The 2009 American Recovery and Reinvestment Act—and the potential rebates and incentives supported by its stimulus package—has served as a catalyst for a new consumer mindset on energy-efficient appliances and sustainable living. This has ignited consumer interest in alternative and renewable energy sources by increasing the affordability of ultra-efficient water-heating systems, including tankless, solar and the emergence of a new generation of heat-pump water heaters.

The HVACR marketplace is witnessing a convergence of technologies, resulting in more efficient equipment that can serve a wide range of applications. And while solar water-heating has the longest history—it was first introduced in California in the 1890s—it continues to lead the way as contractors and technicians find more ways to turn consumers “on” to the power of the sun.

Solar on the rise
The Energy Policy Act of 2005 included the first Federal tax incentive for solar water-heating in nearly 20 years. Through 2016, homeowners can now receive a tax credit of up to 30% of the total installed cost of a solar water-heating system. [Editor’s Note: For more information on EPAct and how it can benefit commercial properties, check out the Tech Tips section of Cooling Down on pg 38.] While no official reporting body for residential solar water-heating systems exists, before 2006, an estimated 6,000 solar water-heaters were installed each year—with roughly half of those systems installed in Hawaii. According to the Solar Energy Industry Association, that number jumped to approximately 20,500 installations in 2008, with tax credits from Federal, State and local governments playing a large role in the increase.

In addition to these generous tax breaks, increasing numbers of State and local governments, as well as utilities, are promoting the use of solar water-heaters through incentive-based programs. These initiatives, coupled with rising energy costs and a growing awareness of the environmental benefits associated with solar, have contributed to significant growth for the sector over the last three years.

While solar water-heating systems may appear complicated, the technology is actually quite simple. Sunlight is collected and converted to heat energy by a solar collector. This heat energy is then transferred from the solar collector to water in a storage tank, where it is stored until needed.

Some homeowners may be more familiar with photovoltaic technology, which is sometimes used to power cell phones, calculators and other home electronics. PV systems convert light into energy and are generally able to yield only 14%–18% useable energy. Conversely, solar water-heaters use solar thermal technology. Solar thermal-collectors are able to convert about 70% of the sun’s heat into useable energy.

The right solar system
When helping a homeowner select the right solar water-heating system to satisfy their needs, it is important to understand the two main types of solar water-heating systems: passive and active.

In a passive system, the transfer of heat occurs naturally, without pumps and controls, requiring the tank to be installed on the roof adjacent to the solar panels. Passive
systems are simple and efficient—there are no moving or mechanical components. And, since they do not incorporate freeze protection, they are best suited for warm, sunny places such as Hawaii or Florida.

In an active system, a pump and control transfer the heat from the solar collectors to the storage tank, which can be located in the garage, mechanical room, basement or attic. This is the most widely used system type in the U.S., largely due to aesthetics. Installed professionally, the collectors in many cases can look similar to a skylight.

In North America, one common misconception about solar water-heating is that these systems only work in warm climates—such as the Sun Belt—when in reality, depending on the system configuration, they can be installed in virtually any climate. Case in point: Austria—a country with a climate similar to Minnesota—has roughly six times the number of solar water-heating systems installed annually compared to the U.S.

Active systems can utilize several different methods of freeze-protection. The two most common types are antifreeze and drainback systems. In an antifreeze system, the heat-transfer fluid is normally a glycol and water mixture, an antifreeze solution that also is used in newer cars or to de-ice runways. The glycol-to-water ratio varies depending on the minimum expected temperature. In a drainback system, the water in the collector loop drains into a reservoir tank when the pumps shut off, ensuring there is no fluid in the collectors—and therefore no freezing. Installing a drainback system requires special attention to the piping’s slope to ensure the water completely drains.

Once the type of system is determined, system configuration is the next consideration. Two general system configurations exist within active and passive systems: open loop and closed loop. An open-loop configuration uses water as the heat-transfer medium and circulates it directly between the collectors and storage tank. Open-loop systems are most commonly installed in Hawaii and southern Florida, as they offer limited freeze protection. To prevent freezing, closed-loop systems utilize a heat-transfer fluid that is circulated between the collectors and a heat exchanger located in, on or around the tank.

Solar water-heating systems typically come with a backup heat source, such as a gas tank water-heater, to ensure hot water is available during inclement weather conditions or heavy hot-water usage. In most cases, however, the system is used to preheat another water heater, either a tankless or tank-type water heater.

Depending on location, a solar water-heating system should provide between 50%–85% of the consumer’s hot-water needs, averaged over the course of the year, with the remainder provided by the backup. Additionally, an individual solar water-heating system annually saves more than 3,000 lb of CO2 offset.

Installation Considerations
All solar water-heating systems should be installed by a qualified professional, and should be preceded by a site survey to determine the size and location for the system. Performing a site survey includes visiting the property and reviewing a number of important variables with which a trained, professional installer is familiar.

Going solar should not require a lifestyle change in hot-water usage, so the solar and backup systems need to be selected and sized to fit the specific customer’s needs. To properly size the system, solar installers always should conduct a homeowner-use and expectation audit to determine the customer’s current hot-water needs, any unique requirements, and any anticipated changes. Additionally, the installer should assess with the homeowner the best available location and space for the primary storage tank and backup systems. Tankless water-heaters are a good high-efficiency backup-system option for homes with limited space available.

“The HVACR marketplace is witnessing a convergence of technologies, resulting in more efficient equipment that can serve a wide range of applications.”
Several factors related to the roof structure also must be assessed for the installation site—including the roofing material, which determines mounting method. An optimum location is on a sunny, south-facing roof, since the collectors work best when angled towards the southern sky.

While not part of the site survey, checking local codes, regulations, and homeowner association covenants is an equally important task to do before the installation. Different areas may require additional considerations such as engineered drawings, architectural preview guidelines, or requirements based on seismic or wind activity.

As 2010 approaches, the installation of solar water-heating systems continues to pick up momentum. With growing consumer awareness of rising fuel prices and the environmental footprint of home appliances, solar water-heating is becoming an increasingly attractive and important product option to help contractors profitably grow their business, while offering customers one of today’s hottest home-comfort products.

Jeff Mahoney is the Alternative Energy Market Manager for Rheem. Mahoney is responsible for helping Rheem meet the continually growing consumer demand for residential solar water-heating solutions. For more information, e-mail jeff.mahoney@rheem.com.

**By Andy Fracica**

With eco-conscious consumers looking for environmentally friendly alternatives to traditional heating and cooling systems that offer higher efficiencies and smaller carbon footprints, geothermal energy is providing opportunities for unprecedented growth to contractors already in or positioned to enter the market. Homeowners installing renewable-energy systems—such as geothermal or solar—are eligible for Federal and, in some cases, State and local government tax incentives; and many power and electric utilities also are offering rebates. In addition, some geothermal manufacturers offer dealer financing plans to help make these systems even more attractive and affordable—as do the savings of up to 70% on heating, cooling and hot-water costs. Selling and installing geothermal systems does not have to be complicated, provided contractors follow five simple steps along the way.

1. When planning a geothermal installation, remember that even the most energy-efficient equipment cannot deliver the anticipated savings if it is improperly sized. With today’s two-stage, high-efficiency equipment, sizing is not as critical as it is with single-stage versions. Still, undersized equipment may run longer than necessary on the second stage, sacrificing efficiency and compromising comfort; while oversized equipment is likely to cost the homeowner more money up front and in the first stage will tend to cycle on and off more frequently—resulting in inefficiency and marginalized comfort. Proper sizing begins with heat-gain/heat-loss calculations that consider everything that impacts a structure’s heat-gain/-loss. Geothermal loop size also is important; the loop must be properly sized to the equipment, the type of soil and the climate. Many geothermal manufacturers have software designed to help with sizing calculations, and some offer contractors geothermal-design and energy-analysis software to help generate designs and proposals for residential or light-commercial projects.

**HVACR contractors who subcontract drilling work should team with a drilling company that is IGSHPA certified.**

Readers who want to see the rest of these tips can view the full article at the new www.rsesjournal.com homepage on the completely redesigned www.rses.org Web site in mid-December.

Andy Fracica is the Director of Marketing for WaterFurnace International Inc. For more information, e-mail andy.fracica@waterfurnace.com.