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Sustainable development of hydropower and biomass energy in Turkey

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Abstract

This paper deals with policies to meet the increasing energy demand for electricity and domestic heating in Turkey. Air pollutant emissions due to power generation and their harmful effects on the environment are also presented. We also argue in favor of small scale dams for sustainable development. Turkey has a total gross hydropower potential of 433 GW, but only 125 GW of the total hydroelectric potential of Turkey can be economically used. By commissioning of new hydropower plants (HPPs), which are under construction, 36% of the economically usable potential of the country would be tapped. On the other hand, biomass (wood and wastes) energy is the second important renewable energy source for Turkey. In 1998, the biomass share of the total energy consumption of the country was 10%. In this study, the potential of important biomass energy sources and animal solid wastes of the country were determined. The effects of hydropower and biomass usage on the environment were also discussed. Considering the total cereal products and fatty seed plants, approximately 50–60 million tons per year of biomass and 8–10 million tons of solid matter animal waste are produced, and 70% of the total biomass is seen as possible to use for energy. Some useful suggestions and recommendations are also presented. © 2002 Elsevier Science Ltd. All rights reserved.

Keywords: Sustainable development; Hydropower; Biomass; Agricultural residues

1. Introduction

Energy is essential to economic and social development and improved quality of life in Turkey, as in other countries. Much of the world's energy, however, is currently produced and consumed in ways that could not be sustained if technology were to remain constant and if overall quantities

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were to increase substantially. The need to control atmospheric emissions of greenhouse and other gases and substances will increasingly require the highest efficiency in energy production, transmission, distribution and consumption in the country. On the other hand, the electricity supply infrastructures in Turkey, as in many developing countries, are being rapidly expanded, as policymakers and investors around the world increasingly recognize electricity's pivotal role in improving living standards and sustaining economic growth. On the contrary, in the coming decades, global environmental issues could significantly affect patterns of energy use around the world, as in Turkey. Any future efforts to limit carbon emissions are likely to alter the composition of total energy related carbon emissions by energy source in the country [1].

Energy is considered a prime agent in the generation of wealth and also a significant factor in economic development. The importance of energy in economic development has been recognized almost universally. The historical data attest to a strong relationship between the availability of energy and economic activity. During the past two decades, the risk and reality of environmental degradation have become more apparent. Growing evidence of environmental problems is due to a combination of several factors, since the environmental impact of human activities has grown dramatically because of the sheer increase of world population, consumption, industrial activity etc. Achieving solutions to the environmental problems that we face today requires long term potential actions for sustainable development. In this regard, renewable energy resources appear to be one of the most efficient and effective solutions. That is why there is an intimate connection between renewable energy and sustainable development [2].

The Kyoto Protocol to the United Nations framework convention on climate change, agreed to in December 1997, marks an important turning point in efforts to promote the use of renewable energy worldwide. Since the original framework convention was signed at the Earth Summit in Rio de Janeiro in 1992, the threat of climate change has spurred many countries to increase their support of renewable energy. Even more ambitious efforts to promote renewable energy can be expected as a result of the Kyoto pact, which includes legally binding emissions limits for industrial countries and, for the first time, specially identifies promotion of renewable energy as a key strategy for reducing greenhouse gas emissions [3].

A water power plant is, in general, a highly effective energy conversion system. There is no pollution of the environment, but objections are raised relative to the flooding of valuable real estate and scenic areas. Whether a particular hydroelectric installation is economically competitive with a fossil fuel power plant will depend upon a number of factors, in particular, fuel and construction costs. In numerous instances, a hydroelectric power plant is clearly economically superior to a comparable thermal power plant. In Turkey, most of the important water power plants have been developed, hence only a modest increase in the hydroelectric generating capability can be anticipated in the next two decades [4].

2. Hydropower and biomass potential in the world

The figures for the economically useful potential of hydropower can vary greatly. Technological advances, the standards used to make economic viability comparisons and the status of environmental protection legislation lead to different results in analyses performed at different times. In 1996, an assessment of studies performed by recognized institutions, such as the United

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