

On the other hand, the German foreign-aid agency GTZ has promoted and supported several PV projects in Bolivia and has carried out an important promotional campaign in favor of renewable energy through the bilateral program for the diffusion of renewable energy (PROPER). Among other things, PROPER carried out activities to increase the number and capabilities of in-country personnel trained in the field of renewable energy at the professional and technical levels, including microenterprise building [43].

23.4.3 Brazil

PV rural electrification projects in Brazil started around 1992/93 with pilot cooperative projects with Germany and the United States [44]. Around 1500 SHS were installed as part of these projects in Northeast Brazil in cooperation with the local electricity distribution companies, who were responsible for systems installation, maintenance and performance monitoring. In 1994, the Brazilian Government launched an initiative to promote the use of renewable energy and the corresponding *action plan* was established in 1995, with the original goal of installing 50 MWp of PV systems by the year 2005 [45]. The program for energy development in the municipalities and the states (PRODEEM) was also launched in 1994 to deliver electricity by means of renewable energy to rural communities not served by the grid [46]. At the same time, several state governments, including Minas Gerais, Sao Paulo and Parana, launched their own PV rural electrification projects.

The PRODEEM program is coordinated by the National Department for Energy Development of the Ministry of Energy and Mines and is technically supported by the National Center for Electrical Research (CEPEL). Since 1995, three program phases have been implemented [47], with a total number of PV installations close to 2400, basically for water pumping, public lighting and other installations such as communal buildings, schools, health centers and churches. A fourth phase has been under consideration for installing about 1300 additional PV systems [48]. The process for the implementation of PRODEEM is well established and documented in the literature cited here.

The Electric Company of Minas Gerais has been actively involved in deploying PV systems, in spite of owning one of the most extensive electrical grids in Latin America, with a total length of 300 000 km. In 1989, CEMIG launched an experimental project to install PV systems for productive and domestic applications in remote places. Between 1995 and 1997, a demonstration phase of the Program of Assistance for the Rural Development of Brazil took place in cooperation with the US Department of Energy and the US National Renewable Energy Laboratory. PV systems for 70 schools and several pumping systems were installed as part of this program [49]. Plans were made to electrify 2000 regional educational centers and to install about 500 water supply systems, all powered by photovoltaics. By 1987, such pumping systems, with PV capacities between 1 and 2 kW each had already been installed [50]. General criteria for eligibility in the CEMIG program include localities farther than 5 km from the nearest electricity grid and a user density of less than 5 people per kilometer. CEMIG provides financing for 64% of the project cost, the remaining 36% being covered by the community authorities. CEMIG has also established a training center for technicians, who provide regular maintenance of the systems. Monthly salary of the technicians is covered by the municipal authorities of the region they serve [49]. A PV “pre-electrification” program was established by CEMIG in 1998 to stimulate the growth of the electrical demand in remote places, to the point where