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Article

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A Comprehensive Analysis of Energy Security in the Member States of the Eurasian Economic Union, 2000-2014

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ABSTRACT

The article analyzes how well the countries of the Eurasian Economic Union (EAEU) are doing in terms of energy security. This research relies on a comprehensive concept of energy security that distinguishes the total of four dimensions of energy security: Availability, affordability, efficiency, and environmental stewardship. We construct an energy security performance index in order analyze the relative energy security performance of the EAEU countries. The index is composed of ten indicators, and each of them reflects a certain dimension of energy security. We evaluate the relative energy security performance of the whole union and each country individually from 2000 to 2014. Our analysis shows that the EAEU energy security is quite low due to countries' diverse energy security performance.

Keywords: Energy Security, Eurasian Economic Union, Security of Supply
JEL Classifications: Q2, Q3, Q4

1. INTRODUCTION

The energy sector has always been a top priority in integration processes between the former republics of the Soviet Union. A regional organization uniting Belarus, Kazakhstan, Kyrgyzstan, Russia, and Tajikistan, the Eurasian Economic Community (EEC), was established in 2001 with one of the aims to build a common energy market between these countries (EEC, 2015). The Eurasian Economic Space (EES), a single market that came into existence in 2012, also had a goal of ensuring access to the markets of oil, natural gas, and electricity among its members (EEC, 2015). The treaty of the Eurasian Economic Union (EAEU), a successor of the EEC and the EES, has a whole chapter on energy. For instance, the treaty allows implementing a coordinated energy policy, forecasting the balances of gas, oil, and oil products, as well as establishing a common electricity market al.ng with the common markets for natural gas, oil, and petroleum products (United Nations, n.d.).

Regional cooperation activities in the field of energy are focused on, among other numerous goals, adopting and implementing a comprehensive approach to energy security by ensuring long-term cooperation in the energy sector, conducting coordinated energy policies, and developing common energy markets (EEC, 2015). It is worth mentioning that the EAEU countries have different types of energy markets. Obviously, Russia is an energy hegemon in the economic union in comparison with other EAEU countries. Kazakhstan, a second economy of the union, is also rich with oil and coal. In contrast, Belarus has very small reserves of oil and gas and heavily depends on imports to meet it needs. Kyrgyzstan, a state in Central Asia, also imports oil and natural gas because of its own negligible reserves. There are no proven reserves of fossil fuel in the fifth member of the union, Armenia. The EAEU member countries, nevertheless, have ambitious plans in the energy sector. According to the EEC (2015), the permanent regulatory body of the EAEU, "a common electric power market (of the EAEU) will be fully operational by July 1, 2019, and the

creation of common markets of gas, oil, and petroleum products is expected by January 1, 2025."

In our perspective, to achieve these ambitious goals in the energy sector between such diverse members of the EAEU, energy policies should be precise enough so they can substantially address energy security challenges in each country individually and at the level of the union as a whole. Therefore, it is necessary to understand the current level of energy security performance as well as to analyze long-term trends and patters of its development in order to come up with effective energy policies.

This article conducts a comprehensive analysis of the relative energy security performance in the EAEU countries, namely Armenia, Belarus, Kazakhstan, Kyrgyzstan, and Russia, from 2000 to 2014[1]. To measure the current level of energy security, identify trends, and track progress, we evaluate energy security performance of the current EAEU countries on a set of ten indicators which altogether comprise the total of four dimensions of energy security: Availability, affordability, energy and economic efficiency, and environmental stewardship. Then we use Z-scores to quantitatively identify changes in energy security indicators and to monitor the progress made by the EAEU countries individually and collectively from 2000 to 2014.

To the best of our knowledge, this study is the first one that analyzes energy security in the EAEU member states by constructing an energy security performance index that captures different dimensions of such a complex concept. The current published works on the energy security issues of the EAEU as a whole or its member countries could be divided into two relatively large groups.

The first Group focuses on energy security in the context of energy relations of the EAEU countries with the European Union (EU). For instance, Baev (2012) considers the security of energy supply a political priority under the framework of national security and examines Russia-EU energy relations in a case study. In their review of European energy policies, Kanellakis et al. (2013) state that energy security became a priority for Europe after the interruptions of Russian gas supplies in 2006. In a recently published paper, Jirušek et al. (2017) focus on Russia's energy relations with Greece and Bulgaria, considering energy policy and energy security through the main theories of international relations. Some research is also devoted to the security of energy supply to the EU from Russia and discusses various opportunities for the EU to diversify its energy supply (Leal-Arcasa et al., 2015).

The second Group of research discuss various aspects of energy security in the former republics of the Soviet Union, focusing on the security of energy supply and demand, the common energy market, and national security strategies. Reviewing regional integration processes led by Russia after the collapse of the Soviet Union, Kricovic and Bratersky (2016) briefly mention that Russia's involvement in Central Asia has been very limited and focused on addressing "such issues as water scarcity or energy security." Akhmetov (2015) measures the security of external energy supply and energy exports demand in all five former Soviet Central Asian republics, arguing that the two distinct groups of countries can be identified. Kyrgyzstan, Tajikistan, and Uzbekistan have lower energy security in comparison with the resource-rich countries Kazakhstan and Uzbekistan.

Some research on energy security addresses the issues of the EAEU common energy market. Kunitskaya (2016), a law scholar from Belarus, argues major policies of the post-Soviet economic integration were aimed at creating a common electricity market. Such policies, in her opinion, increase energy security due to greater energy cooperation. However, she states that the EAEU common electricity market should have adequate legal and regulatory mechanisms (Kunitskaya, 2016). Another scholar reviews the EAEU energy policies and some distinct features of the common energy market (Pastukhova and Westphal, 2016). Analyzing the framework of energy regulation in Russia, Redkin (2009) concludes that the concept of energy security is not well defined in the Russian law. A number of scholars in Russia and other post-Soviet countries successfully develop research on energy security in the context of a broader approach to national security. Thus, energy security is perceived as one of the main components of national security (Mastepanov, 2015; Gafurov, 2010). In particular, these scholars discuss various implications of the Energy Security Doctrine of Russia on the federal and local levels (Bushuev et al., 2012; Senderov et al., 2016).

So far the literature has been focused on energy relations between the EAEU member states and with other regions of the world, the common energy market of the EAEU, and general aspects of energy security in the framework of national security. However, there is no research that comprehensively evaluates energy security in the EAEU member countries. Therefore, our article addresses the existing gap and significantly contributes to the understanding of energy security in the EAEU.

The article is structured as follows. Section two reviews the major approaches to energy security in the scholarly literature and discuses the concept of energy security we use in our research. Section three reports on the indicators used to access the level of energy security performance in each country. We also reveal the sources of data and highlight our methodology. Section four provides the results of Z-score normalization and discuses the findings. Lastly, we conclude the paper with final notes.

2. ENERGY SECURITY AS A CONCEPT

The concept of energy security is widely used in the scholarly literature. However, as it always happens with complex phenomena, there is no universally accepted definition of energy security. According to Manson (2014), scholars have different approaches to energy security due to their perceptions of its meaning and scope, the time frame analyzed, or their scientific backgrounds. In our perspective, one could distinguish two general perspectives on energy security in the scholarly literature.

1 The analysis is focused on the period of 2000-2014 because of the availability of data.

Some scholars define energy security, broadly speaking, as the security of energy supply and market prices. For example, analyzing some issues of sustainable development, Vera and Langlois (2007) believe that the main criteria for assessing energy security is based on ensuring the security of energy supply, which should be reliable, sufficient, and affordable. Their approach to energy security is close to one supported by the International Energy Agency (IEA). Energy security is viewed by the agency as "the physical availability of supplies to satisfy demand at a given price" (IEA, 2001). The World Bank (2005. p. 3), another international organization, defines energy security as countries' ability to "sustainably produce and use energy at a reasonable cost on order to: (1) Facilitate economic growth and, through this, poverty reduction; and (2) directly improve the quality of peoples' lives by broadening access to modern energy services." Consequently, there are three pillars of energy security: Energy efficiency, diversification of energy supplies, and dealing with volatility (World Bank, 2005). In a study conducted by the Asia Pacific Research Center (2007. p. 6), energy security is defined "as the ability of an economy to guarantee the availability of energy resource supply in a sustainable and timely manner with the energy price being at a level that will not adversely affect the economic performance of the economy."

Other scholars provide a different perspective by including more dimensions into the concept of energy security. They argue that the concept should be expanded beyond the security of supply or prices. As an example, Blum and Legey (2012) argue that the concept of energy security should take into consideration energy surplus opportunities and energy scarcity situations additionally to both demand and supply of energy resources. They define energy security "as the (desirable) ability of an economy to provide sufficient, affordable and environmentally sustainable energy services so as to maintain a maximum welfare state, even when issues would press it otherwise" (Blum and Legey, 2012; 1983). Scholars also argue that, as a concept, energy security should include an environmental component (Cao and Bluth, 2013) and address the issues of climate change (Gracceva and Zenewski, 2014; King and Gulledge, 2014). More than that, some scholars believe that energy "acceptability" (how energy sources are perceived by an economy or society) should be considered a dimension of energy security (Tongsopit et al., 2016). Also, there are papers that identify even more dimensions of energy security, such as the acceptability of technologies (Yao and Chang, 2014) and the military-security dimension (Hippel et al., 2011).

The literature review clearly shows that the concept of energy security is quite complex and depends on many factors. Since the purpose of our research is to conduct a comprehensive analysis of energy security in the EAEU countries, we rely on the concept of energy security developed by Brown et al. (2014). They define energy security as "equitably providing available, affordable, reliable, efficient, environmentally benign, proactively governed and socially acceptable energy services to end-users" (Brown et al., 2014. p. 65). Consequently, there are four dimensions of energy security: (1) "Availability" (diversity of the fuels and dependency on foreign suppliers); (2) "affordability" (reasonable price and low volatility); (3) "energy and economic efficiency" (energy equipment and consumer behavior); and (4) "environmental stewardship" (the natural environment and future generations to be protected) (Sovacool and Brown, 2010).

Since this approach is very well developed in the literature (Sovacool and Brown, 2010; Sovacool, 2011; Sovacool, 2014), we do not discuss the essential features of each energy security dimension and do not focus on causal links between them in this paper. However, we would like to notice why we build our research on the particular concept and methodology. First of all, the four dimensions, developed by Sovacool and Brown (2010), can be operationalized easily due to the availability of data. Therefore, we can construct a comprehensive energy security index, quantitatively measure each dimension, and evaluate energy security performance in every country individually and collectively as the economic union. Second, with the help of Z-score normalization, we are able to identify certain trends and processes in energy security performance over the period of 2000-2014.

3. DATA AND METHODOLOGY

In order to evaluate energy security performance by the EAEU countries, we constructed an energy security performance index with ten indicators that could capture all four dimensions of the energy security concept ("availability," "affordability," "energy affordability and efficiency," and "environmental stewardship") and quantitatively measure them. Our purpose was to choose those indicators that were available and could serve as reliable proxies for the dimensions of energy security. Also, we intended to avoid any "overload" of the energy security performance index with irrelevant indicators. Then we collected data on all ten indicators. The data came from open sources, namely the IEA, the World Bank, the World Recourse Institute, and the national statistical services of the countries under analysis. The data collected is shown in Tables 1 and 2.

To reflect energy "availability," the following three indicators serve as reliable metrics: "Oil import dependency," "coal import dependency," and "natural gas import dependency." We decided to focus on major fossil fuels because they still constitute the largest part of energy consumption in the EAEU countries (World Bank, 2014a). Dependency on a fossil fuel is calculated according to the approach used by Eurostat (2017). We fully rely on data from the IEA, n.d. and do all the calculations by ourselves.

We use "electricity prices for households" and "pump price for gasoline" indicators as proxies to measure energy "affordability," the second dimension of energy security. The electricity prices data was obtained from the national statistical services' yearbooks of the each country under analysis. The data on the second indicator, "pump price for gasoline," came from the World Bank (2014c). We decided to use "electricity prices for households" and "gasoline prices" because their values better capture how energy is used by the population (Sovacool and Brown, 2010. p. 85). More than that, we adjusted both electricity and gasoline prices for purchasing power parity in order to have a set of comparable values for the analysis of energy security performance in 2000 and 2014 (World Bank, 2014b).

To reflect "energy and economic efficiency," we use the following metrics: "Renewable energy consumption," "gross domestic product (GDP) per unit of energy use," and "electric power consumption." All these three indicators, in our perspective, capture very well how a country uses renewable energy sources and whether it has high or low energy intensity as well as energy demand made on existing electricity supply. The data was collected from the World Bank Open Data (World Bank, n.d.).

Finally, we measure "environmental stewardship" by the amount of sulfur dioxide (SO_2) and carbon dioxide (CO_2) emissions. These indicators show how well the countries under analysis perform in terms of environmental protection and climate change policies. Acid deposition, as a consequence of the burning of fossil fuels by power plants and other industrial facilities, has significant negative impacts on sensitive ecosystems (EPA, 2016). The combustion of fossil fuels also increases CO_2 emissions and contributes to global warming (King and Gulledge, 2014). The data for these indicators was collected from the national statistical services and the World Resource Institute (WRI, 2008).

Since our indicators used diverse units of measurement, we applied Z-score normalization[2] in order to capture relative magnitudes of change in the indicators between 2000 and 2014. According to Brown and Sovacool (2010. p. 93), the result of Z-score normalization is "a dimensionless quantity that indicates how many standard deviations a country is above or below the mean of the (countries under analysis)." By comparing Z-scores of the indicators in 2000 and 2014, we can identify how well a certain country performs in energy security relative to other EAEU countries. Therefore, positive differences in Z-scores[3] indicate better energy security performance, and vice versa.

4. RESULTS AND DISCUSSION

The results of Z-score normalization are shown in Table 3 and Figures 1-4. Drawing on the results obtained, we can identify three types of energy security performance among the EAEU countries in the period of 2000-2014. First, a country had a very high, relative to other EAEU countries, energy security performance index in 2000 but then decreased the level of energy security still remaining, however, the most energy secure country in the economic union (Russia). Second, a country had a negative value of the energy security performance index in 2000 but then, in 2014, became one of the most energy secure country (Kyrgyzstan and Kazakhstan). Third, a country was not energy secure in 2000 and was not able to improve its status by 2014 (Armenia and Belarus). We will discuss each country's performance individually further in the text.

There are a few findings to be highlighted. The countries with the highest energy security performance, Russia and Kazakhstan, have large reserves of fossil fuels and are in no way dependent on their imports. Consequently, they have cheaper electricity and gasoline prices, relative to other EAEU countries.[4] These two factors boost up energy "affordability." At the same time, Russia and Kazakhstan score poorly on "environmental stewardship" due to high CO_2 emission. In contrast, both s Armenia and Belarus lack own natural endowments and are heavily dependent on imported fossil fuels. As a result, they have low energy "availability" and "affordability." Kyrgyzstan has a unique position on our index. Without sufficient reserves of fossil fuels, the country has been able to achieve a moderate level of energy security, relative to

Figure 1: Shifts in energy security performance index by country (Z-scores, 2000-2014)

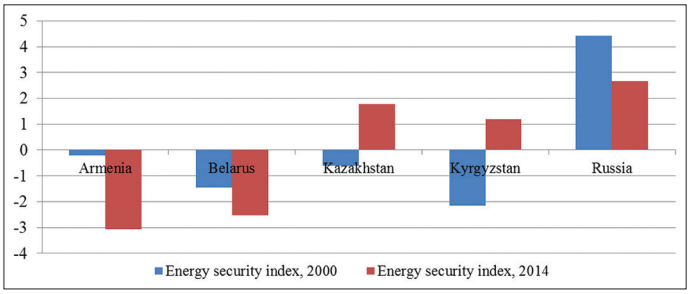


Figure 2: Energy security index in 2000[4]

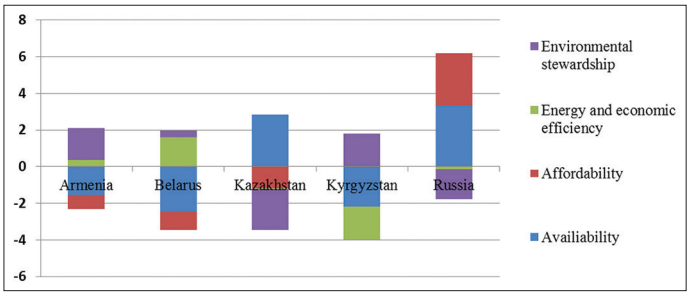


Figure 3: Energy security index in 2014

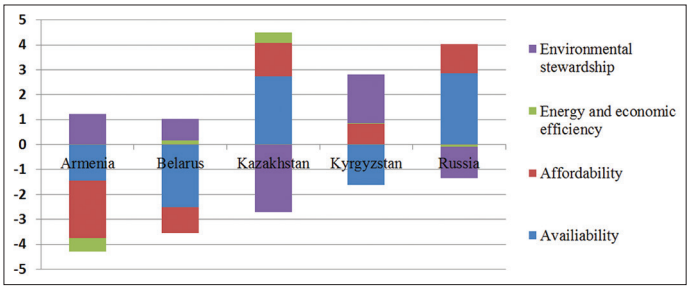
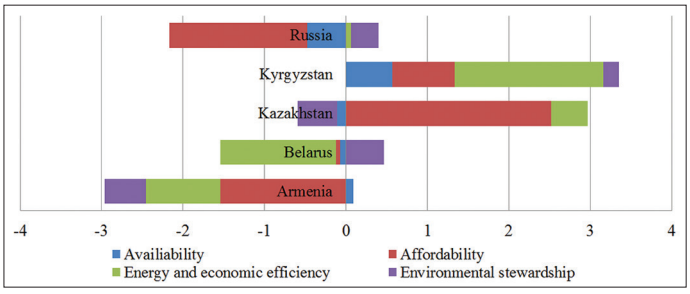


Figure 4: Shifts in energy security performance index by country (Z-scores, 2000-2014)



2 Z-scores are calculated by subtracting the mean value out of each data point and then dividing it by the standard deviation of the whole indicator (Brown et al., 2014. p. 67; Obadi and Korcek, 2017. p. 115).

3 We also reversed the signs of the original Z-scores in order to be consistent with our index (following Brown et al., 2014. p. 67).

4 Lower numbers indicate worse energy security, and vice versa.

Table 1: Energy security performance index for the member states of the Eurasian Economic Union, 2000

Country	Availability[5]			Affordability	
	Oil import dependence (%)	Coal import dependence (%)	Natural gas import dependence (%)	Electricity price for households (US$/100 kWh)[6]	Pump price for gasoline (US$/L)[7]
Armenia	121.65	0	255.12	17.59	2.04
Belarus	112.21	66.55	442.52	13.35	2.58
Kazakhstan	−433.70	−379.38	−31.23	17.25	2.31
Kyrgyzstan	80.34	151.96	352.15	7.39[8]	2.59
Russia	−212.23	−56.23	−124.66	5.36	1.27
Median	80.34	0	255.12	13.35	2.31
Mean	−66.346	−184.698	178.762	12.19	2.16
Country	Energy and economic efficiency[7]			Environmental stewardship	
	Renewable energy consumption (% of total final energy consumption)	GDP per unit of energy use (constant 2011 PPP US$/kg of oil equivalent)	Electric power consumption (kWh per capita)	SO_2 emissions (tons per capita)[9]	CO_2 emissions (tons per capita)[2]
Armenia	7.164	4.456	1297.568	0.004	1.11
Belarus	4.983	3.071	2996.309	0.022	5.21
Kazakhstan	2.505	4.151	3169.523	0.137	7.53
Kyrgyzstan	35.167	4.382	1696.064	0.006	0.91
Russia	3.497	3.326	5198.417	0.067	10.06
Median	4.983	4.151	2996.309	0.022	5.21
Mean	10.6632	3.8772	2871.5762	0.0472	4.96

GDP: Gross domestic product

other EAEU countries, due to its reliance on hydroelectric power and good performance on the "affordability" and "environmental stewardship" dimensions.

In general, our index shows that the EAEU has low energy security due to diverse performance of its member countries on the four dimensions of energy security. Only Kyrgyzstan and Kazakhstan have been able to improve their energy security since 2000 mainly due to changes in energy "affordability" and energy "efficiency." Armenia and Belarus have worsened their energy security performance dramatically. Russia remains the most energy secure country among the EAEU countries.

4.1. Russia

Russia was the only country that had a positive energy security index in 2000 among other current members of the EAEU, and its value was pretty large (4.27). "Availability" and "affordability" were the largest dimensions of the index, constituting 42% and 36% respectively. Obviously, Russia's leading position in the index in 2000 was caused by its large reserves of fossil fuels and cheap gasoline and electricity prices. In comparison with the countries under analysis, Russia had the most affordable electricity and gasoline prices (2.3 and 1.7 times less than average). However, Russia performed poorly on the other two dimensions of the energy security index. First, Russia had the highest CO_2 emissions per capita (10.06 tones, 2 times more than average) and pretty high SO_2 emissions per capita (0.067 tones, 0.7 times higher than average). As a consequence, the country had a negative score on the "environmental stewardship" dimension. Second, Russia had low "economic and energy efficiency," with less than average on the "renewable energy consumption" and "GDP per unit of energy use" indicators.

Since 2000, Russia has decreased its energy security by 40%, according to our 2014 index. First and foremost, Russia has worsened on two measures of energy "affordability," with significantly increased electricity and gasoline prices. Second, Russia has decreased its "availability" dimension, relative to other EAEU countries, because of the dramatically increased export of coal. However, Russia has remained the most energy secure EAEU country, enjoying some improvements on "environmental stewardship" and energy efficiency in 2014.

4.2. Armenia

Armenia was the second most energy secure country in 2000. However, its energy security index was below zero by 0.21 points. The country scored poorly on the "availability" and "affordability" dimensions. Armenia had high dependency on imported fossil fuels. In addition, electricity prices in Armenia were 31% higher than average. However, Armenia performed very well on the "environmental stewardship" dimension in 2000. Also, Armenia succeeded, relative to other EAEU counties, on two measures of energy and economic efficiency, with the best performance on the "GDP per unit of energy use" indicator, and

5 Data for oil, coal, natural gas, and CO2 emissions comes from the International Energy Agency (IEA, n.d.).

6 Values for electricity prices for households, adjusted for PPP (World Bank, 2014b), are from the national statistical services: National Statistical Service of the Republic of Armenia (NSSRA, 2001; 2015), National Statistical Committee of the Republic of Belarus (NSCRB, 2000, 2016), Committee on Statistics of the Republic of Kazakhstan (ARKS, 2001; CSRK, 2015), National Statistical Committee of the Kyrgyz Republic (NSCKR, 2004, 2016), and Federal State Statistics Service of the Russian Federation (Rosstat, 2004, 2015).

7 Values for gasoline prices (adjusted for PPP), renewable energy consumption, and GDP per unit of energy use are from the World Bank (2014c).

8 Data for electricity prices for households in the Kyrgyz Republic starts at 2002 instead of 2000.

9 Data for SO2 emissions in 2000 is provided by the World Recourse Institute (WRI, 2008).

Table 2: Energy security performance index for the member states of the Eurasian Economic Union, 2014

Country	Availability			Affordability	
	Oil import dependence (%)	Coal import dependence (%)	Natural gas import dependence (%)	Electricity prices for households (US$ 100/kWh)	Pump price for gasoline (US$/L)
Armenia	112.19	0	159.54	24.65	2.73
Belarus	105.33	68.94	354.11	19.06	2.41
Kazakhstan	−703.2	−120.26	−187.92	11.91	1.57
Kyrgyzstan	117.35	92.28	132.67	3.56	2.46
Russia	−225.73	−762.62	−111.32	14.80	1.46
Median	105.33	0	132.67	14.80	2.41
Mean	−118.81	−144.33	69.416	14.80	2.13
Country	**Energy and economic efficiency**			**Environmental stewardship**	
	Renewable energy consumption (% of total final energy consumption)	GDP per unit of energy use (constant 2011 PPP $ per kg of oil equivalent)	Electric power consumption (kWh per capita)	SO_2 emissions (tons per capita)	CO_2 emissions (tons per capita)
Armenia	7.725	7.83	1965.784	0.013[10]	1.74
Belarus	6.634	6.127	3679.978	0.005[11]	6.06
Kazakhstan	1.363	5.319	5599.904	0.042[12]	12.94
Kyrgyzstan	28.25	4.892	1941.222	0.002[13]	1.43
Russia	3.456	5.113	6602.658	0.027[14]	10.20
Median	6.634	5.319	3679.978	0.013	6.06
Mean	9.4856	5.8562	3957.9092	0.0178	6.47

Table 3: Energy security performance Z-scores, 2000-2014[15]

Country	Energy security index		Difference
	2000	2014	
Armenia	−0.213	−3.08	−2.867
Belarus	−1.453	−2.536	−1.082
Kazakhstan	−0.599	1.780	2.379
Kyrgyzstan	−2.163	1.187	3.350
Russia	4.427	2.664	−1.763

the second performance on the "renewable energy consumption" indicator.

Unfortunately, Armenia has sharply decreased its energy security performance by 2014 and lost 2.9 points in total. First, electricity and gasoline prices in Armenia have increased by 29% and 25%, respectively. The consequence has been the deterioration in energy "affordability" and in the overall energy security performance index. Second, the country has worsened in every other metric, including the "energy and economic efficiency" and "environmental stewardship" dimensions, with increased SO_2 and CO_2 emissions. As a result, Armenia has transitioned from being the second most energy secured country in 2000 to being the least secure one by 2014.

10 Values for SO2 emissions for Armenia are provided by the National Statistical Service of the Republic of Armenia for the year of 2016 (NSSRA, 2016).

11 Data comes from the National Statistical Committee of the Republic of Belarus (NSCRB, 2015).

12 SO2 emission values are from the Committee on Statistics of the Republic of Kazakhstan (CSRK, 2016).

13 Data for the Kyrgyz Republic is from the Regional Program on Sustainable and Climate Sensitive Use for Economic Development in Central Asia (Nishanbaeva, 2015) and starts at 2013 instead of 2014.

14 Values for SO2 emissions in Russia come from the Government of the Russian Federation (2015).

15 Positive differences in z-scores indicate better energy security.

4.3. Kazakhstan

Kazakhstan hold the third result in 2000, with the overall energy security performance being slightly below zero. As in the case of Russia, Kazakhstan performed well on all measures of energy "availability" due to large reserves of fossil fuels. However, the country performed poorly on all other three dimensions. First, high CO_2 and SO_2 emissions had a negative impact on the "environmental stewardship" dimension. Second, electricity and gasoline prices were 29% and 6.5% higher than average in 2000.

Kazakhstan has become the second most secure state in the EAEU by 2014. Kazakhstan exhibits improvement on the two dimensions of energy security. First, low electricity and gasoline prices have positively affected Kazakhstan's performance on energy "affordability." Second, Kazakhstan has improved on a measure of "energy and economic efficiency." The only areas the country has no improvements are on the "affordability" and "environmental stewardship" dimensions. With regard to energy "availability," Kazakhstan has lost 0.1 points because of greater exports of oil and natural gas, coupled with decreased exports of coal. At the same time, the country has worsened on both measures of "environmental stewardship." In the period of 2000-2014, Kazakhstan has increased CO_2 emissions by 5.4 tomes per capita and become the biggest pollutant among the countries under analysis.

4.4. Belarus

Another EAEU current member, Belarus, performed poorly in 2000, with the results similar to the performance of Armenia. Belarus was secured only in the two dimensions of the index, "energy and economic efficiency" and "environmental stewardship." With regard to efficiency, the country scored well on all three measures. Low SO_2 and CO_2 emissions, relative to other EAEU countries, positively affected the "environmental stewardship" dimension. However, Belarus was very dependent

on imported fossil fuels, especially on oil. Therefore, the country did not perform well on the "availability" dimension. More than that, electricity and gasoline prices were higher than average by 8.7% and 16.3%, respectively.

Since 2000, Belarus has worsened its energy security by 1 point. While energy "availability" and "affordability" have remained on the same level, the country has experienced the major decline on the "energy and economic efficiency" dimension. In comparison with the 2000 index, Belarus has lost 1.4 points by 2014. However, the country has improved on the two measures of "environmental stewardship," with reduced SO_2 and CO_2 emissions.

4.5. Kyrgyzstan

Kyrgyzstan was the least energy secure country, relative to other EAEU countries, in 2000 mainly due to low performance on the "availability" and "energy and economic efficiency" dimensions. With less CO_2 and SO_2 emissions than average (by the total of 82%), the country scored very high on "environmental stewardship." Surprisingly, energy "affordability" in Kyrgyzstan had almost no effect on its energy security performance in 2000.

Over the period 2000-2014, Kyrgyzstan has experienced the most impressive growth by 3.3 points. The growth has been caused by improvement on the four dimensions of energy security. First, Kyrgyzstan exhibits major improvement on "energy and economic efficiency" (by 0.8 points) mainly due to high renewable energy consumption as a result of high hydropower consumption. Second, electricity and gasoline prices in Kyrgyzstan have decreased by the total of 57%. Third, the country has improved on an indicator of "environmental stewardship," with decreased SO_2 emissions. Lastly, Kyrgyzstan has been able to reduce its dependency on coal and natural gas, boosting up its energy "availability." All together, these improvements have provided the most impressive growth in energy security for Kyrgyzstan.

5. CONCLUSION

The growing processes of economic integration between the former Soviet republics do not leave aside the issues of in-depth energy cooperation and common energy markets. Nevertheless, the EAEU countries have very different energy markets and conduct different energy policies. These factors inevitably affect the level of their energy security. We undertook an analysis of the energy security performance of the EAEU countries over the period of 2000-2014. We used a comprehensive concept of energy security with four dimensions: Energy "availability," energy "affordability," "energy and economic efficiency," and "environmental stewardship." To quantitatively measure each dimension, we constructed the energy security performance index with ten indicators. Z-score normalization was applied in order to identify differences in energy security performance between 2000 and 2014.

According to our analysis, Russia and Kazakhstan, the countries with large reserves of energy resources, had higher energy security. However, because of very high CO_2 emissions, they did not perform well on the "environmental stewardship" dimension. At the same time, Armenia and Belarus were highly dependent on imported fossil fuels and scored poorly on other dimensions. As a result, they even worsened their energy security in the period of 2000-2014. The last country under analysis, Kyrgyzstan, was able to improve its performance on all four dimensions of energy security and demonstrated the largest growth among all other EAEU countries. In general, our index shows that the EAEU energy security is weak because of the existing disparities between the members of the economic union.

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APPENDICES

Table A1: Energy security performance Z-scores, 2000

Country	Availability	Affordability	Energy and economic efficiency	Environmental stewardship	Total
Armenia	−1.55	−0.76	0.37	1.73	−0.21
Belarus	−2.45	−0.98	1.6	0.39	−1.45
Kazakhstan	2.85	−1.18	−0.03	−2.24	−0.6
Kyrgyzstan	−2.18	0.07	−1.8	1.75	−2.16
Russia	3.34	2.85	−0.13	−1.621	4.43

Table A2: Energy security performance Z-scores, 2014

Country	Availability	Affordability	Energy and economic efficiency	Environmental stewardship	Total
Armenia	−1.46	−2.3	−0.54	1.22	−3.08
Belarus	−2.53	−1.03	0.17	0.85	−2.53
Kazakhstan	2.74	1.34	0.42	−2.72	1.78
Kyrgyzstan	−1.61	0.84	0.02	1.94	1.19
Russia	2.86	1.16	−0.07	−1.28	2.66

Table A3: Differences in Z-scores, 2014-2000

Country	Availability	Affordability	Energy and economic efficiency	Environmental stewardship	Total
Armenia	0.09	−1.54	−0.91	−0.51	−2.87
Belarus	−0.07	−0.04	−1.43	0.46	−1.08
Kazakhstan	−0.11	2.52	0.45	−0.48	2.38
Kyrgyzstan	0.57	0.77	1.82	0.19	3.35
Russia	−0.47	−1.69	0.06	0.34	−1.76