

Almas Heshmati · Shahrouz Abolhosseini  
Jörn Altmann

# The Development of Renewable Energy Sources and its Significance for the Environment

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# Preface

The ongoing concerns about climate change have made renewable energy sources an important topic of research. Several scholars have applied different methodologies for examining the relationship between energy consumption, environment and economic growth of individual countries and groups of countries, in order to understand the effects of energy policies. In particular, previous studies have analyzed carbon dioxide emission savings made through the use of renewable energy from an individual source or in combination with traditional sources of energy by applying life-cycle analysis methods. This research has shown that after a certain period, economic growth leads to the promotion of the environmental quality. However, econometric critiques have opposed the results of these studies. Moreover, the effectiveness of governance-related parameters has been neglected in these studies. In this research, among others we analyze the impact of renewable energy development on carbon dioxide emission reduction.

In this volume, a number of issues are discussed that play a crucial role in enhancing the deployment of renewable energy, namely, the energy–environment relationship, alternative renewable energy production technologies, regulation frameworks for renewable energy sources, financing renewable energy development, and the market design for trading commoditized electricity generated by small renewable energy sources. Local power generation, which is the basis of renewable energy production, encourages the production of renewable energy resources, decreases transmission loss, increases saving energy, and enhances energy efficiency. Therefore, the integration of local, renewable energy sources and smart grids through local marketplaces that trade renewable energy in small units is a promising solution.

There are several points making this book unique compared to others. It analyzes important aspects of renewable energy development and its challenges. A model is developed to evaluate the effectiveness of renewable energy development, technological innovation, market for trade, and market regulations with respect to carbon dioxide emission reduction. For this purpose, a panel data model is applied to data from the EU-15 countries between 1995 and 2010. The effects of renewable energy on carbon emission reduction in EU-15 is investigated. The findings show that the effects of climate change can be mitigated by governance-

related parameters in addition to regulations, economic incentives, and technology development measures. It proposes a marketplace for trading renewable energy sources and provides suitable and evidence-based policy recommendations to promote renewable energies to substitute fossil fuels.

The subject of this work is development of renewable energy sources and their significance for the environment. A number of issues of particular interest to the readers are raised. We present the development of different renewable sources in recent decades and forecasts for future illustrated in figures and tables. Some regression analysis is also used for establishing relationship between emission and use of renewable energies. The key features of this work is its deep review and analysis of technologies, finances, environment and trade markets for renewable energy sources. It provides an up-to-date review of the literature considering production and consumption of renewable energy sources at country, regional and global levels.

Deployment of renewable energy and technological innovations can be used to reduce carbon emissions. Tariffs, finances, tax policies, and energy efficiency are used by governments to develop renewable energy. State research and development support, innovation, finances, and regulations have impacted the market for renewable energies. The effects of different technology, regulations and financial support factors on emission reductions are estimated. The structure of a marketplace for renewable energy sources is proposed and the requirements for the marketplace to function are outlined. Suitable policy recommendations are provided to enhance the efficient operation of market for renewable energies. Researchers, professionals, decision makers, environmentalists, non-governmental organizations, graduate students, postgraduate students, and public and private utilities will benefit from reading this research.

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# List of Abbreviations

AIC	Akaike information criterion
APEC	Asia-Pacific Economic Cooperation
ASEAN	Association of Southeast Asian Nations
BIC	Bayesian information criterion
BRICS	Brazil, Russia, India, China, and South Africa
CCGT	Combined cycle gas turbine
CCHP	Combined cooling heat and power
CCMT	Carbon-change-mitigation technology
CDM	Clean development mechanism
CHP	Combined heat and power
CSP	Concentrated solar power plant
CVPP	Commercial virtual power plant
DER	Distributed energy resources
DG	Distributed generation
EEX	European Energy Exchange
EIA	Energy Information Administration
EKC	Environmental Kuznets curve
EMS	Environmental management system
EPBT	Energy payback time
ERGO	Electric recharging grid operator
EROI	Energy return on investment
ETS	Emission trading system
EV	Electric vehicle
EXAA	Energy Exchange Austria
FDI	Foreign direct investment
FE	Fixed-effect
FGLS	Feasible generalized least square
FIT	Feed-in tariff
GDP	Gross domestic product
GHG	Greenhouse gas
GLS	Generalized least square