

Sustainable Energy in Kazakhstan: Moving to Cleaner Energy in a Resource-Rich Country. Edited by Yelena Kalyuzhnova and Richard Pomfret. Routledge. 2018. (ISBN-13: 9781138238442).

An increased consumption of natural resources has created an imbalance between the environment, society and economy. *Sustainable Energy in Kazakhstan: Moving to Cleaner Energy in a Resource-Rich Country* reflects the views of experts from both Kazakhstan and the United Kingdom. This book examines the perspectives of sustainable energy production. The focus is energy production in Kazakhstan and the transfer from fossil resources to renewable ones, with case studies from other oil-rich countries.

The book covers interconnected domains in sustainable energy resources: the environment (geographical conditions), green energy policy, transition economics, and pro-green energy culture. The book chapters develop two approaches in energy transition: renewable energy and energy-efficient technologies.

Structurally, the book is set in four parts that describe the challenges that could lead Kazakhstan to introduce green energy technologies. The first part explores the political choices involved in transforming an oil-based energy program to one also incorporating renewables; the economic repercussions that such a transition would entail; and the feasibility of this kind of transition. The political treaties on CO₂ emission reduction are also considered, and the non-preparedness of some countries to follow the rules stipulated in these treaties, because of conflicts with the oil and gas strategies and technologies that are already deeply entrenched. The economic security of the country is based on carbon resources, and “green energy” needs comprehensive study before its introduction.

The next section takes a close look at opportunities to develop renewable energy resources that can replace the oil-based energy which is the main cause of greenhouse gases (GHG). Discussion of the integration of wind and solar power reveals the complexities within the attempt to integrate in this field. Essentially, there are few incentives that are outweighed by a raft of barriers in the way of allowing goals to be achieved. On top of this, there is not a process in place to help eliminate the barriers. Without this, there cannot be the right motivation to intergrade wind and solar reserves.

As an opportunity to introduce these energy resources, wind and solar maps have been worked out and three scenarios (base-case, green-scenario with expensive gas, and green-scenario with cheap gas) are discussed as possible ways on the green energy path. Detailed analysis of energy production costs and the price of energy consump-

tion is another interesting discussion in efficient energy technology development. Moreover, a proper dispatch of power energy that saves energy consumption requires the renovation of power plant operations. Along the path to low GHG emissions, there are some scenarios that can be applied to mitigate both transport and industry GHG emissions inexpensively.

The authors argue that, through the development of efficient technologies such as carbon capture and storage and carbon clean technologies, and the usage of appropriate carbon-storing geo-formations, Kazakhstan can effectively move to reduce environmental pollution. In their view, there are several areas where the existing energy industry needs to improve, notably in the area of coordination of research and application between energy researchers, producers, and distributors. They suggest that the creation of service centers for the coordination of these elements can help the energy industry achieve better results in the future, allowing for enhanced efficiency and also a better climate for the ongoing incorporation of innovative ideas and technologies. This might become the basis to build and increase an effective energy service capacity. In addition, we can see the experience of Samuruk Green Energy LLP in promoting solar and wind-based energy generation and developing renewable energy production plant equipment. These attempts face a high cost of R&D to construct such plants. In addition, the Chinese market significantly makes wind-solar plant energy sales revenue non-profitable. Despite these facts, the study results give some recommendations on avoiding the obstacles and developing wind/solar plants further to create a clean-energy producing country.

The third part of the book presents arguments in the clean energy debate. The authors share their study on the examples of case studies on creating other sources of sustainable energy: producing biogas out of biomass and biofuel out of wheat and crops. These fields in green energy remain an extra potential for Kazakhstan to develop its green energy. However, these capacities are possible but in the future. It is worth considering the two chapters on pro-green energy activities of businesses, particularly how businesses can use incentives for the transfer to green energy, for example, the relocation of green technology developing enterprises from technologically developed countries to Masdar City to test their equipment to reduce GHG emissions. Thus, operating their businesses in the city is another start-up project in attempting to reach cleaner environment. The studies in this chapter share ideas and give possible ways to adopt other practices, considering Kazakhstan's economic, political, financial and environmental stipulations.

The fourth part of the book contains a wrap-up chapter which shares the predic-

tions of the author for the energy sector in Kazakhstan up to 2050, based on the studies given in the book. He claims that despite Kazakhstan joining the Kyoto Protocol and the Paris Accord and its demographic state, energy production is intensive and exceeds the global norm. Nevertheless, climate change will cause a gradual reduction in its GHG emissions in the future. In addition, the author argues that demand for coal-based energy production might continue as long as industries are equipped with conservative technologies while oil and gas based energy might be reduced as a result of innovations in the transport sector where this energy continues to be widely used. These innovations in the transport sector, using electricity and natural gas, will replace the demand for oil and gas resources. It is the assumption of the author that Kazakhstan has a high potential to develop its gas industry and wind-solar based energy and export the energy to other countries. Moreover, there are high expectations for the Eurasian grid construction to change the energy sector, both internally and externally. The recommendations given by the author in this chapter are that Kazakhstan needs to focus on its energy policy and economy along with its management. The energy sector should become a key sector in the formation of the country's policy up to 2050. Another issue which concerns the technological aspect of power grids is the shift from an internal electricity grid to an international one. Further, the author states that there is weak collaboration and interconnection of institutes in achieving sustainable energy growth.

This book gives a comprehensive view of contemporary issues in energy policy, production, and economics in Kazakhstan, in a period in which the country is exploring ways to reshape this field with the advent of new green energy ideas and technologies. It also considers the reality of businesses in the energy market along with the technological and managerial capacity to integrate cleantech equipment to reduce GHG emissions. In addition, it investigates their ability to construct wind-solar power plants and consider potentials on developing biogas and biofuel sources. The authors have tried to bring this issue to their readers by looking at the situation from the aspect of "insiders," Kazakhstani experts, and "outsiders," the foreign experts in this field. This attempt has been successful in my view. Moreover, unlike many foreign papers where a literature review is based only on the foreign sources, the papers included in this collection are rich in Kazakhstani official documents, databases, and statistics and refer to local experts who know the issues of the energy sector in Kazakhstan and its related policies intimately. This fact makes the book a reliable study of the energy sector of Kazakhstan. The views and recommendations of the foreign authors in this book open new thoughts and look at developing a sustainable energy sector. Joining

these two significant perspectives, this book is a valuable resource for those who seek to find new approaches to creating sustainable energy development in the country and will be a foundation to bring balanced environmental, economic and social development while using safe natural resources for future generations.

The authors' calls for better coordination between the various institutions in the Kazakhstan energy sector and the creation of service centers to improve networking and interconnectedness are something that merits consideration and further study.

This book is valuable for a wide audience: students, scholars, practitioners in this field, policy-makers, investors and those who work in innovation technology centers. It might be read in tandem with the book by Daniel Yergin *The Quest: Energy, Security, and the Remaking of the Modern World*, which might give thought-provoking ideas on the case of Kazakhstan energy sources and its in-time shift to sustainable energy resources.

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