## Guidelines for Passive Solar Design Strategies

Through the collaboration of the Passive Solar Industries Council, its member organizations (including the National Association of Home Builders), and the Solar Energy Research Institute, the results of more than 10 years of research on passive solar design were compiled and packaged into a form useful to home builders, developers, and designers. The design strategy packages are site-specific and consist of guidelines and simplified calculation procedures. A computerized "expert system" version of the guidelines is currently being developed at the request of the Passive Solar Industries Council and the National Association of Home Builders. The *Passive Solar Design Strategies* package represents the first design tool to have the endorsement of the association's Standing Committee on Energy.

During the past year, the Passive Solar Industries Council and the National Association of Home Builders initiated a series of workshops designed to assist builders, developers, and designers in using the guidelines package. These workshops are held following the publication of articles and announcements regarding the availability of the design strategies in trade journals and other media.

## Low-Mass, Purgeable Boiler

Conventional boilers used to heat homes lose a significant amount of energy when the burner shuts off and the energy remaining in the boiler water and the heat exchanger escapes out the flue pipe or chimney. The amount of this "off-period cycling loss" depends on the mass of the heat exchanger and the temperature of the boiler water at the time of burner shut-off. DOE researchers at the Brookhaven National Laboratory suggested a change in the boiler's fundamental design to overcome this energy loss, namely, to purge the hot water from the boiler into a reservoir of usable heat during the off period.

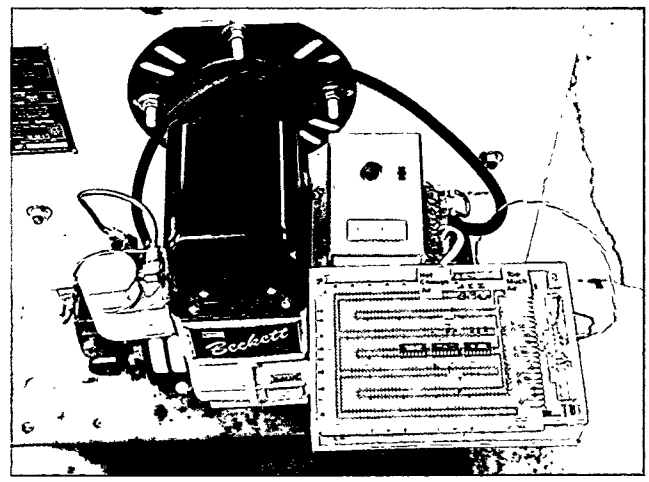
With support from DOE, the Energy Kinetics Corporation developed a prototype low-mass purgeable boiler that was tested successfully at Brookhaven in 1980. The low-mass boiler consists of a 10-foot-long, hollow, coiled section that behaves as a heat exchanger. Water flows internally and is warmed as hot combustion gases pass outside the coil on their way from the firebox to the exhaust stack. Water in the boiler flows counter to the flow of the hot gases with the coolest water on the external loop, minimizing the external jacket heat loss.

The system uses a microprocessor control that purges all the heat remaining in the boiler and allows separate zones of the house to be heated. The purged heat is sent to either the last zone requiring heat or, when the thermostat is satisfied, the water heater tank, which can be connected to receive heat from the boiler water. Because of the low volume of water in the boiler (less than three gallons), the boiler is able to reach the operating temperature in less than one minute and to purge stored heat at a rate of 30°F per minute. The boiler operates with a steady-state efficiency of 83.3%, but more importantly, the purging mode increases the cyclic (seasonal) efficiency of the boiler from 71.9% to 82.5%. Energy Kinetics achieved a market penetration of about 2000 units per year for its System 2000 low-mass purgeable boiler.

## Low-Cost Analyzer for Oil-Burner Flames

Residential oil-fired furnaces usually operate at less than optimal efficiency. During installation and servicing, burners are sometimes improperly adjusted or calibrated. When the furnace is in use, soot accumulates on heat-exchanger surfaces, causing thermal performance to deteriorate by 2% or more each year between tune-ups.

To improve furnace energy performance, DOE supported development of an optical flame monitor that can be incorporated into a furnace. The monitor,




*A low-cost monitor helps oil-fired furnaces in homes operate at optimal efficiency.*