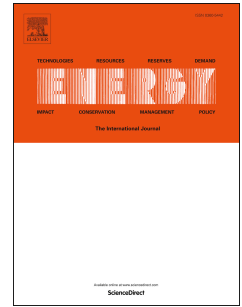


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# A Framework for Water and Carbon Footprint Analysis of National Electricity Production Scenarios

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## Abstract

While carbon footprint reduction potential and energy security aspects of renewable and non-renewable resources are widely considered in energy policy, their effects on water resources are mostly overlooked. This research aims to develop a framework for water and carbon footprint analysis to estimate the current and future trends of water consumption and withdrawal by electricity production sectors for national energy development plans – alongside carbon emissions from various electricity sources. With this motivation, the Turkish electric power industry is selected as a case study and a decision support tool is developed to determine the water consumption, withdrawal and carbon emissions from energy mixes under three different scenarios, namely Business-As-Usual (BAU), Official Governmental Plan (OGP), and Renewable Energy-Focused Development Plan (REFDP). The results indicate that water is used substantially even by renewable resources, such as hydroelectricity and biomass, which are generally considered to be more environmental friendly than other energy sources. The average water consumption of the OGP energy mix in 2030 is estimated to be about 8.1% and 9.6% less than that of the BAU and REFDP scenarios, respectively. On the other hand, it is found that the water withdrawal of the energy mix in 2030 under the REFDP scenario is about 46.3% and 16.9% less than that of BAU and OGP scenarios. Carbon emissions from BAU are projected to be 24% higher than OGP and 39% higher than REFDP in 2030. Carbon emissions and water usage are strongly correlated in BAU scenario as compared with OGP and REFDP, thus carbon friendly energy sources will result in fewer water consumptions and withdrawals, particularly under REFDP.

**Key words:** Water and carbon footprint; electricity production; scenario analysis; energy policy; decision support tool.

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