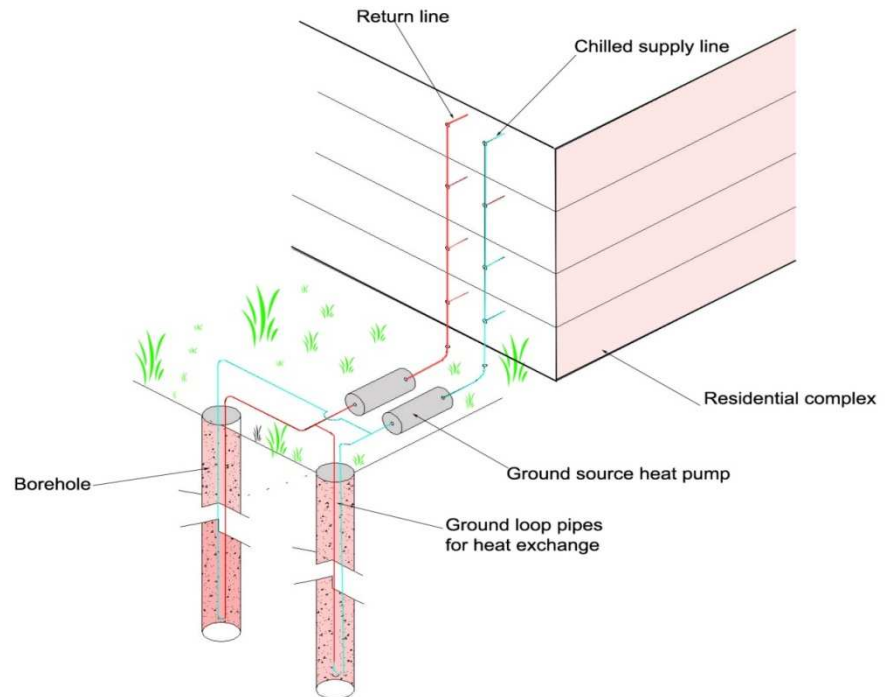


6. Geothermal heat pumps

A. Ground source heat pumps

Geo-Thermal wonder works by taking advantage of the near constant temperature of the earth which exists only a few feet below the surface. For example, when cooling, air-to-air heat pumps and other air conditioning units found in most homes actually remove heat from the air in the building through their compressorized refrigeration mechanisms and move the heat to the outdoors where they attempt to expel it into the air. As summer progresses and the average daytime temperatures raise, these other units find it more difficult to expel this heat into hot air - the system actually loses efficiency and labors to keep up with cooling demands.

In contrast, the Geo-Thermal Heat Pump uses the same type of compressorized refrigeration system to remove heat from the building, but it transfers the heat into the temperate earth and not into hot air. Because it is easier to move heat to the cooler earth than into the sweltering summer air, Geo-Thermal Heat Pumps do not have to work as hard to cool your home. This efficiency has a bottom line - substantial savings reflected in your monthly utility bill.



6. A.1

When heating, the compressor system of the Geo-Thermal Heat Pump uses the heat energy stored in the earth to efficiently heat your home while other heat pump systems are laboring to gather heat from the frigid outdoor air, or are even freezing up. Because Geo-Thermal Heat Pumps utilize such a large amount of



the earth's stored energy, they are typically more efficient than even heaters which burn environmentally damaging fossil fuels.

6. A.2

Ground source heat pump uses ground to reject the heat. Conventional heat pumps (chillers or Air conditioners) reject heat, either to water or air. The ground temperature below 4 m is always constant and it is equal to annual average temperature of a particular geographical location. For Bangalore, the temperature below the earth is 24 °C (Described in EAT section). The ground system links the heat pump to the underground and allows for extraction of heat from the ground or injection of heat into the ground. The system can maintain space temperature up to 22 °C.

Types of Ground source heat pumps

- Vertical Open loop
- Vertical Closed loop
- Horizontal loop

Advantage

- It consumes 70% of the energy compared to conventional highly efficient water cooled chillers
- User can set to any temperature in the range of 18°C to 28°C
- Can work in huge diversity temperature ranging from 10% to 100%
- Able to produce hot water for residents at lower energy cost
- Best suitable for hot and humid climate



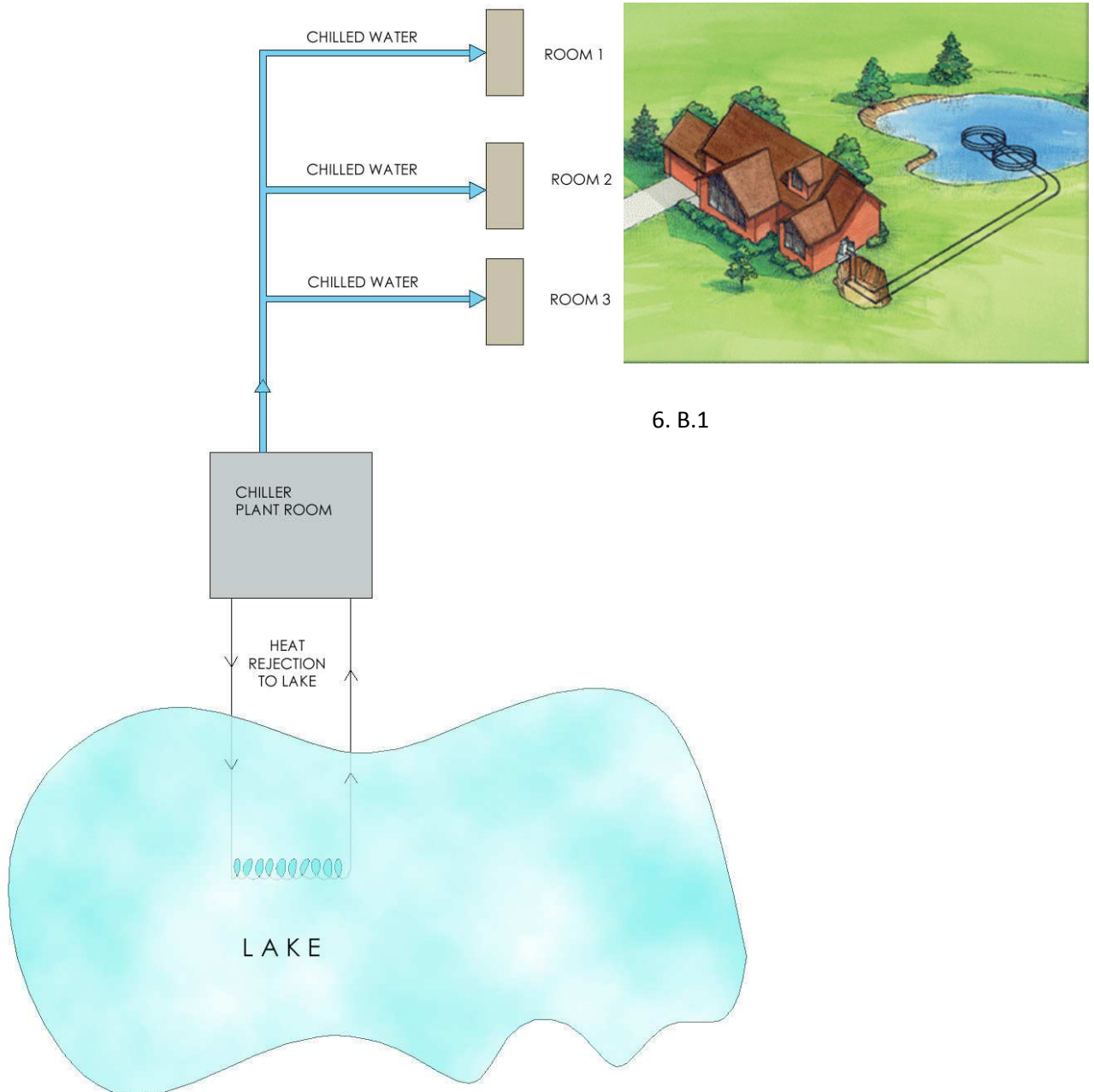
6. A.3



6. A.4

B. Lake Source heat pumps

Lake Source central air conditioning system is an energy efficient system, which uses lake to reject the heat instead of rejecting heat to the atmospheric air. The lake water below the depth of 1.5m is cooler than the outside air temperature and it is very easy for compressor to reject the heat to cooler water than the hot air. This air condition system requires less power compared to other central air condition system available in the world. It consumes 75% of energy of the best energy efficient air condition system available.



6. B.1