

## **EXECUTIVE SUMMARY**

A year long study was conducted by the NAHB Research Center, Inc. The study quantified the human comfort and energy savings resulting from operating a properly designed zoning system. The intent of this report is to lay the foundation for manufacturers, distributors, contractors and utility companies to realize the impact of the role of zoning in the future.

Operating cost utilizing zoning with thermostat setup/setback strategies had a 29 percent energy savings over the central system during the cooling season and 27 percent energy savings during the heating season. The thermal comfort attributable to zoning was dramatically improved over the central thermostat system. The test results showed that operating a zoning system without setup/setback strategies could cause higher operating cost compared to a central thermostat system, however, the level of comfort is consistently superior.

The study was conducted in a research house that's typical of the building methods and home characteristics found in the 1990s. An extensive Data Acquisition System was used to monitor and log data from over 150 input sensors. Thermal comfort was quantified for each zone. Two control schemes were tested and measured. The first, a single zone system utilizing one thermostat centrally located and a central duct configuration. The second was a zoned system utilizing four thermostats and a zoned duct configuration.

The cooling test results showed the zone system took advantage of electric demand diversity. The daily average outdoor temperature is a reliable predictor of energy consumption. This is used in determining time-of day and standard electric rates. The intent is to reduce or shift electric loads to off-peak periods. For every degree rise in outdoor temperature, daily average energy consumption increases approximately 2 KWH. Balance point temperature is another factor that influences energy consumption. This is the temperature at which no consumption occurs. The zone thermostat system showed a balance point approximately 3°F warmer than the central system. This is a result of the system dynamics of zoning dampers and thermostat setup/setback settings.

The test results indicated the load estimate overpredicted the cooling load by 24 percent for the zoned system and 16 percent of the central system. However, the results measured a significant difference in the comfort levels indicating the ability of the zoning system to take advantage of cooling load diversity.