Finally, there is another method of valuing PV systems that uses some of the same mathematical techniques as the above measures, but expresses the result differently; namely, the levelized energy cost (LEC) or levelized bus bar energy cost (LBEC). This approach is particularly appropriate to energy providers such as electric utilities. This method provides a unit cost of electricity in \$/kWh that is constant over time (i.e. levelized) and expressed in monetary units at the beginning of a commercial operation. The LEC method is useful to utilities, who sell electricity on a \$/kWh basis, since it is easy to compare the computed LEC to the costs of electricity from other conventional or renewable sources. This method can also be adapted for nonutility system owners.

The LEC method is based on the same discounted cash-flow concepts illustrated by Table 21.1 and equations (21.1–21.8). These latter results represent the total discounted worth of a PV system over its economic life stated in dollars, and these dollars implicitly incorporate the annual PV energy produced. The LEC method, in effect, takes a present worth of the cost (but not revenue) streams as in equation (21.9) and computes a stream of constant annual values having the same present worth. This annual value is divided by the rated annual energy production of the system to get an annualized cost of electricity.

$$LEC = \frac{(NPW_C)(CRF)}{E} \tag{21.14}$$

where CRF is called the capital recovery factor, defined as

$$CRF = \frac{m(1+m)^n}{(1+m)^n - 1} = \frac{a}{P} \tag{21.15}$$

The capital recovery factor (CRF) is the inverse of the present worth of a uniform series defined in equation (21.4). NPW_C is computed from equation (21.10), which, in turn, is based on equation (21.8) with revenues, R, set to zero. The numerator of equation (21.14) is the annualized value of the costs associated with the system construction and operation, that is, it defines a uniform annual series of costs that have the same present value as NPW_C. The term E is the annual energy in kilowatt hour generated by the system.

21.2.2 General Methodology

A general methodology for the economic assessment of PV systems is illustrated in Figure 21.2. The assessment begins in Step 1, system design, which must be done prior to an economic analysis. For an assessment addressing multiple systems and/or applications, the methodology of Figure 21.2 must be carried out for each system of interest and the results summed to determine the economic potential.

Steps 2, 3, 4: system cost. In determining system cost, completeness and accuracy in individual component costs lead to a good estimate of system cost. Figure 21.2 suggests two paths to estimate system cost. If the system design is based on the currently available technology, then defining a complete bill of materials and then obtaining quotations from the vendors is the path to be followed. If the cell/module technology is to be projected into the future, or if a current technology is not in volume production so that its costs are not available, then the price can be predicted from the modeling of the manufacturing process.