

Making Your Home Ready For Solar Water Heating

During construction or a major renovation, making a home ready to use solar energy can be easy and inexpensive. When the time comes to install your solar water heater, a few preparations now can save you hundreds of dollars and will ensure that your system will provide maximum energy savings.

Many types of solar energy systems are available in Canada: solar water heating, solar space heating, and solar photovoltaics. This document is a guideline for packaged solar domestic hot water systems that conform to or are certified to CSA CAN F379.1-88 (R2004) (liquid-to-liquid heat transfer SDHW systems). These systems provide approximately 50% of the hot water requirements for a typical family home of 2-6 occupants.

This Guide has been designed for homeowners and renovators who are doing a major home renovation and for architects, designers and builders who want to provide their customer the option of using solar water heating in the future. CanSIA has a brochure for builders which outlines the marketing advantages of building Solar Ready Homes – this is available at www.cansia.ca/solarready.

Basic Solar Design Issues

Unfortunately not all existing homes are suitable for a solar water heater. It is estimated that shading and improper roof orientation eliminate about one out of every four current homes from using this clean, renewable energy source. If you are building a new house then you are fortunate as you can ensure that your home has maximum solar potential.

Making your home Solar Ready involves preparation in three areas of your home:

- The roof - where the solar hot water collectors will be installed;
- The utility room – where the controls and solar hot water tank will be installed;
- The pipe run or “chase” – where the pipes will be run between the roof and the utility room.

It is easy to install a solar water heating system into homes that have:

- A southerly facing roof with clear area of about 4m long x 3m high (12' x 10') that has solar exposure throughout the year.
- A conventional water heater located underneath the solar collectors. While there is considerable flexibility in location, if the collectors and water storage are properly aligned it will reduce installation costs and provide you with the greatest selection of potential solar water heating systems.

This document is a guideline for the general installation requirements of solar domestic hot water systems sold in Canada. Following these guidelines will allow you the greatest selection of solar suppliers at the time of installation. However for detailed installation information you are advised to consult with a solar professional. They can provide you specific advice on installation of the systems they carry. A searchable directory of Canadian solar professionals who are CanSIA members is available at www.cansia.ca. For more information, see page 8, *Selecting Your Solar Professional*.

Guideline Highlights

Location	Requirements
On the Roof	South facing
	Slope = to latitude
	4m long x 3m high clear of all obstacles
	Free of shade year around
	0.6m from all roof edges
	As close to the peak as possible
In the Utility Room	Floor space of 1.2m x 0.6m x 2m high
	A wall space of 1m x 0.6m adjacent
	Clear space on the wall behind
	Floor to be able to take the weight (minimum 270 kg)
Pipe Run	Solar space on roof directly above the utility room space (pipes must slope at >20°)
	Install a single 4" chase or 2 – 2" chases
	Minimum of 0.3m headroom above the end of the pipe run in the attic

On the Roof

Roof Orientation

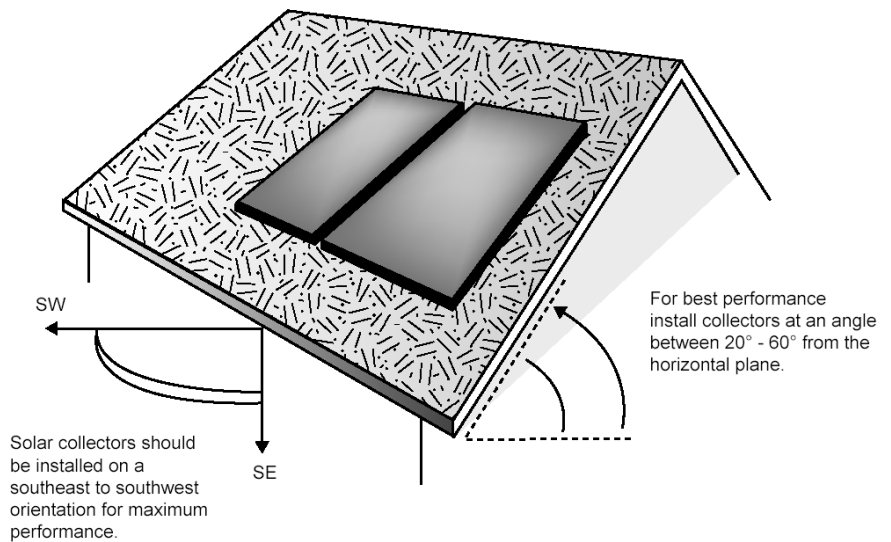
Direction: South east to south west

Solar thermal can typically be installed within 45° of south with only marginal performance losses.

Slope: 20° to 60°

The slope of the solar collector when it is installed should roughly match your latitude (e.g. 53° in Edmonton and 44° in Toronto). Changes of as much as 15° will not affect the system's performance significantly. No roof need be ruled out due to its slope because roof racks are available to adjust the angle of the solar collectors. Some collector designs have minimal slope requirements of for proper operation.

ROOF ORIENTATION AND DIRECTION



Roofing Tip – Understanding Roof Pitch

Roof slope is often expressed in a pitch of 1/12th increments. A 1 in 12 pitch equals a slope of 3.5°, thus a 4 in 12 pitch equals a slope of 15°al. An ideal roof for solar water heating in most locations in Canada will have an 8 in 12 to 12 in 12 pitch.

20°

Space on the Roof

Typically flat plate solar collectors are 1.2m x 2.4m or 1.2m x 3m (4'x8 or 4'x10') and are usually installed with the short edge parallel to the roof's eaves. Vacuum tube collectors are typically in banks of 1.8m to 2.4m long (6' to 8') long) and 0.9m to 1.2m high (3' to 4' high). A 3.6m wide x 3m high wide x 10' high clear area allows for the installation of most solar water collector arrays. This space must be clear of chimneys, roof vents, gables and other protrusions.

There should be a minimum of 0.6m (2') of space left between all sides of the collectors and the roof edge to allow for maintenance and safe access from ladders to the roof for roof contractors and the fire department.

The solar space on the roof should be as close to the peak as possible to allow for a simpler installation. Pipe connections to the solar collectors are normally done at the bottom and the top of the collectors. Often positioning of the pipes is done in the attic and this may be difficult in a low-pitched roof or where the collectors are installed close to the eaves. See [Pipe Run](#) section for further information.

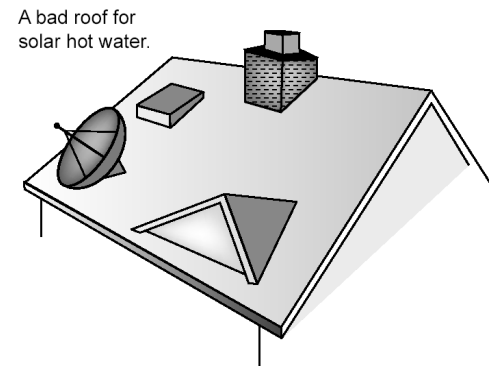
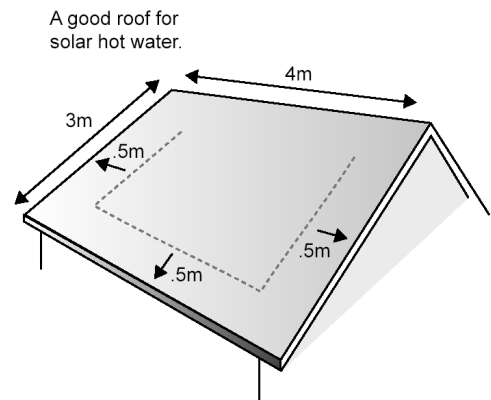
Roof Loading

Most solar collectors have a "filled weight" of approximately 20 kg per m² and thus solar water collectors do not require any increased structural support on modern roofs. However solar systems that have their water storage on the roof can be heavy so extra preparation may be necessary to ensure that the roof can support the extra weight. Solar collectors installed on a roof rack above the roof will experience greater wind loading and may also require increased structural support. If you have a low sloped (<20°) roof you should contact a solar professional for specific advice.

Shading

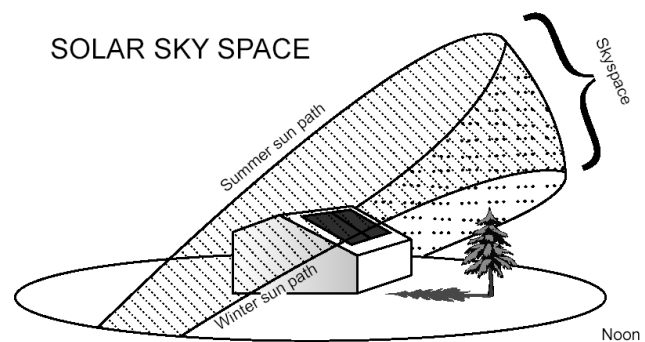
Solar energy systems need full sunshine to operate at peak performance. Your solar water collectors must be clear from shading all year long. A visual inspection of the roof's solar potential must take into account that the sun is much lower in the winter than in the summer and trees can grow 0.5m per year. It is highly recommended where there is a possibility of shading that a solar sky space analysis is done. Most solar professionals can also provide you with a solar assessment or rental of equipment that allows you to carry one out yourself. Some jurisdictions have legislation protecting

WHAT MAKES A GOOD ROOF/BAD ROOF?



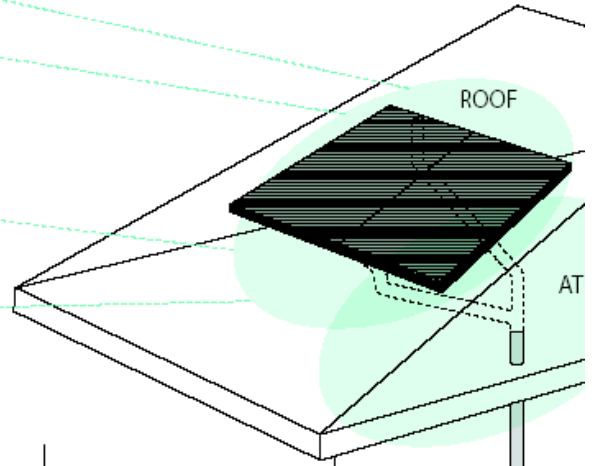
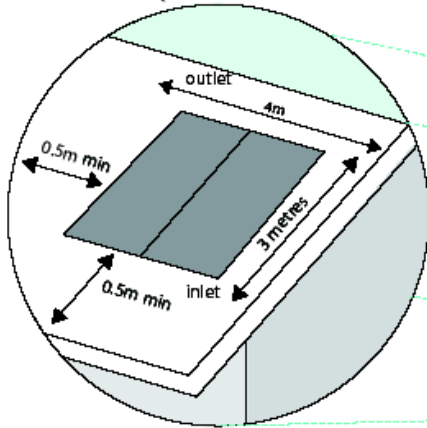
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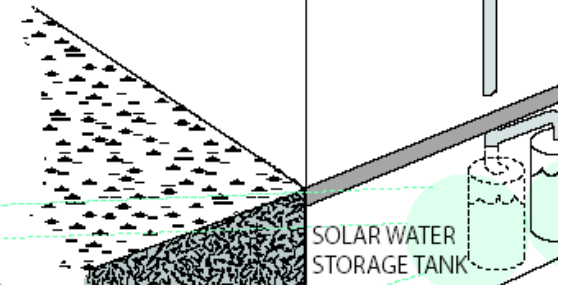
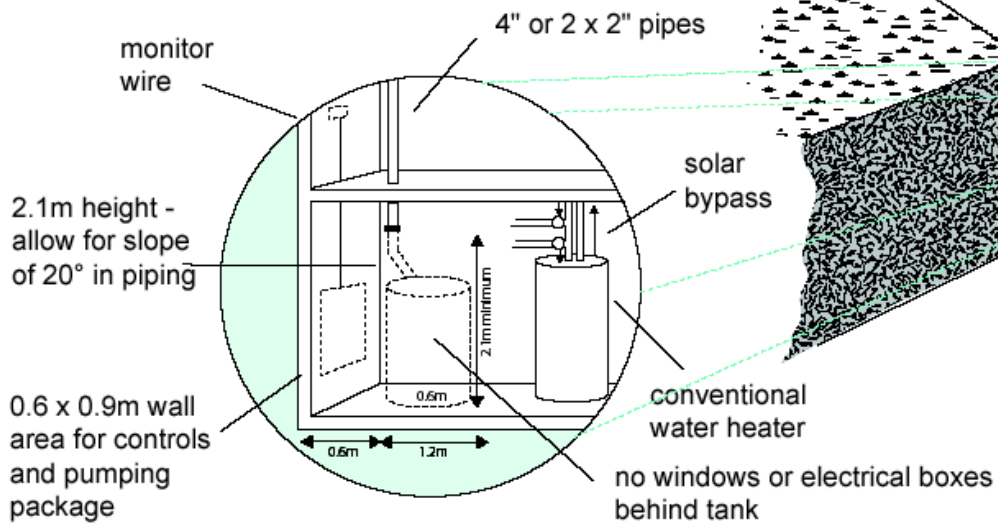


their residents' access to sunlight for energy systems.

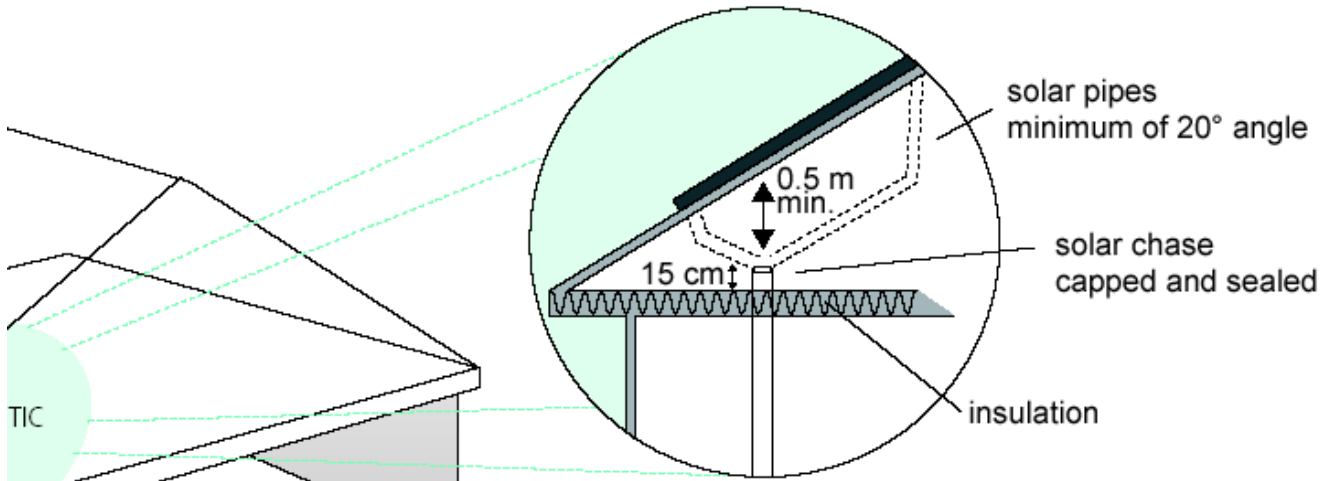
ROOF (MAGNIFIED VIEW)



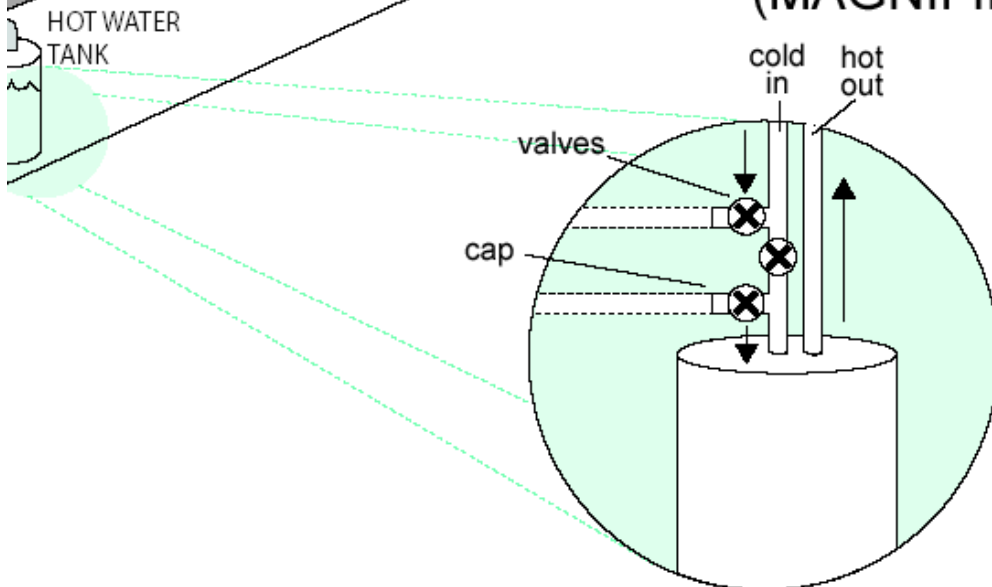
SOLAR WATER STORAGE TANK (MAGNIFIED VIEW)



ATTIC (MAGNIFIED VIEW)



HOT WATER TANK (MAGNIFIED VIEW)



In the Utility Room

Space Requirements

The solar hot water storage tank and the pumping package are the two major components that are installed in the utility room. Your conventional water heater becomes the backup heater when the solar water heater is installed. There should be an area of 1.2m x 0.6m x 2m high (4' x 2' x 7' high) adjacent to the conventional water heater for the solar hot water tank. Since the pipe run terminates directly above this space, it should not include electrical panels or windows. See the Pipe Run section for more information on pipe termination.

This area should be adjacent to a wall space of 1m x 0.6m (3' x 2') where the installer can place the controls and pump package.

There should be an electrical outlet within 1.8m (6') of this area for connecting which the solar controls and pump. This area should also have a floor drain.

Pre Plumbing The Solar Bypass

Installing the solar plumbing connections at the time of home construction or when replacing a water tank will save extra costs at the time of the solar installation. A solar bypass valve (see diagram) should be installed on the cold-water feed of the water heater. These pipes should be capped to prevent the valves from being accidentally opened. Many municipal building codes now require a backflow preventer and pressure tank installed in the cold water feed. A professional plumber should do this work.

Floor Loading

Solar hot water storage tanks typically hold 200 – 300 L of water and will weigh approximately 270 kg to 400 kg when filled. Generally basement and concrete floors will not have a problem with this additional loading. However new homes with instantaneous water heaters may not have the water heater installed in a conventional utility room and you should ensure that the location of your solar water tank can withstand the increased floor loading.

Pipe Run

Layout of the Pipe Run

Option A (preferred): Installation of a Chase

Where the solar collectors are directly above the utility room or horizontal pipe runs can be done in the attic or utility room then installing a straight “pipe chase” is the preferred method in making the home solar ready.

A single straight 4” pipe chase or two 2” pipe chases from the utility room to the roof space will allow the installation of the solar pipes and pipe insulation during solar system installation. The chase pipe(s) should be made of lightweight PVC such as solid sewer pipe. Simply leaving a boxed-in open space in the wall rather than installing an actual chase pipe is not recommended as other trades, unaware of the space’s function, may inadvertently install wires and plumbing through it.

The chase should have test caps installed on both ends and the chase sealed at the ceiling-attic penetration to maintain home air tightness and floor fire rating.

Option B: Installing the Solar Pipe Run

Where the pipe run between the roof space and the utility room travels at a slope, the pipe run bends, or there is no attic space, the actual pipe run between the utility room and the roof space should be installed.

If you choose this option then you should contact a solar professional who can prescribe pipe and insulation size. Using Option B may limit your supplier selection at the time of purchasing a solar water heating system. Information on pipe size requirements for specific solar DHW systems can be found in the Canadian Solar Performance Directory available on the CanSIA website.

Generally most solar water heating systems will use two ½” diameter copper pipes. Both pipes must be independently insulated with R-4 insulation (minimum) with a temperature rating of at least 180°C (356°F). You can obtain this type of pipe insulation from a solar professional. The pipes should be security fashioned throughout the run. As with Option A, they should be capped and the ceiling-attic penetration sealed to maintain air tightness and floor fire rating. The pipes should be pressure tested to ensure there are no leaks. If they are leaking at the time of the solar installation they will have to be replaced – often at great expense.

Some solar hot water systems require that the pipes between the solar collectors and the utility room have a minimum slope of 20° so run these pipes at a minimum of 20° slope. Improperly sloped pipe runs could void warranties offered by your solar professional.

A 14 gauge, 2-wire cable or a wire specified by a solar professional must be run with the piping if Option B is pursued. This will be used as the temperature sensor wire for the pump controller or as the photovoltaic module’s power cable to directly power the pump. This cable runs from the utility room to the attic and should have enough extra length in the attic to reach the roof penetration and stretch 3m (10’) onto the roof. Leave enough in the utility room enough to reach the location of the solar storage tank.

Termination in the Attic or on the Roof

There are two options for terminating the chase or the pipe run. If you are installing a chase(s) then these should be terminated in the attic. If you are installing the actual solar pipes then they can be installed to the attic or onto the roof.

Option A (preferred): Installing to the Attic

The chase or pipes should protrude above the attic insulation by 15cm (6”) and there should be at least 0.3m (1’) of headspace between the pipes and the rafters to make eventual connection easier.

Option B: Installing onto the Roof

If the pipes are run to the roof, they must terminate at the proper location relative to the solar collector configuration. Installing a single chase up to the roof is not recommended as the inlet and outlet pipes may be at different locations for different systems. If you are considering this option, consult with a solar professional on the layout of the plumbing run.

Finishing Touches: Solar Monitor

Installing a solar monitor in the living space of your home allows you to monitor the performance of the solar water heating system. It is a highly recommended feature.

For the solar monitor, run six 16-18-gauge wires such as thermostat wire from the solar space in the utility room to the monitor location. Most monitors are installed near the thermostat or in the kitchen. The wires should terminate in the living space in a covered electrical box with 15cm (6") of extra wire. This wire run should be less than 15 metres.

Selecting Your Solar Professional

There are several factors to consider when selecting a solar professional. The company you select should be experienced so ask how long they have been in business and ask for a list of past clients to use as references. Look for a company that sells CSA certified solar products and employees are CanSIA Certified SDHW Installers. Solar firms that are members of the Canadian Solar Industries Association (CanSIA) must abide by the solar industry's code of ethics (available on CanSIA's website). Remember that Solar DHW Systems can provide 20-30 years of free energy so a higher priced system may actually be the better deal if it buys you a superior SDHW system that provides years of trouble free operation!

To find a solar professional use CanSIA's online industry directory, at www.cansia.ca/directory/. The directory can help you to conveniently find CanSIA members in your region.

For links to more resources and documents, see www.cansia.ca/solarready.asp.



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Builders: Use CanSIA's Solar Ready Tags for Your Solar Ready Projects

Making a home solar ready? Install these tags on the pipes or chase to remind future homeowners that their home is ready for a solar hot water system. These tags are available from CanSIA – go to www.cansia.ca/solarready.asp for details.

The development of this document was funded by Natural Resources Canada .

Ce document est aussi disponible en français. Visitez www.cansia.ca/solarready.asp pour le télécharger.

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