Sunshine Coast Regional District
Building Division Policy

Geo-exchange (Geothermal) Systems
for Single and Two Family Dwellings

Subject: The purpose of this guide is to outline the permit requirement for Geo-exchange systems.

Policy:

"This information is provided for convenience only and is not in substitution of applicable SCRD Bylaws or Provincial or Federal Codes or laws. You must satisfy yourself that any existing or proposed construction or other works complies with such Bylaws, Codes or other laws."

Geo-exchange systems are also known as earth energy systems, geothermal heat pump systems, and ground-source heat pump systems. Geo-exchange systems consist of three primary subsystems:

1. Source Side System: the thermal exchange coupling with the earth, also known as the ground heat exchanger (GHX), allows heat transfer between the ground and the heat pump system. In heating mode, heat is extracted from the ground through the GHX. In cooling mode, heat is moved from the heat pump system and transferred to the ground through the GHX.

2. Heat Pump System: equipment using the principles of refrigeration to move heat across temperature gradients (also referred to as heating and/or cooling plant).

3. Load Side System: the distribution system that moves heat throughout the building (generally referred to as the heating, ventilating and air conditioning system or HVAC system).

The temperature of the GHX side varies in response to the “rate” (power) and cumulative “quantity” (energy) of heat extracted from or rejected into the earth, and the earth’s ability to store and conduct heat to or away from the GHX. The resulting GHX temperature variation directly affects the capacity and performance efficiency of the building “load” side of the system.
Therefore, the vast majority of actual geo-exchange applications experience constantly changing earth source temperatures, system capacity and performance efficiency.

This mutual “thermal interdependence” relationship between the building “load” side and GHX side of the system is the most complex. The greatest challenge is to properly size the GHX, so that the GHX temperatures are kept within an acceptable operating range.

Single-Source Responsibility:

Geo-exchange technology requires a thorough “multi-disciplinary” cooperation and coordination throughout the design and installation process. A single source professional responsibility for the entire geo-exchange design, installation and performance greatly improves the chances of a successful system application.

The importance of thorough multi-disciplinary commissioning of the entire geo-exchange system must be emphasized. If parts of the overall system are commissioned independently from each other there is a likelihood that important system integration features may be overlooked or critical commissioning steps may be missed.

The above information is extracts from “Geo-exchange Energy Systems Professional Design Guidelines” and is available at www.geoexchangebc.ca.

Guidelines for Drilling Geothermal Wells:

The geo-exchange systems currently available are generally open system or closed-loop system. The open system is not accepted in Burnaby without a written authorization from the “Ministry of Environment, Water Management Branch, groundwater section”, and must follow the Water Act, Water Protection Act and the Environmental Management Act.

The closed-loop system is mainly constructed of polybutylene or polyethylene pipe in which an “antifreeze” fluid is circulating as a heat exchange/transport medium. Common fluids used include water, calcium magnesium acetate, potassium acetate, sodium chloride and water, potassium chloride and water, ethylene glycol and water, and propylene glycol and water.

Direct exchange (DX) systems use a liquid refrigerant (such as R-22) circulated through copper tubing (or other conductive, corrosive resistant metals) lops, but otherwise operates the same as other closed-loop systems.

Typical “vertical” closed-loop systems are constructed by drilling vertical or directional 4 to 6 inch diameter holes into which the closed loop pipe or tube is installed. The holes are then completely filled with an approved grout or a thermally enhanced grout material. A licensed water well construction contractor must be used to drill, install/construct, and seal the system.

Both heat/pump systems must comply with the “Guidelines for Minimum Standards in Water Well Construction – Province of British Columbia”. The Guidelines can be found at www.env.gov.bc.ca.

Heating Permit Requirements:

Generally, the heating requirements of a regular heating system is built into the cost of a building permit for construction.

No additional heating permit is required for the installation of a heating system, including forced air and hydronic heating, for single and two family dwellings.

There will however be a permit fee upgrade if hydronic or GHX heating systems are contemplated as these systems add to the overall construction value of the building. The value is based on the actual additional cost of the system chosen over and above a standard fuel fired forced air or electric heating system.

If the geo-exchange system is part of the heating system the following requirements should form part of the heating permit application.

In addition to the regular documentation such as heat loss calculation, a heating permit application with geo-exchange system must also include the following documentation signed and sealed by a Professional Engineer responsible for the Geo-exchange System :

1. A statement indicating the type of the geo-exchange system and if it’s vertical or horizontal installation.

2. Drilling contractor’s name and license.

3. A site plan (1:250 scalable drawing) showing the proposed location of the wells, including identification of the construction materials (loops material, type of circulating fluid), system layout, approximate depth of borehole and distance from the property line and any existing service lines or proposed future service line.

4. A description of the proposed grout material to be used to seal the borehole.

5. A schematic diagram showing the geo-exchange system including the heat pump and any back up system required to compensate for the shortfall of the geo-exchange system.

6. Letters of Assurance, Schedule B1 and B2, for the geo-exchange system, taking responsibility including the heat pump.

7. A statement/letter indicating the heating capacity of the geo-exchange system and confirming that the Geo-exchange Engineer has reviewed the heat loss calculation by a heating contractor for the forced-air or hydronic heating system and the geo-exchange system is capable of supplying the required heat for the house with or without a back up system. Heat loss calculations may be required to confirm building heating requirements are in fact met.

Upon completion of the entire geo-exchange system the Geo-exchange Engineer should submit the Schedule C to the inspector.

Please contact the Building Department for any further questions.

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