pressure on electricity authorities to extend the grid to their communities, or individually resort to the use of small gasoline-fuelled generator sets. Small generator sets have the advantage of supplying alternate current of the right voltage, so that conventional appliances can be used. But their service is usually restricted to a few hours a day, because of the increasing cost of operation and maintenance of the equipment.

Experience shows that even when grid electricity is available, people in rural areas normally use it to light a few bulbs and perhaps to power small radios or typically black and white TV sets. Most people in rural areas lack the money needed to buy larger electric appliances, such as refrigerators and washing machines, or are simply not acquainted with them. Hence, because the number and size of appliances now in use is small, rural electrification represents an important niche of opportunity for the application of photovoltaic technology.

23.3 THE PV ALTERNATIVE

Photovoltaic (PV) technology nowadays is considered one of the most appropriate options to electrify dispersed population in remote places [8]. From an engineering point of view, modularity is perhaps the single most attractive feature of this technology. It allows designers to tailor electricity-generating systems as small in capacity as a few watts, or as large as many megawatts to suit specific needs, just following basic rules of electrical engineering. This feature combined with the suitability of the technology for autonomous operation, producing electricity with locally available sunshine, plus other characteristics such as lightweight, low-maintenance requirements and long useful life, has led people to consider photovoltaics as an attractive option for rural electrification. Ever since the technology was applied to power space satellites in the mid 1950s, the concept of reliable electricity generation for remote applications was firmly established. Terrestrial applications were developed with the basic idea of powering loads in remote places, where the cost of extending the grid was just too high. Today, hundreds of thousands of PV systems have been installed around the world to substitute for candles and kerosene lamps, gasoline- or diesel-powered generating sets, or even for unreliable grid extensions. The types of applications of PV technology in remote areas range from telecommunications, lighthouses and alarm systems in certain industries, to domestic applications and delivery of basic services. Leisure applications, such as sailboats and mountain cottages now carry PV panels to provide the required amounts of electricity, instead of noisy and smoky combustion engines. Even the petroleum industry, which is nowadays the basis for the world's energy supply, is using photovoltaics to supply electricity in offshore rigs or to power remote valve stations in oil and gas ducts.

The advantages of PV technology for rural electrification were demonstrated through a number of early projects in the period between 1968 and 1977 in Niger, Mexico and India. Applications included PV powered educational television, telephones, medical dispensaries and boarding schools for native Indian children. This early work demonstrated not only the technical viability of the systems but also the benefits to the user [9–11]. Some of these installations are still operational and in good condition, although with the limitations of a 30-or-so-year-old technology. Unfortunately, a critical mass of early projects was never achieved as to make a noticeable impact on society, and the lessons derived from the few projects on record have mostly fallen into oblivion. Only the notion that the technology