



# Energy economy system and risk management: a contribution toward China meeting its goals for the Paris climate accord

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Environmental issues caused by energy consumption have attracted global concerns in recent years. As a major energy consumer, China spares no effort to take a wide range actions to avoid increasingly serious climate change. However, China is currently under the tripartite pressures of economic growth, carbon emissions control, and environmental pollution reduction. It becomes essential to minimize the environmental burdens associated with energy production and use. The economic development process resulting from the consumption of energy may exert a significant pressure on the environment. Because technological progress is difficult to achieve in the short term, sustainable energy utilization and environmental protection are important to green development. As a result, it is critical to further study energy issues but more from a sustainable perspective. Besides, there is a complicated interaction between economics and energy, and to meet the increasing energy demand represents a major challenge for sustainable economic development. As a raw material for industrial production, it is generally acknowledged that energy has great impacts on the economy (Hamilton 1983; Kilian 2008). Deeply exploring the operation mechanism of energy economy system is the inherent part in dealing with the issue.

In order to meet these challenges, one of the purposes of this special issue of *Natural Hazards* is to encourage and provide an opportunity for scholars in and from China to publish their research on energy economy issues. Given the space limitations of the journal, we accepted 21 research articles and 3 review articles of high quality after rigorous peer review in the end. Using a variety of theories, methodologies and models, these articles address a wide range of topics on energy, economy and environment related to China and the world. Based on specific research questions, the articles are grouped into the

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following four themes to better reflect the focus of these articles: Industrial transformation and green development, energy price and sustainable development, investment and financing of renewable energy and risk control, and environmental governance and ecological efficiency. Before describing the contents of the issue, however, we would like to thank Editors-in-Chief of *Natural Hazards*: T.S. Murty, V. Schenk and Th. Glade, as well as the journal's publisher Springer Nature for their continuous support. We also like to thank all the reviewers who donated their valuable time to provide useful comments to help the authors further improve the contents.

## 1 Industrial transformation and green development

The first set of 11 articles is grouped along with the first theme. It focuses on industrial transformation and green development. These articles address a wide range of topics, with four on coal, power and other industrial sectors, three on energy-consuming enterprises, and four on residential low-carbon consumption behaviors.

Zhang et al. (2018) analyze the historical evolution and predict the development trends of subcritical (Sub-C), supercritical (SC) and ultra-supercritical (USC) coal-fired power generation technologies in China. They find that, currently Sub-C coal-fired power generation technology is in the mature stage, SC technology is in the late growth period, and USC technology is in the rapid growth phase. Based on Chinese National Knowledge Infrastructure database, Wang et al. (2018a) present the status and hot spots reported in studies on the carbon emissions of the coal mining industry. The authors highlight that the coal spontaneous combustion during the coal mining process and the coal production structure represented by the number of coal mines and the minimum capacity requirement could be important factors for achieving future carbon emission reductions in the coal mining sector. The paper by Zhou et al. (2018) shows that Chinese construction industrial development is no longer occurring at the expense of faster energy consumption growth, with the labor factor is the dominant factor in the appearance of the decoupling status. Focusing on multiple industries, Gao et al. (2018) investigate the impact of changes in environmental regulation stringency on carbon productivity growth in China's major industrial sectors.

From an environmental perspective, several articles address the influencing factors affecting corporate performance. He et al. (2018) investigate the effects of green credit policy on enterprises in China's mining, power, and steel industries. Zhang and Liu (2018) explore the influences of carbon emissions trading on the financial performance of high energy-consuming firms in China. Zhu and Zhu (2019) study the impact of China's energy policy and market environment on petrochemical enterprises.

Given the fact that household consumptions are significant sources of carbon emission in the world (Nejat et al. 2015), several articles focus on the forming mechanism and influencing factors of residential low-carbon consumption behavior. Li et al. (2018) analyze the willing to pay for green housing using two sets of experiments from the perspectives of consumer behavior theory and behavioral economics. Jiang et al. (2018) suggest that the role of cultural values can help better explain Chinese residential low-carbon consumption behavior intention. Liu et al. (2018b) explore the factors of low-carbon consumer behavior among college students and situational factors which contribute to explain intention–behavior gap. Ding et al. (2018) study the factors affecting heating energy-saving behavior of residents in hot summer and cold winter regions.

## 2 Energy price and sustainable development

Since global financial crisis in 2008, the financial property of energy, especially crude oil, has been gradually enhanced. As a result, information and risk transmission across energy markets and financial markets is becoming increasingly obvious. Exploring the influencing factors of energy price and its interaction with financial markets can help us better understand the context of energy and economy. In this regard, Liu et al. (2018c) review current literature pertaining to financial factors affecting oil price change and the influence of oil prices on stock market returns and volatility. Since the exchange rate is one of the important channels for the international crude oil price shock to pass to the real economy and financial markets. Qiang et al. (2018) review the literature on the interactive relationships between international crude oil prices and the exchange rate of oil importing countries.

## 3 Investment and financing of renewable energy and risk control

The vigorous development of renewable energy is one of the main means of addressing climate change. Meanwhile, government financial support is indispensable for renewable energy development, among which financial subsidies is one of the most important forms. Zhu and Liao (2018) analyze the impact of government subsidies on the financial performance of China's listed renewable energy companies. Their empirical results show that government subsidies do not promote improvements in corporate financial performance, and renewable energy companies are less profitable than other companies. The paper by Li and Liu (2018) simulates environmental protection investment (EPI) response strategies by constructing a discrete model of the interaction between EPI and economic growth. The global climate will continue to change, in trends of more vulnerability and more natural variability over this century and beyond. A clear understanding of the climate change risk is suggested to be the foundation of the human adaptation. Zhang and Zhou (2019) formulate an enhanced non-compensatory assessment scheme to reassess country's risk performance under climate change by means of penalizing underlying indicators that fail to satisfy certain criteria. Moreover, climate risks have significant economic impacts on the various sectors of an economy through direct and indirect channels. Using panel data, Sun et al. (2018) examine the impact of five types of climate risks on 47 sectors in China from 2000 to 2014 through the application of a threshold model. They find that climate risks indirectly influence sector output through capital stock in a significantly positive way.

## 4 Environmental governance and ecological efficiency

Defining an internationally equitable distribution of the burdens of reducing greenhouse gases has been one of core concerns for once climate policies have been debated. Mi et al. (2018) suggest the specific formulae and indicators for four equity principles for international climate policy including the ability to pay, egalitarianism, grandfathering, and historical responsibility. They introduce the carbon trading scheme into the integrated assessment model to assess and compare the global climate policies which are based on the four principles. By effectively measuring the development level of the green economy, ecological efficiency is conducive to observing the development and the change of the green economy

to achieve a win–win development of economic and environmental benefits. Constructing an index system and a super efficiency slack-based model, Liu et al. (2018a) measure the level of green financial development and regional ecological efficiency, respectively, for Chinese 30 provinces from 2010 to 2015. Their results reveal significant regional differences in the impacts of green financial development on ecological efficiency.

Considering the different development levels of provinces, to calculate energy efficiency fairly is paramount for formulating energy policies. Employing a three-stage data envelopment analysis model that considered environmental constraints, Yin et al. (2018) evaluate the energy efficiency of China's 30 provinces in 2015 and redefined traditional energy efficiency as energy environment efficiency which calculated under environmental constraints. Wang et al. (2018b) assess the ecological efficiency and potential promotion of 28 typical coal cities in China, as well as the influencing factors affecting ecological efficiency with the Tobit method.

CO<sub>2</sub> is the most important greenhouse gas in the atmosphere, and its concentration is closely related to global warming. Fan et al. (2018) study the evolution of CO<sub>2</sub> emissions and driving factors in the Tongzhou District in Beijing, China. The paper by Zhong et al. (2018) analyzes the change of the sulfur oxides (SOX) emissions embodied in trade associated with energy consumption from the perspective of a country and a sector between 1995 and 2011. The implementation of personal carbon trading (PCT) scheme is urgently required in the context of low-carbon development. Guo et al. (2018) analyze the influences of the heterogeneous emotions of government and individuals on their equilibrium strategies about the pattern of implementing PCT scheme with a game model.

## References

- Ding ZH, Li YQ, Zhao C, Liu Y, Li R (2018) Factors affecting heating energy-saving behavior of residents in hot summer and cold winter regions. *Nat Hazards*. <https://doi.org/10.1007/s11069-018-3489-3>
- Fan J-L, Cao Z, Zhang M, Liu L, Zhang X (2018) Evolution of CO<sub>2</sub> emissions and driving factors in the Tongzhou District in Beijing. *Nat Hazards*. <https://doi.org/10.1007/s11069-018-3439-0>
- Gao G, Wang K, Zhang C, Wei Y-M (2018) Synergistic effects of environmental regulations on carbon productivity growth in China's major industrial sectors. *Nat Hazards*. <https://doi.org/10.1007/s11069-018-3446-1>
- Guo D, Chen H, Long R (2018) How to involve individuals in personal carbon trading? A game model taking into account the heterogeneous emotions of government and individuals. *Nat Hazards*. <https://doi.org/10.1007/s11069-018-3496-4>
- Hamilton JD (1983) Oil and the macroeconomy since World War II. *J Polit Econ* 91:228–248. <https://doi.org/10.1086/261140>
- He L, Wu C, Yang X, Liu J (2018) Corporate social responsibility, green credit, and corporate performance: an empirical analysis based on the mining, power, and steel industries of China. *Nat Hazards*. <https://doi.org/10.1007/s11069-018-3440-7>
- Jiang X, Ding Z, Liu R (2018) Can Chinese residential low-carbon consumption behavior intention be better explained? The role of cultural values. *Nat Hazards*. <https://doi.org/10.1007/s11069-018-3461-2>
- Kilian L (2008) The economic effects of energy price shocks. *J Econ Lit* 46:871–909
- Li X, Liu Q (2018) Simulation research on the interaction between environmental protection investment and economic growth in China. *Nat Hazards*. <https://doi.org/10.1007/s11069-018-3471-0>
- Li Q, Long R, Chen H, Chen F, Cheng X (2018) Chinese urban resident willingness to pay for green housing based on double-entry mental accounting theory. *Nat Hazards*. <https://doi.org/10.1007/s11069-018-3435-4>
- Liu R, Wang D, Zhang L, Zhang L (2018a) Can green financial development promote regional ecological efficiency? A case study of China. *Nat Hazards*. <https://doi.org/10.1007/s11069-018-3502-x>
- Liu Y, Liu R, Jiang X (2018b) What drives low-carbon consumption behavior of Chinese college students? The regulation of situational factors. *Nat Hazards*. <https://doi.org/10.1007/s11069-018-3497-3>

- Liu Z, Ding Z, Lv T, Wu JS, Qiang W (2018c) Financial factors affecting oil price change and oil-stock interactions: a review and future perspectives. *Nat Hazards*. <https://doi.org/10.1007/s11069-018-3473-y>
- Mi Z, Liao H, Coffman DM, Wei Y-M (2018) Assessment of equity principles for international climate policy based on an integrated assessment model. *Nat Hazards*. <https://doi.org/10.1007/s11069-018-3408-7>
- Nejat P, Jomehzadeh F, Taheri MM, Gohari M, Abd. Majid MZ (2015) A global review of energy consumption, CO<sub>2</sub> emissions and policy in the residential sector (with an overview of the top ten CO<sub>2</sub> emitting countries). *Renew Sustain Energy Rev* 43:843–862. <https://doi.org/10.1016/j.rser.2014.11.066>
- Qiang W, Lin A, Zhao C, Liu Z, Liu M, Wang X (2018) The impact of international crude oil price fluctuation on the exchange rate of petroleum-importing countries: a summary of recent studies. *Nat Hazards*. <https://doi.org/10.1007/s11069-018-3501-y>
- Sun Y, Zou X, Shi X, Zhang P (2018) The economic impact of climate risks in China: evidence from 47-sector panel data, 2000–2014. *Nat Hazards*. <https://doi.org/10.1007/s11069-018-3447-0>
- Wang B, Cui C-Q, Zhao Y-X, Chen M, Yuan X-C (2018a) Climate change mitigation in the coal mining industry: low-carbon pathways and mine safety indicators. *Nat Hazards*. <https://doi.org/10.1007/s11069-018-3438-1>
- Wang D, Wan K, Yang J (2018b) Ecological efficiency of coal cities in China: evaluation and influence factors. *Nat Hazards*. <https://doi.org/10.1007/s11069-018-3441-6>
- Yin J-Y, Cao Y-F, Tang B-J (2018) Fairness of China's provincial energy environment efficiency evaluation: empirical analysis using a three-stage data envelopment analysis model. *Nat Hazards*. <https://doi.org/10.1007/s11069-018-3399-4>
- Zhang Y-J, Liu J-Y (2018) Does carbon emissions trading affect the financial performance of high energy-consuming firms in China? *Nat Hazards*. <https://doi.org/10.1007/s11069-018-3434-5>
- Zhang LP, Zhou P (2019) Reassessment of global climate risk: non-compensatory or compensatory? *Nat Hazards*. <https://doi.org/10.1007/s11069-018-3558-7>
- Zhang M, Lv T, Deng X, Dai Y, Sajid M (2018) Diffusion of China's coal-fired power generation technologies: historical evolution and development trends. *Nat Hazards*. <https://doi.org/10.1007/s11069-018-3524-4>
- Zhong Z, Zhang X, Shao W (2018) Measuring global energy-related sulfur oxides emissions embodied in trade: a multi-regional and multi-sectoral analysis. *Nat Hazards*. <https://doi.org/10.1007/s11069-018-3437-2>
- Zhou D, Zhang L, Zha D, Wu F, Wang Q (2018) Decoupling and decomposing analysis of construction industry's energy consumption in China. *Nat Hazards*. <https://doi.org/10.1007/s11069-018-3436-3>
- Zhu Z, Liao H (2018) Do subsidies improve the financial performance of renewable energy companies? Evidence from China. *Nat Hazards*. <https://doi.org/10.1007/s11069-018-3423-8>
- Zhu L, Zhu X (2019) Energy policy, market environment and the economic benefits of enterprises: evidence from China's petrochemical enterprises. *Nat Hazards*. <https://doi.org/10.1007/s11069-019-03579-3>

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