technology, and the third [5] compared the 500X concentrator systems with Si technology to GaAs technology in plants of the same annual energy capacity. All three studies modeled the cell- and module-manufacturing processes using the STAMPP model, and included both flat-plate and 500X concentrator collectors.

Financial studies of complex systems require extensive data input, and can produce volumes of data output. Restriction of space in this chapter limits the details that can be provided to only a small fraction of what was there in the original studies. The numerical values of inputs and outputs are based on the time at which the studies were performed, so the objective is to illustrate methodology and relative technology comparisons, not to give current quantitative cost results.

21.2.3.1 Module price for silicon technology

From the beginning of the photovoltaic commercialization efforts in the 1970s, crystalline-silicon-cell technology has been dominant. The availability of refined silicon wafers resulting from semiconductor development, the availability of mature processing equipment developed by that industry, and the simplicity of the Si-cell fabrication technology relative to thin-film Si or compound semiconductors such as gallium arsenide or copper indium diselenide were, and still are, major factors that influence the role of silicon in photovoltaics. The first cost analysis conducted by the authors [3], which was also the genesis of the STAMPP program defined earlier, compared silicon-module prices fabricated by several different methods. (In [3], the STAMPP model was called IMCAP, but the model is essentially the same.) While the results discussed here were determined in 1986, there still are some relevant and useful lessons to be learned from the comparison of different cell- and module-fabrication methods, and the focus here is on these rather than on current absolute cost of cells and modules.

Five different cell technologies and modules fabricated from them were examined in this study:

- Flat-plate modules using silicon cells from single-crystal Czochralski wafers.
- Flat-plate modules using silicon cells fabricated on silicon dendritic web substrate.
- Flat-plate modules using single-junction amorphous-silicon cells (a-Si:H) grown on glass.
- Flat-plate modules using tandem-junction amorphous-silicon cells (a-Si:H/a-SiGe:H) grown on glass.
- 500X Fresnel lens concentrator module using high-performance cells from float-zone single-crystal silicon wafers.

The concentrator module incorporated cells under separate development by the study sponsor and the cell fabrication was not modeled with STAMPP. The cells were treated as a purchased item. All of the manufacturing processes were defined to produce annually modules with a total rating of 25 MW.

The module prices computed for this study were intended to give a comparison of significantly different cell technologies and to provide a perspective on how low the prices might fall in the future. The cost of materials and other items for a base case