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Introduction

1.1 RESEARCH CONTEXT

China holds a critical position in the global fight against climate change. As the world's largest energy producer, consumer, and emitter of greenhouse gases (GHGs), China faces immense pressure to decarbonise its energy sector, which constitutes the most significant contributor to coal consumption and GHG emissions. According to Tsinghua University and the International Energy Agency (IEA), 85 per cent of China's energy mix is derived from fossil fuels, thereby rendering its economy heavily reliant on such energy sources.[1] This reliance is evident in the country's power sector, where coal-fired power generation accounts for 65 per cent of the electricity supply and over 40 per cent of GHG emissions.[2]

Nonetheless, in September 2020, Chinese President Xi Jinping announced, during the UN General Assembly, China's commitment to achieving carbon neutrality before 2060.[3] One of the key tenets of this objective is to peak emissions before 2030, a more ambitious goal than the previous National Determined Contributions, which aimed to peak emissions 'around 2030'.[4] These new pledges show that China is committed to peaking emissions before 2030 and achieving carbon neutrality before 2060.

China's adoption of a carbon neutrality objective would significantly contribute to achieving the temperature goals of the Paris Agreement. These new pledges are

[1] 'The Role of China's ETS in Power Sector Decarbonisation' (Tsinghua University and IEA, April 2021), <https://iea.blob.core.windows.net/assets/61d5f58d-4702-42bd-a6b6–59be3008ecc9/The_Role_of_China_ETS_in_Power_Sector_Decarbonisation.pdf>.

[2] Ibid.

[3] 'Xi Focus: Xi Announces China Aims to Achieve Carbon Neutrality before 2060' (Xinhua Net, 23 September 2020), <www.xinhuanet.com/english/2020–09/23/c_139388764.htm>.

[4] 'Enhanced Actions on Climate Change: China's Intended Nationally Determined Contributions' (China's NDC), <www4.unfccc.int/sites/ndcstaging/PublishedDocuments/China%20First/China%27s%20First%20NDC%20Submission.pdf>.

indicative of China's determination to peak its emissions before 2030 and achieve carbon neutrality before 2060, thus making a significant contribution to realising the Paris Agreement's temperature goals. The implementation of this carbon neutrality objective implies a fundamental shift in the organisation of energy systems and the economy, thereby raising crucial questions regarding energy law and regulation in China. Energy law and regulation play a crucial role in defining the obligations and responsibilities of key stakeholders, establishing regulatory systems and processes to transform the energy market structure, and overseeing the enforcement and implementation of relevant rules and provisions,[5] all of which lie at the centre of China's pursuit of carbon neutrality.

Over the past decade, China's energy legal system has undergone significant evolution, but deciphering the legal processes, obligations, and implementation remains a complex and challenging task. The normative rules related to the energy sector are derived from formal legal documents, including national laws and administrative regulations, as well as normative documents such as central government policies. Some law provisions require careful interpretation, such as Article 14 of China's Renewable Energy Law, which mandates grid enterprises to 'fully purchase the electricity generated by grid-connected renewable energy generators which satisfy the relevant technical standards within their grid coverage' – a provision which has led to various, often contradictory interpretations.[6] In addition to national laws, ministerial rules, and specific central government policies, such as those issued by the National Development and Reform Commission (NDRC) and the National Energy Administration (NEA), may also give rise to obligations and regulatory processes. This complex array of laws, regulations, and government policies has made it difficult to comprehend China's energy legal and regulatory systems. Nonetheless, these systems, which are essential to the strategies and pathways for achieving net-zero emissions in China's energy industry, are at the forefront of energy market reform and for achieving China's carbon neutrality target.

Despite some flexibility as to how China's 2060 target can be achieved based on the existing projections and forecasts, all the pathways point to four essential strategies, namely:

(a) decarbonising power generation through ramping up clean energy (i.e. nuclear and renewables);
(b) accelerating fuel switching to cut down coal consumption;

[5] Kim Talus, *Introduction to EU Energy Law* (Oxford University Press, 2016); Raphael Heffron, *Energy Law: An Introduction* (Routledge, 2014); Kim Talus, *EU Energy Law and Policy: A Critical Account* (Oxford University Press, 2013); Martha M. Roggenkamp et al. (eds), *Energy Networks and the Law: Innovative Solutions in Changing Markets* (Oxford University Press, 2012).

[6] See discussion in Chapter 3.

(c) electrifying end-use such as transport, industry, heating and cooling; and
(d) adopting carbon removal mechanisms such as carbon capture and storage (CCS) or carbon offset through new forest growth.[7]

Achieving China's carbon neutrality target is dependent on the abovementioned set of strategies that are indispensable on their own but also rely on one another. As the largest energy producer and consumer, China's carbon neutrality objective can only be realised through structural changes to energy production and consumption, primarily by phasing out fossil fuels, especially coal. Among all the sectors, the electricity sector provides the most significant opportunities for emissions reductions in the short term due to the promotion of renewable energy generation and the increasing competitiveness of wind and solar power. However, the large-scale electrification of end-use sectors necessitates decarbonising electricity generation, creating a critical enabling condition for fuel switching. Otherwise, the increased electricity demand is likely to be met by coal power, delaying the process of retiring coal power plants.

Moreover, current forecasts and models by China's top think tanks, such as Tsinghua University's Institute of Climate Change and Sustainable Development and the Energy Research Institute of the NDRC, indicate that coal and gas would still make up more than 10 per cent of electricity production under the carbon-neutral scenario by 2050.[8] To address this, CCS can be paired with fossil fuel use to remove the CO_2 that would otherwise be released into the atmosphere. Alternatively, the forestry carbon sink under the domestic carbon offset mechanism can provide another CO_2 sequestration option. Deploying CCS and relying on new forestry growth offers an alternative that allows for the continued use of fossil fuels in sectors where complete phase-out is challenging or technically impractical.[9]

As energy law has gradually developed as a field of study, considerable attention has focused on Global North (e.g. EU)[10] and more relatively intricate normative and

[7] Smriti Mallapaty, 'How China Could Be Carbon Neutral by Mid-Century' (2020) 586 *Nature* 482; Michal Meidan, 'Unpacking China's 2060 Carbon Neutrality Pledge' (The Oxford Institute of Energy Studies, December 2020), <www.oxfordenergy.org/wpcms/wp-content/uploads/2020/12/Unpacking-Chinas-carbon-neutrality-pledge.pdf>.

[8] Kejun Jiang et al., 'Transition of the Chinese Economy in the Face of Deep Greenhouse Gas Emissions Cuts in the Future' (2021) 16 *Asian Economic Policy Review* 142; 'Launch of the Outcome of the Research on China's Long-Term Low-Carbon Development Strategy and Pathway' (Institute of Climate Change and Sustainable Development of Tsinghua University, October 2020), <www.efchina.org/News-en/Program-Updates-en/programupdate-lceg-20201020-en>.

[9] 'Roadmap for Carbon Capture and Storage Demonstration and Deployment in the People's Republic of China' (Asian Development Bank, November 2015), <www.adb.org/sites/default/files/publication/175347/roadmap-ccs-prc.pdf>.

[10] Talus (n 5); Heffron (n 5).

institutional developments in the Global South, including China.[11] However, the existing energy law scholarship has paid little attention to the domestic energy law system in the context of developing countries, and the role that energy law and regulation can play in driving the decarbonisation of the energy sector in a country's specific context. With the announcement of China's carbon neutrality target, there is a pressing need for an in-depth analysis and understanding of Chinese energy laws and regulations that underpin the strategies and pathways required to achieve the long-term net-zero emissions goal. To date, there has been limited comprehensive analysis of the extent to which China's existing energy legal and regulatory system can steer the transformation necessary to pursue the carbon neutrality target.

This book aims to fill a gap in our understanding of the Chinese energy legal and regulatory system in the context of carbon neutrality. It seeks to comprehensively analyse the doctrines and implementation of national energy laws and regulations related to the four essential strategies and pathways towards carbon neutrality. To achieve this, the book employs both doctrinal and comparative analysis methods. The doctrinal analysis is necessary due to the need to interpret ambiguous provisions in Chinese sources of law, including laws, regulations, ministerial rules, and policies. Comparative analysis helps provide insights into China's practices based on legal developments and practices in other jurisdictions.

One key focus of the book is on the role of law and energy market reform in decarbonising China's electricity sector and accelerating fuel switching. The power and gas markets, known as the network-dependent energy industries, must respond to new regulatory demands to achieve these goals. These new demands arise from the diversification of electricity generators, particularly renewable energy, and the need to improve the efficiency of transporting natural gas to consumption points. The book explores how these new developments in China's energy sectors align with the models of more liberalised energy markets and focus on liberalised wholesale and retail markets, a more flexible and efficient transmission network, and transparent management of the gas pipeline networks. These developments necessitate an improved regulatory framework governing these sectors and robust oversight over their operation. The book examines these new legal developments in electricity and gas sectors in respective chapters.

This analysis is of significant importance beyond its academic value, especially given the increasing number of energy-related disputes in China. These disputes may involve the interpretation of critical provisions in domestic energy law and regulation or may see national law norms implemented in contradictions with newly

[11] Sufang Zhang and Philip Andrews-Speed, 'State versus Market in China's Low-Carbon Energy Transition: An Institutional Perspective' (2020) 66 *Energy Research and Social Sciences* 101503; Hao Zhang, 'Prioritizing Access of Renewable Energy to the Grid in China: Regulatory Mechanisms and Challenges for Implementation' (2019) 3(2) *Chinese Journal of Environmental Law* 167; Junxia Liu, 'China's Renewable Energy Law and Policy: A Critical Review' (2019) 99 *Renewable and Sustainable Energy Reviews* 212.

adopted rules aimed at liberalising the energy market. For instance, in Chapter 5, we discuss the establishment of an independent oil and gas pipeline corporation, PipeChina, and the adoption of Third Party Access (TPA) rules to promote the fair opening of pipelines. However, certain provincial and urban gas companies have been granted concession rights to manage and use intra-provincial gas pipelines exclusively to gain profits, which contradicts TPA rules. To resolve these contradictions, it is necessary to analyse the rights and obligations of various stakeholders under existing legal systems. However, there is currently no comprehensive analysis of these issues in the literature, making this book a valuable resource for both researchers and practitioners. Additionally, this book is relevant to ongoing initiatives to reform energy markets in China. Its analysis can inform policymakers and public regulators about the convergence and divergence of energy law related to market reform in China compared to the approaches in other jurisdictions.

1.2 STRUCTURE OF THE BOOK

The book is divided into four parts, each of which focuses on one of the four essential strategies and pathways to achieve China's carbon neutrality target. The first part examines the legal framework governing the electricity sector and its decarbonisation processes. Rather than reiterating the barriers and implementation challenges already discussed in the existing literature, this part offers a legal and regulatory analysis of sector-specific laws, regulations, and policy documents governing the electricity sector (Chapter 2) and the integration of renewable energy (Chapter 3).

Chapter 2 identifies the current legal and regulatory arrangements related to China's electricity sector by examining the institutions and governing authority, tariff regulation, and investment approval. These regulatory aspects often determine the market features and characteristics of an electricity system. This chapter provides the foundation for understanding the design of critical supporting mechanisms adopted by the Renewable Energy Law and their implementation, which are discussed in the subsequent chapter.

Chapter 3 provides an in-depth analysis of the contributing factors, mainly from legal and regulatory perspectives, to the curtailment of renewable energy in China. It also discusses newly adopted administrative measures to facilitate the integration of renewable energy. This chapter sheds light on the limited role of market reform in achieving large-scale renewable energy penetration in China and highlights the future direction of market development based on the latest reform objectives.

The second part of this book analyses the progress and prospects of fuel switching, also known as the coal-to-gas conversation, in the context of coal sector regulation and the relatively new regulatory framework governing transmission tariffs and TPA for the gas sector in China. Chapter 4 lays the groundwork by discussing the critical components of coal sector regulation in China, including pricing, investment

approval, and capacity control. While the coal sector in China has been steered towards marketisation, government intervention, primarily through pricing regulation and investment approval, has created regulatory ambiguities and complexities for implementation. This chapter also discusses the implications of the capacity control mechanism on coal production and consumption, raising essential questions about the scope of fuel switching under the existing legal and regulatory arrangements.

Chapter 5 delves into fuel switching in the context of market and law reform in China's gas sector. With the objective of increasing natural gas supply and consumption, the reform of the gas sector in China has taken a significant step forward since December 2019, with the establishment of an independent pipeline operator (PipeChina) and the promulgation of essential regulations on tariffs and TPA. This chapter discusses the overall regulatory governance of China's gas sector, assessing the extent to which market reform and newly promulgated regulations can drive the desired outcomes of increasing natural gas supply and consumption to accelerate fuel switching.

The third part of this book examines the legal developments specific to energy efficiency and energy storage, as well as lithium and electric vehicles (EVs). Energy efficiency and energy storage are critical measures that can help China achieve the carbon neutrality objective in a cost-effective and sustainable manner. By improving the energy efficiency of industrial sectors, buildings, and transportation, China can reduce the amount of energy needed to achieve its economic and climate goals, which benefits energy security and emission reductions. Offering sustainable solutions for decarbonising China's fuel mix, energy storage has become a crucial aspect of the technological toolbox to address the challenges in balancing electricity demand and production. Additionally, the uptake of energy storage and EVs in the context of global energy transition has led to a growing demand for lithium, a critical material in the production of lithium-ion batteries. China has prioritised the development of the world's largest EV market as part of its efforts to reduce dependence on oil imports, address air pollution, and reduce greenhouse gas emissions from the transport sector. As such, lithium has become a critical energy transition mineral and has been given strategic importance in China's national policy agenda.

To unfold the underlying legal and policy support for lithium and EVs, Chapter 6 introduces the overarching law provisions in the Energy Conservation Law related to low-carbon development targets, energy efficiency regulation, energy storage, and financial support prescribed to incentivise these mechanisms. This chapter examines the essential regulatory measures adopted by the Energy Conservation Law and critically analyses the regulatory development concerning energy efficiency and energy storage in China. Chapter 7 focuses on China's domestic policy imperatives and regulatory/policy support to enhance its dominance in the lithium supply chain. It examines incentive regimes designed to support EVs and the policy transition

from government-led to market-oriented approaches. Given the increasing demand for EV power batteries and the supply shortage for lithium resources and products, this chapter critically analyses whether and to what extent China can achieve greater lithium supply chain sustainability. It highlights the need for sustainable material consumption through harmonised circularity standards and indicators such as recyclability, efficiency, environmental protection, carbon footprint, corporate due diligence, and accountability.

The fourth part of this book examines two mechanisms available to support carbon removal: domestic forestry carbon sequestration, and CCS. It analyses the current design of the legal and regulatory systems that underpin these mechanisms. Chapter 8 focuses on the carbon offset scheme in China, with a particular emphasis on forestry carbon sequestration, which is a critical element of the nature-based solution to meet carbon neutrality requirements. This chapter examines the substantive and procedural requirements that support the functionality of the domestic carbon offset scheme. However, the existing regulatory framework for the offset scheme does not fully support the proliferation of forestry offset projects. The chapter identifies two specific implications. First, the current regime faces challenges in incentivising the adoption of more advanced methodologies for forestry carbon sequestration projects and translating them into the legal framework. Second, implementing existing methodologies is challenging in securing environmental integrity and enhancing the economic viability of forestry projects. To address these challenges, improvements are needed in the parameters of the methodologies and admission standards for new projects. Additionally, the legal ambiguity concerning the ownership of forestry carbon sinks needs clarification.

Chapter 9 analyses the CCS-related regulations in China, given its indispensable role in achieving the carbon neutrality target. It starts by elaborating on the essential components of CCS regulation, particularly risk allocation, to provide an analytical framework against which the Chinese regulatory framework for CCS is assessed. This chapter examines the current design of the legal and regulatory systems, identifies the regulatory gaps and uncertainties that hinder the implementation of CCS, and discusses the measures needed to address these gaps and uncertainties. It also explores the legal and regulatory implications of using CO_2 as a resource, which has the potential to enhance the commercial viability of CCS and promote the development of the CCS industry.

Chapter 10 of the book provides an overall evaluation of China's energy law and regulation and its effectiveness in achieving the carbon neutrality goal. The analysis of the book indicates that China's energy laws and regulations have significantly evolved due to the energy market reform and the government's policy emphasis on low-carbon development. The evolving energy law and regulation have created legal obligations towards energy decarbonisation from different sources of law and regulation, which can be interpreted and applied effectively.

However, despite the progress made, the book's analysis highlights several shortcomings of China's current energy laws and regulations in facilitating the energy transition and achieving carbon neutrality. This includes the lack of clear legal guidance for the implementation of energy decarbonisation obligations, insufficient enforcement measures, and inadequate legal and regulatory incentives for investment in low-carbon energy systems.

To address these challenges, Chapter 10 suggests areas for further legal development and research. These include the need for more comprehensive and detailed regulations governing the electricity trading market and the introduction of incentives and enforcement mechanisms to encourage the adoption of low-carbon technologies. Additionally, the chapter advocates for enhanced enforcement capacity of national energy regulators and more robust supervision when implementing regulatory measures. This book's analysis underscores the significance of energy laws and regulations in achieving the carbon neutrality target and highlights the need for continued efforts to strengthen China's legal and regulatory framework for energy transition.