



INTERNATIONAL SUMMER SCHOOL on Direct Application of Geothermal Energy

Under the auspice of the
Division of Earth Sciences



HEATMAP © GEO: The Key to Geothermal District Energy Feasibility Analysis, Design and Operation

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Determining the technical and economic feasibility of geothermal district energy (district heat and cooling) systems is a two-track process. One is directed toward establishing the thermal and chemical characteristics of the resource and the other to establishing the economic and technical viability of building and operating a district energy system.

To date most programs have been directed toward identification and characterization of the resource. However, exploration, confirmation drilling, resource characterization and reservoir engineering are all expensive activities that may or may not be justifiable unless the economics of the proposed use of that resource are extremely favorable. Fortunately, at least in the case of geothermal district energy, determining the technical and economic viability of using the resource can now be readily determined at a fraction of the cost of a detailed resource characterization process.

With support from the United States Department of Energy, Office of Wind and Geothermal the Washington State Energy Program has developed and recently released a sophisticated computer model designed to be used for not only determining the technical and economic viability of geothermal district energy, but also to serve as a detailed design and operational tool. HEATMAP© GEO, one of a suit of HEATMAP© models, has been under development since the late 1980's and is now recognized internationally as the standard

for integrated district energy analysis planning, design and operation. Other entities who have supported development of the model include: The U.S. Department of Defense, U.S. Navy, U.S. Army Corps of Engineers, The New York State Energy Research and Development Authority, The Canadian Ministry of Energy and Mines, The Swedish Council for Building Research and The Swedish Trade Office.

HEATMAP© Geo provides several **unique** economic and technical features for geothermal analysis, including: the ability to assess thermal distribution opportunities of produced energy that will be available for sale to various space heating and cooling, greenhouse, industrial processing, and industrial distribution consumers; the design of direct use geothermal applications in conjunction with fossil fuel peaking and thermal storage; integration of geothermal energy with the production and sale of electricity (e.g., cogeneration); integration of geothermal with cooling applications; integration of various economic alternatives including well pumping and disposal with district energy provided from a geothermal or geothermal/fossil fuel peaking source; the capacity to quantify and provide graphical analysis of actual greenhouse gas emission reduction for specific geothermal site applications; and enhanced economic analysis capability optimized for geothermal operation and maintenance to ensure reliability of service and long term economic system life.

The software program is easy to use and provides a simple means for planning new geothermal district energy opportunities as well as evaluating existing system performance or to model the effects of various potential alternative system strategies. The software can be a valuable tool for community planners or other groups in defining all aspects of developing, evaluating, and justifying a potential geothermal project.

The model has four primary modules. The first is designed to establish peak and yearly energy demand on a building-by-building level. The load characteristic module allows for input of actual loads derived from utility bills or from estimation of loads based on climatological data and end use consumption characteristics. The second module is the production module; it allows for geographical placement of all production and injection wells as well as central heat exchangers and integral peaking, back up or storage facilities. The third module allows for the lay out of the distribution network, complete sizing of the pipes to meet consumer loads and hydraulic and thermal analysis of flows within the network. The final module is a robust economic model based on another WSU EP product RELCOST. Both public and private sector financing scenarios can be fully analyzed.

The model provides complete tax tables, bank, bond and equity financing mechanisms and calculates both minimum sales price based upon minimum revenue requirements or a more traditional life cycle cost analysis.

The entire model is coupled to AutoCAD for geographic control. Work is underway to open the model so as to be compatible with other CAD and GIS graphic packages. Finally, the model has a complete library of climatological information, production equipment, distribution system components and fiscal tables. All of the libraries are user modifiable.

HEATMAP© GEO underwent expensive testing prior to release and has now been used by WSU EP to conduct studies in 14 communities over the past two years as an integral part of our ongoing testing program. The program is also receiving considerable attention in Europe and the development of customized versions of the program for use in several Eastern European countries is now under discussion.

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