

Latitude 18.5



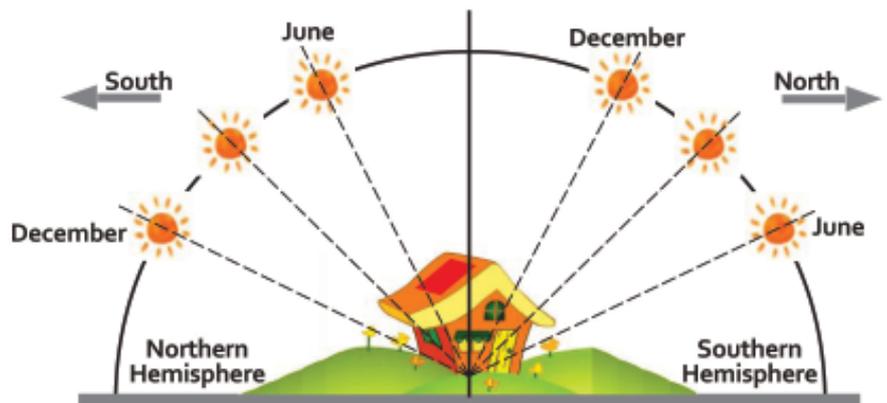
Best Angulation and Direction for Solar Absorber Panels

The general rule in Chiang Mai area is that solar absorber panels (collectors) should face due South at an angle of about 20° to the horizontal, and be in a position without shadow. Optimal positioning of panels maximises performance. Key basic factors are direction and angle of panel position. Other factors include any shading on site, seasonal climatic considerations and periods of high and low usage.

In the northern hemisphere collectors should point South, or as close as possible.

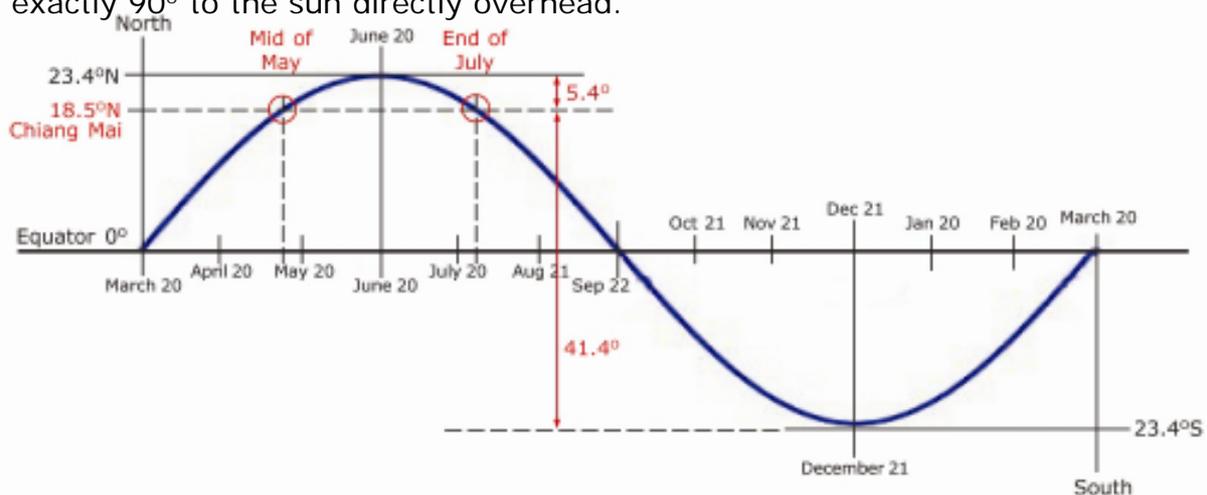
Roof mounted panel direction will be dictated by the alignment of the roof. If the alignment is more than 30° from due South the panels would probably be better ground mounted to ensure full South orientation.

In northern Thailand, at latitude approximately 18° to 19° north of the equator, the sun actually shines from the North for about two months. During this period South orientation is not optimal, but solar radiation is at its highest level during the year, which compensates for this effect.



As a general rule of thumb, the angle of orientation should be the same as the latitude of the site. So in Chiang Mai, 18.5° latitude north of the Equator, collectors should ideally be mounted with an angle to the ground of 18.5° , also about 20° , and face South. Solar absorption is optimal if the collector is at right angles to the sun's radiation.

For example at mid-day on the equator on the spring equinox on March 20 and autumnal equinox on September 22 the collector should theoretically be parallel to the ground, thereby being at exactly 90° to the sun directly overhead.

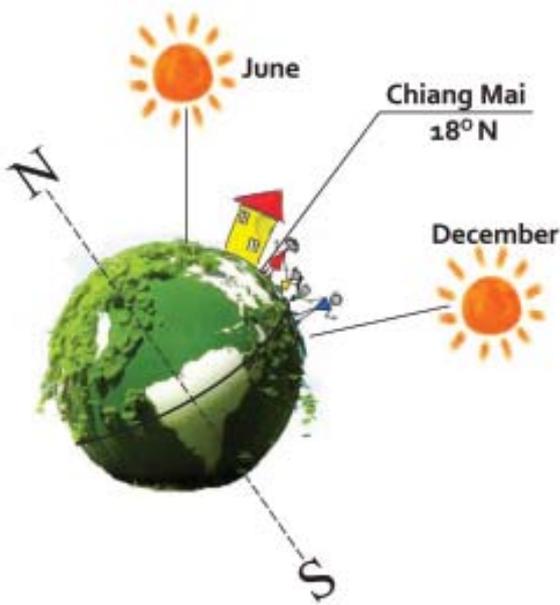


At summer solstice on June 20 the sun stands at mid-day vertical to the ground at the latitude of 23.4° north, the most northern latitude the sun reaches. Geographically seen from Chiang Mai, this is a little further north of Thailand, in Chinas Yunnan province. This is than about 5° of latitude away from Chiang Mai. The perfect angle of the solar collector at Chiang Mai would at that date be 5° in northern direction.

At winter solstice on December 21 the sun stands at mid-day vertical to the ground at the latitude of 23.4° south, the most southern latitude the sun reaches. Geographically seen from Chiang Mai, this is somewhere in Australia.

[continue next page...](#)

...from previous page



The maximum solar insolation rate for Chiang Mai is reached in mid of May and the end of July when the sun stands at mid-day exactly vertical to the ground. In practice a compromise angle is selected which optimises overall daily solar absorption without the need for a complex system to constantly reposition the collectors in relation to the changing position of the sun.

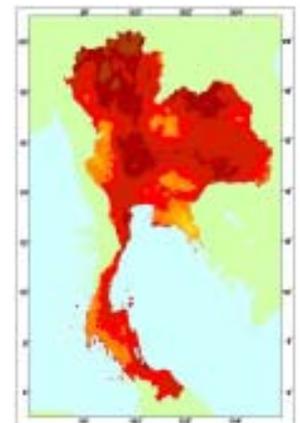
To maximise winter absorption rates the angle would be about 40°. This would reduce summer collection, but this can be advantageous in some circumstances as it reduces the risk of over-heating at that time of year. For hospitality use where winter visitors are higher than in rainy season there is a case to increase angulation rate up to 40° to maximise winter hot water harvest.

In early morning and late afternoon solar radiation is much lower than at mid-day. In mid-summer radiation is stronger than in mid-winter and in winter the requirement for heating is generally greater than in summer time, due to changes in ambient water temperature and relative cooling rates at different times of year. In Chiang Mai area winter sunlight is almost continuous but in rainy season there is extensive cloud cover. Taking account of all of these factors, it remains the case that South orientation and angulation of 20° optimises performance in this part of the world.

However, if your roof angle is within 10° +/- of your desired angle you can just mount the solar collector flushing against the roof surface. The added trouble of adjusting the collector to a precise angle will not result in a great improvement in efficiency. Solar water collectors have generally a very high efficiency of about 92% to 96%, for that we can afford some losses.

Insolation rate is a measure of how much solar energy strikes a square meter of horizontal surface per day. In Thailand the rate is about 5 kWh/day (kilowatt hours per day), one of the highest rates in the world. In consequence a correctly sited collector in Thailand will collect more energy than practically anywhere else. This makes the economics of solar water heating in our area very attractive on a world comparison basis. A relatively small collector will absorb as much energy as one twice its size and cost in say Europe.

Solar absorbers can harvest more heat than is required on occasions. For instance with low usage rate, holidays and protracted sunshine at mid-summer, the temperature of the stored water can approach and even achieve boiling point, with negative consequences. Letting the system stagnate is not ideal as high pressure and temperature can build up. The correct design of the system with a pressure relief safety valve will result in vented steam or small amounts of wasted water. If necessary the simplest way to prevent seasonal over heating is to shade the collectors when appropriate.



Average Solar Insolation at Chiang Mai is about 5 kWh/m²/day

Latitude:

- Mae Sai = 20°
- Chiang Rai, Fang = 19.5°
- Chiang Mai, Mae Hong Son = 18.5°
- Lampang, Hot, Phrae = 18°
- Tak, Phitsanulok = 17°

