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Toward a sustainable energy future in Turkey: An environmental perspective

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ABSTRACT

As long as the energy future of Turkey is concerned there is a consensus among all parties involved in the subject that a strong sustainability based on diverse range of renewable and variety of sources with efficient and fair use of energy is a must. The main criterion in this approach is to use energy with the least possible greenhouse gases and other harmful emissions. A shift in focus to meeting the needs of energy service sector will be immediately felt in the sustainable energy future in Turkey. Another important aspect of the sustainable energy future of Turkey is that all energy users, as more knowledgeable and active participants will be more involved in various stages of the process. However, Turkey has a long way to reach this vision, because of growing greenhouse emissions related to energy production and utilization of alternative energy is slow. Besides, the intensity of energy of the Turkish economy is decreasing slower than many other OECD countries. In addition, energy consumption per person in Turkey is far above the service needs, even for modern lifestyles. There are substantial obstacles on the way to a sustainable energy future of Turkey, such as various aspects of economic structure, a misdirected energy market process, and a lack of vision among the decision makers.

Contents

1. Introduction

Energy is one of the main elements for both economic and social development and for quality of life in all countries as well as

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Turkey [1,2]. However, the current situation in production and consuming much of the world's energy is not that much promising as far as sustainability is concerned if technology for producing and consuming energy remains more or less same and overall quantities do not change substantially [4]. It would not be a speculation to claim that the need to control greenhouse and other harmful gases and substances will increase [5,6]. It is also clear that this control can be achieved through utilization of more efficient methods in energy production, transportation, distribution and consumption. Infrastructures for electric supply in many developing countries around the world are constantly increasing as decision makers and investors are recognizing pivotal role of electricity in improving quality in sustainable economic growth. However, compromise in sustainable development if a balance between economic, environmental and social outcomes is not achieved with proper measures is a growing concern [1–7].

In this paper, three specific issues those are important for the sustainable development of Turkey are analyzed. These three issues are potential consequences of climate change, technological developments for reducing air pollution and taking various measures for sustainable use of natural resources. Indicators to determine the current state and measure progress in each specific area are presented. An evaluation of potential problems as well as an assessment of government policies in those three areas is provided. Institutional organizations are also discussed whether they are appropriate to be able to integrate policies across various elements of sustainable development. An overview on renewable resources and sustainable development in Turkey is also provided.

2. Methodology

This section presents the methodology for the energy indicators for sustainable development, grouped according to the social, economic and environmental dimensions. The units specified for the indicators in each of the methodology sheets represent, in most cases, recommended units based on data availability and should facilitate international analysis. Individual countries may decide to use different units based on national practices and the specific objectives sought in using this analytical tool. It is recommended that all economic data used to develop the energy indicators for sustainable development should be in terms of constant prices. These data may be in national currencies. Table 1 presents the list of indicators and each weights for Turkey [8].

2.1. Social dimension

It is estimated that about one-third of the world's population, depend mainly on traditional biomass sources of energy; 1.5 billion are without electricity. About 250 million people have been connected to electricity grids or have been provided with modern biomass or other forms of commercial energy options since 2000 [9–11]. However, in the absence of adequate measures, the number of people with no access to commercial energy will remain stable or continue to grow as demographic growth outpaces electrification in some parts of the world. Therefore, a sustainable development goal is to increase the accessibility and affordability of energy services for the lower-income groups of the population in developing countries so as to alleviate poverty and promote social and economic development [9].

(a) *Underlying definitions and concepts*: Consumption of traditional fuels refers to the non-commercial consumption of fuelwood, charcoal, bagasse, and animal and vegetable wastes. Total household energy use might comprise commercial energy.

Table 1
Weights of indicators for Turkey.

Pillars	Percent (%)
Environmental dimension	
Production of reusable waste	6.43
Production of toxic waste	6.16
Environmental conditions	5.74
Education for environmental issues	5.65
Waste recycling, collection, treatment and reuse	6.34
Energy generation versus energy demand indicates	6.72
Environmental dimension total weight	**37.34**
Economic dimension	
Energy generation and energy demand	6.42
Projected demand	6.56
Investment capacity	6.36
Control of environmental liability	6.23
Environmental protection expenditure	6.32
Economic growth	6.10
Local economy basis	6.34
Economic dimension total weight	**44.33**
Social dimension	
Program to encourage the conscientious use of energy	6.12
Household income per capita	6.09
Existence of technical training schools	6.12
Social dimension total weight	**18.33**
Total	**100.00**

(b) *Measuring methods:* This indicator is defined by the share of households without access to commercial energy and by the share of households for which dependence on non-commercial fuel exceeds 65% of total energy use.

(c) *Limitations of the indicators:* Availability of data on the number of households without access to commercial energy or electricity may be a limitation. Heavy dependence on non-commercial energy, defined as 70% dependence on traditional energy, is an arbitrary benchmark for this indicator [9,12].

(d) *Alternative indicators:* An alternative indicator may be useful is 'Per capita consumption of non-commercial or traditional energy'. However, this does not really capture the essence of the issue.

2.2. Economic dimension

(a) *Purpose:* This dimension measures the level of energy use on a per capita basis and reflects the energy-use patterns and aggregate energy intensity of a society [9].

(b) *Relevance to sustainable development:* Energy is a key factor in economic development and in providing vital services that improve quality of life. Although energy is a key requirement for economic progress, its production, use and byproducts have resulted in major pressures on the environment, both by depleting resources and by creating pollution [9–12].

(c) *International conventions and agreements:* Currently, there are no conventions or agreements that specifically refer to the regulation and/or limitation of energy use per capita. However, calls have been made for the prudent and rational utilization of natural resources, improved energy efficiency and a switch to cleaner forms of energy. The United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol call for limitations on total greenhouse gas (GHG) emissions, which result mainly from the combustion of fossil fuels [9].

(d) *Linkages to other indicators:* This indicator is closely linked with other economic indicators, such as energy use per unit of gross domestic product (GDP), energy prices, energy intensities and energy net imports; with environmental indicators such as GHG emissions, air quality and waste generation; and