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Agricultural Engineering

ENERGY MANAGEMENT SERIES

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ENERGY CONSERVATION IN THE RURAL HOME

How To Determine Your Insulation Needs

The cost for heating and cooling an average home for a year climbed drastically from $600 in 1974 to $1,090 in 1977. You can help control those costs in existing or new homes by adding insulation. The cost of adding insulation ranges from $300 to $1,500 depending on the size and needs of the house. However, you should be able to recover your insulation costs through fuel savings in a few years.

Several programs are available through your local power or gas distributor or the Farmers Home Administration to assist you in financing your insulation costs at comparatively low interest rates.

How Much Insulation?

The amount of insulation to use depends on the climate in the zone where you live, your specific area, and local utility costs. For example, persons living where the climate is mild year-round will not require as much insulation as those who live in areas of extreme climatic conditions.

Insulation needs are usually measured in inches of thickness. R value, however, is a better indicator of its effectiveness. R stands for Resistance and indicates the capacity of insulation to resist heat flow. The higher the R value, the better the insulation. You can find which insulation is the best buy by comparing dollar costs per R value, just as you might compare dollars per ounce of food at the grocery market.

To determine the minimum total R value recommended for insulating ceilings, walls, and floors in your area see the map (figure 3).

After determining the total R value recommended for your area, find out how much more insulation you will need to add beyond what your home already has in order to bring it up to the recommended level.

Example—let's say that a home was constructed several years ago in St. Louis, Missouri. You want to find out how much additional ceiling insulation is required for best results. You would do the following:

Step 1. Find the recommended R values for the St. Louis, Mo., area. The map in figure 1 indicates these to be R-30/19/19. This means it recommends R-30 for ceilings, R-19 for walls, and R-19 for floors. Therefore, for the ceiling, R-30 is the total insulating value to be achieved.

Step 2. Now measure the thickness and note the type of insulation already in the home. Use a ruler or yardstick. To determine the type of insulation, compare it with the description given in table 1. If you are still not sure, ask a local building supplier to identify a sample. Let's say you find that between 3-1/2" to 4" of fiberglass batt is already used for insulation.

WHERE

Figures 1 and 2 indicate where insulation or other protective measures are most needed.

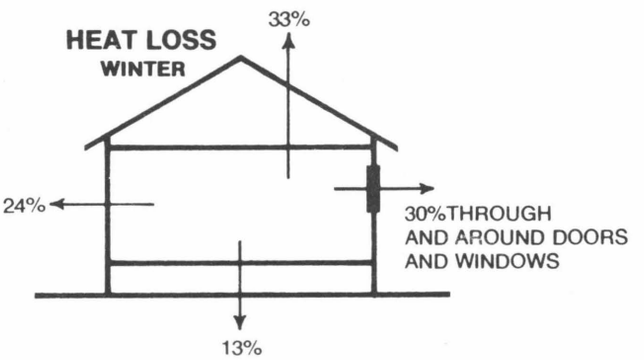


Figure 1. Points of winter heat loss.

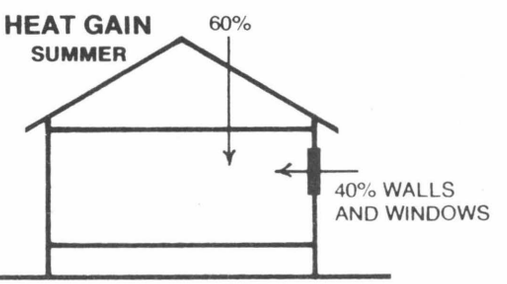


Figure 2. Points of summer heat gain.

Step 3. Determine the R value of existing insulation. From table 3, which compares total insulation thickness, types and R values, you can see that 3-1/2" to 4" of fiberglass batt has an R value of R-11.

Step 4. Now determine how much more insulation is needed by subtracting what is already there (R-11) from the recommended amount (R-30 for the ceiling).

Step 5. Finally, determine the amount of insulation you must add to add an additional R-19. Go back to table 2 and read across from R-19. You will have several choices. You could add:

(a) 6"-6 1/2" fiberglass batts or blankets
(b) 5-1/4" rock wool batts or blankets
(c) 8"-9" blown or poured in fiberglass
(d) 6"-7" blown or poured in rock wool
(e) 5" blown-or poured-in cellulose

Any one of these choices would provide the total recommended insulation required added to the existing insulation. Your final decision may be based on which material is most economical, most readily available, or other individual requirements.

Fix Loss Leaders First

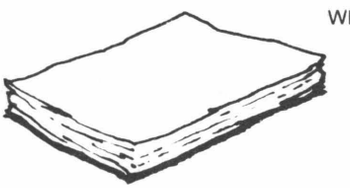
In the winter, about 24 percent of the heat loss in a home occurs through or around the doors and windows. Another 33 percent goes through the ceiling. The remaining 13 percent goes through the floor if there is a vented crawlspace or no basement. In the summer, heat enters through the ceiling, the side walls, and windows. Therefore, for maximum year-round comfort, the side walls, floors, and ceiling need to be insulated. Remember that windows and doors should be insulated in the form of weatherstripping, double glazing, or storm windows and doors. In northern climates storm windows over existing double glazing may pay off in fuel saved.

In existing homes, first caulk and weatherstrip around windows and doors to eliminate air leaks. Next, insulate in the attic. Then insulate doors and windows by adding storm sashes of glass or plastic. Finally, if your home has a crawlspace, add underfloor insulation, or insulate the walls of the crawlspace or basement.

What about adding insulation to existing exterior walls? It usually costs too much for the insulation to pay for itself within a reasonable length of time. It can, however, increase the comfort level.

TABLE 1. MAJOR TYPES OF INSULATION

BATTS — glass fiber, rock wool

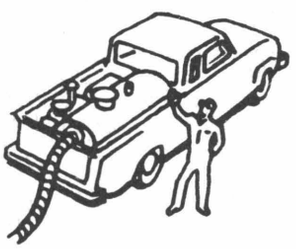


Where they're used to insulate:
unfinished attic floor
unfinished attic rafters
underside of floors
open sidewalls

BLANKETS — glass fiber, rock wool

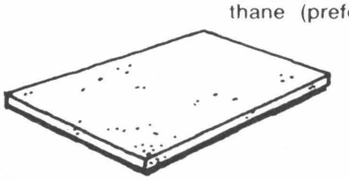
Where they're used to insulate:
unfinished attic floor
unfinished attic rafters
underside of floors
open sidewalls

FOAMED-IN-PLACE — EXPANDED URETHANE



Where it's used to insulate:
finished frame walls

RIGID BOARD — polystyrene (extruded), expanded urethane (preformed), glass fiber, polysty rene (molded beads)



Where it's used to insulate:
exterior wall sheathing
floor slab perimeter

NOTE: Care should be taken with these products to assure fire safety.

LOOSE FILL (blown-in) — glass fiber, rock wool, cellulose

Where it's used to insulate:
unfinished attic floor
finished attic floor
finished frame walls
underside of floors

LOOSE FILL (poured-in) - glass fiber, rock wool cellulose, vermiculite, perlite

Where it's used to insulate:
unfinished attic floor

TABLE 2. INSULATING VALUES OF SEVERAL INSULATING AND BUILDING MATERIALS

MATERIAL	*INSULATION VALUE* *"R" PER INCH THICKNESS*	*"R" FOR THICKNESS INDICATED*
BATT or BLANKET INSULATION		
Wood or cellulose fiber with vapor barrier and paper facing	3.20-4.00	
Glass wool or mineral wool	3.00.3.80	
LOOSE FILL INSULATION		
Mineral wool (rock, glass, or slag)	2.80-3.70	
Vermiculite (expanded) Perlite (expanded)	2.13-2.70	
Cellulose	3.50-3.70	
RIGID INSULATION		
Polystyrene foam, extruded or expanded	4.00-5.40	
Polystyrene, molded beads	3.57	
Expanded urethane, sprayed or preformed	5.80-8.00	
Polyurethane, expanded	6.25-8.00	
Glass fiber	4.00	
Insulating sheating board (1/2" reg. density)	1.32	
(25/32" reg. density)	2.06	
CONSTRUCTION MATERIALS		
Concrete, sand, and stone aggregate	0.08	
Concrete block, three hole, 8"		0.95-1.11
Concrete block, lightweight aggregate, 8"		1.72-2.18
Concrete block, lighweight aggregate, 8" (Cores filled with vermiculite)		4.00-5.03
Face brick 4"		.44
Hardwoods, maple, oak, etc.	0.91	
Softwoods, fir, pine	1.25	
3/8" Plywood		0.47
1/2" Plywood		0.62
Hardboard, 1/4" tempered		0.25
Wood siding, 1/2" thick clapboard		0.81
Asphalt shingles		.44
Aluminum or steel over flat sheathing		0.5-0.65
Gypsum of plaster board 3/8"		0.32
Gypsum or plaster board 1/2"		0.45
Plaster, brick or stucco	0.11-0.20	
Steel or aluminum	0.0007	
Glass	0.003	
DOORS		
Solid wood 1 inch	1.55	
Solid wood 2 inch		2.32
Solid wood 2 inch plus metal and glass storm door		3.45
WINDOWS (glass only)		
Single glazing		0.88
Double glazing (1/4" to 1/2" air space)		1.60-1.75
Single glazing with storm windows		1.75-1.89
AIR SPACE		
Bounded by ordinary materials (vertical space)	3/4" or more	.97
Horizontal-heat flow down	3/4" or more	1.25
Horizontal-heat flow up	3/4" or more	.85

TABLE 3. INSULATING R VALUE EQUIVALENTS

	BATTS OR Blankets		LOOSE FILL			
	glass fiber	rock wool	glass fiber	rock wool	cellulosic fiber	
R-11	3 1/2"-4"	3"	5"	4"	3"	R-11
R-19	6"-6 1/2"	5 1/4"	8"-9"	6"-7"	5"	R-19
R-22	6 1/2"	6"	10"	7"-8"	6"	R-22
R-30	9 1/2"-10 1/2"*	9"*	13"-14"	10"-11"	8"	R-30
R-38	12"-13"*	10 1/2"*	17"-18"	13"-14"	10"-11"	R-38

*Two batts or blankets required.

**Must be poured or blown to mfg. specification for correct density.

Agriculture Fact Sheet
United States Department of Agriculture

How much do you need? Well, where do you live?

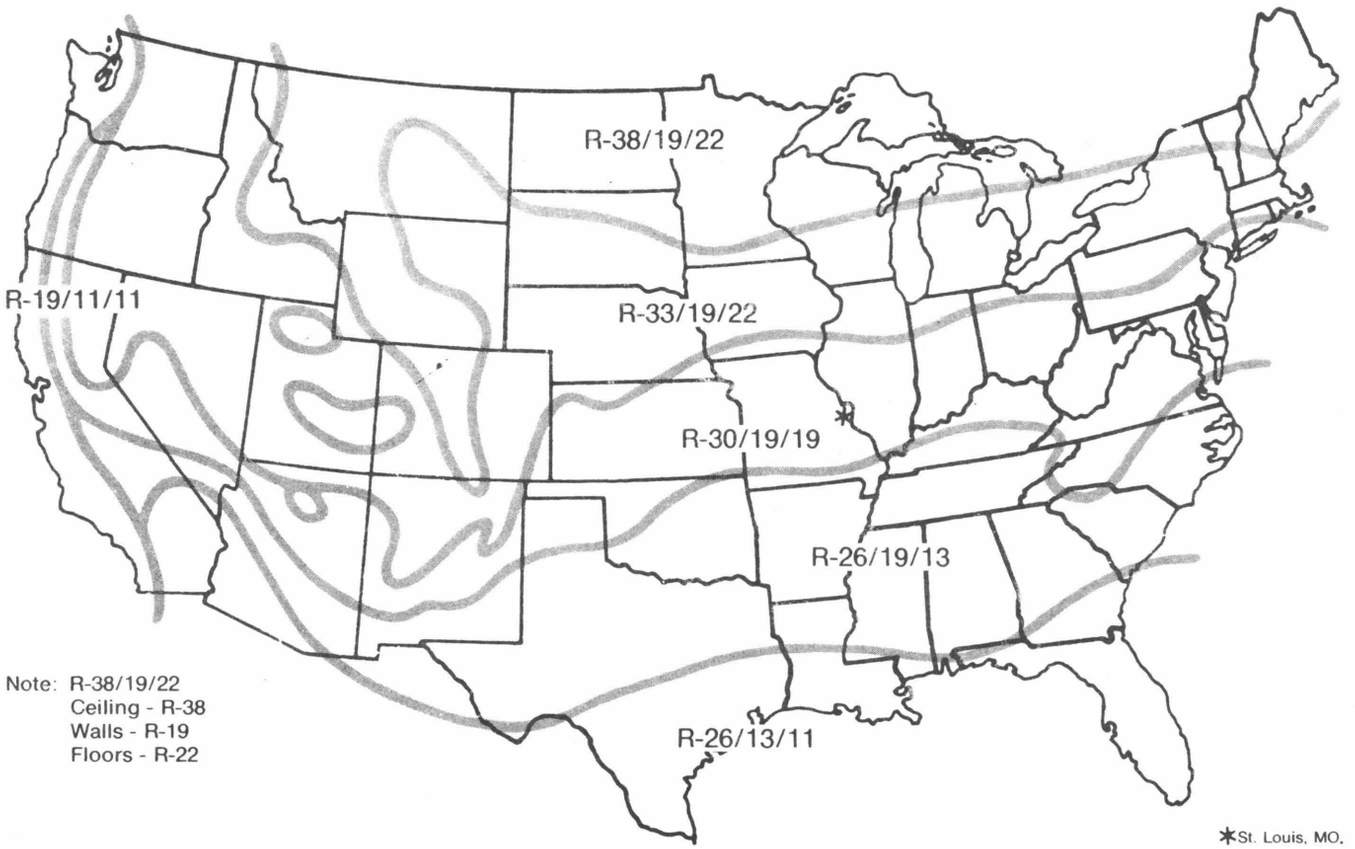


Figure 3. Map Indicating Minimum Recommended R-Values by Area and Climate

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Issued in futherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, and September 30, 1977, in cooperation with the U. S. Department of Agriculture. Mitchell R. Geasler, Interim Dean, Extension Division, Cooperative Extension Service, Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061; M. C. Harding, Sr., Administrator, 1890 Extension Program, Virginia State University, Petersburg, Virginia 23803.