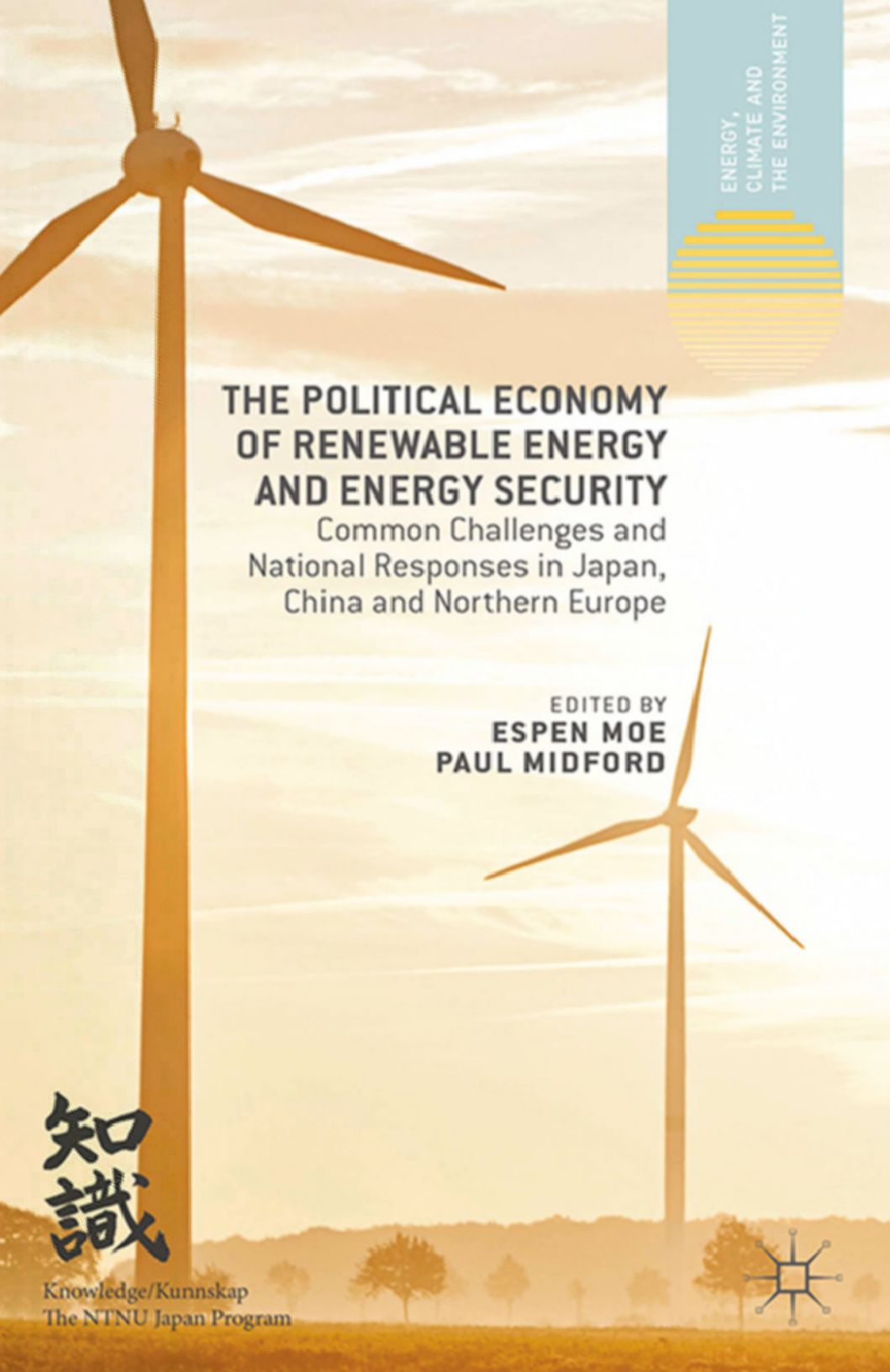
ENERGY, CLIMATE AND THE ENVIRONMENT
THE POLITICAL ECONOMY OF RENEWABLE ENERGY AND ENERGY SECURITY
Common Challenges and National Responses in Japan, China and Northern Europe
EDITED BY
ESPEN MOE
PAUL MIDFORD
知識
Knowledge/Kunnskap
The NTNU Japan Program

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The Political Economy of Renewable Energy and Energy Security

Common Challenges and National Responses in Japan, China and Northern Europe

Edited by

Espen Moe
Associate Professor, Norwegian University of Science and Technology, Trondheim, Norway

and

Paul Midford
Professor, Norwegian University of Science and Technology, Trondheim, Norway

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Series Editor's Preface

Concerns about the potential environmental, social and economic impacts of climate change have led to a major international debate over what could and should be done to reduce emissions of greenhouse gases. There is still a scientific debate over the likely *scale* of climate change, and over the complex interactions between human activities and climate systems, but global average temperatures have risen, and the cause is almost certainly the observed build-up of atmospheric greenhouse gases.

Whatever we now do, there will have to be a lot of social and economic adaptation to climate change – preparing for increased flooding and other climate-related problems. However, the more fundamental response is to try to reduce or avoid the human activities that are causing climate change. That means, primarily, trying to reduce or eliminate emission of greenhouse gasses from the combustion of fossil fuels. Given that around 80 percent of the energy used in the world at present comes from these sources, this will be a major technological, economic and political undertaking. It will involve reducing demand for energy (via lifestyle choice changes – and policies enabling such choices to be made), producing and using whatever energy we still need more efficiently (getting more from less), and supplying the reduced amount of energy from non-fossil sources (basically switching over to renewables and/or nuclear power).

Each of these options opens up a range of social, economic and environmental issues. Industrial society and modern consumer cultures have been based on the ever-expanding use of fossil fuels, so the changes required will inevitably be challenging. Perhaps equally inevitable are disagreements and conflicts over the merits and demerits of the various options and in relation to strategies and policies for pursuing them. These conflicts and associated debates sometimes concern technical issues, but there are usually also underlying political and ideological commitments and agendas which shape, or at least colour, the ostensibly technical debates. In particular, technical assertions at times can be used to buttress specific policy frameworks in ways which subsequently prove to be flawed.

The aim of this series is to provide texts which lay out the technical, environmental and political issues relating to the various proposed policies for responding to climate change. The focus is not primarily on the science of climate change, or on the technological detail, although there will be accounts of the state of the art in order to aid assessment of the viability of the various options. However, the main focus is the policy conflicts over which strategy to pursue. The series adopts a critical approach and attempts

to identify flaws in emerging policies, propositions and assertions. In particular, it seeks to illuminate counter-intuitive assessments, conclusions and new perspectives. The aim is not simply to map the debates, but to explore their structure, their underlying assumptions and their limitations. Texts are incisive and authoritative sources of critical analysis and commentary, indicating clearly the divergent views that have emerged and also identifying the shortcomings of those views.

The present text is no exception in exploring new trends and challenging received wisdom. It seeks to show, through a series of national case studies, how energy issues increasingly open up new interactions between policy areas which were previously sometimes seen as separate or of low priority – for example energy security and climate policy are now often dominant in economic policy concerns. The selection of countries for study includes major players like China, Germany and Japan, who are all in the process of accelerating the expansion of renewables, alongside smaller players like Denmark and Norway, the former being a pioneer in wind power and the latter increasingly being seen as the 'green battery of Europe', given its large hydro capacity. The Norwegian material emphasizes the importance of grid development and grid balancing, as renewables expand: the technological emphasis is moving from specific supply issues to system-level issues. However, that is set in a wider context of debate about sustainable energy support policy – how to promote the development and deployment renewables successfully. And, on that, the case study chapters and analysis in this text provide many lessons and pointers.

David Elliott

Preface and Acknowledgements

This is the first Norwegian University for Science and Technology (NTNU) Japan Program Policy Study. It is hoped that this study, and the others that follow, will contribute to understanding the major policy issues that face Japan and their relevance for other advanced industrial democracies and, indeed, for the global community as a whole. Japan faces a number of policy challenges in common with other advanced industrial democracies, especially those in Europe. The focus is on using common values as the basis for overcoming common challenges. Energy insecurity and renewable energy constitute one such policy area, and is the subject of this first NTNU Japan Program Policy Study. The next study will look at common challenges facing Japan and Norway in care for the elderly.

The NTNU Japan Program originated in the 1980s and early 1990s, when a number of NTNU scientists and engineers conducted research at Japanese universities as visiting scholars. Based on very favorable experiences and interest from Norwegian industry, NTNU established its Japan Program in 1998. Since the program's establishment it has offered courses on Japanese language, society and politics, and also on East Asian politics. Another hallmark of the program is its annual Japan Seminar, which has become a leading venue for presenting and promoting the latest research on Japan and East Asia in Northern Europe and beyond. It also is a cross-disciplinary seminar and especially promotes cross-disciplinary cooperation between engineering and natural sciences on the one hand and the social sciences on the other.

The present volume emerged from two NTNU Japan Seminars on energy security and renewable energy, the first held in 2008, the second held in 2011, and a panel on energy security held at our 2012 seminar that focused on Japan's recovery from the 3–11 earthquake, tsunami and Fukushima nuclear accident. It is from the 2011 seminar that the idea for this volume emerged. The central idea underpinning this book, and one of the main missions of the NTNU Japan Program itself, is to bring together insights from engineering and the natural sciences on the nature of technological change together with social science insights on how technology affects society, and how society in turn affects the development of technology, its diffusion and use.

Renewable energy and energy security illustrate both the opportunities and the necessity for promoting this collaboration. For social scientists it seems to go without saying that we depend on engineers and natural scientists to get a clear and accurate picture of the current state and changing

nature of technology, a picture that is an absolute prerequisite for us to understand how technology and technological change affects society, economics and politics. Our success in understanding all these fields is thus increasingly tied to understanding technological change. On the other hand, the funding, success and diffusion of innovative technology are not always simply a function of the degree of innovation and the capabilities of the technology in question. Often, the success of new technology follows a social logic more than a technological logic. Among other factors, human perceptions of risk and benefit, economic and political interests can either promote or inhibit the success of any technology, regardless of technological merit.

The area of energy security and renewable energy offers rich examples of this. The inter-play of perceptions of risk and benefit, and economic and political interests, have exercised a powerful impact on which types of energy technology are adopted and diffused, and which are not. The interplay of these social factors plus the objective strengths and weaknesses of various technologies is a theme vividly illustrated in the chapters of this book.

We can see this interplay in the debate about energy security, in the debate about the comparative merits of various forms of renewable energy, such as wind and solar, and also in the debate about the merits of nuclear power – debates that are now raging in Japan as never before. It is striking how often these debates boil down to assertions about comparative technical feasibility: Is it easier to secure nuclear power plants against any kind of earthquake or tsunami, or to build more efficient solar cells or deal with the inevitable power flux/intermittent nature of solar and wind energy? Indeed, in an era of rapid technological change it is not hard to imagine that given a long-enough time horizon, all these goals could be largely achieved, which means that these debates are perhaps not ultimately about technological feasibility, even though that is how they are often portrayed.

Rather, the technical issues in these debates often mask the real issues at stake, which are more about values, interests, identity, and perceptions of risk that in significant respects are independent of science and technology. Thus, these debates will ultimately have to address values, interests, identity, and perceptions more directly in order to come to a successful conclusion. What forms of energy will best represent our values, material interests, identity, and risk tolerance? In short, half of the answer to this question will be technological, and the other half will be social. We believe this volume makes an important contribution to addressing both sides of this question, the technical and social aspects of renewable energy and energy security.

We owe thanks to a great many people who contributed directly or indirectly to this volume. In particular, we would like to thank participants from the two NTNU Japan Program seminars from 2008 and 2011 from which this volume emerged, and another panel on energy policy held at the 2012

Japan Seminar, including: Taro Kono, a member of the lower house of the Japanese Diet, and the keynote speaker at the 2011 seminar; Finn Gunnar Nielsen of Statoil; Ryuji Shimada and Takanori Isobe of the Tokyo Institute of Technology; Ivar Wangensteen and Robert Nilssen of the Department of Electric Power Engineering at NTNU; Natsuyo Ishibashi, who was a post-doctoral researcher in the NTNU Japan Program from 2010 to 2012; and Eivind Lande, a PhD candidate in the Japan Program. We would also like to thank Paul Scalise, JSPS Research Fellow at the University of Tokyo, and a leading renewable energy skeptic, for being an excellent debate partner as Midford tested out new ideas that proved highly relevant for his chapter and this volume.

Notes on Contributors

Editors

Espen Moe is Associate Professor in the Department of Sociology and Political Science at the Norwegian University of Science and Technology (NTNU) in Trondheim. He obtained his PhD in political science from UCLA. He has worked as a postdoctoral researcher at the Industrial Ecology Programme at NTNU and has been a JSPS Fellow at the Kwansei Gakuin University in Sanda, Japan, and also a visiting professor at the Institut für soziale Ökologie at the Alpen-Adria Universität in Vienna. He is the author of *Governance, Growth and Global Leadership* (2007), and has published extensively on long-term processes of structural economic change, energy policy and transitions, and on renewable energy in journals such as *Review of International Political Economy*, *Energy* and *Energy Policy*. He is currently finishing a book manuscript on the political economy of renewable energy.

Paul Midford is Professor and Director of the Japan Program at the Norwegian University for Science and Technology (NTNU) in Trondheim. He received his PhD in political science from Columbia University. His research interests include Japanese foreign and defense policies, the impact of public opinion on policy, renewables and energy security and East Asian security multilateralism. He has published in *International Organization*, *Security Studies*, *Pacific Review*, *Asian Survey*, *Japan Forum*, and *International Relations of the Asia-Pacific*. He is the author of *Rethinking Japanese Public Opinion and Security: From Pacifism to Realism?* (2011) and is currently finishing a book manuscript on Japan's leadership in promoting regional security multilateralism in East Asia.

Contributors

Kenji Asano holds a PhD in global environmental studies from Kyoto University and has more than ten years' research experience as an environmental economist working on renewable energy policy evaluation. As a research scientist of the Central Research Institute of Electric Power Industry since 2007, he has been involved in policy evaluation of Feed-in Tariff and of bioenergy utilization. Between 2002 and 2004 he was a guest researcher at the Danish National Environmental Research Institute, focusing on renewable policies in selected European countries, and between 2006 and 2007 he was a post-doctoral fellow at the Biomass Technology Research Center of the National Institute of Advanced Industrial Science and Technology

(AIST) in Hiroshima, focusing on cost effectiveness analysis of biofuel from wood residue.

Jørgen Delman is professor of China Studies at the University of Copenhagen. His current research and recent and forthcoming China-related publications focus on China's 'green turn', climate change politics, climate governance at the city level, energy and energy security politics, renewable energy, and the architecture of China's biofuels market. Recently, he published on Chinese rural organization and individualization and on sub-politics in rural China. Professor Delman has extensive development consulting experience relating to rural, agricultural, food industry and private sector development in China, Vietnam, Africa, South America and Russia. He was Program Officer at the FAO Representation in Beijing 1983–86, Director of the China-EU Centre for Agricultural Technology 1991–96, Head of the Private Sector Department, Rambøll, Denmark 1998–2001, and Director of NIAS Nordic Institute of Asian Studies 2002–09.

Gunnar Fermann is Associate Professor in political science in the Department of Sociology and Political Science at the Norwegian University of Science and Technology (NTNU). He has previously worked as a research fellow at the Norwegian Institute of International Relations (NUPI), The Fridtjof Nansen Institute (FNI), Centre for Advanced Studies, Oslo (CAS), and been a visiting scholar at Columbia University (2001–02), Stanford University (2012), and University of California, Berkeley (2013). He has published extensively on international conflict-management, foreign policy analysis and on the relationship between energy and human-induced climate change. His work includes the editing and co-authoring of *Political Economy of Energy in Europe: Forces of Integration and Fragmentation* (2009), and *International Politics of Climate Change: Key Issues and Critical Actors* (1997).

Jakub M. Godzimirski has since 2012 been Research Professor and Head of the Research Group on European Affairs at the Norwegian Institute of International Affairs (NUPI). He holds a PhD in social anthropology. Between 1995 and 2012 he served as a senior research fellow at the Centre and Department of Russian and Eurasian Studies at NUPI. In 2009–10 he was the Head of the NUPI Energy Programme. His present research interests include Russian foreign and security policy, with a focus on energy's role and Russia's relations with the West. He has edited several volumes on these issues and published many peer-reviewed articles and book chapters on Russian energy policy and its reception in Europe. His most recent publication is an edited volume titled *Russian Energy in a Changing World: Outlook for the Hydrocarbons Superpower,* published in 2013.

Jiangwen Guo wrote the chapter she has contributed to this volume when she was a climate policy researcher at the Institute for Global Environmental Strategies (IGES) in Hayama, Japan. Prior to coming to IGES, she worked at

the Environment Development Center of the Ministry of Environmental Protection (MEP), China. In addition to climate change and low carbon development, Jiangwen has expertise in sustainable procurement and consumption (SPC) sustainable procurement and production (SPP), and carbon trading. She serves as senior specialist at the Global Green Growth Institute (GGGI).

Karolina Jankowska wrote this article when she was an independent researcher, political consultant and business advisor, mainly in the fields of energy and environment, and a visiting research fellow in the Fraunhofer Centre for Central and Eastern Europe MOEZ in Leipzig. In January 2014 she joined the WindSys Windsystems and Technologies GmbH in Schrobenhausen in Germany as a sales and marketing manager. She studied sociology, European and political science at the Jagiellonian University in Cracov and the Free University of Berlin. In 2011 she defended her doctoral thesis in political science on Polish renewable energy policy and politics in the electricity sector, titled: "Die Kräfte des Wandels. Die Wandlung Polens von einer auf Kohle basierenden zu einer an erneuerbaren Energien orientierten Gesellschaft", in the Environmental Policy Research Centre (FFU), Otto Suhr Institute of Political Science, at the Free University of Berlin.

Bogi Bech Jensen is Professor of Energy Engineering at the University of the Faroe Islands. He received his doctorate from Newcastle University, UK, where he also held positions as research associate and lecturer. He was associate professor and later Head of Research Group at the Department of Electrical Engineering, Technical University of Denmark (DTU), where he won the Best Teacher Award – Spring 2011. In 2013 he won the AEG Electron Award, which is awarded once a year to an outstanding researcher in Denmark. Professor Jensen has more than 50 peer-reviewed scientific publications, mainly in the field of wind-turbine generators. He is a senior member of IEEE and associate editor of IEEE Transactions on Industry Applications.

Ole Odgaard is a senior policy advisor at the Danish Energy Agency, focusing on energy planning, renewable energy and combined heat and power in Denmark as well as energy and climate policies in China. He is special advisor on China to the Ministry of Energy and Climate and participated in COP 15 in Copenhagen in 2009. He holds a PhD in economic and institutional reform in rural China. He lived and worked for five years in China from 1982 and was posted by the Danish Ministry of Foreign Affairs at the Danish Embassy in Beijing 1992–95. He has published books and articles on China and serves as a commentator on China's environment, energy and climate policies in the electronic and printed media.

Audun Ruud is a senior business developer at SINTEF Energy Research in Norway. Until recently he was a research manager responsible for developing R&D activities related to policy and governance. SINTEF Energy

Research is a major European Research institute on techno-economic issues related to energy and climate, and Ruud has been responsible for extending this research into non-technical, social-scientific concerns. As part of his new position, Ruud has also been responsible for social scientific research at the Centre on Environmental Design of Renewable Energy (CEDREN) in Norway, in which he is member of the management group. Ruud is member of the editorial board of the journal *Business Strategy and the Environment*.

Øystein Tunsjø is an associate professor at the Norwegian Institute for Defence Studies. He is author of *Security and Profits in China's Energy Policy: Hedging Against Risk* (2013) and *US Taiwan Policy: Constructing the Triangle* (2008). Tunsjø is co-editor with Robert Ross and Zhang Tuosheng of *US-China-EU Relations: Managing a New World Order* (2010, translated into Chinese, *Zhong Mei Ou Guanxi: Goujian Xin de Shijie Zhixu*, by World Affairs Press, 2012) and co-editor with Robert S. Ross and Peter Dutton of *Twenty First Century Seapower: Cooperation and Conflict at Sea* (2012). He has published articles in journals such as *Survival*, *International Relations*, *Cooperation and Conflict* and *World Economy and Politics* (in Chinese).

Frank Umbach is Associate Director of the European Centre for Energy and Resource Security (EUCERS), Department of War Studies, King's College London; Senior Associate at the Centre for European Security Strategies (CESS) GmbH, Munich and Senior Fellow at the Atlantic Council of the United States, Washington, D.C. Previously, he was head of the programmes 'International Energy Security' and 'Security Policies in Asia-Pacific' at the German Council on Foreign Relations (DGAP) in Bonn/Berlin (1996–2008), and has also worked at the Federal Institute for East European and International Studies (BIOst) in Cologne, in the office of the NATO General Secretary in Brussels, and at the Japan Institute for International Affairs (JIIA) in Tokyo. He is the author of more than 350 publications; as a contract author, since 2011 he has published regularly in the 'Geopolitical Information Service' (GIS – www.geopolitical-info.com).

Tore Undeland has been a full professor at NTNU since 1984. He has authored more than 150 publications, mostly on power electronics converters for industry applications and in renewable energy. He is the coauthor of the textbook *Power Electronics; Converters, Applications, and Design* (1989).

Yu Wang is an assistant researcher at the Institute of Energy, Environment and Economy, Tsinghua University. She mainly focuses on energy modeling analysis, especially on renewable energy cost-benefit assessment, and on local low-carbon development planning for local governments. She led the research projects 'Beijing Renewable Energy Development Strategy', 'Beijing's Low Carbon Development Planning', and 'Energy Demand and Relevant CO_2 Emissions Forecast of Hainan'. She is a member of a research

group that supervises Beijing's emissions-trading scheme and of a team that reviews progress on energy conservation and CO_2 emission control in Guangxi, Fujian and Guizhou provinces in 2013.

Eric Zusman is a senior policy researcher/area leader at the Institute for Global Environmental Studies in Hayama, Japan. He holds a BA in Mandarin Chinese from Rutgers University, a dual master's in public policy and Asian studies from the University of Texas at Austin and a PhD in political science from the University of California, Los Angeles. For much of the past decade he has worked on environmental issues in Asia. This has included publishing articles and book chapters on water scarcity, air-pollution regulation, environmental law and state capacity in greater China. It has also included working with China's Yellow River Conservancy Commission and the Chinese Research Academy on Environmental Science. He also has held research assistantships with the Woodrow Wilson Center's China Environment Forum as well as Taiwan's Academia Sinica. In his current position, he is looking at the co-benefits of climate policies in developing Asia. He recently published an edited volume on co-benefits in Asia's transport sector, titled *Low Carbon Transport in Asia: Strategies for Optimizing Co-benefits*.

1
Introduction

Espen Moe

Introduction

Energy issues are at the forefront of the political discourse as never before. In a world of $100-per-barrel oil, potential peak oil, and with climate change looming ever larger on the horizon, there is an obvious need for a fresh and critical look at energy politics. The idea of this book, stemming from a conference on renewables and energy security in Japan, East Asia and Norway, hosted by the Japan Program at the Norwegian University of Science and Technology in 2011, has been to blend not only perspectives on renewable energy and energy security, but also those of the natural and the social sciences. Building on the conference, this book has developed into a volume on renewables and energy security in Japan, China and Northern Europe. It offers a distinctive blend of theories, methodologies and geographical cases. One of its cornerstones is the notion that energy security and renewable energy, while often treated as distinct in the general literature, are inextricably linked. Blending perspectives of the natural and the social sciences has also been important. Too long has the field of energy been dominated by a discourse of technical problem-solving. But few areas are now more political. Energy is becoming a strategic resource to an extent that we have not seen since the 1970s oil crises. There is growing concern that energy is not just another tradable commodity in a smoothly functioning and apolitical and global liberal market economy, but that in the future its abundance and ubiquity cannot be taken for granted. Once the 1970s oil crises were forgotten, the energy security debate of the 1980s and 1990s shifted away from risk diversification and oil as a strategic asset towards simply buying petroleum in the market as cheaply as possible. In the words of Japan Research Institute president, Jitsuro Terashima, (2012): For Japan, 'securing energy supply meant building bigger oil tankers'. But the days of blind trust in global oil markets may be coming to an end. Energy will to a greater extent become subject to strategic thinking among energy-importing and energy-exporting countries, bringing energy security back

to amongst the foremost issues of the political agenda (see also Chapter 2 of this book, by Gunnar Fermann). The political nature of these issues – issues that are both of high technical complexity and of major importance to the world economy – means that only by bringing in the linkages between the technological, the economic and the political, can we make a meaningful contribution to the field.

Renewable energy also has a very clear political component to it. We obviously need to take into account the technological innovations and limitations that make energy technologies and industries such a crucial part of economic growth and of everyday life. But we also need to focus on the political processes and the political economy of energy production, as in the pursuit of policies of renewable expansion and in the implementation of these policies.

Energy and energy policy are interesting for the number of linkages they have to other areas. Energy is an area where cross-disciplinary efforts are at their most useful. Energy is linked to foreign policy and to geopolitics through, among other things, energy security. And the links to the political economy are obvious as energy prices most certainly affect the world economy. Energy use is at the core of modern-day economic growth processes. Throughout history there has been a symbiosis between industry and energy. Without new sources of energy, new growth industries would have been improbable. Also, the relationship between energy and political institutions is extremely important. Energy companies are among the world's biggest industrial giants.[1] They wield enormous political influence, and have often managed to secure institutional arrangements that further their own interests. Thus, in many countries, there is a strong bias in favor of the present energy structure, based on fossil fuels (sometimes nuclear) and on big, centralized energy utilities. Finally, energy policy has obvious linkages to industrial policy and climate policy. There are certainly countries that have tried to combine breakthroughs in energy technologies with the promotion of export industries (for instance, both Japan and China). And the argument that the expansion of renewables is necessary to meet climate commitments is one that is made routinely.

By studying a number of quite different countries, we can compare and contrast very different experiences and policies. This makes it easier to draw lessons from the empirical material, lessons that might otherwise remain hidden. Japan is small and densely populated, with few natural resources of its own to satisfy its energy requirements, but is wealthy after 150 years of industrialization. China is a potential superpower, with the largest population in the world, abundant in a number of natural resources, but scarce in others, still poor, but with growth rates so impressive and persistent that satisfying its future energy needs will present major challenges, both to China and the global energy system. Northern Europe is represented by Germany, Sweden, Denmark and Norway, with illustrative empirical

material from other countries. Norway provides most of the subject matter. While obviously not an economic powerhouse like Japan or China, from an energy point of view Norway is a highly interesting country. Small and scarcely populated, it has benefited from being well-endowed in petroleum, and before then in hydropower. Some even see Norway, with its very large hydro reservoir capacity as becoming the storage battery of Northern Europe, helping Denmark, Germany and others to balance the variability of their renewables (Gullberg, 2013). But this also means that, despite a national identity in which closeness to nature and environmental consciousness are important components, Norwegian efforts in renewables beyond hydropower have been feeble. Thus, Norway serves as a counterpoint to Japan and China, and is an outlier in the Northern European context as well, showing what a major challenge it will be to implement strong renewable policies in a country dominated by petroleum. The other Northern European countries bring their own specific contributions, demonstrating the complexity and rich variety of the region's renewable and energy security policies. Germany is an economic powerhouse of global stature. It has for long been a frontrunner on renewables, and its feed-in tariffs (FITs) are widely emulated. Also, following Fukushima, it has turned away from nuclear power, something that presents major challenges in terms of energy security, but also a major challenge – and an opportunity – for renewables in terms of plugging the gap in electricity production that will inevitably follow, making for an obvious comparison with Japan (see otherwise Frank Umbach, Chapter 3). Denmark may be a small country, but it was *the* frontrunner on wind power, and remains a leader, not just being the country with the highest density of wind turbines in the world, but also hosting the wind power giant Vestas. Finally, smart politics is becoming ever more important, making Sweden – one of the frontrunners on Smartgrids – a highly interesting country.

For this book, we have brought together a broad team of scholars from Northern Europe, Japan and China. While they obviously offer different perspectives, approaches and methodologies, their chapters are united by the common perception that renewable energy and energy security should have, at its core, a focus on the intersection among the technological, the economic, and the political. It is only by bringing out the linkages among the three that we can gain a broader understanding of the political economy that underpins the challenges the world is currently facing on renewables and on energy security. Thus, running throughout this book is the argument that none of the three can be left out, which does however happen far too often. North et al. (2009) stress that every explanation of large-scale change contains a theory of economics, a theory of politics and a theory of social behavior, but that very often theories of economics and politics remain independent, scholars not coming to grips with how economic and political development are connected. Technical problem-solving may be an excellent vantage point for analyzing energy policy. But it only gets us so

far. Thus, we have sought to link perspectives on economic and political development, together with the obvious technological bent that any study on energy tends towards, for a thorough understanding of the political economy of renewable energy and energy security.

The book is divided into three parts. The first focuses mainly on energy security. The Fermann chapter (Chapter 2) offers a broad theoretical perspective on energy security, introducing key concepts and theories, whereas Øystein Tunsjø (Chapter 5) and Jakub Godzimirski (Chapter 6) look into the energy security context of China and Norway, respectively. In Chapter 3 Frank Umbach looks at Japanese energy security since Fukushima and the recent German *Energiewende* (energy transformation), suggesting that Japan may learn from Germany's experiences with its nuclear phase-out. The Japanese policy debate has been active and intense. Paul Midford's chapter (Chapter 4) on Japanese public opinion and energy security demonstrates how public opinion is playing a crucial role in shaping energy and energy-security policy, and that public opinion has been far more important than it is often given credit for.

The book's second part has technological perspectives at its core, relating technological problems and drivers to the industrial, climate and energy problems that the technologies are meant to solve. Tore Undeland and Bogi Bech Jensen write about trends in wind turbine generator systems (Chapter 7), whereas Kenji Asano (Chapter 8) brings out the technologies and politics of solar photovoltaic (PV) as he discusses the rise and fall (and potential rise again) of Japan's PV sector. Often overlooked is the electricity grid. The grid is often a very concrete and very major obstacle to the expansion of renewables. Audun Ruud (Chapter 9) looks both at the technologies behind Smartgrids and at why a technology focus alone will not lead to success.

The final part has as its focus a social scientific analysis of the political processes pushing – or hampering – the development of renewables. Yu Wang (Chapter 10) looks at the impact of the original and the modified Renewable Energy Law in China. Jørgen Delman and Ole Odgaard (Chapter 11) analyze the 12th Five-Year Plan and assess the extent to which changes to the Chinese growth model can be expected in the future. Similar themes, of industry and growth interwoven with climate policy can be found in the chapter by Guo et al. (Chapter 12), with an explicit focus on how China is seeking to put itself on a low-carbon path. Karolina Jankowska (Chapter 13) analyzes German PV policies and how Germany became the world leader in PV, but also how the German system has come under threat, both from Chinese imports and from its own success, as government subsidies are becoming ever more expensive. Finally, in identifying institutional and industrial bottlenecks preventing the rise of renewables, Espen Moe (Chapter 14) looks at the vested interest structures of Japan, China, Norway and Denmark, the influence that vested interests wield over energy policy-making, and

the extent to which vested interests have become entrenched in the institutional structures of these countries. Among the lessons is the ease with which renewable energy policy is co-opted by vested interests, and the crucial role of the state in pursuing renewable energy expansion.

Energy Access

Thematically, the chapters deal with a number of recurring topics. Energy access is one. Irrespective of whether or not we have reached peak oil, the world no longer has abundant access to inexpensive energy. Granted, Daniel Yergin (2011) holds forth that the world is still awash in oil. The world's proved oil reserves have kept on increasing, and if we take unconventional sources into account, there is no immediate peak oil. Instead, the question has become one of how eagerly do we pursue the remaining resources and open up new areas for exploration, and the extent to which new technologies can make resources that in the past were technologically unfeasible to exploit. Michael Klare (2012), on the other hand, forcefully states that while it is technically true that we are still awash in oil, the days of 'easy oil' are long gone. Over the next 25 years, the 'easy oil' fields will lose 75 percent of their productive capacity. Shale gas, breakthroughs in fracking, deep-sea drilling, and Arctic oil may prolong the petroleum age. But if the future is still fueled by petroleum, every pretense of this being a cheap and abundant source of energy must be abandoned. And knowing that at least since the Industrial Revolution, the link between energy and economic growth has been intimate, and that waves of economic growth have been fueled by the rapid exploitation of a new cheap and abundant source of energy (Ayres and Warr, 2009; Moe, 2010), a prolonged period of scarce and expensive energy could seriously jeopardize the growth prospects of the entire world economy.

Ideally, the petroleum age ought to end, not because we run out of petroleum, but because we discover new sources of energy. However, to Klare (2008; 2012) a more likely outcome is that the share of renewables will change only little by 2030, because overall energy demand will also keep increasing. Instead, we might be facing a race for the world's final remaining petroleum resources, and a future that we should all dread, both for its increased levels of conflict and for the impact that climate change will have on a world that refuses to move on to sustainable sources of energy.

Energy security and the case for renewables

What the above points to are two things, both of which are at the core of this book. First, that we live in a time when energy security is crucial and different countries have to deal with this issue in different ways, based on needs and on access to resources. Second, that alternatives to fossil fuels need to be phased in, for energy (security) and for climate reasons.

Renewables are obviously not the sole answer. Not to the energy problem, not to the climate problem, and not to future energy security problems. The future is open-ended and, undoubtedly, we will see technological progress and industrial opportunities in areas still unforeseen. However, sitting back and waiting for such progress to magically appear seems foolhardy at best. What we do know is that the future will bring major energy challenges, and at present there are no simple solutions to cheaply and conveniently resolve these problems. What we also know is that climate change will push us towards abandoning fossil fuels, or we face the consequences of a dramatically warming planet. And while recent climate summits have been disappointing, one would hope that as countries perceive of climate problems with more urgency, conditions for renewables will become ever more favorable.

Thus, while we cannot say that renewables will be the definitive industrial champions of tomorrow, the notion that renewables belong to a cluster of technologies and industries that will continue to experience rapid growth, seems a conservative one. True, the countries in this book have varied considerably as to the extent to which they have pursued renewables as an energy (security) strategy or as an export strategy. China, for instance, is by far the market leader in solar PV, supplying nearly 60 percent of global demand, but up until recently there was almost no domestic market. Thus, for China, solar was about exports only and not energy. However, in general, growth in renewables has been rapid. Between 1997 and 2011, wind-power capacity increased by more than 20 percent every year (dipping slightly below 20 in 2012). PV increased by 60 percent a year between 2004 and 2009, and annual investments in renewables have risen from $40 billion in 2004 to $279 billion in 2011. For several of the past few years the United States and Europe have added more power capacity from renewables than from conventional sources (EWEA, 2013; REN21, 2013; WWEA, 2013). As renewables become more price-competitive, and with a number of countries providing favorable economic and regulatory frameworks, renewable energy and industries should have a prosperous future. This is another reason why a book such as this, with renewables as one of its two main pillars makes sense.

However, success is not a given. Success crucially depends on framework conditions. Thus, this book contains several chapters (Asano, Chapter 8; Wang, Chapter 10; Guo et al., Chapter 12; Jankowska, Chapter 13; Moe, Chapter 14) that analyze the importance of framework conditions, the effort of the state, as well as identifying bottlenecks that hinder the rise of renewables in the political–economic system. But often forgotten is that renewables also require an infrastructure, and this infrastructure is often both costly and inadequately developed. Without a proper grid network, a country can expand its installed capacity to infinite levels without much impact on the overall energy situation. Wind turbines in particular are often installed in far-away locations, where wind resources are plentiful, but where the grid

network is typically at its weakest. Thus, linking the installed wind power capacity to the electric grid is a serious problem, for example in both Japan and China. And while in many ways the expansion of renewables can be accomplished fairly easily – given the right support mechanisms – developing the grid takes time, money and deliberate government effort. One chapter deals explicitly with this (see Ruud, Chapter 9).

Barriers to change

The reluctance of some states to pursue renewable avenues of energy production on a large scale also has to do with the inherent power and influence residing in domestic institutional and industrial structures. In any society, there are a number of vested interests seeking to preserve the status quo, including the energy status quo (for example Moe, 2007; 2010). Unruh (2000) has labeled these structures techno-institutional complexes (TICs) – large technological systems embedded trough feedback loops between technological infrastructure and institutions. Once a structure is locked in, it is not easily dislodged. Institutions typically support the already existing actors in the political–economic system, and new and upcoming industrial actors have a far harder time getting access to political decision-makers. The current carbon-based TIC may easily be the most powerful yet, perpetuating a fossil-fuel-based infrastructure and exacerbated by government subsidies and institutions. For all practical purposes, this means that industrial change does not take place simply because new and promising technologies are available, or the price is right. It typically takes political action beyond mere market mechanisms to displace a TIC and implement a new energy structure. And so, structural energy change does not necessarily just happen by itself.

Major external shocks can sometimes be triggers for structural change. The 1970s saw two oil crises. They led Japan to stop taking energy security for granted. These crises rekindled awareness that Japan is among the least energy-secure countries on the planet, and that relying on oil imports at much increased prices might seriously hamper economic growth. This led to initiatives to find alternatives to fossil fuels, including a strongly funded program on solar power (even if the expansion of nuclear was the main strategy). This was an energy security strategy, but with new exports as a potential eventual spin-off. While Japanese solar power has had ups and downs, and while technological progress has been slower than what was anticipated in the 1970s, much progress has come from governmental initiatives as a response to the oil crises.

In March 2011 Japan suffered another external shock. Tragic as Fukushima was, it has ignited a vigorous national debate on energy security and the first serious Japanese rethink of energy policy since the 1970s. Several chapters testify to decades of stalemate and gridlock in Japanese energy policy-making. The influence of the electric utilities and the nuclear lobby on energy

policy-making has been massive, much to the detriment of renewables. With Fukushima and the closing down of, at times, all of the country's nuclear reactors, Japan has lost roughly 30 percent of its electricity supply. This is a challenge from both an energy and an energy security perspective. Japan imports all of its oil. More than 80 percent comes from the Middle East, actually up from 78 percent in 1973. In this regard Japan has not done much to alleviate its vulnerability in terms of energy security (Terashima, 2012). Also, the immediate consequence of Fukushima has been that Japan increased its liquid natural gas (LNG) imports by more than a quarter. Japan is now both the biggest importer of LNGs and the third largest net importer of oil in the world. Thus, while Fukushima has led to a serious energy rethink, it has also made the energy security situation even more precarious, which might lead to an increase in coal consumption by nearly 20 percent before the end of this decade (Adams, 2012). But Fukushima could also be a window of opportunity. It has provided renewables with a boost, and it has challenged the power and influence of the most important vested energy interests of the country, that of the electric utilities and the nuclear village. It is still too early to make firm predictions – apart from the fact that nuclear power, which pre-Fukushima was scheduled for escalation,[2] may now be headed for a gradual phase-out. But no matter what happens, Fukushima may have been instrumental in breaking the deadlock of Japanese energy policy-making (see also Umbach, Chapter 3; Midford, Chapter 4; and Moe, Chapter 14).

China has not suffered any similar energy shock, but one of the realizations that have had an impact on Chinese energy policies is that climate change will hit China harder than most. Thus, China needs to bridge energy security concerns (see Tunsjø, Chapter 5) – Chinese demand for oil is currently rising by 3.6 percent a year (IEA, 2007) and since 2009 China has even become a net importer of coal (Delman and Odgaard, Chapter 11) – with energy-emissions concerns. The fact that wind power was singled out as one of the industries that should secure Chinese economic growth through the current global economic crisis says something about the seriousness with which China pursues renewables. At the same time, because of the overall increase in energy demand, we have seen little in terms of structural change in Chinese energy supply. The importance of coal in the overall energy mix is scheduled to come down somewhat (from 70 to 62 percent of total primary energy supply) but, in terms of absolute figures, China will keep increasing its coal consumption at rates that dwarf the rest of the world, increasing its amount of coal-fired plants by one third only in the next five-year period alone (Wang, Chapter 10; Delman and Odgaard, Chapter 11; Guo et al., Chapter 12). Put together, the China chapters contextualize the tension between the need for more energy and for security of supply and the realization that China needs to change its energy mix.

Barriers to change in major petroleum exporters work somewhat differently. The Norwegian case is quite different in the sense that here, sky-rocketing