**Low-carbon, sustainable future in East Asia**

**-Improving energy system, taxation and policy cooperation-**

**Introduction**

 This book describes and assesses the current situation and policies that are aimed at the development of sustainable, low-carbon economies in East Asia. We consider how existing policies, including carbon and energy taxes, and regulations on nuclear power compare with those of the rest of the world, and how they could be improved upon. Our analysis is carried out in the context of the region’s growing economic and environmental interdependence, which is likely to increase further in future, for example due to international free-trade agreements for finance and services, the Trans-Pacific Partnership and the China-Japan-Korea Free Trade Agreements.

In recent decades East Asia has become established as a key part of the global economy. The region now includes both the second and third largest global economies at market exchange rates, and it seems only a matter of time before China passes the US to become the world’s largest economy.

The rapid growth in living standards in China and the number of people removed from poverty is almost unprecedented in history, and has undoubtedly improved the lives of hundreds of millions of people. Such rapid growth has brought new social and environmental challenges that are increasingly becoming the focus of new policy in China. At the same time the other major economy in the region, Japan, has gone through a period of economic stagnation that is, in part, due to a declining and ageing population. Although there have been some signs of recovery as a result of ‘Abenomics’, Japan faces its own unique challenges that, after the nuclear disaster in 2011, include determining its future energy supply.

In this book we focus on four countries or regions[[1]](#footnote-1) in East Asia, including Korea[[2]](#footnote-2) and Taiwan, as well as China and Japan (Korea and Taiwan were the world’s 15th and 25th largest economies in 2013, respectively, according to IMF statistics). Current estimates show that, in total, the four countries are home to 21-22% of the world’s population and economic production.

Less positively, the East Asia region now accounts for almost one-third of global CO2 emissions (excluding emissions from land-use change). As described in Chapter 1 of this book, the majority of this share originates in China, where coal-fired electricity generation has grown rapidly to fuel the manufacturing sector. However, if Japan replaces its nuclear fleet with fossil-fuel-based plants then it, too, could see its share of global emissions rise. The other countries in the region are also facing decisions on how to develop their energy systems, particularly, relating to electricity generation and transport.

 In our assessments in this book, we employ a variety of analytical approaches, including the application of advanced energy-environment-economy (E3) models so as to get scientific answers for our three main research issues. Two distinct types of modeling are introduced in Chapter 2, and used throughout this book:

* A macroeconometric approach
* Computable General Equilibrium (CGE) modelling

We use the E3ME-Asia[[3]](#footnote-3) model for a macroeconometric approach and, in some chapters, employ CGE models. The E3ME-Asia model, which is based on the E3ME model developed by Cambridge Econometrics[[4]](#footnote-4), was built to analyze the subjects of this book as part of a two-year collaboration between REEPS[[5]](#footnote-5) and Cambridge Econometrics.

 A key feature of this book is the comparison of results from two models with different structures and backgrounds. However, the scope of the analysis is not limited to macroeconomic modeling. Throughout the book other quantitative approaches are applied, including data analysis, input-output techniques and a separate simulation of the energy system. And not all impacts may be quantified; at various points we consider also in detail the qualitative effects of policies that are designed to promote low-carbon development and ‘green’ growth. This book is intended for a broad range of readers, including not only those with experience of macroeconomic modelling and but also those for whom many of the concepts will be new. The book identifies three major questions concerning the pathway to a future in East Asia that is environmentally sustainable; each is allocated its own section.

The first question is “how should East Asia choose its energy and power sources?”. Thus, in Part 1 of the book we discuss the energy system, as overall decarbonization will not be possible without a substantial reduction in emissions from the energy supply sector. As we shall explore, at present there are a range of policy measures in place to promote the use of renewables in East Asia that could be expanded (Chapters 3-4), but the possible role for nuclear power and renewable energies (Chapter 5) remains controversial. In the first part of the book we also discuss the often-neglected issue of energy efficiency (Chapter 6) and cover the related issue of energy security (Chapter 7).

The second question is “how could East Asian countries design energy/carbon taxes or other carbon-pricing instruments?”. In Part 2 of the book we assess the potential for Environmental Tax Reform (ETR) and carbon pricing in East Asia. The use of market-based instruments in climate policy is becoming more common worldwide but is still in its development phase in East Asia. Several different scenarios of possible designs of ETR considering the possibility of ‘double dividend’ are explored in Chapter 8 and they are compared to previous analyses in Chapter 9. This second section of the book also considers related issues, such as fiscal deficits (Chapter 10), social distributional impacts (Chapter 11), and the effects of human capital investment (Chapter 12). In the final two chapters of this section we discuss the difficult question of competitiveness (Chapter 13) and look at one of the potential instruments, border tax adjustments, which could address the issue of carbon leakage (Chapter 14).

The third question is “how should East Asia choose and coordinate low-carbon policies in the tide of free trade?”. Thus, Part 3 of the book considers the relationship between energy/climate policy and international trade. Recent growth in prosperity in East Asia has, in part, been due to increases in trade between countries within the region, and several new deals are currently on the table. As we shall see in this section, the interactions through trade are both complex and growing in importance, with the urgent need for a new view on the ‘national responsibility for emissions’ and for coordination of policy between countries. In Part 3, we then move on to the issue of who is responsible for current emissions and demonstrate the calculation of consumption-based CO2 emissions (instead of the conventional production-based emissions, see Chapters 15-16) and CO2 emissions from the international maritime sector (Chapter 17). Finally, we show that increased trade presents both opportunities and challenges in the development of sustainable and prosperous economies in East Asia (Chapter 18-19).

Whereas each of the three issues has been allocated its own section in the book, readers will find that the interactions between them are strong, and that they cannot be addressed in isolation. The concluding chapter, therefore, considers possible future policy options for East Asia across all three areas. The ultimate aim of the book is to improve the fundamental understanding of possible future energy and environmental initiatives and, thus, to facilitate improved policy coordination between the countries in East Asia.

We believe that our collection of analyses will provide valuable insight to our three key research issues, and that we have opened the door to further detailed analyses of possible policies and pathways – including assessments using E3 models – leading to a sustainable low-carbon future in East Asia. We view our contribution as work-in-progress and are very much looking forward to feedback from our readers.

This book is the synthesis of a collaboration study by the members of REEPS and the staff at Cambridge Econometrics during last two-and-a-half years. The discussions included six intensive workshops (four in Japan and two in Cambridge) and countless electronic discussions. The book is financially supported by Grants-in-Aid for Scientific Research of the Japanese Society for the Promotion of Science. We would like to take this opportunity to thank the Society for this support deeply.

On the behalf of authors of this book

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| Appendix |  |  |

1. The terms ‘countries’ and ‘regions’ are used here to accommodate the China–Taiwan issue, which makes it problematic to simply call Taiwan a country. Throughout this book ‘countries and regions’ will be abbreviated to just ‘countries’ for the sake of simplicity. The authors and editors would like to state clearly that they understand the complexity of the issue, and are by no means making any statement about the statehood of Taiwan by use of the word ‘countries’.

 [↑](#footnote-ref-1)
2. In this book when we say Korea, it means South Korea. [↑](#footnote-ref-2)
3. E3ME stands for Energy-Environment-Economy Model that is Econometric. [↑](#footnote-ref-3)
4. See [www.camecon.com](http://www.camecon.com) [↑](#footnote-ref-4)
5. Research Group for East-Asia Environmental Policy Studies. [↑](#footnote-ref-5)