

Solar Energy Systems

Updated Aug. 19, 2009

This Client Assistance Memo (CAM) was developed jointly by the Department of Planning and Development (DPD) and Seattle City Light (SCL), to ensure that the two types of solar energy systems most commonly used in Seattle, electric and hot water, are installed safely and provide maximum benefit to the owner.

In 2008 the City of Seattle was named a Solar America City, one of 25 cities across the country working to accelerate the adoption of solar energy technologies for a cleaner, more secure energy future. The many benefits of solar energy systems include:

- Lower energy bills and energy conservation.
- Clean energy production that helps meet greenhouse gas reduction targets and climate action goals.
- New economic opportunities and green jobs.
- Power from secure, local energy.

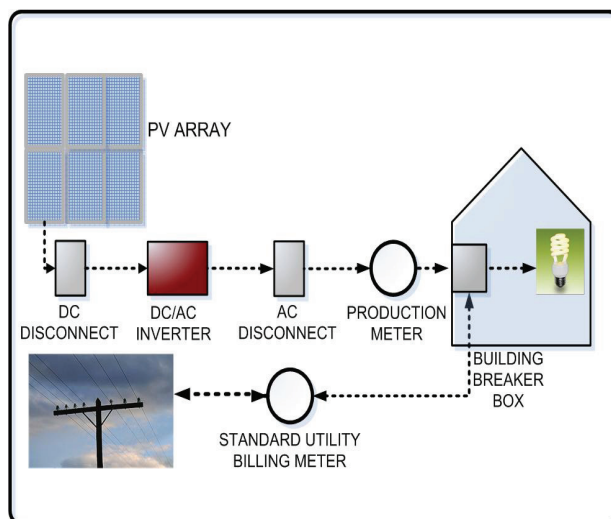
In addition to this CAM, more detailed information on solar access, sizing to fit your project's needs, and performance, is provided in SCL's Guide to Installing a Solar Electric System available at www.seattle.gov/light/solar. Much of the information in the guide is applicable to both solar electric and hot water systems.

Solar Electric (Photovoltaic)

Solar electric systems can displace a portion of utility power used to meet home or business electricity needs. Solar electric systems may be operated independently (off grid) or they may be interconnected to the grid. Off grid systems require storage for a back up battery. A grid connected, customer-owned generation system is operated parallel to the SCL electricity distribution system for the purpose of offsetting part or all of a customer's electricity needs.

Net metering refers to an interconnected customer generation system with a meter that reads the net difference between the customer's electricity generation and electricity consumption. Any excess electricity generated by the customer during a billing period is credited to the customer. Seattle City Light offers a net metering program for interconnected systems up to 100 kilowatts (kW). Figure 1 shows the basic solar electric system components.

Figure 1: Typical utility interconnected solar electric system



city green building

Building a Better Seattle

The Green Building Client Assistance Memo (CAM) series is just one of many resources designed to help you build green and create value for your project from initial concept planning to permitting, construction and operation. To learn more, please visit www.seattle.gov/dpd/greenbuilding.

www.seattle.gov/dpd



City of Seattle
Department of Planning & Development

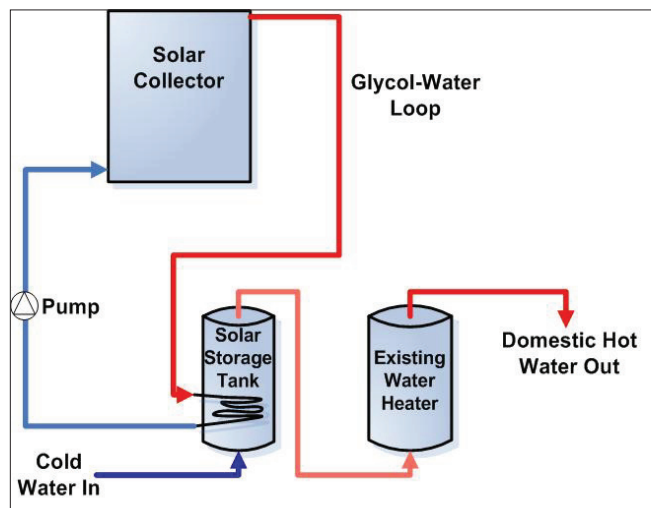
700 5th Avenue, Suite 2000
P.O. Box 34019
Seattle, WA 98124-4019
(206) 684-8600

Solar Hot Water (Thermal)

Solar hot water systems can similarly displace some of a home or businesses' energy needs for heating hot water. Augmenting your conventional water heater with a solar hot water system is an environmentally sound way to reduce your electric or gas bills. Figure 2 shows the basic solar hot water system components.

A residential solar hot water system sized to meet 100 percent of summer needs will meet about 30-50 percent of total annual hot water requirements. Your existing water heater can be used as a backup system to ensure you always have hot water, even on cloudy days.

Figure 2: Typical Solar Water Heating System



PERMIT REQUIREMENTS

In general, the person installing the solar system obtains any required permits. For specific information applicants should contact the DPD's Applicant Service Center (ASC) at (206) 684-8850 or www.seattle.gov/dpd/asc.

Building Permit

Building permits may be required for solar energy systems when:

- Weight is 1,000 pounds or more (a 2 kW photovoltaic system appropriate for a small household weighs approximately 500 pounds and a typical two collector residential solar hot water system weighs approximately 300 pounds).
- Installation is structurally complex (as determined by DPD).

- Solar projects that require stand alone support structures, or are part of building alterations or additions, valued over \$4,000 (not including the value of the solar equipment).
- Project is for a commercial or industrial application.

Electrical Permit

Electrical permits are required for all solar electric systems. Electrical permits (no plan review) for systems up to 26kW may be obtained online, or at the Over-the-Counter (OTC) permit area of DPD's Applicant Service Center (ASC). Electrical systems over 26kW require plan review. Permit fees will vary depending on the size and complexity of the system. Technical questions may be directed to DPD's Electrical Technical Support at (206) 684-5383.

Seattle City Light requires an Interconnection Application and Agreement, which is conditional on final approval of your electrical permit (see Interconnection and Net Metering Requirements on page 5).

Plumbing Permit

A plumbing permit is required when installing a solar hot water system. Plumbing permits are approved and issued by Seattle/King County Health Department Staff. County staff are available at DPD's ASC.

LAND USE REQUIREMENTS

The following information is excerpted from the Seattle Municipal Code (SMC), but does not substitute for complete information provided therein.

In general, alterations and additions to existing buildings must be permitted and conform to lot coverage, height and setback (yard) requirements described in the Land Use Code. Solar collectors are permitted outright as an accessory use. This means the collectors are incidental to and support the principal use of the lot, such as a home or business. Solar collectors are defined as "any device used to collect direct sunlight for use in the heating or cooling of a structure, domestic hot water, or swimming pool, or the generation of electricity" (SMC 23.44.046).

The following information summarizes how solar systems fit in with land use and zoning requirements.

General Height Requirements

In Single Family and Residential Small Lot zones, solar collectors may be mounted to extend up to 4 feet above the zone's height limit, or extend up to 4 feet above the ridge of a pitched roof. However, the total height from existing grade to the top of the solar collectors may not extend more than 9 feet above the zone's height limit (see CAM 220).

In the Lowrise (multifamily) zone, and Commercial and Neighborhood Commercial zones with 30- or 40-foot height limits, and most shoreline-designated areas, solar collectors may not extend more than 4 feet above height limits (additional height for pitched roofs may not be counted in this measurement). In most other nonresidential zones and the Midrise and Highrise zones, solar collectors may extend up to 7 feet above height limits. However, in the nonresidential zones listed below, additional flexibility is provided.

Additional Height Flexibility for Solar Collectors in Nonresidential Zones

Applicable zones: Industrial, Commercial, Neighborhood Commercial, Downtown, Special Review Districts, and Seattle Mixed zones; Urban Harborfront and Urban Stable shoreline-designated areas

- Because many rooftops in nonresidential zones include a variety of mechanical and architectural features, solar collectors are treated just like those features. Solar collectors may extend up to 15 feet above the maximum height limit, so long as the combined total coverage of the rooftop features do not exceed 25% of the roof area when typical features (such as elevator penthouses) are present. If rooftop features exceed the 25% roof coverage, solar collectors may only extend 7 feet above maximum height limits, except in the Seattle Mixed zone.
- Additional height flexibility is available in the Seattle Mixed and Downtown zones, when screening and design considerations are met. Refer to SMC 23.48.010E and 23.49.008C for details.
- In the Special Review Districts such as Pioneer Square or the International District, solar collectors may extend to meet the height limit or exceed the roof height by 7, 8 or 15 feet, depending on whether various setbacks and rooftop coverage limits are met, subject to review by the District's Board. Refer to SMC 23.66.140 for details.

Protecting Solar Access of Property to the North

In the Single Family and Residential Small Lot zones, a solar collector exceeding the zone height limit must be placed so that it does not shade the property to the north on January 21 at noon any more than a structure built to the maximum permitted bulk for that zone. For assistance in determining solar exposure, please see CAM 417, *Sun Chart: Determination of Solar Exposure*.

In most other zones, the applicant shall either locate a solar collector at least 10 feet from the north edge of the roof, or provide shadow diagrams to demonstrate the lack of additional shading on January 21 as described above. However, this is not required in Downtown or Industrial zones.

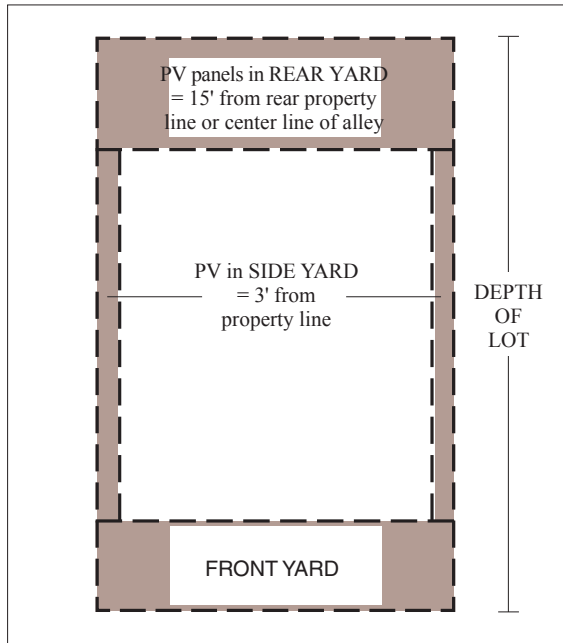
Setback and Yard Requirements

Solar collectors may be located in yards according to the following conditions (see Figure 3):

- Solar collectors are not permitted in a front yard, except for greenhouses that are integrated into the principal structure.
- In Single Family zones, in a rear yard, up to 15 feet from the rear property line. When there is a dedicated alley the solar collector may up to 15 feet (10 feet in Residential Small Lot zones) from the centerline of the alley.
- In a Single Family zone, in a side yard, up to 3 feet from the side property line.
- In Multifamily zones (Lowrise, Midrise, Highrise), solar collectors must be setback 3 feet from the side property line and 5 feet from any principal or accessory structure. The solar collectors in the rear setback must be a minimum of 5 feet from any principal or accessory structure.
- In Commercial and Neighborhood Commercial zones, solar collectors must be set back 5 feet from any principal or accessory structure. Where a lot line abuts a residentially zoned lot, such as Single Family or Multifamily, the required setback is a minimum of 3 feet.
- Other zones do not have specific yard-related setback requirements for solar collectors. However, applicants having projects in Special Review Districts (including Pioneer Square and the International District) should consult with the regulations in SMC 23.66.140C and 23.66.332C for setbacks when solar collectors are rooftop features.

- For additional information about regulations pertaining to greenhouses and sunshades in Multifamily zones, please refer to SMC 23.45.146.

Figure 3: Solar module setback requirements



Lot Coverage Requirements

Solar collectors do not count as lot coverage if minimum standards are met, including but not limited to height and setback requirements. CAM 220, *Lot Coverage, Height and Yard Standards for Homes in Single Family Zones*, provides details and illustrations.

Nonconforming Residential Uses

A solar collector may be added to the existing principal building on a nonconforming residential lot without forcing the entire building to be brought up to current code standards (SMC 23.42.106).

DESIGN AND INSTALLATION CONSIDERATIONS

Solar Access and Performance

For optimal solar performance your collectors should be in a location that has clear unobstructed access to the sun (free of shading from roofs, trees and other landscape features) for most of the day and throughout the year. During a site evaluation, a solar contractor should evaluate potential collector locations using

a tool like a Solar Pathfinder that illustrates annual shade impacts.

Rooftop Structural

For rooftop installations, provide a stable and durable connection to the roof structure for the size and weight of the components used. Take extra care to ensure a leak-proof installation. For unusual, complicated, or heavy installations, consult an experienced building contractor or structural engineer.

In some circumstances, engineering documents may be required to address issues of weight and wind shear if the solar energy system is surface mounted on a flat roof.

If you are unsure about the structural integrity of your roof, or if it is in need of repair, have it professionally inspected to verify its condition and suitability. It may be necessary to make roofing improvements prior to mounting solar modules.

Electrical

A safe electrical connection of solar equipment to an existing electrical service requires careful consideration and planning. Modifications to branch circuit wiring or the panel board may be necessary. A photovoltaic breaker must be connected to the breaker furthest from the main breaker. Information about all changes to the electrical system must be included in the electric permit application. Be sure to follow all manufacturer installation instructions.

All components of the solar electric system, such as photovoltaic modules and inverters, must be listed by a nationally recognized testing laboratory. Article 690 of the National Electrical Code has requirements specific to Solar Photovoltaic Systems. Seattle City Light's Interconnection Standards specify electrical requirements in greater detail.

Building Integrated Photovoltaics

Solar collectors can be incorporated into building materials such as roof tiles, shingles and insulated glass frames. These materials are known as building-integrated photovoltaics (BIPV). Often, these types of materials cost more than simple solar modules, but the cost of BIPV materials can be offset by the cost of ordinary materials that would have been used, and are no longer needed. Further discussion of BIPV applications is beyond the scope of this memo, however, there are resources listed at the end of this CAM that offer further information.

INTERCONNECTION AND NET METERING REQUIREMENTS FOR SOLAR ELECTRIC SYSTEMS

Net Metering Benefits and Options

The advantage of interconnection compared to solar electric systems operated independently of a utility grid, is that customers on the grid are assured of electricity needs being met year round regardless of solar availability and the size of system installed. Any excess electricity generated by the customer during a billing period is credited back to the customer. In addition, a battery-less, interconnected system avoids inefficiencies and maintenance costs associated with battery storage.

Subject to inspection, customer-owned grid connected generating systems (solar, wind, biomass, hydro and fuel cell systems), 100 kW or less, qualify for SCL's Net Metering program.

Net Metering Required Forms

To connect to SCL's grid, an Interconnection Application and Agreement is required. The agreement holds SCL customers accountable for meeting specific interconnection standards and safety requirements. Customers are solely responsible for the proper installation and operation of solar electric systems. The system installation and operation must conform with all applicable codes, regulations and manufacturer's safety and operating manuals.

CHOOSING A CONTRACTOR

Although individuals with the necessary construction and electrical experience are not prohibited from installing their own solar electric systems, using a licensed contractor is highly recommended. Considerations for selecting qualified contractors are:

- Do they have a business license?
- Are they licensed for the work you want them to do (mechanical, electrical, structural, etc.)?
- How long have they been in business?
- How many solar energy systems have they installed?
- Will they provide references?
- Have they attended manufacturer, trade association, or other training on solar electric installations?

Please check the Washington Labor and Industries website to learn more about the listed contractor, licensing status, violations, etc.

The North American Board of Certified Energy Practitioners (NABCEP) runs a quality credentialing and certification program for renewable energy professionals. In order to be NABCEP certified, a practitioner must meet installation experience requirements, sign a code of ethics and pass a four-hour exam. Look for the NABCEP seal on contractors' websites. More information about NABCEP and a list of certified installers can be found at their website.

Resource: Labor and Industries: www.lni.wa.gov/TradesLicensing/Contractors/HireCon

NABCEP: www.nabcep.org

A complete bid for a job will include the total cost of getting a system up and running, including all equipment, wiring, installation, grid connection, permits, sales tax, and warranty.

FINANCIAL INCENTIVES

Federal Tax Credit

Individuals and businesses that install solar energy systems are eligible for a federal tax credit of 30% of the system cost (the total of installation and materials). Individuals use Residential Energy Credits IRS Form 5695 and businesses use the Investment Credit IRS Form 3468. Updated forms can be found on the IRS website, www.irs.gov. For questions on the tax credits please consult your tax advisor.

State Sales Tax Exemption

Beginning July 1, 2009, solar electric systems are eligible for a partial reduction or exemption from state sales taxes, depending on the system's size and year of installation. Consult your contractor for details on this tax exemption. The tax reduction/exemption is scheduled to expire June 30, 2013.

Washington Renewable Energy Production Incentive

As of August 2006, Washington State provides financial incentives for electricity generated from renewable energy resources. Eligible electricity producing renewable energy sources include solar, wind and biomass. The incentive is based on the total number of kilowatt-hours of electricity generated between July

1 and June 30 (or the closest regular billing cycle) of the following year.

Customers who want to receive the incentive must have a SCL production meter installed.

Customers with eligible generation systems certified by the Washington State Department of Revenue will qualify for annual incentive payments as follows:

- \$0.15 /kWh for a PV system with no “Made in Washington” components
- \$0.18 /kWh for a PV system with a “Made in Washington” inverter
- \$0.36 / kWh for a PV systems with “Made in Washington” panels
- \$0.54 / kWh for a PV systems with “Made in Washington” panels and inverter

The program is capped at \$5,000 per year per customer and expires in 2020. Further information and application forms are available at www.seattle.gov/light/solar.

FURTHER ASSISTANCE

In addition to reading this CAM, you may visit DPD’s Applicant Services Center to discuss with a permit specialist or land use planner specific code requirements and installation considerations for your project prior to beginning. General solar-related questions can be directed to the SCL Conservation Helpline at (206) 684-3800.

DPD Applicant Services Center and Public Resource Center

Permit application and issuance, plan review, permit history, publications, self-help computer terminals.

20th floor of Seattle Municipal Tower
700 Fifth Avenue
(206) 684-8850

www.seattle.gov/dpd/asc
www.seattle.gov/dpd/prc

DPD Publications

www.seattle.gov/dpd/publications

- CAM 220, *Lot Coverage, Height and Yard Standards for Homes in Single Family Zones*
- CAM 316, *Subject-to-Field-Inspection (STFI) Permits*

- CAM 417, *Sun Chart: Determination of Solar Exposure*
- Director’s Rule 13-2002, *Solar Collectors: Eligibility Criteria and System Efficiency Requirements*

SCL Conservation Resources Division

Information on renewable energy programs, as well as technical assistance and financial incentives for customers interested in improving home or business energy efficiency and saving money on their electricity bill.

Residential and small businesses (Conservation Helpline): (206) 684-3800

Medium and large businesses: (206) 684-3254
www.seattle.gov/light/conserve

SCL’s solar homepage lists all necessary interconnection and incentive forms and applications, including the Interconnection Application and Agreement and Interconnection Standards:
www.seattle.gov/light/solar

SCL Service Centers

Interconnection and net metering assistance

SCL North Service Center

(for projects north of Denny Way)
1300 N. 97th Street
(206) 615-0600

SCL South Service Center

(for projects south of Denny Way)
3613 Fifth Avenue South
(206) 386-4200

Northwest Solar Center

A program of the WSU Cooperative Extension Energy Program, the Center provides solar energy resources and educational opportunities.

(206) 396-8446
www.northwestsolarcenter.org

Solar Washington

The local chapter of the American Solar Energy Society, which promotes the development of solar and renewable energy through education and training. Events, articles, newsletter and links are posted on the web.

www.solarwashington.org

US Department of Energy

Energy Efficiency and Renewable Energy

This division of the Department of Energy has a focus on enhancing renewable and sustainable energy production. Their web site provides a wealth of information and links to information on types of energy, state information, funding and a consumer guide.

www.eere.energy.gov

Energy Star

Energy Star is a joint program of the U.S. Department of Energy and the U.S. Environmental Protection Agency, providing consumer information on energy efficient products and practices.

www.energystar.gov

Access to Information

Links to electronic versions of DPD **Client Assistance Memos (CAMs), codes and forms** are available on the "Publications" and "Codes" pages of our website at **www.seattle.gov/dpd**. Paper copies of these documents are available from our Public Resource Center, located on the 20th floor of Seattle Municipal Tower at 700 Fifth Ave. in downtown Seattle, (206) 684-8467. Additional information on education, incentives and technical assistance to help you build green, please visit **www.seattle.gov/dpd/greenbuilding**.