The purpose of this article is to analyse integration processes in the nuclear energy sector of Russia and Kazakhstan. Particularly, we will focus on the two countries’ initiatives in peaceful uses of nuclear energy, and evaluate the progress of the integration projects. We also provide an overview of the world nuclear market, Kazakhstan’s and Russia’s uranium industries, elaborating on the roles of the Kazakh national nuclear company Kazatomprom and Russian State atomic energy corporation Rosatom, as main representatives of the countries on the international nuclear market. Finally, we analyse some Russian-Kazakh bilateral cooperation initiatives in nuclear sector. The article is based on the EDB sector report no. 11 “Russian and Kazakhstani nuclear energy: trends in economic cooperation”.

**Introduction**

Nuclear energy presently enjoys a renaissance and plays an increasingly prominent role in the world economy. Notably, developing countries that do not possess the necessary technology are the main driving force behind this revival of interest. States that possess immense fossil fuel resources, such as the United Arab Emirates and Saudi Arabia, are also showing significant interest in nuclear energy.

Nuclear energy is three times cheaper than wind energy and five times cheaper than solar energy. The operation of an NPP is more environmentally friendly than other power stations as there are almost no greenhouse gas emissions. In this respect, the full nuclear energy cycle, including uranium mining, nuclear fuel transportation, construction of reactors and disposal of wastes, is comparable to electricity generation from the renewable sources. If all the world’s 440 reactors were replaced by thermal power plants, generation of the same quantity of electricity would lead to an annual increase in carbon emission of 3.2 billion tons (Deripaska, 2009).

Swift fluctuations in fossil fuel prices and the rapid depletion of oil, gas and coal deposits prompt the main producers of these resources (including Russia and Kazakhstan) to search for new sources of income. Under such conditions, the uranium industry has the opportunity to become the mainstay of these
Eurasian Development Bank

Aigul Absametova “Russian and Kazakhstani Nuclear Energy: Trends in Economic Cooperation”

Economic Cooperation in Industries and Sectors

economies. Moreover, the strong political and economic ties between Russia and Kazakhstan could help them in their quest for leading positions in the global nuclear market. In the near future, cooperation with Russia could enable Kazakhstan to emerge not only as an international supplier of raw materials but also as a nation that has mastered the full nuclear fuel cycle. Russia, in turn, will benefit equally greatly from access to cheap Kazakh uranium.

**Trends in nuclear energy development**

Both the growing energy dependence of most global economies and volatile fossil fuel prices give rise to the search for new sources of energy. Nuclear energy promises to be one of the most reliable, economic and environmentally friendly solutions. According to the International Atomic Energy Agency (IAEA), the use of nuclear energy plants results in reducing CO$_2$ emissions by 2.9 billion tons per annum compared to coal-fired generation, or 24% of the total annual energy market emissions (Technology Roadmap, 2010).

The IAEA forecasts a nearly two-fold increase in global demand for energy in the next 25 years, which cannot be met by conventional sources such as oil, gas or coal. In parallel with that, by 2030 global demand for nuclear energy will rise by 66% from the 2008 level (Vestnik Atomprom, 2009b).

According to the World Nuclear Association, in March 2009 there were 436 functional nuclear reactors in 30 countries; 55 reactors were under construction; 108 reactors were at the project preparation stage; and 266 projects were under consideration. Nuclear energy currently provides 16% of the world’s electricity. However, nuclear energy policy differs between countries: in France, NPPs generate 78% of all electricity consumed, whereas

![Graph showing electricity generation by source (1973 and 2007)](image)

**Figure 12.1.**
Electricity generation by source (1973 and 2007)

in China they account for as little as 2%. Yukio Amano, General Director of the IAEA, says that over 50 nations have declared their interest in developing nuclear energy. This interest is driven by the highly volatile prices of fossil fuel and unstable energy supplies. Uranium is much easier to transport, and decreases the cost of electricity 4-6 times, compared to that generated using coal or natural gas (Vestnik Atomproma, 2009a).

Another advantage of nuclear energy is that the fuel component in the tariff for electricity is small, preventing strong fluctuations in electricity rates. For example, a triple increase in the price for natural gas automatically leads to a triple increase in the price of electricity. By contrast, the same triple increase in the price of uranium would result in a 5-6% increase in the price of electricity generated by a NPP (Simakova, 2009), because fuel cost accounts for merely 24% of all nuclear power plant costs (including...
uranium mining, conversion, enrichment and the actual production of nuclear fuel). Most NPPs purchase nuclear fuel under long-term contracts at prices which are typically lower than the market price (this difference can be up to 60%)(Bank of Moscow, 2008). Operation, maintenance and decommissioning account for 58%, and construction for about 18% of all NPP costs (see Figures 12.2. and 12.3).

An important factor in favour of nuclear power plant (especially after the Chernobyl disaster in 1986) is that reactors are subject to strict safety regulations. All new generation reactors are “passively safe” – that is, in case of an emergency the operator does not need to take any special action, as the reactor design features include automatic shutdown (Simakova, 2009).

Analysis of the world nuclear energy market

It should be noted that the nuclear energy market is a combination of several different markets (see Figure 12.4). The first market is natural uranium production and processing. This fully developed market is dominated by 14 countries; ten of them account for 90% of the world’s uranium production.

The second is uranium enrichment services market. This market has four key players: Russia, the USA, France and the British-German venture URNCO. Russia controls one quarter of the market (export of low enriched uranium).

![Figure 12.4. Key uranium market players](image)

Source: Eurasian Development Bank
Note: * (Kazatomprom, 2010a)
The third market is the production of fuel assemblies. There are many national players on this market. The largest players are TVEL (Russia), AREVA (France), Toshiba/Westinghouse and GE.Hitachi (Japan/USA). This stage of nuclear fuel production accounts for about 6% of the total nuclear fuel cycle cost.

The fourth market is design of reactors. To date, there are several types of nuclear reactors available globally, including Russian, American (General Electric, Westinghouse) and German-French (Siemens-Framatom) designs (Beckman, 2009).

The current status of the Kazakh uranium industry

At present the uranium industry in Kazakhstan shows the most rapid growth rate. The country’s current energy resources structure is as follows: coal – 34%, oil – 8.8%, natural gas – 6.6%, minerals – 4.2%, and uranium – 46%. Thus according to Kairat Kadyrzhanov, General Director of the National Nuclear Centre, Kazakhstan is a uranium nation, and it is nuclear energy that can make the country truly competitive internationally (Shaternikova, 2009). This is facilitated by the fact that Kazakhstan has immense uranium deposits, ranking second globally in recoverable reserves (21% of the world’s total).

In 2009, uranium production in Kazakhstan rose by 63% to about 14,000 tons. Thus, the country became the leading producer of uranium (28% of the world’s production), outperforming Canada (24%) and Australia (19%). To mention, Kazatomprom itself produced only one third of this volume and the rest was mined by joint ventures.

Kazatomprom today

By 2008 Kazatomprom had secured agreements with the key players in the international nuclear market for building conversion, enrichment and fuel assembly facilities, thus finalising its transformation into a vertically integrated company.

Kazatomprom is a holding company comprising 26 subsidiaries engaged in geological exploration; production, processing and enrichment of uranium; production, storing, transportation and processing of molybdenum and copper ores; design of small and medium capacity nuclear reactors; construction of NPPs; generation of electricity and heat; and joint production of nuclear fuel for VVER-1000 type water-cooled power reactors. Kazatomprom owns a uranium plant, a tantalum plant and a beryllium plant which supply materials to the nuclear, aerospace, electric and instrument-making industries, and has commenced construction of sulphuric acid and enrichment facilities at the Ulba Metallurgical Plant.
Kazatomprom also has a research centre, a special training centre and an educational centre. On the whole, Kazatomprom and its affiliate Stepnogorsk Mining-Chemical Complex LLP employ about 22,000 people. Kazatomprom and its subsidiaries operate 16 deposits in Kazakhstan.

Kazakhstan’s uranium production in the first half of 2010 totaled at 8,452 tons – a 42% surplus compared to the same period of the previous year. According to reviewed production plans, 9,770 more tons will be mined in the second half of 2010. The growth was achieved by increased production in almost all subsidiaries of the holding; particular mention should be made on the commencement of commercial production by Baiken-U LLP and Kyzylkum LLP and pilot production by the Ak bastau joint venture (Invest-market, 2010). Kazatomprom’s gross income in the first half of 2010 amounted to 105.687 billion tenge – a 58% rise compared to the first half of 2009. Net income was 19.414 billion tenge (a 64% rise) (Kazatomprom, 2010).

One of the major events of 2010 is the placement of Kazatomprom’s debut 5-year Eurobonds for $500 million with a 6.25%-coupon. The order book totalled $4.3 billion. The proceeds will be used to expand production and repay loans ($50 million will go towards the subsidiaries’ most expensive borrowings). Kazatomprom is also considering acquiring companies that possess uranium conversion and enrichment technology (Kazatomprom, 2010).

Kazatomprom’s nuclear fuel cycle

Prior to independence, Kazakhstan’s uranium industry was under the control of the Soviet military nuclear agency code-named the “Ministry of Medium Engineering”. After the disintegration of the Soviet Union the country mastered two steps of nuclear fuel cycle – uranium mining and production of uranium dioxide pellets. The company plans to set a vertically integrated complex capable of running a full nuclear fuel cycle. The State Programme for Industrial Development in 2010-2014, in particular, provides for the development of missing nuclear fuel cycle stages (conversion, enrichment and production of fuel assemblies) (see Figure 12.5).

Nuclear fuel cycle stages already mastered by Kazatomprom are marked green; stages to be obtained under the company’s development strategy are marked blue; and stages which will not be developed are marked red.

Kazatomprom is currently engaged only in uranium mining and fabrication of UO$_2$ powder and pellets. Notably, 6,537 tons out of 6,609 tons of the company’s uranium sales in 2009 were sold in the form of raw material – triuranium octoxide (U$_3$O$_8$). U$_3$O$_8$ accounts for just 35% of the cost of fuel assembly (Business Resource, 2010).
The current status of the Russian uranium industry

The Russian government attaches great importance to nuclear energy development. About 1 trillion roubles will be invested in this industry by 2015, and another 68 billion roubles will be allocated from the federal budget for the construction of new NPPs (Beroyeva, 2010). Special positions will be created in selected Russian embassies whose responsibility will be to lobby and promote Russian nuclear technology (Kommersant FM, 2010).

Rosatom is a corporation comprising over 240 companies and organisations. These include all civil nuclear companies, military nuclear companies, research institutions, organisations in charge of nuclear and radiation safety, and the nuclear icebreaker fleet. Russian nuclear industry employs over 190,000 people. Uranium is mined by three companies: Priargunsky Mining and Chemical Works JSC, Dalur CJSC and Khiagda JSC.
In 2006 it was decided to establish a specialised vertically integrated company for producing NPP equipment. Nuclear industry was divided into the military and civil segments. All companies in the civil segment were reorganised into joint stock companies, with the corresponding transformations in terms of accounting. According to Rosatom’s General Director Sergey Kiriyenko, the reform was successful: the value of the corporation’s net assets rose by 360% and productivity by 170%. In 2009 Rosatom’s income totalled 518 billion roubles, a 37% surplus compared to 2008 (Kommersant FM, 2010).

Geological exploration was carried out in fields operated by existing and prospective Russian ventures. Some 170,000 running metres were drilled, and total investments in uranium exploration amounted to 1.05 billion roubles. It is expected that a reserve increment of uranium will amount to 8,000 tons. In addition, geological exploration was started in Armenia and Namibia (Vestnik Atomprom, 2010v).

Even now Rosatom has an advantage on the international nuclear energy market, as it has mastered the full nuclear fuel chain from uranium mining to the construction of NPPs (only French AREVA can compete with Rosatom in this regard). Rosatom controls 34% of the enrichment market, 22% of the conversion market, 12% of the nuclear fuel market and 12% of the
NPP construction market. However, the corporation is not satisfied with its current status. During the visit to Volgodonsk NPP Russian Premier Minister Vladimir Putin said: “We need to strengthen our positions in the field of peaceful nuclear energy. These are unique technologies. It is within our power to capture at least 25% of the NPP construction and operation services market. We should actively offer not only NPP construction services, but also operation and maintenance and fuel disposal services” (Beroyeva, 2010).

**Russian–Kazakh cooperation**

Apart from Rosatom, the most active player in the CIS is Kazatomprom. Hence, successful cooperation between these two giants is a precondition for progress not only in the national nuclear energy sectors, but also in the Kazakh and Russian economies in general. Therefore, on December 7, 2006, a comprehensive programme of Russian-Kazakh cooperation in peaceful uses of nuclear energy was adopted, and on November 20, 2009 the parties signed a Roadmap of additional measures for implementing that programme.

On many occasions, the presidents of Rosatom and Kazatomprom have voiced the idea of recreating a single structure identical to the former Ministry of Medium Engineering in a new format. The fact that Russia and Kazakhstan are discussing the creation of a unified nuclear agency has been known widely for long. Respective plans were announced by the Presidents of the two states in a series of negotiations (Gilyova, 2010). The establishment of a unified structure would be beneficial to both parties: Kazakhstan would be able to create high-technology production facilities through which would address a wide range of issues (increase tax revenues, decrease unemployment rate, solve the power shortages problems, etc.), and Russia would gain access to cheaper uranium.

However, these negotiations are still dragging on. In Rosatom’s opinion, the Kazakh party is deliberately protracting the process. Initially Rosatom insisted on owning 50% plus one share, and Kazatomprom stood for parity terms. In the autumn of 2008 Russia agreed to the parity terms which included, inter alia, exchange of all Kazakh assets for equal Russian assets (at market value). Rosatom delivered a draft of intergovernmental agreement establishing a unified company, but no reply followed.

On June 9, 2010, at the ATOMEXPO exhibition, Kazatomprom’s Vice-President Nurlan Ryspanov announced a forthcoming uranium development programme under which Kazatomprom is scheduled to complete its transformation into vertically integrated company with a full nuclear fuel cycle by 2020 (ATOMEXPO, 2010a). In particular, the uranium conversion was entrusted to the specially founded joint venture Ulba Conversion LLP (with Cameco, Canada).
There is also a contradiction between Russia and Kazakhstan concerning the construction of an NPP in Kazakhstan. According to Kazatomprom, at present a respective feasibility study is being agreed. According to the Russian party, a draft agreement was approved and passed to the Kazakh Ministry of Energy and Mineral Resources in 2009. In February 2010 Russia received a new Kazakh version of the agreement. According to Russian party, this version virtually brings the discussion back to the starting point (Konstantinov, 2010).

There were also some positive developments. On July 5, 2010, during the working visit of Russian President Dmitriy Medvedev to Kazakhstan, an added impetus was given to the integration of the two states' nuclear energy sectors. Rosatom’s General Director Sergey Kiriyenko and Kazatomprom’s President Vladimir Shkolnik signed two documents: a Memorandum on integration and cooperation in the field of peaceful uses of nuclear energy and a Joint Statement on the uranium enrichment centre project.

The first document outlines a concept for gradual establishment of a Russian-Kazakh nuclear company. “The parties confirm that they shall adhere to the principles of integration and, whilst taking consecutive steps towards a unified, parity-based nuclear company, shall strive to position it on the global nuclear fuel cycle market as a strong joint player, and make use of market conditions in the best interests of future integration”, reads the memorandum (Baranov, 2010). At an initial stage, this company will sell natural and low enriched uranium, as well as other products and services produced by the joint ventures to end users. The second document seals the parties’ agreements in respect of common use of a uranium enrichment centre in Russia through Kazakhstani shareholding in the Ural Electrochemical Integrated Plant JSC. Moreover, the document outlines the principles of concerted sales and marketing policy.

Thus Kazakhstan receives access to the world’s largest enrichment facility and can increase the value added of nearly a half of all uranium it is now selling to the markets as a raw material. This will reduce Kazatomprom’s dependence on the volatile prices of natural uranium (enrichment services are more stable and predictable). Moreover, the enriched uranium is much more expensive than the natural one. The two documents are equally beneficial to Russia as well.

First, they provide for processing of Kazakh uranium on Russian territory, i.e. Rosatom has secured additional workload for its facilities. Second, Russia has secured the Kazakh government’s support for the forthcoming purchase of assets of Canadian Uranium One by Atomredmetzoloto (see below).

In 2006 ARMZ and Kazatomprom started the consolidation of assets by creating two joint ventures, Zarechnoye and Akbastau. In addition to the
creation of joint ventures, Russian companies enter the Kazakh market by acquiring international uranium companies which operate deposits in Kazakhstan. For example, ARMZ has acquired Effektivnaya Energiya N.V. which owned 50% in Karatau LLP and 25% in the joint venture Akbastau. As a result, ARMZ consolidated Russian assets in Kazakhstan and doubled its production capacity (Vestnik Atomproma, 2010b).

In 2009 ARMZ purchased 16.6% of shares in Uranium One. To be specific, ARMZ exchanged its 50% share in Karatau LLP for 117 million ordinary shares in Uranium One Inc. plus $90 million; up to $60 million more will be paid if Karatau achieves certain financial results within three years. Therefore, ARMZ gained the right to purchase part of Uranium One products (Interfax, 2010).

In June 2010 Atomredmetzoloto entered into another agreement with Uranium One under which it will increase its share in Uranium One by purchasing an additional share issue (356 million ordinary shares) for 50% in Akbastau and 49.7% in Zarechnoye plus $610 million. After closure of this transaction ARMZ’s share in Uranium One will account for at least 51% (and, as a result, ARMZ will have the right to acquire at least 51% of Uranium One’s products) (Tserikh, 2010).

Transaction is subject to the approval of all regulatory authorities in Russia, Kazakhstan, the USA and Australia. According to recent reports, the US Committee on Foreign Investment has approved the transaction on October 25, 2010. Thus, Atomredmetzoloto’s assets in Kazakhstan will comprise Akbastau, Zarechnoye, Betpak Dala, Karatau and Kyzykum uranium fields with total reserves of 133,293 tons.

Rosatom is in the lead in terms of the number of joint projects with Kazatomprom and total uranium production (over 25% of Atomredmetzoloto’s uranium output in 2009 was mined by joint ventures in Kazakhstan, and this figure is expected to increase in 2010). ARMZ plans to strengthen cooperation with Kazakhstan not only through its own subsidiaries but also by supporting the Kazakh subsidiaries of Uranium One. For example, it is expected that Karatau will boost the output of processing solutions to meet the needs of the Akbastau deposit) and, in the longer term, develop refining production based on Karatau JV and build a sulfuric acid plant.

Despite the disagreements, Kazakhstan and Russia recognise the need for collaboration in the nuclear industry, as illustrated by the recent bilateral initiatives. We can presume that the former management of Kazatomprom aimed to maintain a balance between the interests of Russian and other foreign investors and not to allow any particular group of investors to dominate. The current management takes a pro-Russian
stance. This, in our opinion, would greatly facilitate the process of integration of two countries.

Conclusions

The main objective of this industry review was to describe the current status of the global nuclear energy market and nuclear energy market in Russia and Kazakhstan. Our analysis of integration processes in the peaceful uses of nuclear energy in the CIS shows that both Kazakhstan and Russia attach great importance to the development of nuclear industry. Possession of nuclear technology enables a nation to diversify the entire economy – this is especially relevant to large exporters of raw materials and fossil fuel such as Russia and Kazakhstan, as they are highly dependent on world prices for energy resources.

The international nuclear energy market is dominated by competing giants such as AREVA, Cameco and others. In order to keep footing on the market, a country must possess both a strong uranium base and the entire technology. Neither Kazatomprom, which controls immense reserves yet has mastered only two nuclear fuel cycle stages, nor Rosatom, which has mastered the entire nuclear fuel cycle yet has access only to expensive uranium, can boast of having access to both components. Therefore, cooperation between these two companies is the most favorable decision. The understanding of this fact has long been there, but progress is being delayed by various contingencies, resulting in unnecessary losses.

References


