FOR OR AGAINST
GROUND SOURCE HEAT PUMPS

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Objectives

- Discuss what happens when you have a building evaluated for or against heat pumps
- Identify participants that may have an agenda for or against the heat pump project.
- Determine parameters for accuracy in the proposed plan or the evaluation.
- Provide insight into the processes and offer questions you can ask so the correct decision is made.
A participant in the planning process who may have objections to the use of a heat pump system may:

- Inflate the number of wells needed for the building.
- Make the sizes of the equipment needed larger.
- Increase the cost of controls beyond his preferred system.
- Inflate the amount of labor needed to install a heat pump system will be larger than his system.
Increasing the number of wells and their cost.

- It is common to see two to four times as many wells as needed.
- The cost may be two to four times what the driller may charge per well.

- A parameter for the number of wells to use per Sq ft of building would be one well per 750–1000 Sq ft.
- The cost may vary but a good range would be $10-$20 a foot of well.
Over sizing the equipment.

- Over sizing starts with an oversized heating and cooling load estimate and increases the cost dramatically.
- The heating and cooling load should be done accurately including all internal loads. Another parameter is 10 to 15 BTU per Sq ft of office building. This includes heating and cooling even in the far North.
The cost of controls in the heat pump project is stated as being more than conventional.

The heat pumps control themselves for each space and only need to be daisy chained with two wires throughout the building.

The control cost of a heat pump system should be between 60% to 70% of a conventional system.
Labor cost should be equal or less.

Consider a conventional system with four pipe blower coils or VAV’s with reheat. Both require two piping systems with boiler and chiller and controls to modulate valves in multiple locations. The boiler system is going to require expensive metal piping or a high temp plastic.

The heat pump system only requires one set of pipes of polyethylene black plastic insulated in the north but not in the south.

Very little duct work with no boiler and no chiller outside.
For a heat pump system that will not pay off or will not work.

Showing a savings that is not there with the proposed system.

The system is not large enough to do the building as discuss previously.

The system is so large with so many wells that it will never pay for the extra cost.
Find the operating cost of a similar building that is being proposed as new or determine if there are meters on the building to be retrofitted. It is obvious it cannot save more than it cost.

Savings to Pay the extra cost are beyond reason and should be questioned. If it’s too good to be true…. Look for these
If the system has only 200 ft of well for greater than 1000 sq ft of building, it is time to ask questions on how this is possible. It may not be impossible but it is not normal for most locations. As discussed previously 200 ft of well, will on a good design serve 750 to 1000 sq ft.

A work station in an office building will normally produce 1200 BTU of internal cooling load with the worker in it. The shell load or the building load would be added to this for cooling and subtracted for heating. In this way, it is possible to determine a reasonable payback for the project.
Example of efforts to make GSHP projects look impossible and not worth the effort

Letter received from a colleague questioning some of the projections on a project:

11,000 sq. ft chapel located in NE United States
Weather less harsh than ND
Geology of ground was good conductor (mostly sandstone)
However, in the interest of addressing the intent of the ETL, which is to promote the use of highly efficient GSHP systems where economically justifiable, a qualitative assessment of a geothermal system for the Chapel makes it readily apparent that the economics are not favorable. Assuming a 1.2 MMBH heating plant to match the existing boiler capacity and typical ground conditions for northern New England, approximately 35 bores would be required. Conservatively assuming an aggregate cost of $20,000 per bore including related site work, the bore field alone would cost $700,000. Additional costs for the heat pumps, refitting air handlers with larger coils, modifications to existing piping, removal of existing condensing units, etc., and adding 25% for OH&P, cost of a geothermal plant would easily exceed a million dollars.

The cost of replacement of the existing oil boiler with a new natural gas heating plant is approximately $300,000 including OH&P. Given that the total annual natural gas consumption is anticipated to be on the order of $10,000, and even generously assuming that this cost could be halved, a $5000 annual savings would take 140 years to achieve simple payback. This result is typical of such an assessment. Although geothermal can in some cases be economically justifiable for new construction, it is never so when existing systems are already in place that can be partly reused. This is also consistent with the feedback Oak Point Associates received from the Air Force Energy Office at Tyndall AFB in 2009.

**Items Considered for HVAC Upgrades to Remaining Building**

As specifically requested, the project will include the addition of JCI DDC controls to all existing HVAC equipment which ultimately remains. New equipment will also be controlled by DDC. This is currently anticipated to include the following systems: New boilers and pumps, New Chapel HVAC systems (discussed in previous section), New AHU-4 serving the rear office wing (see below), Refit of AHU’s 2A, 2B and 3 and related baseboard zone valves, two cabinet heaters mostly in the “Narthex” corridor at the rear of the Chapel, Interface with new equipment provided for main lobby and secretary’s office (see below). A water meter connected to the DDC would be provided while installing the new backflow preventer. The DDC would also be used to provide emergency shutdown of HVAC, as discussed in the Force Protection section of this report.
Bad and Good

Overkill design

This could have done the job
Efficient Design

37,000 sq/ft office space CES building at Minot AFB (retrofit construction), 110 workstations and conferences rooms cooled and heated with 39 wells and 3 hp with backup.
In Summary

- One 200 ft of well will generally handle 750-1000 sq ft of cooling and heating a building.
- Estimate 1200 BTU for each worker at his desk using his computer in office buildings.
- Cost savings on energy cannot exceed what the building actually uses in heating and cooling.
- Control systems for GSHP should be 60-70% of the cost of conventional systems.
Summary continued...

- Labor costs should be equal or less than conventional system projects.

- Piping costs should be lower than conventional and far less of it.

- Duct work should be much less.
Thank you and Questions???