

Energy Saving and Economic THERMOSORBER

As reported in our March 1, 2006 news release, a "Thermosorber" has been installed at a poultry processing plant in central California. This technology provides hot water and chilled water at roughly double the energy efficiency and half the cost of any conventional technology. The \$180K installation provides approximately \$110K per year savings in natural gas and electric utilities.

The ThermoSorber produces both chilled water and heat pumped hot water from a single heat source. It is powered by the same steam which otherwise would make the hot water, but with two important differences. First, instead of the 98% efficiency of a steam hot water heater, the ThermoSorber achieves 156% efficiency in converting steam to hot water, due to the heat pumping action. Second, the chilled water produced by the ThermoSorber is energy-free.

VISION

Natural gas has the latent ability to provide much useful effect: heating, chilling, and/or power. However, simply burning it to make hot water wastes much of that ability. Applying the natural gas heat to an ammonia water absorption cycle to make both chilling and heat pumped hot water derives twice as much benefit, i.e. it doubles the (Second Law) efficiency.

With cost share assistance from the National Energy Technology Laboratory, Energy Concepts developed a prototype of such an absorption cycle, calling it the "THERMOSORBER". In need of support for a field demonstration, Energy Concepts turned to the CEC Food Industry Energy Research (FIER) program, which graciously funded a demonstration of a 10-ton prototype at a small poultry processing plant, plus a monitoring program on a much larger unit.



OBJECTIVES

The objectives of this project were to demonstrate both the energy savings and the economics of the Thermosorber in a commercial-scale setting. The 10-ton field demonstration prototype funded by FIER has now operated for over three years. However it only operates about five hours a day, five days a week, and only at about half capacity, due to limited hot water needs at the host site. Hence it was not a convincing demonstration of the ability of Thermosorber to save substantial amounts of energy, and to reduce CO2 emissions. A larger scale demonstration was initiated, at a world-class poultry processing plant. This demonstration runs at twenty times higher capacity and four times more operating hours, thus demonstrating eighty times as much annual energy savings. The California Energy Commission provided cost share assistance to monitor operation during three summer months, plus analyze and report the results.



METHODS

A Thermosorber rated for 100 tons of chilling was designed, fabricated, and installed at a poultry processing plant in the Central Valley. It began operation in January 2006. The Thermosorber prechills 110 gallons per minute of 70°F city water to 50°F, enroute to the continuous chiller bath. It also preheats 120 gallons per minute of 70°F city water to 120°F, enroute to the continuous scalding. It is powered by 75-psig steam.

This Thermosorber operates 21 hours per day, five days per week. It is designed to cycle on and off automatically, whenever there is a demand for both chill water and hot water, as indicated by level switches in respective water storage tanks. For the first several months of the demonstration, the Thermosorber had to be manually started each Monday morning, and then it cycled automatically the remainder of the week. An automated cold start capability was added in July, and it now operates with automatic cycling and without operator attention. Several other modifications were found necessary over the first four months of operation, for example the addition of a water booster pump, since city water pressure varied from 5 to 50 psig.

RESULTS

At the design rating of 100 tons, the Thermosorber supplies 3.2 million BTU/hour hot water heating and 100 tons of cold water chilling, from a steam input of two million BTU/hour. This installation achieves 100-ton capacity when the city water pressure is high. The water pressure is usually restricted during plant operation, and the overall average capacity has been 92 tons.

Another unanticipated benefit has been due to the increased capacity of water heating and chilling. This has relieved occasional bottlenecks, thus allowing increased production.



The installed cost of this system was less than \$200,000. PG&E provided an incentive payment for a portion of the cost, proportionate to the savings in natural gas. At design conditions and at the prevailing Central Valley utility rates, the projected annual utility savings are \$130,000.

IMPACT

Because it saves both natural gas and electricity, the economics of the Thermosorber are not affected by the “spark spread”. Many applications achieve a two year payback, plus much-reduced energy bills. The savings apply in just about all-low temperature heating scenarios: water heating, space heating, drying, etc. The energy savings can be further increased by powering the Thermosorber from engine waste heat, or from solar thermal heat. The reduced energy consumption also reduces greenhouse gas emissions.

About Energy Concepts Co. LLC

Energy Concepts Company (ECC) is a research and development company which is dedicated to the development and commercialization of new absorption technology for practical solutions to pressing world problems. ECC has been in operation for over 30 years in Annapolis, Maryland. ECC has a proven track record of performing recognized innovative work, and tempers that with highly practical engineering know-how to ensure overall useful products.

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