Chapter 1
Introduction: Connecting Global Issues of Net-Zero Carbon Society in the 21st Century

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Abstract Climate change has caused severe flooding and droughts, crop yield problems, and habitat changes, which pose a serious threat to the ecosystem and humanity. As a result, stakeholders are reconsidering environmental management policies and economic development limitations. This chapter introduces the overview of the book that explores achieving net-zero emissions through carbon pricing, carbon trade schemes, renewable energy transition, ecological conservation, and carbon sinks. It also examines the economic and social impacts of introducing carbon-neutral policies in the Asia-Pacific region. The urgency of addressing climate change and finding solutions to mitigate its effects on the environment and society is emphasized.

Keywords Net-zero carbon society · IPCC · Asia–Pacific region

1.1 Introduction

2021, the leaders of major industrial countries declared a shared goal of achieving a carbon-neutral international community by mid-century, during the G7 meeting. This objective is in alignment with the Paris Agreement, which aims to limit global warming to well below 2°C, and preferably to 1.5°C, compared to pre-industrial levels. In addition, major carbon-emitting countries such as the European Union, the USA, Japan, Korea, China, and India proposed specific timetables to achieve net-zero carbon emissions during the COP26 held in Glasgow in 2021. The objective of achieving net-zero carbon emissions involves reducing green house gas (GHG) emissions and balancing the remaining emissions through activities that remove GHGs from the atmosphere. These efforts reflect the urgency to address climate change and the need for coordinated action to achieve sustainable development goals.

After then, an Expert Group was designated by the UN Secretary-General to address a "surplus of confusion and deficit of credibility" over net-zero targets of non-State entities among public and private sectors. In 2022, The COP27 held in

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Sharm el-Sheikh, Egypt, kicked off with the release of the report—"Integrity Matters: Net Zero Commitments by Businesses, Financial Institutions, Cities and Regions" (United Nations 2022) by the Expert Group with ten practical recommendations in four key areas of environmental integrity; credibility; accountability; and the role of governments. Policymakers should strengthen global partnerships more closely with scientists, experts, and enterprises to seek appropriate policy instruments. Measures could refer to the carbon tax, carbon pricing (Arimura and Matsumoto 2021), carbon sinks, global or regional carbon emission trade schemes, energy transitions, and other carbon–neutral policies toward a net-zero emission society by mid-century. In the post-COVID-19 era, adopting a more proactive climate change-responsive policy and establishing international cooperation to save the Earth is indispensable.

At a time when carbon pricing policies are being formulated, climate change-related laws and policies will reshape global governance and the industrial layout between 2021 and 2030, and it is critical to move toward energy and industrial transformation, ecological conservation, and sustainable agricultural development. According to the Global Climate Action in the United Nations Framework Convention on Climate Change (UNFCCC), as of November 2022, 30,765 actors are engaging in climate action globally (UNFCCC Global Climate Actions 2022), of which actors consist of 13,909 companies, 1,562 Investors, 3,451 organizations, 286 regions, 11,361 cities, and 196 countries. In the report, the experts convey the importance of putting the net-zero pledge into practice by setting an evidence-based target. Moreover, utilizing voluntary credits could also help create transparent transition plans with accountability. Finally, these measures may improve the advocacy for accelerating the regulation roadmap.

The book focuses on the emerging issues of net-zero from the perspectives of assessment, legal framework, regulation, and policy simulations among the cases grounded in Japan, South Korea, Myanmar, Bhutan, Bangladesh, Taiwan, and the Arctic. With aims to provide an evidence-based approach for policymaking, the content is divided into three sections: net-zero measures from the land through East Asia, Southeast Asia and South Asia (Chaps. 2–5); net-zero measures from the ocean through Taiwan and Japan (Chaps. 6–9), and net-zero measures under international framework (Chaps. 10 and 11).

1.1.1 Part I: Net-Zero Measures from the Land

Carbon pricing is a policy tool designed to account for the externalities of GHG emissions. The externalities refer to the negative effects on the environment and public health that are typically borne by society as a whole. Such impacts include crop damage, medical expenses associated with heat waves and droughts, and property losses due to flooding and sea level rise. Carbon pricing addresses these externalities by connecting them to the price of carbon dioxide emissions, reflecting the social cost of carbon. This approach incentivizes emitters to reduce their GHG emissions and transition towards cleaner alternatives.(World Bank Carbon Pricing Dashboard

2022). The price could refer to the price of greenhouse gases and allows both the emitter and the emitted to shift the burden for the damage caused by greenhouse gas emissions. The price of carbon helps shift the burden for the damage caused by greenhouse gas emissions onto stakeholders responsible for that damage and can avoid it. Rather than dictating who, where, and how emissions should be reduced, a carbon price gives emitters an economic indicator to decide whether to change their activities and reduce emissions or to continue emitting and pay the price.

In Chap. 2: Potential Impacts of Afforestation Expansion under Price Fluctuations of Carbon and Timber, Wan-Yu Liu and Hong-Wen Yu introduce Taiwan's implementation of carbon trade schemes; forest landowners can acquire carbon credit revenue in addition to timber revenue. The land expectation value (LEV) calculated from the price of timber sale is used to assess the impacts on the afforestation area in Taiwan for carbon trading to analyze the correlation with the area of afforestation. Their results showed that timber prices significantly affected the area of afforestation of Taiwania cryptomerioides. It suggests that to increase the afforestation by 1%, LEV^{t}_{log} must increase by an average of 100,261 NTD/ha. After conversion, the price of Taiwania increased by 240 NTD/m^3 or 1.23%. The average carbon credit revenue accounts for less than 3% of the total LEV. It suggests that the total LEV obtained from Taiwania is primarily determined by timber price, with minimal impacts from carbon price fluctuation.

In addition to implementing the large-scale renewable energy project, the Myanmar Department of Rural Development, the leading government agency in implementing the off-grid component of the National Electrification Plan, targets 100% electrification by 2030 through both grid extension and off-grid electrification. Whereas all the policies and plans of the government, a significant population living in remote rural areas will remain far from the national grid and unable to afford connection fees in the distant future. **In Chap. 3: Turning on the Lights with Renewable Energy—Grid System for Lighting in Myanmar**, Li-Chun Chen specifies a tailored pilot project from the International Cooperation Development Fund for rural Myanmar in Magway and Sagaing region. The project achieved the development goals of inclusive growth and environmental protection through access to affordable and clean energy and climate action stated in SDG7 and SDG13. The endeavor from rural areas demonstrates that even the poor or vulnerable groups in developing countries can contribute to a net-zero society.

The current global energy crisis and the climate impacts of non-green energy sources have necessitated the shift toward renewable and sustainable energy in South Asia. However, the limited fossil fuel reserves and Bangladesh's climate change vulnerability index necessitate the country's need to achieve sustainable renewable energy governance and policy development to guarantee net-zero carbon emissions and energy sustainability. **In Chap. 4: Role of Renewable Energy Policy in Ensuring Net-zero Carbon Emissions and Energy Sustainability—A Bangladesh Perspective**, Emadul Islam, Asher Shah, and Tariq A. Karim illustrate the implementation of national and regional policies in addressing the challenges of Bangladesh's transition to green energy from fossil fuels. In addition, the study

contributes to national and intergovernmental green energy policy by developing recommendations along the Bay of Bengal region to increase the scalability of technologies and innovations, highlighting the opportunities and strengths of Bangladesh as the founding member of BIMSTEC integration.

Under the transition of the post-COVID era, the climate "red code" world hugely depends on good governance and a transition to low carbon. While world leaders have repeatedly stated a unified goal of establishing a carbon–neutral society by mid-century, the new index proposed by Bhutan could lead the net-zero initiative with motivation. **In Chap. 5: Opportunities and Challenges in Sustainable Development and Governance in South Asia—Case Study of Bhutan**, Shanawez Hossain and Ahmad Tousif Jami show that South Asia's strong economic expansion has paved the way toward sustainable development, yet the region still has many unsustainable practices, except for Bhutan. As the first-only carbon-negative country globally, it is vital to extensively study, learn, and optimize Bhutan's best practices to improve global climate practices. Bhutan's Three *G* model (Gross Domestic Product—GDP, Greenhouse gasses—GHG, Gross National Happiness—GNH) expands development metrics beyond GDP to people's happiness and environmental well-being. This study demonstrates how adapting practices from Bhutan, which have been molded by local experiences, problems, and opportunities, would effectively bolster green climate practices in the South Asian region.

1.1.2 Part II: Net-zero Measures from the Ocean

The oceans cover about 70% of the Earth's surface and are affected by anthropogenic climate change by absorbing 25% of our carbon dioxide emissions while producing 50% of the oxygen we need, as well as helping capture 90% of the excess heat generated by these emissions. The oceans are not only the "lungs of the planet" but also the largest "carbon sink" and an essential buffer against the effects of climate change (United Nations The ocean—the world's greatest ally against climate change 2022). The ocean-related industry "comprises a range of economic sectors and related policies that together determine whether the use of ocean resources is sustainable," or the so-called Blue Economy defined by the UN. The practice of Blue Economy could actualize the sustainable management of ocean resources, which will require collaboration across borders and sectors through a variety of partnerships among stakeholders, including public–private sectors, development banks, and investment funds (Morgan et al. 2022).

In Chap. 6: Sustainable Fisheries under Net-zero Emissions—A Case Study of the Taiwan Fishery Administration, Ching-Hsien Ho and Kuanting Lee analyze the fishery policies in Taiwan and other developed countries to identify green policy strategies and opportunities for a low-carbon economy in the context of net-zero emissions. By collecting and compiling international policy documents and incorporating Taiwan's implemented or planned policies and measures, they evaluate the gap between the current situation and future policy goals and discuss possible

implementation directions to address the identified gaps. The study also determines policy issues within short-, medium-, and long-term plans and possible opportunities through the use of Global Reporting Initiative (GRI) standards materiality analysis and the priority research direction determination method, with priority stakeholders identified using the boundary identification method. Overall, the study provides a comprehensive analysis of fishery policies, highlighting the need for a collaborative approach to address climate change and promote sustainability in the marine fishing industry.

Blue carbon is another emerging opportunity for an island country like Japan for its potential to capture CO_2. The kelp industry could bring not only economic impacts in the food processing sector but also environmental impact as blue carbon present the carbon credit contributing to achieving the goal of a net-zero society. **In Chap. 7: The Environmental and Economic Potential of Kelp as Blue Carbon—Case of Hakodate, Japan**, Hajime Tanaka, Michael C. Huang, and Atsushi Watanabe provide an overview of the kelp forests in Hakodate City, Hokkaido Prefecture, Japan. These kelp forests are considered to be a noteworthy blue carbon resource that has garnered worldwide attention. Moreover, the kelp forests have had a significant economic impact in Japan throughout history, while its environmental and economic ramifications of these forests have yet to be fully understood. It is recommended that the cultivation of kelp be promoted from both an ecological and economic standpoint, and that financial schemes be implemented to aid in the conservation and restoration of natural kelp.

In response to the sustainable development goals released by the United Nations, the governments have been actively using policy tools to attract foreign investment to help establish the wind power industry. Like many other countries, the Taiwanese government attempts to distribute the economic benefits of the new energy industry to the local companies and people through the policy of local content requirements.

In Chap. 8: The Legitimacy and Effectiveness of Local Content Requirements: A Case of the Offshore Wind Power Industry in Taiwan, Yachi Chiang discusses the development of the offshore wind power industry and the local content requirement (LCR) policies in Taiwan. The study highlights the potential conflicts and exceptions between LCR policies and the regulations established by the World Trade Organization (WTO). Moreover, the advantages and disadvantages of LCR policies are introduced in the literature with a focus on the energy sector. As the effectiveness of LCR policies varies across countries, it is suggested that the Taiwanese government should adopt a trial-and-error approach to determine their unique strategy with caution in LCR policies to align them with the WTO framework to avoid potential conflicts.

Climate change and global warming have significantly threatened food security and the global supply chain. As the trade volume of bulk commodity grains has been growing steadily, ensuring quality while minimizing losses during long-distance shipping between warm and cold seawater has become a critical issue. An evidence-based approach to provide quantified implications is needed to illustrate a roadmap toward a net-zero-carbon society.

In Chap. 9: Impact Assessment of Eco-friendly Cooling System Implementation on Sea Transportation: A GTAP-E-Power Model Application, Michael C. Huang, Yoko Iwaki, and Ming-Huan Liou apply GTAP-E-Power model to assess the potential economic and welfare impacts of introducing eco-friendly cooling systems in sea transportation in Japan, Australia, and New Zealand. The study employs scenarios based on technology changes in Japan derived from SPIAS-e, along with subsidies for capital-use in the electronics, solar power, and sea transportation sectors for the implementation of cooling systems. The simulation results indicate a modest GDP growth of 0.09% in Japan and 0.11% in Australia and New Zealand. Furthermore, the implementation of eco-friendly cooling systems could lead to an improvement in Japan's welfare of USD 4,219 million and a reduction of GHG emissions by 8.4 million tons, representing approximately 0.9% of Japan's total emissions from the shipping sector.

1.1.3 Part III Net-zero Measures under International Framework

Based on the Sixth IPCC assessment report issued in August 2021, man-made greenhouse gases' emission is responsible for approximately 1.1 °C of warming from 1850 to 1900, and the global temperature is expected to reach or exceed 1.5 °C by 2041(Intergovernmental Panel on Climate Change (IPCC) 2022). The IPCC thus urges world leaders to adopt substantial and sustained reductions to reduce carbon dioxide (CO_2) and other greenhouse gas emissions to stabilize global temperature by the next 20–30 years. In East Asia, the Former Prime Minister of Japan, Yoshihide Suga, declared that Japan will become carbon neutral by 2050. The commitment has been further endorsed by his successor Prime Minister Kishida Fumio. Korea enacted the Carbon Neutrality Act, which requires the government to cut greenhouse gas emissions in 2030 by 35% or more from the 2018 levels in August 2021. In China, President Xi Jinping committed to achieving carbon neutrality by 2060 at the UN General Assembly in September 2020. In Taiwan, President Tsai Ing-wen announced on April 22, 2021, that Taiwan will achieve carbon neutrality by 2050.

In Chap. 10: Moving Toward Net-Zero Emission Society—With Special Reference to the Recent Law and Policy Development in Some Selected Countries, Hsing-Hao Wu specifies the road to achieving net-zero emissions is an ambitious but challenging goal for each significant GHGs emitter in the Asia–Pacific region. Each country has its own economic, social, and technological foundation and capabilities and thus requires different approaches to achieve the same goal by exploring the recent global trends with particular references to EU, USA, and Japan's law and policy development aiming to achieve carbon neutrality goals by 2050.

While rapid environmental changes in the Arctic have brought increasing attention from the international community toward the region, considering these circumstances, the Arctic Council (AC) provides an important vehicle for addressing Arctic

issues. **In Chap. 11: Climate Impacts of Black Carbon and Methane Emissions in the Arctic and Current Frameworks for Prevention**, Sakiko Hataya demonstrates a basic overview of the Arctic Council and discusses recent organizational reforms. The content also addresses how Japan is involved in the Arctic, followed by the discussion of what the Arctic Council and other concerned countries are doing to control black carbon emissions, a current problem in the Arctic region.

The focus of these emerging issues is to highlight and explore the various policy instruments that can be leveraged to achieve an inclusive and effective transition towards a net-zero carbon society. In this context, it is important to acknowledge the interconnectedness of land, ocean, and international frameworks, which have significant implications for stakeholders. This interconnectedness is exemplified by the experience of building platforms among public, private, and non-governmental organizations, which are working towards a common goal of addressing climate change. This book aims to promote evidence-based policy-making (EBPM) and encourage the adoption of climate-friendly practices by identifying effective policy instruments to foster a greater understanding of the complexities of climate change and encourage the development and implementation of effective climate policies. Ultimately, the book seeks to provide policymakers, researchers, and other stakeholders with the tools and knowledge necessary to work collaboratively towards a sustainable future.

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