Typical bore field design conditions are 45 F minimum and 90 F maximum. But in the real world, things don’t always go according to plan. When the building puts more BTUs into the ground when cooling than it uses for heating, the building is said to be “cooling dominant” and over time, the bore field can overheat. Conversely, if the building uses more BTUs than are put into the ground, it is said to be “heating dominant” and over time, the bore field can cool below the minimum design temperature.

Overheated bore field temperatures can exceed 120 F. Whenever the bore field exceeds the maximum design temperature, mechanical heating/cooling equipment attached has to work harder, using more energy during cooling operation. MultiGEO is compatible with decentralized, unitary heat pumps, centralized heat pumps and simultaneous heating/cooling chillers such as Multistack’s VME units. The graph below shows the impact an overheated bore field has on the system’s energy consumption.

Yes, you are reading this graph correctly. When the chiller/heater is getting 120 F water from the bore field, the mechanical system is using 62 percent more energy than when receiving 85 F water. And, the compressors are subjected to substantially higher head pressures that can lead to mechanical failures.

In heating, compressor power increases as the bore field temperature drops below design temperature. What causes bore fields to overheat or overcool? Possible causes include:
1) Actual building loads are higher/lower than design
2) Thermal Conductivity (Tc) of the sample bore may not reflect the Tc of the entire bore field
3) A problem with an HVAC component(s). For example, on a job where ventilation air was pre-treated with DX dedicated outdoor air units, the outdoor air units had numerous compressor failures. The outdoor air load was being handled by water source heat pump units with the extra Btu’s going right to the bore field, causing it to
overheat. On this job, MultiGEO made the customer aware of the problem and helped resolve the problem before it significantly impacted building comfort and utility costs.

When dealing with an overheated bore field, the MultiGEO recommendation typically involves adding a closed circuit cooling tower, but any device can be used that will allow MultiGEO to remove unneeded BTUs from the bore field when ambient conditions allow significant BTUs to be removed using a small amount of energy. MultiGEO has used ponds, athletic field watering systems and even sewage storing sumps to shed unneeded BTUs. If over-cooling is the problem a boiler can be used as a source of BTUs but MultiGEO has also used generator water jacket heat, solar, and sewage sumps as a means to provide BTUs to increase bore field temperature.

If you have an overheated bore field, a MultiGEO Rescue Data Collection module is leased for six months and installed on the BAS system. MultiGEO collects flow and temperature data through the BAS system using Modbus, BACnet or LON. After two months a preliminary report is generated for the customer and a final report is issued after six months of data collection, or sooner, if requested. The more data collected the better the results, but in some cases customers don’t have six months available to collect data before implementing recommendations and getting the bore field back under control. The result would still return the bore field to design conditions but maybe a 225-ton closed circuit cooling tower would be recommended versus a 150-ton tower that could have been recommended with a full six months of data collection.

After six months of data collection, the customer has two options:

1) After implementing the report’s recommendations, the MultiGEO Rescue Control algorithms can be purchased and provided via the Rescue Control data collection module that would be left in place. Using the control algorithms MultiGEO has generated in machine-to-machine language expressly for this project will attain the results shown in the final report. MultiGEO then controls the bore field components by sending commands through the BAS system. If connected to the Cloud via remote connection, MultiGEO re-runs the control generating algorithms weekly, using data collected during the previous week, and revises the control algorithms using the new data to optimize system efficiency. Without MultiGEO, the manually generated control algorithms in place at commissioning are still controlling the system until it is replaced. With MultiGEO revising the control algorithms weekly, the system can maintain optimum efficiency over the life of the system.

2) If the customer decides not to implement the recommendations, they simply return the MultiGEO module to Multistack, but they will now know what is causing the overheating condition.

So if you or a customer have a bore field that is operating outside of design conditions, consider MultiGEO from Multistack. MultiGEO can get your system operating within design conditions, reduce energy consumption and improve system reliability.

For more information, contact your local Multistack representative.