

Pathways for achieving efficiency and sustainability of the energy sector: a case of Eurasian Economic Union

Raisa Krayneva¹, Aisulu Parmanasova², and Elena Korneeva^{1,3*}

¹Financial University under the Government of the Russian Federation, 49, Leningradsky Prospekt, 125993, Moscow, Russian Federation

²Kyrgyz National University named after Zhusup Balasagyn, 720033, Bishkek, Kyrgyzstan

³Togliatti State University, 14, Belorusskaya str., 445020, Togliatti, Russian Federation

Abstract. The paper discusses pathways for enhancing the efficiency and sustainability of the energy sector within the Eurasian Economic Union (EAEU), which includes Armenia, Belarus, Kazakhstan, Kyrgyzstan, and Russia. This region is characterized by a rich diversity of energy resources, ranging from Russia's vast fossil fuel reserves to Kyrgyzstan's significant hydropower potential. The study aims to explore how these nations can transition from reliance on traditional energy sources to more sustainable and energy-efficient practices. The research employs an analysis of energy policies, infrastructure, and technological advancements within the EAEU. Key findings indicate that while the region's abundant resources present opportunities for economic growth, achieving sustainability will require significant policy reforms, technological innovations, and regional cooperation. The paper concludes that a balanced approach, integrating energy efficiency and renewable energy technologies, is essential for addressing environmental concerns and ensuring long-term energy security in the EAEU. This transition holds significance not only for the region but also for its contribution to global efforts in sustainable energy development.

1 Introduction

The Eurasian Economic Union (EAEU) is an important regional organization made up of Armenia, Belarus, Kazakhstan, Kyrgyzstan, and Russia. It was initially formed by Belarus, Kazakhstan, and Russia during a 2014 meeting in Astana, with Armenia and Kyrgyzstan joining in 2015 when it became fully operational. The union's primary goal is to promote economic integration and enable the unrestricted flow of goods, services, capital, and labour among its member countries. [1,2]. Given its substantial reserves of natural resources, especially in the energy sector, the EAEU plays a pivotal role in regional and global energy markets [3]. The introduction to energy practices within the EAEU is essential for understanding both the economic strategies of the union and its potential impact on sustainability and global energy dynamics.

* Corresponding author: enkorneeva@fa.ru

Energy practices in the EAEU are predominantly shaped by the availability of vast natural resources, particularly in Russia and Kazakhstan, which are rich in oil, natural gas, coal, and uranium [4]. These resources have positioned the EAEU as a critical player in the global energy supply chain. Russia, for instance, is one of the world's top energy producers and exporters, holding significant influence over energy markets through its extensive pipeline networks and export relationships [5, 6]. Similarly, Kazakhstan is a major exporter of oil and uranium, contributing significantly to the global energy supply and directly impacting the economic stability and growth of the region [7].

The energy practices within the EAEU are not solely focused on exportation but also on meeting the internal energy needs of member states. The union's energy strategy emphasizes the importance of modernizing energy infrastructure, improving energy efficiency, and ensuring the reliable supply of energy across the region [8]. This is particularly important in addressing the domestic demands of smaller member states like Armenia and Kyrgyzstan, which rely on energy imports to meet their consumption needs.

However, the promotion of efficient energy practices is somewhat hampered by the pressing need for sustainability. The global shift towards cleaner and renewable energy sources compels the EAEU to reassess its energy policies and practices to align with environmental sustainability goals [9]. This requires investing in renewable energy initiatives and technologies, including wind, solar, and hydroelectric power, to minimize the environmental effects of energy generation and use within the union. Incorporating renewable energy sources is vital not only for environmental benefits but also for broadening the energy mix of member states, decreasing reliance on fossil fuels, and strengthening energy security [10].

Contemplating the balance between exploiting abundant fossil fuel reserves and transitioning to sustainable energy practices is a major challenge for the EAEU. The union's commitment to energy efficiency and sustainability, therefore, demands a comprehensive approach, encompassing policy reform, technological innovation, and cooperation among member states [11]. By investigating and adopting more efficient and sustainable energy practices, the EAEU has the chance to enhance its economic standing while also playing a role in global efforts to tackle climate change and support the advancement of a sustainable future.

2 Energy policy of EAEU

Due to its size and abundance in fossil fuels (mostly provided by its two members - Russia and Kazakhstan), EAEU plays a significant role in the global energy landscape. Its current energy policy is shaped by the unique resources and strategic objectives of its member states. As one of the world's largest producers and exporters of energy, particularly oil and natural gas, the EAEU's energy policy is heavily geared towards maintaining and enhancing its role in global energy markets while simultaneously seeking to improve energy efficiency and sustainability within its borders [12, 13].

The EAEU's energy policy is primarily focused on the integration and unification of its energy markets, which aims to ensure the security of supply, reliability, and accessibility. This involves cooperation in the development of energy infrastructure, including pipelines, electricity grids, and renewable energy projects. The policy emphasizes the importance of harmonizing regulatory frameworks among member states to facilitate cross-border energy trade and investment [14]. Such harmonization is vital for maximizing the efficiency of energy systems across different countries, thereby reducing redundancies and improving the reliability of energy supplies.

A key component of the EAEU's energy strategy is to support energy efficiency across industrial, residential, and transportation sectors. Member states are encouraged to adopt

modern technologies and implement policies that promote energy-saving measures. This includes upgrading older equipment, optimizing energy usage, and encouraging research and development activities related to energy efficiency. By lowering its energy consumption without compromising output the EAEU seeks to lessen its carbon footprint and steadily shift towards a more sustainable energy framework [15, 16].

Additionally, the EAEU is gradually increasing its focus on renewable energy sources. While the region remains heavily reliant on fossil fuels, there is a growing recognition of the need to diversify energy sources to include wind, solar, hydroelectric, and bioenergy. The exploration of renewable energy options is not only driven by environmental considerations but also by the economic need to future-proof the region's energy sector against volatile fossil fuel markets [17]. By doing so, EAEU is investing in renewable energy trying to lessen its reliance on oil and gas revenues which have historically made them susceptible to changes in global energy prices [18].

Politically, the energy policy within the EAEU is interwoven with broader geopolitical considerations. Russia, as the dominant energy producer within the union, often leverages its energy resources as a tool of influence both within the union and in its relations with external partners [19, 20]. Consequently, energy policy discussions within the EAEU also involve addressing the balance of power and ensuring equitable benefits for smaller member states from shared resources.

Overall, the EAEU's current energy policy is a complex mosaic attempting to balance economic growth, energy security, and sustainability goals while operating within a multifaceted geopolitical framework. As the global energy landscape continues to evolve, the EAEU's policy will likely adapt, seeking to enhance efficiency and sustainability in a challenging and dynamic environment.

3 Sustainability and energy sector challenges

As outlined before, EAEU permanently faces considerable sustainability challenges within its energy sector. These challenges can be attributed to the region's heavy reliance on fossil fuels, aging infrastructure, and the often-fragmented nature of energy policies among the member states. This complex energy landscape presents significant hurdles as the EAEU endeavours to transition towards more sustainable and efficient energy practices [21].

One of the principal sustainability challenges in the EAEU is its dependence on non-renewable energy sources. The region is richly endowed with hydrocarbons, particularly in Russia and Kazakhstan, which historically has translated into a reliance on oil, gas, and coal for energy production. This reliance not only heightens the region's vulnerability to global market fluctuations in fossil fuel prices but also perpetuates high levels of carbon emissions that contribute to climate change [22]. With increasing global pressure to move away from carbon-heavy energy sources, the EAEU is confronted with the pressing need to diversify its energy mix and reduce its carbon emissions.

In addition to the challenge of fossil fuel dependency, the EAEU must address the issue of outdated infrastructure. Much of the region's energy infrastructure is decades old and characterized by inefficiencies that result in substantial energy losses. This infrastructure deficit is particularly pronounced in electricity grids, which require significant modernization to improve energy efficiency and integrate renewable energy sources. Upgrading infrastructure will necessitate considerable investment and cooperation among the member states to ensure a reliable and sustainable energy supply [23, 24].

Moreover, the lack of a cohesive energy policy across the EAEU further complicates efforts to achieve sustainability. The differing economic goals and energy approaches of the member states can result in fragmented policies, creating challenges in executing region-wide initiatives that support sustainable energy transitions. Harmonizing energy policies across the

union is essential to create a unified approach that leverages the collective strengths of the member states while addressing shared challenges [25].

Thence, the EAEU's energy sector faces significant sustainability challenges, including an overreliance on fossil fuels, aging infrastructure, and fragmented energy policies. Addressing these issues is critical to realizing a sustainable energy future and requires substantial investment, policy reform, and regional collaboration to align the member states on a common path towards achieving energy efficiency and sustainability.

4 Technological Innovations and energy efficiency in EAEU

Technological advancements have become key forces in improving energy efficiency across the EAEU, which is aiming to optimize energy use and minimize its environmental impact. At the forefront of these innovations is the development and integration of smart grid technologies. These systems allow for real-time monitoring and more efficient management of energy distribution networks, ensuring that electricity is delivered precisely where and when it is needed. This not only reduces energy waste but also enhances the reliability of power systems across a region characterized by diverse energy demands [26].

Figure 1 that follows shows the trade balance of EAEU countries from 2011 to 2021 (in billion U.S. dollars).

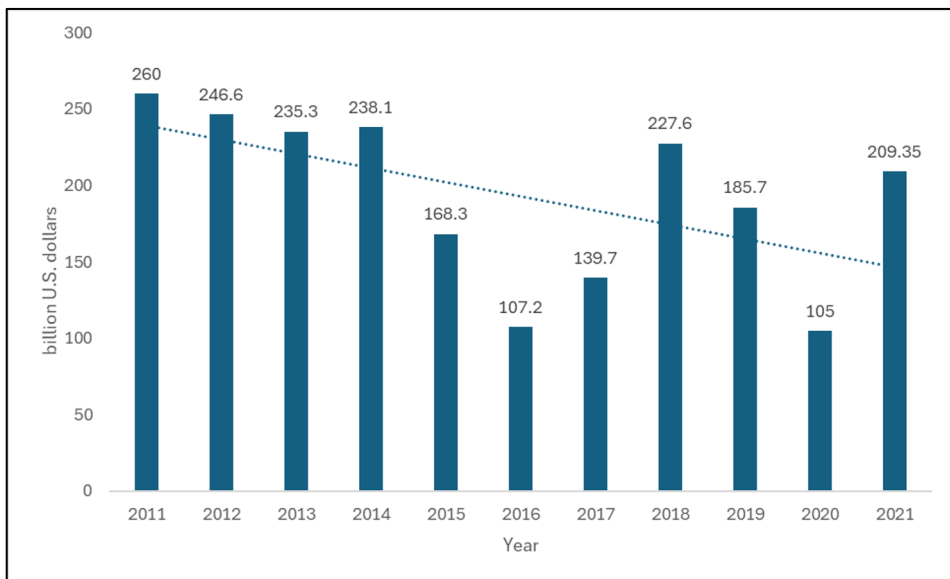


Fig. 1. Trade balance of EAEU countries (2011-2021). Source: [27].

In addition to smart grids, the EAEU has witnessed significant advancements in the field of renewable energy technologies, which are vital for reducing dependency on fossil fuels and minimizing carbon emissions. Solar energy, for instance, has seen considerable investment, with improved photovoltaic technologies capable of operating efficiently even in the less sunny parts of the region. Wind energy, particularly in the steppes of Kazakhstan and the plains of Russia, is another area seeing substantial growth, boosted by advances in turbine technology that allow for higher energy yields even at lower wind speeds [28, 29].

These renewable sources are increasingly complemented by energy storage solutions, such as advanced battery systems, which ensure a stable supply of electricity despite the inherent intermittency of solar and wind energy. Furthermore, the adoption of energy-

efficient building technologies is changing the landscape of urban development in the EAEU. Innovations such as advanced insulation materials, energy-efficient windows, and smart heating and cooling systems are becoming standard practice [30]. These technologies drastically reduce energy consumption in buildings, which are traditionally one of the largest energy-consuming sectors. In addition, building management systems that use artificial intelligence and machine learning are optimizing energy use by integrating data from various sensors to predict and adjust heating, lighting, and appliance use according to current and anticipated occupancy patterns [31].

Transportation is another sector where technological innovation is driving energy efficiency. The EAEU is witnessing an uptake in electric vehicles (EVs), supported by advancements in battery technology that increase the range and reduce the charging time of these vehicles. Moreover, the development of related infrastructure, such as fast-charging stations, is crucial for encouraging more consumers and businesses to transition to EVs. Additionally, improvements in public transport networks, including the implementation of energy-efficient buses and trains, are reducing the carbon footprint associated with mass transportation [32].

Collectively, these technological innovations not only enhance energy efficiency but also contribute to the broader goals of sustainability within the EAEU. By embracing cutting-edge solutions in energy generation, distribution, consumption, and transportation, the region is making tangible strides towards reducing its environmental impact and securing a more sustainable energy future. These efforts are bolstered by collaborative initiatives among member states, aimed at fostering research and shared technological advancements to overcome regional energy challenges.

5 Energy resources and energy security in EAEU

In general terms, EAEU exhibits a diverse array of energy resources that form the backbone of its member states' economies. The analysis of these resources provides valuable insights into the region's capacity for achieving both energy efficiency and sustainability. As the largest country within the EAEU, Russia holds extensive reserves of natural gas, oil, and coal, which together make up a significant share of its economic production [33].

Russia's natural gas reserves are among the largest in the world, positioning the country as a pivotal player in the global energy market. These resources have historically powered the industrial sector and contributed significantly to exports. However, the heavy dependence on fossil fuels poses challenges in terms of sustainability and environmental impact [34, 35].

Similarly, Kazakhstan, another member of the EAEU, is rich in energy resources, especially oil and coal. The Tengiz and Kashagan oil fields in Kazakhstan rank among the largest globally, establishing the nation as a major oil exporter. In addition to oil, Kazakhstan has significant coal reserves, which are mainly used for domestic energy generation. While these resources ensure energy security, they also raise concerns about carbon emissions and the ecological footprint.

Unlike Russia or Kazakhstan, Belarus is not abundant in natural resources, particularly lacking significant fossil fuels, which makes it reliant on Russia for energy imports. Instead, Belarus has concentrated on developing its technological, industrial, and agricultural sectors. To address its energy needs, the country has been working on diversifying its energy sources by improving energy efficiency and integrating renewable energy solutions. Belarus's energy strategy emphasizes the importance of energy-saving technologies and the development of renewable resources to reduce dependency on imports and promote sustainability within the sector [37].

Examining Armenia reveals a different energy landscape, primarily due to its limited natural resources. The country relies significantly on imported natural gas and has invested

in nuclear energy to meet its energy demands. The Armenian Nuclear Power Plant plays a crucial role in the country's energy mix. Armenia is also exploring renewable resources, especially solar power, as part of its strategic goal to diversify its energy sources and reduce reliance on imports [38].

Kyrgyzstan stands out within the EAEU for its substantial hydroelectric capacity, which provides a significant portion of the country's energy needs. The availability of abundant water resources has positioned hydropower as a cornerstone of Kyrgyzstan's energy strategy. Yet, challenges persist in terms of maintaining and modernizing outdated infrastructure to enhance efficiency and reliability [39].

Energy security is of utmost importance in the EAEU, as it is vital for maintaining the stability and economic well-being of its member nations. As far as EAEU is rich in natural resources, some of its members are the key global players in the energy markets. Energy security in this region is about more than just the supply and demand dynamics; it encompasses economic stability, geopolitical considerations, and sustainable development practices [40].

Another important aspect is the energy security is vital for the EAEU because it directly impacts the region's economic development. Energy exports, particularly from Russia and Kazakhstan, are significant contributors to national incomes and influence the global energy market. These exports not only provide essential revenue for domestic growth but also support the economic integration processes among EAEU member states. This revenue stream can fund critical infrastructure projects that further strengthen the economic ties within the union. Ensuring a stable supply of energy can, therefore, contribute to predictable economic planning and growth [41].

Furthermore, energy security is inherently linked to geopolitical stability in the EAEU. The region's geopolitical landscape is complex, and energy resources are often at the centre of international relations. With Russia controlling vast energy resources, energy policy becomes a tool of both domestic influence and international diplomacy. By ensuring secure and sustainable energy practices, the EAEU can mitigate potential risks from external pressures or market fluctuations that might otherwise exploit vulnerabilities in energy supply [42].

Yet another aspect of energy security in the EAEU is its impact on sustainable development. Traditional energy practices have raised environmental concerns, such as pollution and carbon emissions, which can undermine long-term economic and health prospects. By adopting energy-efficient technologies and integrating renewable energy sources, EAEU members can reduce their ecological footprints, conflate energy security with environmental sustainability, and enhance their international standing as responsible energy actors [43]. This approach aligns with global energy trends emphasizing decarbonization and sustainability, offering the EAEU opportunities for international collaboration and investment in green energy.

Moreover, energy security enhances the region's resilience against supply disruptions, which may result from geopolitical tensions or market volatility. By diversifying their energy sources and investing in advanced infrastructure, EAEU countries can protect themselves against shortages and price spikes that can severely impact their economies. This necessitates collaboration between member states to align energy policies, exchange technological advancements, and create frameworks for a unified approach to managing risks within the energy sector [44, 45].

It becomes clear that energy security is a linchpin for the EAEU, underpinning economic growth, political stability, and sustainable development. Through concerted efforts to enhance the security, efficiency, and sustainability of energy practices, the EAEU can ensure a stable and prosperous future for its member states, while positioning itself as a key player in the evolving global energy landscape

6 Conclusions

The future of energy technology within the EAEU is marked with significant transformation, driven by both the global shift towards sustainability and the unique regional imperatives of its member states. As the world progresses towards cleaner and more sustainable energy practices, the EAEU is expected to follow suit, with particular emphasis on advancing technologies that enhance efficiency and reduce carbon emissions. This evolution in energy technology will have profound impacts on the economic and environmental landscapes of the EAEU countries.

One of the most promising trends in energy technology is the growing emphasis on renewable energy sources. Solar and wind power are expected to take centre stage as technological advancements make these options increasingly viable and cost-effective. The improved efficiency of solar panels and wind turbines, coupled with falling prices, is likely to result in greater adoption of these technologies across the EAEU.

Countries such as Kazakhstan, with its expansive open areas ideal for wind energy, and Russia, which benefits from plentiful sunlight in its southern regions, are especially well-positioned to take advantage of these renewable resources. The adoption of these technologies is expected to not only broaden the EAEU's energy mix but also reduce the region's dependence on fossil fuels, contributing to lower greenhouse gas emissions.

Additionally, future developments are likely to bring significant improvements in energy storage systems, including batteries and other storage technologies. These advancements are vital for managing the intermittent nature of renewable energy. Efficient energy storage will help stabilize the energy supply, enabling the consistent use of renewable sources even when environmental conditions are not optimal for energy production. As these technologies evolve, the EAEU countries could benefit from a more reliable energy grid that accommodates a higher proportion of renewables, ensuring energy security and reducing vulnerability to supply disruptions.

Moreover, smart grid technology is expected to revolutionize the efficiency of energy consumption and distribution across the EAEU. By leveraging the power of digitalization, smart grids can optimize electricity usage, reduce waste, and enhance the reliability of energy systems. These systems enable real-time monitoring and management of energy distribution, ensuring that electricity is delivered efficiently and sustainably. For the EAEU, adopting such intelligent systems can lead to substantial cost savings, improved service delivery, and ultimately support the transition to a low-carbon economy.

The influence of these new energy technologies is expected to be transformative, encouraging increased collaboration among EAEU nations as they pursue common energy objectives. This shift toward more efficient and sustainable energy systems will strengthen regional energy security and economic competitiveness while also amplifying the EAEU's role in global initiatives to fight climate change. As these future trends unfold, the EAEU stands at the cusp of an energy revolution that promises significant environmental and economic benefits for the region.

These fossil fuels are not only deeply embedded in the economies of EAEU member states but also extensively support national revenues and employment. Transitioning to renewable energy would require substantial investment in new infrastructure, technology, and skills retraining, which poses financial challenges. Compounding this issue, fluctuating global oil and gas prices impact fiscal stability, often resulting in reduced investment in long-term projects such as renewable energy.

Another significant impediment is the regulatory and policy environment. Many EAEU countries suffer from a lack of coherent policies or inconsistencies in regulatory frameworks governing renewable energy. The absence of clear, supportive policy structures and incentives for renewable energy projects discourages both domestic and foreign investments.

Furthermore, bureaucratic hurdles can delay project approvals and dampen investor confidence. For example, complex permitting processes, coupled with the lack of a harmonized regulatory approach across EAEU members, further hinders the swift adoption of renewable technologies.

Additionally, the geopolitical landscape of the region heavily influences energy strategies. The strategic interests and national security concerns of member states often prioritize energy independence and control over energy resources, which can conflict with cross-border renewable energy initiatives that require cooperation and shared infrastructure. Political tensions, both within the region and globally, can thus serve to stall collaborative efforts in adopting widespread renewable solutions.

Technical and knowledge constraints also present significant barriers. The successful adoption of renewable energy technologies requires expertise and skilled personnel, sectors where EAEU countries often face shortages. Research and development focused on energy technologies tailored to the region's unique climatic and geographical conditions is currently limited, which is critical for the successful deployment of renewable energy. Additionally, public perception and acceptance, influenced by a long-standing dependence on fossil fuels and scepticism towards new technologies, may hinder the adoption of renewable energy. This highlights the need for educational campaigns and demonstrations to shift public opinion toward supporting renewable initiatives.

Together, these obstacles create a difficult environment for the EAEU to successfully transition to renewable energy. Overcoming these challenges will require strong political commitment, well-crafted policy strategies, financial investment, and educational efforts, all requiring coordinated and sustained action across various sectors and governments. The region's heavy reliance on fossil fuels highlights the pressing need for a shift towards renewable energy, though this transition must be carefully managed to ensure both economic stability and energy security. By investing in renewable energy technologies such as wind, solar, and hydroelectric power, the EAEU can reduce its carbon footprint and mitigate the impacts of climate change. Developing these sectors will require robust policy frameworks, financial incentives, and international cooperation to attract investments and foster innovation.

Enhancing energy efficiency is another critical component of the EAEU's sustainable energy transition. The region faces substantial energy wastage due to outdated infrastructure and technologies. By modernizing energy systems and implementing energy-saving measures, the EAEU can significantly reduce consumption and emissions. Initiatives such as retrofitting buildings, upgrading industrial processes, and improving grid infrastructure are essential. Furthermore, promoting consciousness around conservation and efficiency within industries and among consumers can drive sustainable practices.

Regional collaboration is crucial in advancing these objectives, leveraging the strengths and resources of each member state. Harmonizing energy policies and standards across the EAEU will facilitate cross-border investments and technology transfers. Sharing best practices and successful models among the member countries can expedite the adoption of efficient and sustainable energy practices. Additionally, engaging the private sector through public-private partnerships can catalyse innovation and funding, complementing governmental efforts.

Continued engagement with the global community is also imperative. The EAEU stands to benefit from international expertise, technology, and financial mechanisms designed to support sustainable energy transitions. Active participation in international agreements and initiatives can bolster the EAEU's efforts in adopting global best practices and achieving its sustainability goals.

All in all, a more sustainable energy future for the EAEU is within reach if the region commits to transforming its energy landscape through strategic investments, regional

cooperation, and international engagement. This transition will not only secure a more sustainable and resilient energy system but also enhance the competitiveness and economic prosperity of the EAEU member states. As they navigate this transformative journey, the EAEU has the potential to emerge as a leader in sustainable energy practices, setting an example for other regions striving to balance energy efficiency, sustainability, and economic growth

References

1. L. Kiss, A. Bektasheva, B. Szabó, *Przegląd Europejski* **3**, 35-64 (2021)
2. A. Patalakh, *Fudan Journal of the Humanities and Social Sciences* **11(1)**, 31-48 (2018)
3. L. Steblyakova, E. Vechkinzova, Z. Khussainova, Z. Zhartay, Y. Gordeyeva, *Energies* **15(14)**, 5091 (2022)
4. G. Mahanta, *Himalayan and Central Asian Studies* **22(1/2)**, 112-137 (2018)
5. L. Gorina, E. Korneeva, O. Kovaleva, W. Strielkowski, *Sustainable Development* **32(5)**, 5294-5310 (2024)
6. E. Sauvageot, *Energy Policy* **145**, 111699 (2020)
7. A. Yalçinkaya, Y. Rashid, *Karadeniz Araştırmaları* **18(71)**, 491-514 (2021)
8. A. Gibadullin, V. Pulyaeva, *E3S Web of Conferences* **114**, 02002 (2019)
9. M. Skalamera, *Europe-Asia Studies* **74(9)**, 1640-1656 (2022)
10. W. Strielkowski, E. Lisin, M. Tvaronavičienė, *Journal of Security and Sustainability Issues* **6(2)**, 235-244 (2016)
11. J. Eder, *Post-Communist Economies* **33(2-3)**, 331-358 (2021)
12. E. Sokolova, O. Panina, N. Krasjukova, N. Kushchev, *International Journal of Energy Economics and Policy* **12(1)**, 258-265 (2022)
13. A. Boute, *Geopolitics* **28(5)**, 2042-2073 (2023)
14. V. Ivlev, V. Ponkratov, M. Maramygin, N. Kuznetsov, A. Pakhomov, I. Elyakova, *Montenegrin Journal of Economics* **16(2)**, 155-166 (2020)
15. O. Digilina, M. Arutyunov, V. Pinchuk, *Energy Cooperation of the EAEU in Today's Conditions. ESG Management of the Development of the Green Economy in Central Asia* (Springer International Publishing, Cham, 2023)
16. B. Petkova-Chobanova, T. Babayan, I. Gorovykh, *Energy efficiency policies and programmes in the Eastern Partnership and Central Asian countries: The role of the Energy Charter PEEREA review process. Energy Efficiency in Developing Countries* (Routledge, New York, 2020)
17. M. Saiymova, A. Shakharova, A. Rakaeva et al, *International Journal of Energy Economics and Policy* **10(4)**, 293-299 (2020)
18. N. Sadovnikova, V. Abramov, A. Ogryzov, O. Makhova, *International Journal of Energy Economics and Policy* **10(5)**, 272-280 (2020)
19. I. Busygina, M. Filippov, *Problems of Post-Communism* **68(6)**, 477-486 (2021)
20. W. Strielkowski, T. Kulagovskaya, G. Panaedova, L. Smutka, S. Kontsevaya, D. Štreimikienė, *Economic research-Ekonomska istraživanja* **36(1)**, 2021-2044 (2023)
21. M. Muratova, H. Sadri, Z. Medeubayeva, A. Issayeva, *Journal of Eurasian Studies* **18793665231215799** (2023)
22. M. Skalamera, *International Affairs* **96(6)**, 1623-1642 (2020)

23. E. Korneeva, A. Omarova, O. Nurova, E3S Web of Conferences **531**, 02001 (2024)
24. E. Lisin, A. Rogalev, W. Strielkowski, I. Komarov, Sustainability **7(9)**, 11378-11400 (2015)
25. F. Salvati, *Power asymmetries and integration process: challenges ahead for the EAEU. The Elgar Companion to the Eurasian Economic Union* (Edward Elgar Publishing, 2024)
26. I. Rodionova, T. Kokuytseva, O. Shuvalova, E3S Web of Conferences **159**, 02002 (2020)
27. EEC. EAEU Statistics. Available at: https://eec.eaeunion.org/en/commission/department/migration/statistical_data.php (accessed on 01.10.2024)
28. G. Chebotareva, W. Strielkowski, D. Streimikiene, Journal of Cleaner Production **269**, 122110 (2020)
29. H. Pourasl, V. Khojastehnezhad, Proceedings of the Institution of Mechanical Engineers, Part A: Journal of Power and Energy **235(6)**, 1563-1576 (2021)
30. M. Shabalov, Y. Zhukovskiy, A. Buldysko, B. Gil, V. Starshaia, Energy Reports **7**, 2664-2680 (2021)
31. W. Strielkowski, S. Zenchenko, A. Tarasova, Y. Radyukova, Sustainability **14(12)**, 7267 (2022)
32. B. Kondev, J. Dixon, Z. Zhou, R. Sabyrbekov, K. Sultanaliev, S. Hirmer, Transport Policy **131**, 87-96 (2023)
33. V. Kutcherov, M. Morgunova, V. Bessel, A. Lopatin, Energy Strategy Reviews **30**, 100511 (2020).
34. J. Yang, S. Rizvi, Z. Tan, M. Umar, M. Koondhar, Resources Policy **72**, 102100 (2021)
35. E. Korneeva, N. Olander, W. Strielkowski, Energies **14(23)**, 7913 (2021)
36. T. Turganbayeva, ESAM Ekonomik ve Sosyal Araştırmalar Dergisi **1(2)**, 225-244 (2020)
37. M. Luțaș, D. Bako, B. Pincu, EURINT **7**, 209-234 (2020)
38. M. Keogh, Caucasus Analytical Digest **120**, 7-11 (2021)
39. E. Shadrina, Energies **13(11)**, 2963 (2020)
40. G. Movkebayeva, A. Aktymbayeva, Y. Tyurina, N. Baikadamov, K. Beketova, M. Troyanskaya, A. Imangaliyeva, International Journal of Energy Economics and Policy **10(2)**, 497-503 (2020)
41. S. Iskajyan, I. Kiseleva, A. Tramova, N. Litovka, Nexo Revista Científica **35(1)**, 212-219 (2022)
42. T. Casier, *Russia's energy leverage over the EU: myth or reality? In European Security Governance and the European Neighbourhood after the Lisbon Treaty* (Routledge, London, 2013)
43. T. Sternberg, C. McCarthy, B. Hoshino, Water **12(10)**, 2690 (2020)
44. A. Gast, *The Eurasian Economic Union: keeping up with the EU and China. Global Governance and Interaction between International Institutions* (Routledge, London, 2023)
45. A. Burnasov, M. Ilyushkina, Y. Kovalev, A. Stepanov, Studies of the Industrial Geography Commission of the Polish Geographical Society **34(4)**, 138-150 (2020)