Central geothermal chillers

A central geothermal system uses the earth as a heat sink and energy source to provide cooling and heating. Unlike a distributed ground-source heat pump system, a central geothermal system uses centrally located chillers instead of small unitary heat pumps distributed throughout the building. This system allows greater freedom of airside system selection as heated and chilled water can be distributed to system coils throughout the building.

Application considerations

- Inputting the entire cooling and heating load is critical for chiller selection and modeling. Include all end-use components such as domestic hot water (refer to “Domestic hot water assigned to a boiler” on page 3–62), dedicated outside air systems (refer to “Dedicated outdoor-air systems” on page 4–45), etc.

- The Building Cool/Heat Demand report shows airside coil loads from the System simulation. The Plant Load Summary report...
shows all loads assigned to the central geothermal chiller system including all end-use components.

Central geothermal systems may have additional pumps. Be sure to include all pumps within Create Plants. If additional pumps are needed, they may be modeled as accessory pumps within Miscellaneous Accessories. The bidirectional cascade system employs condenser and evaporator energy transfer pumps, which are modeled as Miscellaneous Accessories in this example.

**Related reading**

- *Central Geothermal Systems Application Guide* (Trane literature number SYS-APG002-EN)

**Sample scenario**

A central geothermal system uses two RTWD chillers in parallel, each capable of providing 200 tons of cooling and 1870 Mbh of heating. This system is set up as a bidirectional cascade and uses two energy transfer loops with pumps to transfer energy between the chillers during simultaneous cooling and heating.

**Figure 3–21 Two-chiller bidirectional cascade central geothermal system**

The following procedure demonstrates how to implement the cooling plants, pumps, geothermal loop, and heating equipment.
Define the cooling plant by selecting Create Plants in the Project Navigator window.

1. Drag two water-cooled chillers to the cooling plant and click the Cooling Equipment tab.

For each chiller:

2. Select the appropriate equipment type.

3. Pick Parallel as the sequencing type.

4. Enter the cooling capacity (200 tons).

5. Enter the cooling capacity for the chiller when it is in heat recovery mode (1870 Mbh).

6. Specify the full-load energy consumption for the chiller in the cooling mode and in the heat recovery mode.

7. Enter the pump types and full-load energy consumption rates for the chilled water pump and condenser water pump. (If there is no heat rejection device, there would be no condenser water pump.) The bidirectional cascade pumps for the evaporator and condenser energy transfer loops will be entered as miscellaneous accessories in a later step, as will a secondary distribution pump and a borefield pump.

8. Click Controls.

Note: The two chillers are identical. As an alternative, drag only one water-cooled chiller to the cooling plant, follow steps 2 through 14, and then click Copy Equip to create the other chiller.
9 Select the back-up heating plant for Reject heat to plant.

10 Select Ground loop for Reject condenser heat.

11 Click Cooling Plant and Geothermal Controls to open the Plant Controls dialog box.

12 Choose the geothermal loop type by specifying the temperature of the loop entering the building in the TLoop Ent Bldg field.

Note: IGSHPA should only be used for horizontal borefields. Vertical bore requires a separate IDF file to be used in conjunction with the project. The Custom selection in this field requires a separate Geothermal schedule defined in the Schedules Library. When using either IGSHPA or Custom geothermal loop types, plant- or equipment-level thermal storage should be defined to reflect the capacity of the borefield loop.

13 Enter the geothermal loop flow rate, geothermal loop pump type and associated full-load energy rate. Enter Bidirectional cascade as the flow scheme.

14 If a primary-secondary distribution system will be used, enter the secondary distribution pump type and full load consumption rate.
15 Enter the evaporator and condenser energy transfer pumps within the **Base Utility / Misc. Accessory screen**. The evaporator energy transfer pump will be activated when the chiller(s) are in cooling mode, and the condenser energy transfer pump will be activated when the chiller(s) are in heating mode. In simultaneous mode, both pumps will be active. The pumps only need to be assigned to the Cooling Plant using the **Plant** field. To ensure proper bidirectional cascade pump modeling, it is critical to use the standard library members already created for this system (**Evap energy transfer pump** and **Cond energy transfer pump**).

16 Configure the back-up heating water system on the **Heating Equipment** tab by choosing a boiler **type**, **capacity**, **full-load energy rate**, **hot water pump type**, and pump **full-load consumption rate**.