Ground Coupled Heat Pumps

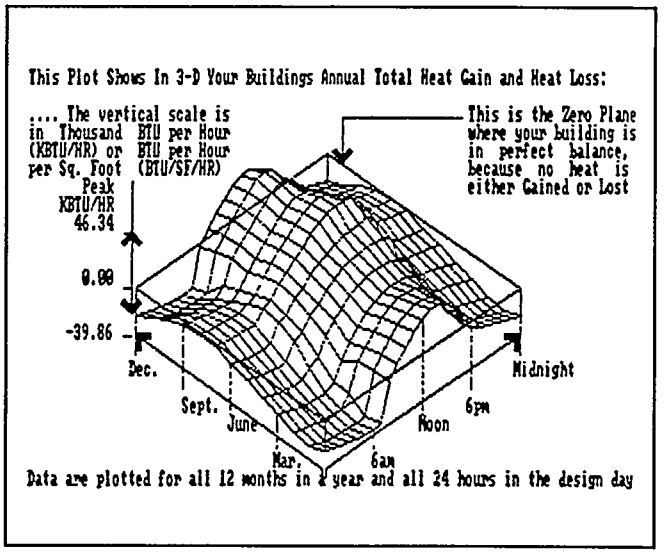
About one-third of new homes are heated and cooled by air source heat pumps. Because ground coupled heat pumps can save over half of the energy used by air source heat pumps, DOE initiated a multifaceted research and development program to develop an advanced ground coupled heat pump. Analytic design tools were developed, tested, validated, and distributed to the private sector to assist manufacturers in designing more cost-effective ground coil heat exchangers and more efficient mechanical packages for the heat pump. These design tools were applied in the development of an advanced ground coupled heat pump system. DOE, a utility company, and a leading manufacturer jointly collaborated in the design, fabrication, and field evaluation of two experimental prototypes. The advanced systems improved the cost effectiveness of ground coupled heat pumps by reducing the payback period from 6-10 years to 3-5 years. The participating utility company estimates that the improvements should increase sales of ground coupled heat pumps by about 60 percent. Ground coupled heat pumps using this advanced design will save approximately 0.32 quads by the year 2010.

Program for the Energy Analysis of Residences (PEAR)

DOE recognized the need for an easy-to-use, nontechnical energy analysis tool to assist residential builders to make choices among energy-conserving building design options. These options include home insulation levels, window types and glazing layers, infiltration levels, amount of thermal mass, and equipment efficiency. PEAR is an energy analysis tool that enables builders and designers to estimate the annual energy use of new houses with different infiltration rates and equipped with various conservation measures such as ceiling, wall, and floor insulation, and thermal or storm windows. Using PEAR, builders and designers can also determine the effects of innovative measures such as changes in roof and wall color or an attached sunspace. PEAR can perform energy analyses for new residential buildings throughout the continental United States.

Solar-5

A building's future energy efficiency is often determined in the early stages of the design process. Designers lacked a way to assess the effect of different design strategies on energy performance until DOE developed Solar-5 to provide a visual display of building energy flows at the design stage for residential and commercial buildings. Solar-5 uses a matrix to display data and provides the results of its energy analysis immediately. This enables users to revise a design and to see instantly the results displayed on the matrix. A user can combine up to nine different schemes into one design and observe a graphic presentation of the resulting energy flows. Solar-5 has received the *Progressive Architecture* magazine award citation and a DOE award for excellence. It is the most popular computer program available from the Designers Software Exchange, with approximately 500 copies sold to date.



This computer-generated plot, produced with the SOLAR-5 program, shows a building's total heat gain and heat loss. Data are plotted for all 12 months and all 24 hours.