

The shadowing effect of trees is very important, as the trees will be very dense during the summer. Even during the winter, when trees lose their leaves, the branches give too much shade.

The aspect of growth is sometimes underestimated. Planning for the future growth of trees is very important and must be done carefully to avoid problems a few years after the building has been completed or the PV system has been installed.

Solutions can be to

- only plant trees on the north side of buildings,
- plant only small trees up to two stories high,
- prune trees annually to keep them small.

#### **22.4.1.4 Zoning**

In future, a special solar zoning will be needed in urban areas with PV systems. The borders of building areas can be clearly marked on three-dimensional maps to prevent future problems. The amount of sunlight can also be determined on these maps.

#### **22.4.1.5 Reflection**

Although not a major problem, under certain circumstances, reflection can occur. In low-rise buildings, there are no significant problems, but in mixed low- and high-rise areas residents in high-rise buildings may experience some annoying reflections if all the surrounding houses have (glass-covered) PV modules. The fact that there are certain distances between buildings (for shadowing) may eliminate most of the potential problems.

### **22.4.2 Practical Rules for Integration**

There are a few important rules for integrating modules into buildings. These rules concern the functioning and maintenance of the system, for example:

1. shadow is not allowed on the module,
  2. ventilation is required at the back of the modules (not as important for thin film a-Si),
  3. make it easy to mount and remove a module,
  4. ensure that the module stays clean or can be cleaned,
  5. make easy electrical connections,
  6. ensure that wiring is sun-proof and weather-proof.
1. As previously mentioned, even partial shadow on the modules will decrease the energy output. Profiled mounting constructions, in particular like awnings, can produce shadows along the edge of the adjacent module that will result in loss of efficiency.
  2. Modules with crystalline cells have a higher output when the temperature is lower. With ventilation at the back of the module it is possible to keep the temperature low