

Lincoln Loan Program

Analysis of Energy Savings

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Nebraska Energy Office

Introduction

Lincoln's city government completed its energy conservation interest subsidy and rebate program in 1991. Over the life of the program, interest rates ranged from zero to three percent and rebates up to 25 percent (a maximum of \$2,500) for making energy conservation improvements in residential and mixed use buildings.

A total of 419 different projects was provided financial assistance before the program ceased.

The city was originally granted \$321,260 in Exxon funds for the subsidies and \$28,740 for operating the program. Funds spent to date total \$341,971. Additional support was provided in the form of a cash match of \$946,836 from the city and the Nebraska Investment Finance Authority plus an additional in-kind match of \$33,800.

Any subsidies that are not fully utilized through 2002 will be returned to the Energy Office. Unused Subsidies result when property changes hands and loans are paid in full earlier than scheduled.

The total cost of the work done on the 419 projects was \$1,417,849.

Data Analysis

Monthly energy consumption and cost data was collected for all 417 loans to estimate the success of the program in terms of energy savings, dollar savings on energy bills, and environmental impacts. This information along with the total cost of the work done through the program was used to estimate the economic impact of the program.

Data for 227 of the loans was processed and evaluated. After reviewing this data to determine ownership and/or occupancy changes, bad/missing data and identification of fuels affected by projects, 161 loans were available to evaluate electricity savings and 184 loans to evaluate for natural gas savings. For these loans, all energy consumption and cost data were adjusted to reflect consumption and costs in a "normal" weather year.

Estimates for these loans were grouped by the types of projects financed and used to project savings estimates for all other loans in the program.

The information provided for analysis had the following short-comings:

- Consumption and cost data for the year prior to completion of the financed work included the quarter in which the work was completed. Thus 1-2 months of prior data actually represented conditions after the improvements were made. It is believed that savings are 10-12% conservative for this reason.
- For projects involving air conditioning, no details were provided to indicate if a central AC was replaced with a more efficient unit, if a window unit was replaced with central AC, or if no AC was present prior to the installation of the new unit. Thus the results for air conditioning equipment include all of these situations.
- No information was provided on the efficiency of furnaces installed.

Impact of Heat Pump Projects

There were 46 loans which financed the replacement of a natural gas furnace with an electric heat pump/natural gas furnace or the replacement of an electric heat pump/natural gas furnace with a more efficient unit. Of these, 31 were evaluated for their impact on electricity and natural gas use. These projects may or may not have financed other projects such as insulation, windows, etc.

Total adjusted natural gas consumption for the 31 residences evaluated for the 12 months prior to completion of the loan financed work was 30,650 therms at a cost of \$15,254. Total estimated savings was 13,020 therms of natural gas at a savings of \$6,928 annually. On average, these homes consumed 989 therms of natural gas in the year prior to program participation and saved an average of 420 therms (or \$223) annually. For these 31 loans, natural gas consumption was reduced 42.48%.

Total adjusted electricity consumption for the 31 residences evaluated for the 12 months prior to completion of the loan financed work was 319,877 kWh at a cost of \$18,284. Total estimated savings was -80,383 kWh at an additional cost of \$4,385 annually. On average these homes consumed 10,319 kWh of electricity in the year prior to program participation and increased usage by 2,593 kWh (or \$141) annually. For these 31 loans, electricity consumption increased 25.13%.

Total adjusted energy consumption for the 31 residences evaluated for the 12 months prior to completion of the loan financed work was 6,456 million Btu at a cost of \$33,538. Total estimated savings was 450 million Btu at a savings of \$2,543 annually. On average these homes consumed 208 million Btu in the year prior to program participation and saved an average of 15 million Btu (or \$82) annually. For these 31 loans, total energy use was reduced 6.97%.

Impacts of the heat pump projects are summarized in Table 1 below:

Table 1. Impact of Heat Pumps on Energy Use

Description	No. of Loans	Prior Use (therms)	Therms Saved	Prior Use (kWh)	kWh Saved	\$ Saved
Heat Pump (all projects)	31	989	420	10,319	-2,593	82
Heat Pump only	6	932	357	11,471	-1,811	86
Heat Pump and non-specified other	5	899	273	10,390	-2,697	-3
Heat Pump and Insulation	4	1,049	491	8,087	-2,839	107
Heat Pump, Insulation, and non-specified other	5	1,205	555	8,797	3,555	127

Natural Gas Savings

There were 153 loans evaluated (excluding heat pump projects) which had an impact on natural gas use.

Total adjusted natural gas consumption for the 153 residences evaluated for the 12 months prior to completion of the loan financed work was 149,495 therms at a cost of \$70,777. Total estimated savings was 19,180 therms of natural gas at a cost of \$9,234 annually. On average, these homes consumed 977 therms of natural gas prior to program participation and saved 125 therms (or \$60) annually. For these 153 loans, natural gas consumption was reduced 12.83%.

Of these 153 loans, 6 financed only additional insulation. These homes used an average of 1,092 therms of natural gas in the year prior to program participation and saved an average of 188 therms (or \$93) annually. For these 6 loans, natural gas consumption was reduced 17.19%.

Nine of these 153 loans financed window projects. These homes used an average of 1,095 therms of natural gas in the year prior to program participation and saved an average of 42 therms (or \$19) annually. For these 9 loans, natural gas consumption was reduced 3.83%.

The replacement of a natural gas furnace with a more efficient model was financed by 20 of the evaluated loans. These homes used an average of 992 therms of natural gas in the year prior to program participation and saved an average of 113 therms (or \$53) annually. For these 20 loans, natural gas consumption was reduced 11.36%.

Twenty four loans financed both the replacement of a natural gas furnace and a new air conditioner. These homes used an average of 896 therms of natural gas in the year prior to program participation and saved an average of 117 therms (or \$57) annually. For these 24 loans, natural gas consumption was reduced 13.04%.

Twenty two loans financed the replacement of a natural gas furnace, a new air conditioner, and miscellaneous other projects (such as a humidifier, air cleaner, setback thermostat, water heater blanket, etc.). These homes used an average of 1,000 therms of natural gas in the year prior to program participation and saved an average of 121 therms (or \$59) annually. For these 22 loans, natural gas consumption was reduced 12.05%.

These impacts of the Lincoln Loan Program on natural gas consumption are summarized in Table 2 below:

Table 2. Average Natural Gas Savings per Loan

Description of Category	No. of Loans	Prior Use	Therms Saved	% Saved	\$ Saved
All loans affecting natural gas	153	977	125	12.83	60
Insulation only	6	1,092	188	17.19	93
Windows only	9	1,095	42	3.83	19
Furnace project only	20	992	113	11.36	53
Furnace and Air Conditioner Project	24	896	117	13.04	57
Furnace, Air Conditioner, and Miscellaneous Other Projects	22	1,000	121	12.05	59

Electricity Savings

There were 130 loans evaluated (excluding heat pump projects) which had an impact on electricity use. One of these loans involved an all-electric home, thus results from the remaining 129 loans are summarized below.

Total adjusted electricity consumption for the 129 residences evaluated for the 12 months prior to completion of the loan financed work was 1,208,452 kWh at a cost of \$73,318. Total estimated savings was 25,741 kWh at a cost of \$1,823 annually. On average, these homes consumed 9,368 kWh of electricity prior to program participation and saved 200 kWh (or \$14) annually. For these loans, electricity consumption was reduced 2.13%.

Of these 129 loans, 6 financed only additional insulation. These homes used an average of 9,290 kWh of electricity in the year prior to program participation and saved an average of

161 kWh (or \$12) annually. For these 6 loans, electricity consumption was reduced 1.73%.

Nine of these 129 loans financed window projects. These homes used an average of 11,843 kWh of electricity in the year prior to program participation and had an average increase in electricity use of 67 kWh (or \$4) annually. For these 9 loans, electricity consumption increased 0.56%.

The replacement of air conditioning equipment was the only project financed by 7 loans evaluated. These homes used an average of 10,929 kWh of electricity in the year prior to program participation and saved an average of 1,150 kWh (or \$70) annually. For these 7 loans, electricity consumption was reduced 10.52%.

Twenty four loans financed both the replacement of a natural gas furnace and a new air conditioner. These homes used an average of 9,531 kWh of electricity in the year prior to program participation and had an average increase in electricity use of 87 kWh (or \$3) annually. For these 24 loans, electricity consumption increased 0.91%.

Twenty two loans financed the replacement of a natural gas furnace, a new air conditioner, and miscellaneous other projects (such as a humidifier, air cleaner, setback thermostat, water heater blanket, etc.). These homes used an average of 10,229 kWh of electricity in the year prior to program participation and had an average increase in electricity use of 127 kWh (or \$6). For these 22 loans, electricity consumption increased 1.24%.

These impacts of the Lincoln Loan Program on electricity consumption are summarized in Table 3 below:

Table 3. Average Electricity Savings per Loan

Description of Category	No. of Loans	Prior Use	kWh Saved	% Saved	\$ Saved
All loans affecting electricity	129	9,368	200	2.13	14
Insulation only	6	9,290	161	1.73	12
Windows only	9	11,843	-67	-0.56	-4
Air Conditioner project only	7	10,929	1,150	10.52	70
Furnace and Air Conditioner Project	24	9,531	-87	-0.91	-3
Furnace, Air Conditioner, and Miscellaneous Other Projects	22	10,229	-127	-1.24	6

Total Loan Program Benefits

The total annual energy savings from the Lincoln Energy Conservation Interest Subsidy and Rebate Program are summarized in Table 4 below:

Table 4. Summary of Energy Savings

Group of Loans	# of Loans	Electricity Savings (kWh)	Natural Gas Savings (therms)	Total Savings (mill. Btu)
Heat Pump Loans	46	-108,857	19,385	784.6
All Other Loans	373	111,516	45,340	5,716.1
Total	419	2,659	64,725	6,500.7

In addition to reducing their energy consumption and thus their energy bills, loan participants are also benefitting society because of the reduction in greenhouse emissions resulting from their reduced energy use. The total reduction in greenhouse emissions due to the Lincoln Loan Program are:

Sulfur Dioxide	16 pounds
Nitrous Oxides	609 pounds
Carbon Dioxide	377 tons

Among the economic impacts from the Lincoln Energy Conservation Interest Subsidy and Rebate Program is the estimated \$34,396 annual savings to loan participants on their energy bills. Also, based on an analysis for the Dollar and Energy Savings Loan Program, it is estimated that the economic activity generated by the work financed by the loans and the 10 years of savings on energy bills will support 22.3 job-years of employment and \$491,000 in added wage and salary compensation. Average over the 10 years, the economy will sustain a net improvement of 2.23 jobs each year for the 10-year period. Wage and salary income will increase by an average of \$49,100 each year for 10 years. It is expected that these benefits will contribute a total of \$797,000 to the Nebraska Gross State Product over the 10-year period, or an average of \$79,700 annually.

It should be noted that these are probably conservative estimates of the economic benefits, since many of the projects funded have an expected life of more than 10 years.