by adding a well-designed PV system. On the other hand, a well-designed building with a nicely integrated PV system will be accepted by everybody.

The following section aims to explain some basic thoughts about PV to non-designers, from an architectural and design point of view.

Note: All specified power of PV systems is the power under standard test conditions and tilt which may be greater than the power delivered when installed in nonoptimum orientation required by the BIPV application.

22.2 PV IN ARCHITECTURE

22.2.1 Architectural Functions of PV Modules

Basically there are three locations for integrating PV systems into buildings. The main locations are the roof and façade, with all other locations being known as *building components*.

A PV system can be integrated into the roof in several ways. One choice is for the integrated system to be part of the external skin and therefore be part of an impermeable layer in the construction. In the 1990s, several building projects were constructed on the basis of this principle (Figure 22.3) [9]. The other choice for roof mounting the PV system is above the impermeable layer. This is a more secure option but not without some risk, as the impermeable layer has to be pierced in order to mount the system on the roof. Using PV modules as roof covering reduces the amount of building materials needed, which is very favorable for a sustainable building and can help reduce costs. In addition to covering the complete roof with modules, there are also many products for small-scale use, for example, PV shingles and tiles. The small scale of these products (from 2 cells on a tile to around 20 cells on a look-alike tile) makes them very convenient for use in existing buildings or as do-it-yourself products.

Figure 22.3 Roof integration in a renovation project with the Shell Solar/BOAL profiles in Leiden (NL), providing a 2.1 kWp system per house. The PV roof is an impermeable layer. Reproduced from Maycock P *et al*., *Building with Photovoltaics*, 78–81, Ten Hagen & Stam, Den Haag (1995) with permission by NOVEM, R Schropp [10]