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WASHINGTON STATE ENERGY OFFICE

Washington Energy Extension Service

Home Conservation

Wise Use of Resources Through Education

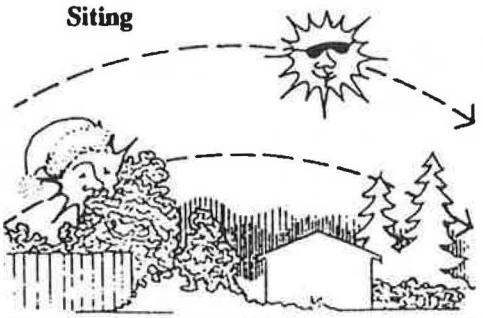
Tips for New Energy-Efficient Homes

In recent years, demand for energy-efficient homes has increased. As more energy-efficient homes are built and new designs tested, the components which make up this kind of construction are better understood.

This guide gives direction to a new home buyer as to what to look for, or design for, when considering an energy-efficient home. Current building practices, per standard codes, do *not* require some of the recommendations listed below. However, model conservation standards for energy-efficient construction do include most of these ideas.

Orientation and Siting

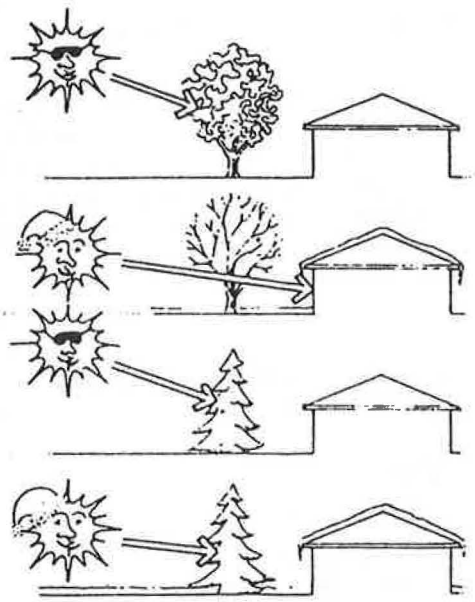
- The house should have southern exposure to take advantage of the winter sun.
- Position house with protection from the winter wind – near a hill or other building.
- Provide protection with trees and shrubs – deciduous trees give shade in the summer, but allow some sun in during winter months.
- The lot should slope away from the house site to allow for good drainage.
- Is the layout of the house compatible with the lot size? A narrow lot may not allow solar access.
- Consider local climatic conditions such as wind direction, amount of rainfall, and temperature variations.



During the winter months the sun is low in the sky.

Layout of Floor Space

- Shape of the house: Increased wall area – as in T shaped, L shaped or U shaped houses – usually means increased heat loss.
- Layout of the rooms: Are the areas of major activity on the south side? Baths, utilities and hallways are better placed on the north side.
- Consider protected entryways or vestibules, to help prevent cold air from entering.
- Try to limit the number of interior partitions, unless the home is zone heated.
- Certain areas, like bedrooms, should have the ability to be closed off during the day to reduce heat and air conditioning loads.



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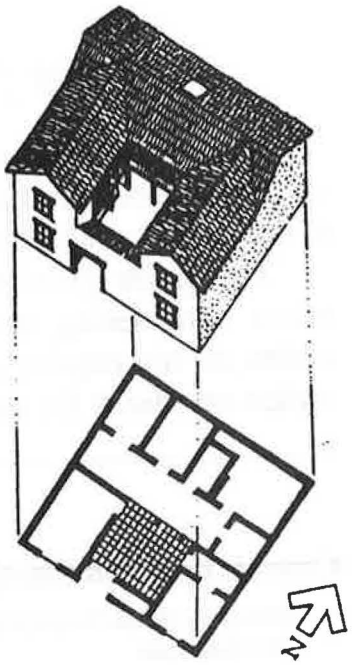
- Try to limit the amount of window area on the east and west sides, or consider shading devices to protect from morning and afternoon sun. Limit window area on the north side to reduce heat loss.
- Create the fewest number of exterior wall penetrations, such as electrical and plumbing, as possible. Fewer holes means more insulation and less air infiltration. Likewise, medicine cabinets should be placed on interior walls.
- Locate a fireplace chimney on an inside, rather than outside, wall for maximum heat gain.
- Reduce long plumbing runs (and associated heat loss) by locating the water heater as close to fixtures as possible.
- Install weather-stripped doors on basement or second story stair wells. This prevents heat loss between floors.
- All combustion appliances (fireplaces, oil and gas furnaces, gas water heater and dryer) should have outside source of air. Six square inches (minimum) per appliance is suggested.
- Operable windows allow cool air to travel through interior rooms in summer (or those marginal months in a house where an air conditioner is installed). Attic ventilators can also be useful if cool air drawn from a shady side is exhausted at the highest point.

Design and Siting



Building Components

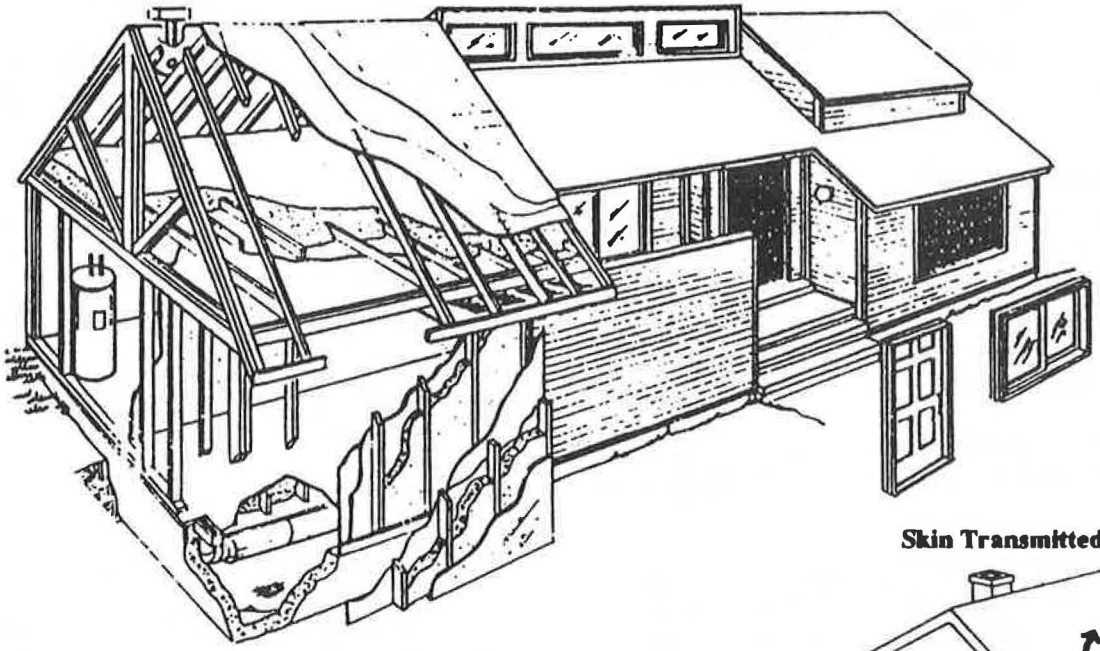
- Moisture barrier of 6 mil polyethylene laid over ground in crawlspace. Lapped in middle and sealed at edges.
- Ventilation in crawlspace recommended at 1 square foot for every 150 square feet under house. Vents should be installed on opposite ends to enhance cross-flow.
- A sill sealer should be on top of foundation to reduce air infiltration.
- Insulation values should be as follows in Table 1.
- Insulation levels at attic doors or ceiling openings should be equivalent to that placed in the ceiling. An attic hatch outside the heated space is ideal.
- Attics should have sufficient ventilation, on the order of 1 square foot for every 300 square feet of attic or floor area.
- All doors and windows should be weatherstripped around jambs and caulked to prevent excessive heat loss. Double or triple pane windows which have thermally improved frames are suggested.
- Exterior doors should be of the insulated, foam core type.
- Exterior walls are usually built of 2 x 4 (with foam), 2 x 6, or 2 x 8 framing to allow for increased insulation. Likewise, built-up trusses and headers (over doors and windows) are constructed to handle higher insulation levels.

Table 1. R-Values for Insulation

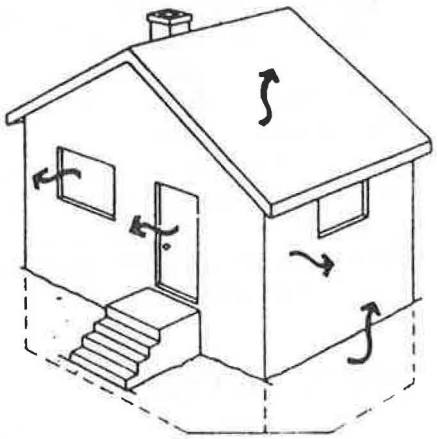
Region	Duct	Walls	Floors	Ceilings	Slab-On-Grade	Pipe
Western Washington	11	19	30	38	10	3
Eastern Washington (Average Winter Conditions)	11	24	30	38	10	3
Eastern Washington (Extreme Winter Conditions)	11	27	30	49	10	3

Source: *Northwest Power Planning Council Bulletin*, Portland, OR, March 27, 1987, Appendix 1-B.
Note: It should be understood that the vapor barrier, when attached to insulation, should face the warm or conditioned side when installed.

Building Components of Energy-Efficient House

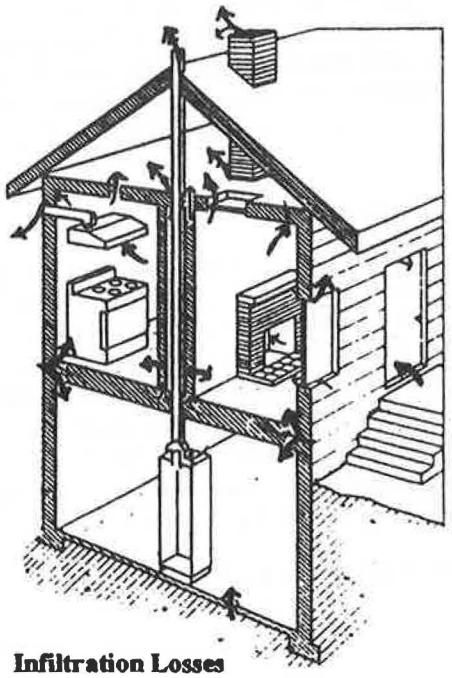


Skin Transmitted Losses



Cooling and Heating Considerations

- The heating system can be of three types: central, zone, or a combination of the two. It should be efficient. Examples of efficient central heating systems are heat pumps and furnaces with AFUE (Annual Fuel Utilization Efficiency) ratings above 75 percent.
- Zone heating systems utilize heaters for individual rooms or zones of the home. This allows for control of heat to areas of activity only.
- Central heating systems should be placed in a location that reduces distance of duct runs.
- Allow for easy access to filters for cleaning and other maintenance.
- Include a two speed fan in a forced air system which produces a low volume when heater is not running.
- A timer switch, which controls ventilator operation, can be installed to reduce the amount of heated air exhausted.
- Locate thermostats away from exterior doors or windows to get more accurate temperature sensing.
- Seal and wrap heating ducts (see insulation values in Table 1) in unheated areas.
- Allow for a return air duct (floor to ceiling) in high-ceiling areas where heat may gather.



Infiltration Losses

Lighting

- Lighting levels should be consistent with area usage. Kitchen and work areas should offer specific task lighting as needed.
- Use fluorescent fixtures in background lighting and extended soffits (kitchen, laundry room, and bathroom) when possible. Fluorescent lighting gives nearly four times the light per watt as incandescent lighting.
- Allow for easy cleaning of fixtures to increase overall light production.
- Paint interior walls white (or similar color) for maximum reflection of all natural and artificial light. Also, carpeting or other floor covering should maintain a light color.

- Install metal halide or high pressure sodium lamps for exterior applications, such as floodlighting, where possible.
- Exterior walls and roofs of a light color stay cooler and reflect the sun in areas of intense solar radiation.

Mechanical Ventilation

In energy-efficient homes, ventilation is a major consideration. As houses become tighter, the need for controlled mechanical ventilation is greater. This method of control has two purposes:

- To bring fresh air into different areas of the house, particularly the bedrooms, living room, and dining room.
- To extract the stale, polluted air from areas such as the kitchen, bathrooms, laundry and storage rooms.

There are two effective ways to meet these objectives. One is the air to air heat exchanger and the other is the whole house ventilator. Commonly referred to as a heat recovery ventilator, the air to air heat exchanger introduces outside air and recovers heat (normally lost) from stale, exhausted air.

The whole-house ventilator allows for incoming air at specific locations in a controlled amount. Stale air is exhausted at a regular rate, insuring a well ventilated interior environment. However, there is no heat recovery available with this system.

Indoor Air Quality

Air pollutants such as radon, formaldehyde, particulates, sulfur dioxide, carbon monoxide, and carbon dioxide can build up in the home if ventilation or source reduction is not provided. Further information on reducing indoor air pollution can be obtained in the WEES publication, "Indoor Air Quality."

Summary

In addition to energy savings, energy-efficient homes offer increased comfort, a healthier living environment, and added resale value.

Each phase of construction, from siting and design, to building techniques and heating and ventilating systems require careful attention to detail. Well installed insulation, windows, doors and weatherstripping are paramount in maintaining comfort and quality in an energy-efficient home.

Written by Tim Weaver

Suggested Reading

Energy-Efficient Home Construction Techniques Manual, Washington State Energy Office, March 1984.

Fundamentals of Commercial and Industrial Lighting, The Electrification Council, 5th Edition, Washington, D.C., 1983

How to Write a Homeowner's Guide to Solar Energy for Your Community, Western Sun, 1981.

Selecting a Designer or Architect for Your Energy-Efficient Home, Oregon State University Extension Service, FS 295, January 1983.

Tips for Energy Savers, U.S. Department of Energy, DOE/CS 0020, March 1978.

Washington State Energy Code, Washington Association of Building Officials, Second Edition, Olympia, WA, November 1986.

Suggested WEES Publications

Indoor Air Quality (WAOENG-8920).
The Energy-Efficient House (FS-1003).

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