

## BOOK REVIEWS

*Handbook on Energy and Climate Change* edited by ROGER FOUQUET, (Cheltenham, UK; Northampton, MA, USA: Edward Elgar Publishing, 2013), 800 pages, Hardback, ISBN 978 0 857933 368 3.

With increasing focus on the negative impacts of climate change, this book addresses a gap in the field of energy and climate change economics by providing a comprehensive overview of the state of research in this area. Dividing the contents into seven distinct sections allows for easy navigation of the material and encompasses wide ranging topics from the markets for fossil fuels, to governance, to energy policy and implications. This work is made up of contributions from many authors, each focusing on one specific area of energy or climate change.

The initial chapters take us on a tour of the fossil fuel markets—namely oil, gas, and coal. The first three chapters are general discussion chapters looking at how the markets have evolved over time and how dependency on these resources may change in the future as a result of technological progress, increasing energy demands and concerns over climate change. Issues pertaining to these industries such as lack of transparency, conflict, depletion of supplies, cooperation and policy and how they might impact on the evolution of the fossil fuels industry are assessed. It is not until chapter 4 that the first economic modelling is introduced. Here, the authors develop a partial equilibrium model of the world's steam coal markets to look at the interaction of the coal market with climate policies. This allows them to make conclusions about the efficiency of different types of climate policy alternatives, finding the biggest effect on global carbon emissions from a reduction in coal demand as a result of global climate policy.

The second section of the book considers the electricity markets. The initial chapter provides a comprehensive overview of the setup of the U.S. grid, as well as an extensive discussion regarding the upcoming challenges as a result of the increasing focus on renewable energy for electricity generation, along with changing regulation and technology. The conclusion arrived at is that the U.S. is equipped to meet the challenges to 2030 although institutional changes are critical to the evolution of the grid. The next chapter is based on the need to provide policy makers with guidance on targeting R&D support and other incentives. The focus is innovation in grid management and storage as these will be more cost effective and have the feature of neutrality. In order to assess the factors affecting storage and grid management technologies, preliminary empirical results on factors that encourage innovation in system flexibility are presented. The main empirical findings suggest while public R&D has a positive and significant effect, the introduction of renewable energy support measures will have a much greater impact and that innovation in storage and grid management increases as penetration of intermittent renewable energy rises. The final chapter in this section looks at the viability of electric vehicles. An interesting question is posed here. The authors seek to address whether electric vehicles will be cost effective, comparable performance wise with gasoline-powered vehicles, and whether the electric infrastructure exists to support these vehicles. Cost benefit analysis is applied in an effort to address these questions and scenario analysis implemented in an effort to mitigate some concerns with respect to estimating future cash flows and the discount rate used. Given the extensive uncertainties regarding future cash flows, the application of a real options framework to consider whether there is value in the option to delay, while some of these uncertainties are resolved could add to this study. This approach can also resolve the concern over applying the correct discount rate.

Part 3 introduces energy policy. The first two chapters carry out econometric and theoretical analysis to examine the contribution of energy efficiency and feed-in tariffs respectively in reaching the goal of CO<sub>2</sub> reduction. The next chapter follows on naturally from the preceding two and considers the prospect of transitioning to renewable energy sources going forward, stressing the barriers to transitioning such as unsound policies and emissions measurement. Due to the increasing

and ageing global population, the energy demand profile is set to change and the barriers to deployment of some renewable energy sources are discussed. Two key issues raised here are often overlooked in energy and climate change research. First is the failure to count emissions embedded in imported goods in the measurement of greenhouse emissions, resulting in the true emissions figures being under-reported. Second is the fact that renewable energy sources have lower power densities than both fossil fuels and nuclear power sources, making renewable energy sources less appealing to investors. Future research in this field will be considerably enhanced by taking these issues into account. The energy policy section concludes by analysing energy policy and how it has evolved in the U.K. over time.

Part 4 delivers a comprehensive overview of climate agreements. I found the first chapter (chapter 12) in this section to be one of the most interesting and thought provoking in the book. Applying an extended GETS model, the authors find that a higher proportion of the variation of atmospheric CO<sub>2</sub> should be attributed to human sources than previous findings in the literature suggest, a key issue that should be considered in future research. Further, it is found that while short-run changes in CO<sub>2</sub> mainly result from changes in the biosphere, the long-run trend is human induced. This chapter leaves many avenues of future research available. For example, if the authors are correct in their findings, designing incentives for changing behaviour with respect to energy consumption is clearly a more pressing issue than previously thought. The remaining chapters in this section cover many facets of climate agreements, including illustrating why cooperation on climate change is slow to progress, why the Kyoto Protocol is underserving of much of the criticism it has attracted (chapter 14), and an idea for a “Breton Woods Climate Institution” that would promote policy surveillance, best policy practices and a mechanism to channel funding to developing countries to address climate change (chapter 15) because the Kyoto Protocol has failed to deliver.

Part 5 encompasses carbon mitigation policies, considering issues such as identifying the best sources of climate finance, the optimal level of taxation on climate change, carbon trading, and the ethical arguments against permit trading schemes. In chapter 17, the authors implement an Integrated Assessment Model (IAM) to identify the optimal level of taxation, while in chapter 18 an alternative state-contingent approach to pricing is suggested due to problems relating to IAMs. The importance of developing econometric techniques to evaluate climate change policies and their impacts is highlighted again in chapter 20. Due to the energy intensive nature of building construction, a chapter devoted to climate change concerns relating to buildings is also included in this section. The authors suggest the introduction of a coordinated package of instruments centered on energy certification, building codes and smart meters is feasible, and will provide incentives to not only improve energy efficiency but also provide revenues for an energy efficiency fund that can channel capital to poorer households.

Part 6 introduces low carbon behaviour and governance. Personally, I found this section of the book to be particularly enjoyable as I have recently started working with a behavioural psychologist to examine the role of consumer behaviour in renewable energy investment and adoption. As a result, I have come to the conclusion that an interdisciplinary approach is vital to successfully address climate change. The first chapter in this section provides a nice overview of behaviour with respect to energy and climate policy, suggesting behavioural explanations for the energy-efficiency gap. New ways to study how both monetary and non-monetary incentives influence consumer behaviour are introduced. Further chapters suggest that posing the issue of climate change as a moral issue, and consulting the ethics literature might help determine the best approach to successfully achieve carbon reducing behaviour. The need for changing governance is also highlighted as a key issue, while the final chapter in the section asks whether it will take a global crisis of momentous proportions resulting in economic and environmental catastrophe before the issue of climate change is truly addressed.

The book concludes with a section on low-carbon growth. Initial chapters consider whether economic growth will be limited as a result of environmental constraints and if sustainability should

be the goal and provides some key insights into policy formation. Chapter 31 questions whether addressing climate change and maintaining economic growth in China can be consistent goals, and concludes that a transition to a low-carbon economy is achievable, though extremely challenging. The rapid economic development of China and the potential impact on the climate in the future as a result of increasing emissions has made this a critical area for consideration and I believe that further research in this area is warranted, although data availability for comprehensive econometric analysis may be a challenge to source. The author identifies several key areas that are critical for the transition and these provide many avenues for future research. The closing chapter of the text appropriately looks towards the future. Here several future scenarios of the world that lead to many future outcomes of how economies will evolve in terms of climate change are considered. Various constraints of a low-carbon economy are identified as are characteristics such as flexibility and risk that need to be taken into account in order to achieve an optimal outcome of transitioning to a low-carbon world in the future. While the author admittedly does not go into much detail with respect to risk, it is definitely one of the more difficult aspects of modelling climate change to measure and is one of the key areas for research moving forward.

In conclusion, a common central theme throughout this book is that climate change is a pressing global issue that to date has not been adequately addressed. The title of the book “Handbook on Energy and Climate Change” is an appropriate one as it identifies and discusses many key areas of importance for research in this area. I would suggest that moving forward in addressing climate change, it is critical to take a multidisciplinary approach where researchers from such diverse fields as economics, finance, psychology, engineering, and environmental science pool skills and resources in order to come up with renewable energy technologies and policies that are commercially feasible, economically viable and socially optimal. Researchers and academics often consider their own field of research to be the one that will be truly transformative. However, considering the many important issues identified in this book for transitioning to a low carbon economy, it appears essential that pooling knowledge is the only approach to achieve real world solutions.

*Julie Byrne*

*UCD Michael Smurfit Graduate Business School  
Blackrock, Co. Dublin*

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***Singapore in a Post-Kyoto World: Energy, Environment and the Economy*** edited by TILAK K. DOSHI (The Institute of Southeast Asian Studies—Energy Studies, Singapore, 1st Edition, 2015), Paper Back, 306 pages, US\$21.53, ISBN: 9789814620390.

This book has two purposes. The first is to introduce the complex world of energy, economics, environment, and security in climate change negotiations from the perspective of Singapore. It is aimed at readers who may not be energy professionals, but professionals have a lot to learn from the book. Second the book is aimed at students in energy economics and energy policy courses at the undergraduate and master’s programs. The author succeeds on both accounts interweaving the political economy issues from a neoclassical viewpoint. A book like this should be followed up with subsequent editions updating the status of the issues raised and their progress or lack thereof in the negotiations.

The 2015 Paris United Nations Climate Change Conference, COP 21 took place shortly after the book was published. This was the 11<sup>th</sup> meeting of the parties to the UN’s Framework Convention on Climate Change (UNFCCC) since the 1997 Kyoto Protocol. The objective was to fight global warming by reducing greenhouse gas concentrations in the atmosphere to “a level that would prevent dangerous anthropogenic interference with the climate system” (Art. 2).

The author outlines the Kyoto Protocol's multitude of issues on emissions cuts and responsibilities by different states and criteria. Developed countries, Annex I, were "obligated" to reduce current emissions, because they were the ones historically responsible for current greenhouse gases, GHG, in the atmosphere. Mitigation efforts will need to be complemented with adaptation efforts. The Protocol embodied the principles of common but differentiated responsibilities. In addition, it will require financial commitments (with uncertain costs) to assist developing countries, implementation rules and enforcement provisions.

Any negotiations and commitments will be based on the political will, economic resources, and geography of a country. Thus any agreement will be complicated by the heterogeneity of the parties. Singapore, as number of countries, falls into many categories of obligations depending on the view one takes. The author explores these issues from the perspective of Singapore in six well organized chapters.

The three main energy sector policy challenges facing Singapore are discussed in the first chapter. These are to promote energy efficiency and penetration of renewable energy technologies and initiatives. The second challenge (and a very important theme throughout the book) is how to meet mitigation targets given the special economic structure of Singapore. For over a century Singapore has served as an energy industry hub. Thus any mitigation efforts will be relatively expensive and could significantly reduce economic competitiveness. A third challenge is that similar to a number of countries including Japan, it does not have hydrocarbon resources. This creates energy security issues which have to be balanced with measures for climate mitigation and adaptation.

The second chapter provides an overview of the UNFCCC meetings following the signing of the Kyoto Protocol in 1997 which actually did not come into force until 2005. The objective was to develop legal instruments that would stabilize GHG emissions to reduce the danger of a climatic catastrophe. This was to be based on equity, efficiency, long-term environmental goals, and medium-term emissions strategy. Equity was introduced to assess the obligations for primary mitigation efforts to the countries historically most responsible, the industrialized developed countries referred to as Annex I and the developing countries. The long-term goal was to cap emissions to limit the global average surface temperature increase to 2°C. The medium-term strategy was to develop the implementation commitments to meet the targets.

This chapter presents a fascinating review of negotiating positions and concerns of key countries and coalitions through the first decade of the century. This survey covers important industrialized countries, China, ASEAN, small island states. During this period and at different meetings, the classifications and indicators for emissions cuts decomposed into different criteria changing the original simple Annex I and developing country designations. In particular, the newly industrialized countries, NICs, were included in mitigation efforts to varying degrees. Comparisons are made across the different classifications and indicators for various countries including Singapore. What becomes increasingly clear is that Singapore's economic welfare and economic structure will be challenged in any future climate change debates.

This chapter is rather long and a fair amount of detail is presented. It would benefit from cutting into two parts: the first containing the overview and negotiating positions and the second beginning with section 2.4 on the comparison of classifications and indicators. This would make it more digestible for the reader.

Chapter 3 deals with a fundamental issue for any agreement on mitigation and adaptation. Many low income and developing countries often have outdated emissions intensive technologies, little human capital, and insufficient economic resources to address climate issues. They will need finance and human capital training. The estimates range from \$75-\$500 billion per year over the next 15 years. Which countries will be asked to contribute to Clean Development Mechanisms, CDM? There are a large number of tables describing the financial issues of who pays and who receives. Table 3.6 provides a useful summary of the proposals for allocating these obligations.

Another table 3.9 presents possible sources of funds for financing using market mechanisms attempting to internalize the social cost of emissions, bilateral aid, and international finance. Singapore could play an important role in any market mechanism given its experience as an international financial center and knowledge as an energy hub.

The next chapter examines the “country *economic* competitiveness” from different emission mitigation policies. The industrial structure of Singapore, the second major challenge, is discussed industry by industry. The author considers possible responses for the shipping and oil bunkering, refining and petrochemical, civil aviation sectors and the possibility of Singapore serving as a global or regional hub.

Chapter 5 is perhaps my favorite as it discusses the political economy tradeoffs for the five main strategies in Singapore’s National Energy Policy. This is an excellent chapter for creating student debates over the economic and political issues. It allows them to use their skills and tools in an economics or policy classes. The first issue involves getting the prices right through a market mechanism. This section includes a useful summary table 5.1 comparing and contrasting cap-and-trade versus tax regimes for a negative externality. Command and control policies are considered as well. Energy security is the second strategy involving the diversification of oil sources and to alternative fuels like natural gas. Increasing energy efficiency is the third strategy. The author addresses the policy issues of energy efficiency from an economic allocation perspective for “standards” in buildings, appliances, transportation, and industry. The fifth strategy involves engaging Singapore’s workforce in an area for which it is well-known, human capital and high technology. This involves examining the value of an industrial strategy to invest in R&D for renewables like solar.

The final chapter reviews the lessons learned from the previous five for Singapore. There is a “trilemma.” There are three main trade-offs in addressing the challenges. How best to simultaneously meet the objectives of energy security, environmental sustainability, and economic competitiveness. These tradeoffs are not unique to Singapore. Every country faces them.

The benefit to the non-energy professional (including energy professional) and students is that this book provides an analytical framework for examining the issues applicable to any country. The review of the UNFCCC process, history, evolution, and political economic approach with an emphasis on the later is helpful. Further, it concludes with raising intergenerational and climate change issues by examining the savings and investment private and public policy decisions.

*Fred Joutz*  
*Department of Economics*  
*Research Program on Forecasting*  
*The George Washington University*

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***International Energy Markets: Understanding Pricing, Policies and Profits***, CAROL A. DAHL, (Pennwell Publishing, Tulsa: Oklahoma, 2015), 800 Pages, Hardcover, ISBN 10 1-59370-291-4.

Carol Dahl has updated and revised her magisterial work on energy economics, such that it continues to be the recommended text for graduate students, but also extremely useful to many in the industry and government. (More experienced academics will find it an excellent reference volume).

For many years, the vast majority of books on energy and especially petroleum were written not by economists but a bouillabaisse of historians, journalists, hard scientists and environmentalists to where even simple algebraic calculations were rarely employed. As just one of many examples, an otherwise well-written book on the late stage Soviet oil industry included investment

spending and capacity additions—but didn't show the resulting production cost per barrel. Similarly, several physicists have written alarmist books on so-called "peak oil" which demonstrate an alarming ignorance of resource economics as well as the history of the industry.

In many ways, Dahl's book is a remedy to that trend, although it primarily serves as a textbook, since few people are going to continue turning the pages after seeing calculus. However, not only should all energy economists read this book, but utility regulators, petroleum engineers and geologists, environmentalists and investment analysts as beyond the math, it elucidates the theories and concepts that explain the operation of different sectors of the industry, as well as providing a sweeping collection of data.

The coverage includes coal, oil, gas, and electricity although uranium is neglected beyond two pages. The methods she reviews include game theory, linear programming, input-output models and others, as well as the vast array of microeconomics, including monopoly, monopsony, cost curves, transaction costs. Investment analysts and finance students will appreciate the chapters on futures and options. Environmentalists will benefit from the chapters on externalities and pollution, and public goods and climate change, and far too many governments need to read about sustainability and development strategies, a challenge rarely mastered.

The application of theory to the real world is particularly valuable. In three splendid chapters, she covers the U.S. gas market as a case of transaction cost economics, the Asian LNG market as a demonstration of monopsony, and Europe's as an example of applied game theory. The biggest hole, however, is the briefly mentioned shale oil and gas, which are so recent and rapidly evolving that it is still difficult to talk about the economics and production potential.

Students of energy policy will find this book a good starting place, but there is little talk of the evolution of policies in various places, primarily because that would make it a multi-volume enterprise. But for the many people with a superficial understanding of energy, they will find a chapter that will provide them with an excellent background understanding of their area of focus.

*Michael Lynch*  
*Strategic Energy & Economic Research, Inc*