

ZONE HEATING

FACTSHEET

WASHINGTON ENERGY EXTENSION SERVICE

May 1988

INTRODUCTION

Zone heating systems utilize individual heaters and thermostats in each room or zone, providing independent control of temperature in each area. A zone is a part of the house separated from other parts by walls and a doorway.

The ability to lower temperatures in zones, and the elimination of ducts and duct leakage can significantly reduce operating costs compared to central forced air systems. Forced air systems with closable registers allow some independent temperature control, but closing registers may actually increase duct losses and lower overall system efficiency.

Zone systems can be sized precisely to meet the modest heating needs of very well insulated homes. Zone heaters can be used in any home, but homes with more confinable spaces have greater potential for energy savings than those with open floor plans and vaulted ceilings.

This factsheet will examine the pros and cons of zone heating, types of systems, installation and sizing considerations, and thermostats. The discussion relates primarily to electric zone heaters as these are by far the most common, but gas and hydronic units are mentioned where appropriate.

Wall / Fan Convective Heaters

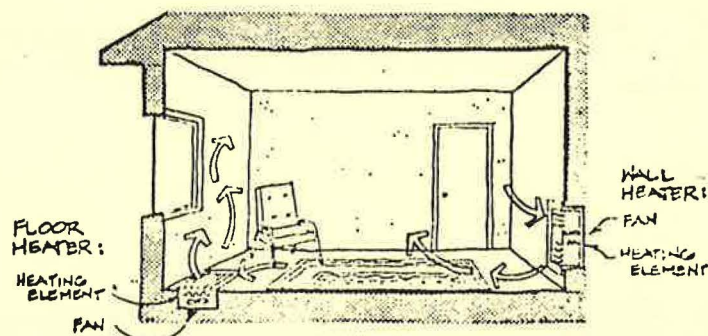


Figure 1.

WISE USE OF RESOURCES THROUGH EDUCATION



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BENEFITS OF ZONE HEAT

- Low Initial Cost - Lower equipment, installation and design costs than central systems. No ducts or chimneys required.
- Low Operating Cost - Reducing heat supply to unoccupied areas saves energy, and there is no heat loss from ducts. Zone systems cost less to operate than electric furnaces and can compare to gas furnaces and heat pumps, depending on utility rates.
- Comfort - People often prefer cool bedrooms, warm living rooms, and warmer bathrooms. Zone heat allows this flexibility.
- Saves Space - No space for furnace room or ducts is required.
- Expandable and Adaptable - Modular equipment is easy to add on to. The variety of system types allow freedom of interior design.
- Integrated with Other Heat Sources - Functions well as auxiliary or primary heat in conjunction with wood, solar and other heat sources.
- Low Maintenance - Simple construction results in long life and low maintenance costs. If one unit fails, others continue to operate.

POTENTIAL DRAWBACKS

- Air Conditioning - absence of a ducted distribution system may require a room by room (zone) solution to air cooling, filtration and humidification needs. This is potentially more expensive than with a central system.
- Air Circulation - Ceiling fans may be required to reduce stagnant air and heat stratification, especially in homes with vaulted ceilings.
- Central Control - Whole house night setback requires lowering of each individual thermostat unless central thermostat control is provided.

TYPES OF ZONE HEATERS

Baseboards

The most commonly used zone heater is the electric baseboard heater. Electric baseboards have the lowest first cost for equipment and installation, and a long, maintenance-free lifetime. Rising warm air heats the room convectively. New lower temperature "low density" units have solved problems of

wall streaking (from burned dust) and popping noises when first turned on. Install baseboards on exterior walls for proper heat distribution with at least 6 inches clearance from furniture and not behind floor length curtains. They are not recommended where free wall space is of prime importance.

Fan-forced Wall Heaters

Electric wall fan units cost slightly more than baseboards, but provide better air circulation and demand less floor space. They are best installed low on interior walls for proper air circulation. New designs are small, quiet, and may look similar to a central forced-air system register. They are also available in models to fit in the kickspace beneath cabinets or other unobtrusive locations when wall space is a premium. To avoid floor discoloration, kickspace units should not exceed 1500 watts, and should have fins to direct heated air upward.

Wall gas heaters are available, and should be of the "sealed combustion" type where both combustion and exhaust air flows are connected to the outside. Unvented gas or kerosene room heaters are not recommended due to concerns for indoor air quality and fire safety.

Wall mounted hydronic fan-coil units act like a radiator, extracting heat from water and delivering warm air to the room. heated water can be provided by a boiler, conventional water heater, coils in a woodstove, solar or other sources. These are zonable to the extent that valves are provided to control water supply to the fan-coil.

Radiant Cove Heater

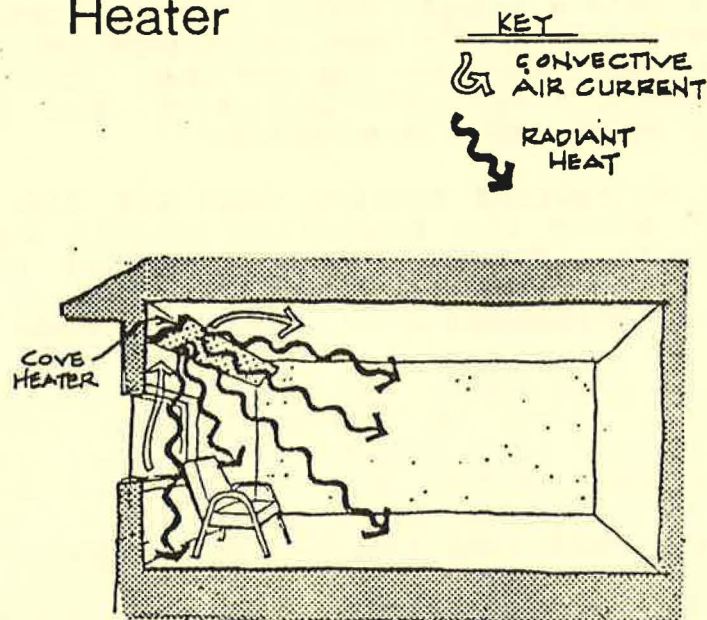


Figure 2.

Radiant Heat

Like the sun's rays, radiant heat warms directly and does not depend on heated air movement. Radiant systems are advertised as more efficient for this reason but independent studies suggest operating costs similar to other zone systems. Most radiant heaters allow complete freedom of floor plan and furniture placement. A variety of systems are available:

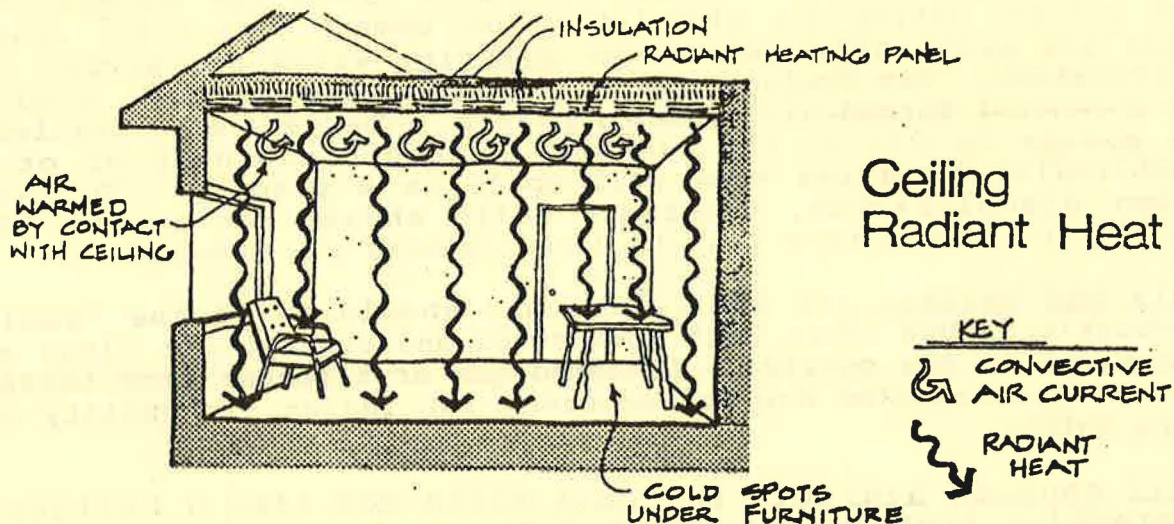


Figure 3.

Radiant Ceiling. First appearing in the 1930's radiant ceiling systems today are much improved. The wire embedded in plaster has been replaced by easy to install fiberglass mat that is stapled to ceiling joists before sheetrocking. Hot spots have been eliminated. Parallel wiring prevents loss of heat to the whole room should a failure occur, but homeowners must still follow dealer advice carefully when installing ceiling hangers or other fasteners that penetrate the ceiling. Initial costs are higher than baseboard or wall-fan units, but the system is invisible and no maintenance is required.

Two variations on radiant ceiling heat are the long, narrow "Cove Heaters" which are installed on the wall near the ceiling, and "Radiant Ceiling Panels". Though visible in the room, these units are easy to install or replace, making them more practical for installation in an existing home.

Radiant Floor. Hot water is distributed through pipes beneath a wooden floor or embedded in a concrete slab. Water can be heated with electricity, oil, gas, or solar collectors. As with ceiling heat, there are no limitations on floor plan or furniture placement. Floors stay warm and comfortable, but thick rugs impede heat transfer and are not recommended. Radiant floor systems can be quite expensive, complex and difficult to repair. An experienced designer and installer are essential.

Floor Radiant Heat

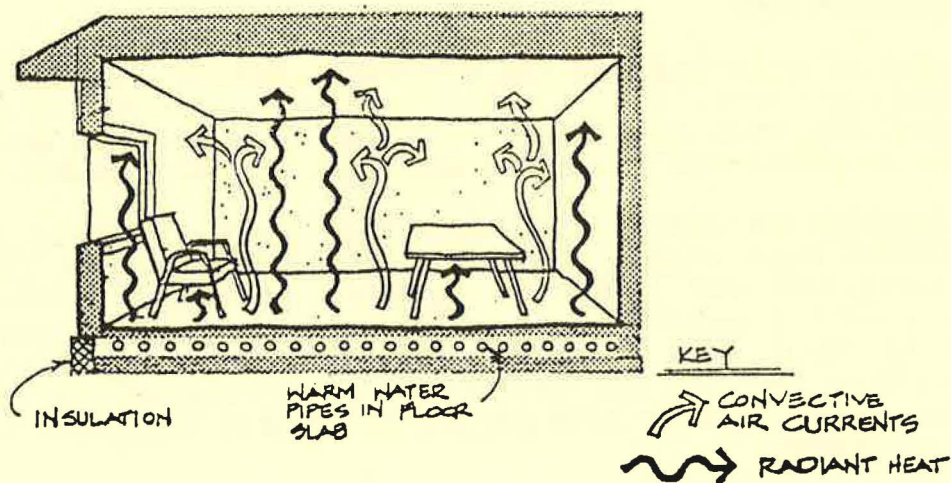


Figure 4.

Zonable Heat Pump

Individual room size heat pumps can provide a zone capability. A few companies are making "split system multi-zone" heat pump with central compressor unit, and several remote fan coils inside the home. Initial cost and maintenance are much higher than standard electric zone heaters but operating costs can be reduced by half. As with other heat pumps, air conditioning (cooling) is provided. Zonable heat pumps make the most sense in large rooms or zones, used in conjunction with standard electric zone heaters in smaller areas.

Portable Heaters

This is a large and diverse class of zone heaters used to complement other heating systems. Portable heaters come in every imaginable design. Both electric and kerosene portable heaters are available, though unvented kerosene heaters are not recommended for home heating due to carbon monoxide and sulfur dioxide emissions.

The advantages of portable heaters, especially the radiant (glowing red coil or quartz tube) and fan-forced models, are low cost and the ability to put heat exactly where needed. Room temperature can be kept low for maximum energy savings, with a portable heater located near occupants.

Note: Before using plug-in portable heaters or any electric device that has a large power draw, an electrician should verify

the adequacy of the wiring. This is especially important in older homes. Also, plug-in heaters with typical gauge extension cords are not recommended.

SIZING CONSIDERATIONS

Proper sizing of zone heaters for new construction, as with other heating systems, requires a room-by room heat loss analysis. Remember that the best heating economy and comfort with zone heat will result if doors are installed and kept closed between zones.

It can be useful to oversize heaters for quick recovery and to meet short-term cold snaps. However, gross oversizing (200% or more) is wasteful and leads to comfort problems. For best results in a well insulated home, size heaters in bedrooms about 20% beyond the heat loss calculation. Heaters in family rooms, kitchen, dining and living rooms can be oversized 25-50% for quicker warm-up. Bathroom heaters are generally sized in the 500-1000 watt range.

In passive solar or wood heated homes, size the heaters as you would for any other home. This assumes that there will be a time when the wood or solar features are not supplying heat to the building.

THERMOSTATS

Thermostat quality determines how accurately room temperature will follow the setting on the dial. Better thermostats have a feature called the "heat anticipator" which helps maintain a stable temperature. Low voltage thermostats cost roughly \$150 more per house than standard line voltage thermostats, but are required for accuracy if more than 3000 watts are to be controlled. Digital thermostats are the most accurate and the most expensive. The thermostat should be calibrated to manufacturers' specification after it is installed.

Thermostats that are built into the heater unit (as on many older baseboard heaters) are not recommended. They are difficult to reach and to read, and also less accurate. Separate wall mounted units are best, and should be located on interior walls, about 5 feet above the floor and near the entry to the room, but away from direct sunlight or cold drafts from exterior doors.

Programmable thermostats can automatically set temperatures back, and then turn up in time for the home to be warm when you awake or arrive home from work. This is especially useful for some radiant ceiling or floor systems that have a slow recovery rate. Another valuable option is a central control panel, which allows adjustment (on-off-setback) of all thermostats in the home from one location.

CONCLUSION

Zone heating systems are economical, comfortable, and versatile. We would scarcely consider putting all the lights in a home on one switch, yet that is analogous to current practice with central heating systems. Zone heat is an old idea whose time has come.

SUGGESTED READING

1. A State-of-the-Art Review of the Performance of Gas Furnace Systems, Tsongas, G., Portland State University, Portland, OR, October 1986.
2. Zone Electric Heat: Old Idea, New Choices, Puget Sound Power and Light Company, Bellevue, WA, 1986.
3. Centsable Zonal Electric Heat Application Standards, Portland General Electric, Portland, OR, 1986.
4. Super Good Sense Technical Reference Manual, Oregon State University, Corvallis, OR, under contract to the Bonneville Power Administration, September 1986.

WEES PUBLICATIONS

Central Forced Air Heating Systems (FS1202)
Heat Pumps (FS1203)
Comparing the Cost of Home Heating Fuels (TN1204)
Thermostats (TN1203)

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All graphics courtesy of the Bonneville Power Administration.

Washington Energy Extension Service, a Washington State Energy Office program, is funded by the Bonneville Power Administration and the U.S. Department of Energy.

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