

# The interconnections between Renewable Energy, Economic Development and Environmental Pollution. A simultaneous equation system approach

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## Executive summary

While the causal relationship between energy consumption and economic growth has been widely explored in the literature, the research on renewable energy-human development nexus is rare. The existing empirical studies generally focus on total energy consumption and use economic indicators, such as gross domestic product, to measure the impact of energy use on economic growth. Few attention has been given to alternative measures of economic development, in particular to the Human Development Index (*HDI*), to welfare gains from renewable energy deployment, or improvements in the quality of the standards of living. Moreover, most of the approaches used are quantitative in nature and no attempt has been made to explain the mechanism that describes the important interconnections between economic variables and renewable energy consumption.

The aim of this paper is to explore the interconnections between renewable energy, economic development, and environmental pollution by using a different approach to tackle the literature's shortcomings, namely: (i) we employ a more suitable economic indicator based on the *HDI*, which is linked to the sustainable economic growth and development concept; (ii) we use a simultaneous equation system, which describes the interrelations between economic variables, renewable energy and pollution emissions with feedback effects and circular expanding tendencies. The model is applied to a set of 28 OECD countries using panel data over the recent period 2004-2015. Different dynamic versions of the model are estimated, based on the partial adjustment principle. All models are estimated by *3sls*, the most efficient method that captures the circular tendencies among the core variables and controls for endogeneity.

Results provide robust evidence that renewable energy consumption, human and physical capital are important factors for explaining the level of sustainable development. The deployment of renewable energy is mostly determined by higher levels of human capital, R&D, and the countries' development stage. In turn, renewable energy contributes substantially for improving economic conditions and the level of sustainable development. This confirms the circular interdependence between the *HDI* and the share of renewable energy. Finally, human capital, renewable energy share, total energy consumption and the development level are all important factors for explaining environmental pollution.

**Keywords:** renewable energy, human development index, simultaneous equation system, panel data.

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