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Electrochemical Storage for Photovoltaics

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18.1 INTRODUCTION

The availability of solar energy is not only different with respect to the annual yield but varies within the seasons of the year, during day and night and from day to day due to the weather conditions. So do the electrical loads. To balance the differing time patterns of loads and solar energy production, energy storage must be included in almost all autonomous power supply systems. Thirty percent or even more of the lifetime costs of autonomous power supply systems based on solar energy may be attributed to the storage. Only very few autonomous photovoltaic (PV) power supply systems have no battery storage system. These are PV or wind-pumping systems where the difference between water demand and energy supply (solar radiation) is levelled out by means of a water storage tank.

PV-powered autonomous power supplies power the complete range of appliances from very small appliances (watches, calculators) with a few milliwatt power requirements to large village power supply systems with about 10 kW power requirements. This chapter is dedicated to applications of PV generators in the range of approximately 10 W to 10 kW. This excludes very small appliances where different storage concepts are used.

There are a number of technical solutions to the problem of energy storage. Storing energy in the electric field of a capacitor is a solution for storage times ranging from microseconds up to 10 s. Storing energy in the magnetic field of a coil is a technology that has been under development for many years (supraconducting coils). It has, however, until today, not resulted in a product that has entered the commercial market.

Medium and high-speed flywheels are being operated in small numbers in grid support, uninterruptible power supplies and in underground railways or buses to overtake

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