

Accepted Manuscript

A spatial electricity market model for the power system: The Kazakhstan case study

Makpal Assembayeva, Jonas Egerer, Roman Mendelevitch, Nurkhat Zhakiyev

PII: S0360-5442(18)30238-X

DOI: [10.1016/j.energy.2018.02.011](https://doi.org/10.1016/j.energy.2018.02.011)

Reference: EGY 12311

To appear in: *Energy*

Received Date: 2 May 2017

Revised Date: 15 January 2018

Accepted Date: 4 February 2018

Please cite this article as: Assembayeva M, Egerer J, Mendelevitch R, Zhakiyev N, A spatial electricity market model for the power system: The Kazakhstan case study, *Energy* (2018), doi: 10.1016/j.energy.2018.02.011.

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.



A spatial electricity market model for the power system: The Kazakhstan Case Study

Makpal Assembayeva^{a, b}, Jonas Egerer^{b, e}, Roman Mendelevitch^{c, d, *}, Nurkhat Zhakiyev^a

^a*Nazarbayev University, National Laboratory Astana, Laboratory Energy, Ecology and Climate, 53 Kabanbay batyr ave., 010000 Astana*

^b*Technische Universität Berlin, Workgroup for Infrastructure Policy (WIP), Straße des 17. Juni 135, 10623 Berlin*

^c*German Institute for Economic Research (DIW Berlin), Dept. Energy, Transport, Environment, Mohrenstr. 58, 10117 Berlin*

^d*Humboldt Universität zu Berlin, Resource Economics Group, Unter den Linden 6, 10999 Berlin*

^e*Friedrich-Alexander-Universität Erlangen-Nürnberg, Chair of Economic Theory, Chair of Industrial Organization and Energy Markets, and Energie Campus Nürnberg (EnCN), Lange Gasse 20, 90403 Nürnberg*

*Corresponding author

Email address: roman.mendelevitch@hu-berlin.de (Roman Mendelevitch)

Abstract

abstract Kazakhstan envisions a transition towards a green economy in the next decades, which poses an immense challenge as the country's economy and energy system depends heavily on (hydro-)carbon resources. Here, it lacks inclusive and transparent tools assessing technical, economic, and environmental implications resulting from changes in its electricity system. We present such a tool: our comprehensive techno-economic unit-commitment model determines the hourly least-cost generation dispatch, based on publicly available data on the technical and economic characteristics of the system. It accounts for particularities of the Kazakh electricity system by representing combined heat and power, and endogenously determining line losses. Model results examine two typical weeks: winter (annual peak load) and summer (hour of lowest annual load) presenting regionally and temporally disaggregated results for power generation, line utilization, and nodal prices. In an application to market design, the paper compares nodal and zonal pricing as two possible pricing schemes in Kazakhstan for the envisioned strengthening of the day-ahead market. The model analyzes the current Kazakh electricity system and can be easily expanded to assess the sector's future development. Possible applications include investment in generation and transmission infrastructure, policy assessment for renewables integration, carbon pricing, emission reduction, and questions of market design.

Keywords: Kazakhstan, Central Asia, Electricity sector, Techno-economic modeling, Transmission network

1. Introduction

The energy sector of Kazakhstan faces many challenges but also opportunities in the upcoming decades. It could foster its role as a transit hub with the development of transmission infrastructure linking Russia, Central Asia, and China. Kazakhstan, with its reliance on oil exports and coal-fired power generation has to find its place in a world which moves towards a sustainable energy supply. And last but not least, the energy sector might follow a pathway towards a more transparent and competitive market design. Thorough analyses on these developments in Kazakhstan require qualitative and quantitative research to which this paper contributes focusing on the electricity sector.

In the time of the Soviet Union, the electricity system of Kazakhstan was split between the northern regions with large coal generation capacities (connected to the Russian network) and the Central Asian Power System (CAPS) in the south, which relied on regional cooperation on water (and hydro power) management of river basins. Despite significant oil reserves, there was no development of an oil industry on larger scale. After the breakdown of the Soviet Union had caused a severe economic downturn, international investments, mainly in the oil sector, allowed Kazakhstan to restore its

Download English Version:

<https://daneshyari.com/en/article/8071965>

Download Persian Version:

<https://daneshyari.com/article/8071965>

[Daneshyari.com](https://daneshyari.com)