LIVING WITH THE ENERGY CRISIS

ISSUED BY THE
SMALL HOMES COUNCIL - BUILDING RESEARCH COUNCIL

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ENERGY COSTS IN THE FUTURE

With the expanding use of energy in the United States and the World, the price of all fuels and electricity will rise sharply. Enormous expenditures will be required to:

- explore for oil and gas at greater depths and in remote areas, and to transport them to the consumer,
- pay increased prices imposed by foreign nations, which are already supplying about 25% of our petroleum needs,
- build special, insulated "thermos-bottle" ships to transport liquefied natural gas,
- develop and operate facilities to convert oil shale, tar sands, and coal to gas and liquid fuels,
- extract sulfur from coal and sulfur dioxide from flue gas, and haul low-sulfur coal to distant power stations,
- construct new "clean" power stations.

THE BROADER CHALLENGE

Even though an individual's contribution towards energy conservation may seem small, the combined practices of millions of people can greatly reduce total energy requirements. There are many factors to consider in saving energy, some of which are:

Quality. A wide range of quality exists in appliances, such as furnaces, air conditioners, washers, driers, vacuum cleaners, etc. To save materials and energy, as well as service costs, greater emphasis on quality is needed.

Obsolescence. Throw-away items and planned obsolescence violate the principles of conservation and best use of resources.

Fire Losses. Valuable materials are wasted by fire, as well as energy expended in their production and assembly.

Vandalism. Replacement costs of broken windows, damaged furnishings, and graffiti removal in schools and public buildings are outrageous wastes of funds and resources.

Safety. Accidents on the highway, in the home, and at work waste lives and energy.

Mobile Homes. The problems of durability, heating, and cooling in mobile homes are sufficiently serious to warrant special efforts.

Multi-family Dwellings. For equal space, multi-family dwellings require less energy to heat and cool than single-family homes.

Illumination. Much commercial lighting is brighter than needed. Reducing illumination saves energy used in lighting and in removing the heat given off by the lights. Outdoor lighting should be reappraised.

Industrial Heat. Engineering improvements can reduce the tremendous heat losses from power stations, smelters, kilns, heat-treatment furnaces, and other commercial and industrial plants.

Ventilation. Public and commercial buildings can save energy by reducing ventilation during periods of low occupancy.

Transportation. Energy requirements for transportation are large. Mass transportation, smaller automobiles, lower speeds, and more efficient engines will save energy.

CHECK LIST FOR ENERGY CONSERVATION IN THE HOME

Future shortages of some fuels might require shifts in energy sources for heating. Home heating systems should be planned for possible conversion to other fuels or electricity. Energy conservation requires a constant awareness of ways in which resources can be conserved. A major breakthrough in research could occur to make an unlimited energy supply commercially feasible. Meanwhile, we need to live on the basis that our energy supply is not to be consumed as if there were no tomorrow.
ENERGY CONSERVATION—THROUGH OPERATION

WINTER

☐ 1. Windbreak planting. Winter winds increase heat loss from buildings. A tall fence or a dense growth of evergreens will reduce wind impact.

☐ 2. Fireplace damper. Close the fireplace damper when fireplace is not in use. A glass shield for the fireplace is also effective.

☐ 3. Ventilation. Exhaust fans in kitchen and bath remove heated air from the house. Less smoking and cooking odors will reduce fan use.

☐ 4. Air leakage. Enough air leakage occurs in the ordinary house without opening windows or doors. The only need to open windows in cold weather is to reduce smoke and odors.

☐ 5. Clothes drying. Any air drying of clothes reduces dryer usage. Venting of an electric dryer into the house in cold climates conserves heat, but can cause moisture and lint problems. A lint trap should be installed, and the practice discontinued if moisture problem occurs. Gas dryers must be vented outside the house.

☐ 6. Closing Rooms. Spare rooms can be closed and heat shut off. Do not close return air grilles, or more than 1/3 of all registers, in a warm-air heating system. Room temperatures should not be allowed to drop below 40°F.

☐ 7. Attached garages. Doors to the outdoors should be closed except for use. Any heated garage should be fully insulated and maintained at the lowest practical temperature.

☐ 8. Storm sash (or double glazing). Install storm sash early in the heating season or leave them up year around where convenient. Triple glazing may be justified. See page 6.

☐ 9. Outside doors. Install a storm door with a door closer. Weatherstrip both the storm door and inside door.

☐ 10. Caulking. Cracks can form around window and door frames, and where wood meets metal or masonry. Caulking cracks reduces air and moisture leakage.

SUMMER

☐ 11. Shade planting. Tall, deciduous shade trees on the East, South, and West sides will reduce solar heat gain of walls, windows, and roofs. In winter, the leafless trees permit the sun to warm the house.

☐ 12. Cooling unit. The compressor-condenser unit should be shaded by structure or plantings. A central cooling unit is usually more efficient and durable than window units of the same total capacity. Keep condenser unit open to air flow.

☐ 13. Illumination. Light levels should be adequate but not excessive. Reduced wattage may be appropriate in some areas. Turn off lights when the room is not occupied.

☐ 14. Clothes drying. All dryers should be vented to the outdoors in mild or warm weather. Damp drying, rather than over-drying, enables clothes to be ironed without sprinkling.

☐ 15. Hand tools. When possible, hand tools and appliances should be used rather than power equipment. Power operated toys for children are not appropriate for conservation training.

☐ 16. Kitchen appliances. Operation of dishwashers and ovens (including cleaning cycle) should be delayed until late evening when power loads are less and outdoors is cooler. Try to prevent oven spills and spattering to minimize the number of cleaning cycles of self-cleaning ovens.

☐ 17. Water conservation. Any saving of water in bathing, washing, cooking, or gardening saves pumping energy. Hot water should be used conservatively and at lowest practical temperature.

☐ 18. Pipe insulation. All hot water pipes in crawl spaces should be insulated to prevent heat loss from pipes and waste of water during each faucet operation. Insulated cold water pipes reduce chances of freezing in winter and warming of water in summer.
WINTER

19. Basement. When the basement is used for other than storage, the walls and windows should be insulated against heat loss. If used only for storage, the floor above should be insulated and the basement maintained at the lowest practical temperature.

20. Crawl-space vents. Vents should be closed in winter unless the heating unit is in the crawl space, or there is a moisture problem. Control of moisture in the crawl space is discussed in SHC-BRC Circular F4.4. If a vent cannot be closed, a closure panel can be inserted from the outside.

21. Mobile home foundation. Skirt boards should be installed around the foundation to reduce outdoor air flow below the structure.

22. Attic Space. Vents must be left open for outdoor air to remove water vapor from the attic. Therefore, adequate ceiling insulation is a necessity. See page 6.

23. Attic ducts. All heat ducts in the attic should be insulated (2 inches or more) since heat lost from attic ducts is totally wasted.

24. Insulated house. A well-insulated house is more comfortable at a given air temperature than a poorly insulated house. See page 6.

25. Clothes. Warmer clothing, including the covering of arms and legs, will enable a person to be comfortable at reduced air temperatures.

26. Thermostat setting. Each 1°F reduction in setting of the room thermostat can save 2 to 3% in fuel. Vacation settings of the thermostat should not be below about 50°F.

27. Night setback. A large setback of 10°F at night may save about 7% in fuel for poorly insulated houses, and much less for insulated houses.

28. Cold weather operation. Large night setbacks of the room thermostat are not recommended during extremely cold nights because recovery period may be too long.

SUMMER

29. Recycling. All materials (wood, paper, plastic, glass, brick, and metals) require energy in their production and manufacturing. Any reuse or recycling of materials will save energy spent in production or disposal.

30. Cooking. The oven is more efficient than surface units when several dishes are cooked at one time. Use lids on pans to retain heat and moisture. Outdoor cooking reduces odor and heat input to the house.

31. Storm sash. Double glazing reduces summer heat gain. Year-round use of storm sash is recommended except on windows needed for ventilation.


33. Dehumidification. Where dehumidifiers are used in basement, keep basement doors and windows closed to reduce entry of outdoor moisture.

34. Drainage. Earth fill around the house should divert water away from foundation. Rain water which collects in low areas around the foundation may cause damp basement or crawl space. This requires dehumidifier operation. Basement areaaways can be covered with glass to divert rain water.

35. Crawl space. A vapor barrier should cover the entire crawl space to prevent moisture input to the house.

36. Crawl space vents. These should be opened in summer to reduce crawl space humidity.

37. Attic. Open attic windows and vents for ventilation by outdoor air to reduce attic temperature and moisture. Temperatures can reach 140°F in a closed attic with sun exposure.

38. Thermostat setting (for homes with cooling equipment). In humid weather, even with mild outdoor temperatures, keep the house closed and operate the unit to reduce indoor moisture.
COMPETENT SERVICE MAN REQUIRED

☐ 39. Servicing and adjustments. When serviced annually, equipment will operate better and replacements will be deferred. The following adjustments by a competent service man will produce fuel savings with greater comfort.

☐ 40. Warm-air systems. Check and clean burners, oil fan and motor bearings, inspect fan belt, and replace or clean filters. Return-air grilles should be vacuumed as necessary. Adjust controls for continuous air circulation during average cold weather. Cut-in temperature of fan switch should be set at about 110°F and cut-out about 85°F. If burner is greatly oversized and off more than 10% of the time even on coldest days, a reduction in fuel input is recommended, but some reserve capacity must be available for maximum demand days.

☐ 41. Hydronic (hot-water) systems. If the boiler is used for house heating only, for maximum fuel economy the room thermostat should control burner operation directly. Circulators can be operated continuously or from room thermostat. If a boiler is used for both heating and for domestic hot water this control system cannot be applied. If burner is greatly oversized (see above) a reduction in fuel input is recommended.

ENERGY CONSERVATION—THROUGH DESIGN AND CONSTRUCTION

In winter, the dwelling must shield the occupants from outdoor cold, precipitation, and wind. In summer, it protects against outdoor heat, humidity, and sun.

Insulation and storm sash are effective in all regions, not only to save heating energy in winter, but also to save cooling energy in summer. Increased winter comfort is also provided by warmer surface temperature resulting from insulation and double glazing. See Circular F6.0, Insulation in the Home.

INSULATION FOR YOUR HOME

<table>
<thead>
<tr>
<th>Item no.</th>
<th>Item</th>
<th>Measure</th>
<th>Heat loss Present condition</th>
<th>Heat loss After improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>42</td>
<td>Ceiling</td>
<td>sq. ft.</td>
<td>Btuh</td>
<td>Btuh</td>
</tr>
<tr>
<td>43</td>
<td>Walls (net)</td>
<td>sq. ft.</td>
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<tr>
<td>44</td>
<td>Movable</td>
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</tr>
<tr>
<td>45</td>
<td>Fixed</td>
<td>sq. ft.</td>
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<td></td>
</tr>
<tr>
<td>46</td>
<td>Doors</td>
<td>(no.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>47</td>
<td>Basement</td>
<td>sq. ft.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>48</td>
<td>Crawl space</td>
<td>sq. ft.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>49</td>
<td>Slab floor</td>
<td>sq. ft.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total heat loss for 0°F outdoors</td>
<td>Btuh</td>
<td>Btuh</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Savings difference for 0°F outdoors</td>
<td>Btuh</td>
<td>Btuh</td>
<td></td>
</tr>
</tbody>
</table>

Note: Pre-calculated values are for standard frame construction, exposed to 0°F outdoor temperature, 15 mile per hour wind, and for 75°F indoor air temperature. Attic temperature is assumed as 10°F. Each 1000 Btuh of design heat loss represents 2 to 3 gallons of oil, or 3 to 4 therms of gas, or 55 to 80 kwh of electricity per year for each 1000 heating degree days in your area.

Circular C1.5, Living With the Energy Crisis
42. Ceiling insulation. The values show the heat loss of each 1000 square feet of ceiling area with an attic space above. For a 30 ft. x 50 ft. ceiling (1500 square feet) the heat loss will be 1.5 x 4000 or 6000 Btu per hour for a 4-inch thickness of mineral wool insulation (or equivalent) in the joist spaces. The same ceiling with a 6-inch thick insulation would lose 1.5 x 2900 or 4350 Btu per hour. When ceiling insulation exceeds 6 inches the heat loss through the ceiling becomes almost negligible. As a matter of comparison, four occupants give off about 1800 Btu per hour.

The temperatures given at the right are surface temperatures of the ceiling facing the occupants. A person loses less heat to warmer surfaces (such as ceilings, walls, windows, and floors) and is more comfortable as surface temperatures approach room temperatures.

43. Wall insulation. For typical frame construction, each 1000 square feet of wall surface (excluding windows and doors) will show the heat loss indicated. For example a house having 1300 square feet of net wall surface will lose 1.3 x 4725 or 6140 Btuh with 3-1/2 inch insulation in the wall. The 5-1/2-inch thickness of insulation is based on the use of 2 x 6 studs, 24 inches on center. This construction requires deep window and door frames, available at additional cost. With thicker insulation, the wall surface temperature approaches the room-air temperature of 75 degrees.

44. Windows, movable. The average window unit is about 15 square feet. The heat loss through the window combines the loss through the glass with the loss of heated air leaking through cracks of the window unit. For example, if a given house has 10 windows of average size, without storm sash, the heat loss may be as much as 10 x 1580 or 15,800 Btuh. While surface temperatures of well-insulated ceilings and walls approach room-air temperatures, the surface temperature of a window is much below room-air temperature, even with triple glazing. The heat radiation from the body to the glass surfaces can cause discomfort, especially with single glazing. In addition, with single glass, moisture often condenses as water, frost, or ice. Triple glazing is not common, but is commercially available.

45. Windows, fixed. Tightly sealed fixed windows will lose heat through the glass, but have no air leakage. The values shown are for each 15 square feet of window area. For example, a picture window that is 4 ft. high and 6 ft. wide (24 square feet) will have a heat loss of 24/15 or 1.6 times the number shown.

46. Doors, outside. Doors have considerable air leakage around the frame even when closed, and this has been included in these calculations. A common outside door is 3 ft. x 6 ft. 8 in. (20 square feet) and 1-3/4 in. thick.
47. Basement foundation. A warm basement space provides for warmer floors in the rooms overhead and for improved comfort conditions. Heat lost from the basement is as expensive as heat lost from an upstairs room. To reduce heat loss from the basement, install storm windows, caulk the sill joint, insulate the band joist with batt insulation, and insulate the basement walls. Wall areas which are more than two feet below ground level may be left uninsulated. For example, an uninsulated basement of 1500 square feet (30' x 50') will lose 1.5 x 14,350 or 21,520 Btu per hour when the outdoor temperature is 0°F. When properly insulated, the same basement will lose only 1.5 x 7600 or 11,400 Btu per hour.

48. Crawl-space foundation. A warm crawl space reduces heat loss through the floor above. In the winter, vents in the crawl space should be closed, and heat loss reduced as much as possible. (If moisture and dampness problems arise, the source of moisture must be corrected first). The indicated crawl-space temperatures are based on a tight space, and for outdoor air temperature of 0°F. For example, a 30' x 24' floor over an uninsulated crawl space will show a heat loss of 0.72 x 6030 or 4340 Btu per hour. By insulating the crawl space as indicated, the loss can be reduced approximately one-half.

49. Slab floor foundation. The heat loss from a slab floor occurs mainly at the edge of the floor exposed to outdoors. For example, a 30' x 50' slab floor, uninsulated, will show a floor loss of 1.5 x 7800 or 11,700 Btu per hour, when heating ducts are not embedded in the floor.

In an existing house, edge insulation can be installed vertically on the outside of the foundation and up to the lower edge of the siding. Polystyrene or impregnated fiberglass boards will best resist moisture and temperature change.

Circular C1.5, Living With the Energy Crisis
Page 7
WINTER

☐ 50. Building shape. For a given floor area, a square floor plan provides the least wall exposure through which heat loss occurs.

☐ 51. Size. A larger building usually has less heat loss per square foot of floor area than a small one.

☐ 52. Roof overhang. Any roof overhang protects the wall surface against weather.

☐ 53. South wall. A properly designed overhang on the south wall protects the wall from summer sun and exposes the wall to winter sun.

☐ 54. Vestibule. A vestibule with an inner door reduces the flow of outdoor air into living quarters, especially in homes with heavy traffic.

☐ 55. Window areas. For a given area, windows and doors lose more heat than do walls. For example, a double-glazed window will lose about seven times as much heat as a well-insulated wall of the same area.

☐ 56. Earth protection. Caves served early man not only as protection against animals, but also as a constant temperature haven. Rooms at basement level or partly underground have additional protection against weather.

☐ 57. Inside chimney. A chimney inside the house gives off heat to the house. A chimney on the outside wall of the house loses most of its heat to the outdoors, and, incidentally, provides a poorer draft.

☐ 58. Window draperies. Closing a tightly woven drapery will trap cool air at the window.

☐ 59. Room over garage. The floor of a room located over a garage should have ample insulation (4 to 6 inches deep) between the floor joists, and fire protection (such as 5/8-inch UL listed gypsum wallboard) for the garage ceiling.

☐ 60. Sill plate sealer. A compressible filler placed on top of the foundation before the sill plate is fastened will retard air infiltration at this junction. On older houses, air leaks at the sill should be caulked.

SUMMER

☐ 61. Building orientation. For a given building design, an East-West orientation will result in smaller heat gain than a North-South orientation.

☐ 62. Roof surface. A light-colored roof surface reflects sun radiation more than a dark-colored roof. (This is not important if the attic is properly ventilated). A flat-deck roof can be sprayed with reflective paint or covered with white stone chips.

☐ 63. Attic ventilation. The roof surface serves as an effective umbrella for the house, especially if an attic space is provided. Ventilation of the attic space removes heated air. See SHC-BRC Circular F6.2, Moisture Condensation.

☐ 64. Extended porch. A wide porch serves as outdoor living space, and also shades the walls and windows against solar heat gain.

☐ 65. Glass on East and West walls. Solar heat gain through unshaded East and West windows is twice as great as through equal-sized windows on the South wall.

☐ 66. Shading effectiveness. Window shading equipment reduces solar heat gain. Each shading method below can be compared on the scale. Priority of window treatment is east, west, then south.

HEAT GAIN PER WEST WINDOW (15 sq. ft.)

<table>
<thead>
<tr>
<th>B.T.U./HOUR</th>
<th>B.t.u./hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000</td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td></td>
</tr>
<tr>
<td>3000</td>
<td></td>
</tr>
</tbody>
</table>

- Single glass, unshaded
- Double glass, unshaded
- Triple glass, unshaded
- Single, heat absorbing
- Single, full length drapery
- Single, venetian blinds
- Single, roller shades
- Single, louvered screens
- Tree shade
- External shutter, closed

☐ 67. Year-round double glass. Consider use of double or even triple layers of glass on all windows.

☐ 68. Operable shutters. In older times, window shutters served a useful function as sun shades for windows.