IGSHPA *NEW* Commercial Designer Certification

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New IGSHPA Program

October 22, 2024

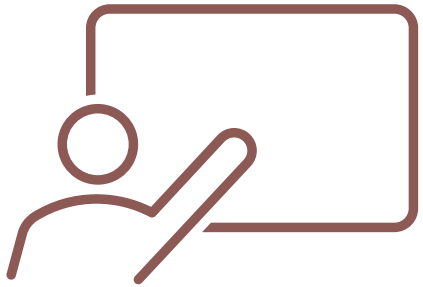
The team

- IGSHPA
- Canadian Standards Association (CSA Group)
- SMEs

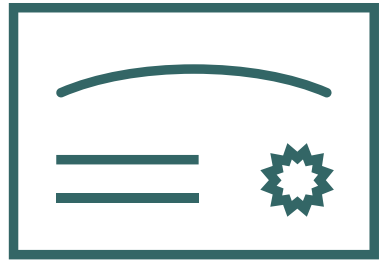
IGSHPA offerings

Web-based training

Instructor-led workshop



Personnel certification



Prioritized courses

1. Commercial Designer
2. Geothermal Inspector
3. Residential Designer

Additional job roles identified by IGSHPA and the Scheme Committee

- Vertical Loop Technician
- Fusion Technician I
- Fusion Technician II
- GSHP Technician
- GSHP Service Technician

New program objectives

Enhance the industry's reputation by

- Encouraging the sharing of knowledge and resources
- Mentoring the next generation and industry newcomers
- Providing a consistent training and certification experience

The Resource Center at the Southern Union State Community College in Wadley, AL is located near a 13-acre lake with a maximum depth of 15 ft. The building was completed in 2016 and is connected to a surface water heat exchanger of one-inch High Density Polyethylene (HDPE) tubing 30,000 feet in total length. The coil is connected to 20 water-to-air pumps that heat and cool the building. Three additional WAHPs condition the ventilation air. The annual Energy Use Intensity (EUI) was 8.1 kWh/ft^2-and the peak demand was 3.1 W/ft^2. Occupants have rated the comfort, air quality, lighting, acoustics, and maintenance at 5.0/5.0 and controllability at 4.8/5.0 (Very Satisfied). The cost of the system was $609,000 ($30.45/ft^2). The owner was advised that the system would cost more than existing campus water loop heat pump (WLHP) systems (with boilers/cooling towers). The SWHP actually cost less.

Building Details	Floor area = 20,000 ft^2, 80 occupants average during 9-month full-load operation but less for 3-month part-load Annual Energy Use: 162,000 (8.1 kWh/ft^2) Peak Electrical Demand: 62 kW (3.1 W/ft^2)			
HVAC Equipment	20 water-to-air heat pumps, 3 water-to-air ventilation air heat pumps (66 tons total), 2 mini-split ACs (4 tons total), 5-hp circulation pump (with 5-hp back-up). At end of year two cooling season, the lake temperature near coils = 76°F.			
Surface Water Heat Exchanger Description	Sixty 1-inch HDPE 500 ft. coils in five circuits with 12 coils per circuit (450 ft/ton). Coils placed at 14 ft. depth.			
Installation Costs Total HVAC & Loop $609,000 $30.45/sq. ft.	HVAC	Item cost	Percent of total	$/Ton
	Lake loop total	$90,000	13.1%	$1,286
	Heat pumps (23) Mini-splits (2)	$151,000	**21.9%**	$2,157
	Pumps (2)	$20,500	3.0%	$293
	Vent Air Access.	$29,500	4.8%	$421
Note: The controls cost more than the surface water heat exchanger and at $2,157/ton, a 3-ton WAHP cost = $6,471.	Ductwork	$110,000	18.1%	$1,571
	Interior Piping	$76,000	12.5%	$1,086
	Controls	$81,000	**13.3%**	$1,157
	Insulation	$40,000	6.6%	$571
	Miscellaneous	$11,000	1.8%	$157
	Total	$609,000		
	Total per sq. ft.	$30.45	Total per ton	$8,700
Occupant Satisfaction	Cooling comfort	5.0/5.0	Heating comfort	5.0/5.0
	Indoor Air Quality	5.0/5.0	Lighting	5.0/5.0
	Acoustics	5.0/5.0	Controllability	4.8/5.0
	Maint. Frequency	5.0/5.0	Maint. response	5.0/5.0

Reference: *ASHRAE Journal*, April 2018

Note: Consider a vertical ground heat exchanger (GHX) in 2016 at a cost of $15/ft. For a length of 250 ft./ton, the cost for the 66 tons of WAHPs would be $247,500. This would raise the cost to $766,500 ($38.3/ft^2) for a vertical GHX system.

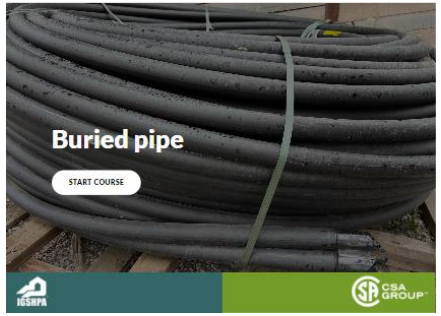
Training

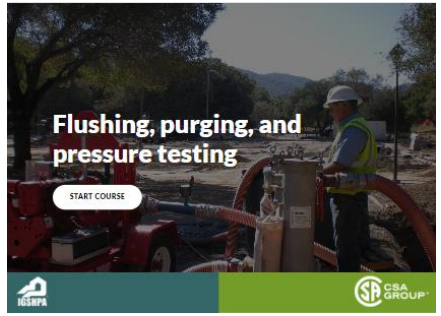
Web-based and instructor-led workshop

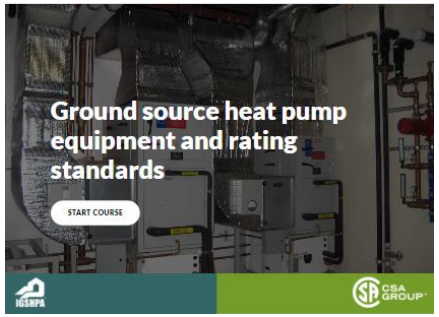
New training overview

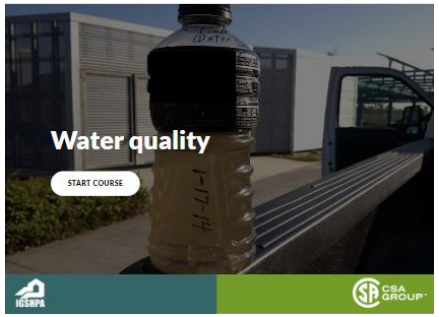
- Consistent
- Current
- Peer-reviewed
- Insights from industry professionals
- Interactive

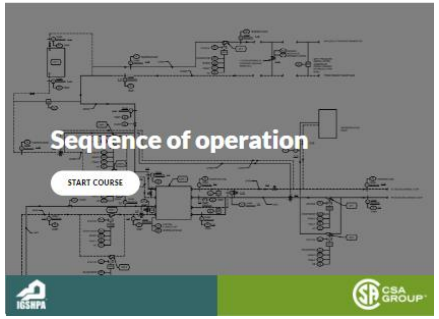
Web-based training modules

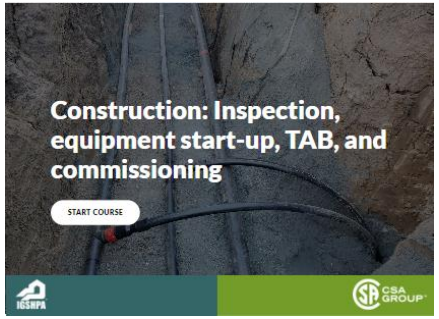






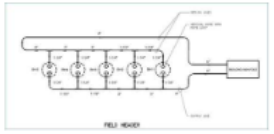






Field headers and horizontal piping

Field headers were introduced in ***Introduction to ground source heat pump systems, standards, and design philosophy***, and are defined as a buried or submerged pipe assembly that connects multiple boreholes or loops to supply and return piping. If you are not familiar with field headers, it is suggested that you take that module before continuing. In the previous example, the field header is also the main supply and return pipes.



Field headers and connection to the building manifold.

The design flow rate of a GSHP system for a small office building is 60 gpm. Once the pipe sizes have been selected, it is time to determine how many field headers and loops are needed. The vertical ground heat exchanger for this building is designed with HDPE and is to be configured in a 2 x 6 grid (12 vertical loops total). Instead of connecting all the vertical loops to one field header, you have chosen to use two field headers of 6 loops each.

Assuming that DR11 will be used for the field headers and the vertical loops, what size pipe do you recommend for each of the two field headers?

- ○ 12 gpm
- ○ 30 gpm

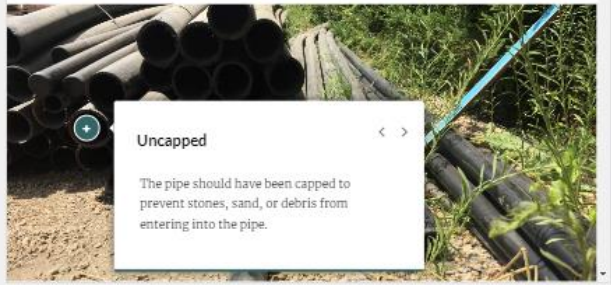
Piping and fitting on-site storage

The u-bend assemblies used for vertical or directional drilling are typically shipped to the project site on pallets and shrink-wrapped to not just keep the pipe on the pallet during shipping, but to keep the pipe clean until it is installed. When straight PE pipe and copper ground loops come to the site it is very important that they be kept free of contamination that might physically damage or reduce the integrity of the pipe and fitting material, or compromise its reliability.

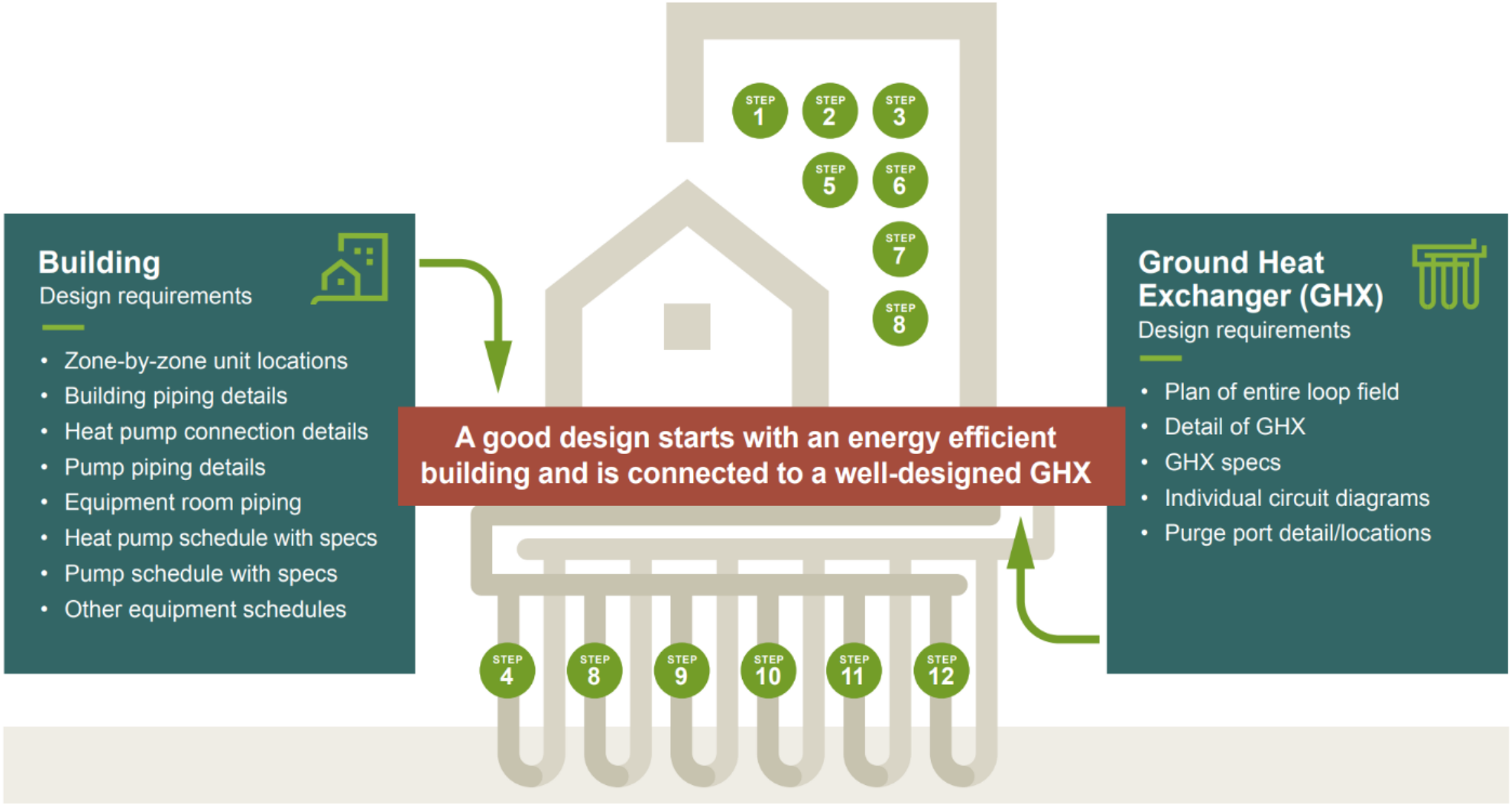
To keep material clean it is recommended to plug or cap the pipe. This not only helps to keep the pipes clean but also to prevent insects, vermin, or wildlife from getting in!

It is important that the site storage that requirements be specified in the design so that construction components are kept clean. These requirements are typically spelled out in the 'boiler plate' of a standard specification set; however, additional mention in the specifications for the ground heat exchanger adds emphasis and can highlight that it is way easier to prevent debris from getting into a pipe than it is to get it out later during the flushing process.

Click the + markers on the image below.

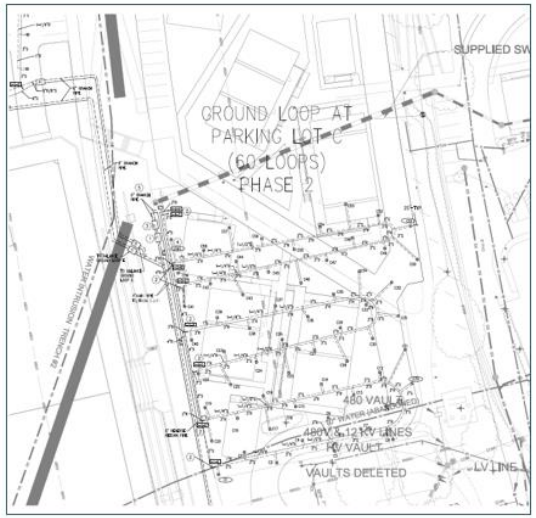


Instructor led workshop



Design by others

Design by you



Workbook

IGSHPA

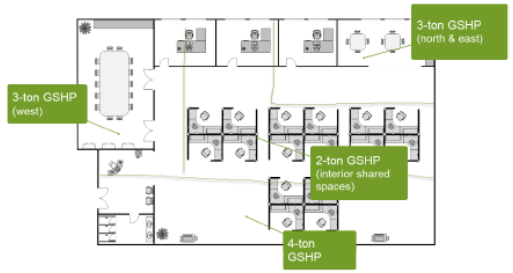
Commercial Designer

Workbook

Step 3: Peak Block Load Example

Zone peak load — the maximum heating or cooling load in a zone, used to elect the heat pump capacity in that zone.

Small office building designed with the following GSHP equipment and zoning



Total equipment capacity = 12 tons

GHEx needs to manage peak block load of the building for each time block

Summer Cooling Requirements:

- Morning: Minimal cooling is needed on the west and south sides. The GHEx may only need to handle a nominal 5-ton peak block load for the interior and east offices.
- Noon: The cooling demand increases to 9 tons to cover the south offices.
- Afternoon: The cooling demand shifts more to the west side, maintaining a 9-ton peak load.

Design considerations

What happens if the designer sizes the GHEx for a 12-ton peak load instead of considering the peak block loading across different time blocks in a day?

Inputs into the GHEx design software are the actual loads NOT the equipment capacity.

Step 4: Estimate thermal properties for given drill log

Follow these steps to estimate the thermal conductivity of a 300-foot borehole. Calculate the weighted average of the formation to 300 ft.

1. Use the **Drill Log** to enter the *Formation description* [A] and the *Depth* [B]
2. Look up the properties in Table 3.4 and Table 3.5 to select a thermal conductivity (TC) value for that material [C]. If a range is given, use an average or conservative value. Apply your engineering judgement.
3. Multiply each TC value by its depth (thickness). [D]
4. Calculate the sum of *depth x estimated TC*.
5. Divide the sum of these (depth x TC) values by 300 feet to determine the weighted TC.

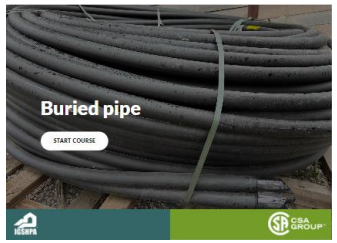
A. Formation description	B. Depth (ft)	C. Estimated TC value (Btu/hrft°F)	D. Depth x estimated TC
Weathered tan clay	10 feet	0.8	8
Brown clay	3 feet		
Tan shade			

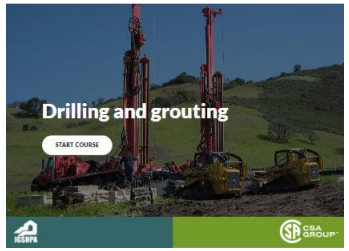
Sum	
Divide sum by 300 ft	

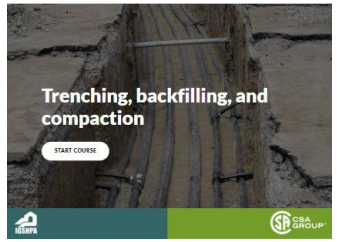
How does this answer compare to the tested value (1.12 btu/hrft°F)?

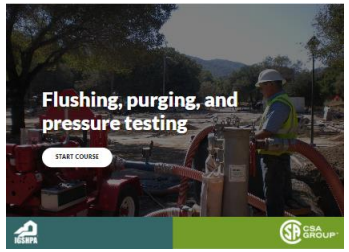
Why is it different?

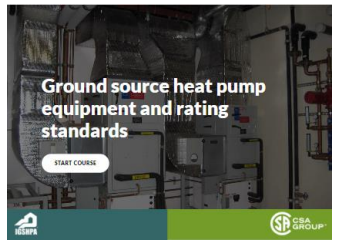
Example of learning path A



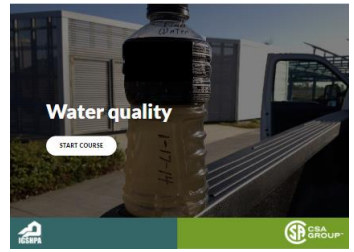


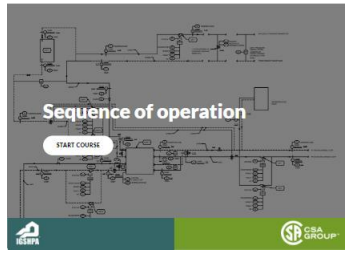


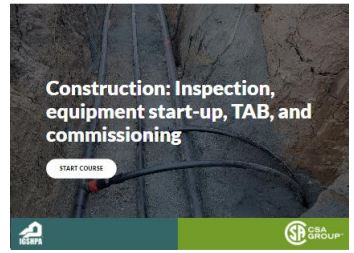


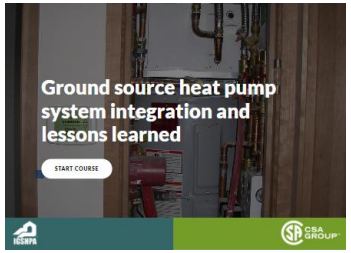


Instructor led workshop

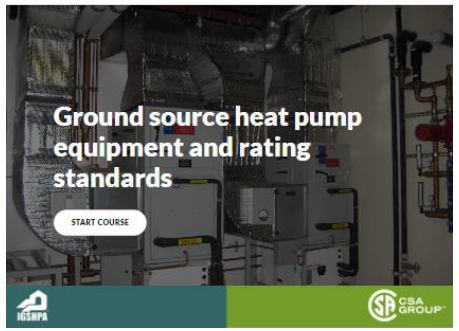




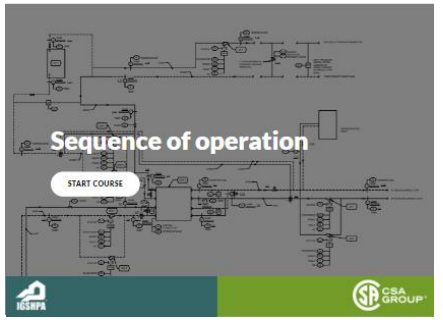


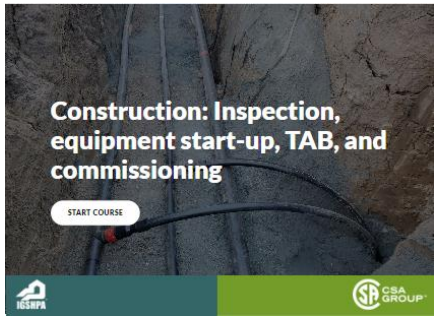


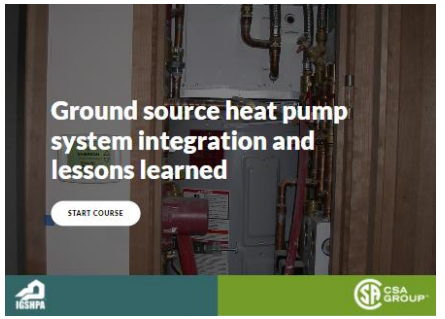
Example of learning path B



Instructor led workshop

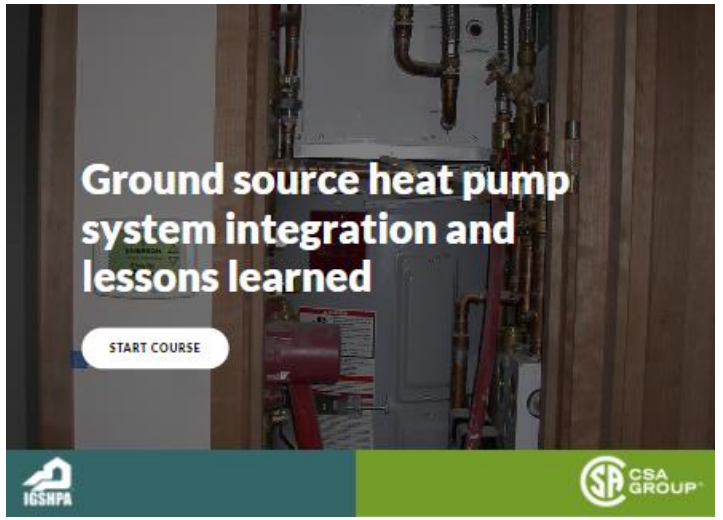






Example of learning path C

Instructor led workshop



Personnel Certification

Personnel Certification Development

- Commercial Designer
- Geothermal Inspector
- Residential Designer

- Successful candidates will have the demonstrated knowledge and skills necessary to design (inspect) a GSHP system in compliance with ANSI/ CSA/IGSHPA C448 *Design and installation of ground source heat pump systems for commercial and residential buildings*.

Commercial Systems	**Residential Systems**
More than 3 heat pumps	3 or fewer heat pumps
More than 4000 sq ft (370 sq m)	4000 sq ft or less (370 sq m)

Personnel Certification Development

- ✓ Needs assessment (domain analysis)
- ✓ Industry engagement
- ✓ Defined competencies, skills and knowledge (job task analysis)
- ✓ Defined certification paths and criteria (eligibility and passing requirements)
- Design the assessment (item writing)
- Pilot testing (beta the exam)
- Implementation (launch)

Personnel Certification

- Commercial Designer – Summer 2025
- Geothermal Inspector – Fall 2025
- Residential Designer – Fall 2025

Assessment - Qs

- What is the standard upon which all IGHSPA Training will be based?
- What are the first three job roles for which training and personnel training are being developed?
- For the instructor led portion of the IGSHPA Commercial Designer training, what is the key reference document?

Assessment - As

- ANSI/CSA/IGSHPA C448 Design and installation of ground source heat pump system for commercial and residential budlings
- IGSHPA Commercial Designer, IGSHPA Geothermal Inspector, and IGSHPA Residential Designers
- Geothermal Heating and Cooling – Design of Ground Source Heat Pump Systems

Questions?

Thank you.

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