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Chapter 1

Introduction

1.1 Introduction

In addition to the inevitable depletion of the fossil fuels that are now the major sources of energy, and the relatively smaller current alternatives, there is another matter that is very important in considering the effective use of the energy that is available. This is the relationship between the several types of energy supplies and the various uses of energy.

Worldwide energy consumption is between 500 and 600 EJ ($5\text{--}6 \times 10^{20}$ J). In terms of consumption rate, this is 15–18 TW ($1.5\text{--}1.8 \times 10^{13}$ W). The United States consumes about 25% of the total, although its share of the World’s population is about 5%.

A recent estimate of the major United States sources of energy is shown in Table 1.1. The current distribution of energy use, by major category, is indicated in Table 1.2.

These different types of applications have different requirements for access to energy, and different characteristics of its use. One of the important problems with the effective use of available energy supplies is that the schedule of energy use is often not synchronous with its acquisition, even from natural sources. Thus, buffer, or storage systems are necessary.

This requirement for storage mechanisms is highly dependent upon the type of use. Those that use fossil fuels, or their derivatives, for combustion purposes, such as for space heating or internal combustion-powered automobiles, require one type of storage and distribution system. Another, quite different, category involves the various applications that acquire their energy from the large-scale electric power transmission and distribution (T&D) grid. In that case, there are two types of storage systems to consider. One has to do with the electric power grid system itself, and the time dependence of its energy supplies and demands, and the other has to do with storage mechanisms applicable to the various systems and devices that acquire their energy from the grid.