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A new way to learn ground coupled heat pump system design:

IGSHPA Certified GeoExchange Design (CGD) Course

Taking the CGD course takes a good chunk of time out of your week. Three days to attend the course. A day to get to where the course is being offered. Four days out of a week where you can't be productive. And it's seldom offered at a time and place that is convenient.

How about having the CGD course come to you, on your schedule, in your own offices. You and two of your design team can earn CGD Accreditation for about the same cost of one person travelling across the country to attend a course. Plus receive these benefits:

- Invite up to 7 additional colleagues to attend all or part of the course (architects or contractors you work with, your drafting techs, site personnel, or even potential clients, etc.) at no additional cost.
- Eight hours of consulting time with your instructor. Ask questions, refresh your memory of the course material, review designs, learn the software, discuss ideas and concepts for projects you're working on, etc.
- This course is eligible of Continuing Education Credits with most engineering associations.

Classroom in Your Office:

The course material is covered in about 16-20 hours. Additional time can be scheduled to learn to maximize the capacity of GHX design software. Schedule the course for afternoons and evenings to maximize your productivity in the office. Take advantage of your instructor's time and review one of your actual projects.

Online Interactive Webinar:

Online interactive webinars can be scheduled to meet your needs. 10 training modules can be delivered to you and your team on a schedule that works for you. Each module ranges from 90 to 150 minutes. A popular scheduling option delivers one module, one evening per week, for 10 weeks. The scheduling is easily adjusted to what works best for you and your team.

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The Details:

Attending a traditional design workshop or seminar is often difficult if not impossible to fit into your schedule. The courses are seldom offered when and where you can take advantage of them. Sending one person to a 3-day workshop halfway across the country can easily cost $6-7,000 when you consider travel costs and time, lost productivity and opportunities when away from the office. Bringing an experienced instructor into your office for either an In-house workshop makes it available to 3 people from your team when it's most convenient to you and your team and eliminates travel time and costs…for 20% less than the cost of sending 2 people to a course halfway across the country. Having 3 team members attend the course online is only 30% more than sending 1 to a traditional classroom session. Either way, you get a full day of the instructor's time for follow up questions plus you can invite other team members to sit in on the sessions at no additional cost.

In-House Classroom Sessions	Online, Interactive Webinars	Traditional Course Delivery
• **3 CGD Certifications** • 3 sets of IGSHPA manuals • 20 hours formal course material delivered in your offices on your schedule • Include up to 7 colleagues at no additional cost • Instructor's expenses • Schedule for your needs • 8 hours for follow up questions & review for 2 months after course • Course available in metric or imperial units	• **3 CGD Certifications** • 3 sets of IGSHPA manuals • 20 hours of formal course material delivered online on your schedule • Include up to 7 colleagues at no additional cost • Scheduled for your needs • 8 hours for follow-up questions & review for 2 months after course • Course available in metric or imperial units	• **3 CGD Certification** • 3 Set of IGSHPA manuals • 20 hours of formal course material delivered at location of course **$6,000** • Travel, lodging, meals for 3 people **$4,500** • Lost productivity for 3 people out of the office for 3 days **$9,000** • Opportunity for follow-up questions for 2 months after course • Opportunity to invite colleagues **Not available**
Total Cost: $10,500 [1, 2]	**Total Cost: $8,500** [1]	**Total Cost: $19,500**

1 *Add one copy of Ground Loop Design (GLD) Premier Edition for only $3,250 (value $3,650)*
2 *Based on estimated $2,000 travel costs for instructor – will be adjusted based on invoice costs*

All costs in US$

Additional Follow-up if needed:

The goal of the CGD Course is to ensure you and your design team are completely familiar with the design and implementation of ground coupled heat pump systems. After completing the course, it's not uncommon for questions to arise as you and your team design more ground coupled heat pump systems. Additional blocks of the instructor's time can be purchased to review designs, provide software training, and provide general design assistance by phone, email, Skype, online webinars.

- 8 hours: $1,400 (time can be used over 2 months)
- 16 hours: $2,600 (time can be used over over 4 months)
- 24 hours: $3,800 (time can be used over over 6 months)
- 40 hours: $6,000 (time can be used over over 12 months)

Who Will Benefit from this Workshop

Building owners and developers are trying to stay more competitive and are looking for ways to make their buildings more efficient. Mechanical system designers are being pressed to consider GeoExchange system options more often. This workshop is designed to provide a solid understanding of GeoExchange systems for mechanical designers and the process needed to design a system that is cost-effective to build and predictable in long term operation.

This course was developed for the International Ground Source Heat Pump Association. Accreditation is offered by the Association of Energy Engineers. This workshop is eligible for 20 professional development hours (2 CEU's) for most engineering associations.

Workshop Description

Designing a ground heat exchanger (GHX) is unlike designing a conventional HVAC system. With a conventional system you are simply connecting to the energy source someone else has designed. The designer of a GeoExchange system is responsible for designing the energy source rather than simply connecting to one someone else is responsible for.

This 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 efficiently over the long term with a GHX. It also illustrates the effective use of various hybrid options. The workshop shows the designer how to generate information needed by a client to develop financial models to determine the economic feasibility of constructing a geothermal system for their project compared to a conventional HVAC system based on local utility rates.

Methods of testing the soil / rock properties are discussed. When is a thermal conductivity test warranted? Testing for a horizontal GHX and pump testing an open well system are considered. Important design details, including fluid selection, design temperatures, pipe specifications, pipe placement, number of pipe circuits, flushing and filling the system, pumping strategies, pumping cost, borehole diameter, grouting, etc. are discussed in detail.

The mechanical system and GHX is a system. The workshop discusses the impact of different design strategies such as distributed heat pump systems, central water to water 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 is needed for commissioning? What does the building operator need? There are numerous potential issues that can be dealt with if a complete commissioning procedure is followed.

0 Introduction to Commercial Geothermal System Design.....*Section 1*

1 Feasibility

1.1 Energy modeling ……*Section 2*
- 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 ……*Section 3.*
- 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 ……*Section 4*
- 1.3.1 Land area available for GHX
- 1.3.2 Geology
- 1.3.3 Regulations
- 1.3.4 Integrated GHX options
- 1.3.5 Hybrid options

1.4 GHX preliminary modeling……*Section 5*
- 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 Feasibility ……*Section 6*
- 1.5.1 What makes a project feasible
- 1.5.2 Energy cost comparison
- 1.5.3 Capital cost

2 Confirmation

2.1 Confirmation of preliminary design ……*Section 7*
- 2.1.1 TC testing – vertical GHX
- 2.1.2 TC testing – horizontal GHX
- 2.1.3 Pump testing – open well

3 System Design

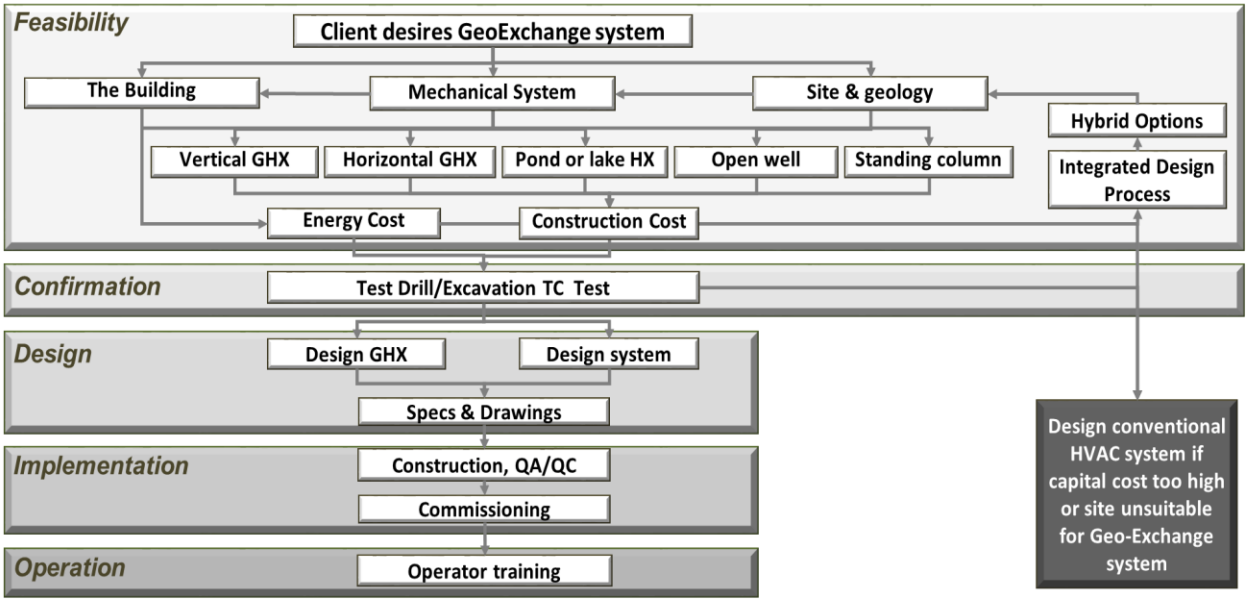
3.1 Configuring the GHX……. *Section 8*
- 3.1.1 GHX nomenclature
- 3.1.2 Pipe selection
- 3.1.3 Heat transfer fluid
- 3.1.4 Number of GHX circuits
- 3.1.5 Flushing / purging considerations
- 3.1.6 Supply / return header configuration
- 3.1.7 Supply / return runouts
- 3.1.8 Geothermal vaults
- 3.1.9 Building 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 .....*Section 9*
- 3.2.1 Water to air equipment
- 3.2.2 Distribution system considerations
- 3.2.3 Water to water equipment
- 3.2.4 Distribution system considerations
- 3.2.5 Equipment and material specifications
- 3.2.6 Integration of energy storage

4 Implementation

4.1 Construction & Commissioning ….……*Section 10*
- 4.1.1 Quality assurance / quality control considerations
- 4.1.2 Pre-construction site meetings
- 4.1.3 Site inspections
- 4.1.4 Commissioning the system
- 4.1.5 Functional performance testing
- 4.1.6 Owner / operator training / system turnover

This flowchart illustrates the design process that will help optimize the design of a cost-effective and sustainable geothermal heating and cooling system. The workshop is designed to help a geothermal system designer understand and develop their own approach that is suitable for their clients and the projects in the areas they work.



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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

The Instructor – Ed Lohrenz, B.E.S., CGD

Ed Lohrenz has been working in the geothermal heat pump industry for over 30 years. He has worked in most facets of the industry, including system installation, system design, an equipment supplier and manufacturer, and a commercial system design consultant. In 2006 Ed founded Geo-Xergy Systems Inc., one of the few engineering design firms specializing in the design of larger commercial geothermal systems. The firm was responsible for the design of several significant GeoExchange systems, including:

- Gibsons District Geothermal Energy system, Gibsons, BC, 2008 – Development of a geothermal utility owned and operated by the Town, the development will include 750 homes, commercial/retail space, and recover energy from the community ice arena.
- IKEA Store, Centennial, CO – 2010 – Conceptual system and GHX design for the 400,000 square foot retail store. The firm worked closely with the client and design team to develop an innovative system to integrate an ice storage system to reduce electrical demand and a snow-melt/heat dissipation hybrid system to reduce GHX construction cost and improve efficiency. The simple payback for the system is less than 4 years.
- Seasons of Tuxedo Shopping Centre, Winnipeg, MB – 2011 – The 1.5 million square foot retail centre is built on 200 acres of land. A horizontal directionally drilled GHX provides the space heating and cooling for the project. The developer owns and operates the system and supplies heating and cooling to the tenants.
- Goldfields Oasis Leisure Centre, Kalgoorlie, Western Australia, 2013 – Even though the facility is located in a hot, desert climate, there is a large heating requirement because of the Olympic size pool and leisure pools. A horizontal GHX is designed to act as a solar collector and heat dissipation device to allow a reduction in the amount of costly vertical drilling required and help manage the temperature of the vertical GHX.

More recently, Ed has created GEOptimize Inc., a consulting firm specializing in the delivery of design workshops for designers who

With an extensive background in the design and implementation of geothermal systems, Ed brings experience in methods to reduce the cost of GCHP systems, ways to improve operating efficiency and ensure the system will continue to work efficiently for many years.

For further information about Ed:

- https://www.linkedin.com/in/edlohrenz
- http://www.geoptimize.ca/

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