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Quantifying the impact of energy consumption sources on GHG emissions in major economies

Energy Strategy Reviews

Abstract:

This article aims to quantify the impact of different energy consumption sources on greenhouse gas (GHG) emissions for three major economies: the United States of America (USA), China, and the European Union (EU). To achieve this, energy consumption and GHG emissions data were obtained from “Our World in Data” for the period 1965–2021. Then, two machine learning techniques were utilized. Gradient Boosting (GB) was used to identify the major energy consumption sources contributing to GHG. While Artificial Neural Network (ANN) was used to quantify the effects of these major energy consumption sources on GHG emissions. The findings have significant implications for policymakers, as they suggest that effective strategies to reduce GHG emissions must be tailored based on the energy utilization sources of each country. Specifically, for the USA it was found that reducing coal consumption could be the most effective strategy to reduce GHG emissions, as increasing coal consumption by 25% would result in a 13% increase in GHG emissions. In contrast, increasing nuclear consumption by 25% in China would result in an 11% decrease in GHG emissions due to the displacement of fossil fuel-based energy sources. Increasing wind energy consumption by 25% in China would result in a 3% decrease in GHG emissions. In the EU, the study found that increasing oil consumption has a minor effect on GHG emissions while increasing coal consumption by 25% would result in an 11% increase in GHG emissions, highlighting the importance of reducing coal consumption. This study’s originality lies in the use of machine learning techniques to identify the key energy consumption sources driving GHG emissions in the three major economies, as well as its specific recommendations for reducing emissions.

Journal ranking:

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