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Special Report 106—1983  
Energy Handbook Chapter 8

# How to Estimate Home Heating Expense in Minnesota

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The author wishes to thank those who reviewed and commented on this report during its development:

Dick Greenlund—Minnegasco  
May Hutchison—Minnesota Housing Finance Agency  
Bruce Nelson—Minnesota Department of Energy  
Valdi Stefanson—St. Paul Energy Resource Center  
Wanda Olson—University of Minnesota  
Becky Yust—University of Minnesota  
Lewis Hendricks—University of Minnesota  
Shirley Barber—Ramsey County Extension Service  
Delos Barber—Ramsey County resident  
Catherine Huebner—Stevens County Extension Service  
Joan Sprain—Washington County Extension Service  
Toni Smith—Wabasha County Extension Service  
Brian Schreiber—Goodhue County Extension Service  
Janet Krofta—Hennepin County Extension Service  
Jeanette Hauschild—Lincoln County Extension Service  
Tom Musil—Continuing Education in Real Estate, University of Minnesota.

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COVER: As a couple reviews plans for a new home, their builder points out energy conservation features and a real estate agent uses Special Report 106 and a desktop calculator to prepare an estimate of heating expense. The estimate will be presented to the mortgage lender when terms and amount of the mortgage are discussed.

# HOW TO ESTIMATE HOME HEATING EXPENSE IN MINNESOTA

## Why Is A Heating Expense Estimate So Important?

If you are *buying* a house, it is important to use a reliable method for estimating heating expenses. An average-size home in Minnesota may cost \$200-2000 per year to heat depending on insulation, quality of construction, location, type of fuel, and other factors shown in graph on page 4. A larger than average home may cost more than \$2000 per year for heating. Even in newly-built "energy-efficient" homes, heating can be nearly \$1000 per year. Household fuel prices are rising faster than wages or salaries; if you build or buy a new house without an estimate of energy expenses, you could soon find the bills difficult to manage.

If you are *planning or building* a new home, heating estimates are particularly useful. Your plans and blueprints should include the features that will give low heating bills. Table 1 gives several examples of heating expense according to amount of insulation.

If you are *remodeling or renovating*, there may be excellent opportunities to reduce heating cost. The worksheet on page 9 provides step-by-step instructions on how to estimate the fuel you will save from adding insulation. Caulking and weatherstripping should be done before adding insulation.

Family size, ages, and type of home management also influence heating expense. Higher thermostat setting, frequent door opening, and frequent use of ventilation fans are factors that can increase heating expense and it is helpful to consider such factors when doing an estimate.

## Time and Tools Needed

For an *existing house with past heating bills available*, all that is needed are the bills and perhaps an adding machine or hand calculator. It takes only a few minutes to determine a rough estimate of heating expense. Adjusting past bills for the weather, if the bills are from a heating season that was comparatively mild, takes a little longer (a later section explains how).

For a *new house*, you will need the blueprints. Ask the builder or seller to write insulation specifications on the blueprints. If you return to ask for higher insulation standards, these should also be written on the blueprints and signed by the builder. A hand calculator will be helpful. Calculations will require one to two hours.

For an *existing house with no records*, you will need a ruler or tape measure as well as a calculator. Once you have gathered measurements and information on the insulation in the house, the calculations will require one to two hours. A qualified energy auditor can be hired to do measurements, inspection, and calculations.

By using the method shown on page 9, you can figure the savings from insulating a particular area of the house in about 5-10 minutes.

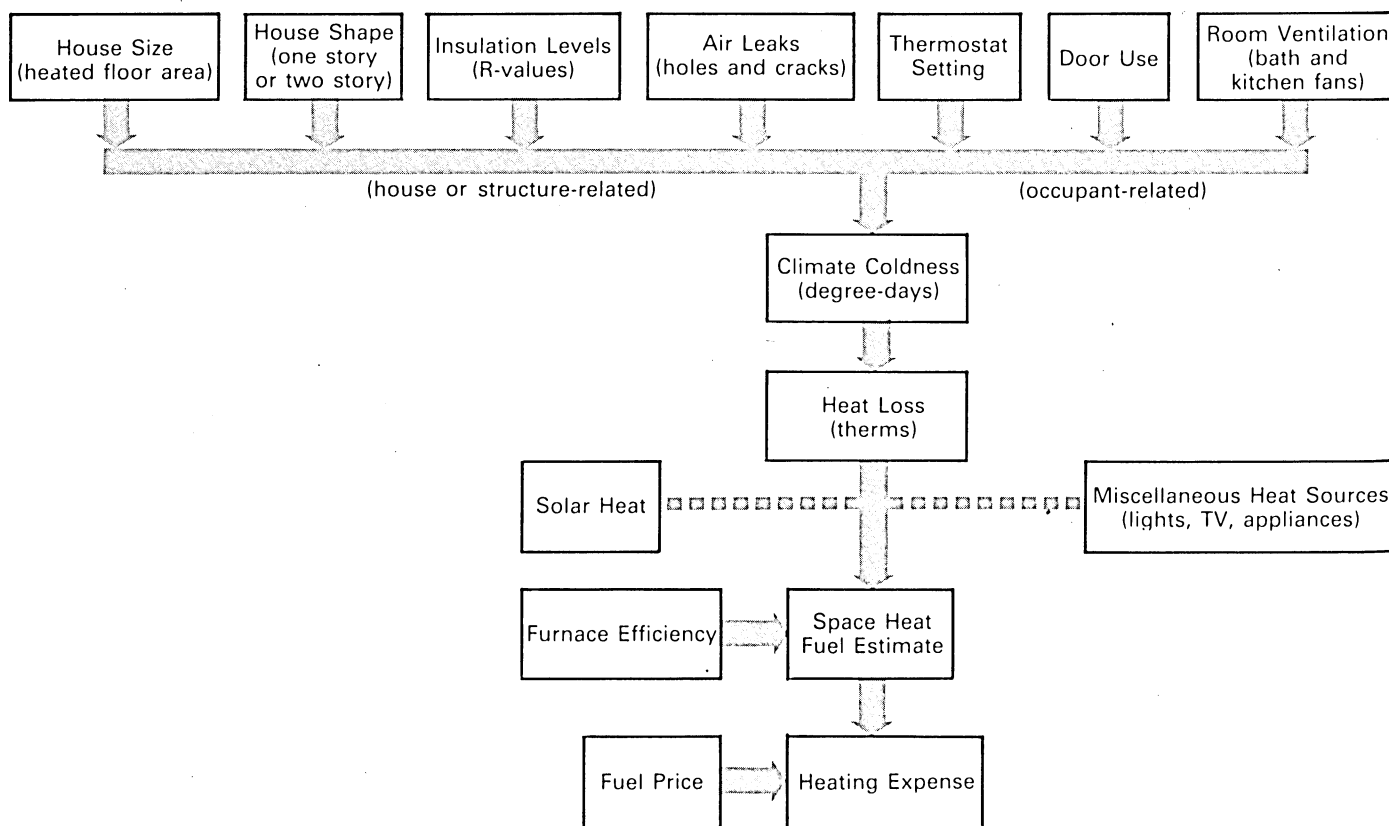
## Heating Terms

*Heat loss* is the process of thermal energy escaping from the indoor space of your home. *Conduction* is a form of heat loss that occurs through contact within the materials of exterior parts. Heat conduction is always a movement of thermal energy from a warm material (indoors) towards a cold material (outdoors). Exterior square footage includes the walls, ceilings, and other parts of the house that separate heated indoor space from outdoors or unheated spaces. A ceiling with an unheated attic above, for example, is an "exterior" area. *Insulation* is a material that resists conduction of heat more than glass, wood, metal, or masonry.

*R-value* is a rating of thermal insulating value. The "R" stands for resistance to heat flow. The higher the "R," the more insulating power. A rating of R17, for example, means that it takes 17 hours for one unit (British Thermal Unit) of heat to pass through a 1 square foot surface (exposed to 1 degree of indoor-outdoor difference of temperature). For a rating of R2, it takes only two hours to lose one unit of heat. The "R" rating does not include air leakage (infiltration) heat loss.

*Air leakage* is another form of heat loss and is estimated separately because it depends on how tightly the various materials are fitted together and how many holes are present. Since warm air is lighter than cold air, houses will tend to lose warm air through cracks or holes in the ceiling or from windows in upstairs rooms. Wind increases air leakage. *Air change rate* is the average rate at which heated air leaks out and is replaced by unheated air, expressed as volume of the house changed per hour. For example, a house with 1,000 square feet heated floor area and 8 feet ceiling height has 8,000 cubic feet of interior volume. If

Figure 1. Factors in Heating Expense



the air change rate is 1.5 (air changes per hour), then 12,000 cubic feet per hour is the average air change. Dryness of inside air, indicated by static shocks or dry nose and throat may be a sign that your house has a fairly high air change rate.

If you are unsure about the tightness of your house in terms of air exchange rate, you can assume a maximum (2.0) and minimum (0.5) value for use in the worksheet on page 6, to obtain a high and low estimate of heating expense. A few new homes with very tight construction may have an air change rate less than 0.5, but this is difficult to verify since wind conditions, use of doors, and ventilating fans are also factors in air change.

*Therm* is a unit of heating equal to 100,000 British Thermal Units (BTU). One BTU is about the amount of heat given by a wooden kitchen match. One BTU will warm 1 pint of water by 1 degree Fahrenheit. *CCF* stands for 100 cubic feet of natural gas. *KWH* stands for kilowatt-hour of electricity.

A more accurate worksheet method for estimating heat loss and fuel requirement is available from your county extension office. Ask for the "Heat Loss and Solar Gain Estimation Workbook." The workbook includes detailed information about R-values, air change rating, ventilation equipment, passive solar, and local climate. You may also consult with a qualified archi-

tect, engineer, heating contractor, or your utility to obtain a heating expense estimate.

### How to Estimate For an Existing House (Past Heating Records Available)

If you are looking at a house that is at least a year old, the first step is to examine the past fuel bills. Minnesota law requires an Energy Disclosure Report, including fuel use records, for a house when it is advertised or listed for sale. The report must be prepared by an energy auditor who is certified by the Minnesota Department of Energy. Past expenses are usually good information, but remember that prices may be going up 20 percent per year for certain heating fuels. If the house has a woodburner, kerosene heater, or other heat source that does not show on the bills, be sure to ask how much extra fuel has been used. Also ask what thermostat setting was normally used, or if any areas of the house were closed off. Each degree of thermostat setting lower than 70°F will cost 3 percent less in heating expense.

If the past fuel bills are for a season that was not as cold as the long-run average, you should realize that your bills for a season of average cold will be higher. Ask the utility company to help you account for the weather, or obtain a copy of Extension Folder 563.

**Table 1. Insulation Level and Annual Heating Expense Examples in Minnesota**

INSULATION LEVELS <sup>1</sup> (see below)	HEAT <sup>2</sup>		NATURAL GAS <sup>3</sup>		ELECTRIC HEAT <sup>4</sup>		OIL HEAT <sup>5</sup>	
	THERMS/YR		CCF/YR	\$/YR	KWH/YR	\$/YR	GAL/YR	\$/YR
FHA—Standard	1095		1,369	\$821	32,080	\$1,604	1095	\$1,314
Moderately-Insulated	693		866	\$520	20,310	\$1,015	693	\$ 832
Well-Insulated	417		521	\$312	12,220	\$ 611	417	\$ 500
Super-Insulated	198		248	\$149	5,800	\$ 290	198	\$ 238

	FHA—STANDARD		MODERATELY-INSULATED		WELL-INSULATED		SUPER-INSULATED	
	R-VALUE	THERMS	R-VALUE	THERMS	R-VALUE	THERMS	R-VALUE	THERMS
Windows <sup>6</sup>	Double	109	Double	109	Triple	69	Tpl + shade	47
Doors	R10	8	R10	8	R10	8	R15	5
Walls <sup>7</sup>	R17	110	R24	79	R30	62	R48	39
Ceiling	R40	59	R50	47	R60	40	R70	34
Foundation <sup>8</sup>	R3	305	R8	114	R13	70	R23	39
Air Change	1.5	504	1.0	336	0.5	168	0.1	34
		1095		693		417		198

1. Insulation levels for walls, doors, ceiling, and foundation are given in R-value (hr/BTU-F-sq ft). House size assumed to be 1200 square feet heated floor area, rectangular plan, with a full size basement. Air change is given in terms of air change rate in volume of house per hour. House is assumed to have 9600 cubic feet of heated volume.
2. Heat requirement assumes a 65°F average room temperature, e.g., 70°F day and 60°F night. A portion of the heat requirement will be supplied by lights and appliances. Climate of 8,159 degree-days per year is assumed. See map on page 6 to adjust heating expense for locations in southern and northern Minnesota.
3. Natural gas at 60¢ per CCF (hundred cubic feet), and 1.25 CCF per therm of heat supplied by the furnace.
4. Electricity at 5¢ per KWH (kilowatt-hour), and 29.3 KWH per therm. (Actual pricing will vary depending where the electricity is purchased) and may depend on quantity used and time of day it is used.
5. Oil heat at \$1.20 per gallon, and 1 gallon per therm supplied by furnace.
6. Windows given as double-pane, triple-pane, or triple-pane with thermal shade.
7. Walls are assumed to be 15 percent wood framing area (studs, jacks, plates, headers, etc). The R-value of the framing portions has been taken into account as well as the insulated cavity portions.
8. Foundations are assumed to be 12-inch concrete block, with one foot above grade and 7 feet below grade.

### How to Estimate For An Existing House (No Past Records)

If the R-value of walls, ceilings, and foundation is known, and an approximation of air change rate is made, the heating expense can be estimated using worksheet on page 6. You will also need measurements of the house to calculate square feet of exposed parts.

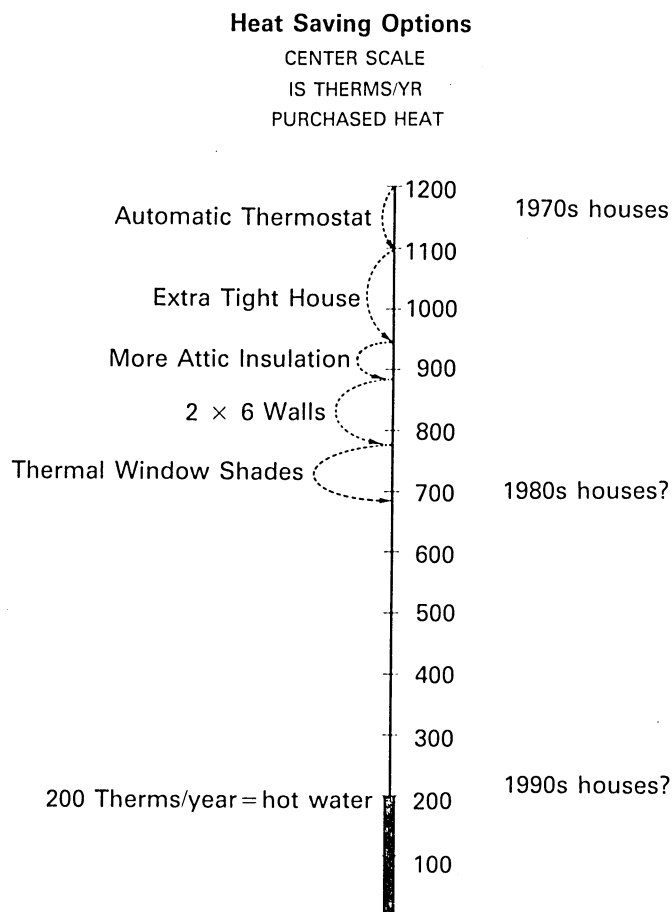
The older the house, however, the more important it is to have past records. Hidden defects or uneven insulation in older homes can make it difficult to obtain a good estimate by calculations.

### How To Estimate For A New House

Table 1 gives examples of heating expense in central Minnesota for several levels of insulation, assuming a one-story 1200-square-foot home. For other size homes, split-levels, two-story, other types of insulation, or other parts of Minnesota, use worksheet on page 6. You will need blueprints and construction specifications of the house.

### An "Energy Ruler" for Measuring Houses

The "energy ruler" is a scale or "ruler" of total purchased heat for a 1200 square foot home, with construction typical of the 1970s. The house will require 1200 therms of purchased heat. The ruler shows the results of building a 1200 square feet home in the 1980s with improvements such as automatic set-back thermostat, extra tight construction, more attic insulation, 2 x 6 walls and thermal window shades.

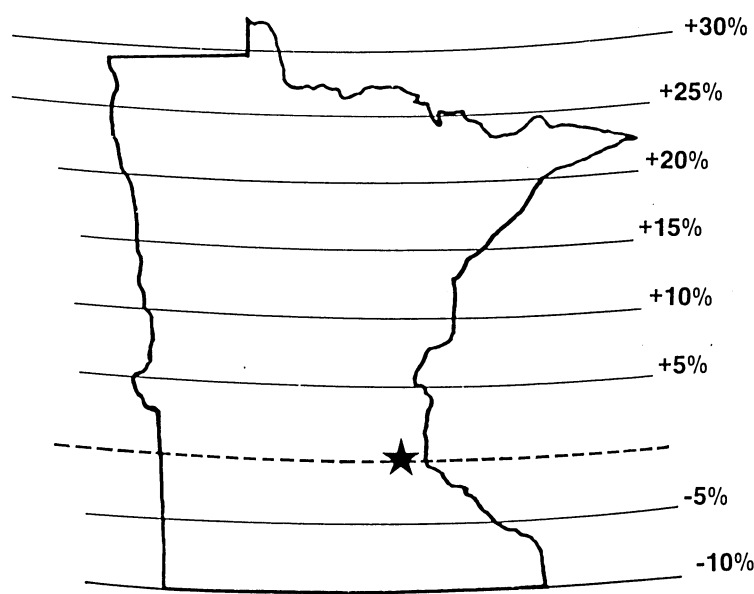


### Annual Heating Expense

PART OF HOUSE	EXTERIOR SQUARE FEET	×	THERMS PER SQUARE FOOT (See Tables 2-5)	=	THERMS
Windows					
Doors					
Walls					
Ceilings					
Foundation (above ground)					
Foundation (below ground)					
					SUBTOTAL A

<input style="width: 100%;" type="text"/> Square Feet Heated (Total House)	×	<input style="width: 100%;" type="text"/> Ceiling Height	×	<input style="width: 100%;" type="text"/> Air Exchange Rate (tight = 0.5) (average = 1.0) (loose = 1.5) (drafty = 2.0)	×	.035	=	<input style="width: 100%;" type="text"/> SUBTOTAL B
--	---	---	---	---	---	------	---	---

<input style="width: 100%;" type="text"/> TOTAL therms ( A + B )
---



×	<input style="width: 100%;" type="text"/> Fuel per therm (See table 6)
---	--

<input style="width: 100%;" type="text"/> TOTAL fuel
---

×	<input style="width: 100%;" type="text"/> \$ /unit Price of fuel
---	---

<input style="width: 100%;" type="text"/> Annual heating expense
---

If you live north or south of the dashed line, adjust annual heating expense by percentage shown on map.

**Table 2. Annual Conduction Heat Loss of Windows<sup>1</sup>**  
(per square foot)

	R-VALUE	HEAT LOSS (THERMS)
Single pane		
with no storm window	1.01	1.938
with broken or loose storm window	1.50	1.305
with tightly fitted storm <sup>2</sup>	2.15	.911
Double pane (or single with storm) <sup>2</sup>		
<sup>3</sup> / <sub>16</sub> in. air space	1.70	1.152
<sup>1</sup> / <sub>4</sub> in. air space	1.81	1.082
<sup>1</sup> / <sub>2</sub> in. air space or more	2.15	.911
Triple pane (or double with storm) <sup>2</sup>		
<sup>1</sup> / <sub>4</sub> in. air space	2.70	.725
<sup>1</sup> / <sub>2</sub> in. air space or more	3.40	.576
heat reflective inner glazing	4.00	.490
Insulating shade (used 16 hours/day) <sup>3</sup>		
on double pane window	—	.529
on triple pane window	—	.392
Insulating shutter (used 16 hours/day) <sup>3</sup>		
on double pane window	—	.392
on triple pane window	—	.294

1. Table does not include heat loss or fuel use due to air leakage. A typical heat loss of 2 therms (200,000 BTU) per year per window occurs due to the air leakage through weatherstripping and cracks around the window woodwork. Caulking the woodwork cracks with clear rubber sealant will reduce loss by about one-half. R-values assume that windows are 20% frame and 80% glass.
2. Plastic storm windows, or plastic stretched across windows, outside or inside, has the same R-value as glass storm windows. Edges of plastic must be tightly secured.
3. For part-time window insulation, such as shades or shutters, two R-values would need to be given (in-place and not-in-place). The heat loss and fuel amounts have been figured assuming an R4 shade material and R-10 shutter.

**Table 3. Annual Conduction Heat Loss of Doors<sup>1</sup>**  
(per square foot)

	R-VALUE	HEAT LOSS (THERMS)
Wood door	3	.653
Wood door and storm door	4	.490
Wood door with vestibule	8	.245
Metal door with foam core	10	.196
Metal doors with vestibule	15	.130
Double-pane glass door wood frame		
with <sup>1</sup> / <sub>4</sub> in. air space	1.81	1.082
with <sup>1</sup> / <sub>2</sub> in. air space	2.15	.911
Double-pane glass door metal frame		
with <sup>1</sup> / <sub>4</sub> in. air space	1.72	1.138
with <sup>1</sup> / <sub>2</sub> in. air space	2.04	.960
Triple-pane glass door wood frame		
with <sup>1</sup> / <sub>4</sub> in. air space	2.70	.725
with <sup>1</sup> / <sub>2</sub> in. air space	3.40	.576
Triple-pane glass door metal frame		
with <sup>1</sup> / <sub>4</sub> in. air space	2.56	.765
with <sup>1</sup> / <sub>2</sub> in. air space	3.22	.608

1. Air leakage heat loss of doors will be 10-50 percent of the conduction heat loss, depending on quality of weatherstripping.
2. Metal doors or frames must have "thermal break" edges to achieve the listed R-Value. Warning: doors without thermal break will have ice buildup problems and may not achieve listed R-Values.

**Table 4. Annual Conduction Heat Loss of Walls<sup>1</sup>**  
(per square foot)  
(for walls below ground, heat loss is about one-third)

	R-VALUE	HEAT LOSS (THERMS)
Concrete block (uninsulated)	3	.653
Insulated concrete block		
with 1 in. "styrofoam"	8	.245
with 2 in. "styrofoam"	13	.150
with 3 in. "styrofoam"	18	.109
with 4 in. "styrofoam"	23	.085
2 × 4 wood studs		
no insulation in stud space	4	.489
2 in. insul. in stud space	9	.218
full insul. in stud space	13	.150
stud full plus 1 in. "styrofoam"	17	.115
stud full plus 2 in. "styrofoam"	23	.085
2 × 6 wood studs		
full insul. in stud space	20	.098
stud full plus 1 in. "styrofoam"	24	.082
stud full plus 2 in. "styrofoam"	30	.065
Double wood studs		
8 in. insulation	32	.061
10 in. insulation	40	.049
12 in. insulation	48	.041

1. Use net square footage, after window and door areas have been calculated. R-values are for overall wall area, including effect of structural framing. The 2 × 4 wood studs are spaced at 16 inches and the 2 × 6 wood studs or double studs are assumed to be at 24 inch spacing.

**Table 5. Annual Conduction Heat Loss of Ceilings<sup>1</sup>**  
(per square foot)

	R-VALUE	HEAT LOSS (THERMS)
3 inches insulation depth <sup>2</sup>	8	.245
6 inches	19	.103
9 inches	30	.065
12 inches	40	.049
15 inches	50	.039
18 inches	60	.033
21 inches	70	.028
24 inches	80	.024

1. Does not include air leakage heat loss that may occur through cracks and holes in ceiling. Tops of walls may have openings which allow warm air to rise up inside the wall and filter through the overhead insulation. Sealing all filtration points is important.
2. Fiberglass, mineral wool, or cellulose. R-value of 3.33 per inch has been assumed. See the product label for exact R-value per inch.

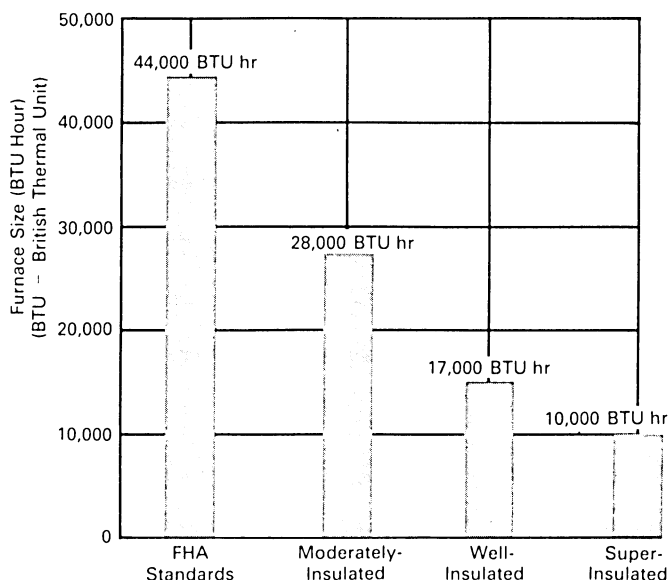
**Table 6. Fuel Usage Per Therm of Heat Loss**

CCF=hundred cubic feet natural gas  
 KWH=kilowatt-hour electricity  
 Therm = 100,000 British Thermal Units

Type of Heating System <sup>1</sup>	Fuel Per Therm	Percent Seasonal Efficiency <sup>2</sup> Assumed in Fuel/Therm
Oil/old design (well tuned)	1.00 gal	70
Oil/new design	.90 gal	80
Oil/theoretical	.72 gal	100
Gas/pilot (pre 1980)	1.67 CCF	60
Gas/automatic ignition	1.52 CCF	66
Gas/damper	1.40 CCF	71
Gas/power vented	1.25 CCF	80
Gas/recuperative	1.16 CCF	86
Gas/pulse combustion	1.10 CCF	91
Gas/theoretical	1.00 CCF	100
Propane/pilot (pre 1980)	1.82 gal	60
Propane/automatic ignition	1.65 gal	66
Propane/damper	1.53 gal	71
Propane/power vented	1.36 gal	80
Propane/recuperative	1.26 gal	86
Propane/pulse combustion	1.19 gal	91
Propane/theoretical	1.09 gal	100
Wood/fireplace	156 pounds <sup>3</sup>	10
Wood/airtight stove	28 pounds <sup>3</sup>	55
Electric resistance	29.3 KWH	100
Electric heat pump	21.0 KWH	140

1. See Extension Folder 565, "Furnace Efficiency" in chapter 17 of the *Home Energy Handbook* at your county extension office.
2. Seasonal efficiency may differ from steady-burn efficiency, because the seasonal efficiency includes on-off cycle vent loss.
3. At 20 percent moisture content, there are approximately 6,400 BTU's per pound of wood. Average weight for one cord: oak 4,000 pounds, white birch 3,200 pounds, aspen 2,300 pounds. A cord of stacked firewood measures 4 feet high by 4 feet wide by 8 feet long.

**Furnace Size (or Radiant Heat) Needed for a 1200 Square Foot House in Saint Paul**



(See table 1 for details)

**What Is "Superinsulation"?**

No precise definition is agreed upon, but it is generally accepted that R-40 walls and an R-70 ceiling are "super" insulation. Careful vapor barriers and virtually air-tight construction are needed to make the idea work. A well-insulated foundation and triple-glazed or quad-glazed windows balance out a full superinsulation package.

The methods of building superinsulated houses were developed in Alaska, Canada, Sweden, Denmark, and the University of Illinois. In 1976, Illinois published plans for a "Lo-Cal" house with thickly insulated double-wall construction. The researchers found that much less fuel is consumed annually, and that smaller, less expensive heating equipment could be installed in superinsulated houses (see graph on page 8). Improvement in comfort was also noted.

Superinsulation in a new home will typically add \$5,000 to \$8,000 to building cost as compared to a house with code-minimum insulation. Heating bills will run 70-80 percent less than a code-minimum house, so payback will be 5-10 years, depending on type and price of fuel locally available (see table 1). In an older home, superinsulation makes sense only if a house needs major renovating. When new siding is needed, walls can be insulated to R-30 or more and an air-vapor barrier can be installed for \$2000-\$8000 depending on house size and cost of materials and labor. Payback on superinsulation jobs for older homes may run 10-15 years. In new or old houses, however, a "super" insulation job reduces heating bills enough to be an attractive selling feature if you move. Superinsulated plans and ideas are available from:

1. Minnesota Department of Energy  
 980 American Center Building  
 150 East Kellogg Blvd.  
 St. Paul, Minnesota 55101  
 phone: 612-296-5175 or 800-652-9747
2. National Center for Appropriate Technology  
 P.O. Box 3838  
 Butte, Montana 59702
3. Office of Energy Conservation  
 1914 Hamilton Street  
 Regina, Saskatchewan  
 CANADA S4P 4V4
4. Small Homes Council  
 University of Illinois  
 One East St. Mary Road  
 Champaign, IL 61820
5. *The Superinsulated Retrofit Book*  
 Renewable Energy in Canada  
 107 Amelia Street  
 Toronto, CANADA M4X 1E5
6. *Low Energy Home Designs*  
 Alberta Energy and Natural Resources  
 Highfield Place 2nd Floor  
 10010-106 Street  
 Edmonton, Alberta  
 CANADA T5J 3L8

## Method to Figure the Savings From a Particular Insulation Improvement

Step 1. _____ (sq ft)	Exterior square footage to be insulated
Step 2. _____ (therms/sq ft)	Heat loss per exterior square foot <i>before</i> improvement (from tables 2-5)
Step 3. _____ (therms/sq ft)	Heat loss per exterior square foot <i>after</i> improvement (from tables 2-5)
Step 4. _____ (therms/sq ft)	Heat saved per exterior square foot (step 2 minus step 3)
Step 5. _____ (therms)	Heat savings per year (step 1 times step 4)
Step 6. _____ (fuel/therm)	Fuel equivalent per therm (from table 6)
Step 7. _____ (fuel)	Fuel savings per year (step 5 times step 6)
Step 8. _____ (\$/fuel)	Price of fuel
Step 9. _____ (\$)	Dollar savings first year (step 7 times step 8).
_____	Dollar savings adjusted for location (see map on page 6).

**To calculate the fuel savings from a more efficient furnace, follow the steps below:**

Step 1. _____ (fuel/therm)	Existing furnace or "standard model" fuel per therm of heat (See table 6)
Step 2. _____ (fuel/therm)	Replacement furnace or "better model" fuel per therm of heat (See table 6)
Step 3. _____ (fuel/therm)	Difference of fuel per therm of heat (step 1 minus step 2)
Step 4. _____ (therms/yr)	Annual heat needed (from worksheet on page 6) or "Heat Loss Workbook," or figured from existing fuel bills, see "NOTE" below)
Step 5. _____ (fuel/yr)	Annual fuel savings from more efficient furnace (step 3 times step 4)

**NOTE:** To figure heat needed in therms, using existing bills:

$$\frac{\text{fuel used in typical heating season}}{\text{fuel/therm (table 6)}} = \text{therm/yr}$$

## What Form of Heating Is Best?

Decisions about the best method of heating can be complicated. The cost of all equipment needed and installation should be considered, including as necessary a chimney, vent, damper, fuel storage, supply lines, meters, and thermostats. When planning a new house, your options are open to any heat source that is locally available.

Electric heating *may* be economical for well-insulated houses, since the equipment generally costs less than other heating methods. Check into local electricity rates, including off-peak, time-of-day, space heat rate, and "interruptible" pricing that may be offered by the local electricity supplier. The interruptible pricing includes an agreement that the utility can shut off your electric heating whenever the base generating capacity cannot meet all customers' demands. Your backup system (oil, propane, or wood) must be ready to go for periods when your electric heat may be shut off during cold weather. Under this plan, the electric heat kilowatt-hours are priced at about one-half the regular electric rate.

For an existing house, switching to a different fuel can reduce your heating budget. Cost margins between fuels are becoming less, however, so a careful judgment is needed to be sure that the new equipment will pay for itself in a reasonable time. Wood heating can trim your budget if low-cost wood is available.

## Will A High-Efficiency Furnace Give Lower Heating Bills?

A house with a highly efficient furnace can have as much as 30 percent lower heating bills than one with a basic furnace, even if the heat loss of both houses is the same. In cases where past records of heating expenses are available, furnace efficiency is "built-in" to the bills. A qualified technician can test the furnace and tell you if efficiency can be improved. Call a local utility or fuel supplier for furnace checkup services. If the furnace is in good working order, the typical efficiencies and fuel equivalents of furnaces from table 6 will be fairly accurate.

## What About Solar Heating?

Solar heat through windows will be a factor if the south side of your house is unshaded in the winter. If the largest windows in your house are on the south side, solar may provide a noticeable amount of heating. Since solar heating is not available every day, the methods to estimate solar benefit are a bit complicated. If you are planning a "passive solar" home or addition, you may wish to read the "Heat Loss and Solar Gain Estimating Workbook" in Chapter 8 of the *Home Energy Handbook* at your county extension office.

For a new house in Minnesota, heavy insulation will generally payoff more than passive solar windows. A very well insulated and sealed house with a normal amount of windows is more fuel-efficient than a moderately insulated house with large windows. In an existing house, adding insulation to walls, ceilings,

and foundation or triple-glazing will payoff more than adding solar windows in most cases.

Solar collectors for room heating may be effective if reasonably priced. They can be wall-mounted, with an appearance similar to a window. Mounting can be flush to the wall or a slight tilt (60-70 degree angle of collector to level ground). If the south yard is unshaded in winter, payoff may be reasonably good. For further information, refer to Folder 651 *Solar Heating Ideas for Minnesota Homes* at your county extension office. Collectors should be added only after insulating a home to high standards.

## What About The Cost of Operating Appliances?

Although this report focuses on heating, it also is important to consider the cost of household hot water (for showers, laundry, dish-washing, etc.), appliances, lights, and possibly air conditioning. Hot water costs can be estimated using a computer program or pamphlet available at your county extension office. Average cost in 1983 is \$200 per year for a gas water heater and \$400 per year for electric water heaters. Your water use, equipment, and local energy prices can cause a wide variation from average, however. Average costs for operating appliances, lights, and air conditioning can be obtained from your power company, or county extension office.

## By Including Fuel-Efficient Features, Will My Mortgage Payment Be Higher?

Yes, in many cases, but your heating expense may be less by an equal amount. For example, triple glazing on all windows might add \$8 to the monthly payment. But if your heating expense will be nearly \$8 less per month (assuming "budget plan" billing) the option is worth serious consideration. The savings from a fuel-efficiency feature will increase, in proportion to the increase of fuel prices.

Your banker can inform you how much a given item will cost in monthly payments. It is generally advisable to add features if they save an amount close to the increase to the mortgage payment. Remember also that mortgage interest is tax-deductible, whereas fuel expense is not, so you may wish to consider the "after-deduction" net effect on the mortgage payment. For large investments, it may be advisable to do a cash-flow study when deciding on energy features (see "Economics of Saving Energy: Cash Flow, Payback, and Long-Run Result" in Chapter 6 of the *Home Energy Handbook* at your county extension office). An accountant may be able to help you with the cash-flow forms. Certain tax rules may also enter the picture.

## Heating Expense Estimating for Builders, Real Estate Agents, and Financing Institutions

Real estate agents who represent buyers can provide a valuable service in estimating the heating expense of alternate homes. A home buyer, particularly if from out-of-state, needs to compare homes and to plan for the heating expense along with mortgage payments, taxes, and homeowner's insurance.

Financing institutions are now beginning to consider energy expenses as one of the factors in qualifying for long-term mortgage financing. The "PITI" (principal, interest, taxes, and insurance) is now becoming "PITIE", with an "E" added for energy expense. By formal consideration of energy expense in the mortgage-qualifying process, home buyers will be able to afford energy efficiency features without necessarily sacrificing other features they would like to have. Lenders will be more assured of the

buyer's ability to repay the mortgage if energy expenses remain in control.

Real estate agents who represent sellers of energy-efficient new homes can provide an estimate of heating expense as a selling feature. Designers and builders can develop model homes where the energy-efficiency features are maintaining the PITIE within affordable range of today's buyers.

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\*Publications by Roger Peterson are available at your county extension office.

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Issued in furtherance of cooperative extension work in agriculture and home economics, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Norman A. Brown, Director of Agricultural Extension Service, University of Minnesota, St. Paul, Minnesota 55108. The University of Minnesota, including the Agricultural Extension Service, is committed to the policy that all persons shall have equal access to its programs, facilities, and employment without regard to race, creed, color, sex, national origin, or handicap.

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