Chapter 8

Renewable Energy Technologies

ABSTRACT

This chapter presents different types of renewable and/or sustainable energy resources. It discusses their impact on the globe in terms of economy, pricing, and environment.

Renewable Energy (RE) resources have some special features and attributes that differ from conventional energy resources. Conventional energy resources, however, put some constraints on the application or usage of RE. Such limitations include: site specificity, small size of power output, and current marginal feasibility. The environmental benefits of RE resources favor them over conventional resources.

The role of RE resources in the electricity industry is explained from present and future perspectives. The promotion strategies and methods of utilizing these resources are outlined. Such promotion is a very important issue that must be adopted by all countries. This will lead to encouraging investments in this promising area, and will result in huge long-term benefits for countries, institutes, and individuals.

INTRODUCTION

Energy is consumed by humans for everyday use and for their race survival, and exists in various forms, including mechanical, thermal, chemical, electrical, radiant, and atomic and are all inter-convertible. The resources of energy on earth are classified as renewable and nonrenewable (see Figure 1). These include chemical reactions (mainly combustion), nuclear reactions (fission), the effect of gravity (mainly hydraulic) and direct (photovoltaic) and indirect (photosynthesis and wind) solar energy conversion. A RE Resource (RES) can be replaced in nature at the same rate of consumption, while a nonrenewable resource exists in a fixed amount, or is used up faster than it can be replaced in nature. Our demand for, and use of, resources sometimes exceeds the supply that is available.

In general, RE usually comes from sources that are naturally replenish such as sunlight, wind, geothermal heat, etc. however, new renewable sources are developed that include: small hydro, modern bio-mass, wind, solar, geothermal, and

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bio-fuels (World Energy Assessment, 2001; Clean Edge, 2009; IEA, 2007).

The concept of renewability is based upon the scale of human events and if the source can be replaced during that period. For instance, wood is a renewable bio-mass energy source as long as adequate conditions are kept for reserves to be replenished. Rates of exploitation/deforestation in a number of areas are so high that bio-mass may be considered as a non-renewable source in those circumstances.

Currently both developed and developing countries are facing serious challenges in the energy sector (Fanchi, 2004). Traditional energy-based systems, i.e. fossil fuel-based systems, have tremendous growing problems including the soaring prices, over-reliance on a limited number of suppliers, geopolitical and technical risks that can affect supply, resource depletion and environmental damage (Sorensen, 2004).

This necessitated the need for securing reliable, affordable and environmentally friendly supply of energy. The other problem of limited amount of available resources (e.g. oil is expected to last 40 years, gas 80 years, coal 170 years, and Uranium for 60 more years) escalates this present problem.

Fossil fuel technologies are also changing in response to economic and environmental challenges, resulting in increasing efficiency of energy generation and new ways to dramatically reduce CO$_2$ emissions (e.g. with carbon capture and storage technologies).

The above represent driving forces that call for countries, utilities, and industries to search for more sustainable energy supplies that are associated with either new or improved RE technologies (Fanchi, 2005). RES with less environmental impact are attractive and are gaining market share, while technological innovation is bringing further efficiency gains and cost savings.

Figure 2 shows the sources and usage areas of RES. It is obvious that RES are potential candidates that can replace conventional fuels in the following areas:
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