

Solar Energy

Overview

The sun is the primary source of energy on planet Earth. You already use it to provide light and warmth directly into your home. You can increase your use of this clean, free, renewable energy by installing photovoltaic (PV) panels and solar thermal collectors to heat water or generate electricity on-site, reducing your dependence on grid-supplied energy. PV and solar thermal systems are eligible for Federal tax credits, State sales tax exemptions and other incentives. The price of PV panels has fallen significantly in recent years, making this an attractive investment opportunity.

When is This Applicable?

A solar energy system can be installed on almost any new or existing residential, commercial or agricultural property. You need a location that gets direct, unfiltered sunshine for most of the year. Systems are typically mounted on a south-sloping roof where load and height limit regulations must be considered, but other locations and orientations may be workable.

What Makes it Green?

Solar energy systems will reduce your utility bills. They produce clean energy that helps meet County greenhouse gas reduction goals. Solar energy systems that include battery storage can reduce or even eliminate your dependence on the electrical grid, making them attractive for home sites with no existing power supply, and locations that are prone to electrical power outages.

Solar energy systems can earn additional credit in Built Green, LEED for Homes, Passive House and other green building rating systems.



Best Practices

CONSIDERATIONS AND EXAMPLES FOR SOLAR ENERGY SYSTEMS FOR YOUR PROJECT

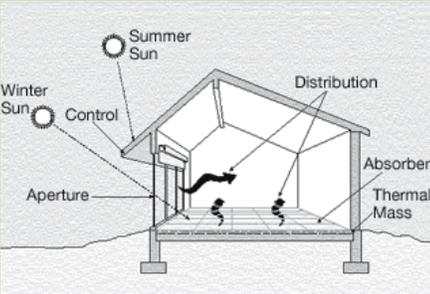
System Type	Considerations	Benefits
<p>Solar Photovoltaic (PV) Panels absorb the sun’s energy and convert it into direct current (DC) electricity, which can be stored or converted into alternating current (AC) electricity (using an inverter) for use in your home.</p> <p>There are two main types of PV panels – rigid crystalline panels tend to be more efficient at converting solar energy to electricity; thin film PV is lighter, more flexible and generally cheaper, but less efficient.</p>  <p><i>Solar PV system being installed on a metal roof. Source: Studio Hamlet Architects.</i></p> <p>In recent years, the simple payback for a solar PV system has improved dramatically, from about 20 years to less than six years today, and costs are still declining rapidly.</p>	<ul style="list-style-type: none"> • PV systems producing AC current can be connected to the electricity grid through a utility net-metering arrangement which allows you to “sell” electricity to the grid when you have a surplus, and “buy” electricity from the grid when you need more than you can produce. • DC systems typically store electricity in on-site battery banks. Stored electricity can be converted from DC to AC before use in a home that is also connected to the grid. Some off-grid homes use DC throughout the house, but this limits lighting and appliance options • The capacity of a PV array is typically defined by “Peak Wattage” – a measure of maximum energy output in standardized test conditions. A typical panel is about 15 square feet in area and is rated at 250 to 300 Peak Watts. • Actual PV output depends largely on roof design, including available space, angle and orientation to the sun, amount of shading, and hours of sunlight exposure. For King County, an easy rule of thumb is that one 250 Watt PV panel with good exposure will generate about 250 kWh per year. • In late 2014, PV panels cost about \$1 to \$1.50 per Peak Watt. Installed cost is roughly three to four times the panel cost, for an average total cost in the range of about \$3 to \$6 per Peak Watt. 	<p>A solar electric system produces clean, renewable energy for almost no cost, once the system is installed.</p> <p>A grid-connected system can be optimized to give you the best output during the summer months, while letting you use utility electricity during the winter. If you produce more than you consume, your electric meter will literally run backwards.</p> <p>In addition to the sales tax exemption (available through June, 2018) Washington State also pays you a “production incentive” of almost three times what you pay for electricity (with some restrictions, and expiring 2020 – See Solar Washington for details)</p> <p>PV panels are very durable and have low maintenance requirements.</p>

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<p>Solar Thermal Collectors or Solar Water Heaters absorb and collect the sun's radiant heat and transfer it to a hot water system.</p> <p>There are two main types of collectors: "flat plate," and "evacuated glass tube." Flat plate collectors tend to have lower initial cost and are more durable. Evacuated glass tube collectors are more expensive, however they are generally believed to generate more heat in King County's cloudy weather.</p>  <p><i>Flat Plate solar thermal collector. Source: EPA</i></p>  <p><i>Solar Thermal Collection on Williams Apartments. Source: Plymouth Housing.</i></p>	<ul style="list-style-type: none"> • In King County, solar thermal is a good choice for domestic water heating, especially in multifamily buildings, but less effective for space heating because solar thermal is most efficient in the summertime, when space heating is not required. • In addition to solar collectors, you will also require a larger than average, well-insulated combined solar/electric tank water heater, or a separate "solar pre-heat" tank to store your heated water, before running it into the regular water heater. • Select a reputable solar installer who will properly assess your needs and the site's best solar assets, size and design your system. Make sure they tell you what scope is included in their bids. • Typically, the payback for solar thermal is longer than solar PV. <p>Go Further:</p> <ul style="list-style-type: none"> • In some "net zero energy" projects, where value is not only measured in dollars, solar thermal collectors may be used to capture and store summertime heat in the ground. A heat pump (see Heat Pumps) is then used to move that heat into the house in the winter. 	<p>Solar thermal collectors are very efficient, moderately priced and have long service life with moderate maintenance.</p> <p>The best application for solar thermal is for domestic hot water heating. A standard sized system can reduce an average household's water heating bill by 50 percent.</p>



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<p>Passive Solar Design</p> <p>Passive solar design is a heating concept used for centuries. In its current form, it typically involves a very efficient thermal envelope, with most glazing facing to the South or South west, to collect heat from the low angle winter sun, with deep horizontal shading to shade it from the summer sun. Inside these windows, a large thermal mass (such as a concrete slab floor or masonry wall) is used to buffer heat gain and store daytime thermal energy to keep the house warm at night.</p>  <p><i>Diagram of passive solar principles.</i> Source: Wikipedia.</p>	<ul style="list-style-type: none"> • With a passive solar design, you will still be required to install a mechanical heating system as a back-up. If the design performs well, the back-up heating will rarely be required. For this application, a simple efficient system, such as a ductless heat pump, will give you the lowest operating cost, but low-cost electric resistance heaters may be more cost effective overall because of the small annual demand. • Well-designed passive solar homes in King County can meet 60 percent to 80 percent of their annual heating loads with solar only. • Some passive solar techniques can be utilized with existing homes, such as increasing thermal mass, or smart use of window shading devices (leaving blinds open during the day and closed at night, for example). • To get the best out of a passive solar home, the occupants must be actively involved in tuning and adjusting shading devices and other controls to get optimum performance. 	<p>In the right location, with good solar access, careful planning and design, quality construction and an active approach to tuning the home to the changing weather and occupant numbers and needs, a passive solar home can provide thermal comfort at moderate initial cost and low energy bills.</p>



Applicable References/ Standards

Bulletin 36: Mechanical Permits FAQs

Resources

For the complete King County Green Building Handbook and individual Green Sheet PDF files, please visit our website at: <http://kingcounty.gov/property/permits/publications/greenbuild.aspx>. For additional information, please email dperwebinquiries@kingcounty.gov or call 206-296-6600.

See these related DPER Green Sheets (GS):

- Insulation, GS Number 13
- Right Sizing Heating/Cooling Systems, GS Number 17
- Roofing Materials, GS Number 4

PSE Rebates and Offers: This provides information for current Puget Sound Energy rebates.

Solar Water Heaters: This Department of Energy site provides additional information for system type, storage considerations, and installation and maintenance details.

Solar Washington: This nonprofit organization works to advance the solar industry in our state. Provides information on financial incentives for installing solar.

Office of Energy Efficiency & Renewable Energy Solar Photovoltaic Resources: This site contains a plethora of information, cost estimates, market data, and resources.

Permit Tips

Solar energy systems must comply with applicable fire, electrical and plumbing code requirements. The following tips provide additional considerations to smooth your permit application and inspection process.

- For solar thermal or PV panels, you will need to engineer the roof for dead loads of the panels (meaning their weight) and note the information on your plans. Many systems do not exceed the standard dead load limits for roof design;
- Talk to a plans examiner and permit review coordinator **before** submitting your application.
- Certain solar panel installations are exempt from obtaining a building permit (reference K.C.C. 1602)

