**Building Science Education Solution Center – Smart Thermostats and Dual Fuel Control**

Proficiency Level 1: Remember

**Learning Objective 1.1:**

* Define what a thermostat is and what it does.

**Lecture Notes 1.1:**

1. What is a thermostat?

Residential Heating Ventilation and Air Conditioning (HVAC) systems such as heat pumps, air conditioners, and electric furnaces are controlled by a thermostat. The thermostat senses the indoor air temperature in a home and commands the heating or cooling system to operate based on the temperature setpoint set by the occupant. The thermostat market consists of many manufacturers and models, ranging from very basic manual controllers to smart or connected thermostats that can be controlled remotely and learn occupant behavior.

2. What are the different types of thermostats?

Manual thermostats are the simplest type of thermostat which controls the home temperature to a given setpoint and the setpoint does not change until the user manually changes it at the thermostat. The thermostat may operate in heating mode, cooling mode, or may automatically transition between heating and cooling using separate heating and cooling setpoints (dual setpoints).

Programmable thermostats allow the user to program automatic setpoint changes throughout the day. The time resolution with which the setpoint may be scheduled varies across the industry. For example, a programmable thermostat may allow the user to define a different schedule on every day of the week or only allow separate schedules for weekdays and weekends.

Smart or connected thermostats are connected to the home internet network, typically though a wireless connection, but may also be wired. The network connection enables several features: (a) the thermostat may be controlled remotely via an online portal or mobile application, (b) the thermostat may obtain outdoor weather conditions, and (c) the thermostat may upload data to a remote server.

Learning thermostats are a subcategory of the smart/connected thermostats that are able to gather data and make data-driven decisions. For example, if enabled, a learning thermostat will learn an occupant’s preferred temperature setpoint.

**Problem Set 1.1:**

1. A thermostat is used to open and close the windows and doors.

True or False.

2. A thermostat controls the operation of the heating and cooling based on a temperature setpoint defined by the occupant.

True or False.

3. A smart thermostat connects to the internet and can be controlled remotely.

True or False.

4. A programmable thermostat allows you to set up schedules for different times and days throughout the week.

True or False.