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SOLAR THERMAL REDUCES HOT WATER EXPENSES FOR ASIAN BUFFET RESTAURANT

ENEREF INSTITUTE EXAMINES AN ASIAN BUFFET RESTAURANT USING UTILITY SOLAR THERMAL REBATE TO REDUCE HOT WATER EXPENSE.

The success of the Buffet@Asia restaurant chain in Las Vegas rests on high volume. All three locations are packed from ten in the morning until ten at night, offering virtually endless choices of Asian dishes at exceptionally low

prices. The wide variety of food at the all-you-can-eat buffet naturally brings with it an enormous amount of dishes to clean throughout the day. On a busy day, each Buffet@Asia washes approximately 20,000 medium-sized plates.

YOU CAN USE LESS GAS AND YOU CAN SAVE MONEY, TOO. WHY NOT?

AARON CHEN | *Restaurant Owner*

As part of our Efficient Heating and Cooling initiative to reduce energy use, Enerref Institute interviewed a number of stakeholders on the recently installed solar thermal hot water system on three Buffet@Asia restaurants in Nevada.

The three buffet restaurants have benefited from the increasing popularity of the city's growing Asian area. "When I came in 1990 there was no Chinatown," said Professor Bob Boehm, Director of the Center for Energy Research at the University of Nevada, Las Vegas. "But now, you'd be utterly amazed."

LARGE HOT WATER DEMAND

Despite today's relatively low natural gas prices, hot water consumption is a large component of Buffet@Asia's energy expenses. For restaurant owner Aaron Chen, any opportunity to reduce expenses means staying competitive and having the ability to continue offering reasonable prices for a loyal customer base. So when Dave Zheng, solar entrepreneur, suggested the installation of a solar water

heating system to lower energy costs, Chen was skeptical but interested in what Zheng had to say.

Zheng, an electrical and electronics engineer, made an assessment of Chen's hot water usage. Zheng was so confident the restaurant would save money with a properly-fitted solar water heating system he offered the restaurateur a money back guarantee.

To incentivize the restaurant's investment, a rebate was available for solar water heating installations, with a natural gas backup, from Southwest Gas, lowering the final cost of the installation under the utility's *Smarter Greener Better*® Solar Water Heating (Solar) program. Zheng incorporated the rebate when calculating the potential savings for Chen.

HOW THE TECHNOLOGY WORKS

Unlike the more common solar photovoltaic (PV) energy systems, which are designed to generate electricity, solar water heating systems use the sun's energy to heat water. Much the

same way the sun heats water in a garden hose on a hot day, the sun's energy can also heat water using solar collectors.

Solar water heating systems generally utilize either flat plate collectors (large shallow boxes) or long cylindrical vacuum tube collectors. Each offers their advantages, although flat plates have a much longer history. In fact, many flat plate systems installed in the 1980s are still in operation today. However, regardless of which type of solar water heating system is used, most installations require conventional resources, such as natural gas or electricity, as a backup or to supplement.

The technology Zheng designed and installed for the three Buffet@Asia restaurants used vacuum tube collectors; the system heats the restaurants' potable water on the roof and delivers it to a hot water storage tank near the kitchen.

Because of seasonal changes throughout the year, solar thermal technology employs various systems to detect potential freezing during cold months or overheating during the summer months. Zheng employed sensors to measure the water temperature, which activate control mechanisms to provide



VACUUM TUBE COLLECTORS

The system heats the restaurants' potable water on the roof and delivers it to a hot water storage tank near the kitchen.

freeze protection and safeguards against overheating. Furthermore, since the restaurant is busy seven days a week, hot water is constantly moving through the system, making overheating and freezing unlikely.

Professor Boehm was impressed enough with the vacuum tube collector system that he installed Zheng's solar water heating system at his Nevada home.

"I think that they are a very elegant solution," said Boehm, whose experience in energy use reduction dates back to his days

at UC Berkeley, where he earned his Ph.D. in 1968.

Solar water heating systems are rated by the amount of energy they produce under an assumed set of operating conditions. Based on a rating provided by the Solar Rating and Certification Corporation (SRCC), the eight collectors in the Buffet@Asia system have the potential to save about 158 cubic feet of natural gas per day. That's the heat content—or the potential heat that can be generated from the fuel—of about 1.6 therms. Natural gas companies usually bill in therms.

THE SYSTEM INSTALLATION

In each of the restaurants' configurations, eight collector panels were installed on the roof at a 30° angle, each with eighteen vacuum tubes. One panel requires about one hour for installation. Typically, the amount of hot water needed by a building—the load—determines the number of collectors. Boehm's residential system, by comparison, is only one-eighth the size. Zheng sized the system to maximize energy performance while factoring in the space limitations on the roof.



FACT

**BUILDINGS ACCOUNT
FOR 39% OF CO₂ EMISSIONS
IN THE UNITED STATES.**

*U.S. buildings produce more CO₂
than any other country except China.*

IN NEVADA, SOUTHWEST GAS OFFERS A REBATE TO CUSTOMERS WHO INSTALL SOLAR WATER HEATING.

The Southwest Gas incentive program provides rebates to qualifying Nevada customers who install solar water heating systems with a natural gas back-up.

Because the amount of available thermal energy from the sun changes from moment to moment, often an installation warrants a solar site analysis to predict the best angle and location to position collectors. Zheng's solar analysis yielded a water temperature in the collectors of between 130°F and 160°F.

In addition to the restaurant's pre-existing 130-gallon natural gas-heated water tank, Zheng installed two new additional 100-gallon solar storage tanks, which are connected to the rooftop solar collectors. To find space for the two new tanks, the restaurant removed several shelves in the kitchen area. The new solar-heated tanks feed hot water directly into the natural gas-heated water tank, greatly reducing the restaurant's reliance on natural gas water heating.

SEA-Group also managed the permit process with the City of Las Vegas for the installation. Upon completion, city inspectors verified the system met local building codes.

The restaurant remained opened and operated as usual during the installation and the system has been online without interruption since September 2013. "We did

not need to turn off the water because the solar system was able to be isolated," said Zheng. "They did not even know we were there." The installation was completed within one week.

RESULTS EXCEEDED EXPECTATIONS

All in all, each restaurant location was able to utilize \$7,500 in Southwest Gas energy efficiency rebates towards the cost of installing the solar water heating system, amounting to \$22,500 in total savings. The solar water heating systems are estimated to save each restaurant location about \$300 per year on their natural gas energy bill.

Although restaurant owner Aaron Chen was skeptical at first, he was happy with the installation of his new solar thermal water heating systems, knowing that it would amount to greater savings in the long run for all three of his restaurants.

"You can use less gas and you can save money, too. Why not?" said Chen.

To qualify for the utility rebate, businesses must employ a contractor listed on the Southwest

Gas Solar program website. Installations require pre-approval from the utility and a final inspection when the project is completed. The amount of the rebate allowed is calculated from the potential energy savings for each installation.

Restaurants are a good fit for solar water heating, and many across the U.S. have already adopted this technology, which is already quite common in both Europe and Asia.

The benefits of solar water heating also extend to other businesses that require large hot water demands. As with restaurants like Buffet@Asia, a solar water heating system can help offset energy usage with an abundant renewable resource and can amount to significant cost savings.

Research and reporting compiled and provided by Eneref Institute.



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