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## BOOK REVIEWS

*Energy Sustainability and Development in ASEAN*, edited by Han Phoumin, Harhad Taghizadeh-Hesary, and Fukunari Kimura. (Routledge, 2021). 228 pages, ISBN 978-03674-59123 (hard cover), ISBN 9781003026075 (ebook).

As the title suggests, the book focuses on the role of energy in the economic development of Southeast Asia and is part of the Routledge Studies in Development Economics series. As the introduction notes, Southeast Asia is a rapidly developing region across many metrics. Economic growth is expected to grow at about 4 percent annually, while population increases steadily at 0.6 percent annually through 2040. Energy is one of the key ingredients to fueling the economic growth. Final energy consumption is expected to grow by 83 percent between 2013 and 2040.

Each of the 9 chapters is a research study, some published by the editors. The editors have extensively published on sustainable energy development, policies, and energy security issues in the Asia Pacific region and have brought together a diverse group of authors. A consistent message throughout the book is that renewable energy can lead to improved economic development through avoiding health impacts, contributing positively to energy security, or providing long-run benefits that align with economic development ambitions.

The book begins with an exploration of air pollution on health and the economy in Southeast Asia. The authors Farhad Taghizadeh-Hesary and Farzad Taghizadeh-Hesary apply a vector autoregression on panel data from 2000-2016 for the ten Member States of the Association of Southeast Asian Nations (ASEAN). Emissions from fossil fuel combustion with impacts on health and economic activity in the ASEAN Member States. The authors found that access to inexpensive fossil fuels is a key driver of economic growth in ASEAN, but this leads to increased air pollution and the resulting increase in respiratory diseases, which has a negative effect in the long run not only on direct health care costs but on reduction in the labor supply, which compound to become an economic burden. The empirical results show that utilization of fossil fuels is one reason for economic growth in Southeast Asia, but there is a latent cost (negative health impact). The chapter would have benefited from a high-level cost-benefit analysis to further illustrate the implications of these findings.

In Chapter 2, the focus turns towards indoor air pollution from wood biomass cooking in Cambodia. As expected, combustion of wood biomass indoors for heating and cooking is dangerous to human health. Han Phoumin, Fukunari Kimura, and Suwin Sandu hypothesize that access and utilization of electricity provide direct and indirect opportunities for income-generating activities. Using a sample of nearly 4,000 Cambodian households, they empirically confirm that households use electricity for productivity. Other variables such as human capital (education) and assets have a positive and statistically significant role.

Building on the statistical findings, Han et al identify an important dilemma with increased electrification. Despite the progress in electrification, high electricity tariffs, especially in rural areas, mean households still rely on wood biomass, leading to adverse health impacts. This dilemma illustrates the complexity of designing goals and the importance of considering the larger energy system. In the case presented about Cambodia, the larger system is the patchwork of market structures, government interventions in subsidized fuel inputs and end-user tariffs, and state-owned enterprises.

The theme of electrification continues in Chapter 3. Youngho Chang investigates renewable energy integration, system flexibility, and decarbonisation in ASEAN. Chang builds on an existing ASEAN power trade model to incorporate system flexibility through introducing energy storage, which is a key concern for policy makers and system operators. The model is a cost-minimizing linear program. One counterintuitive finding is that integrating regional electricity markets

without energy storage could lead to increased CO<sub>2</sub> emissions relative to autarky through increased utilization of existing, less expensive fossil fuel consuming generation units. Chang finds that introducing energy storage in the integrated ASEAN electricity market leads to lower CO<sub>2</sub> emissions, but integration and storage alone will not substantially contribute to decarbonisation.

In Chapter 4, Thai-Ha Le investigates the association between income and CO<sub>2</sub> emissions in Southeast Asia using the environmental Kuznets curve. The study supports the hypothesis that industrialization ultimately reduces CO<sub>2</sub> and other emissions, which is not necessarily groundbreaking. Readers may want to refer to the wider literature on environmental Kuznets curve, including a recent publication by Hasanov, Hunt, and Mikayilov (2021). The chapter also asserts that reducing energy demand is “the most economical and efficient use of energy,” which is circular in nature and warrants more substantiation by the analysis.

Chapter 5 returns to the concept of energy security from the first chapter, by asking if renewable energy promotes energy security and economic growth in ASEAN. Rabindra Nepal, Hammed Musibau, and Farhad Taghizadeh-Hesary construct a theoretical framework based around an extended Cobb-Douglas production function and Westerlund cointegration to assess the relationship between renewable energy, energy security, and economic growth in ASEAN countries. They find that renewable energy supply is positively related to economic growth in ASEAN countries, while energy security is negatively related. One shortcoming the authors note is the lack of consensus around the definition of energy security. Nonetheless, the findings add to the narrative that renewable energy could have additional benefits to economies in Southeast Asia.

Chapter 6 shifts to an examination of energy and food prices. Using a panel vector autoregression model for eight Asian economies, Farhad Taghizadeh-Hesary, Ehsan Rasoulinezhad, and Naoyuki Yoshino find that energy prices have a significant impact on food prices. The authors conclude that given the volatility of fossil fuel prices, food security could be improved by substituting renewables for fossil fuels. This topic is relevant given the ongoing conflict between biofuels production, food security, and land management in several Southeast Asian countries.

In Chapter 7, a causal relationship between energy, income, trade, and environment in India is explored. Sangeeta V. Sharma, Thai-Ha Le, Han Phoumin, and Vinod K. Sharma apply an analytical framework that combines the environmental Kuznets curve with an extended version of the Stochastic Impacts by Regression on Population, Affluence and Technology model. The authors find that the anticipated increase in per capita income will lead to increased per capita energy consumption, which could lead to substantial CO<sub>2</sub> emissions if energy is supplied from fossil fuels.

Chapter 8 focuses on developing composite indices for assessing energy sustainability in Asia. Like energy security, the definition of sustainability is varied and encompasses several conflicting dimensions. Suwin Sandu, Muye Yang, Han Phoumin, and Reza Fathollahzadeh Aghdam measure sustainability along three dimensions: availability, efficiency, and acceptability. They then empirically analyze those indicators and find that energy sustainability has improved between 1990 and 2016 for 19 Asian economies, segmented by development status. This analysis adds a valuable contribution by assessing the nature of interactions between the various dimensions of sustainability.

The issue of domestic environmental policies on exports is explored in Chapter 9. Yiping Deng, Yanrui Wu, and Helian Xu use firm-level data to assess the impact of environmental regulations from the eleventh 5-year economic plan by the Government of China. Through a quasi-difference-in-difference method, the authors find that pollution reduction targets significantly reduced export product quality. The impacts are most prominent in western regions of China, capital-intensive sectors, and privately-owned firms. This topic will likely become more important as embedded carbon emissions become increasingly intertwined in international trade agreements, such as the forthcoming development of the European Union’s carbon border adjustment mechanism.

Southeast Asia, including ASEAN Member States, will be a critical region in future energy and political dynamics. Many players, including international organizations, countries, and industrial actors are expected to focus more on this region in the coming decades. There are many

examples of unintended consequences with existing policy initiatives that offer useful lessons for future policy development.

While the title addresses energy sustainability and development, the recurring focus on energy security vis-à-vis renewable energy adds a new dimension. While somewhat unconventional, the framing largely succeeds in highlighting the linkage between energy, development, and health. Southeast Asia has the highest regional death rate from exposure to outdoor and indoor air pollution—lung cancer is the leading cause of death in men and second in women (after breast cancer), as pointed out in several of the chapters.

This framing is in line with regional and international development goals, most notably the United Nations Sustainable Development Goals, which form key policy goals for many countries in Southeast Asia, including ASEAN Member States.<sup>1</sup>

However, this framing will not work for everyone. Detractors will see a contradiction between the need for economic development and less reliance on inexpensive, domestic fossil fuels. The counter argument is that the developing economies of Southeast Asia cannot afford more expensive, less carbon-intensive energy systems. This book aims to balance the cost and benefits calculus by incorporating health impacts from fossil fuels in the economic development story.

The book's primary audience is technical researchers and not policymakers or non-technical subject matter experts. At points the key takeaways and conclusions are obfuscated by technical procedures and jargon. With that said, the book is a useful entry in the growing body of work such as reports and analyses by the International Energy Agency, International Renewable Energy Agency, the Asia Pacific Energy Research Centre, and others that focus on Southeast Asia. It is recommended for those who are interested in this rapidly developing region. *Energy Sustainability and Development in ASEAN and East Asia* adds a valuable dimension to the body of work about energy and economic activity by presenting useful conceptual frameworks for assessing energy sustainability, economic development, and energy security in a holistic manner.

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Hasanov, F.J., Hunt, L.C., and Mikayilov, J.I. (2021). "Estimating different order polynomial logarithmic environmental Kuznets curves." *Environmental Science and Pollution Resources*. <https://doi.org/10.1007/s11356-021-13463-y>.

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***Regulation of Energy Markets: Economic Mechanisms and Policy Evaluation***, by Machiel Mulder (Springer International Publishing, 2021), 361 pages, ISBN: 978-3-030-58318-7 (hardback), ISBN 978-3-030-58319-4 (ebook).

This timely and highly readable textbook is a compendium of the author's twenty years of experience in government and higher education as a professor of energy economics. Mulder's text explains the basic economic mechanisms behind energy markets and governmental policies that are designed to improve energy market functions. His book covers almost all facets of the energy industry, including markets for electricity, crude oil, natural gas, coal, hydrogen, and renewables. Moreover, the readers are exposed to different forms of government intervention including the regulation

1. For more detail, see the ASEAN Sustainable Development Goals Indicators Progress Report 2020. The members of ASEAN are: Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Viet Nam.

of energy markets; the integration of wholesale markets; environmental regulations; government subsidies; and, energy taxes, among other salient topics.

Mulder's text is primarily aimed at an audience of upper-level undergraduate or graduate students who possess at least a basic understanding of the principles of microeconomic theory. The book's layout consists of systematic analyses of market failures within various energy sectors, including electricity and oil markets, among others. Through the outline of these failures, Mulder discusses the basic underlying economic principles, theory, and government policies.

Although written for an academic audience, Mulder's book is accessible to many different types of readers, including non-economists and policy analysts. To wit, Mulder offers a rich variety of examples, tables, and diagrams, such that most of concepts can be understood by a reader with little or no previous coursework in economics. This accessibility is reflected in the author's stated goal, in which he identifies his skill of creating a "...bridge between academic research and practical application in policy making." To this end, the book will likely appeal to any reader who wishes to learn about the economics and regulation of energy systems and markets.

The book consists of twelve complete chapters, with (mostly analytical) exercises at the end of each chapter (and, a complete set of solutions provided in an appendix). The first three chapters offer a broad overview of energy markets and the role energy plays within modern economies; specifics about different sectors within the industry; and, the energy policy landscape. These chapters are written from a non-disciplinary specific perspective, and the first part of the book intuitively helps to frame the more complex topics covered later in the text.

Mulder's identifies at the outset, in chapter one, that the content within the text follows a "public-interest approach." This approach is operationalized as an analysis of "...how governments can improve welfare by intervening in energy markets...[when] politicians are fully directed at making decisions which foster the well-being and welfare of society as a whole." He acknowledges that the public-interest approach may reflect normative theory but clarifies this approach as "...[trying] to determine the optimal policies from a social-welfare point of view." Although I would have preferred a more concise definition, my interpretation is that this approach falls within welfare economics and attempts to bridge the gap between individual objectives and social goals. To the author's credit though, this approach is described in the opening chapter in which he is attempting to explain these concepts to a lay audience.

Particularly insightful were the author's explanations of the basic scientific principles used for different energy sources in chapter two. These principles include units and measurements, such as how to measure the heat value of natural gas or the units used to explain electricity and its transmission. This simple addition to the text is incredibly helpful for a naïve reader who has no prior knowledge of energy resources, uses, and the transformation of energy. Many energy economic texts do not provide as thorough an overview of that offered in chapter two. This is important as the study of energy is multi-disciplinary in nature and includes many complex concepts from disparate fields such as physics, chemistry, engineering, and geology, among others. Thus, the author lays out the basic scientific principles at the outset so that the reader has a general comfort level before proceeding into the more complicated economic theory in the later chapters.

The chapters that begin to introduce economic theory are somewhat consistent with a standard introductory or intermediate microeconomic course. Chapter four begins with consumer and producer theory, and then explains the basics of market theory, including perfect competition and monopoly power. Additionally, the chapter discusses market failures and cost-benefit analysis from a welfare economics perspective. Chapter five goes into information asymmetries and then offers additional examples of market failures. Mulder's contribution here is in outlining different potential types of market failures, such as supply-side or regulatory failures, that may occur within the energy industry.

Chapter six is motivated as addressing natural monopolies in transportation or distribution systems, but, in fact, deals with a myriad of topics pertaining to the theory of the firm. Interestingly,

the mathematical and theoretical rigor become more complex in this chapter. Topics covered here include natural monopolies, tariff or pricing regulations, cost theory, productivity and efficiency analysis, revenues, and profits (and regulations thereof), among other subjects.

The next three chapters offer additional examples of market failures: externalities and monopoly power. Chapter seven characterizes energy as an impure public good since energy supply can be partially rivalrous or congestible. This chapter provides an overview of energy networks with a primary focus on the transmission and distribution of electricity. The reader may find this chapter insightful as the author carefully steps through the different facets of mechanism design for decentralized or restructured electricity markets.

As in most modern microeconomic texts, the externalities discussion in chapter eight relies on intuitive graphical analyses. The author discusses standard market-based policy solutions: corrective (Pigouvian) taxes and tradable emissions. The monopoly discussion in wholesale and retail energy markets in chapter nine provides many useful examples of the different types of such power and an honest assessment of many of the constraints within energy systems. For example, the author discusses the inflexibility of the supply and demand of crude oil, subject to the difficulty and costliness of energy storage. Moreover, the reader is exposed to governmental monitoring and regulatory measures to address market power.

Chapter ten addresses international trade and restrictions in energy markets. This is the only chapter with a modicum of macroeconomics. Although, the main examples are presented as simple two- or three-country trade agreements, so the models tend to be more microeconomic in scope. Further, the author offers a non-theoretic discussion of the types of international trade agreements, including an extension of grid capacity in electricity markets due to cross-border trading. Finally, the author discusses spillover effects due to the integration of international markets.

Chapter eleven covers issues of equality and social equity within energy markets. The discussion on equity is relatively short but includes many timely examples related to allocative efficiency; the distribution of resource rents; and, energy poverty and insecurity. In this chapter, the author comments on the optimal distribution of welfare in energy markets, in which he argues that "... energy products are generally viewed as basic commodities which should be available at reasonable conditions to everyone." This argument resonated with me given the recent Texas electricity crisis (winter of 2021) that left millions of residential customers stranded without power in near-freezing indoor conditions.

Chapter twelve wraps up the text and offers Mulder's final reflections on the regulatory environment. It includes the author's economic criteria for optimal regulatory design and his thoughts on an efficient energy system as the current (imperfect) system transitions into the future. In this discussion, he seems to advocate for a systems approach to regulation.

In conclusion, I found the book to be an up-to-date primer on energy markets, and the author does a good job of outlining the microeconomic principles that can be used to better understand energy markets and systems. Given Mulder's experience in government and academia, he provides a novel contribution to the literature by systematically analyzing different types of market failures and potential remedies offered by economic theory. Overall, Mulder's textbook should be a valuable reference for students and energy policy analysts.

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