ASSESING MARKET STRATEGIES IN COMPETITIVE WHOLESALE ELECTRICTY MARKET: THE CASE OF KAZAKHSTAN WITH A UNIT COMMITMENT MODEL

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Overview

A crucial issue on designining electricity markets is the level of the liberaliation at different levels of the market, namely production, transmission/distribution and retail. The liberilization usually starts from the production side, enabling different companies to participate in the wholesale market. However, even if the production side is liberilized, there might be caps on bidding for market participants, which practically create a regulated competitive market. Those caps affect the provision of clear price signals, as well as do not allow the formation of dynamic bidding in cases with favourable conditions. Scarcity pricing is usually an unfarouble strategy for regulators and decisions makers, as it might lead to extremely high wholesale prices, and therefore challenge the profitability of retailers as well as the prices for final consumers. On the other hand, such dynamic strategies provide robust signals for new investments, including new production capacity, additional interconnections and active participation of demand side in the wholesale market. This paper aims at examining different bidding strategies ia a competitive wholesale market, where no caps are applied in the formation of bids. It forms different bidding strategies, depending on the ownership of power plants i.e. state-owned, private-owned, as well as on the technology type and and the evolution of fuel prices. A unit commitment model, developed for the needs of the study, is used for assessing these strategies.

Methodology

There is a growing literature on liberilization of energy markets either at national or institutional level. Nikoli and Vona (2019) investigate how political factors and energy liberalization affect renewable energy policies, while Ofuji and Tatsumi (2016) focus on wholesale and retail electricity markets in Japan, providing results of market revitalization measures and prospects for the current reform. Ciarreta et. al. (2016) examine the development of market power in the Spanish power generation sector, by providing perspectives after market liberalization. The methodology applied is ex-post structural and behavioral measures, providing evicense that key dominant companies behaved more competitively in recent periods. Other papers focus on the retail sector, such as Palacios and Saavedra (2017) who examine alternative policies for the liberalization of retail electricity markets in Chile.

The review shows that there is an increasing research on the effects of different stages of liberilization. However, the literature review on Former Soviet Union states is limited, such as the case of Kazakhstan. A comprehensive report by World Bank (Aldayarov et. al., 2017), examine the case of Kazakhstan power sector, providing evidence on reform experiences and challenges ahead. Kalmykov and Malikova (2017) examin the coal sector on Kazakhstan. This report is a primary review of open sources of information describing the state and prospects of development of coal-mining and energy-generating industries in Kazakhstan and their expected impact on the environment. Babazhanova et al. (2017) examine the evolution of a new energy system in the Republic of Kazakhstan. KAZENERGY association (2017) in its National Energy Report 2017, provides an updated assessment of the Outlook for each energy sector, evaluating the most recent energy industry targets and forecasts contained in official state documents. Orazgaliyev S. (2018) examine the state intervention in Kazakhstan's energy sector, aiming to

provide recommendations on the dilemma: Nationalisation or participation? However it focuses on the Kazakhstan's petroleum sector. A recent economic dispatch model focused on the power system of Kazakhstan was provided by Assembayeva et al. (2018), providing insights in regional scarcity examining the interdependency between production side and network. Although there is a growing number of official publications/reports and research paper on the Kazakhstan energy system, there is a lack of quantitative assessments. This paper aims to provide an assessment of market strategies in a competitive wholesale electricity market of Kazakhstan.

The methology used in the paper buids on the work done at the Energy and Environmental Policy Laboratory of the Uiversity of Piraeus on unit commitment modelling (Dagoumas et. al., 2017; Koltsaklis et. al, 2017), as well as on the European market clearing algorithm (Koltsaklis and Dagoumas, 2018 a). The critical question is if the market strategies in the wholesale market, affect the price signal and the energy mix per technology and per producer. The simulations with a unit commitment model, developed for the needs for this study, examine representative seasonal days. The model elaborates all available public information from istritutions such as the Kazakhstan Electricity Association, the Kazakhstan Electricity Grid Operating Company, the Kazakhstan Operator of Electricity Market, KazTransGas and KazAtomProm, as well as information from the above mentioned reports and papers. The model is executed and it determines the following outputs: the total hourly energy generation mix per technology type at a daily level (MWh), the hourly system's marginal price at a daily level ($/MWh), the hourly production (MWh) by power plant and the hourly cross-border electricity flows (net imports or exports) with each interconnected system (MWh). A critical issue of the model is the determination of the bidding strategy for thermal units from the different market participants. This is done dynamically in the model, considering the capability of the market participants to a adopt a scarcity pricing strategy. Different scenarios are formed to capture the impact of fuel type, technology type and power plant ownership.

Results

The model is developed in GAMS environment, supplemented by an interface for running the model and showing the results. Figure 1 provides the hourly energy mix of a indicative representative typical day. Results are preliminary and will be fully exploited when the whole needed information will be elaborated.

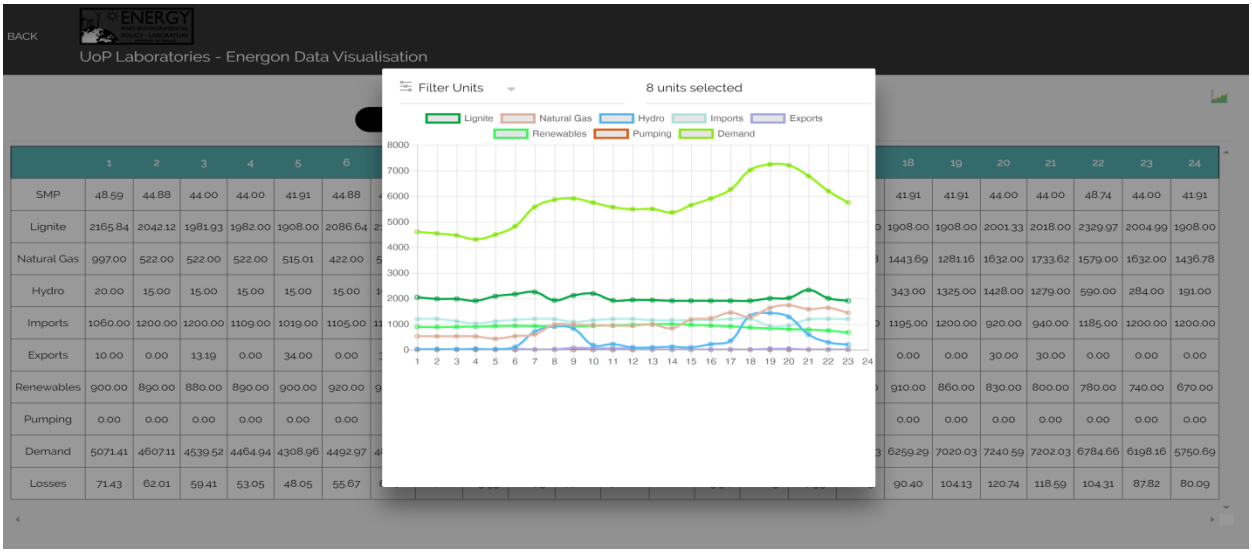

Figure 1. Interface of the model developed, showing the hourly energy mix of indicative day

Conclusions

The paper develops a unit commitment model to examine to assess the impact of market strategies on a competitive wholesale electricity market. It examines the case of Kazakhstan, as there is a lack of quantitative assessments for its power sector. The paper uses all available public information from official institutions and other reports/papers and aims to provide evidence on the wholesale price and energy mix, per technology type, fuel type and ownership.

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