Superinsulation Case Study Fargo, ND
Monitored Results 1985-1986

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5 Homes Built in North Fargo All are 2 story with full basement and 2 stall garage
Energy usage provided by Northern States Power Company

Address and Sq. Footages

1. 2932 Peterson Parkway 1,439 sf lower, 1,439 sf main, 1,085 sf upper 3,963 sf total

2. 2914 Maple Street 1,290 sf lower, 1,290 sf main, 986 sf upper 3,566 sf total

3. 3002 Peterson Parkway 1,511 sf lower, 1,511 sf main, 1,421 sf upper 4,443 sf total

4. 3020 Maple Street 1,380 sf lower, 1,380 sf main, 1,020 sf upper 3,780 sf total

5. 2901 Maple Street 1,380 sf lower, 1,380 sf main, 1,020 sf upper 3,780 sf total

All 5 homes are built to identical specifications as follows;

Walls are R-50 15" staggered double 2x4, 16"oc, 15" standard density fiberglass batts, 3/4 " fiberboard exterior sheathing and 6 mil poly continuous warm side vapor barrier with 1/2 "drywall

Ceilings are R-70 with engineered wood truss 24"oc with 12" energy heel and 24" overhangs, 24"of blown fiberglass insulation, continuous vented soffit with ridge venting of 1 sf per 300 sf of ceiling area, 6 mil poly warm side vapor barrier with 5/8 "drywall

Basement walls are R-22 with 8"x 96"poured concrete walls and exterior waterproofing, 2" R-10 extruded polystyrene on exterior from footing to top of wall, interior walls are 2x4, 16"oc with 3 ½" R-11 standard density fiberglass batts

Windows are triple glazed for homes 1, 2, and 3 and Low E for homes 4 and 5

Infiltration as measured by blower door averaged 1.25 ach50 or .0625 natural air change

Heat recovery ventilation (HRV) was used at a rate of .3 ach with an efficiency of 70%

Introduction; The homes cited in this study were built in Fargo, ND from 1983 to 1985, all by the same building company. Mortgage rates averaged about 13% and

natural gas was .45 per therm (100,000 btu's). Electricity was .047 per kwh for the first 1,000 kwh used and .037 per kwh for any additional monthly usage. The first four homes built were all electric and the fifth home used natural gas for space heating only using a Lennox Pulse furnace with a 90% efficiency. The four electrically heated homes had one centrally located wall AC and the fifth gas heated home had central AC. The two homes on Peterson Parkway had the attached garages on the southern exposure with some south facing glass but the bulk of the windows in back of the house faced north. The homes located on Maple Street had attached garages on the east or west side with most windows facing east and west with little south facing glass. Two of the homes in the study were monitored for two years and the remaining three homes were monitored for one year. Fargo, ND is a cold climate to be sure with the 30 year average for heating degree days (HDD) at 9,095. The heating portion of the electrically heated homes was determined as follows, for the five non heating months May, June, July, August, and September the electrical usage for each house is totaled and divided by five. This gives the average monthly electrical usage for each home for the non heating season. This monthly average is multiplied by twelve months and deducted from the total electrical usage to determine the actual electricity used for heating. For the gas heated home the usage is the actual monthly gas meter reading.

The monitored results are listed below;

2914 Maple Street Year 1985 9,667 HDD 3,566 Sq. Ft.

28,018 kwh total electricity used
1,223 kwh base monthly non heating
14,680 kwh yearly non heating
13,338 kwh for heating x 3,412 btu per kwh
45,509,256 btu annual heating load
1.32 BTU/SF/HDD

2932 Peterson Parkway Year 1985 9,667 HDD 3,963 Sq. Ft.

29,075 kwh total electricity used
1,299 kwh base monthly non heating
15,588 kwh yearly non heating
13,487 kwh for heating x 3,412 btu per kwh
46,017,644 btu annual heating load
1.20 BTU/SF/HDD

2914 Maple Street Year 1986 8,627 HDD 3,566 Sq. Ft.

29,336 kwh total electricity used
1,318 kwh base monthly non heating
15,816 kwh yearly non heating
13,520 kwh for heating x 3,412 btu per kwh

46,130,240 btu annual heating load
1.50 BTU/SF/HDD

2932 Peterson Parkway Year 1986 8,627 HDD 3,963 Sq.Ft.

27,102 kwh total electricity used
1,265 kwh base monthly non heating
15,180 kwh yearly non heating
11,922 kwh for heating x 3,412 btu per kwh
40,677,864 btu annual heating load
1.19 BTU/SF/HDD

3002 Peterson Parkway Year 1986 8,627 HDD 4,443 Sq. Ft.

28,966 kwh total electricity used
1,360 kwh base monthly non heating
16,320 kwh yearly non heating
12,646 kwh for heating x 3,412 btu per kwh
43,148,152 btu annual heating load
1.13 BTU/SF/HDD

3020 Maple Street Year 1986 8,627 HDD 3,780 Sq. Ft.

32,344 kwh total electricity used
1,600 kwh base monthly non heating
19,200 kwh yearly non heating
13,144 kwh for heating x 3,412 btu per kwh
44,847,328 btu annual heating load
1.38 BTU/SF/HDD

2901 Maple Street Year 1986 8,627 HDD 3,780 Sq. Ft.

431 therms natural gas used @ 100,000 btu per therm
43,100,000 btu annual heating load
1.32 BTU/SF/HDD

Summary;

Consistent construction techniques provide consistent results. The largest home performed slightly better than the smallest home because the thermal boundary (building envelope) sq. footage is smaller as a percentage of floor space. The homes

with some south facing glass used less energy than the homes with little south exposure. Although electricity as a heating source was twice as expensive as natural gas, the cost of a central heating system (approximately $6,000.00 additional) could not be justified to cut the $400.00 annual electric heating bill to $200.00 with natural gas. The cooling load in these homes is virtually nonexistent. The homes were probably over ventilated via the air exchanger as no quality controls were available at the time. None of the homes had the ideal orientation for a cold climate which would have the garage on the northwest corner and most of the glass on the back of the house facing south. The builder did build one house in South Fargo with a 12", R-40 double wall with the above described orientation, all other building specifications the same as the North Fargo homes. The home was a split entry, 3,000 Sq. Ft. total and had for the winter of 1986-1987 (7697 HDD) a natural gas usage of 207 therms (20,700,000 btu's) with gas @ .45 per therm or an annual heating bill of $93.15 (.90 BTU/SF/HDD) .

The homes in this study were built and sold competitively, saving the owners many thousands of dollars in heating costs over the years. Superinsulated homes use 1/4 to 1/3 of the energy needed to heat conventionally built housing while providing a very healthy living environment. The dynamics have changed considerably since the time these homes were built. Mortgage interest rates have fallen from about 13% to about 6% and energy costs are essentially double what they were in 1985-1986. The cost effectiveness of building with energy efficiency as a goal has never been greater, with payback periods for efficiency measures often being just a few years. The savvy homebuyer looking for the highest return on investment will seek quality built, highly efficient homes.

Questions or comments on this study should be sent to info@airfoilinc.com