

Solar thermal energy in Thimphu, Bhutan - possibilities and challenges

by

Peter Bennewitz & Johan Persson

In a river valley in the Himalayas lies Thimphu. It is the capital and largest city of Bhutan, a forested, mountainous developing country sandwiched between northern India and southern China.

The high altitude make the winters in Thimphu sunny but cold. This combined with the easy access to firewood has made Bhutan one of the world's highest per capita users of firewood. This article summarizes a study made to see how great or small the contribution of solar thermal energy could be for domestic heating while at the same time reducing the firewood use.

Bhutan is covered with 70 % forest and the Bhutanese government has set up a goal that the forest coverage should not fall below 60%. As large quantities of wood is used for heating in the residential sector in Bhutan there is a great interest in exploring alternative sources of energy. The source investigated in the study summarized here was solar thermal energy.

To investigate the situation, both rural and urban houses in the area were investigated on site in Thimphu. Two computer models were made in which different scenarios could be tested.

It was found that in some cases the solar thermal heating could replace the firewood completely. When only using solar thermal heating and no firewood, the indoor temperature only reached about 15 °C during the day. This might seem low but is actually the current situation in Thimphu today when using only firewood.

If instead both systems are used in tandem a more comfortable temperature can be reached. The solar thermal system will heat as much as it can and the firewood heating will kick in as a backup when temperatures drop too low.

When doing this the firewood use could be reduced with 50% while the indoor temperature reached 18 °C.

However, even when combining both firewood and solar thermal heating it is hard to reach a reasonable comfort level during nighttime in January when ambient temperatures sometimes fall below -10 °C. Indoor temperatures then typically fell below 10 °C even when using both firewood and solar thermal heating. It was found that the heat simply leaks out too quickly as Bhutanese houses are basically not insulated at all.

As insulation was found to be lacking, cases were tested where the insulation in the computer

model was increased. This led to a much better temperature level, both during nighttime and daytime, while decreasing the use of firewood even further.