

Human Capital and the Energy Trilemma: Causal Evidence on Energy Poverty and Affordability from Pakistan

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Extended Abstract

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Abstract Summary

Despite near-universal electrification in many developing countries, substantial disparities in energy access, affordability, and quality persist. This paper examines the determinants of multidimensional energy poverty in Pakistan, with a particular focus on the role of intergenerational human capital.

Using nationally representative data from the Pakistan Social and Living Standards Measurement Survey (PSLM–HIES 2018–19), the study analyses four dimensions of energy poverty: reliance on solid fuels, energy expenditure burden, Low-Income–High-Cost (LIHC) status, and a multidimensional energy poverty index. The central explanatory variable is the educational attainment of the eldest child, capturing intra-household human capital dynamics.

To address endogeneity, eldest child education is instrumented using community-level adult education. Causal effects are estimated using IV-2SLS, IV-Probit, and a control-function approach within an ordered probit framework for the multidimensional outcome. Results show that education significantly reduces reliance on solid fuels and severe multidimensional energy poverty, but increases short-run energy expenditure burden, reflecting a transition toward modern energy use.

Mechanism analysis using Generalised Structural Equation Modelling (GSEM) indicates that digital access accounts for a substantial share of the total effect, while remittances play a limited role. Further heterogeneity analysis reveals nonlinear effects across education quintiles and significant gender differences in affordability outcomes.

The findings suggest that energy poverty is not solely an income or infrastructure constraint but also reflects capability limitations. Human capital emerges as a key driver of energy transition, with important implications for poverty reduction policy. Integrating education and digital inclusion into energy policy frameworks may be critical for achieving equitable and sustainable development.

Presenting Author Biography

Sana Younas is a researcher in development and energy economics at the University of Portsmouth, UK specialising in the microeconomics of energy poverty and sustainable transitions. Her work applies causal inference and household-level data to examine how human capital, gender dynamics, and digital inclusion influence energy access and affordability in developing countries. She is particularly interested in understanding the behavioural and structural barriers that persist even after infrastructure expansion and in designing policy-relevant insights for equitable energy transitions.