Studies in Solar Water Heating at Solar Dynamics Ltd.

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Background

Solar water heating is a booming industry in the Caribbean. Managed by Mr. James Husbands, Solar Dynamics Ltd. has been in the forefront of the industry since its formation in 1974. Their association with the Barbados Interdisciplinary Tropical Studies (BITS) program has enabled a team of three engineering students from McGill University the chance to work alongside Mr. Husbands and his company to try to improve the efficiency of the water heating systems.

Design

A combination of fieldwork, research, and application has allowed the group to take great experimental steps in towards a superior design. The objective was to redesign a tank with greater heating efficiency; in turn enabling the production of a smaller solar water heater. This will result in the reduction of building materials and ultimately cut down on expenses and energy consumed by the Solar Dynamics Ltd. business.

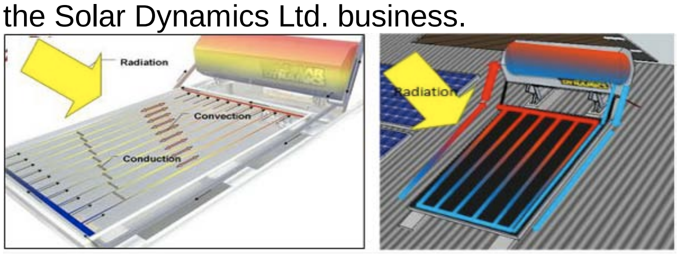

Figure 1: A demonstration of the existing Natural Convection System currently used at Solar Dynamics

With the guidance of Mr. James Husbands, the engineering team was able to select two areas of design improvement to focus on. The primary option selected was a double-glazed solar panel. This was used in the past by Solar Dynamics but only for theoretical purposes and never formally assessed for experimental data. The BITS program students also developed a second prototype. The focus for this prototype was on increased startup heating efficiency. The design behind the idea was a heat-collecting panel with added copper piping. This would increase the surface area where heat conduction would occur from the copper to the water. It would also open additional pathways for water to flow through, enhancing the pace of the convection current flowing within the panel.

Applying the Science

After gaining hands-on experience in the field with the technicians from Solar Dynamics, the group of students commenced construction. It was agreed that the double-glazed panel would be completed and tested and the additional copper piping design would follow. Several days were put in at the Solar Dynamics workshop to complete the copious amount of welding, riveting and metal forming required to build a panel.

Figure 2: Matt completes a weld on the copper of the second prototype

Working directly alongside the technicians at the company headquarters allowed us to gain a thorough understanding of the workings of both the panels and the tanks comprising the systems.

This allowed for an educated hypothesis regarding the outcomes from the two prototypes that were created. It was predicted that the double-glazing would have superior insulative qualities, rather than increased rates of heat absorption. The quality of increased heat absorption was predicted for the panel designed with more copper tubing.

The completed prototypes were brought to the Bellairs Research Institute for testing, where the team observed temperature levels and rate of change. The experimental results were documented and graphed for their comparison to theoretical calculated data.

Figure 3: The prototypes undergo tests at Bellairs

Outcome

It was observed that the experimental data matched the hypothesis that had been put forward by the team of students. The double-glazed panel saw improved rates of heat retention, while the additional copper pipes directly increased the system's heating capacity and efficiency. The concept of applying extra pipes to the panel was considered to be a success in particular, since the rate of heat capturing and therefore efficiency was increased. This met the main objective of the project.

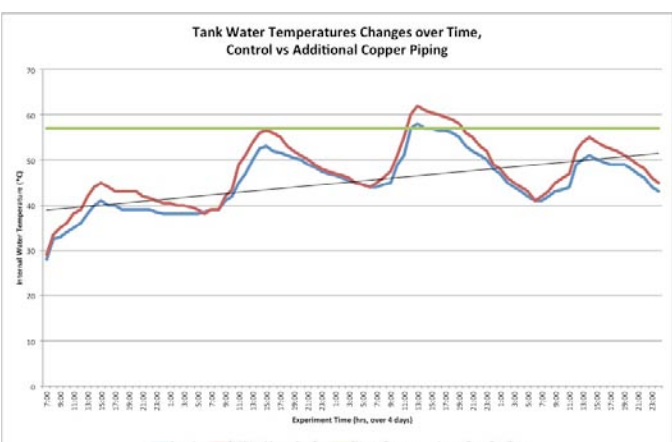

Figure 4: Tank Water Temperature Changes Over Time, Additional Copper Piping vs. Control

Acknowledgements

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