

Abstract

Indonesia's structural dependence on fossil fuels, combined with the absence of studies simultaneously incorporating renewable energy, non-renewable energy, investment, capital, and labor variables within a single long-run framework for Indonesia, motivates this study. A Vector Error Correction Model (VECM) with Granger causality tests, Impulse Response Function (IRF), and Variance Decomposition is applied to analyze ET, ENT, FDI, GCF, and LFPR effects on Indonesia's economic growth over 1990–2024, extending prior work by covering post-COVID dynamics. The novelty lies in the first simultaneous long-run quantification of ET and ENT elasticities alongside investment and labor determinants in a single VECM, establishing that renewable energy's growth contribution is nearly three times greater than fossil energy.

Results show no significant short-run effects. In the long run, ET (0.028990), ENT (0.008965), FDI, and LFPR are positive and significant, while GCF yields a negative coefficient (−0.168153) reflecting capital allocation inefficiencies. Granger causality confirms a unidirectional relationship from GDP to ET, supporting the conservation hypothesis.

Variance Decomposition identifies GCF as the dominant driver of GDP volatility (37.87–49.93%), while FDI's contribution rises from 3.82% to 21.79%, consistent with technology spillover dynamics. These findings justify prioritizing renewable energy investment as a fiscal policy instrument, alongside improvements in capital allocation and human capital development as pillars of Indonesia's sustainable long-run growth.

Keywords: economic growth, renewable energy, non-renewable energy, VECM, Variance Decomposition, Indonesia

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