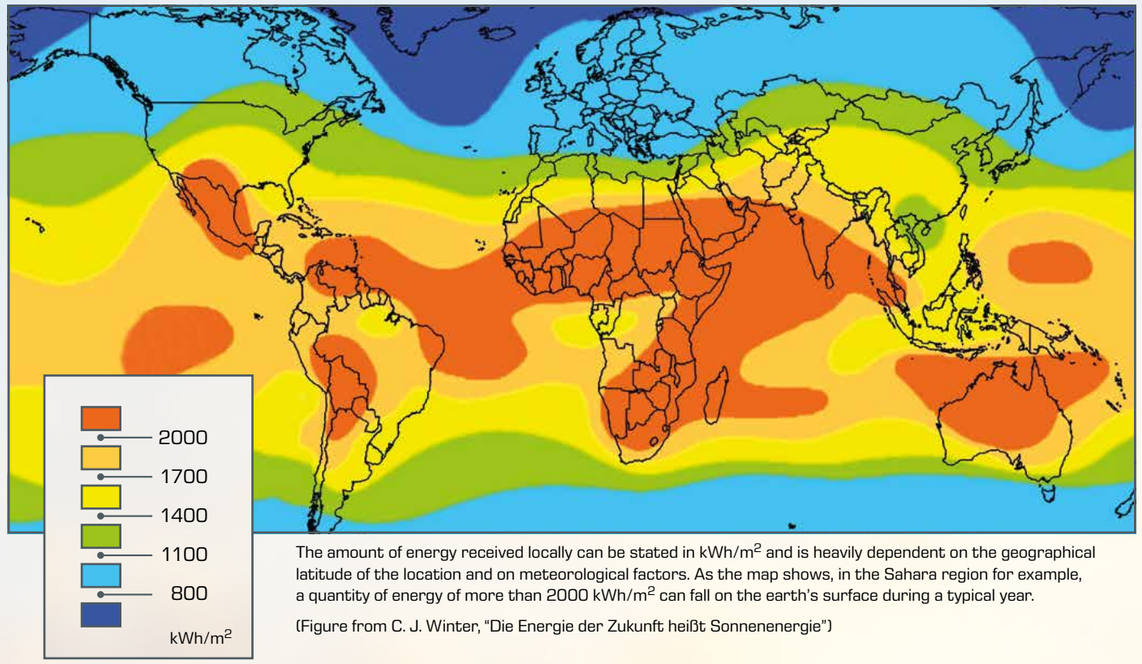
Basic knowledge
Solar energy

Energy galore

The amount of solar energy that falls on the Earth's land areas in a year is almost 2,000 times greater than the entire world's energy demand. Given the global climate problem, using this potential in the best possible way seems self-evident.

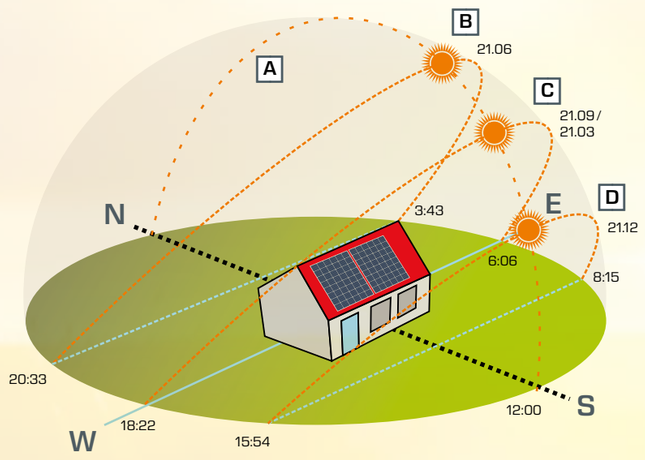


The amount of energy received locally can be stated in kWh/m² and is heavily dependent on the geographical latitude of the location and on meteorological factors. As the map shows, in the Sahara region for example, a quantity of energy of more than 2000 kWh/m² can fall on the earth's surface during a typical year.

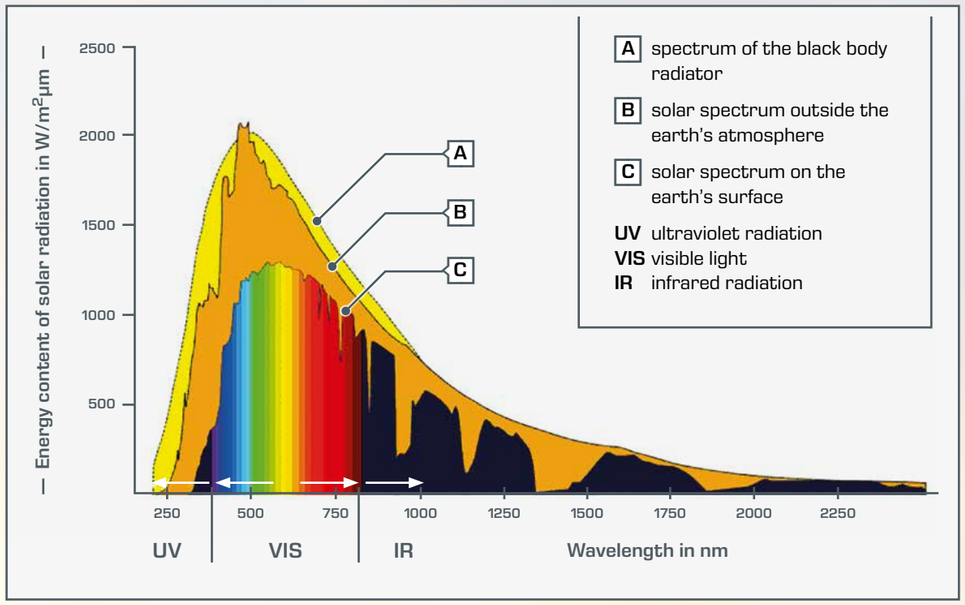
(Figure from C. J. Winter, "Die Energie der Zukunft heißt Sonnenenergie")

The orientation of the module surfaces to the cardinal point and their inclination play a significant role in optimising the yield of a solar installation. The illustration shows the path of the sun visible on the Earth at different seasons of the year. The times given for sunrise and sunset are for Berlin:

- **A** zenith
- **B** summer solstice
- **C** beginning of spring/autumn
- **D** winter solstice



In order to optimise the use of solar radiation, it is necessary to understand its properties. The spectral composition of sunlight is of interest in this regard. Through spectroscopic studies, it is possible to determine the energy content of sunlight at different wavelengths. If one is then able to better adapt the spectral properties of the receiver or absorber to the solar spectrum, then a key condition for improving the energy balance is met.



The spectrum of sunlight

Inside the sun fusion processes lead to temperatures of up to $15 \cdot 10^6$ K. However, the spectrum of emitted sunlight is based on processes in the outer layers of the sun. The spectral composition can be described theoretically by a so-called black body with a surface temperature of 5777K.

On its way to the earth's surface, the solar radiation is weakened in the atmosphere by scattering and absorption.