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The Instructional Value of SHW Manipulatives

Presented By:

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Wyman has a B.S. degree and over 10 years experience in environmental engineering field and 8 years experience in sales for a national magnetics manufacturer. In addition to her sales activities at SunDog Solar, she evaluates market potential for renewable energy technologies, prepares grant proposals for renewable energy demonstration projects, presents to both public and technical audiences and works with elected officials to promote the renewable energy agenda.

Abstract

Solar thermal equipment is large and sometimes heavy, making it difficult to transport into a classroom setting, however hands on demonstrations are crucial to student comprehension. Unlike photovoltaics, where a functioning system can be presented in a classroom, solar thermal systems do not lend themselves to being contained in a small space. Adding to this difficulty, in traditional solar thermal systems, much of the internal functions of the systems are enclosed by tanks and hidden by copper tubing.

Manipulatives, in the form of visual models, have been proven to help students solve problems and develop concepts to increase comprehension faster and more thoroughly than learning subjects without the use of manipulatives. Using a scaled down (but functional and operating) mobile solar thermal system as part of a solar thermal installation class allows solar thermal teachers to demonstrate a fully functioning system within the confines of a classroom with no loss of system ability.

The functional model is made with clear tanks and piping. Utilizing this equipment allows the students to see how the heat exchange fluid moves through the solar loop and see where the heat exchangers are located in the tanks and how they interact with the domestic hot water and the heat exchange fluid. The unit can be used outside or inside (with a heat lamp) to provide Btus to the system, allowing the students to see how orientation effects the energy collection.

The Rover model demonstrates how thermal supplies are created, through the use of solar thermal collectors that collect the energy, tanks that store the energy and pumps to move the energy from one place to another. The Pup model (also a fully functioning portable model) shows how thermal loads are distributed; in the domestic hot water system, through radiant floor heating systems and forced hot air systems.

Challenges of Teaching SHW

- **Equipment**
- **Expense**
- **Weather**
- **Time**
- **Skill Sets (Reading Schematics)**

Advantage of Teaching w/ Manipulatives

- **Students can see the effects of orientation on production.**
- **Students see how fluid moves through the solar loop.**
- **Students can feel and touch real equipment while it's operating.**
- **Students can adjust valves and sensors and see their effects on the system.**

Orientation

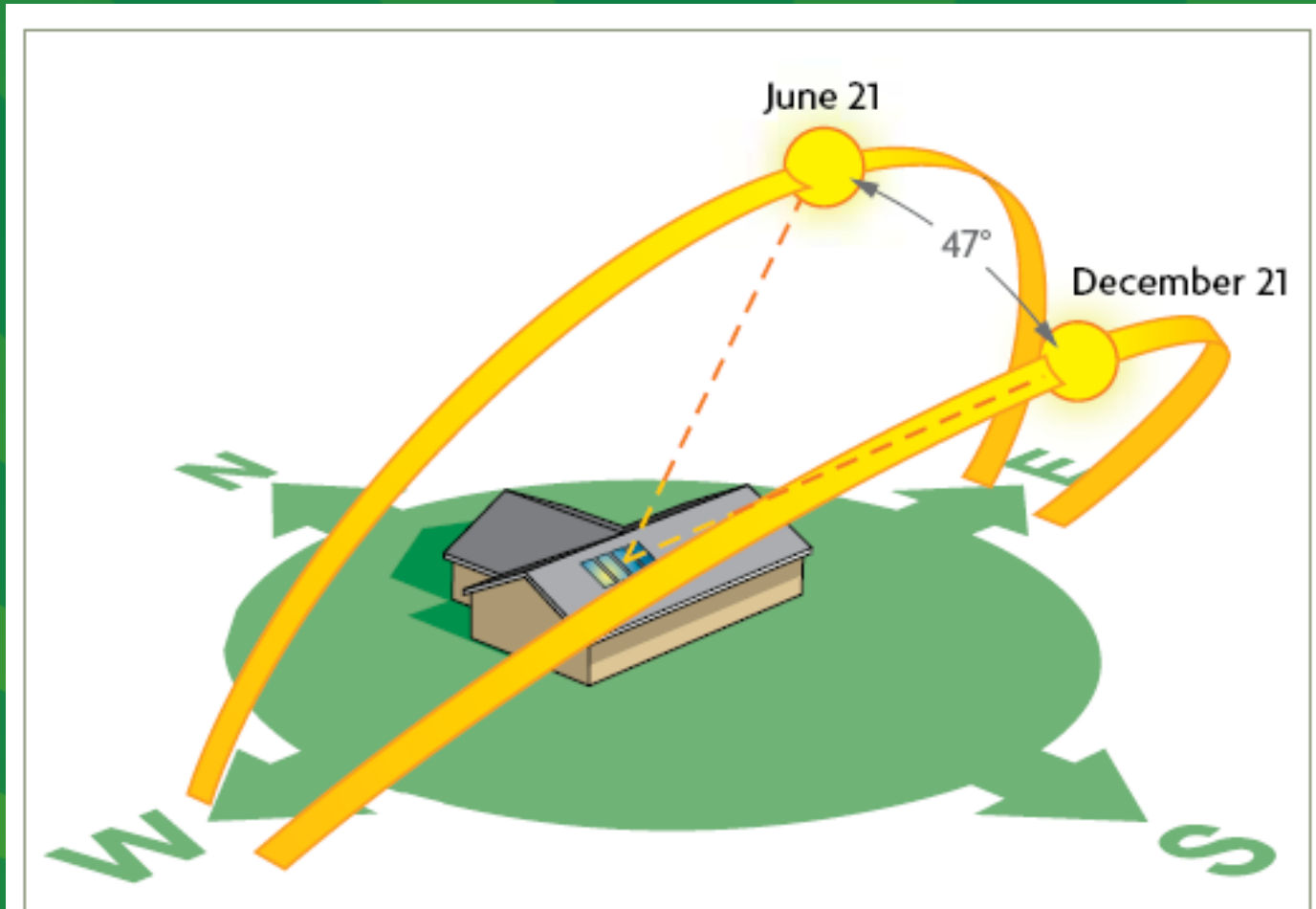
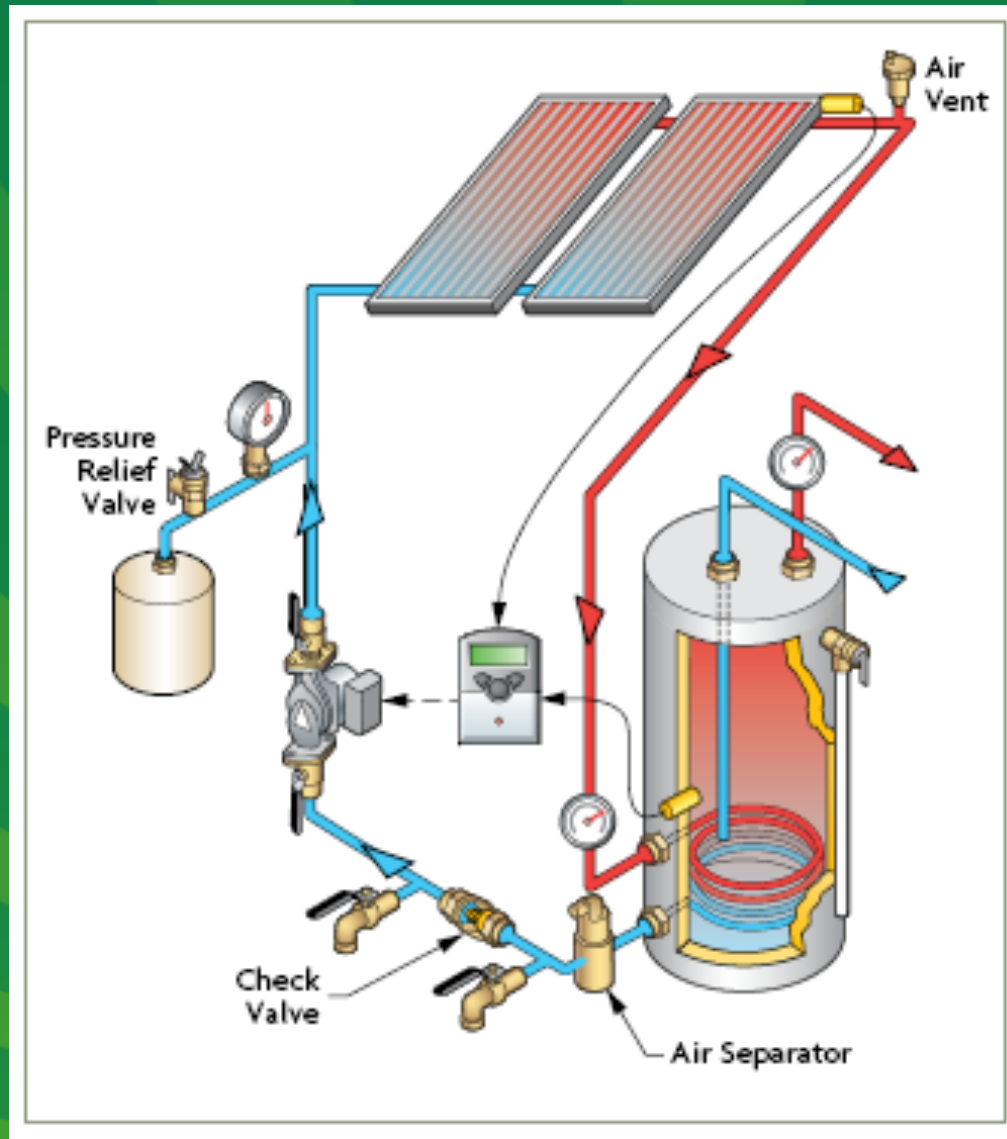
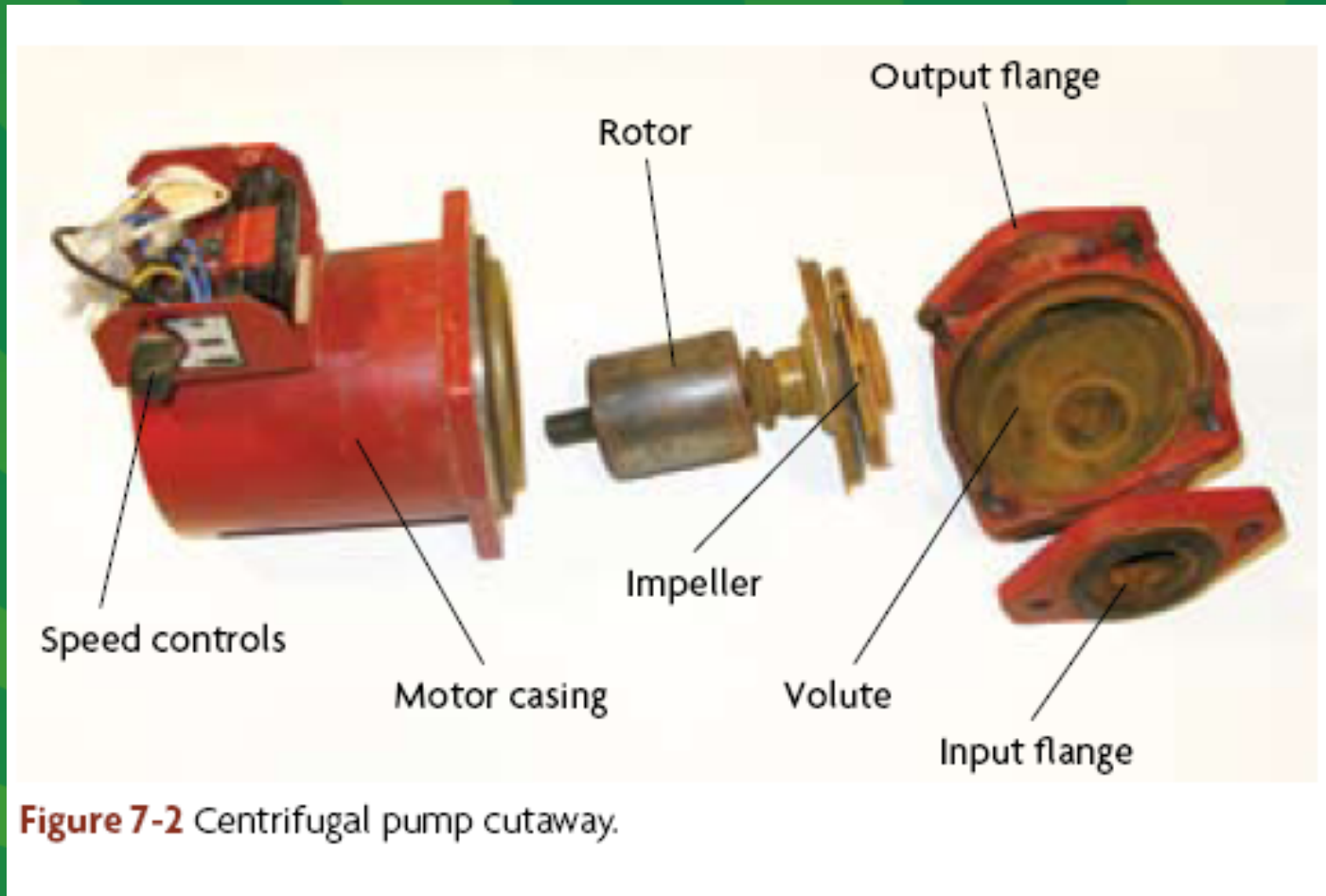


Figure 1-5: Seasonal Sun paths.

Schematic of CLP System



Cross Section of A Pump



Example of Digital Controller



Figure 10-2: Resol digital controller.