The fuel saving which can be achieved by adding insulation or storm windows to a house is often quite large. It is also easily calculated. Table 1, on the following page, provides an approximation of the energy required for house heating in Kentucky for an entire year. The values listed in the table are for one square foot of outside surface area. A few measurements of your house can provide the information for you to determine the fuel you can save by adding insulation or storm windows.

To determine the approximate energy you can save, measure the outside dimensions of your house and calculate the total square footage of ceiling area. Measure the windows and calculate the total square feet of window surface. For a one-story house, calculate the linear distance around the house and multiply by 8 ft. to get the total outside wall surface area. Subtract the window area to obtain the net wall area in square feet. For a two story house multiply the distance around the house by 17 ft. to obtain the outside wall surface area. Then subtract the window area. For a house with partial basement, the table will apply only to the part above the ground line.

**Example:** Suppose your single story house is 28 x 50. The ceiling area is 28 x 50 = 1,400 sq. ft. The linear distance around the house is 50 ft. + 50 ft. + 28 ft. + 28 ft. = 156 ft. Then calculate 156 ft. x 8 ft. = 1,248 sq. ft. of outside wall area including the windows. Suppose the window area is 160 sq. ft., then 1,248 sq. ft. - 160 sq. ft. = 1,088 sq. ft. net wall area.

If you have a house which was poorly insulated with 2 inches of ceiling insulation, no insulation in the walls, and single pane windows, how much fuel could you save by adding 4 inches of ceiling insulation, 3-1/2 inches of wall insulation and storm windows?

Read the fuel used for each square foot of outside surface per year from the attached table. If propane is the fuel, read the table under propane for 2 inches of insulation; that is, 0.154 gallons per year for each square foot of ceiling area. Add 4 inches of insulation (2 + 4 = 6 inches). Read value for 6 inches of ceiling insulation = 0.064 gallons of propane per year for each square foot.

**Ceiling**

For ceiling with 2" insulation 0.154 gal/yr-ft²
For ceiling with 6" insulation -0.064 gal/yr-ft²
The savings is: 0.090 gallons per year for each square foot of ceiling area
Total ceiling saving = 0.90 x 1,400 sq. ft. = 125 gal/yr

**Windows**

Read from the table:
For single pane window 1.84 gal/yr-ft²
For double pane window 0.91 gal/yr-ft²
The savings is: 0.93 gallons per year for each square foot of window area
Total window saving = .93 x 160 = 149.8 gallons per year

(Saving due to decreased heat conduction only. Additional saving due to decreased air infiltration is difficult to estimate but depends on the fit of existing windows. If existing windows are not weather stripped, this saving could be quite large.)

**Walls**

Read from the table:
For wall with no insulation 0.374 gal/yr-ft²
For wall with 3/4" insulation -0.099 gal/yr-ft²
The savings is: 0.275 gallons per year per square foot
Total wall saving = wall area x 0.275 = 1,088 x 0.275 = 299 gallons

**Total Fuel Saved**

Ceiling savings = 126 gallons per year
Window savings = 149.8 gallons per year
Wall savings = 299 gallons per year
TOTAL SAVINGS 574.8 gallons per year

The money saved per year in heating cost is obtained by multiplying the saved fuel by the cost of fuel in your area. The improved insulation will assist in keeping your house cool in summer. If your house is air-conditioned, the insulation and storm windows will decrease operating cost of the air-conditioner.
Fuel savings for your home can be estimated in a similar manner. The savings of fuel values calculated are good estimates for an average year in Kentucky. With variable weather, some years less fuel would be saved; in others, more would be saved. Slightly more would be saved in northern Kentucky and slightly less in southern parts of the State. These calculated savings will provide data for making a decision on the amount of insulation you should add to your existing house or use in new construction.

Generally, it is much easier to add to ceiling insulation and to install storm windows than to add insulation to the wall after a house is built. Also, unless the house has a vapor barrier in the wall, it will be necessary to add a vapor barrier (4-mil polyethylene) on the inside of the insulation (warm side) when the insulation is added to the wall. In the case of blown-in insulation, the vapor barrier may be obtained by painting with two coats of aluminum paint. The paint must be added to a smooth surface on the inside of every outside wall. Regular indoor paint can be added on top of the two coats of aluminum paint for desired finish. If paneling is being added, polyethylene film placed under the panels is recommended.

The attic above an insulated ceiling should be ventilated by use of gable louvers. For hip roofs, eave and roof vents are recommended. This practice will prevent condensation of moisture which may migrate through the ceiling where the vapor barrier is not perfect.

For houses with crawl spaces, heating fuel can be saved by closing the vents to conserve the heat which is lost from furnace pipes. If there is no furnace in the crawl space, then 3-1/2 inches of insulation are needed between the floor joists. A 4 to 6 mil plastic ground cover should be used in all crawl spaces to prevent moisture evaporation and damp conditions.

### TABLE 1: APPROXIMATE ENERGY REQUIRED ANNUALLY FOR HOUSE HEATING IN KENTUCKY

(The numbers in this table give the annual fuel required for each square foot of the outside surface)

<table>
<thead>
<tr>
<th>Surface</th>
<th>Insulation</th>
<th>Electricity (KWH/yr-ft²)</th>
<th>Natural Gas (cu ft/yr-ft²)</th>
<th>Propane (gal/yr-ft²)</th>
<th>Fuel Oil #2 (gal/yr-ft²)</th>
<th>Coal (lb/yr-ft²)</th>
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</thead>
<tbody>
<tr>
<td>Ceiling*</td>
<td>None</td>
<td>10.5</td>
<td>45.0</td>
<td>0.490</td>
<td>0.369</td>
<td>5.13</td>
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<td>2&quot;</td>
<td>3.31</td>
<td>14.1</td>
<td>0.134</td>
<td>0.116</td>
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<td>2.17</td>
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<td>0.076</td>
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<td>8&quot;</td>
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<td>4.55</td>
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<td>Wall**</td>
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<td>1.84</td>
<td>1.39</td>
<td>1.93</td>
</tr>
<tr>
<td>&quot;</td>
<td>Double</td>
<td>19.6</td>
<td>83</td>
<td>0.91</td>
<td>0.69</td>
<td>0.95</td>
</tr>
</tbody>
</table>

* Ceiling of plaster or gypsum board and gable roof with wood sheathing and asphalt shingles.
** Bruck or wood siding, 1/2" fiber board or wood sheathing on wood studs and plaster or gypsum board on inside surface.
*** Storm windows which provide double windows will decrease air infiltration and result in additional fuel saving. This table is based on the conduction heat loss only.
ESTIMATING FORM

CEILING
Calculate ceiling area -- you may need to divide house into two or more rectangles.

Rectangle one: Length _____ feet x Width _____ feet = _______ square feet
Rectangle two: Length _____ feet x Width _____ feet = _______ square feet
TOTAL= _______ square feet

Existing ceiling insulation _____ inches: From Table, energy required _____ per sq. ft. per yr.
Planned ceiling insulation _____ inches: From Table, energy required _____ per sq. ft. per yr.
Subtract to obtain savings _____ per sq. ft. per yr.

Multiply total square feet______ x savings per square foot______ = _______ ceiling savings per year

OUTSIDE WALLS
Calculate total exposed wall area.

Length around house _____ feet x 8 ft. for one story = _______ square feet
or x 17 ft. for two story = _______ square feet

Calculate total window area.
Window #1: Length _____ x Width _____ = _______
Window #2: Length _____ x Width _____ = _______
Window #3: Length _____ x Width _____ = _______
Etc.

TOTAL WINDOW AREA = _______

Total Wall Area : _______ square feet
Subtract total Window Area: _______ square feet
NET WALL AREA : _______ square feet
Existing wall insulation _____ inches: From Table, energy required _____ per sq. ft. per yr.
Planned wall insulation _____ inches: From Table, energy required _____ per sq. ft. per yr.
Subtract to obtain savings _____ per sq. ft. per yr.

Multiply net wall area______ sq. ft. x savings per square foot______ = _______ wall savings per year

WINDOWS
Existing windows: From Table, energy required _____ per sq. ft. per yr.
Planned windows: From Table, energy required _____ per sq. ft. per yr.
Subtract to obtain savings _____ per sq. ft. per yr.

Multiply window area______ sq. ft; x savings per square foot______ = _______ window savings per year

TOTAL SAVINGS EACH YEAR
Ceiling savings = _______
Wall savings = _______ = _______ TOTAL SAVINGS
Window savings = _______