it come from. The purely financial comparison of electricity sources by private entities often becomes subservient to public economic-development initiatives, and national and international politics may play a strong role. The choice of electric energy sources for the classes of applications must still be made, and the cost of energy delivered, in the sense employed for developed regions may still be computed, but generally not by individuals or small economic units, because they will not pay for them.

21.2 ECONOMIC ANALYSIS

Once the technical requirements of a PV application have been stated and a PV system design completed, the economic analysis can be carried out. The economic assessment includes both costs and benefits of the system. The methodology for this assessment constitutes a major portion of this chapter.

21.2.1 Key Concepts

The purchase of a PV system represents an expenditure of capital resources at a given time with the expectation of benefits in the form of electric energy delivered over some future period, which is generally the life of the PV system. Other benefits, such as reductions in greenhouse gases, might be quantified. For large systems, the construction expenditures may occur over more than one year. The future benefits, primarily the value of the electricity generated, may be realized over a 10- to 30-year period. Thus, the basic issue is how to measure the value of future benefits from a present expenditure. Further, the issue is how to compare that value for a PV system with a consistently defined value for an alternative system such as a diesel-electric system, a fuel cell, or electricity from the grid. Salvage value at the end of the system life is also a future benefit. In many cases, there will not only be future benefits but future costs as well. The cost of maintenance and the replacement of failed modules are primary examples. In addition, qualitative benefits, such as energy independence or reduction in the risk of future escalation of energy costs, may enter the decision process, although they are not dealt with here.

We generally recognize intuitively that the value of a cost or benefit in the future is not equal to the same cost or benefit today. If we were to receive $100, we would rather get it today than five years from now. Why? Perhaps because we could buy something today with the money and enjoy its use for the next five years, rather than wait to enjoy it. More practically, we could put the $100 in a savings account and it would be worth perhaps $125 in 5 years; so the value of money possessed now as opposed to later can be measured in this simple way. All of this goes to say that there is a “time value of money,” and defining that time value pervades the whole process of economic analysis for PV systems. These expenditures and benefits, as measured in monetary terms, are usually called *cash flows*.

As suggested above, the purchase and operation of a PV system involves a stream of cash flows over a period of years, and economic assessment requires some consistent measure of these cash flows to be made. It may in some instances require the comparison of the value associated with that stream with the value of a different stream for a competing system. For a PV system, such a stream might look like what is shown in Figure 21.1. Outflows, such as the purchase cost and maintenance costs, are shown as negative, while