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Data Envelopment Analysis for Efficiency Assessment in the Energy Sector*

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Abstract

The growing demand for sustainable and efficient electricity generation calls for robust evaluation tools to guide investment and policy decisions. While numerous studies assess performance using isolated indicators, there remains a significant gap in integrating technological, economic, and environmental dimensions into a unified efficiency measure. This study addresses that gap by reviewing and applying Data Envelopment Analysis (DEA) as a multi-criteria method to assess the relative efficiency of electricity generation technologies. DEA is particularly suited to this context due to its non-parametric nature, capacity to handle multiple inputs and outputs, and flexibility in incorporating both desirable outputs (e.g., electricity generated) and undesirable ones (e.g., emissions). The study examines advanced DEA models that reflect the specific needs of the energy sector, such as the inclusion of non-energy inputs and environmental externalities. Through this approach, we demonstrate how DEA can identify best-performing technologies and provide benchmarks for improving less efficient units. The findings underscore DEA's potential to support strategic decision-making by offering a comprehensive performance metric that aligns with sustainability goals. The study contributes to the literature by highlighting DEA's evolving role in energy efficiency assessment and its relevance in shaping a cleaner energy future.

Keywords: Data Envelopment Analysis (DEA), Efficiency assessment, Power generation technologies, Energy sector,

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