

22.4 STEPS IN THE DESIGN PROCESS WITH PV

22.4.1 Urban Aspects

The aim of integrating PV systems into buildings is to reduce costs. To generate maximum power from building-integrated systems, certain urban and architectural aspects are important.

The main starting point is the maximum power that can be generated by a system. The primary hindrances can be the (partly) shadowing of a system by other buildings or objects, and the nonoptimum orientation relative to the sun. Reflection can also be a problem for the surrounding buildings.

22.4.1.1 Orientation and angle

The amount of irradiance depends on the latitude. The maximum irradiance corresponds to surfaces, tilted at an angle equal to about the latitude minus 10° (see Chapter 20 for calculations on solar irradiance). At 52° north good results ($>90\%$) can be achieved by orienting the modules between southeast and southwest, with system angles between 30° and 50° from the horizontal. Orientations between east and southeast, and between southwest and west, are fairly reasonable with system angles between 10° and 30° from horizontal. The irradiance will be reduced by around 15% of the maximum.

Flat-roof systems with very low angles (between 5° and 10°) can be a good solution for difficult orientations. The loss of irradiance will be between 5% (south) and 20% (north).

22.4.1.2 Distance between buildings

Shadowing is a critical issue for BIPV. In general, designs in which the PV modules are shaded for much of the year should be avoided. For low-rise areas, the problem is easy to solve. The distance between individual houses can be calculated. For mixed height neighborhoods, it will be more difficult. A high-rise apartment building in a low-rise neighborhood can cause a lot of unwanted shading.

The density of an area also has a lot of influence. In high-density areas (cities) the distances between buildings are often so small that there is significant shadowing throughout a large part of the year.

On a general note, it is worth mentioning that facade systems (vertical) are more sensitive to shading and need longer distances from other buildings than tilted systems (roofs). Horizontal systems have a lower irradiance, as previously mentioned, but will be the best solutions for avoiding shadow. Only neighborhoods with a mixture of low- and high-rise buildings might be unsuitable for horizontal systems.

22.4.1.3 Trees

Greening the area around buildings makes the area look very attractive and the microclimate more comfortable for the inhabitants.