of energy shortage probability, but different names can be found for the *LLP*: Deficit of Energy [64], Loss of Power Probability [65] and Loss of Power Supply Probability [66]. Moreover, the Load Coverage Rate [67] or Solar Fraction [68], *SF*, defined as the fraction of energy load covered by the PV system is also used to quantify reliability. Clearly, $SF = 1 - LLP$.

The "size" of a PV system means the size of both the generator (PV modules) and the accumulator (batteries or other storage device). It is useful to relate these sizes to the size of the load, in terms of average daily energies. Thus, the generator capacity, C_A, is defined as the ratio of the average daily energy output of the generator divided by the average daily energy consumption of the load. The accumulator capacity, C_S, is defined as the maximum energy that can be extracted from the accumulator divided by the average daily energy consumption of the load. Thus,

$$C_A = \frac{\eta_G \cdot A_G \cdot \overline{G_d}}{L} \text{ and } C_S = \frac{C_u}{L} \tag{20.80}$$

where A_G and η_G are the area and conversion efficiency of the photovoltaic generator, respectively, $\overline{G_d}$ is the mean value of the daily irradiation on the surface of the generator, L is the mean value of the daily energy consumed by the load and C_u is the useful energy storage capacity of the accumulator. More strictly, η_G should be the path efficiency from the array to the load, and C_u is the product of the nominal capacity (which refers to the whole energy that can be extracted from the accumulator if no particular limitations were imposed) and the maximum allowable depth of discharge. We will deal with the practical meaning of such parameters later. Meanwhile, it is worth pointing out that C_A depends on the local solar climate conditions. Therefore, the same photovoltaic generator, connected to the same load, may seem big in one place and small in another where there is less radiation.

Figure 20.22 shows how the energy generation varies over an assumed period of j days, for a given location and load, and for two different sizes of the generator ($C_{A1} < C_{A2}$). The shaded areas underneath the line $y = 1$, illustrate the temporal deficits of energy generation that need to be compensated by extraction of energy from the accumulator. It can be observed that the larger the generator, the lower the deficit and, hence, the smaller the required accumulator. Two ideas are now intuitively apparent: the first is that it is possible to find different combinations of C_A and C_S that lead to the same value of *LLP*; the second is that the larger the photovoltaic system, the better the reliability, that is, the lower the value of *LLP*, but also the greater the cost.

A certain degree of reliability is (or should be) a requirement depending on the typology of the load. For example, reliability requirements of telecommunication equipment are usually higher than that required by domestic appliances (higher reliability means lower *LLP* values). The problem confronting the PV engineer then takes the following "theoretical" form: Which combination of C_A and C_S achieves the desired *LLP* with minimum cost? Since cost estimation is a classic economic problem discussed widely in the literature, the PV-sizing problem is mainly rooted in the relationship between C_A, C_S and *LLP*. Later, C_A and C_S must be translated into the number and power of PV modules and battery capacity.