

Workshop Description

Designing a ground heat exchanger (GHX) is not like designing a conventional HVAC system. A GeoExchange designer is responsible for the energy source of the system much like the utility is responsible for designing the gas wells and pipelines delivering gas to the furnace or boiler, or designing a cooling tower rather than simply selecting one from a catalogue.

The workshop describes a design process that demonstrates the importance of accurate energy modeling on the configuration, size and cost of a GHX and geothermal system. It shows the influence a designer can have on the feasibility of constructing a geothermal system using an iterative design process and working closely with the entire building design team in an integrated design process.

The process illustrates the site specific nature of geothermal system design and helps the designer optimize the building to work over the long term with a GHX designed to provide energy for the entire system. It also shows the impact of various types of hybrid options.

The workshop shows the designer how to generate information needed by a client to develop financial models needed to determine the economic feasibility of constructing a geothermal system for their project compared to a conventional HVAC system based on the utility rates applicable to their project.

The workshop describes methods of testing the capacity of the soil / rock to transfer energy and shows examples of when a thermal conductivity test is warranted in a vertical GHX, methods of determining the capacity of the soil for a horizontal GHX and discussion about pump testing for an open well system.

There are many factors that influence the design of a GHX, including the heat transfer fluid, temperature range it is expected to operate at, pipe size and specifications, methods of placing pipe in the ground, the number of circuits of pipe, considerations for flushing and filling the system, pumping strategies, pumping cost, borehole diameter, grouting, etc. These details are discussed during the workshop.

The mechanical system and GHX must be considered as a system. The workshop discusses the impact of different design strategies such as distributed heat pump systems, distribution operating temperatures, simultaneous heating and cooling opportunities, energy storage, control strategies, etc.

Quality control during construction of the any mechanical system is critical if the system is to operate as expected. This is especially true of the GHX since it is buried, and is, for all practical purposes, inaccessible. The workshop outlines many typical things to review during a pre-construction site meeting and during construction site inspections.

Commissioning and system review with the building operator can make or break a project. What do you look for during commissioning? What does the building operator need to know? There are numerous potential issues that can be dealt with if a complete commissioning procedure is followed.

Developing a Design Process for Cost-effective GeoExchange™ Systems

0	Introduction to Commercial Geothermal System Design	<i>Session 1</i>
1	Feasibility	
1.1	Energy modeling.....	<i>Session 2</i>
	1.1.1 Peak loads	
	1.1.2 Energy loads	
	1.1.3 Energy balance	
	1.1.4 Reducing & balancing building loads	
	1.1.5 Energy modeling software requirements	
1.2	Mechanical system.....	<i>Session 3</i>
	1.2.1 Equipment efficiency	
	1.2.2 Impact of the distribution system	
	1.2.3 Ventilation strategy & impact on energy loads	
	1.2.4 Energy storage	
1.3	The site & geology.....	<i>Session 4</i>
	1.3.1 Land area available for GHX	
	1.3.2 Geology	
	1.3.3 Regulations	
1.4	GHX preliminary modeling.....	<i>Session 5</i>
	1.4.1 Vertical	
	1.4.2 Horizontal	
	1.4.3 Pond / lake	
	1.4.4 Open well	
	1.4.5 Standing column	
	1.4.6 Hybrid options	
	1.4.7 GHX software requirements	
1.5	Economics	<i>Session 6</i>
	1.5.1 Energy cost comparison	
	1.5.2 Capital cost	
2	Confirmation	
2.1	Confirmation of preliminary design.....	<i>Session 7</i>
	2.1.1 TC testing – vertical GHX	
	2.1.2 TC testing – horizontal GHX	
	2.1.3 Pump testing – open well	
3	System Design	
3.1	Configuring the GHX.....	<i>Session 8</i>
	3.1.1 GHX nomenclature	
	3.1.2 Pipe selection	
	3.1.3 Heat transfer fluid	
	3.1.4 Number of GHX circuits	
	3.1.5 Flushing / purging considerations	
	3.1.6 Supply / return header configuration	
	3.1.7 Supply / return runouts	
	3.1.8 Geothermal vaults	
	3.1.9 Building penetrations	
	3.1.10 Supply & return manifolds	
	3.1.11 Pumping strategies and options	
	3.1.12 Piping and material specifications	
	3.1.13 GHX layout and details	
3.2	Designing the Mechanical System.....	<i>Session 9</i>
	3.2.1 Water to air equipment	
	3.2.2 Distribution system considerations	
	3.2.3 Water to water equipment	

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- 3.2.4 Distribution system considerations
- 3.2.5 Equipment and material specifications

4 ImplementationSession 10

- 4.1 Construction
 - 4.1.1 Quality assurance / quality control considerations
 - 4.1.2 Pre-construction site meetings
 - 4.1.3 Site inspections
- 4.2 Commissioning the system
 - 4.2.1 Commissioning the system
 - 4.2.2 Functional performance testing
 - 4.2.3 Owner / operator training / system turnover

It is beneficial for participants in the course to have access to software needed to design ground heat exchangers. Ground Loop Design (GLD) has agreed to provide temporary licences for the duration of the course. Temporary USB activation keys will be provided in the classroom and will be couriered to online participants. GLD also provides a discount of 10% to all course participants.

A trial version of the software can be downloaded at www.groundloopdesign.com



