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Water Management and Southeastern Anatolia Project (GAP) for Energy Production in Turkey

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Abstract

The burning of Southeastern Anatolia Project (GAP) region in Turkey is rich in water for irrigation and hydroelectric power. The Euphrates and Tigris Rivers represent over 28% of the nation's water supply by rivers. On the other hand, 85% of the total hydro capacity in operation has been developed by DSI, corresponding to 9,931 MW (49 hydro plants) and 35,795 GWh/year respectively. The largest and most comprehensive regional development project ever implemented by DSI in Turkey is "The Southeast Anatolian (GAP) Project", which is located in the region of Southeast Anatolia on the Euprates and Tigris Rivers and their tributaries, which originate in Turkey. The energy potential of the Tigris and Euphrates is estimated as 12,000 GW h and 35,000 GW h, respectively. These two rivers constitute 10% and 30% of the total hydroelectric energy potential. The GAP region with this capacity will supply 25% of Turkey's electricity and 85% of its hydroelectric energy. This paper deals with water management and southeastern anatolia project (GAP) for energy production in Turkey.

Keywords: Southeastern Anatolia Project (GAP), Hydroelectric, Water Resources, Turkey

1. Introduction

By the year 2010, Turkey is planning to exploit two-thirds of its hydropower potential, aiming to increase hydro-production to about 75 000 GWh/yr. By 2020 this will rise to 100 000 GWh/yr, and by 2030 it could be 140 000 GWh/yr (DSI, 2006). The total gross potential and total energy production capacity of these sites are nearly 50 GW and 112 TWh/yr, respectively. As an average, 30 % of the total gross potential may be economically exploitable. At present, only about 18 % of the total hydroelectric power potential is exploited. The national development plan aims to harvest all of the hydroelectric potential by 2010 [1-3]. On the other hand, in the modern industrial societies routinely and dramatically modify the hydrologic cycle through unprecedented construction of massive engineering projects for flood control, water supply, hydropower, and irrigation [4-7]. The GAP project on the Euphrates and Tgris Rivers encompasses 22 dams and 19 hydroelectric power plants and irrigation schemes on an area extending over 1.7 million hectares. The total cost of the project is 32 billion US$. The total installed capacity of its power plants is 7476 MW, which means an annual production of 27 billion kW h [8-10]. The GAP will play an important role in the development of Turkey's energy and agriculture sector in the near future. For this reason, it is suitable to examine the general structure of this project and its effects. The GAP project on the Euphrates and Tigris Rivers encompasses 20 dams and 17 hydroelectric plants. Once completed, 27 billion kWh of electricity will be generated annually, which is 45 % of the total economically exploitable hydroelectric potential [11]. In this paper, general structure of the project, the natural resources and the hydro-electrical energy generation potential of the GAP is aimed to be evaluated as well as investigating the physical characteristics of the water source systems of the region in relation to planning-application problems [6, 11-14].

2. Water Development in Turkey

Hydro-electric power plants capture the energy released by water falling through a vertical distance, and transform this energy into useful electricity. In general, falling water is channeled through a turbine (Figure 1) which converts the water's energy into mechanical power. The rotation of the water turbines is transferred to a generator which produces electricity. The amount of electricity which can be generated at a hydro-electric plant is dependant upon two factors. These factors are (1) the vertical distance through which the water falls, called the "head", and (2) the flow rate, measured as volume per unit time. The electricity produced is proportional to the product of the head and the rate of flow. The following is an equation which may be used to roughly determine the amount of electricity which can be generated by a potential hydro-electric power site [15, 16]:

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