must be taken into account by investors. Comparison must not be made between prices of different alternatives at the same moment in time but for equal cumulated market. In other words, we must compare the price of an option today with that of its more mature competitor in some moment of the past and we must also consider the experience factor. In other words, sometimes a product that at a given moment is more expensive than its competition can become cheaper sooner because it bears internally the seed for lower cost and comparable performance. But, of course, not every more-expensive novel product bears this seed. This is the risky nature of entrepreneurship.

We conclude, and this is our position concerning the controversy pointed out in myth 4, that basic R&D in photovoltaics must be looking for breakthroughs if we want photovoltaics to fulfill the goals that society requests. At the same time, support to the market will help create a sizeable industry that will be able to commercialize breakthroughs worldwide. In any case we are not talking of a cottage industry. The PV industry has the potential of becoming a major electricity supplier in the twenty-first century and to constitute a powerful industry able to abate environmental stresses, to facilitate the human development of the poorest, and to constitute an element of safety in our electric supply.

1.6 WHAT ARE THE GOALS OF TODAY'S PV RESEARCH AND MANUFACTURING?

Chapters 5 to 15 in this book focus on individual technologies and will give specific examples of where the research and manufacturing effort is concentrating to reduce costs and improve performance. But several trends are common to all. These are listed in Table 1.3.

Since the overall goal is to produce a low cost PV *system*, we need more than low-cost-efficient solar cells, we need a low cost efficient system including mounting hardware, power conditioning electronics, fuses, cables, storage, tracking, and so on. Less research and development has gone into these areas than into PV solar cells and modules.

Table 1.3 Goals of current solar cell research and manufacturing

- Use less semiconductor material by making thinner cells or
- Use less expensive semiconductor materials. These tend to be less pure and less perfect.
- Improve solar cell performance with less expensive, less perfect semiconductors
- Even with this poorer material keep a high production yield, that is, reduce the number of cells or modules rejected by the quality control.
- Increase material utilization by reducing waste in semiconductor and cell fabrication
- Increase solar cell flux on the solar cells by using concentrators without increasing cost or optical losses too much. In this way, less semiconductor material is used.
- Increase solar radiation utilization by absorbing more of the spectrum efficiently
- Increase speed and throughput of manufacturing processes
- Simplify processing steps (this reduces fabrication costs and increases the yield) and reduce equipment costs
- Reduce costs and improve reliability of BOS (auxiliary elements).