



# Solar Assessment Checklist

The sun is a source of free energy for space heating (passive solar design), solar water heating and electricity generation (photovoltaic electricity). Even a small amount of sun can help improve your home's energy efficiency and comfort, and several sunshine hours a day gives you the options of considering reducing your power bills with solar hot water and photovoltaic electricity.

Understanding the site where your house is located is important for selecting the most appropriate renewable technology for your household with the best chance of performing well in your home. This guide helps you to understand the main issues that you will need to think about in assessing your site and situation for using solar energy.



Three inter-related factors are key to optimum solar resource use

- A) Orientation and Sun Angle
- B) Available Sunshine Hours
- C) Positioning

**NOTE: Seek professional advice if there is any doubt or difficulty with the assessment, and before any system decisions are made.**

Work through the following three checklists to assess your site:

- Checklist A: Orientation and Sun Angle
- Checklist B: Available Sunshine Hours
- Checklist C: Positioning

## CHECKLIST A: Solar Feature: Orientation and Sun Angle



### Important points:

- The sun shines from the north, so any surface facing north (preferably in a range of 20° west to 30° east of true north) will capture sun. True north can be found from local maps and street directories; or use a rough visual while on the site - the line between you and the sun at midday is an estimate of true north.
- Winter sun is lower angled than summer sun, so it sits lower in the sky. This affects the required 'tilt' of solar water heating and photovoltaic panels, as well as the amount of winter sun captured for passive heating.
- Tilt angle is the angle of the solar panels in relation to the ground. Generally for the best average performance over a year, the latitude of the site is the tilt angle for a photovoltaic panel, or solar collector. Latitude varies down New Zealand: Auckland is around 36°, Wellington 41° and Dunedin 45°.
- Tilting the panels an extra 10 degrees above latitude (so the angle is steeper) will give more electricity or hot water in the winter because the sun is lower in the sky. Decreasing the angle from latitude so the panel is flatter will provide more electricity or hot water in the summer because the sun is higher in the sky.
- The chosen tilt angle will depend on what the systems are meant to deliver for each situation (winter hot water may be more important for some, or maximum electricity from summer sun may be needed for others).

# Orientation and Sun Angle Checklist

## Passive Space Heating

**Question:** Which way does the house face?

**TIP:** It should face north - walls/windows should be larger on the north side. North-facing walls and windows capture sun during the day; West-facing capture afternoon/evening sun and East-facing will capture morning sun.



**Good**

All day sun especially in winter



**Possible**

Sun for about 4 hours/day



**Not Good**

Sun for less than 4 hours, morning or evening only

**Question:** Does the house have eaves?

**TIP:** Eaves/overhangs should be of a length to provide shade during the summer and allow low-angled winter sun in.



**Good**

Standard eaves that let in winter sun



**Not Good**

Long eaves/verandahs that block winter sun

**Question:** Do the windows allow enough sun into the right rooms?

**TIP:** High thermal mass surfaces inside the house (concrete/brick floors or walls), which are exposed to sun, will store the sun's warmth and release it later in the day when the temperature drops.



**Good**

Windows let in sun onto heat absorbing surfaces



**Possible**

Either windows or some wall space to retrofit them



**Not Good**

No option to retrofit windows or alter floor surface

## Orientation and Sun Angle Checklist (part 2)

### Solar Water Heating (SWH) and Photovoltaic Electricity (PV)

**Question:** How much of the roof faces north? Is there enough space to place a solar water heater or a photovoltaic panel?

**TIP:** Roofing and eaves can be designed to allow for passive heating and cooling needs inside the house, while ensuring maximum access to sun on the roof. Only part of the roof needs to face north to be useful for placing a system - PV needs more than solar water heating.



#### Good

Need at least 5-8 m<sup>2</sup> facing north for SWH and at least twice that for PV panels



#### Possible

Less than area above, or option for a frame to be placed facing north



#### Not Good

Roof shaded most of the day with no option to place a frame on the roof

**Question:** What is the pitch of the roof?

**TIP:** A flat/low pitch (usually less than 15°) will capture more summer sun, while a steep roof (greater than 40°) will capture more winter sun. Roof pitch is part of ensuring the right tilt angle for SWH and PV –because it's not always the same as site latitude, a frame can be used to position the system to perform better.



#### Good

For solar water heating, north facing roof pitched between 30-40 degrees



#### Possible

SWH as above or steeper, will give better winter options



#### Not Good

Flat roof will give limited success, a frame would be needed. [Note: for PV, it depends on when/how much electricity is needed]

**Question:** How robust is the roof structure?

**TIP:** A frame may be required for roof-mounting PV panels to get optimum tilt angle, and/or the roof also needs to take the weight of a SWH system



#### Good

Structurally sound and able to take weight of panels and possibly a frame



#### Not Good

Old unsound roof, or limited strengthening options

## Orientation and Sun Angle Checklist (part 3)

### Passive Space Heating, Solar Water Heating and PV

**Question:** Does the shape of the site allow for buildings to be constructed or changed enabling more sun to be used?

**TIP:** The more area exposed to the north, the more sun is available.

This may also depend on what matters most – views, shelter from weather, privacy, exposure to sun or other specific features.

**Good**

North-facing site with room to meet all needs

**Possible**

Access to sun requires building redesign or sacrifice of other features

**Not Good**

Few options to access sun or other needs prioritised higher

**Question:** If a roof is not used for PV panels, is there a suitable area available for ground-mounted PV?

**TIP:** For ground-mounted PV, a suitable area should be facing north, be big enough to safely position the system without risk of damage, and close enough to point-of-use to minimise electrical losses from long cables.

**Good**

Enough area close to point of use & safe to use

**Not Good**

Not enough area

### SUMMARY: ORIENTATION & SUN ANGLE

#### Good

The house and site generally fit the 'Good' criteria above. A north-facing site is best especially for a new build as it allows for whole house to be designed for passive space heating and other solar systems.

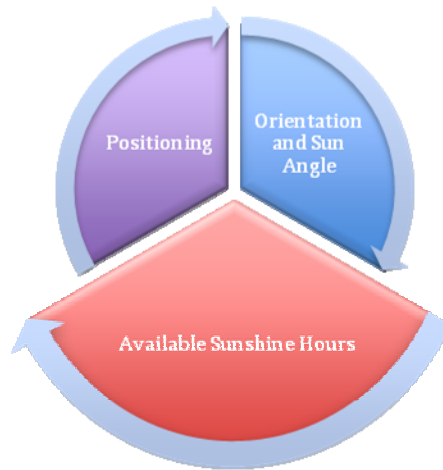
#### Possible

The house and site have a mix of the criteria above. If there is access to sun but other features are possible or not good, then seek professional advice to properly assess the options.

#### Not Good

The house and site criteria are generally 'Not Good' especially if there is little option to get access to sun through either retrofitting or changing site features.

## CHECKLIST B: Solar Feature: Available Sunshine Hours



### Important points:

- More sunshine hours means more available solar energy. Sunshine hours are measured by weather stations all round the country and the data for specific locations can be sourced from NIWA's National Climate Database
- **When** sunshine is available can be as important as **how much**, if space/water heating or electricity is required at a specific time. System design needs to manage both these factors.

## Available Sunshine Hours Checklist

### Passive Space Heating, Solar Water Heating and PV

**Question:** How many hours of direct sunshine are available through the year (especially in winter)? All day or only a couple of hours?

**TIP:** The more hours you have, the more space or water heating can be gained. PV's operate all day but work best with plenty of direct sun. Clouds and haze will reduce available sunshine.



#### Good

At least 6-8 clear hours, preferably all day



#### Possible

At least 4 hours during the middle of the day in winter



#### Not Good

Less than 4 hours or at either end of the day (sun is weaker)

**Question:** How much do your sunshine hours vary between summer and winter, and how does this fit with when it's needed most?

**TIP:** Sun path and sun angle change with season, so sometimes hills and obstacles can provide shade at different times of the year, or weather patterns might affect clouds and haze. Whatever system is used will need to be positioned according to the best time for sun in the house and/or on the roof.

#### Good

No significant seasonal weather or obstacles for 6-8 hours sun a day



#### Possible

Obstacles to sun can be removed or allowed for to get at 4 hours as above



#### Not Good

Seasonal weather, obstacles to sun cannot be removed or allowed for

### SUMMARY: AVAILABLE SUNSHINE HOURS

#### Good

The house and site fit the 'Good' criteria above. All day sun with clear winter days is best, if winter heat and electricity are a priority

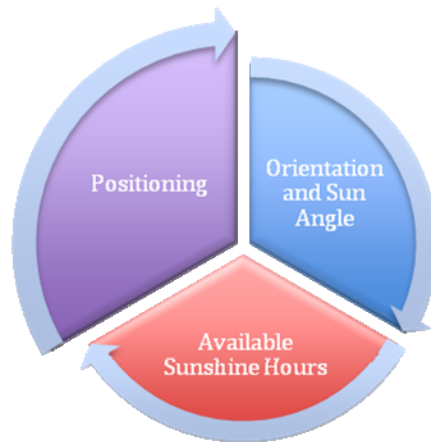
#### Possible

The house and site can access around 4 hours of sun. Orientation and sun angle criteria would have to be good.

#### Not Good

The house and site 'Not Good' especially if there is little option to get access to sun through either retrofitting or changing site features.

## CHECKLIST C: Solar Feature: Positioning



### Important points:

- Shading from obstacles must be minimised to ensure the best performance of any solar system - in winter, obstacles on the north side cast shadows two to three times their height. (Shade can be designed in for summer cooling while not interrupting performance of roof-mounted systems. Any shading of panels reduces efficiency)
- Slope of a site can affect seasonal access to sun – clever design of new build or retrofit features can sometimes overcome this.
- Keeping views and shelter from prevailing weather usually needs to be balanced against positioning for the sun.



## Positioning

### Passive Space Heating, Solar Water Heating and PV

**Question:** How close are hills, neighbours and trees? Is this likely to change (being built-out or growing bigger)? Can they be reduced or removed?

**TIP:** At least six metres from a single storey (more for higher buildings) to the north is preferable for sun access. Aerial photos can help identify neighbourhood features. Removal is not always practical! Privacy can be a reason for not altering obstacles if you or the neighbours are concerned



#### Good

Large obstacles more than 6 metres away with no risk of change



#### Possible

Obstacles exist but can be altered, or house redesign can reduce effect



#### Not Good

Large obstacles are too close and cannot be removed

**Question:** Sloping sites - where does the slope face, and are there options for the best positioning for sun?

**TIP:** North-facing is best, south facing slopes lose sun early in winter. The steeper the slope the fewer options there are for sun. A narrow site may give fewer options for avoiding shading.



#### Good

North-facing site, or options exist to position rooms /systems for sun access



#### Possible

Narrow site but north facing; slope facing east or west but options exist to position rooms /systems for sun access



#### Not Good

Narrow south-facing slope, with no options for system placement or house redesign

**Question:** Is the appearance of SWH or PV important?

**TIP:** If these systems are deemed unattractive, then they may need to be positioned to reduce visual impact as long as they can still work. This can be an issue in some of New Zealand's heritage precincts



#### Good

Appearance not an issue



#### Not Good

Appearance is an issue for position where system will work best

## Positioning (part 2)

### Passive Space Heating, Solar Water Heating and PV

**Question:** How does the site change at different times of the day and in different weather conditions?

**TIP:** Understanding this can help strike a balance with sun, wind, shelter, views and privacy

#### Good

Site can deliver for all needs while allowing a solar system to perform

#### Not Good

Site changes with time and weather means other needs are prioritised above

### SUMMARY: SOLAR POTENTIAL BASED ON POSITIONING

#### Good

The house and site fit the 'Good' criteria - there are plenty of options for accessing sun by managing slope and obstacles

#### Possible

The house and site meet a mix of criteria with some thought needed to ensure the best positioning for rooms and/or systems

#### Not Good

The house and site have few or no options for positioning, or other needs are more important than accessing sun