLEMENTATION OF THIS ECO WILL COST \$ 3,190 [WHICH INCLUDES A \$ 712 LABOR CHARGE]. THIS ECO WILL SAVE \$ 1,737 IN ANNUAL ENERGY COSTS. YOU WILL BEGIN TO SEE A SAVINGS IN ELECTRIC BILLS THAT WILL REPAY YOUR ADDITIONAL COST OF IMPLEMENTATION WITHIN 1.84 YEARS.</p>
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ECO #2	RECONFIGURE LIGHTING ALONG SHOWROOM SOUTHERN WINDOW
	<p>THE SHOWROOM LIGHTING TOWARDS THE SOUTHERN WINDOWS IS OVER LIGHTED EXCEPT DURING OVERCAST WEATHER CONDITIONS, EARLY MORNING HOURS AND LATE NIGHT HOURS. YOU CAN REDUCE YOUR ENERGY COSTS BY INSTALLING A SEPARATE LIGHT SWITCH TO APPROPRIATE THE TWOS ROWS OF LIGHTS CLOSEST TO THE WINDOWS ONLY WHEN NEEDED. THE SAVINGS FOR THIS ECO WAS CALCULATED ASSUMING THAT ECO #1 HAS BEEN OR WILL BE IMPLEMENTED I CONJUNCTION WITH THIS ECO. HOWEVER, THE SAME PROPORTION OF SAVING WILL BE REALIZED IF THIS ECO IS IMPLEMENTED WITH THE EXISTING LIGHTING SYSTEM.</p>
	<p>THE IMPLEMENTATION COST FOR THIS ECO IS \$ 240 [WHICH IS THE LABOR COST]. THE ANNUAL COST SAVINGS COMES TO \$ 717. THEREFORE CONFIGURING THE LIGHTING ON A SEPARATE LIGHT SWITCH HAS A PAYBACK PERIOD OF .33 YEARS.</p>
ECO #3	DISCONNECT AND RETROFIT LIGHTING AT SERVICE COUNTER
	<p>THE LIGHTING LEVEL IN THE SERVICE COUNTER AREA IS 90 FOOTCANDLES. THE RECOMMENDED LIGHTING LEVEL FOR THIS TYPE OF WORK IS 70 FOOTCANDLES. THIS AREA IS LIGHTED BY LOW EFFICIENCY FLUORESCENT LAMPS, AND FORTUNATELY AS MENTIONED BEFORE THE EFFICIENCY OF LIGHTING HAS IMPROVED DRAMATICALLY IN RECENT YEARS. THUS, WE RECOMMEND YOU CHANGE THE LIGHTING LAYOUT BY, DISCONNECTING FOUR FIXTURES AND RETROFIT A NEW ENERGY EFFICIENT LIGHTING SYSTEM USING HIGH-EFFICIENCY T-8, 32-WATT LAMPS AND ELECTRONIC BALLASTS .</p>
	<p>IMPLEMENTATION OF THIS ECO WILL COST \$ 302 [WHICH INCLUDES A \$ 92 LABOR CHARGE]. THIS ECO WILL SAVE \$ 329 IN ANNUAL ENERGY COSTS. YOU WILL BEGIN TO SEE A SAVINGS IN ELECTRIC BILLS THAT WILL REPAY YOUR ADDITIONAL COST OF IMPLEMENTATION WITHIN .92 YEARS.</p>

ECO #4	<p>DISCONNECT AND RETROFIT LIGHTING IN THE TOOL ROOM</p> <p>THE LIGHTING LEVEL IN THE TOOL ROOM IS 70 FOOTCANDLES. THE RECOMMENDED LIGHTING LEVEL FOR THIS TYPE OF WORK IS 50 FOOTCANDLES. THIS AREA IS LIGHTED BY LOW EFFICIENCY FLUORESCENT LAMPS. IF YOU CHANGE THE LIGHTING LAYOUT BY DISCONNECTING THREE FIXTURES AND RETROFIT A NEW ENERGY EFFICIENT LIGHTING SYSTEM USING HIGH-EFFICIENCY T-8, 32-WATT LAMPS AND ELECTRONIC BALLASTS, YOU WILL REDUCE YOUR ENERGY COSTS.</p> <p>THE IMPLEMENTATION COST FOR THIS ECO IS \$ 3,339 [WHICH INCLUDES A \$ 94 LABOR COST]. THE ANNUAL COST SAVINGS COMES TO \$ 325. THEREFORE, DISCONNECTING AND RETROFITTING LIGHTING HAS A PAYBACK PERIOD OF 1.04 YEARS.</p>
ECO #5	<p>INSTALL HIGH-EFFICIENCY T-8 LIGHTING SYSTEM IN UPSTAIRS OFFICE AREAS</p> <p>THE ENTIRE OFFICE AREA IS LIGHTED BY LOW-EFFICIENCY FLUORESCENT LAMPS. YOU CAN RETROFIT A NEW, ENERGY-EFFICIENT LIGHTING SYSTEM USING HIGH-EFFICIENCY T-8, 32-WATT LAMPS AND ELECTRONIC BALLASTS.</p> <p>IMPLEMENTATION OF THIS ECO WILL COST \$ 1,333 [WHICH INCLUDES A \$ 300 LABOR CHARGE]. THIS ECO WILL SAVE \$ 594 IN ANNUAL ENERGY COSTS. YOU WILL BEGIN TO SEE A SAVINGS IN ELECTRIC BILLS THAT WILL REPAY YOUR ADDITIONAL COST OF IMPLEMENTATION WITHIN 2.24 YEARS.</p>
ECO #6	<p>INSTALL HIGH-EFFICIENCY SECURITY LIGHTING</p> <p>THE SECURITY LIGHTING OUTSIDE IS CURRENTLY LIGHTED WITH LESS EFFICIENT LAMPS. REPLACING YOUR PRESENT LAMPS WITH HIGH-EFFICIENCY LAMPS AS THEY BURN OUT, WILL ALLOW YOU TO IMPLEMENT THIS ECO WITHOUT INCURRING AN APPRECIABLE IMPLEMENTATION COST.</p> <ul style="list-style-type: none"> ○ REPLACE 150-WATT PAR 32 LAMPS WITH A HIGH-EFFICIENCY 100-WATT PAR 32 LAMPS. <p>THE IMPLEMENTATION COST FOR THIS ECO IS \$ 7, AND THE ASSOCIATED COST SAVINGS IS \$317. THIS RESULTS IN A PAYBACK PERIOD OF .022 YEARS OR 8 DAYS.</p>

ECO #7	INSTALL OCCUPANCY SENSORS AND HIGH-EFFICIENCY LIGHTING IN BACK STORAGE LOFTS
	<p>THE BACK STORAGE LOFTS ARE SELDOM USED AND HAVE LITTLE TRAFFIC FLOW. INSTALL OCCUPANCY SENSING DEVICES TO CONTROL LIGHTING DURING PERIODS WHEN NO ONE IS USING THESE AREAS. THE AREAS ARE ALSO CURRENTLY LIGHTED WITH LESS EFFICIENT LAMPS. REPLACING YOUR PRESENT LAMPS WITH HIGH-EFFICIENT LAMPS WILL RESULT IN INCREASED SAVINGS. THE LIGHTING LAYOUT IN THE LOFTS SHOULD ALSO BE CHANGED, THIS WILL RESULT IN EVEN LOWER ENERGY COSTS. WE SUGGEST THE CENTER ROW OF LIGHTING BE DISCONNECTED AND THE TWO ROWS OF LIGHTING ON EITHER SIDE OF THE CENTER ROW BE REDUCED BY DISCONNECTING HALF THE BALLASTS.</p>
	<p>THE IMPLEMENTATION COST FOR THIS ECO IS \$ 493 [INCLUDING \$ 306 IN LABOR COSTS]. THE ANNUAL COST SAVINGS IS \$ 695. INSTALLING OCCUPANCY SENSORS, HIGH-EFFICIENCY LAMPS, AND RECONFIGURING THE LIGHTING YIELDS A PAYBACK PERIOD OF .71 YEARS.</p>
ECO #8	INSTALL REFLECTOR LAMPS IN DOOR STORAGE AREA
	<p>THE DOOR STORAGE AREA IS CURRENTLY LIGHTED WITH INCANDESCENT LAMPS WHICH PROJECT LIGHT IN ALL DIRECTIONS. EVEN THOUGH THE AREA IS LIGHTED WITH 100 WATT LAMPS, THE AREA IS DIM BECAUSE THE LIGHT IS BEING PROJECTED UP INTO THE RAFTERS <u>AND NOT DOWN ONTO THE WORK AREA</u>. WE SUGGEST REPLACING THE A-LAMPS WITH REFLECTOR LAMPS. REFLECTOR LAMPS OFFER A BETTER DOWNWARD CONTROL OF THE LIGHTING AND <u>WILL</u> THEREFORE ALLOW AN INCREASE IN LIGHTING LEVELS WHILE REDUCING WATTAGE AND SAVINGS.</p>
	<p>THE IMPLEMENTATION COST FOR THIS ECO IS \$ 17 [INCLUDING \$.50 IN LABOR COSTS]. THE ASSOCIATED ANNUAL SAVINGS COMES TO \$ 22. INSTALLING REFLECTOR LAMPS HAS A PAYBACK PERIOD OF .79 YEARS.</p>

**ENERGY CONSERVATION OPPORTUNITIES (ECOs)
SUMMARY OF SAVINGS AND COSTS**

ECO Number and Description	Potential Savings (\$/yr)	Cost to Implement (\$)	Payback Period (yrs)	Energy Savings (KWH/yr)	Demand Reduction (KW)
1. INSTALL HIGH-EFFICIENCY T-8 LIGHTING SYSTEM IN SHOWROOM	1,737	3190	1.84	19,972.64	3.750
2. RECONFIGURE LIGHTING ALONG SHOWROOM SOUTHERN WINDOWS	717	240	0.33	8,053.48	0.000
3. DISCONNECT AND RETROFIT LIGHTING AT SERVICE COUNTER	329	302	0.92	3,692.70	.784
4. DISCONNECT AND RETROFIT LIGHTING IN TOOL ROOM	325	33	1.04	3,655.38	.776
5. INSTALL HIGH-EFFICIENCY T-8 LIGHTING SYSTEM IN OFFICE AREAS	594	1,333	2.24	6,674.82	1.417
6. INSTALL HIGH-EFFICIENCY SECURITY LIGHTING	317	7	0.02	3,567.20	.700
7. INSTALL OCCUPANCY SENSOR AND HIGH-EFFICIENCY LIGHTING IN BACK STORAGE LOFTS	695	493	0.71	7,883.41	1.270
8. INSTALL REFLECTOR LAMPS IN DOOR STORAGE AREA	22	17	0.79	241.80	.075
Totals	4,736	\$5,921	1.25	53,741.43	8.772

HOW TO PAY FOR YOUR ENERGY CONSERVATION MEASURES

IN-HOUSE CAPITAL

IN-HOUSE CAPITAL OR INTERNAL FINANCING IS THE MOST COMMON WAY THAT COMPANIES PAY FOR THEIR ENERGY EFFICIENCY MEASURES. UNDER THIS METHOD, YOU USE FUNDS AVAILABLE WITHIN YOUR ORGANIZATION TO FINANCE A PROJECT OR PURCHASE THE EQUIPMENT UNDER CONSIDERATION. THE COST OF USING THESE FUNDS IS WHAT THEY COULD HAVE PRODUCED IF INVESTED SOMEWHERE ELSE OR USED FOR ANOTHER PROJECT.

DEVELOP AN ENERGY MANAGEMENT ACCOUNT

MOST BUSINESSES DO NOT HAVE SUFFICIENT FUNDS ON HAND TO IMPLEMENT ALL OF THE COST-EFFECTIVE ECOS AT ONE TIME. HOWEVER, DEVELOPING AN ENERGY MANAGEMENT ACCOUNT ALLOWS YOU TO ACCUMULATE THE FUNDS NECESSARY TO IMPLEMENT ENERGY CONSERVATION MEASURES. IF YOU TAKE THE ENERGY COST SAVINGS YOU REALIZE FROM IMPLEMENTING ONE ECO AND APPLY ALL OR PART OF THOSE DOLLARS TOWARD PAYING FOR ANOTHER ECO, YOU CAN USE MONEY THAT WAS BUDGETED FOR ENERGY BILLS TO PAY FOR INSTALLING OTHER ENERGY-SAVING MEASURES. IF YOU WANT TO USE SOME OF THE SAVINGS FOR OTHER BUSINESS PURPOSES, YOU CAN REDUCE THE AMOUNT OF THE SAVINGS YOU PUT INTO THIS ENERGY MANAGEMENT ACCOUNT.

THE ENERGY MANAGEMENT ACCOUNT CAN BE ESPECIALLY VALUABLE WHEN IT IS USED TO ACCUMULATE THE DOLLAR SAVINGS FROM ANY ECOS WHICH HAVE LITTLE OR NO IMPLEMENTATION COST. IF YOU "DEPOSIT" THE SAVINGS FROM THESE LOW OR NO-COST ECOS IN YOUR ENERGY MANAGEMENT ACCOUNT, YOU CAN OFTEN PAY FOR THE OTHER ECOS OUT OF THAT ACCOUNT WITH NO SUPPLEMENTAL FUNDING.

OTHER FINANCING PROGRAMS

EVEN WITH AN ENERGY MANAGEMENT ACCOUNT, YOU MAY FIND IT DIFFICULT TO FINANCE SOME OF THE ECOS. HOWEVER, THERE ARE A NUMBER OF METHODS AVAILABLE FOR PAYING FOR ENERGY EFFICIENCY IMPROVEMENTS.

○ UTILITY INCENTIVES

SOME UTILITIES OFFER REBATES OR FINANCIAL INCENTIVES TO HELP THEIR CUSTOMERS REDUCE THE INITIAL COST OF CERTAIN ENERGY EFFICIENCY IMPROVEMENTS. THESE UTILITY PROGRAMS WILL OFTEN REIMBURSE YOU FOR A PORTION OF THE COST OF THE ENERGY EFFICIENCY MEASURE.

○ COMMERCIAL LOANS

COMMERCIAL LENDING INSTITUTIONS OFTEN LOAN MONEY FOR ENERGY EFFICIENCY PROJECTS. ALTHOUGH YOU ARE CHARGED INTEREST ON THE LOAN, THE MONTHLY PAYMENTS ARE GENERALLY LESS THAN THE MONTHLY SAVINGS ON YOUR ENERGY BILL.

○ **GOVERNMENT
LOANS**

THE STATE OF FLORIDA LOANS MONEY TO SMALL BUSINESSES TO HELP THEM REDUCE THEIR ENERGY CONSUMPTION. TO QUALIFY FOR THE FLORIDA ENERGY LOAN PROGRAM (FELP), A COMPANY MUST HAVE 200 EMPLOYEES OR LESS, AND MUST HAVE MADE A PROFIT FOR THE PAST TWO CONSECUTIVE YEARS. ELIGIBLE CONSERVATION MEASURES INCLUDE REPLACING EQUIPMENT WITH MORE ENERGY EFFICIENT MODELS; RENOVATION OF THE BUSINESS (AIR CONDITIONING DUCTS, RELOCATION OF THERMOSTATS, ETC.) FOR THE PURPOSE OF ENERGY CONSERVATION; AND BUILDING RETROFITS INCLUDING REPLACEMENT OF WINDOWS AND HEATING, VENTILATION, AND AIR CONDITIONING UNITS. THE TERM OF THE LOAN IS FOR A MAXIMUM OF 7 YEARS. THE MONTHLY PAYMENT IS APPROXIMATELY 75% OF THE AVERAGE MONTHLY ENERGY SAVINGS. THE INTEREST RATE VARIES: IT IS 5% FOR LOANS UP TO \$5,000; 7% FOR \$5,001 TO \$10,000; AND 9% FOR \$11,000 TO \$25,000.

○ **PERFORMANCE
CONTRACTS**

PERFORMANCE CONTRACTS (SHARED SAVINGS, ESCO, GUARANTEED SAVINGS) ARE ATTRACTIVE FINANCING OPTIONS. THE BASIS FOR THIS TYPE OF FINANCING IS QUITE SIMPLE; THE AVOIDED ENERGY COST RESULTING FROM THE INCREASED ENERGY EFFICIENCY OF THE NEW EQUIPMENT PAYS FOR THE EQUIPMENT. HOWEVER, YOU MUST BE SURE THE COST-BENEFIT ANALYSIS HAS BEEN DONE CORRECTLY, AND YOU MUST CHECK TO SEE THAT THE NEW EQUIPMENT IS BEING USED CORRECTLY.

PERFORMANCE CONTRACTING CAN BE SIMPLE IF THE PROJECT INVOLVES SOMETHING LIKE A STRAIGHT-FORWARD LIGHTING CHANGE-OUT WHERE THE COST SAVINGS CAN EASILY BE CALCULATED. IN MOST CASES, THE COST AND RISK OF THE PROJECT IS LARGELY TAKEN BY THE CONTRACTOR, BUT THE USER MUST RELINQUISH A CERTAIN AMOUNT OF CONTROL. ALSO MANY OF THE FACTORS TO BE CONSIDERED WILL REQUIRE IN-HOUSE EXPERTISE. NEVERTHELESS, PERFORMANCE CONTRACTING IS AN OPTION THAT YOU SHOULD CONSIDER CAREFULLY BECAUSE OF THE BENEFITS IT CAN BRING IF DONE RIGHT.

SHARED SAVINGS IS A PARTICULARLY USEFUL OPTION FOR BUSINESSES THAT DO NOT HAVE THE CAPITAL TO PURSUE NEEDED ENERGY PROJECTS. THIS OPTION IS BASED ON USING THE ENERGY COST SAVINGS IN THE EXISTING ENERGY BUDGET TO PAY FOR THE PROJECT. THE SHARED SAVINGS COMPANY IS USUALLY RESPONSIBLE FOR THE ENGINEERING STUDY, ENERGY AND ECONOMIC EVALUATION, PURCHASE AND INSTALLATION, AND MAINTENANCE. THE CUSTOMER PAYS SOME PERCENTAGE OF THE SAVINGS (USUALLY AROUND 50%) TO THE SHARED SAVINGS

COMPANY FOR A SPECIFIED PERIOD OF TIME (NORMALLY 5-10 YEARS).

PERFORMANCE CONTRACT FOR ENERGY SERVICES IS A VARIATION OF A SHARED SAVINGS PROGRAM. AN ENERGY SERVICE COMPANY (ESCO) CONTRACTS WITH THE CUSTOMER TO PROVIDE CERTAIN ENERGY SERVICES SUCH AS PROVIDING SPECIFIC LEVELS OF HEATING, COOLING, ILLUMINATION, OR THE USE OF EQUIPMENT FOR OTHER PURPOSES. THE ESCO THEN TAKES OVER THE PAYMENT OF THE UTILITY BILLS THAT ARE DIRECTLY RELATED TO THE ENERGY SERVICES PROVIDED.

ENERGY BILLS

EVALUATING THE ENERGY AND COST RECORDS FOR YOUR COMPANY IS AN IMPORTANT STEP IN AN ENERGY USE ASSESSMENT. THESE FIGURES CAN REVEAL TRENDS AND IRREGULARITIES IN ENERGY USAGE AND COSTS.

ELECTRIC USE

YOUR COMPANY RECEIVES ITS ELECTRIC UTILITY SERVICE FROM GAINESVILLE REGIONAL UTILITIES.

- Annual Cost of Electricity

YOUR COMPANY PAID A TOTAL OF \$ 12,874.69 FOR 144,106 KWH OF ELECTRICITY FOR THE YEAR.

- Graph

THE FOLLOWING GRAPH SHOWS THE ELECTRIC ENERGY USAGE AND COSTS INCURRED OVER THE PERIOD OF APRIL 1994 TO MARCH 1995.

- Explanation of Electric Bills

YOUR ENERGY AND DEMAND CHARTS SHOW A CONSISTENT PATTERN OF USE. YOUR ELECTRIC ENERGY USE IS HIGHER IN THE SUMMER MONTHS THAN THE WINTER MONTHS BECAUSE OF YOUR AIR CONDITIONING LOAD.

LIGHTING TIPS

1. IN THE FUTURE IF THE TRACK LIGHTING IN THE SHOWROOM SHOULD EVER BE USED ON A REGULAR BASIS BE SURE TO REPLACE THE CURRENT LESS EFFICIENT PAR-LAMPS WITH HIGH-EFFICIENCY PAR-LAMPS. THIS WILL REDUCE THE TOTAL ENERGY CONSUMED BY THE TRACK LIGHTING SYSTEM.

2. MANY OF THE CURRENT FIXTURES ARE DUSTY AND LENSES DISCOLORED. DUST ACCUMULATION ON LIGHTING FIXTURES CAN REDUCE LIGHT UTILIZATION BY UP TO 40 % AND INCREASE HEAT PRODUCTION. CLEANING LENSES AND LAMPS ON A REGULAR BASIS AND REPLACING DISCOLORED LENSES CAN REDUCE ENERGY USAGE AND IMPROVE LIGHTING LEVELS.

-NOTE: THE CLEANING OF FIXTURES MUST OCCUR WHEN LAMPS ARE COOL.

3. CURRENTLY YOUR FACILITY USES SPOT RELAMPING AS A MEANS OF REPLACING BURNED OUT LAMPS. HOWEVER, THIS RELAMPING STRATEGY MAY NOT BE THE BEST ONE FOR YOUR FACILITY. IT DOES NOT CONSIDER SUCH FACTORS AS LABOR COSTS OR LUMEN DEPRECIATION. AN ALTERNATIVE TO SPOT RELAMPING IS GROUP RELAMPING, IN WHICH ALL LAMPS ARE REPLACED AT ONE TIME. IN FACT, IT IS OFTEN MORE ECONOMICAL TO REPLACE ALL LAMPS IN THE FACILITY AT ONE TIME. WE RECOMMEND THAT FIXTURES BE GROUP RELAMPED WHEN LAMPS ARE AT 80 % OF THEIR RATED LAMP LIFE. IN THE CASE OF THE SHOWROOM THAT WOULD BE AFTER 16,000 HOURS OR ABOUT EVERY 5 YEARS. THE FINANCIAL BENEFITS OF GROUP RELAMPING INCLUDE:

- REDUCED LABOR COSTS--SPOT RELAMPING MAY REQUIRE 30 MINUTES TO REPLACE ONE LAMP WHILE GROUP RELAMPING MAY REQUIRE ONLY 5 MINUTES TO CLEAN AND REPLACE EACH LAMP. THIS IS BECAUSE SPOT RELAMPING REQUIRES THE TIME TO MOVE FURNISHINGS, SET UP, REPLACE THE LAMP, AND THEN PUT AWAY THE EQUIPMENT (LADDER, OLD LAMPS, ETC.) FOR EACH LAMP TO BE REPLACED. MANY MANAGERS OFTEN FEEL THAT BY REPLACING THE LAMPS BEFORE THEY HAVE BLOWN IS SIMPLY THROWING MONEY AWAY, HOWEVER, THE LOSS OF USE COST OF REPLACING A FEW LAMPS BEFORE THEY BURN OUT IS LESS THAN THE INCREASED LABOR COST TO INDIVIDUALLY REPLACE THE BURNED OUT LAMPS.

- REDUCED LAMP COSTS--YOU CAN REDUCE THE LAMP COST BY PURCHASING A LARGE NUMBER OF LAMPS AT ONE TIME AND THEREFORE OBTAINING A HIGH VOLUME DISCOUNT.

3. A TIMER IS CURRENTLY BEING USED TO CONTROL OUTDOOR LIGHTING AND IS A GREAT APPROACH TO SAVING ON ENERGY COSTS. HOWEVER, THEY ARE SOMETIMES SUBJECT TO INACCURACY DUE TO SEASONAL CHANGES IN DAY-LENGTH, DAYLIGHT SAVINGS TIME CHANGES, CLOCK SLIPPAGES AND POWER OUTAGES. WE SUGGEST ADJUSTMENT BE MADE TO THE TIMER ABOUT FOUR TIMES A YEAR TO PREVENT UNNECESSARY OPERATION OF LIGHTING.

4. THE STORAGE LOFTS ARE CURRENTLY USING SKYLIGHTS TO SUPPLEMENT THE LIGHTING IN THIS AREA. HOWEVER ALL OF THESE SKYLIGHT PANELS SHOULD BE CLEANED TO REMOVE LEAVES, MOLD, AND ANY OTHER OBSTRUCTIONS. THIS WILL DRAMATICALLY IMPROVE THE OVERALL LIGHTING LEVELS IN THE STORAGE LOFTS.

5. IF THE ECO'S MENTIONED PREVIOUSLY CAN IN NO WAY BE IMPLEMENTED THEN WE SUGGEST THE FOLLOWING TIP. THE ENTIRE FACILITY IS CURRENTLY LIGHTED WITH LESS EFFICIENT LAMPS. REPLACING YOUR PRESENT LAMPS WITH HIGH-EFFICIENCY LAMPS AS THEY BURN OUT WILL ALLOW YOU TO IMPLEMENT THIS ECO WITHOUT INCURRING ANY APPRECIABLE IMPLEMENTATION COST.

- REPLACE 40-WATT FLUORESCENT LAMPS WITH HIGH-EFFICIENCY 34-WATT FLUORESCENT LAMPS.
- REPLACE 75-WATT FLUORESCENT LAMPS WITH HIGH-EFFICIENCY 60-WATT FLUORESCENT LAMPS.

THE IMPLEMENTATION COST FOR THIS ECO IS \$135, AND THE ASSOCIATED COST SAVINGS IS \$1,535. THIS RESULTS IN A PAYBACK PERIOD OF .088 YEARS OR THE EQUIVALENT OF ONLY 32 DAYS.

HVAC TIPS

1. IN ORDER TO REDUCE YOUR ENERGY COSTS THE HVAC SYSTEM SHOULD REMAIN AT 78°F DURING THE SUMMER MONTHS AND 68°F DURING THE WINTER MONTHS. THIS HAS THE EFFECT OF REDUCING YOUR COOLING LOAD AND THEREFOR REDUCES THE ENERGY CONSUMPTION. ALSO, PEOPLE ARE RELATIVELY INSENSITIVE TO A SLOW CHANGE IN AIR TEMPERATURE, THEREFOR WE SUGGEST THAT THE AIR CONDITIONING BE TURNED DOWN OF OFF 30 MINUTES TO AN HOUR BEFORE QUITTING TIME AND LETTING THE TEMPERATURE DRIFT.

2. HVAC MAINTENANCE CAN SIGNIFICANTLY REDUCE ENERGY CONSUMPTION AND MAKE IT A MORE COMFORTABLE AND SAFER ENVIRONMENT. THE HVAC FILTERS IN YOUR FACILITY ARE VERY DIRTY AND WE RECOMMEND THAT YOU REPLACE OR CLEAN THEM. THE RETURN AIR GRILLS ARE ALSO DIRTY AND WE SUGGEST CLEANING THEM AND REMOVING ANY POSSIBLE OBSTRUCTIONS TO AIR FLOW. THESE MAINTENANCE ITEMS DO NOT COST MUCH TO IMPLEMENT, AND THE BENEFITS NOT ONLY INCLUDE CLEANER AIR TO BREATH BUT ALSO INCREASED HVAC EFFICIENCY, THEREFORE SAVING MONEY IN THE LONG-RUN.

3. YOUR FACILITY HAS ABOUT 37 TONS OF AIR-CONDITIONING. THE UNITS PRODUCING THIS AIR-CONDITIONING RANGE IN SIZE FROM .41 TO 30 TONS AND HAVE BEEN OPERATING FOR ABOUT 15 YEARS. IT IS KNOWN THAT LARGE AIR-CONDITIONING UNITS OFTEN OPERATE FOR 15 TO 20 YEARS. HOWEVER, BY THE TIME THEY ARE ABOUT 15 YEARS OLD, THEY WILL NEED SUBSTANTIAL MAINTENANCE. IN YOUR CASE, THE COMPRESSORS WERE REPLACED APPROXIMATELY FOUR YEARS AGO DUE TO A LIGHTING STRIKE. THEREFORE, WHEN THIS UNIT SHOULD FAIL, YOU SHOULD EXAMINE THE POTENTIAL SAVINGS AVAILABLE FROM REPLACING IT WITH A HIGH-EFFICIENCY MODEL. NORMALLY, THIS SAVINGS WILL INCLUDE AN ENERGY SAVINGS AND A REDUCED MAINTENANCE COST.

4. WEATHERSTRIP THE MAIN ENTRANCE DOORS TO REDUCE YOUR COOLING LOAD. WIND PRESSURE WILL CAUSE AN INFILTRATION OF AIR BETWEEN DOOR AND DOOR-FRAMES WHICH INCREASES THE AIR CONDITIONER LOAD. HOWEVER, IF THE SPACE IS WEATHER-STRIPPED, THE AIRFLOW RATE IS DECREASED AND THE QUANTITY OF AIR WHICH CAN INFILTRATE IS ALSO DECREASED.

MISCELLANEOUS TIPS

1. YOUR WATER HEATER IS CURRENTLY NOT OPERATIONAL. HOWEVER, IF IN THE FUTURE THE WATER HEATER IS USED, WE RECOMMEND THAT YOU INSTALL A TIMER ON IT AND ONLY OPERATE IT WHEN NEEDED. THIS WILL REDUCE ANY FUTURE ENERGY COSTS THAT WILL BE INCURRED DUE TO WATER HEATER USE.

2. YOUR WATER HEATER IS CURRENTLY NOT OPERATING AND HAS NO INSULATION. HOWEVER, IF IN THE FUTURE THE WATER HEATER IS USED, WE RECOMMEND INSTALLING A JACKET OF R-11 INSULATION AROUND IT. THIS WILL INCREASE THE WATER HEATER'S EFFICIENCY AND THUS, WILL REDUCE COSTS INCURRED DUE TO USING IT.

THE WORK AND RECOMMENDATIONS DESCRIBED IN THIS REPORT ARE A SERVICE PROVIDED BY STUDENTS IN THE ENERGY MANAGEMENT CLASS AT THE UNIVERSITY OF FLORIDA AS PART OF A PILOT PROJECT FUNDED BY THE U.S. DEPARTMENT OF ENERGY.

THE PRIMARY OBJECTIVE OF THE COMMERCIAL ENERGY AUDIT PROGRAM IS TO IDENTIFY AND EVALUATE OPPORTUNITIES FOR ENERGY CONSERVATION AND DEMAND REDUCTION THROUGH VISITS TO COMMERCIAL FACILITIES. DATA ARE GATHERED DURING A ONE-DAY SITE VISIT AND OPPORTUNITIES FOR SAVING ENERGY AND REDUCING DEMAND ARE IDENTIFIED. SINCE THE SITE VISITS ARE BRIEF, THEY ARE NECESSARILY LIMITED IN SCOPE. THEREFORE, IF YOU ARE INTERESTED IN PURSUING AN ENERGY CONSERVATION OPPORTUNITY (ECO) WHICH INVOLVES ENGINEERING DESIGN AND SIGNIFICANT CAPITAL INVESTMENT, YOU NEED TO ENGAGE A CONSULTING ENGINEERING FIRM TO PERFORM THE DETAILED ENGINEERING DESIGN AND COST ESTIMATIONS FOR IMPLEMENTING THE ECO.

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Combs Lumber

Mr. Billy Combs

UF EADC COMMERCIAL AUDIT PILOT PROGRAM

CLIENT QUESTIONNAIRE

During the Spring semester, you participated in a pilot program in which engineering students from the Energy Management Class at the University of Florida performed an energy audit at your business/facility. As part of the project, we need to evaluate the students' performance and determine whether this program is satisfactory to the companies who received the audits.

I would like to ask you a few questions about the audit if you have time. If you would rather, I can send you a questionnaire to fill out and return to us: _____

1. Did you get a copy of the students' audit report?

Yes.

2. Were you happy with the student audit?

Yes

Were the students efficient and courteous?

Good.

Would you be willing to participate in another similar student project?

Would you recommend the student energy audits to someone else?

Yes.

What change(s) in our student energy audit process (initial contact, audit visit, audit report, etc.) would improve this program the most?

3. Were you pleased with the students' audit report?

Was it easy to understand?

Yes

Do you have any suggestions for changing the report to make it easier to read and understand?

No.

Would you want to see the students' calculations?

4. Are you planning to implement/follow any of the students' suggestions?

If so, which ones? (Please list them here)

-- Redo the lighting ✓
- If AC fails -

5. Do you think we should continue this program?

Yes.

6. Do you have any suggestions for improving the program?

--- No ---

7. Would you be willing to pay a fee for the audit to help defray the costs of running this program?

No, because ARV would do it free!!

If so, how much do you think would be a reasonable fee?

\$50? \$100? \$150? \$200? Other?

4. Are you planning to implement/follow any of the students' suggestions?

If so, which ones? (Please list them here)

-- Redo the lighting ✓
- If AC fails -

5. Do you think we should continue this program?

Yes.

6. Do you have any suggestions for improving the program?

No

7. Would you be willing to pay a fee for the audit to help defray the costs of running this program?

No, because ARU would do it free!!

If so, how much do you think would be a reasonable fee?

\$50? \$100? \$150? \$200? Other?