

Settling the metric selection debate for assessing the energy efficiency of energy-intensive industries

Prashant Giri¹ and Tarun Sharma^{1,2,}*

This study addresses recent calls to adopt multifactor efficiency measures in energy efficiency policymaking, moving beyond the traditional reliance on single-factor measures. Using firm-level panel data from 2003–04 to 2021–22, sourced from the Prowess database, we evaluate Total Factor Energy Efficiency (TFEE) and attainable energy-saving objectives for India's energy-intensive industries: aluminum, cement, fertilizer, pulp & paper, iron & steel, and textiles.

We applied Data Envelopment Analysis (DEA), including input-oriented Slack-Based Models with variable returns to scale, to determine energy efficiency potential. Our TFEE analysis reveals significant efficiency gains in iron & steel and textiles, contrasting with limited improvements observed in single-factor studies under the Perform Achieve and Trade (PAT) scheme. Despite a potential of 55.9% energy savings across industries, overall energy efficiency improved significantly during the period studied. The textile, iron and steel, and pulp and paper sectors show the greatest potential for improvements, at 65%, 61%, and 29%, respectively.

This manuscript offers a novel contribution by employing the Slack-Based Model in India's context and juxtaposing TFEE with single-factor measures, providing critical insights for policymaking. We confirm that the work has not been previously published, is not under consideration elsewhere, and complies with all ethical and publication standards.

¹Department of Management Studies, IIT Roorkee-247667, India.

²Center for Sustainable Energy, IIT Roorkee- 247667, India.

*Corresponding Author. Email: tarunsharma@ms.iitr.ac.in, prashant_g@ms.iitr.ac.in