



The space and water heating system conceptualized and simulated for the garage and residence consists of two water storage tanks: a solar preheat tank and a main tank.

The preheat tank is heated as much as possible by a fairly typical solar water heating collector. To maintain stratification, water is drawn from the bottom (the tank's coldest point), passed through a solar collector and returned to the top.

The main tank is kept at a temperature suitable for running both the night breeze fan coils (in heating) and for providing domestic hot water (approximately 140F in simulations) by a water-to-water heat pump. The load side of the water-to-water heat pump is connected to the main tank. The source side of the water-to-water heat pump is connected both to the solar preheat tank and to a ground loop. The preheat and main tanks are also directly connected by a piping loop. When the solar preheat tank is very hot, water is directly circulated from the preheat tank to the top of the main tank; water from the bottom of the main tank is circulated back to the bottom of the preheat tank. As the preheat tank temperature falls, direct circulation stops and the heat pump is used to move energy from the preheat tank to the main tank, cooling the preheat tank in the process. If the temperature of the preheat tank falls so far that the heat pump cannot effectively move energy from that tank to the main tank, the heat pump instead moves energy from the ground into the main tank.

Mains water to replace domestic hot water use enters the preheat tank and from there flows into the mains tank. It is assumed that a pump is unnecessary and that mains pressure is sufficient to drive the flow. Mains water is used to temper the domestic water line to 140 F in case the mains tank is overheated. Not shown in the drawing is that return water from the fan coils is used to temper the fan coil supply to 120F.