

UCSU 20/6.22/9.935
c.1

~~UCSU 20/6.22/9.935~~
c.1

Energy conservation for the home— siting and house design

Betty Jo White 1/

no. 9.935

in **RECEIVED**
Action

Adult Education Resource Center

6647 S. Santa Fe Drive
Englewood, Colorado 80110

COLORADO STATE PUBLICATIONS LIBRARY local
UCSU 20/6.22/9.935
White, Betty Jo/ Energy conservation for
3 1799 00011 7515

Quick Facts

- Siting and house design can contribute to an energy efficient structure.
- Natural features of the site should be used to best advantage.
- The house should be oriented with the sun and wind in mind.
- Landscaping should protect the house as well as beautify.
- House shapes and types that are practical to heat and cool should be selected.
- Floor plans can be designed to conserve energy.
- Large glass expanses should be limited.

Many features of the home can make a difference in both winter and summer comfort, as well as in energy savings for heating, cooling and lighting. The following checklist for siting and house design can help consumers learn about energy efficient structures and evaluate a home.

Siting

When planning the siting and orientation for a home, the local zoning ordinances and subdivision regulations should be checked. In many communities, the setback requirements may be inflexible so that good siting is difficult. However, in open, rural areas, proper siting for energy conservation may be possible and is particularly important.

Natural features of the site should be used to best advantage.

Houses can be tucked into valleys instead of built on hilltops, put on protected sides of hills, built on the south or southwest (sunny) sides of slopes, or built partly into hills for natural insulation.

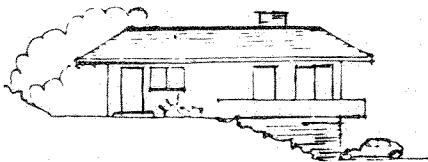


Figure 1: Houses can be built into hillsides for natural insulation.

Rooms at basement level or partly underground have additional earth protection against weather. The relatively constant year-round ground temperature reduces winter heat loss through below-grade walls and provides a cooling effect during summer. Excessively exposed foundation walls have high winter heat loss through the concrete. The ground surface around the house should be adequately sloped so that surface water will drain away from the dwelling.

Avoid clearing vegetation and protruding rock formations that can act as protection. Natural streams should not be filled in or covered during construction: a

site with running water will be cooler in the summer than a dry one.

Orient the house with wind and sun in mind.

If there is a choice, it is thermally advantageous to have the main roof of the house about parallel to the east/west axis allowing more south-facing windows for better summer cooling and to provide a more desirable location for a solar heat collector in the future.

In cold weather areas, winter winds generally come from the north, hence walls with the best insulation and the least glass should face that direction. If design permits, the shortest wall should face north; however, with a mobile home, the short side should face into the prevailing wind, from whatever direction it comes.

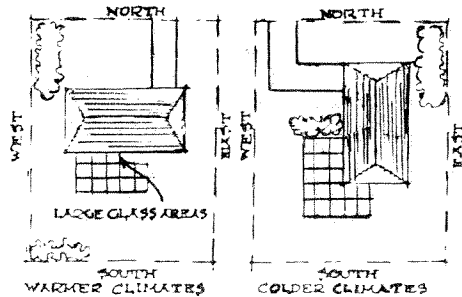


Figure 2: Houses should be oriented with climate in mind.

If extensive glass areas are used, they should face south so that the low winter sun will shine into them during much of the winter daylight hours and be shaded by an overhang from warm summer sun. This is equally important in warmer climates where cooling is the primary concern. With properly designed (wide) roof overhangs or awnings, little or no sun will come in during the summer. By contrast, east or west windows pick up heat almost half the day, putting an extra load on the cooling system.

Garages/carports/porches can be placed to reduce energy load.

In cold climates, locate attached garages on the north, northeast or northwest exposures. Keep the doors of any attached garage closed when not in use. In hot climates, the attached garages or carports should be on the east or west walls of the dwelling to shade east or west glass, thereby reducing heat gain. Attached porches also shade walls and windows from direct sun rays.

Landscaping should protect as well as beautify.

A row of evergreens or a slatted fence located a short distance to the north or northwest of a house can be an effective barrier to cold winter winds which increase heat loss from buildings. Shrubs or berms that surround an exposed doorway have the same effect.

Tall, deciduous shade trees on the south, west or east sides will reduce solar heat gain of walls, windows and roofs in the summer, yet in winter when the leaves have

1/Betty Jo White, CSU assistant professor, housing (12/1/76)

fallen, will not block the roof and walls from the warming rays of the sun. Vines and low shrubbery on the south and west sides of the house also provide protection. Cooling units (compressor-condenser units) also should be shaded by structures or plantings.

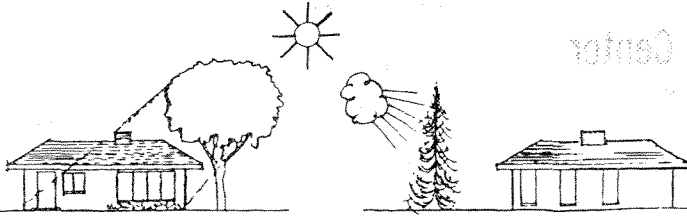


Figure 3: Landscaping should protect as well as beautify.

House Design

When designing or planning to have a new home built, a check with local authorities on building codes should be made to see if the design can be built in the area.

— *Local climate conditions must be considered.*

A house that is functional and practical in southern California might look just as good in Colorado, but a sprawling layout and large glass expanses could make it very expensive to heat and cool.

— *Choose house shapes and types that are practical to heat and cool.*

The key is the ratio of wall area to floor area: reducing the ratio of exterior wall area to floor area will reduce energy demand. A round house is the most efficient in this regard, but this shape is difficult to build and perhaps to live in. A square house is the next best, and after it, the simple rectangular shape.

Avoiding the use of L-, H-, U- and T-shaped dwellings conserves energy. One can see why mobile homes present a special heating and cooling challenge since they provide more outside wall surface for heat loss.

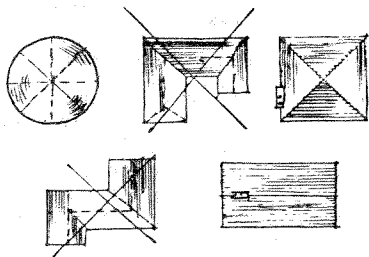


Figure 4: Some house shapes are more practical to heat and cool.

Wherever practical and especially in colder areas, two-story houses should be built. Less heat is lost through the roof in a two-story unit since there is a lower proportion of roof area to floor area.

Multifamily construction reduces heat loss and heat gain. Townhouses, semi-detached dwellings, duplexes, triplexes and apartments in multifamily structures all have less heat loss per square foot of floor area than single-family detached dwellings, other things being equal, since they each share one or more common walls with another dwelling unit.

— *Floor plans can be designed to conserve energy.*

Entry halls for front and back doors can be closed off to form "vestibules," reducing the flow of cold air into the

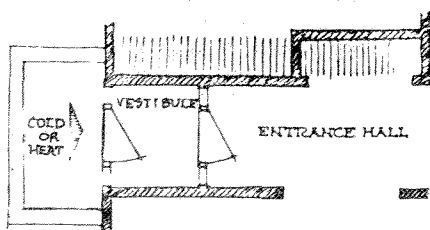


Figure 5: Entry halls can reduce the flow of cold air into the house.

house and preventing the warm air from escaping, especially in homes with heavy traffic. Additionally, a family trained to open and close doors quickly and no more than necessary can reduce its fuel costs. An aid for an "untrainable family" is the automatic door closer.

Grouping common living space in one part of a house and the sleeping quarters in another facilitates zoned heating and cooling and also allows one section to be easily closed off when not in use.

If the main living area has as few partitions as possible, heat can be distributed best. Family rooms, living rooms, kitchens and dining rooms facing south and west will be warmed by the afternoon sun. Bedrooms can be oriented to the morning sun, thus easily cooled down for comfortable sleeping.

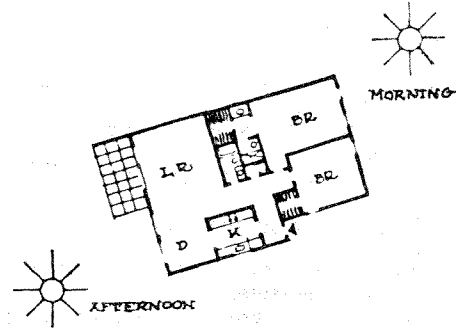


Figure 6: A good floor plan can help conserve energy.

— *Large glass expanses should be limited.*

Glass is the single largest source of heat loss from a structure, even with storm glass or double glazing. The window area of the typical dwelling is probably equal to about 15 per cent of the floor area. This can be reduced under most local building codes to 10 per cent.

When reducing window area, it is preferable to do so by raising the sill height. This has two advantages. First, it keeps the upper portion of the window which provides better natural illumination. Second, it helps to reduce heat gain in the summer because the upper portion of the window is more easily shaded by the overhang.

Windows should not be positioned only with a view in mind; wind and sun direction also must be considered. East and west windows should be kept to a minimum unless they can be shaded by trees, tall shrubs, fences, awnings or tinted glass. Panoramic windows may not be advisable on the east or west sides of a house even if the most scenic view is there. As noted previously, large glass expanses should almost always be located on the more temperate southern side.

Shading southern exposure glass with a retractable overhang, awning or operable shutters is an important method of reducing heat gain in the summer without impairing heat gain in the winter, while providing wind protection at all times. If half of the 10-per-cent glass area is in operable windows and the other half in fixed-glass (inoperable, insulated, double glass windows), the result will be the benefits of both ventilation (operable) and less heat loss (inoperable). Operable windows should be placed so that cool air can travel through the house in summer and escape at the high point of interior space, such as an upstairs hallway window.

— *Roofs should be designed with climate in mind.*

Even with a well-insulated ceiling, the color of the roof makes a difference in heat gain. Light-colored roofing materials reflect rather than absorb sunlight, thus considerably reduce the load on cooling equipment in warm climates; however, a dark-colored roof may be better in cold areas.

Cathedral or vaulted ceilings are dramatic but can create serious problems in both heating and cooling. Since warm air rises, heating high-ceiling rooms is especially difficult. Energy may be wasted conditioning air in the high unused spaces except with forced air heat where return air grilles are placed high in that area.

For more information on energy conservation for the home, see Service in Action sheet 9.936.