

Energy Efficiency as a Hidden Growth Engine: Evidence from Pakistan's Economic Performance

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ABSTRACT

Energy efficiency has increasingly emerged as an important mechanism for promoting sustainable economic growth, particularly in developing economies facing energy shortages, rising import dependence, and production inefficiencies. This study investigates whether energy efficiency can act as a hidden growth engine for Pakistan by examining its relationship with economic performance over the period 1990–2024. Annual time-series data are obtained from the World Development Indicators (WDI), with GDP per capita growth serving as the measure of economic performance and energy intensity representing energy efficiency. The analysis further incorporates energy imports, industrial value added, and urbanization as control variables. An econometric framework based on stationarity testing, correlation analysis, diagnostic tests, and the Autoregressive Distributed Lag (ARDL)–Error Correction Model (ECM) is employed using EViews. The findings indicate a stable long-run relationship between economic growth and the selected energy and structural variables. The significant and negative error correction term of -0.384 demonstrates that approximately 38.4% of short-run disequilibrium is corrected within one year, confirming a meaningful adjustment toward long-run equilibrium. The results further indicate that energy efficiency plays an important structural role in Pakistan's economic performance, although its effects are more evident in the long run than through immediate year-to-year changes. The study highlights the importance of demand-side energy policies, industrial efficiency improvements, energy audits, efficient technologies, and reduced energy import dependence. Strengthening energy efficiency can therefore contribute to productivity, economic resilience, and sustainable long-term growth in Pakistan.

Keywords: Energy Efficiency, Energy Intensity, Economic Growth, Pakistan