paying their monthly bills is perhaps the closest they get to the electricity business. But even fewer people realize the technical and administrative complexities behind the process of generation, transmission and distribution of electricity that allows factories to run and people to enjoy the benefits of modern services.

Understanding the physical principles that turn primary energy into electricity belongs to a small group of technical elite in the universities, research centers and electric companies. For the layman, it makes little difference whether primary energy is hydropower, nuclear power, fossil fuels or solar energy. Thus, the fact that electricity can be locally produced using the sunrays as the primary source of energy, with no wires connecting to remote and unknown places and facilities, would be of significance only to the most knowledgeable people. It is interesting to know that PV users in native communities in many parts of the world make a cosmogonist connection between electricity and their ancient god, the Sun. Thus, for most of these people PV technology is an appealing means to get a long-awaited service.

However, after learning about photovoltaics people are inclined to ask why is it that with so many virtues and so many advocates, PV technology has only reached one-tenth of a percent of the world's rural population with no access to the grid? The answer is found in the number of barriers a new technology such as this has to overcome to fully enter the market. In the case of photovoltaics, some such barriers are well known, others still unknown; some technical in nature and others having to do with institutional, social and financing issues. Just as conventional electricity is generated, in large and distant facilities, transmitted and then distributed to reach the individual consumer, so is PV technology produced in a small number of facilities in Europe, Japan and the United States, transported across the continents and distributed to reach the final user in very remote rural areas. And at each step a number of operations need to take place, which involve different degrees of complexity and cost. Therefore, bringing the PV solution to those sites where the grid has not been able to reach can be a very difficult task, unless such barriers are successfully removed.

23.3.3 Technical Barriers

PV systems are claimed to be reliable and long lasting. This is true and proven insofar as the PV module is concerned, but not every component of the system's balance has the same degree of technological maturity. In both, stand-alone and hybrid systems, batteries are perhaps the weakest links. Batteries are exposed to overcharging and over-discharging, which usually reduce their useful lifetime. Batteries also demand a fair amount of attention and regular maintenance, albeit relatively simple. However, even the simplest technical tasks may prove to be complicated in rural areas where a high degree of illiteracy and a lack of familiarity with modern technology, and with electricity in particular, is more the rule than the exception. The problem with batteries arises in part because of the fact that the lead-acid technology now in use, available for over one hundred years, was not specifically designed for use in PV systems. Adaptations of the current technology into what is now called *solar batteries*, and development of new battery types, such as nickel-metal hydride [21], promise to ease many of the current problems.

SHS also face other problems, mostly in the charge controllers and the lamps, basically as a result of an industry that has until now had an uneven degree of development