GEOTHERMAL HEAT PUMP PERFORMANCE

Tonya L. Boyd and Paul J. Lienau

Geo-Heat Center
Oregon Institute of Technology
Klamath Falls, OR

ABSTRACT

Geothermal heat pump systems are a promising new energy technology that has shown rapid increase in usage over the past ten years in the United States. These systems offer substantial benefits to customers and utilities in energy (kWh) and demand (kW) savings. The purpose of this study was to determine what existing monitored data was available mainly from electric utilities on heat pump performance, energy savings and demand reduction for residential, school, and commercial building applications. Information was developed on the status of electric utility marketing programs, barriers to market penetration, incentive programs, and benefits.

INTRODUCTION

The Department of Energy (DOE) and the Environmental Protection Agency (EPA) are rapidly expanding their involvement in programs to promote increased use of both renewable-energy resources and energy-efficient technology. Federal implementation of the Clean Air Act Amendments of 1990 and the Energy Policy Act of 1992, and other regulations still under development are a result of an increasing worldwide environmental consciousness. Furthermore, the environmental and efficiency aspects of energy production and use are expected to remain top-priority items in President Clinton's administration. Geothermal heat pumps (GHPs) can help meet the challenge by increasing our energy efficiency, with resulting benefits to utilities in better load management, to customers in lower utility bills, and to society in a cleaner environment (Pratsch, 1992).

UTILITY ISSUES

Electric utilities are the ultimate market target for GHPs, especially utilities that are already committed to demand-side management (DSM). Recommendations must be consistent with prevailing energy policies and supported by data. The data must show that the resource, and technology is available, reliable, plus cost competitive with other options. Concerns of utilities considering GHP technology as a DSM option include:

- Amount of demand and energy savings,
- First cost of ground loop and wells,
- Effect of ground-loop temperature increase for summer and long-term operation, especially for commercial applications,
- Utility rebates and other incentives, and
- Infrastructure availability of heat pump dealers and loop installation contractors.

MONITORING PARAMETERS

The object of this study was to compare as many types of like case studies, with monitored data, taken from as many sources as possible throughout the United. States. The monitoring strategy for GHPs can be classified into:

<u>Basic Parameters</u>:

- Heat pump demand (kW) and energy (kWh),
- Supply and return ground-loop temperatures, and
- Flow in ground loop, a one-time measurement.

<u>Comprehensive Parameters</u>:

- Ground-loop pump kW and kWh,
- Fan kW and kWh,
- Air flow,
- Air supply and return temperatures, and
- Space and outside temperatures.

Due to the complex variations that affect a system's performance, it is difficult to exactly compare two different applications. The goal of this study was to compare as many case studies of similar data as possible, to establish a pattern rather than attempt to remove the variables for an exact comparison.

PERFORMANCE

The energy performance of a GHP system can be influenced by three primary factors: the heat pump machine, the circulating pump or well pump, and the ground-coupling or groundwater characteristics.