Learning Goals:

- Learn how a solar water heater works by observing the temperature variations in a real system
- Explain how the system can work without a mechanical pump
- Appreciate that the sun is a free, clean energy source
- Understand that Legionella bacteria can grow in solar water heater under certain conditions

Directions:

Part1: Heating and cooling of the water

1. Choose a 24-hour time period to study and one temperature sensor (T1-T18)
2. Create a plot of temperature for your chosen sensor and time period. Also plot the data for sensors T19 and T20.

Question: What happens to the temperature of the water over the 24-hour period? What is the difference between the *maximum* and *minimum* temperature?

Part2: Heat distribution inside the tank

1. Choose a 24-hour period to study
2. Plot the temperature data for sensors T1-T18 over this period

Question: Which part of the tank contains the warmest water? Which part of the tank contains the coolest water? Which temperature sensor has the coolest temperature?

Part3: Monitoring the water heater for Legionella growth

1. Choose a 7-day period when you expect the outside temperature to be quite warm.
2. Plot the data for the temperature sensor that is located in the coldest part of the tank (use your answer from Part 2)
3. Repeat step 2 for another 7-day period when you expect the outside temperature to be quite cold.

Question: At the end of each 7-day period, were any of the conditions in the Table satisfied?
(to see the **Table of Conditions** go to www.farlabs.edu.au -> Environment -> Elaborate:Solar Water Heater).
Was the water safe to use? If yes, which temperature conditions from the table were satisfied?

Test your knowledge:

1. Why does the temperature of the water rise and fall over a 24-hour period?

2. Why do you think the temperature of the water is not the same everywhere inside the tank?

3. This solar hot-water heater does not have a pump. Explain how water is able to flow between the storage tank and the collector.

4. Would it be better to place the storage tank above or below the collector?

5. Why is black the best colour for the collector?

6. Why was the sensor from the *coldest* part of the tank used to decide whether Legionella bacteria may be present?

7. If there is a water shortage in the community, why is it important that the water in the solar hot-water heater is kept well below 100°C?

8. This solar hot-water heater is located in Melbourne. However, it was designed to be used in hotter areas such as outback Australia. How could you stop the growth of Legionella bacteria in this system in a cooler area like Melbourne.