

Nuclear and Alternative Energy in Central Asia

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Abstract This article reviews the introduction of nuclear and renewable energy in Central Asia. It delves into the motivations and challenges in this development. Although, Central Asia has a huge potential in nuclear, due to uranium resources, and wind and solar powers, due to geography, the shift to these sources will be minimal. Central Asian states will still rely on hydrocarbons and coal at least till 2050. However, the planning and the implementation of projects on “green energy” will have geopolitical and economic impact.

Keywords Central Asia. Energy. Nuclear. Renewables. Resources.

Summary 1 Introduction. – 2 Nuclear Energy in Central Asia. – 3 Renewable Energy. – 4 Implications for the Region. – 5 Conclusion.

1 Introduction

Central Asian states have long been known for its role in the global energy market, mainly due to its large reserves of hydrocarbons. The influx of foreign investments and opportunities for developing the regional energy potential opened up as soon as the countries got independence in 1991. Scholarship on energy in Central Asia has focused on “Resource Curse” attributes of the hydrocarbons bonanza (Auty; Soysa 2006; Overland et al. 2010), geopolitics (Ehteshami 2004; Petersen; Barysch 2011; Yenikayeff 2011) and economic governance (Heinrich; Pleines 2015; Pleines; Wösthelrich 2016). However, Central Asian states are diversifying their energy prospects with the turn to nuclear energy and renewables.



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This article explores the development of nuclear energy in Central Asia and looks into the motivations and challenges, and prospects for the growth in renewable energy in the region. The author uses case studies of Kazakhstan and Uzbekistan in their attempts to install nuclear power or, in the case of Kyrgyzstan, to invest in uranium mining, with the social backlash it created. The paper then proceeds to give an overview of Central Asia's path to the use of renewable energy and compliance with the Paris Agreement. It concludes with the overall assessment of the importance of nuclear and renewable energy introduction in the region.

2 Nuclear Energy in Central Asia

Central Asia has been attributed to experience the “renaissance” in nuclear energy and, especially, in uranium mining (Kassenova 2010, 211). After the collapse of the Soviet Union, Kazakhstan inherited the fourth largest nuclear arsenal in the world, which it renounced in support of a global non-proliferation movement.

2.1 Central Asia Nuclear Free Zone

Resolving the security dilemma that existed in front of Central Asian states at the dawn of independence was an important issue not only for national security but also for ensuring the economic growth and flow of investments. There was an unwritten consensus to commit to the nuclear non-proliferation regime by all five Central Asian states. They became signatories of the Treaty on Non-Proliferation of Nuclear Weapons (NPT), Comprehensive Nuclear-Test-Ban Treaty (CTBT) and IAEA Safeguards Agreements and Additional Protocols (Kassenova 2010, 236).

Another important factor contributing to nuclear non-proliferation in the region was the establishment of the Central Asia Nuclear Weapons Free Zone (CANWFZ). This zone created a regional vacuum in nuclear arms presence, which was a crucial geopolitical move, especially considering the proximity of neighbouring nuclear powers (Russia, China, India and Pakistan). It also stipulated the ban on the imports of nuclear waste, which is important to keep in mind, as the countries need to develop their own repositories of nuclear waste if they want to develop nuclear energy.

2.2 Kazakhstan

Among all Central Asian states, Kazakhstan was the first one to make significant plans on nuclear energy. After the collapse of the Soviet Union and overall economic downturn, the uranium industry in Kazakhstan significantly dropped in output. In the 2000s Kazakhstan's government decided to revamp the industry (as part of the emphasis of the role of natural resources in the economic development) and established a new state-owned company Kazatomprom to do so. In 2004 at World Nuclear Association symposium Kazatomprom revealed the program "15,000t of uranium by 2010" (Kazatomprom 2019). Over the last two decades, the country not only bypassed that goal but became one of the top uranium producers in the world. In 2016 Kazakhstan produced more than Canada and Australia combined, as second and third producers (Nuclear Energy Agency, International Atomic Energy Agency 2018).

Kazakhstan has significant reserves of uranium of 14% of global (USD 130/kgU) and will be continuing to be a major player in the uranium production, despite reductions in output due to decreasing world prices (World Nuclear Association, 2019c). The country developed partnerships with Japan, China, Russia and France, to name the few in the nuclear industry (Tskhay 2012). With the expanding uranium production, Kazakhstan has started developing the idea of realisation of the full nuclear fuel cycle.

The plan for nuclear fuel pellets production plant first emerged when a joint-venture between Kazatomprom and French Areva was signed in 2010 (World Nuclear Association 2019a). In 2016 the construction of the plant has started, but in cooperation with China General Nuclear Power Corporation, however, with the use of Areva's technology (Areva 2016). This is an indication of China's growing interest in Kazakhstan's uranium and nuclear fuel pellets to supply the Chinese market.

Kazakhstan developed cooperation with Russia not only in the area of uranium mining but more importantly, in nuclear power plant construction. In 2011 Kazakhstan and Russia signed an agreement for a feasibility study of nuclear power plant construction, and in 2014 an MOU was signed between Rosatom and Kazatomprom on this issue (World Nuclear Association 2019a). However, more precise details the technical details of the plant or the location of it has not been agreed upon.

Being the nuclear testing ground during Soviet times, there is a strong civil society movement against nuclear non-proliferation. Therefore, the decision for the location of the nuclear power plant results in intensified public debates. It especially comes with discontent from the public, as some experts have shared that it could be near Almaty province (close to the largest city - Almaty) (Pannier 2019).

Thus, the plans for the nuclear power plant are still in the making and President Kassym-Jomart Tokayev has stated that the issue is not on the agenda (Vaal 2019).

The reason for introducing nuclear energy in Kazakhstan is to match the electricity demand in southern regions and boost economic growth. This will also diversify the coal-dependent electricity sector. In various plans and project feasibility studies, the idea of a nuclear power plant with capacity of 300-1200MWe is discussed (World Nuclear Association, 2019a). Overall, even though the plans for nuclear power plant construction have been discussed for years, Kazakhstan seems to be dragging the issue. Keeping in mind that nuclear energy would be a minor contribution to the general electricity production, the country will still be dependent on hydrocarbons and coal, at least till 2050 when the “Concept for Green Economy” should be implemented (Government of the Republic of Kazakhstan, 2013; Tskhay 2012).

2.3 Kyrgyzstan

Although Kyrgyzstan has not expressed its plans to construct a nuclear power plant or develop nuclear energy, yet uranium mining sparked a countrywide debate and became a point of contention. This debate is crucial to understand the mix of political and economic issues tied with the uranium mining and nuclear energy, in general, in the country.

Kyrgyzstan’s industrial output is dominated by the mining sector, which creates challenges for its economic growth and social stability (Doolot; Heathershaw 2015). The country has 566t in reserves of gold (Extractive Industries Transparency Initiative 2019) and presumably 10,000t in reserves of uranium – however, this figure is difficult to confirm (Kassenova 2010, 226). The country’s low economic prosperity puts it in dire need of investments and, thus, the government is keen to develop and expand its mining potential, specifically in resource-rich Osh and Issyk-Kul regions.

In 2010 “UrAziya” company has received the licence for geological exploration in the Tash-Bulak field (Musabayeva 2019). The company has reportedly been conducting exploratory works since 2012. In April 2019, local residents in the Issyk-Kul region where Tash-Bulak field is located, protested against uranium mining, raising concerns for health and environmental safety. Similar protests also occurred in the capital Bishkek, with the calls for a ban on uranium mining throughout the country. Several political party representatives have supported this cause and also pointed at the government for failing to provide necessary safety measures. Being under pressure, the government of Kyrgyzstan has first revoked the licence of

“UrAziya” in April 2019 and then put a temporary ban on all uranium mining and exploratory works (Auyezov 2019; Sputnik.kg, 2019).

The case of the uranium mining ban in Kyrgyzstan demonstrates two important points. First, there is significant distrust of the nuclear energy sector, mostly due to the well-known harmful effects of Chernobyl and Fukushima catastrophes. The imagery and the messaging that Kyrgyz protesters used had references to both events. Therefore, there is a lack of understanding among the general public about the nuclear and uranium industry and what it entails, especially regarding risks and safety. Second is related to the previous one, in the lack of trust among the population in the government and investors. The two revolutions (2005 and 2010) and clashes between workers and mining companies are just mere examples of this. Moreover, lack of transparency and accountability on who gets the mining licences and how will the mining sector improve the economic conditions of the population in the regions supports the antagonistic feelings towards the government and extractive companies. Third, historically Kyrgyzstan has served as a nuclear waste base when, during the Soviet times, tons of radioactive materials were buried in the country's territory (Muzalevsky 2013). Almost thirty years after independence many radioactive waste sites need relocation or safety standards improvements, otherwise posing significant environmental and health hazard (Moldogazieva 2010).

The politicization of the uranium mining issue is hard to ignore, from the fast spread of protest movements from the periphery to the capital to the representation of political parties among those protests. Some analysts associate this to the upcoming Parliamentary elections in 2020. However, it is true to say that the uranium topic became a powerful one to mobilize people and put pressure on the government.

2.4 Uzbekistan

Uzbekistan reportedly holds 2% of global uranium reserves and accounts for 3.9% of global uranium production (Nuclear Energy Agency, International Atomic Energy Agency 2018). The uranium mining industry has been active since the Soviet times in the country, peaking in the mid-1980s. Since independence, Uzbekistan developed partnerships and joint ventures in uranium exploration and mining with China, Japan and Russia.

An important factor to consider in analyzing Uzbekistan's energy sector is its reliance on natural gas.

Gas production contributes to Uzbekistan's economy not only for export but also for domestic consumption. Currently, the gas is generating 85% of electricity, whilst hydropower and coal contribute to

the remaining 15% (Nuclear Engineering International 2019). The projected economic growth of 5.5% in 2020 will require a two-fold increase in electricity production (Mirzakhmudovis 2019). Thus, the new energy strategy for 2030 is projecting to double the production of electricity and, more importantly, to decrease the reliance on gas. Nuclear energy will play a big role in this transformation. The gas will be used in high-value-added products in the petrochemical industry.

As in Kazakhstan, the presence of uranium mining gives Uzbekistan an advantage in launching its domestic nuclear energy. An agreement on the construction of a nuclear power plant was signed between Russia by President Vladimir Putin and President Shavkat Mirziyoyev (Astrasheuskaya 2019). Construction is expected to begin in 2022 with the launch of a power plant in 2028. Both governments have agreed on the location of the plant one year earlier than planned, which will be in central Navoi region (Eurasianet 2019).

One should underestimate the plans for nuclear energy development in Uzbekistan, as they will generate ripples on regional cooperation. The construction of the nuclear power plant is funded through loans from Russia with an estimated budget of \$11bln (Astrsheuskaya 2019). In addition, the CANWFZ requirements forbid Uzbekistan to install uranium enrichment facilities, hence, it would need to resort to other parties for nuclear fuel. Keeping this in mind, Russia would be a viable partner for Uzbekistan to cooperate within the nuclear industry sector. Russia already expressed its willingness to enrich Uzbekistan's uranium at the International Uranium Enrichment Center in Angarsk in 2007 (World Nuclear Association 2019b). Moreover, Moscow is interested in getting more involved in the region, in general, and in Uzbekistan in particular. Combined with an agreement signed with Kazakhstan it puts Russia into a significant strategic position.

Uzbekistan's officials also cite the country's commitment to the Paris Agreement and, subsequently, the reduction of carbon emissions as the reason to switch to nuclear energy. The projects to increase the use of alternative and renewable energy is prevalent among all Central Asian states, which is discussed later in this paper.

3 Renewable Energy

The first issue necessary to point out is that all Central Asian states have signed the Paris Agreement (but Kyrgyzstan has not ratified it yet). Therefore, in principle, all states have agreed to commit to the reduction of CO₂ emissions and have started developing strategies to tackle climate change. This would include implementation of such steps as (1) to diversify the domestic energy mix, (2) to improve export of electricity, (3) to facilitate financing mechanisms and investment into green technologies and green economy.

Thus, for example, Kazakhstan ambitiously aims to achieve 50% of the energy generated from renewable or nuclear energy sources by 2050. Similarly, Uzbekistan's government plans to attract foreign investments (\$5.3bln) and spend its own money (\$81mln) to develop hydro, solar and wind power by 2025. For Kyrgyzstan and Tajikistan, the hydropower is a focus, not only for domestic consumption but also for energy export.

Kyrgyzstan and Tajikistan are both upstream countries and control the flow of major rivers in the region, such as the Amu Darya and the Syr Darya. During the Soviet period, a system of water allocation quotas and water-energy nexus in the region was established. Downstream countries received larger quotas due to their population size and vast agricultural sector, upstream countries would in return receive energy supplies during the winter season. The maintenance of water facilities and dams was paid by Moscow (Zakhirova 2013). Since this arrangement was no longer sustainable for all the parties involved after gaining independence in 1991, periodic conflicts over water resources in the region occurred (see International Crisis Group 2002; Ito et al. 2016; Petrov; Normatov 2016; Zakhirova 2013).

The construction of large hydropower plants in these countries has been a point of friction for Tashkent for decades (Ito et al. 2016; Petrov; Normatov 2010). The persistent conflict situations surround water management in Central Asia have forced states to develop alternative strategies. Thus, both Kyrgyzstan and Tajikistan are investing in expanding their hydropower potential and laying plans for hydropower plants construction. Moreover, Russia is investing in hydropower plants construction in Kyrgyzstan as an agreement signed on March 27, 2019, indicates (Putz 2019).

The inception of the hydropower plant project in Tajikistan started in 1976, however, was not materialised due to the collapse of the Soviet Union (Bekchanov et al. 2015). The long civil war and financial challenges have also prevented from the launch of the Rogun dam construction, notwithstanding, an attempt by the Tajik government to raise funds from selling shares in the project among the general population (Menga 2015). In 2016, the construction officially started with a projected cost of \$3.9bln and the first turbine (out of six) was unveiled in 2018 (Putz 2018). There are high hopes associated with the construction of the Rogun dam, especially due to significant seasonal shortages of electricity in Tajikistan (Menga 2015, 484). At the same time, the electricity generated from Rogun could also be used for export, especially with the launch of CASA-1000 (a project to distribute the surplus of electricity from Central Asia to South Asia). Yet, despite the potential benefits of the Rogun hydropower plant to the Tajik economy, the project is surrounded by investment challenges, the sustainability of construction plans and the intended usage of the dam (either for domestic purposes, for export of electricity, or for both) (Putz 2018).

Kazakhstan adopted a Concept for the transition to the green economy, which frames the main areas of work to be done in tackling climate change and environmental commitments in 2013 (Government of the Republic of Kazakhstan 2013). For example, the country intends to increase efficiency in the use of energy and water resources, to improve agriculture productivity, to implement gasification of regions, to reduce carbon dioxide emissions and air pollution, and to install waste utilization and recycling, among many other steps. These steps are divided into concrete action plans to be achieved by 2020, 2030, and 2050. It is not surprising that the theme for the EXPO-2017 held in Astana was “Future Energy”, which again demonstrates the commitment of Kazakhstan’s government to these issues. The new International Centre for Green Technologies and Investment Projects was founded in 2018 to discuss and implement green technologies in Kazakhstan and to replicate them across Central Asia (Shamsharkhan 2018). Kyrgyzstan has also launched a similar institution, Climate Finance Center, which focuses on attracting investments to environmental projects (*Climate Finance Center of the Kyrgyz Republic* 2019).

Solar energy is one of the directions of the “green” investments with the construction of solar power plants. A good example of this is the opening of the largest solar plant in Central Asia in the small town of Saran in central Kazakhstan with a capacity of 100 megawatts (Konyrova 2019). Uzbekistan plans to build 25 solar power plants by 2030 (The Times of Central Asia 2019). Currently, Uzbekistan and Tajikistan generate 3% of electricity from solar power (Marques 2018).

Wind energy has also big potential in Central Asia, however, it is less developed than other sources of energy (Bahrami, et al., 2019). At the moment, only Kazakhstan has more elaborate projects (completed and ongoing) on the use of wind energy. The country launched a large-scale wind farm Yerementau, which is the biggest in Central Asia, in the northern part of the country with a \$70mln loan from the EBRD of in 2014 (Koch 2018). Other Central Asian states built small-scale wind farms in specific regions and only Uzbekistan has plans to install new ones (Eshchanov et al. 2019).

4 Implications for the Region

The presented above overview of the trends in the diversification of energy sources in Central Asia demonstrates the intended directions of the energy sector’s development in the region. I would like to draw three important issues for the region and regional cooperation, in the light of this.

First, the use of nuclear and renewable energy is viewed as an addition to conventional hydrocarbons and coal as sources of energy. As global actions to tackle climate change push for a reduction in

CO₂ emissions, Central Asian are also getting concerned on how to achieve it domestically. Thus, the move towards nuclear or renewable sources is not only to diversify the energy sector but mostly as another way of attracting foreign investments and boost economic development.

Second, cooperation with foreign donors and strategic partners (Russia and China) is essential for the development of the nuclear and renewable sector in the region. Russia is an important partner for the construction of nuclear power plants in Kazakhstan and Uzbekistan. The nuclear energy sector also bears geopolitical implications on the increased links between big powers (Russia and China) and Central Asia.

Third, the use of hydropower will also depend on good relations within the region and common work on the resolution of the water usage dilemma and to avoid open conflict. This is also important in the light of the future success of the CASA-1000 project, and, hence, whether Central Asian states would be able to export energy to South Asia.

By looking at these three points, one can understand even the conception of plans for introducing nuclear and renewable energy in the region brings significant intra-regional and inter-regional implications. These infrastructure projects require huge financial contributions, multi-state cooperation and long-term planning.

5 Conclusion

This article presented an overview of the developments in nuclear and alternative energy industries in Central Asian states. Subsequently, several conclusions could be outlined to indicate the direction of the energy sector advancement in the region.

First, the introduction of nuclear energy in the region is still at an initial stage. Uzbekistan is ahead, due to agreements with Russia on the construction of a plant and a selected site for it. Kazakhstan, although it is planning the introduction of nuclear energy, it is still unclear when it will happen and the technical specifics of the project and its location. Kyrgyzstan has just banned uranium mining and has a strong civil resistance to issues related to nuclear waste storage and management.

The second point is the presence of outside powers is key, especially in consideration of financial and strategic issues. Russia plays an important role in cooperating with Central Asian states on nuclear energy, promoting their technology and experiences. This is especially important in adding another link between Russia and Central Asian states. China is also interested in the nuclear industry in Central Asia, especially from the perspective of nuclear fuel and urani-

um supply. Japan, South Korea and France have been also providing assistance and knowledge exchange, thus, representing a balancing option against Russia and China as partners. Such geopolitical competition between major players is also present in the renewable energy sector and will continue to have an impact on the development of the energy sector in the region as a whole (Koch 2018).

Third, renewable energy is pushed for in the region to mixed results. Hydropower development in Kyrgyzstan and Tajikistan is controversial and comes with environmental and political concerns on the use of water from transboundary rivers in the region. Installed wind and solar plants have not yet become significant enough in the energy mix. Thus, hydrocarbon predominance will persist in the mid-term future, with major shifts in the energy mix planned for after 2050.

In general, the shift to nuclear and renewables is the desire of Central Asian states to attract investments, diversify their economy and support future electricity demand, not only domestically, but also in a wider regional perspective. Environmental concerns and commitment to the Paris Agreement are often cited for the drive towards renewable energy in the region. It is therefore important to keep an eye on as it may change the economic performance of the countries, at the same time these long-term outlooks are challenged by the feasibility of such projects (Rogun dam, for example) and political commitment.

Bibliography

- Areva (2016). *The Construction of Nuclear Fuel Fabrication Plant Has Started in Kazakhstan*. URL <http://www.sa.areva.com/EN/news-10887/the-construction-of-nuclear-fuel-fabrication-plant-has-started-in-kazakhstan.html> (2019-11-21).
- Atrsasheuskaya, Nastassiya (2019). "Uzbekistan Turns to Nuclear Energy to Power Economy". *The Financial Times*. 14 January 2014. URL <https://www.ft.com/content/a99c1b58-0466-11e9-99df-6183d3002ee1> (2019-11-21).
- Auty, Richard M.; de Soysa, Indra (eds) (2006). *Energy, Wealth and Governance in the Caucasus and Central Asia*. London: Routledge.
- Auyezov, Olzhas (2019). "Kyrgyzstan Bans Uranium Mining After Protests". *Reuters*. URL <https://www.reuters.com/article/us-kyrgyzstan-uranium/kyrgyzstan-bans-uranium-mining-after-protests-idUSKCN1S81NN> (2019-11-21).
- Bahrami, Arian; Teimourian, Amir; Okoye, Chiemeka Onyeka; Khosravi, Ni-ma (2019). "Assessing the Feasibility of Wind Energy as a Power Source in Turkmenistan; a Major Opportunity for Central Asia's Energy Market". *Energy*, 183, 415-27. DOI 10.1016/j.energy.2019.06.108.
- Bekchanov, Maksyid; Ringler, Claudia; Bhaduri, Anik; Jeuland, Marc (2015). "How Would the Rogun Dam Affect Water and Energy Scarcity in Central Asia?". *Water International*, 40(5-6), 856-76. DOI 10.1080/02508060.2015.1051788.

- Doolot, Assel; Heathershaw, John (2015). "State as Resource, Mediator and Performer: Understanding the Local and Global Politics of Gold Mining in Kyrgyzstan". *Central Asian Survey*, 34(1), 93-109. DOI 10.1080/02634937.2015.1010853.
- EBRD. (2018). "Kyrgyz PPCR: Financing the Establishment and Operations of the Centre on Climate Finance of the Kyrgyz Republic". URL <https://www.ebrd.com/work-with-us/projects/tcpsd/kyrgyz-ppcr-financing-the-establishment-and-operations-of-the-centre-on-climate-finance-of-the-kyrgyz-republic.html>.
- Ehteshami, Anoushirawan (2004). "Geopolitics of Hydrocarbons in Central and Western Asia". Akiner, Shirin (ed.), *The Caspian: Politics, Energy and Security*. Abingdon: RoutledgeCurzon, 63-76.
- Endebaeva, Gaukhar (2017). "Turkmenistan Aims to Take Lead in Renewable Energy". *Caspian News*. URL <https://caspiannews.com/news-detail/turkmenistan-aims-to-take-lead-in-renewable-energy-1495109995270> (2019-11-21).
- Eshchanov, Bahtiyor; Abylkasymova, Alina; Aminjonov, Farkhod; Moldokanov, Daniyar; Overland, Indra; Vakulchuk, Roman (2019). "Wind Power Potential of the Central Asian Countries". *Central Asia Regional Data Review*, 17, 1-7.
- Eurasianet (2019). "Uzbekistan, Russia Agree on Site for Nuclear Plant". *Eurasianet*. URL <https://eurasianet.org/uzbekistan-russia-agree-on-site-for-nuclear-plant> (2019-11-21).
- Extractive Industries Transparency Initiative (2019). "Kyrgyz Republic". EITI.org. URL <https://eiti.org/kyrgyz-republic#production> (2019-11-21).
- Government of the Republic of Kazakhstan (2013). "Concept for the Transition of the Republic of Kazakhstan to a 'Green Economy'". URL https://greenkaz.org/images/for_news/pdf/npa/koncepciya-po-perehodu.pdf (2019-11-21).
- Heinrich, Andreas; Pleines, Heiko (2015). "Mixing Geopolitics and Business: How Ruling Elites in the Caspian States Justify their Choice of Export Pipelines". *Journal of Eurasian Studies*, 6(2), 107-13. DOI 10.1016/j.euras.2015.03.003.
- International Crisis Group (2002). "Central Asia: Water and Conflict". *ICG Asia Report* 34. URL https://www.files.ethz.ch/isn/28347/034_central_asia_water_conflict.pdf (2019-11-21).
- Ito, Sonoko; El Khatib, Sameh; Nakayama, Mikiyasu (2016). "Conflict Over a Hydropower Plant Project Between Tajikistan and Uzbekistan". *International Journal of Water Resources Development*, 32(5), 692-707. DOI 10.1080/07900627.2015.1076381.
- Kassenova, Togzhan (2010). "Uranium Production and Nuclear Energy in Central Asia: Assessment of Security Challenges and Risks". *China and Eurasia Forum Quarterly*, 8(2), 221-241. URL <https://www.files.ethz.ch/isn/120724/cefq8.2-2010.pdf> (2019-11-21).
- Kazatomprom (2019). "History". *Kazatomprom*. URL https://www.kazatomprom.kz/ru/page/istoriya_kompanii (2019-06-11).
- Koch, Natalie R. (2018). "The Geopolitics of Renewable Energy in Kazakhstan". *Central Asia Program*. DOI 10.2139/ssrn.2998305.
- Konyrova, Kulpash (2019). "European Investors Launch Central Asia's Largest Solar Plant in Kazakhstan". URL <https://www.neweurope.eu/ar->

- ticle/european-investors-launch-central-asias-largest-solar-plant-in-kazakhstan (2019-11-21).
- Krause, M. (2017). "Strengthening Links With a New Member State: IAEA Mission to Turkmenistan Explores New Areas of Cooperation". *IAEA*. URL <https://www.iaea.org/newscenter/news/strengthening-links-with-a-new-member-state-iaea-mission-to-turkmenistan-explores-new-areas-of-cooperation> (2019-11-21).
- Marques, Joao Gaspar (2018). "Renewables in Central Asia". URL <https://www.thebusinessyear.com/the-challenges-of-renewable-energy-in-central-asia/focus> (2019-11-21).
- Menga, Filippo (2015). "Building a Nation Through a Dam: the Case of Rogun in Tajikistan". *Nationalities Papers*, 43(3), 479-94. DOI 10.1080/00905992.2014.924489.
- Mirzakhmudov, Jurabek (2019). "Viewpoint: the Logic of Nuclear Power for Central Asia". *World Nuclear News*. URL <http://world-nuclear-news.org/Articles/Viewpoint-The-logic-of-nuclear-power-for-Central-A> (2019-11-21).
- Moldogazieva, Kalia (2010). "Radioactive Tailings in Kyrgyzstan: Challenges and Solutions". *China and Eurasia Forum Quarterly*, 8(2), 203-19. URL <https://www.files.ethz.ch/isn/120724/cefq8.2-2010.pdf> (2019-11-21).
- Musabayeva, Anar (2019). "Протестный апрель 2019: Митинги против урана в Кыргызстане". URL <https://caa-network.org/archives/16037> (2019-11-21).
- Muzalevsky, Roman (2013). "Uranium Waste in Central Asia Presents Serious Security Challenges". *Eurasia Daily Monitor*, 10(13). URL <https://jamestown.org/program/uranium-waste-in-central-asia-presents-serious-security-challenges> (2019-11-21).
- Nuclear Energy Agency; International Atomic Energy Agency (2018). "Uranium 2018 Resources, Production and Demand". URL <https://www.oecd-nea.org/ndd/pubs/2018/7413-uranium-2018.pdf> (2019-11-21).
- Overland, Indra; Kjaernet, Heidi; Kendall-Taylor, Andrea (eds) (2010). *Caspian Energy Politics: Azerbaijan, Kazakhstan and Turkmenistan*. Abingdon: Routledge.
- Pannier, Bruce (2019). "Putin Offers Russian Help To Build Kazakh Nuclear Plant". URL <https://www.rferl.org/a/kazakhstan-putin-offers-russian-nuclear-plant-help/29865177.html> (2019-11-21).
- Petersen, Alexandros; Barysch, Katinka (2011). "Russia, China and the Geopolitics of Energy in Central Asia". URL <https://www.cer.eu/publications/archive/report/2011/russia-china-and-geopolitics-energy-central-asia> (2019-11-21).
- Petrov, G.N.; Normatov, I. Sh. (2010). "Conflict of Interests Between Water Users in the Central Asian Region and Possible Ways to Its Elimination". *Water Resources*, 37(1), 113-20. DOI 10.1134/S0097807810010112.
- Pleines, Heiko; Wösthelrich, Ronja (2016). "The International-Domestic Nexus in Anti-corruption Policy Making: The Case of Caspian Oil and Gas States". *Europe-Asia Studies*, 68(2), 291-311. DOI 10.1080/09668136.2015.1126232.
- Putz, Catherine (2018). "Tajikistan's Rogun Dam Begins Operations". *The Diplomat*. URL <https://thediplomat.com/2018/11/tajikistans-megadam-rogun-begins-operations> (2019-11-21).
- Putz, Catherine (2019). "Putin in Kyrgyzstan: A Tiny Base Expansion and a Hydropower Agreement". *The Diplomat*. URL <https://thediplomat.com/2019/05/putin-in-kyrgyzstan-a-tiny-base-expansion-and-a-hydropower-agreement> (2019-11-21).

- com/2019/03/putin-in-kyrgyzstan-a-tiny-base-expansion-and-a-hydropower-agreement (2019-11-21).
- Shamsharkhan, Raushan (2018). "Kazakh PM Presents International Centre of Green Technologies in Astana". *The Astana Times*, 21 May 2018. URL <https://astanatimes.com/2018/05/kazakh-pm-presents-international-centre-of-green-technologies-in-astana> (2019-11-21).
- Sputnik.kg (2019). "Лицензия на урановое месторождение на Иссык-Куле отозвана, заявил Боронов". URL <https://ru.sputnik.kg/economy/20190425/1044109873/kyrgyzstan-uran-licenziya-otzyv.html> (2019-11-21).
- The Times of Central Asia (2019). "Uzbekistan to Build 25 Solar Power Plants by 2030". URL <https://www.timesca.com/index.php/news/21008-uzbekistan-to-build-25-solar-power-plants-by-2030> (2019-11-21).
- Tskhay, Aliya (2012). "The Development of Nuclear Energy in Kazakhstan and its Integration to the Country's Energy Sector". *Global Studies Journal*, 2(7), 109-19.
- Vaal, Tamara (2019). "Вопрос о строительстве АЭС в Казахстане на повестке не стоит – Токаев". *Vlast.kz*. URL <https://vlast.kz/novosti/33694-vopros-o-stroitelstve-aes-v-kazahstane-na-povestke-ne-stoit-tokaev.html> (2019-11-21).
- World Nuclear Association (2019a). "Uranium and Nuclear Power in Kazakhstan". URL <http://www.world-nuclear.org/information-library/country-profiles/countries-g-n/kazakhstan.aspx> (2019-11-21).
- World Nuclear Association (2019b). "Uzbekistan Uranium". URL <http://www.world-nuclear.org/information-library/country-profiles/countries-t-z/uzbekistan.aspx> (2019-11-21).
- World Nuclear Association (2019c). "World Uranium Mining Production". URL <https://www.world-nuclear.org/information-library/nuclear-fuel-cycle/mining-of-uranium/world-uranium-mining-production.aspx> (2019-06-06).
- Yenikeeff, Shamil M. (2011). "Energy Interests of the "Great Powers" in Central Asia: Cooperation or Conflict?". *International Spectator*, 46(3), 61-78. DOI 10.1080/03932729.2011.601115.
- Zakhirova, Leila (2013). "The International Politics of Water Security in Central Asia". *Europe-Asia Studies*, 65(10), 1994-2013. DOI 10.1080/09668136.2013.848647.

