

Doctoral Dissertation

**Energy Landscape in Developing Countries: An Assessment of Mix,
Transition, and Market Mechanism
(Summary)**

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September 2023

Summary of the dissertation

This dissertation focuses on analyzing the energy landscape in developing countries, with a specific emphasis on the energy mix, transition, and market mechanisms. It highlights the importance of energy in driving economic growth and development while acknowledging the environmental challenges associated with reliance on fossil fuels. Developing countries face a trade-off between addressing environmental concerns and meeting their energy needs for continued economic growth. They also encounter various energy-related problems, such as energy poverty, limited access to reliable and affordable energy sources, inadequate energy infrastructure, energy insecurity, and energy inefficiency.

The study emphasizes four key reasons for assessing energy mix, transition, and market mechanisms in developing countries. Firstly, developing countries possess both conventional and renewable energy sources, and finding a balance between cost-effective conventional sources and environmentally friendly renewables is crucial. Secondly, evaluating the energy mix helps assess the sustainability of current portfolios and their environmental impact. Thirdly, it contributes to achieving sustainable development practices defined by the United Nations' Sustainable Development Goals, particularly SDG 7 (affordable and clean energy) and SDG 11 (sustainable cities and communities). Lastly, a well-functioning energy market promotes economic growth, energy access, affordability, sustainable development, and energy security.

The dissertation comprises four key chapters. Chapters 2 and 3 explore global energy mix and transition trends in developing countries using the pooled mean group autoregressive distributed lag (PMG-ARDL) models. These chapters examine the relationship between a country's development level and its energy mix, as well as the associations of remittances, real GDP per capita, and urbanization on residential energy transition.

Chapters 4 and 5 focus on India as a case study to investigate the interdependencies among renewable energy certificates (REC), electricity prices, trade volume, and coal prices within the energy market setup. Chapter 4 utilizes the partial wavelet coherence approach to analyze the relationship between REC and electricity prices, while Chapter 5 introduces the Quantile-on-Quantile approach to explore the relationships between coal price changes and spot electricity market movements.

Chapter 2 evaluates the evolution of the energy mix in 23 emerging countries from 1990 to 2016, considering non-renewable, traditional renewable, and modern renewable energy sources. The findings indicate a positive long-run relationship between development level and modern renewable sources, a negative relationship with traditional renewable sources, and a positive relationship with non-renewable sources.

Chapter 3 explores the relationship between remittances and residential energy transition in developing countries using data from 27 countries between 1995 and 2018. The study finds a positive long-run relationship between remittances, real GDP per capita, urbanization, and the use of high-efficiency energy sources in the residential sector.

Chapter 4 investigates the relationship between renewable energy certificates (REC) and electricity prices in the Indian power exchange market. The study employs the partial wavelet coherence approach and reveals a co-movement between REC and electricity prices, with a reversal in the co-movement direction as the REC market progresses.

Chapter 5 focuses on the relationships between coal price changes and spot electricity market movements in India. The study utilizes the Quantile-on-Quantile approach and finds positive associations between electricity price returns and coal price returns, as well as negative associations between electricity trade volume changes and coal price returns. These associations are particularly pronounced in higher quantiles of electricity price returns and electricity trade volume changes.

Overall, the dissertation provides valuable insights into the energy landscape of developing countries, focusing on energy mix, transition, and market mechanisms. The findings highlight the importance of balancing economic growth with environmental sustainability and the role of factors such as development level, remittances, and market mechanisms in shaping the energy landscape. The case study of India offers specific context and findings related to the interdependencies within the energy market.