



Economic Development and Retail Services Department

March 23, 2009

Solar Heating

What is solar energy all about? How does it work? How much do I need? How much does it cost? What is the payback? How can it benefit me? These are common questions frequently asked and most people are pleasantly surprised by the answers.

Solar energy takes advantages of the sun's rays not only to generate electricity but also to produce heat. When considering solar for residential, commercial and industrial use, there are three distinct applications to consider:

- Electricity Generation
- Heating Hot Water
- Air Heating

Each application uses different types of panels, or technology to produce energy.

Solar photovoltaic panels are comprised of semiconductor material such as silicon arranged as a series of cells to produce electricity. In layperson terms, electrons move across the cell when activated by the sunlight's energy. The electrons, referred to as DC current, move into an electrical circuit within a solar panel. Several panels are wired together as circuits or strings. These strings are then wired into an intelligent device called an inverter which converts the DC current to AC current for use in the building or home through the circuit-breaker panel.

Solar hot water panels are composed of copper or aluminum tubing encapsulated in a panel covered by tempered glass. The sun's energy heats the surface of the collectors to produce heat in the panel. The heat is removed from the panels using a glycol solution or water, which is pumped through the panels. The heat is then transferred into a hot water tank, thus heating the hot water. Solar hot water systems can be used to heat a hot water tank or to warm a home's radiant heating system. Swimming pools and hot tubs use a modified solar hot water system for heating water. In general there are three types of solar collectors to choose from for hot water heating:

1. Flat- plate
2. Integral collector-storage (ICS)
3. Evacuated- tube collectors

Solar air heating panels are comprised of a dark painted transpired metal (metal surface with holes) encapsulated in a panel covered by tempered glass or exist as an add-on on a wall surface. The sun's energy heats the surface of the collectors to produce heat in the panel and cool air is circulated over the panel by fans to transfer the heat into a home, or building.

To effectively use solar energy you must have a clear southerly exposure on your home, or building - no shading from trees or other building. A certified solar professional can evaluate your site for the proper application of solar.

Determining System Size

Determining the size of any system to meet your needs initially requires a review of your utility bills, electric and gas, for the last 12 or 24 months. This reveals your energy usage pattern and allows for initial system sizing. The size of a system is correlated to your home's energy-use needs, available space for a system, and overall costs for the system components and installation. If investing in solar is practical, the next step would be to set up a site survey, which allows for a detailed analysis for installing a system and an assessment for energy efficiency improvements.



Cost

The cost of the system depends upon the application and usage.

- Solar Photovoltaic Systems are the most expensive of the three applications. For example, A 3 kWh solar electric system will produce 3,937 kWh a year, which represents about 25 – 35 percent of the average home's usage in the KC area. Installation by a licensed professional will cost approximately \$27,000 - \$30,000. Generally, the industry costs out systems based on cost-per-watt, in this case \$9 - \$10 a watt. That total includes the cost for all components - solar panels, panel mounts, and inverter - and labor associated with installation. Tax and permits are not included. It does not however, reflect all the avoided costs, such as the tax breaks and the credits received through net metering.
- Solar Hot Water Systems are the second most expensive application. For domestic solar hot water heating for a home with four occupants, the installed cost of a system by a licensed professional would be \$8,000 - \$10,000. Radiant floor heating applications are considerably more and depend upon the size of the home. Pool heating systems are practical and dependent upon the size of the pool.
- Solar Air Heating Systems are the least expensive. The installed cost for a panel intended to heat between 600 - 800 ft ranges from \$2,700 - \$3,000.

Payback

The payback period for solar energy systems is influenced by tax credits and state incentives. As of January 1, 2009, through December 31, 2016, homeowners who purchase Solar Photovoltaic systems will enjoy a one-time full 30 percent federal tax credit as an incentive. The State of Kansas does not currently offer a tax credit. Businesses receive the same 30 percent federal tax credit, as well as the benefits of depreciation of a 5-year modified accelerated recovery schedule. (Review IRS forms 3468 and 5695 for more details). Assuming the installed cost of a 3 kW system is \$30,000, the federal tax credit would be valued at \$9,000. This reduces the cost basis of a system by 30 percent. Factor in the cost of energy and inflation; the simple payback period for a system would range from about 19 - 21 years for a residential system and 18 - 12 years for a business. That's a big improvement over the 28-year payback without incentives.

Solar hot water systems purchased by homeowners currently enjoy a \$2,000 tax credit and this will continue to December 31, 2016. A pay back for solar hot water heating systems will be approximately 8 - 10 years. Businesses receive a full 30% tax credit as well as the benefits of depreciation of a 5-year modified accelerated recovery schedule. Typically, business pay back periods will be 5 - 8 years.

Solar air heating systems for residential applications offer the best payback period, typically 4 - 6 years. There are no tax credits or incentives for this application. However businesses can take advantage of a full 30 percent tax credit - as well as the benefits of depreciation of a 5-year modified accelerated recovery schedule - are available. Business payback periods will range 4 - 6 years as well.

Benefits - Increase Home Value

One additional benefit to consider is added value to a home. According to the National Appraisers Association, for every \$1 of annual energy savings, the value of a home increases \$20. So homeowners who save between \$300 and \$500 a year in electricity costs could see their home's value jump \$6,000 - \$10,000.

Remember solar energy, or fuel for these systems is free! It is an infinitely renewable resource and unique for its ability to generate energy in a quiet, clean and consistent manner.

To sum it up, solar energy systems add to the value of your home or building and enable you to reduce your carbon footprint. These are benefits we can all live with.