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Renewable Energy Transition and Economic Growth: Evidence from Panel ARDL Analysis of Developed and Emerging Economies

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Abstract: This study examines the dynamic nexus between renewable energy use and economic growth for a balanced panel of 30 developed and emerging economies over 2000-2023. A panel ARDL model estimated by the Pooled Mean Group (PMG) estimator identifies long-run relationships and heterogeneous short-run dynamics. Renewable energy share has a significant negative long-run effect on GDP per capita (coefficient = −0.0137; $p < 0.001$), interpreted as transitional adjustment frictions rather than incompatibility between renewables and growth. Energy intensity also lowers output, whereas trade openness, urbanisation and inflation are positively associated with long-run GDP per capita. Capital formation is the only significant short-run determinant. The findings call for policy sequencing that combines renewable deployment with investment in energy efficiency, grid modernisation and technology transfer.

Keywords: Renewable Energy Transition, Economic Growth, Panel ARDL, Pooled Mean Group Estimator, Energy Intensity

JEL Classification Number: Q43, Q42, O44, C23

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