MEASURED RESULTS OF ENERGY RETROFITS IN BUILDINGS OF NON-PROFIT AGENCIES

William Nortz, John Katrakis, Anne Evens
Center for Neighborhood Technology

ABSTRACT

This paper discusses the results of energy retrofits on existing buildings owned by non-profit agencies. These building are participants in the Neighborhood Non-Profit Energy Program (NNEP) in Chicago which is administered by the Center for Neighborhood Technology (CNT). The NNEP program has provided technical and financial assistance to over 160 existing buildings owned by neighborhood-based non-profit community organizations. The buildings cover a broad range of construction details, floor areas, usage, and HVAC system types. However, they are representative of many older commercial and institutional buildings found in urban areas such as the City of Chicago.

This paper demonstrates that significant energy savings, particularly in natural gas consumption, can be realized in these types of buildings. For the first 48 retrofits to be completed and monitored in the NNEP program actual reduction in annual natural gas usage averaged 23%. The program-wide simple payback is about 9 years.

The results indicate the necessity of sound energy management and equipment maintenance practices and monitoring of building conditions and utility bills to insure a successful retrofit. Finally, improvements to the NNEP program and the potential for further savings are discussed.

PROGRAM DESCRIPTION

The buildings examined in this paper are participants in the Neighborhood Non-Profit Energy Program (NNEP). This program was initiated in the spring of 1982, funded by $4.7 million in grant money and $2.9 million in loan money. The program is targeted at buildings owned by non-profit community based social service agencies in the Chicago metropolitan area. The major intent of the program is to alleviate the impact of rising energy costs that threaten the growth of new programs, and in some cases, the very existence of non-profit neighborhood organizations and social service agencies. Through the end of 1987 the program has provided assistance to over 160 buildings owned by more than 120 neighborhood based non-profit community organizations.

Each participating agency receives a complete package of technical services, as well as financing for recommended conservation measures. The technical service package includes a comprehensive energy audit, preparation of bid specifications for recommended measures, management of a competitive bidding process, facilitation of contract document signing between agency and contractor, contractor payout inspections, agency staff energy management training and performance monitoring of completed retrofits.

The financing consists of a grant for one-half the total retrofit and construction management fee costs. The other half of these costs is financed through a five year loan at 0% interest. Program funders underwrite the interest on the loan and also pay 90% of the technical service costs. Each recommended retrofit package is designed to have a simple payback of no more than 10 years. Thus, the payback on the loaned amount is no more than 5 years. The intent is to offset an agency's annual debt service with annual energy savings and ideally create a positive cash flow for each year of the loan agreement.

DESCRIPTION OF BUILDINGS RETROFITTED

In general, the buildings owned by the agencies participating in the NNEP program are buildings which were originally designed for other uses such as light industrial. Many of the buildings are older with HVAC systems that are not well suited to the current building use. Typical use of buildings currently in the program include YMCA's and Boy's Clubs, day care and health care centers, homeless shelters, sheltered workshops, and various other social and cultural centers. Many of the older buildings contain steam heating systems. Hot water and forced air systems are also common.

Another problem related to the age of the buildings and financial priorities of the agencies is a history of incomplete or deferred maintenance. The typical agency has a small maintenance budget and a maintenance staff with custodial skills rather than those of building operators. Mechanical equipment tends to be poorly maintained, nearing the end of its useful life, or inefficiently operating. In addition , the maintenance staff usually does not have keen energy conservation awarenes or knowledge of how to use sophisticated energy management control systems.

Over 95% of the buildings in the program use natural gas as fuel for space heating, while the remaining 5% use oil or electricity. Only those buildings which use natural gas as fuel for space heating are analyzed in this paper. At the time of the initial planning phase of the program in 1981, electricity costs were considerably lower than they are today. Early clients typically spent less than 20% of their energy budget on electricity. Therefore, the early stages of the program emphasized natural gas conservation. The most frequently recommended energy conservation measures (ECM's) were ceiling insulation, storm windows, heating plant repair or replacement, temperature controls, distribution system balancing, and replacement fluorescent lighting. This paper presents actual measured savings of the first 48 retrofits completed under this program and focuses on natural gas conservation.

TECHNICAL SERVICES

Audit Report

A comprehensive energy audit report is the first deliverable product which a participating agency receives. The audit report is the result of extensive field work at the building site, interviews with agency staff, and comprehensive engineering analysis. Field work includes measuring steady-state efficiency of the heating plant, space temperatures, and lighting illuminance levels. The audit report includes a description of the building envelope, HVAC and electrical systems, energy consumption projections, and cost and savings estimates for implementation of various ECM's. A final ECM package is recommended which is the most cost effective and addresses the critical needs of the building.

Construction Phase

Following agency approval of the recommended measures, bid specifications are prepared for the installation of the ECM's. Management of a competitive bidding process and the development of a contract agreement between the agency and selected contractors is also provided. Contractor payouts are made upon satisfactory inspection of work.

Energy Management Training

After substantial completion of the energy retrofit an Energy Management Training (EMT) session for agency staff is conducted. The training is meant to create a general energy conservation awareness among agency staff and present the specific energy reduction goals of the retrofit. Agency maintenance staff are also trained in general maintenance of HVAC equipment and specific operation of new equipment and controls. At the EMT session the agency is presented with an EMT manual which includes instructions on reading gas and electric meters, setting up a maintenance program and general and specific operating and mantenance procedures for building equipment.

Performance Monitoring

Utility bills are analyzed, as described below, for a period of two years after the completion of a retrofit. This is the phase where actual performance of a retrofitted building is determined. The performance monitoring results of the first 48 buildings in the program are presented and discussed in this paper.

ANALYSIS METHODOLOGY

Utility Bill Analysis

Utility bills from each building are analyzed during the energy audit to estimate annual energy consumption and costs to be used as the basis for energy savings calculations. The consumption data are then used to determine the building's energy indices (explained later in the paper) as a basis for comparison to similar buildings and potential energy savings. Utility bills spanning one to three years are usally available for this pre-retrofit analysis. When sufficient utility bills are not available or a change in building use is expected, natural gas consumption is estimated using an ASHRAE "UA" model of the building and a bin analysis program. Electricity consumption is estimated from equipment nameplate data, estimated efficiencies and estimated hours of operation. Estimated consumption data is matched to actual utility bills whenever possible.

Determination of energy consumption from utility bills is accomplished using a "modified degree-day" method. Energy consumption between actual meter readings is used. The desirable span between readings is as close to a full year as possible. Natural gas consumption is disaggregated into base load (domestic hot water, cooking), which is relatively constant throughout the year, and space heating load which is degree-day dependant. Base load is determined by averaging gas usage during the non-space heating season (typically May 15 thru september 15). Actual billing periods are used whenever possible. However, the determination of base load often involves judgement due to estimated billings. The base load, in therms/day, is subtracted from the total gas consumption for each analysis period. The remaining gas consumption is allocated to space heating which is adjusted to reflect normal Chicago weather conditons. Total space heating therms for the analysis period is divided by the number of degree-days (65^{o}F base) for the period resulting in an average space heating gas load in units of therms/degree-day. This average space heating load is then spread over an entire 'normal' Chicago year of 6500 degree-days (from O'Hare weather data) to arrive at annual consumption.

Electricity consumption is determined as an annual total of all uses in the building. However, summertime bills (May 15 thru September 15) are analyzed separately due to the seasonal use of air conditioning and higher summertime electricity rates. For each analysis period consumption is determined as an average usage in units of kilowatt-hour/day.

Energy Consumption Indices

The energy consumption estimates derived from utility bill analysis are used to establish pre-retrofit energy consumption indices for natural gas and electricity usage. Electricity usage is converted into units of primary energy using a conversion factor of 11,600 Btu/kwhr. All indices are in units of Btu/yr-sq ft and are adjusted to reflect a year with normal Chicago weather conditions of 6500 heating degree-days and 850 cooling degree-days. The indices are useful to compare a building with similar buildings in the program and initially determine its potential for energy savings.

The pre-retrofit indices have been sorted according to building size, building usage and HVAC system type for comparison purposes. Of the first 131 buildings investigated in the program no correlation between energy indices and building size, usage, or HVAC system type was found. A more in depth analysis of building energy consumption indices would be a good topic for a future study.

Cost & Savings Estimates

Cost estimates for ECM installations are obtained primarily from three sources: Actual costs from previous retrofits in the program, estimates from contractors, or cost data from reference books.

Savings estimates rely upon engineering analysis using modified degree-day and bin analysis methods prescribed in ASHRAE Fundamantals Handbook, DOE manuals, and other energy conservation references.

Actual Savings

Actual savings resulting from a retrofit are determined in the performance monitoring phase of the program by analyzing post-retrofit utility bills. The same methodology applied to pre-retrofit utility bill analysis is also applied to post-retrofit analysis. Savings are indicated in terms of percent change in energy consumption between the pre-retrofit period and the post-retrofit period by the specific category of energy usage. Only bills with actual meter readings are used for the analysis. This savings methodology was checked against a regression analysis and it was concluded that this simplified method of determining savings was sufficiently accurate (Katrakis, 1984).

MEASURED RESULTS

Table I shows the measured results of the first 48 retrofits in the NNEP Program. The projects represented in this table are only buildings which use natural gas as fuel for space heating. The few retrofits that involved fuel conversions (ie. from oil or electricity to natural gas) are not analyzed as part of this report. Table I also presents building floor area, pre-retrofit energy costs, and estimated retrofit cost and savings data for each project.

Pre-retrofit annual energy costs shown in Table I were derived from audit report estimates of annual energy consumption and average fuel prices of $0.50/therm for natural gas and $0.10/kwhr for electricity. These fuel prices are not necessarily the prices that were predicted in the audit reports or the prices that an agency currently pays for fuel. Rather they represent the average prices for gas and electricity in the City of Chicago over the past two years, and they include tax charges. For comparison purposes and because energy savings are realized over several years, in which fuel prices may fluctuate, these average fuel prices were chosen.

Estimated retrofit costs and percent savings shown in Table I represent the values that were presented in the energy audit reports. Taken separately, estimated gas or electricity percent savings are the same with respect to either consumption or cost. Estimated total energy percent savings shown in Table I, taken from audit reports, are relative to total energy costs and are dependent on the relative unit prices for gas and electricity that were predicted in the audit.

Actual retrofit costs represent the actual amount of dollars spent on a retrofit. Half of these costs were funded by a grant and the other half was financed by a five-year, 0% loan.

Actual gas and electric percent savings represent the percent change between pre-retrofit and post-retrofit gas and electric consumption. To be consistent with the estimated values, the actual total energy percent savings are relative to total energy costs and are based on the average fuel prices mentioned above. Energy savings in dollars are based on the same average fuel prices. The simple payback was calculated by dividing the actual retrofit cost by actual annual dollar savings.

As shown in Table I, the average actual percent savings in natural gas consumption for the first 48 retrofits is 23%. Actual annual reduction in natural gas consumption ranged from 51% to -7%. Twenty five of the retrofits resulted in a reduction in natural gas consumption of 25% or more. The average actual percent savings in electricity consumption is 0% with a range from 44% to -152% Eleven buildings experienced an increase in annual electricity consumption. Total actual energy cost savings averaged 12% and ranged from 41% to -61%. Nineteen of the retrofits resulted in a reduction in total energy consumption of 15% or more.

The results on a program-wide basis show that overall savings in energy costs were 18% for natural gas, 2% for electricity and 10% for total energy. A total of $1,635,960 was spent on the 48 retrofits resulting in total annual energy savings of $179,920. The program-wide simple payback for the 48 retrofits is 9.1 years.

DISCUSSION OF RESULTS

Program Success

The overall program money spent on the first 48 retrofits resulted in overall annual energy savings of 10%. The program-wide simple payback of 9.1 years is less than the program target of 10 years. Twenty four of the retrofits produced simple paybacks of less than ten years, which results in positive cash flows for the agencies. Seven retrofits produced a simple payback of more than 20 years. However, changes in building use or structure precluded energy savings in almost all of these retrofits. As shown in the comment column of Table I the retrofits of several of the buildings addressed critical needs such as improved ventilation or repair of inoperable cooling equipment. In such cases comfort in the building was improved at the expense of additional energy consumption.

Actual savings in dollars are dependant on the unit fuel prices chosen for gas and electricity. The average fuel prices that were used to calculate the actual dollar savings are less than the fuel prices that were predicted in virtually all of the audit estimates. Therefore, lower dollar savings are partly the result of decreases in gas prices in recent years rather than the increases that were expected at the time the audits were conducted. The recent lower gas prices relative to electricity prices in the City of Chigaco also adversely affect the total energy percent savings.

As mentioned previously, the focus of the retrofits early in the program was on natural gas conservation. Thus, for the 48 retrofits shown in Table I, we are mostly concerned with the success in reducing natural gas consumption. The average gas savings of 23% and overall gas savings of 18% demonstrate that the NNEP program has been successful at reducing gas consumption

Electricity consumption savings were acheived in almost all of the retrofits in which the use or structure of the building was not altered. However, there was a very large range in electricity consumption savings with several buildings showing an increase in usage. Again, this was usually the result of a change in building use or structure or a retrofit that addressed critical building needs such as improved ventilation or repair of inoperable equipment.

As shown in Table I, using the average fuel costs mentioned before, total annual pre-retrofit electricity costs ($906,481) are higher than the total annual pre-retrofit gas costs ($879,693). This is a startling fact, which is due in part to rising electricity prices in the City of Chicago since the inception of the NNEP program. However, more emphasis has been focused on electricity conservation in retrofits since the 48 presented in this paper. Performance monitoring of thses later projects is needed to access the success of electricity conservation in the program.

Predictive Accuracy

The accuracy of estimated retrofit costs was very accurate as compared to the actual costs. The total program actual retrofit cost, for the 48 projects ($1,635,960), is within 2% of the estimated total program retrofit cost ($1,604,892). Audit estimates for retrofit costs were within 10% of the actual costs for 25 of the projects. This result seems to indicate that the present methods used to estimate retrofit costs are sound. It also stands to reason that accuracy for estimating costs will improve as actual retrofit costs from more projects are added to the database.

The accuracy of estimated energy savings for the 48 completed retrofits was generally good. Actual gas savings were greater than 70% of the estimated values for 22 of the 40 buildings where gas and electric savings were presented separately. Fourteen of the buildings realized actual gas savings of less than 50% of their estimated values. Many of these buildings were found to have excessive space temperatures, improper control settings, structural problems, poorly manitained equipment, or altered building usage.

Certain adjustments are necessary to more accurately estimate energy savings and insure a high degree of confidence in audit results. This is especially true where retrofit investments are to be financed under market conditions and risks are therefore greater for the borrower. Suggestions for improvements include the following:

1. more quantitative data on savings of conservation measures

2. more accurate modeling of building balance points, particularly during unoccupied periods

3. more accurate determination of gas base loads, perhaps by submetering usage

4. measure actual amperage draw of electrical equipment rather than utilizing nameplate data

5. more accurate determination of interactions between conservation measures

6. more analysis of building indices to more accurately gauge savings potential of a retrofit project

Progress has been made in obtaining quantitative data on savings of certain conservation measures for steam systems. CNT is completing a three year research project sponsored by the Gas Research Institute (GRI) to document individual performance of effective retrofits of single-pipe steam heating systems, which are typical in the NNEP program. The results of this study should be available in the summer of 1988.

The use of post-retrofit energy data needs more development to help accurately guage savings potential of a retrofit project. More analysis is needed of the indices especially when more post-retrofit data is available for buildings with an emphasis in electricity conservation.

<u>Keys to a Successful Retrofit</u>

A successful retrofit in the NNEP program is one where a positive annual cash flow for the agency is created and occupant comfort and energy awareness are increased. Based on CNT's experience with the program thus far a successful retrofit has much less to do with accurate audit estimates than with good ECM installation and sound operation and maintenance practices.

The overall savings results of the first 48 completed NNEP retrofits are positive. Significant energy savings were achieved in most cases. In those buildings where savings were not significant, anomalous conditions were usually found, such as excessive space temperatures, incorrectly set controls, or improper equipment operation. These conditions were discovered only after monitoring post-retrofit utility bills. Thus, a performance monitoring phase is essential to insure the success of a retrofit. The discovery of anomolous conditions suggest the importance of proper energy management of a building and that it is also a key to a successful retrofit. The results of the NNEP retrofits presented in this paper indicate that a successful retrofit should include but not be limited to the following:

1. Appoint an Energy Manager to be responsible for the success of the retrofit. This person may or may not be technically trained but should be aware of the general operation of the building and coordinate performance monitoring activities.

2. Establish a regular maintenance program for all equipment in the building. Hire an outside contractor if necessary. It is important to realize that building systems must be in sound operating condition before implementation of conservation measures. Treatment of deferred maintenance will often result in energy savings.

3. Educate agency staff on the importance of energy conservation and the goals of the retrofit. Allow agency staff, particularly maintenance personnel input into the retrofit design. Staff who are involved in the retrofit design are much more interested in operating equipment properly and monitoring results.

4. Keep building control systems simple. They are only as effective as the people that operate them (simple direct temperature controls have proven to be very effective). Establish desired control setpoints and allow limited access to change these setpoints (tamperproof covers should almost always be installed with new thermostats).

5. Continually monitor performance by reviewing utility bills, checking space temperatures, updating control setpoints, verifying equipment operating conditions, and checking for wasteful practices, such as excessive space temperatures, open windows, unnecessary equipment left on, etc.

POTENTIAL FOR FURTHER SAVINGS

The program originally emphasized gas conservation over electricity conservation because electricity was considerably cheaper at the onset of the program and buildings surveyed at program inception spent less than 20% of their energy budgets on electricity. Since the 48 retrofits presented in this paper the program has focused more on electricity conservation as well as gas conservation. We have also seen in recent years great advances in electricity conserving devices especially in lighting equipment. We will have more confidence in recommending such measures once they have established a 'track record'. As a result, much larger electricity savings should be realized in the more recent projects as compared to the first 48 buildings. Also as fuel prices continue to rise, energy savings in dollars will proportionately rise, making investments in energy conservation even more attractive.

ACKNOWLEDGEMENTS

The authors would like to thank the Amoco Foundation for making the Neighborhood Energy Conservation Program possible and for their continued support.

REFERENCES

1. John Katrakis and Daniel Becker, "Energy Savings in Buildings of Neighborhood-Based Non-Profit Organizations", Doing Better: Setting an Agenda for the Second Decade, Proceedings of ACEEE Summer Study 1984

Table I: Measured Results of NNEP Energy Program
(Savings in percentage of dollar)

Project #	Floor Area (SQFT)	Pre-Retrofit Annual Energy Cost: Gas ($)	Pre-Retrofit Annual Energy Cost: Elec ($)	Pre-Retrofit Annual Energy Cost: Total ($)	Estimated Values: Retrofit Cost ($)	Estimated Values: Gas Savings (%)	Estimated Values: Elec Savings (%)	Estimated Values: Total Savings (%)	Actual Values: Retrofit Cost ($)	Actual Values: Gas Savings (%)	Actual Values: Elec Savings (%)	Actual Values: Total Savings (%)	Actual Values: Gas Savings ($)	Actual Values: Elec Savings ($)	Actual Values: Total Savings ($)	Simple Payback (years)	Comments
1	67000	45,560	38,286	83,846	98,615	20	0	12	61,400	18	NA	9	8,200		8,200	7.5	
2	18030	6,022	11,000	17,022	29,325			46	41,294	32	6	15	1,927	660	2,587	16.0	
3	44000	12,210	25,707	37,917	36,815			20	36,178	13	10	10	1,587	2,570	4,157	8.7	
4	113000	96,430	71,250	167,680	71,222			23	71,200	12	11	11	11,571	7,837	19,408	3.7	
5	13000	4,315	4,500	8,815	12,390	32	8	20	18,953	27	0	13	1,165	0	1,165	16.3	
6	11500	9,500	5,400	14,900	28,072	42	14	30	29,712	27	0	17	2,565	0	2,565	11.6	
7	14900	6,977	11,863	18,840	12,845	30	3	14	14,400	32	-4	9	2,232	-474	1,758	8.2	
8	49500	33,500	27,400	60,900	42,100			12	43,031	8	NA	4	2,680		2,680	16.1	
9	10700	5,250	9,100	14,350	23,670	18	25	30	17,025	0	44	27	0	4,004	4,004	4.3	
10	2258	1,770	2,012	3,782	6,444	28	18	23	7,030	8	14	11	141	281	422	16.7	
11	6858	2,395	4,110	6,505	10,320	35	13	23	11,970	0	25	15	0	1,027	1,027	11.7	
12	43000	12,500	14,100	26,600	39,072	39	7	23	37,846	34	-25	2	4,250	-3,525	725	52.2	Increased building use
13	11400	8,130	3,090	11,220	37,685	48	16	43	41,292	51	16	41	4,146	494	4,640	8.9	
14	8300	6,220	6,000	12,220	21,193	42	4	24	20,544	37	NA	18	2,301		2,301	8.9	
15	23600	12,050	9,700	21,750	36,900	44	5	27	40,400	41	NA	22	4,940		4,940	8.2	
16	22850	14,500	7,500	22,000	58,332	33	35	34	58,332	43	19	34	6,235	1,425	7,660	7.6	
17	13800	4,400	11,300	15,700	34,469	24	21	22	33,728	3	17	13	132	1,921	2,053	16.4	
18	6800	1,550	2,600	4,150	7,195	44	18	27	6,835	29	10	17	449	260	709	9.6	
19	5100	2,545	6,360	8,905	10,368	33	9	18	12,400	31	0	8	788	0	788	15.7	
20	32000	12,500	11,600	24,100	28,302	23	9	17	30,820	4	9	6	500	1,044	1,544	20.0	
21	7400	6,800	4,700	11,500	20,962	33	6	23	20,962	14	14	14	952	658	1,610	13.0	
22	20500	8,250	7,300	15,550	14,157	17	2	10	16,485	46	-5	22	3,795	-365	3,430	4.8	
23	19500	5,500	3,700	9,200	10,612	32	8	17	12,632	-1	-152	-61	-55	-5,624	-5,679	-2.2	Altered building structure
24	50000	35,050	21,300	56,350	50,940	36	0	23	53,800	40	NA	24	14,020		14,020	3.8	
25	70000	33,500	62,500	96,000	72,927	31	10	22	76,425	-7	-14	-11	-2,345	-8,750	-11,095	-6.9	Increased ventilation
26	15700	11,325	12,504	23,829	33,015	48	0	40	42,778	35	1	17	3,963	125	4,088	10.5	
27	49500	18,500	29,000	47,500	32,174	23	2	11	22,940	22	9	14	4,070	2,610	6,680	3.4	
28	43200	17,450	17,900	35,350	38,360	38	9	25	39,992	12	7	9	2,094	1,253	3,347	11.9	
29	25000	12,500	15,000	27,500	32,340			16	31,000	18	7	12	2,250	1,050	3,300	9.4	
30	11200	4,450	6,250	10,700	9,876	30	2	12	11,453	6	11	8	267	687	954	12.0	
31	32000	23,552	34,332	57,884	19,578	40	0	19	19,800	29	-15	2	6,830	-5,149	1,681	11.8	Increased ventilation
32	41600	22,400	116,000	138,400	44,828	36	13	21	47,185	NA	11	9		12,760	12,760	3.7	
33	10200	8,250	18,000	26,250	25,652	41	18	26	31,105	4	1	1	330	180	510	61.0	Increased ventilation
34	7500	4,381	7,260	11,641	17,303	47	16	28	23,770	32	18	23	1,401	1,306	2,707	8.8	
35	24000	12,000	9,200	21,200	37,752	45	8	22	39,282	43	-22	14	5,160	-2,024	3,136	12.2	Added cooling
36	13700	7,815	8,016	15,831	23,916	34	30	32	27,000	32	30	30	2,500	2,404	4,904	5.5	
37	24000	25,450	1,300	26,750	50,904	30	0	29	48,200	39	NA	37	9,925		9,925	4.9	
38	121000	71,590	36,135	107,725	66,586			29	64,000	13	NA	8	9,306		9,306	6.9	
39	12400	11,100	7,500	18,600	28,716	32	10	23	27,753	44	-13	21	4,884	-975	3,909	7.1	
40	12500	7,100	11,400	18,500	27,780	53	11	26	41,600	50	5	22	3,550	570	4,120	10.1	
41	23965	30,150	19,400	49,550	36,960	17	3	14	43,400	0	-27	-10	0	-5,238	-5,238	-8.3	Increased ventilation
42	19000	11,800	8,900	20,700	34,740	42	11	28	29,000	31	-39		3,658	-3,471	187	155.1	Increased building use
43	12300	9,440	14,800	24,240	27,152	16	9	11	22,600	18	1	7	1,699	148	1,847	12.2	Added cooling
44	17000	13,150	24,000	37,150	35,247			36	41,384	42	16	38	5,523	8,640	14,163	2.9	
45	35000	20,500	14,000	34,500	39,857	25	9	22	35,561	17	-21	1	3,485	-2,940	545	65.2	
46	12000	14,815	6,215	21,030	31,580	39	12	32	30,317	32	8	24	4,740	497	5,237	5.8	
47	83000	102,500	79,000	181,500	64,130	14	21	16	52,286	2	7	4	2,050	5,530	7,580	6.9	
48	20950	32,050	27,990	60,040	31,524	27	10	17	49,800	27	NA	14	8,653		8,653	5.3	
PROGRAM TOT:	1361241	379,693	906,481	1,286,176	1,604,392				1,635,960	18	2	10	158,514	21,406	179,920	9.1	
PROGRAM AVG:	28359	18,126	18,885	37,211	33,435	33	10	23	34,082	23	0	12	3,372	535	3,748		

Notes: 1. Total Savings ($) values based on average fuel prices of $.50/therm for natural gas and $.10/kwhr for electricity.