Editorial: Energy Market and Energy Transition: Dynamics and Prospects

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Editorial on the Research Topic

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To mitigate the impact of climate change, the worldwide transition from fossil fuels to renewable energy is inevitable and the trend is irreversible. As a consequence of both a strong push from governments and technological progress, the global energy mix has experienced a significant shift toward renewables in the last decade. Transition is progressing, and a lot of changes have been seen in the global energy markets. While some of these changes may facilitate energy transition, others can bring forward challenges to the transition process. For example, the recent epidemic of COVID-19 has brought plenty of uncertainties and changes in the global market (Zhang et al., 2020). Its impacts on the global economy are profound, which have also spread to the energy markets. It has shrunk global energy demand and collapsed fossil fuel prices. Therefore, renewable energy projects are relatively losing their competitiveness that is making the energy transitions more difficult (Yoshino et al., 2020).

At the national level, the dynamics of the energy market and transition process differ greatly from one to the other, partly due to national policy frameworks (Liu et al., 2019a) and partly because of the level of economic development. Each country's ability to cope with the market dynamics and maintain a smooth energy transition process is, therefore, varying. Additional complexity is at the firm level, whereas large multinational energy companies operating in many countries have diversified products, spanning conventional and renewable energy (Geng et al., 2021). Their decision-making process tends to be affected by many, often non-market factors (Zhang et al., 2020; Zhao et al., 2020).

Under the current circumstance, exploring global energy market dynamics and unfolding challenges toward broader energy transition are equally important. Answers to relevant questions can bring forward critical information to both policymakers and corporate leaders. They can also lead to intensive academic debates and general interests to further exploring this exciting area. The current collection of research covers 21 papers looking into the dynamics of fossil fuel markets, renewable energy markets, and electricity markets. Notably, one-third of these papers address renewable energy issues in China. This is not entirely surprising as China is the leader of renewable energy investment in the world and its policies on renewable energy development are dynamic and especially interesting to many emerging economies (Wang et al., 2020). The second most popular topic is oil prices. It is an old topic but constantly attracts new attention. The international crude oil markets have been extremely dynamic since the shale revolution (Chen et al., 2020). During the COVID-19 pandemic, the oil prices shocked the world again and again, with the most astonishing one, in the end, that is the negative WTI price. These events demonstrate that much more about oil price shocks are yet to find out. Behavior economics,

an emerging subject in energy and environmental studies (e.g., Liu et al., 2019b; Li et al., 2021), is also heavily investigated in this special issue.

Now, let's go briefly over each of the contributing papers:

Starting from Guo et al., which simulate the impacts of different renewable energy subsidies on China's energy transition. Subsidies are often considered critical driving factors to renewable energy development, their results, however, show that even with fewer subsidies, the Chinese government's 2030 targets on total energy consumption and carbon emission intensity can be achieved. Liang et al. evaluated the overall efficiency score of hydropower electricity generation in the three main regions of China. Using the Epsilon-based Measure model with the Data Envelopment Analysis method, they found that the western region has the highest efficiency, followed by the central region and then the eastern region. Efficiency level is mainly determined by natural water resources and geographical advantages, but little to do with economic development.

Bu and Zhang assess the completion pressure of a newly modified quota in 30 provinces under China's new renewable portfolio standard policy issued in 2019. They find that 17 provinces face significant challenges, while ten other provinces have no difficulty in achieving the target. Furthermore, Zhang et al. propose a comprehensive model for the allocation of China's total renewable electricity consumption (REC) targets to sub-national levels. Their analysis shows that China's existing REC policy is still conservative. The total achievable REC under China's current REC guarantee mechanism can be further increased by 15.36–20.25%.

Three provincial case studies are presented to investigate the different topics pertaining to renewable energy development in China. In a case study of the photovoltaic (PV) system in Beijing, China's capital, Zhang et al. estimate the deployment potential of rooftop PV in Beijing. It is found to be about 11. 47 GW and the large-scale commercial rooftop PV is approaching grid parity. With the consideration of expanding renewable energy on the generation mix, Lv et al. propose a generation expansion planning method in the case of Jiangsu Province in China. The results show that the province could achieve a renewable energy share from 17.9 to 53.7% and the required flexibility can be achieved with the existing technologies. Liu et al. analyze renewable energy in the electricity market with China's Guangdong province as a case study. They find that a competitive electricity market is conducive to renewable penetration, but the economic viability of renewables still needs the support of feed-in-tariff.

The oil market is the second most popular subject in this special issue, with four papers devoted to studying the dynamic behaviors of the international oil market and the impact of such behaviors on the macro-economy or firms. Chen et al. (2020) examine how global oil prices had affected China's consumer and producer prices. They reveal a non-linear effect of oil prices on consumer/producer prices and find the non-linear effect is different between the Brent and West Texas Intermediate (WTI) crude oil prices. Li and Su investigate the time-frequency dynamics of stochastic volatility spillovers between international

crude oil markets and China's commodity sectors. The results suggest that international crude oil markets have significant volatility spillover effects on China's bulk commodity markets, and the volatility spillovers are sensitive to extreme geopolitical or financial events. Cao et al. find that the coefficient of oil price uncertainty negatively affects corporate investment and its efficiency. Regarding the emerging benchmark prices in East Asia, Liu et al. find that China's crude oil futures market (INE market) has been well integrated with traditional benchmarks, such as WTI and Brent despite its recent launch in March 2018.

Three papers study the energy transition directly. Taghizadeh-Hesary and Rasoulinezhad investigate how energy transition patterns were affected by economic variables in 45 Asian economies. They find that economic growth and CO_2 emissions have opposite effects on the energy transition, with the former being positive. To deepen the understanding of energy transition, Wei et al. explore the evolution of national and global energy consumption structure (ECS) with the distribution dynamics approach. They find that while the relative consumption of coal and oil may be reduced, the oil will remain the most common form of energy source, while natural gas has a significant variability. As fuel switching between coal and natural gas is an effective strategy to mitigate the emissions and environmental pollutions of other forms of fossil fuel energy, Hao et al., quantify the role of natural gas in achieving urban Ecological Civilization in China using a case study.

Three papers exploring behavioral issues. Zhao et al. analyze the crucial influencing factors of governments' and manufacturers' strategies. They set up a theoretical model that governments' subsidy policies, manufacturers' environmental quality measures, and customer environmental awareness (CEA) are modeled in a game. Their analysis reveals that increases in penalties, the subsidy coefficient, environmental quality, and CEA can promote manufacturers' integrity. Baek et al. study how Kenyan households choose their lighting fuels using survey data. They confirm the energy ladder hypothesis and find that modern fuels are more likely to be chosen by households with a female head, higher income, more wealth, and higher levels of education. Zhou et al., investigate the effect of provincial social capital on environmental performance in China and find a heterogeneous relationship between social capital and environmental performance in different regions. The relationship is more consistent in the eastern and southwest regions than in other regions.

The rest four papers address a mix of compelling issues. Raath and Ensor explore the time-varying relationship between energy and water commodities with the application of the wavelet technique. They demonstrate that during specific localized economic events, water prices lead to energy prices at certain time horizons. Their findings suggest that reforming energy markets and gas prices are conducive to promote the use of natural gas for lower emissions. Gong et al. conceptualize an energy-economic resilience concept to evaluate the economic recovery ability of an economy. They test their model in a preliminary empirical analysis of 14 countries after the 2007–2008 global financial crisis. Li and Liao examine the heterogeneous impact of financial development on green total

factor productivity for 40 countries. An inverted U-shaped relationship between financial development and green total factor productivity is found in developing countries. In developed countries, the development of bank and insurance tends to undermine green total factor productivity, while the development of securities has the opposite effect. With a proposed green mining efficiency, Wang et al. employ a two-stage combination Data Envelopment Analysis examined to assess some coal mines in China.

In the end, we would like to thank all the contributing authors, anonymous reviewers for their invaluable thoughts and insightful discussions. We also appreciate the journal editors and publication team behind it. Their hard work makes this collection possible.

AUTHOR CONTRIBUTIONS

XS has drafted the text and all authors listed have made a substantial, direct, and intellectual contribution to the work, and approved it for publication.

ACKNOWLEDGMENTS

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