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BRICS+ Agenda for Sustainable Nuclear Development: Current Status and Emerging Trends

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Abstract. Nuclear energy is becoming a strategically significant component of the energy balance of the BRICS+ countries, reflecting both the growing demand for energy resources and the pursuit of technological sovereignty. This study analyzes the distribution of nuclear power plant capacities, uranium reserves, and ongoing projects among the BRICS+ states, allowing their efforts to be considered within the broader context of global energy diversification and security. The analysis is based on data regarding operational nuclear power plants, reactors under construction, and uranium resources, collected from international energy databases and official reports. The results indicate that Russia, China, and India constitute the technological and production core of BRICS+, concentrating the majority of operational reactors and new construction projects, while Brazil and South Africa maintain stable but more modest programs, relying on domestic uranium production. Egypt, Ethiopia, Iran, Indinesia and the United Arab Emirates emerge as new participants advancing ambitious nuclear energy projects. These trends suggest the formation of BRICS+'s collective influence on the global nuclear energy and fuel market, as well as the strengthening of their role in ensuring global energy stability.

Keywords: BRICS+, nuclear energy, peaceful atom, uranium reserves, energy security, global energy, diversification

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Introduction

In the 21st century, nuclear energy has once again come to the forefront of international discussions, combining scientific and technological development, environmental challenges, and issues of global security. Whereas during the Cold War the "peaceful atom" was primarily regarded as an element of national prestige and a tool for demonstrating technological superiority, today it has acquired a new dimension — as a factor of geopolitical stability, energy independence, and diversification of economic growth.

In this context, the BRICS+ association emerges as a unique platform for rethinking the role of nuclear energy in the changing world order. The BRICS+ countries, possessing diverse levels of technological development and different models of energy sector regulation, demonstrate their aspiration to form alternative centers of power, including in the field of nuclear technologies. Here, nuclear energy becomes not only an instrument of internal modernization but also a tool of foreign policy positioning, influencing the balance of forces within the global energy architecture. The relevance of studying the "peaceful atom" within the BRICS+ framework is determined by several factors. First, there is the growing role of nuclear energy in addressing energy security and decarbonization challenges. Second, the deepening technological cooperation and exchange of expertise within BRICS+ are shaping new models of interaction that can compete with Western institutions and corporations. Third, nuclear energy is becoming part of a broader BRICS+ strategy aimed at

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strengthening sovereignty and reducing dependence on Western markets and infrastructures.

Thus, the study of the geopolitical dimension of nuclear energy within BRICS+ makes it possible to identify how the "peaceful atom" is transforming from a sphere of purely technological progress into one of the key factors in the redistribution of influence in global politics.

Materials and Methods

This study employs a comparative and interdisciplinary approach to analyze the nuclear complexes of BRICS+ countries, their strategic documents, and relevant industry statistics. The primary objective is to identify patterns in the development of nuclear energy and to assess the role of this sector in shaping alternative centers of power within the global energy landscape.

The research draws on the following materials: Official strategic documents of BRICS+ — including declarations, joint statements, roadmaps, and forum reports (Fortaleza Declaration 2014; Joint Statement of BRICS Foreign Ministers 2024; BRICS Energy Cooperation Roadmap 2025–2030; Kazan Declaration 2024). Statistical data on nuclear energy in BRICS+ countries — covering operational and under-construction nuclear power plants (NPPs), information on project companies, investments, and scientific-technical initiatives, sourced from international databases and national energy agencies. Scientific publications and analytical reports — peer-reviewed articles, industry reviews, and reports from specialized organizations, addressing nuclear technologies, energy security, and international cooperation in the nuclear sector.

The study applies the following methodological approaches: comparative analysis — evaluating technical characteristics of nuclear complexes, project scales, technological development levels, and models of industry regulation across different countries; content analysis of BRICS+ strategic documents — identifying key priorities, objectives, and principles of cooperation in nuclear energy; quantitative analysis of statistical data — processing information on NPP capacities, energy generation volumes, investments, and industry growth rates using descriptive statistics and graphical visualization techniques; interdisciplinary integration — combining geopolitical, economic, and technological perspectives to assess the role of nuclear energy as a tool for domestic modernization and foreign policy positioning.

This study does not involve human or animal subjects; therefore, formal ethics approval was not required. All secondary data are utilized in compliance with copyright regulations and open-access policies.

GenAI tools were employed solely for data organization and concise summarization of extensive literature.

Results and Discussion

To provide a clearer overview of BRICS+ nuclear capabilities, key quantitative indicators — including reactor numbers, installed capacity, and major projects — are summarized in Table 1.

1. A high concentration of nuclear technologies is observed in Russia, China, and India, which together constitute the core of BRICS+ competencies and production capacities.

2. Significant uranium reserves are concentrated in Russia, South Africa, China, and Brazil, providing the group with relative fuel autonomy. The Middle East and Africa (Egypt, Ethiopia, UAE) demonstrate a strategic shift toward the "peaceful atom," although domestic uranium resources in these regions remain limited.
3. The accelerated construction of new reactors (China — 24 units under construction; Egypt — El-Dabaa; UAE — Barakah) strengthens BRICS+ role in the global energy balance.
4. Energy diversification is manifested through varying levels of national engagement: from advanced nuclear programs (Russia, China) to the early stages of infrastructure development (Ethiopia, Saudi Arabia). This creates the potential for BRICS+ to exert collective influence on the global nuclear energy and fuel market, including the export of technologies, services, and safety standards.

The main indicators of nuclear energy in BRICS+ are summarized in the Table below.

Nuclear Energy Profiles of BRICS+ Member States, 2024

Country	Number of operating reactors	Installed capacity, MW	Key projects / notes
Brazil	2	1,884	Angra 1 & 2; enrichment program underway; focus on peaceful nuclear development
Russia	37	27,727	11 NPPs; floating NPP (Akademik Lomonosov); export projects in India, China, Bangladesh, Egypt, Brazil, Argentina, Hungary, Turkey
India	24	8,055	Koodankulam NPP (4,000 MW), 12 reactors planned; focus on thorium and innovative nuclear technologies
China	56	53,152	24 reactors under construction; 6–8 reactors planned annually; multiple state-owned corporations (CGN, CNNC, SNPTC)
South Africa	1	1,880	Koeberg NPP; no new plants planned until 2030; strong coal dominance
Egypt	0 (research reactors)	N/A	El-Dabaa NPP under construction (4,8 GW, 4 units) with Rosatom
Indonesia	0	N/A	MoU with Rosatom; plans for floating and land-based small reactors; high seismic risk considerations
Iran	1	915	Bushehr NPP; strategic focus on peaceful nuclear program; past international restrictions and sanctions
UAE	4	4,011	Barakah NPP (first Arab NPP); KEPCO-built; two additional units under negotiation
Ethiopia	0	N/A	Planning phase for nuclear development; cooperation with Rosatom and China; part of broader energy diversification strategy

Source: compiled by Vahe Davtyan.

Nuclear Energy in the BRICS+ Strategic Documents

A review of key BRICS+ declarations and roadmaps reveals a steadily increasing emphasis on energy issues, with particular attention to nuclear power. The Fortaleza Declaration (2014) underscores the importance of strengthening multilateral economic mechanisms, advancing sustainable development, and transitioning to cleaner energy sources, while highlighting the role of international cooperation in renewable and "clean" technologies [1].

The Joint Statement of BRICS Foreign Ministers (Nizhny Novgorod, 2024) explicitly calls for "fair and balanced energy transitions" that make use of the entire spectrum of available resources — renewables, biofuels, hydropower, fossil fuels, hydrogen, and nuclear energy — in order to secure sustainable energy systems, supply stability, and economic growth among member states [2].

Particular attention is devoted to the institutionalization of nuclear cooperation. The establishment of the BRICS Nuclear Energy Platform aims to facilitate knowledge exchange and support the development of nuclear technologies. According to the BRICS+ Forum, nearly all member countries are engaged in large-scale nuclear energy projects, with the combined capacity of operational NPPs exceeding 390 GW. The platform is envisioned as a voluntary consortium of companies, professional communities, and non-governmental organizations dedicated to advancing cutting-edge technologies — including non-power applications such as medicine and scientific research — while coordinating efforts to have nuclear power formally recognized as a "clean" energy source [3].

The BRICS Energy Cooperation Roadmap 2025–2030 defines priority directions such as enhanced coordination on the international energy agenda, infrastructure development, expansion of energy trade, and joint investment initiatives. It explicitly reaffirms the principle of technological neutrality, positioning nuclear energy — alongside renewables and carbon capture technologies — as a central pillar of decarbonization strategies and energy security [4].

The Kazan Declaration of BRICS+ (2024) further consolidates nuclear energy's status as an integral component of the "clean" energy mix. It stresses the necessity of deepening cooperation on the peaceful uses of nuclear technology, exchanging best practices, and jointly pursuing innovative solutions. The document also endorses efforts to expand the BRICS Nuclear Platform and to reinforce the technological sovereignty of participating states [5].

In summary, BRICS+ strategic documents articulate a coherent framework that positions nuclear energy as a catalyst for low-carbon development, industrial modernization, and technological exchange across the Global South. The creation of a dedicated nuclear platform and the formal inclusion of nuclear power in the clean energy portfolio underscore BRICS+'s determination to consolidate nuclear technology as an instrument of energy sovereignty and sustainable growth.

Cross-Country Analysis

The study of nuclear energy development prospects across the BRICS+ space necessitates an assessment of both potential and the identification of risks and threats to the growth of nuclear complexes in member states of the platform. To this end, the following analysis examines the development of nuclear energy within BRICS+ countries, enabling the identification of parallels and opportunities for cooperation in advancing the "peaceful atom" across the BRICS+ framework. In this context, nuclear energy development is regarded by BRICS+ countries as a key and most rational model of energy transition. Accordingly, the formulation of comprehensive measures to implement policies for the transition to low-carbon energy within BRICS+ constitutes an important integrative challenge, aligning with the concept of sustainable development and contemporary climate agendas.

Energy transition is traditionally understood as the process of shifting from carbon-intensive fossil fuels to low-carbon energy sources. Throughout human civilization, there have been four major energy transitions: (1) from biomass to coal, (2) from coal to oil, (3) from oil to natural gas, and (4) the adoption of renewable energy sources, energy efficiency measures, and carbon capture.

Within the latest stage of the energy transition, nuclear energy is gaining increasing significance as a clean energy source. Notably, NPPs exhibit the lowest lifecycle emissions among all forms of "clean" energy, amounting to approximately 5.5 g CO_2-equivalent per kWh. Existing NPPs worldwide prevent CO_2 emissions in volumes comparable to the carbon sequestration capacity of all forests on the planet [6].

In Brazil, the development of nuclear energy was initially driven largely by the military, particularly Vice Admiral Álvaro Alberto, often referred to as the "father of the Brazilian nuclear project". He successfully lobbied for the creation of the National Nuclear Energy Commission (CNEN) in 1956. In the early stages, nuclear research in Brazil was oriented toward the development of nuclear weapons; however, following the 1973–1974 oil crisis, the country recognized the need to diversify its energy system. The "Second National Development Plan (1973–1979)" for the first time envisaged a comprehensive development of nuclear energy. In accordance with this plan, a program was developed to construct several NPPs, with a total capacity projected to reach 10,000 MW by 1990. Germany (FRG) became Brazil's key partner in the development of the "peaceful atom", which generated significant concern both in other Latin American countries and in Washington. In particular, President Jimmy Carter described the Brazilian–West German collaboration in the field of nuclear energy as "nuclear madness", imposing restrictions on the supply of nuclear fuel and technologies for the production and use of atomic energy to Brazil [7]. By the 1980s, however, Brazil had begun domestic uranium production, quickly becoming the undisputed leader in Latin America. According to World Population Review data for 2022, Brazil ranks 13th in the world in uranium production [8]. In terms of the volume of the cheapest uranium (production cost approximately USD40 per kilogram), Brazil is second only to Canada. The country's only operational uranium deposit is Lagoa Real/Caetité. Currently, Brazil also imports uranium from Russia; in 2023, imports amounted to USD 72 million [9].

It is noteworthy that under these conditions — characterized by the dominance of hydroelectric power in Brazil's energy sector and the need to develop nuclear capacities to meet domestic demand — militaristic attitudes and objectives continued to prevail in Brazilian nuclear energy. Only with the advent of civilian rule in 1985 did the country adopt a policy of exclusively peaceful use of nuclear energy. Brazil formally joined the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) only in 1998, despite the fact that the Treaty of Tlatelolco, which prohibited nuclear weapons in Latin America and the Caribbean, had been opened for signature as early as 1967 [7].

As of 2022, nuclear energy accounted for approximately 3% of Brazil's energy balance, whereas hydrocarbons and hydroelectric power together represented 63%. By 2024, the country operates only one NPP, Angra, which houses two operational reactors, Angra-1 and Angra-2. Their combined electric capacity is 1,884 MW, and electricity generation in 2023 reached 14.5 TWh [10].

Currently, Brazil is actively developing a uranium enrichment program to enhance national energy security, with a sufficiently advanced domestic industrial base, as evidenced by the country's centrifuge projects. Simultaneously, Brazil is targeting the exploitation of its domestic uranium deposits, which would allow it not only to achieve self-sufficiency in nuclear energy but also to strengthen its position as a uranium exporter in the future.

Russia ranks fourth in the world in nuclear energy generation. NPPs account for approximately 20% of the country's electricity production. Currently, Russia operates 11 NPPs with 37 reactors in total, possessing a combined installed capacity of 27,727 MW and generating around 217 TWh of electricity in 2023 [10].

In 2021, the Government of the Russian Federation approved the Strategy for Socio-Economic Development with Low Greenhouse Gas Emissions up to 2050. The strategy outlines two development scenarios: inertial and intensive. The first, inertial scenario anticipates a reduction in state budget revenues due to decreased hydrocarbon exports, followed by a transition to new "green" energy technologies. The second, intensive scenario envisages a 9.4% reduction in the share of traditional sectors in GDP by 2050, with the proportion of high-tech sectors, including nuclear energy, expected to increase by 11.8 percentage points [6].

The development of the Soviet, and subsequently Russian, nuclear industry has been underpinned by abundant uranium deposits. According to Porter's theory of competitive advantage (the "Porter diamond"), this factor can be regarded as a foundational condition shaping Russia's nuclear energy strategy [11].

Official data indicate that Russian uranium reserves account for approximately 7.9% of global reserves, totaling 705,000 tons [12]. According to the World Nuclear Association, Russia ranks sixth globally in uranium production [13]. Most operational Russian NPPs are located in proximity to uranium deposits. In this context, E. Ivkova and A. Kataev highlight significant nuclear development potential in regions such as Zabaykalsky Krai, the Republic of Buryatia, Krasnoyarsk Krai, and Tomsk Oblast (including the BREST-OD-300 site) [6].

One of the key nuclear projects currently underway in Russia is the modernization of the floating NPP (FNPP) "Akademik Lomonosov" [14]. This modernization addresses the need to develop energy supply in Chukotka, a region with limited fuel resources. Following the FNPP expansion, Chukotka will achieve full electricity self-sufficiency, which is also promising given the presence of potential uranium deposits in the area. The state corporation Rosatom serves as the leading company in Russia's nuclear sector and one of the global leaders in constructing nuclear reactors abroad. Within the BRICS+ framework, Rosatom plays a crucial role in strengthening a multipolar energy architecture and promoting Russian technologies in the global market. In Asia, strategic partners include India, where Rosatom is engaged in the construction and outfitting of the Kudankulam NPP units with comprehensive collaboration on the fuel cycle and service operations, as well as China, where the corporation participates in the expansion of Tianwan and Xudapu NPPs, transferring critical technologies and training specialists. Significant Asian projects also include the Ruppur NPP in Bangladesh, reinforcing Rosatom's presence in South Asia. In Africa, the construction of Egypt's El-Dabaa NPP represents the largest Russian–Egyptian initiative on the Mediterranean coast, alongside developing contacts with South Africa on small modular reactors and advanced fuel solutions. In Latin America, Brazil and Argentina are involved in joint research and consultations regarding the fuel cycle and modernization of existing capacities. In Europe, Hungary is a key focus, with the Paks-2 project demonstrating the competitiveness of Russian technologies even within the

EU market. Beyond BRICS+, notable examples include Turkey's Akkuyu NPP and several countries in the Middle East and Southeast Asia, strengthening the diversification of Russia's export portfolio.

Thus, Russia serves not only as a technology provider but also as a linking node among Global South states, forming alternative centers of technological leadership and contributing to the balancing of the global nuclear architecture.

Coal and oil have traditionally dominated India's energy balance, accounting for approximately 60% of total energy production. However, this composition is not fully aligned with the country's long-term economic development strategy. The current decade has been designated as a period of active energy diversification, with plans to increase the share of renewable energy to 24.2% of total production by 2026–2027.

Nuclear energy accounts for 3% of India's energy balance. At present, India operates 24 nuclear reactors with a combined installed capacity of 8,055 MW. Over the next 25 years, electricity consumption is projected to quadruple due to population growth, industrialization, and urbanization. In response, Indian authorities have developed a long-term nuclear energy development program: by 2032, installed nuclear capacity is expected to reach 63,000 MW, and by 2050, approximately 25% of electricity will be generated by NPPs [15]. By mid-century, it is planned that about 30% of the country's energy needs will be met by thorium reactors. A key aspect of this program is the implementation of projects in collaboration with Russia: over the next two decades, 12 nuclear reactors are planned, six of which are currently under various stages of construction with a total capacity of 5,200 MW, including four Kudankulam NPP units totaling 4,000 MW [16].

India is also actively developing innovative nuclear technologies with applications in adjacent economic sectors, such as medicine, agriculture, and water desalination and purification. In nuclear medicine, these technologies are used for cancer diagnosis and therapy, sterilization of medical equipment, and the development of lasers applied in surgical procedures. In agriculture, nuclear methods enhance crop yields through genetic modification of seeds. Moreover, nuclear desalination and water purification technologies have become widely adopted in arid regions, providing access to quality water and supporting the resilience of agricultural and domestic sectors. India has traditionally faced restrictions in the trade of nuclear technologies.

The country has not ratified the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) due to its own military nuclear program. Following India's first nuclear test in 1974, the Nuclear Suppliers Group (NSG) was established in 1975, imposing a 34-year restriction on the export of nuclear equipment and technologies to India. These restrictions significantly hindered the development of civilian nuclear energy in the country. In 2008, India was granted exemptions, lifting NSG restrictions and substantially expanding its nuclear energy capabilities while mitigating energy resource deficits. The decision to provide these exemptions was largely driven by U.S. strategic interests, seeking to strengthen geopolitical influence in Asia and create a counterbalance to China's rising influence [17].

Currently, India's nuclear energy development is heavily influenced by competition among major foreign technology suppliers. The country maintains strategic partnerships with leading global players in the nuclear fuel cycle, including Russia, France, and the United States. The most successful and effective collaboration remains with Russia: two Kudankulam NPP units in Tamil Nadu have already been commissioned, demonstrating Russia's sustained leadership in India's nuclear market. In contrast, cooperation with the U.S. and France has progressed less dynamically. The United States initially received two sites for NPP construction — Kovvada in Andhra Pradesh and Mithivirdi in Gujarat — but these projects were suspended due to legal restrictions. France planned to build the Jaitapur NPP, but project timelines have been repeatedly postponed. Simultaneously, India is expanding its international nuclear cooperation: in 2015, a civil nuclear agreement was concluded with the United Kingdom, and in 2016, a similar agreement was signed with Japan. In 2025, India and France signed a letter of intent to collaborate on advanced small modular reactors, and in the same month, the parties reached an agreement with the United States to fully implement the U.S.–India 123 Agreement, advancing plans for U.S.-designed reactor construction in India. It should be noted that India possesses uranium deposits, providing certain conditions for industry development; in 2022, the country produced 600 tons of uranium [18].

Energy development in China occupies a central position in discussions concerning the country's socio-economic dynamics and its growing influence on the global stage. Issues such as the transition to carbon neutrality, improvements in energy efficiency, and the promotion of "green" energy sectors were reflected in the new Five-Year Plan presented on 5 March 2021 [19]. Previously, in September 2020, Xi Jinping announced the goal of achieving carbon neutrality by 2060 [20].

The majority of electricity in China is generated from coal-fired power plants, which contributes to air pollution. The environmental situation necessitates a transition to low-carbon, renewable, and particularly nuclear power capacities. The Five-Year Plan mentions coal production extensively, emphasizing its "clean and efficient use." Notably, the plan sets a normative target for total energy production capacity at over 4.6 billion tons of standard coal equivalent. For comparison, China's energy consumption in 2019 reached 4.86 billion tons, and according to CNPC projections, primary energy demand may rise to 5.6 billion tons by 2035.

According to the National Energy Administration, China aims to occupy a leading position globally in nuclear energy technologies, considering the sector as a foundation for its future energy system. Both the 12th and 13th Five-Year Plans included provisions for nuclear energy development. Under the objectives of the 13th Five-Year Plan, China aimed to reach an installed nuclear capacity of 58 GW by the end of 2020 and to construct new NPPs and reactors. Most planned construction projects were implemented; however, the target was not fully achieved, with installed nuclear capacity reaching 52 GW by 2020. Nevertheless, during the 13th Five-Year Plan period, nuclear capacity nearly doubled.

The new Five-Year Plan emphasizes the national transition to "green" energy and the active use of alternative energy sources. Nuclear energy receives less attention in the document, though key information is provided. The plan envisages an increase in the share of non-renewable energy sources, including nuclear power. The target share was set at 15% in 2020, with an expected increase to approximately 20% by 2025. The plan also sets specific nuclear capacity development goals: by 2025, installed capacity is projected to reach 70 GW [21]. However, current data indicate that this target may not be fully achieved within the planned timeframe. Presently, China operates 56 reactors (excluding Taiwan) with a combined installed capacity of 53,152 MW. In 2023, Chinese NPPs generated 433 TWh of electricity [10]. Nuclear energy currently accounts for approximately 5% of China's energy balance. Beijing plans to commission 6–8 reactors annually, with 24 reactors currently under construction [22]. It is noteworthy that China's under-construction reactor capacity accounts for more than 40% of the global total [23].

The main directions of Chinese nuclear energy development were initially linked to Sino-Soviet relations and later to Sino-Russian collaboration. For instance, in 1958, an experimental heavy-water reactor was installed in China in cooperation with Soviet scientists [20].

In China, as in Russia, nuclear energy is a state monopoly. However, unlike Russia, where the nuclear sector is dominated by a single company, Rosatom, China's market is divided among three state-owned corporations: China General Nuclear Power Group (CGN), China National Nuclear Corporation (CNNC), and State Nuclear Power Technology Corporation (SNPTC). China also possesses fundamental factor conditions for nuclear development, including some of the world's largest uranium reserves. As of 2023, the country held 270,500 tons of uranium, representing approximately 5% of global reserves [24].

The energy transition is considered one of the priority directions for South Africa's energy development. This is largely due to the dominance of high-carbon sources in the national energy mix: approximately 70% of electricity production in South Africa comes from coal-fired power plants. The share of nuclear power is barely 4%, and according to national economic and energy development programs, long-term nuclear energy development is not treated as a priority. As noted by A. Mastepanov, A. Sumin, and B. Chigarev, South Africa has a powerful "green" lobby, which has enabled the country to participate in a number of international climate organizations. At the same time, South Africa traditionally maintains significant support for coal energy, including within political circles, which creates obstacles to the transition toward low-carbon energy [25]. Evidence of this is the 2010 "Integrated Resource Plan," which simultaneously prioritized coal and nuclear generation. In subsequent revisions of the Plan, natural gas use became the predominant energy priority [25]. Nevertheless, South Africa has committed to reducing greenhouse gas emissions to 350–420 million tons of CO_2-equivalent by 2030 [26].

Under current energy development conditions, achieving this target appears highly challenging: according to available estimates, approximately 13% of South Africans lack access to electricity. This situation presents significant socio-political risks, which are realistically assessed by the country's political leadership. As South African Minister of Energy G. Mantashe noted, "If we do not solve the problem of energy poverty, and focus only on climate change mitigation plans, there will be an uprising in the country" [27]. In these circumstances, coal-fired generation appears to be the most practical means to overcome energy poverty in South Africa.

In the mining sector, uranium production plays an important role. In 2022, the country produced 200 tons of uranium. South Africa's uranium reserves are estimated at 320,900 tons, representing approximately 5% of global reserves [28]. Despite these substantial reserves, South Africa operates only one NPP — Koeberg (1880 MWt)—commissioned in 1984. The plant is expected to reach the end of its operational life by the mid-2040s, although authorities do not rule out extending its service life by an additional 20 years. Despite the challenges of sustainable development and the energy transition, South Africa's strategic documents indicate that no new NPPs are planned before 2030.

The fifteenth BRICS summit, convened in Johannesburg in August 2023, marked a watershed moment in the bloc's evolution, distinguished as the most broadly representative gathering in its history. Invitations were extended to 67 states, underscoring BRICS's aspiration to project itself as a central platform of the Global South. Ultimately, six nations — Argentina, Egypt, Ethiopia, Indonesia, Iran, Saudi Arabia, and the United Arab Emirates — were formally admitted, reflecting a calculated strategy to amplify the group's geopolitical and economic weight.

Viewed through the prism of global energy dynamics, this enlargement is poised to exert transformative effects on patterns of investment, trade, and strategic coordination. The new configuration consolidates within BRICS a unique constellation of actors: preeminent oil producers and exporters, holders of critical mineral resources, and rapidly developing energy consumers. Such a composition not only diversifies the bloc's internal energy landscape but also enhances its collective bargaining capacity in shaping future energy governance frameworks [29].

However, the formal process of admission has not proceeded uniformly. Argentina, though initially among the six invited states and scheduled to become a full member on 1 January 2024, formally rejected the invitation. Argentina's new government under President Javier Milei declared that the timing was "not opportune" for full membership, thereby withdrawing from the integration process. Similarly, Saudi Arabia has not yet committed to full membership. While invited to join alongside the other five, Riyadh has been publicly assessing the implications and has not finalized acceptance. As of early 2025, Saudi officials stated that the country is still evaluating the costs, benefits, and geopolitical ramifications of joining the bloc.

The nuclear potential of the new BRICS+ members requires separate consideration and assessment. For most of these countries, "peaceful nuclear energy" is either already a priority in their energy development or is viewed as such in the long-term perspective. In the following, we provide a brief overview of each of the new members individually.

The economy of the Arab Republic of Egypt is one of the largest in Africa. In recent years, however, the country has experienced high inflation rates, which has generally affected social and political stability. The public debt-to-GDP ratio exceeds 87%, and it is evident that these adverse economic conditions impact the country's energy sector [30]. Egypt's primary energy consumption is structured as follows: 57% natural gas, 36% oil, 6% renewable energy, and 1% coal [30]. Notably, the current energy balance does not include a nuclear component, which does not imply that Egypt lacks ambitions in this sector.

At present, Egypt operates a research nuclear program with two reactors: one of Soviet origin (commissioned in 1961) and another of Argentine design. To integrate nuclear energy into the national energy balance, in 2015 the Egyptian government signed an agreement with Rosatom for the construction and operation of the El Dabaa NPP, with a planned capacity of 4.8 GW (four reactors). The plant is located approximately 300 km from Cairo on the Mediterranean coast. Construction of the reactors began in 2022 and continues intensively. As noted by A. Filonik, "The nuclear power plant gives Egypt additional political weight within the Arab world and places it alongside the UAE, where the Barakah NPP is under construction in Abu Dhabi. These developments clearly demonstrate the determination of Arab countries, each on its trajectory toward the future, to develop modern industrial and power sectors, organize their territories, raise the welfare of their populations, and demonstrate the capacity for sustainable development, naturally, according to available resources" [31].

The development of nuclear energy aligns with Egypt's climate objectives: projections indicate that by 2100, Egypt will experience higher levels of warming than the global average, which will sharply increase electricity demand [30].

Indonesia's energy balance is structured as follows: coal — 42.7%, oil — 30.7%, natural gas — 16.2%, renewables — 8.2%, and hydropower — 2.2% [32]. Consequently, the country currently lacks nuclear capacity. Indicators of electricity production per capita and per unit of GDP are already significantly below global averages. Energy demand is projected to increase more than fivefold, reaching 731.058 million tonnes of oil equivalent by 2050.

In 2015, Rosatom and the National Nuclear Energy Agency of Indonesia signed a memorandum of understanding on "peaceful nuclear energy." Currently, active dialogue is ongoing to establish a baseline scenario for the development of nuclear power in Indonesia. Given the country's location along the Pacific "Ring of Fire," characterized by high tectonic activity, approximately 6–7 thousand earthquakes of magnitude above 4.0 are recorded annually. Accordingly, Rosatom's proposals primarily focus on the design of floating NPPs for offshore deployment.

In 2021, negotiations were held regarding the construction of an NPP on the island of Kalimantan, which exhibits relatively low seismic activity and possesses significant uranium resources, enabling autonomous fuel supply for the plant. Concurrently, the Indonesian government has planned the deployment of light-water reactors on the most densely populated islands — Bali, Java, Madura, and Sumatra — beginning in 2027. Additionally, compact floating nuclear stations of up to 100 MW are planned for Kalimantan, Sulawesi, and several other islands to provide electricity and heat to industrial facilities. In October 2022, Moscow proposed the construction of a NPP in Indonesia's new capital, Nusantara [33].

Indonesia's high seismic activity contributes, in part, to a generally negative public discourse regarding "peaceful nuclear energy," which is common across much of the region. For example, public opposition prevented the commissioning of a completed NPP in the Philippines. Therefore, extensive public outreach and educational efforts are necessary for the full implementation of a peaceful nuclear energy policy in Indonesia.

For the past 20 years, Iran's nuclear program has been at the center of international attention. In 2002, Tehran announced its priorities for the development of nuclear energy and the initiation of work across various areas of nuclear technology. Due to concerns raised by the International Atomic Energy Agency (IAEA), the UN Security Council adopted several resolutions requiring Iran to halt uranium enrichment as well as activities related to the design of the IR-40 research reactor.

In 2013, Germany, the United Kingdom, France, China, Russia, and the United States (E3+3) adopted a Joint Plan of Action (JPA) with Iran, aimed at ensuring the exclusively peaceful nature of Iran's nuclear program [Dyakov]. In 2015, the E3+3 and Iran agreed on the Joint Comprehensive Plan of Action (JCPOA), which further guaranteed the peaceful character of Iran's nuclear activities. The JCPOA facilitated the easing of anti-Iranian economic sanctions, leading to some reactivation of Western investment in Iran. However, in 2018, U.S. President Donald Trump announced the withdrawal of the United States from the JCPOA and the reinstatement of economic sanctions on Iran, citing concerns that Tehran was pursuing nuclear weapons. Following the Iran–Israel escalation in the summer of 2025, a crisis emerged in Iran–IAEA relations, marked by restricted access to certain strategic sites. By September 2025, however, both parties signed an agreement to resume cooperation; nevertheless, the process once again reached a deadlock [34].

According to the 2024 Statistical Review of World Energy by the Energy Institute, Iran's total primary energy consumption amounted to 12.71 exajoules, of which approximately 70% came from natural gas, 27% from oil, 1.6% from hydropower, 0.7% from coal, 0.5% from nuclear energy, and 0.2% from renewable sources [35]. Despite the relatively small share of nuclear energy in the national energy balance, it is traditionally considered by Iran as a strategically important sector. The country's first NPP, Bushehr, with a capacity of 915 MW, was commissioned in 2011 with support from Moscow. Construction commenced on a second unit with a capacity of 1057 MW at the Bushehr NPP site in 2019; a third unit and the Karun 300 MW NPP are planned.

Like several other BRICS+ members, Iran possesses uranium reserves. In 2022, domestic production amounted to 20 tonnes. Overall, according to various sources, Iran's uranium reserves are estimated at 4–5 thousand tonnes [36].

According to the 2024 Statistical Review of World Energy, the total primary energy consumption in the United Arab Emirates (UAE) amounted to 5.13 exajoules, of which approximately 47% came from natural gas, 42.9% from oil, 5.7% from nuclear energy, 1.9% from coal, and 2.5% from renewable sources [37].

The UAE's nuclear program is relatively recent. In 2006, six member states of the Gulf Cooperation Council (GCC)—Kuwait, Saudi Arabia, Bahrain, the UAE, Qatar, and Oman — agreed on a research program for the peaceful use of nuclear energy. This initiative led to the construction of the Barakah NPP, commissioned in 2020 as the first nuclear power station in the Arab world. The plant has a total capacity of 4,011 MW. The project was executed by the South Korean consortium KEPCO, which in 2023 began negotiations with the UAE regarding the construction of two additional units at the Barakah site.

Given the UAE's ambitious goal of achieving net-zero emissions by 2050, the development of the nuclear energy sector is considered a strategic necessity.

Ethiopia. The energy balance of Ethiopia is characterized by a pronounced dominance of renewable sources, accounting for 98.44% of the total, including biomass-fired thermal power plants (4.81%), hydropower plants (88.18%), wind power (5.03%), solar photovoltaic (0.34%), and geothermal power plants (0.11%). Non-renewable sources constitute only 1.54%, entirely represented by thermal power plants using organic fuel. Hydropower, therefore, occupies a central role in Ethiopia's energy system. Notably, in September 2025, Ethiopia commissioned Africa's largest hydropower facility, the Grand Renaissance Dam, with an installed capacity of 5,150 MW.

At the same time, Ethiopia is pursuing energy diversification, including plans for nuclear power development. The key partner within the BRICS+ framework is Rosatom, with additional cooperation being established with China. In September 2025, Prime Minister Abiy Ahmed announced that Ethiopia intends to invest USD30 billion in infrastructure development, including nuclear power. He emphasized that the future NPP would be comparable in scale and significance to the recently commissioned Grand Renaissance hydropower plant.

Conclusions

Thus, the "peaceful atom" constitutes one of the key megatrends of sustainable energy development within the BRICS+ space, serving as a fundamental tool for the transition to a low-carbon energy system. Comparative cross-country analysis demonstrates that the BRICS+ countries possess unevenly developed nuclear infrastructures, shaped by both geographical features and the resource endowments of each state. In this context, the presence of domestic uranium reserves is considered a basic precondition for sustainable development of the nuclear sector.

Equally important are international cooperation, the establishment of national scientific schools and human capital in nuclear energy, as well as adherence to non-proliferation regimes and the assurance of exclusively peaceful use of nuclear technology. These measures ensure sector stability and mitigate geopolitical and technological risks.

The analysis indicates that the BRICS+ space holds substantial potential for the expansion of the "peaceful atom". Key players — Russia, China, and India — act as locomotives of this development, capable of providing technology transfers within the limits of national security, as well as facilitating the exchange of scientific and managerial expertise. Simultaneously, the uranium resources possessed by many BRICS+ countries create conditions for significant growth of nuclear energy, aimed at enhancing the energy sustainability of the Global South.

The development of a dedicated BRICS+ ecological and energy agenda, including low-carbon transition and sustainable infrastructure issues, appears strategically expedient. Such an agenda would allow for systematic determination of priorities for financing and developing "sustainable infrastructure" within the framework of the New Development Bank of BRICS, ensuring long-term synergy between the economic, environmental, and technological objectives of member states.

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Повестка БРИКС+ в области устойчивого развития ядерной энергетики: современное состояние и новые тенденции

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Аннотация. Ядерная энергетика становится стратегически значимым компонентом энергетического баланса стран БРИКС+, отражая как растущий спрос на энергоресурсы, так и стремление к технологическому суверенитету. В данном исследовании анализируется распределение мощностей атомных электростанций, запасов урана и реализуемых проектов среди государств БРИКС+, что позволяет рассматривать их усилия в более широком контексте глобальной диверсификации и безопасности энергосистем. Анализ основан на данных о действующих атомных электростанциях, реакторах, находящихся в стадии строительства, и ресурсах урана, собранных из международных энергетических баз данных и официальных отчетов. Результаты показывают, что Россия, Китай и Индия формируют технологическое и производственное ядро БРИКС+, концентрируя большинство действующих реакторов и новых проектов строительства, в то время как Бразилия и Южная Африка поддерживают стабильные, но более скромные программы, опираясь на собственную добычу урана. Египет, Эфиопия, Иран, Индонезия и Объединенные Арабские Эмираты становятся новыми участниками, продвигающими амбициозные проекты в области ядерной энергетики. Эти тенденции свидетельствуют о формировании коллективного влияния БРИКС+ на глобальный рынок ядерной энергии и ядерного топлива, а также об усилении их роли в обеспечении глобальной энергетической стабильности.

Ключевые слова: БРИКС+, ядерная энергетика, мирный атом, запасы урана, энергетическая безопасность, глобальная энергетика, диверсификация

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