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The Role of BRICS in Global Energy Transition

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Abstract. This article examines the evolving role of BRICS nations in the global energy transition within the context of their expanded membership and growing geopolitical influence. As BRICS has expanded to include Egypt, Ethiopia, Iran, UAE, and Indonesia, the bloc now represents approximately 45% of the global population, 28% of global GDP, and 42% of global oil production, making it a significant player in shaping energy policies. The research employs statistical data analysis of energy indicators from 2017–2023 alongside SWOT analysis to assess the current energy landscape and transition trajectories across member states. Findings reveal diverse national energy profiles: China leads in renewable capacity but remains heavily coal-dependent; India shows rapid solar growth targeting 50% non-fossil electricity by 2030; Brazil relies on hydropower while expanding other renewables; and Russia and South Africa demonstrate slower transitions toward cleaner energy sources. Collectively, BRICS nations have nearly doubled their renewable energy capacity since 2017, with increasing emphasis on wind and solar, though fossil fuels still dominate their energy mix. The research concludes that despite challenges including economic disparities, political tensions, and infrastructure deficits, BRICS possesses significant potential to drive global energy transition through enhanced cooperation, technology sharing, and leveraging their collective economic weight to secure necessary financing, provided they balance national circumstances with shared climate commitments.
Keywords: BRICS, energy transition, renewable energy, sustainable development, energy security, climate policy

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Introduction

The emergence of new leaders in the global political and economic arena, the change in the economic power ratios of individual countries and the beginning of the transformation of the unipolar world order into a multipolar world led to significant changes in both the political situation and the entire system of international relations. BRICS has turned into a multidisciplinary strategic partnership based on three key "pillars": politics and security, economics and finance, culture and humanitarian ties [1]. Initially formed as a loose coalition of emerging economies to enhance cooperation and challenge Western dominance in global affairs, BRICS has expanded its membership and nowadays it includes: Brazil, Russia, India, China, South Africa, Egypt, Ethiopia, Iran, UAE; this expansion is set to take effect in January 2024 and in January 2025 Indonesia joined in, further solidifying BRICS' role in the global energy landscape.

With the new members, BRICS represents approximately 45% of the global population; 30% of the world's land area; 28% of global GDP; 42% of global oil production [2]. The combined economies of BRICS members are projected to exceed $28 trillion. This demographic and economic weight positions BRICS as a significant player on the world stage, particularly in challenging the existing order dominated by Western powers [3].

The BRICS energy cooperation framework has evolved significantly from the 2022 Beijing Declaration, which established the fundamental role of energy security in achieving Sustainable Development Goals while recognizing that "energy transformations are unique in each country due to national circumstances" [4]. "The Kazan Summit further strengthened this commitment by emphasizing the need for" enhanced cooperation among BRICS countries as major producers and consumers of energy products and

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calling for balancing energy security, access and energy transitions with the full and effective implementation of the UNFCCC and its Paris Agreement" [5]. This progression culminated in the 2025 Rio Declaration, which acknowledged BRICS nations' shared responsibility as both major producers and consumers of energy while committing to just and inclusive energy transitions" aligned with national circumstances and universal access to affordable, reliable, sustainable energy (SDG7).

The Rio Declaration represents the most comprehensive BRICS energy framework to date, recognizing that fossil fuels will still play an important role in the world's energy mix, particularly for emerging markets and developing economies, while calling for just, orderly, equitable and inclusive energy transitions that reduce GHG emissions in line with climate goals. It specifically addresses critical implementation gaps by demanding adequate, predictable and accessible low-cost and concessional finance from developed to developing countries and recognizing the key role of critical minerals for the development of zero- and low-emission energy technologies. The declaration also advances sector-specific solutions, endorsing Sustainable Aviation Fuels (SAF), Lower Carbon Aviation Fuels (LCAF), and other Aviation Cleaner Energies as pathways for reducing emissions, while welcoming the updated Roadmap for BRICS Energy Cooperation 2025–2030 that operationalizes these commitments through concrete mechanisms rather than merely stating principles [6].

The summit reiterated the fundamental role of energy access in achieving SDGs, particularly in developing countries. It acknowledged the risks to energy security that could impede progress towards these goals, stressing that access to energy is not just a commodity issue but a critical component of social and economic development. The final declaration emphasized the necessity for BRICS nations, as major producers and consumers of energy, to work together towards fair, inclusive, and sustainable energy transitions. This cooperation is framed within the context of ensuring that energy security, access, and transitions are balanced, considering national circumstances such as climate conditions and economic structures. The summit highlighted the importance of considering the specific challenges faced by developing countries that heavily rely on fossil fuels. It called for a just transition that recognizes these nations' economic dependencies while moving towards more sustainable energy sources.

Through various summits and declarations, BRICS countries have articulated their commitment to sustainable energy practices and their alignment with the United Nations Sustainable Development Goals (SDGs). Through collaborative efforts at various summits, these nations are not only addressing their domestic energy needs but also contributing to global sustainability initiatives. As they continue to navigate the complexities of energy transitions, the alignment with the SDGs will be crucial for achieving long-term sustainability and resilience in the face of climate change.

Materials and Methods

This study builds upon six key scholarly works that collectively establish the theoretical and empirical foundation for analyzing energy transitions within the BRICS framework. The examination by A. Vylegzhannin, D. Ivanov, and M. Milyukova [7] of renewable energy from a Russian legal perspective provides critical insight into institutional mechanisms like the BRICS Energy Research Platform while revealing Russia's cautious approach to international renewable energy regulations due to energy security concerns. This directly informs authors analysis of national policy variations within BRICS, particularly regarding how different legal frameworks shape

collective energy transition efforts. Research by V. Yurtaev and A. Rogov research on BRICS and SCO participation in Eurasian integration [8] offers essential geopolitical context, demonstrating how BRICS functions as both an economic and political entity that establishes alternative energy corridors while complementing other regional integration structures — this framework is indispensable for understanding the broader strategic positioning of BRICS energy cooperation in my research.

M. Ryazanova's analysis of multilateral energy cooperation [9] identifies key institutional structures including the Memorandum of Understanding on energy conservation and efficiency, providing the operational context necessary for evaluating current cooperation mechanisms in my study. M. Sasu's study, *Energy Revolution under the BRICS Nations* [10], establishes the historical significance of energy cooperation for addressing social, economic, and environmental challenges while documenting existing collaboration frameworks with international bodies like the International Energy Agency — this historical perspective anchors author's analysis of evolving energy transition strategies.

The research on BRICS' legal infrastructure for oil trading [11] reveals crucial developments in creating independent payment systems and contract standardization outside Western-dominated financial structures, directly supporting my examination of trade resilience mechanisms. Finally, the work on renewable energy mainstreaming in BRICS countries [12] provides comparative data on generation sources and adoption trends across member states, establishing the baseline metrics that enable authors mixed-methods approach to systematically analyze both quantitative trends in renewable energy adoption and qualitative factors influencing policy implementation across diverse national contexts within the BRICS framework. This methodology includes statistical data analysis, and SWOT analysis to assess the current future trends in energy environment.

Results and Discussion

The energy transition in BRICS countries is a complex and multifaceted issue, particularly in the context of rising primary energy consumption. These countries, while diverse in terms of their energy profiles and economic structures, are all grappling with the challenge of balancing economic growth, energy demand, and sustainability.

In exajoules

	Primary energy Consumption	Oil Production	Oil Consumption	Natural gas Production	Natural gas Consumption	Coal Production	Coal Consumption	Electricity Generation	Nuclear energy Generation
Brazil 2017	12.47	5.97	4.95	0.98	1.35	0.09	0.7	2.12	0.06
Brazil 2023	13.87	7.69	5.11	0.84	1.08	0.1	0.57	2.56	0.05
Russia 2017	29.29	23.38	6.6	22.88	15.52	8.62	3.51	3.93	0.73
Russia 2023	31.29	22.67	7.21	21.11	16.32	9.21	3.83	4.24	0.78
China 2017	138.27	8.02	25.86	5.37	8.69	73.17	78.9	23.77	0.89
China 2023	170.74	8.75	32.73	8.43	14.57	93.1	91.94	34.04	1.56
India 2017	30.96	1.69	9.32	1	1.93	11.99	17.05	5.3	0.13
India 2023	39.02	1.36	10.57	1.14	2.25	16.75	21.98	7.05	0.17
South Africa 2017	5.32		1.2		0.14	5.97	3.72	0.92	0.05
South Africa 2023	4.85		1.09		0.17	5.41	3.33	0.8	0.03

Figure 1. The Main Indicators of Economic and Energy Development of the BRICS Countries in 2017 and 2023

Source: created by Daniyal Ranjbar Meshkin, Elizaveta E. Mogileva based on data from K. Zhai [13].

According to the Figure 1 and Figure 2 as the world's largest energy consumer, China's primary energy consumption has been steadily increasing. This is driven by rapid industrialization, urbanization, and a growing middle class. This trend is likely driven by the expansion of infrastructure, heavy manufacturing industries, and the demand for electricity to power its growing population and urban centers. Moreover, China's energy mix continues to rely heavily on coal, although there is increasing investment in renewable and nuclear energy to offset the environmental impact of coal consumption [14]. Since 2013, China has significantly increased its investment in renewable energy sources, focusing on clean energy research, development, and deployment (RD&D). As a result, China has become the second-largest public sector investor in renewable energy, following the United States (though the European Union collectively invests more). In line with its ambitious dual carbon goals — to peak CO_2 emissions before 2030 and reach net-zero emissions by 2060 — China is moving toward phasing out coal. This transition is supported by structural changes in the economy and the rapid expansion of renewable energy sources, which will be crucial for the shift away from fossil fuels. However, while China is committed to the energy transition, the path to net-zero emissions remains complex. It is still uncertain how quickly coal consumption will decline and whether carbon capture, utilization, and storage technologies will be scaled up in time to meet the country's targets [15].

Russia's energy consumption has not grown dramatically, suggesting a stable, mature economy with relatively less growth in domestic demand. On the production side, Russia's oil and natural gas output remains high, reinforcing its position as one of the world's largest exporters of energy resources. The slight decrease in oil production from 23.38 exajoules in 2017 to 22.67 exajoules in 2023 may indicate a shift in production priorities, potentially related to geopolitical factors regarding western sanctions or an emphasis on maintaining natural gas production [16].

India's population and economic growth are major drivers behind its increasing energy demand. The country has been expanding its energy infrastructure to meet the needs of its growing industrial base and urban centers. Coal, despite being the most polluting energy source, still plays a dominant role in India's energy mix, but there are growing efforts to diversify into renewable energy sources. India's renewable energy potential, green hydrogen strategy, and climate action plan position it as a key player in the global energy transition. The country is targeting net-zero emissions by 2070, with plans to achieve 50% non-fossil fuel electricity by 2030. It currently ranks fourth in the world for renewable energy capacity, bolstered by a 36.5% compound annual growth rate (CAGR) in solar energy over the past 11 years [17]. The relatively slow growth in oil production (compared to other countries like Russia and China) indicates India's continued dependence on imports to meet its oil needs.

Brazil's growth in energy consumption reflects a developing economy, although at a slower pace compared to the large BRICS nations like China and India. The increase in oil consumption and production indicates Brazil's reliance on oil for both domestic use and exports. However, Brazil's emphasis on renewable energy sources, particularly hydropower, likely contributes to the relatively low increase in coal production and the small increases in electricity generation. For many decades, hydropower has been the dominant source of electricity generation in Brazil, thanks to its cost-effectiveness and significant potential within the country. Brazil has heavily depended on hydroelectric power as the foundation of its energy system, utilizing the nation's plentiful rivers and natural resources to produce clean, renewable energy [18].

South Africa's economy has faced challenges in recent years, with slow economic growth and energy infrastructure issues. Despite being a major coal producer, the country's overall energy production has stagnated. South Africa's continued reliance on coal as its primary energy source is a key challenge, especially in terms of sustainability and environmental concerns [19]. The minimal growth in electricity generation and nuclear energy suggests that the country has not been able to expand its clean energy capacity as rapidly as other BRICS nations. The low levels of nuclear energy production point to possible underinvestment in this sector, which is vital for diversifying South Africa's energy mix.

While countries like China and India are still focused on coal and oil, there is a gradual shift in some BRICS nations toward cleaner sources of energy. Russia's increase in nuclear energy generation suggests a deliberate move toward diversifying its energy mix and reducing reliance on fossil fuels. However, Brazil and South Africa show little to no growth in nuclear energy generation, signaling a slower transition toward renewables and low-carbon sources of energy. China has been making strides in renewable energy, but coal's dominance persists.

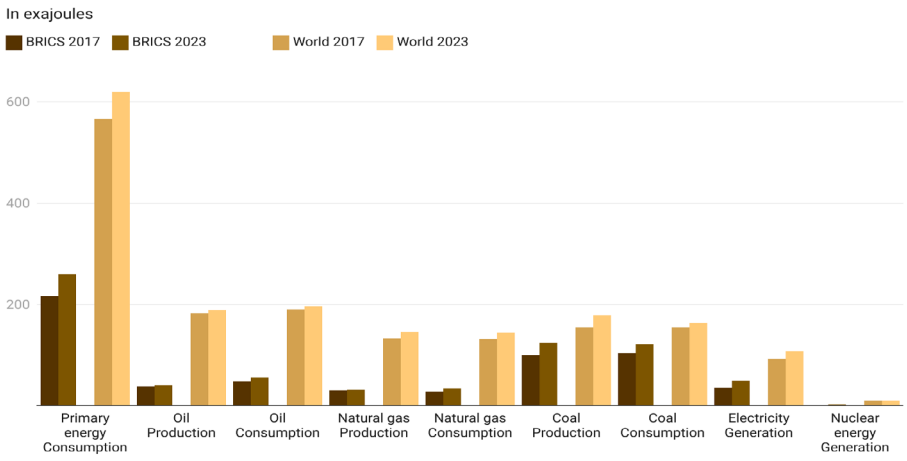


Figure 2. The Main Indicators of Economic and Energy Development of the BRICS Countries and the World in 2017 and 2023

Source: created by Daniyal Ranjbar Meshkin, Elizaveta E. Mogileva based on data from K. Zhai [13].

The dominance of coal in the BRICS nations reflects both the historical energy infrastructure and the ongoing economic reliance on coal as a cost-effective energy source for heavy industry. China's dramatic increase in coal production (from 73.17 to 91.94 exajoules) and consumption (from 78.9 to 91.94 exajoules) highlights its continued reliance on coal, despite the growing adoption of renewable energy technologies. Other countries like India and South Africa are also heavily dependent on coal, which creates a challenge for future environmental sustainability.

There is a clear correlation between economic development and energy growth in these countries, with China and India showing the largest increases in energy consumption and production. Economic expansion directly fuels energy demand, and the countries experiencing the most rapid growth (like China and India) are also seeing large increases in energy metrics. As these countries continue to industrialize and urbanize, their energy needs will likely continue to rise, placing pressure on both the environment and their energy infrastructure to keep up with demand.

According to the Energy Institute Statistical Review of World Energy 2024, primary energy comprises commercially traded fuels, including modern renewables used to generate electricity. Energy from all sources of non-fossil power generation is accounted for on an input-equivalent basis [13].

Overall, BRICS countries are significantly influencing global energy trends, driven by the large-scale consumption of coal, oil, and natural gas. While the world is slowly transitioning towards cleaner energy sources, BRICS countries still heavily depend on fossil fuels for their energy needs. The differences in energy consumption and production between BRICS and the World underline the challenges and opportunities of global energy development, especially as developing nations grow, and their energy demands continue to rise.

Clean energy is being integrated into the global energy system at an unparalleled pace, with over 560 gigawatts (GW) of new renewable capacity added in 2023 alone. However, the deployment of these technologies is not evenly distributed across different countries and sectors. Investment in clean energy projects is approaching USD2 trillion annually, nearly double the combined spending on new oil, gas, and coal projects. Additionally, the costs of most clean technologies are once again decreasing after an initial rise following the COVID-19 pandemic. This trend is driving the growth of renewable energy capacity from 4.250 GW today to nearly 10,000 GW by 2030, falling short of the COP28 target to triple capacity, but still more than sufficient to meet the increase in global electricity demand and reduce coal-fired generation. Alongside nuclear power, which is seeing renewed interest in many countries, low-emission energy sources are expected to generate over half of the world's electricity by 2030 [20].

The demand for electricity in the world will double under any scenario of the energy and climate policy of the countries. The shift to renewable energy sources is one of the most significant global trends of the 21st century, driven by a combination of environmental concerns, technological advances, economic factors, and policy shifts. As nations and companies alike strive to reduce carbon emissions and mitigate the impacts of climate change, renewable energy is becoming the centerpiece of this transition. The movement away from fossil fuels and toward cleaner energy sources has multifaceted implications, with varying progress depending on the region, technology, and market forces.

The shift to renewable energy is not just a trend but a necessary evolution in how the world generates and consumes energy. While renewable energy sources are growing rapidly, they face challenges in integration, financing, and political will. Nonetheless, the progress made in solar, wind, and energy storage, alongside favorable policy frameworks, makes the shift toward a cleaner, more sustainable energy system inevitable. As the cost of renewables continues to decline, and new technologies emerge, the energy landscape is likely to become even more decentralized, resilient, and greener in the coming decades.

The data indicates a clear trend toward the expansion of renewable energy in the BRICS countries, particularly in China and India. While China remains dominant in terms of absolute renewable energy capacity, Brazil and India are making substantial progress. Russia and South Africa, though growing, are not yet at the same scale as the other nations. The BRICS nations, as a group, are contributing significantly to global renewable energy capacity growth (Figure 3). The total renewable energy capacity for BRICS nations has almost doubled, signifying a strong collective shift towards renewable energy solutions within the group.

While countries like China and India are still focused on coal and oil, there is a gradual shift in some BRICS nations toward cleaner sources of energy. Russia's increase in nuclear energy generation suggests a deliberate move toward diversifying its energy mix and reducing reliance on fossil fuels. However, Brazil and South Africa show little to no growth in nuclear energy generation, signaling a slower transition toward renewables and low-carbon sources of energy. China has been making strides in renewable energy, but coal's dominance persists.

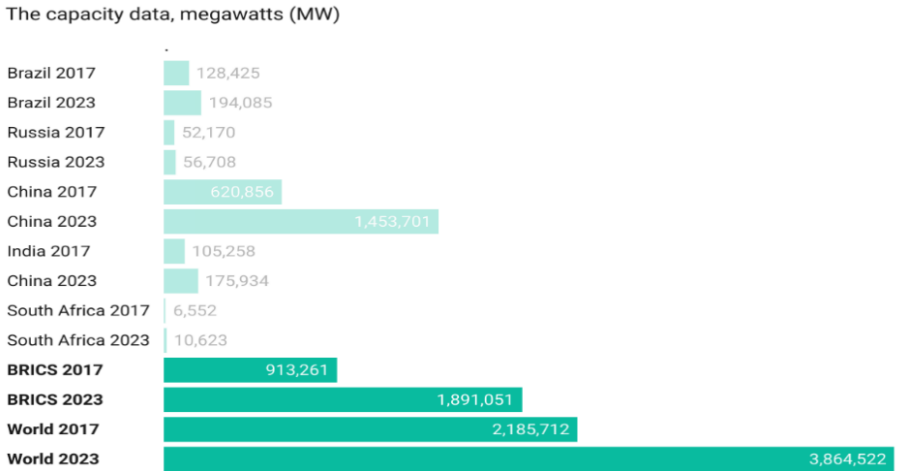


Figure 3. Total Renewable Energy

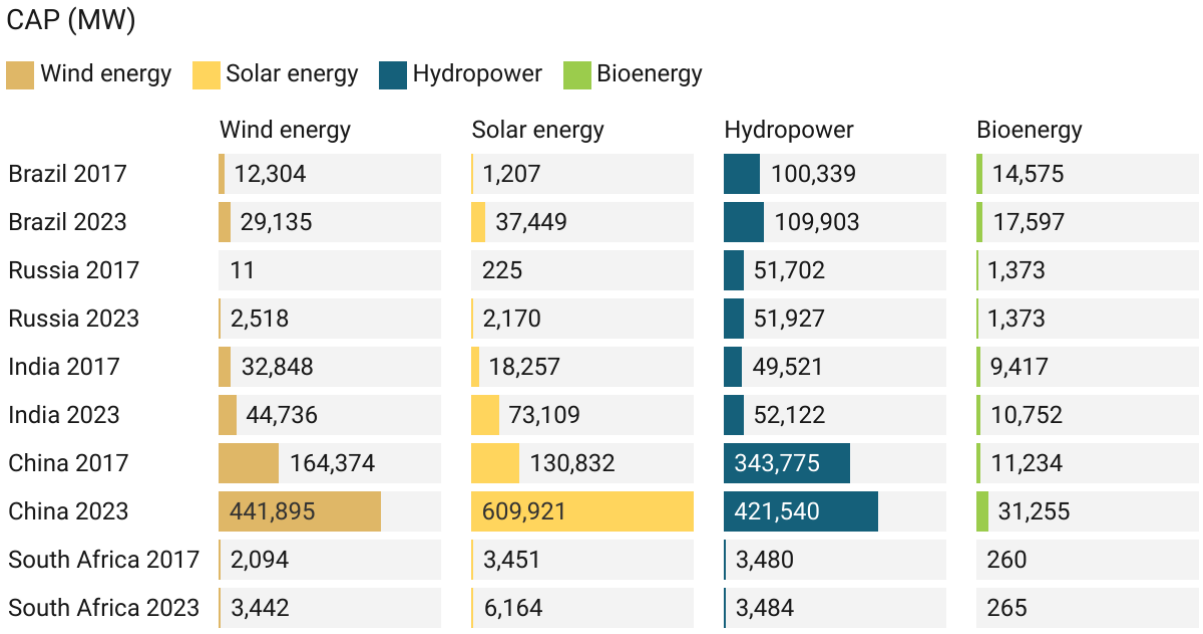
Source: created by Daniyal Ranjbar Meshkin, Elizaveta E. Mogileva based on data from International Renewable Energy Agency [21].

The BRICS nations form a formidable alliance on the global stage, largely due to their significant economic influence and diverse natural resources. Delving into renewable energy partnerships among these countries presents a promising opportunity to drive sustainable innovation and tackle the pressing energy challenges faced worldwide. By leveraging their combined resources, technological expertise, and policy initiatives, BRICS countries have the potential to play a central role in shaping a cleaner and more sustainable global energy future. Each nation brings unique strengths that can complement the others, fostering a rich environment for collaboration.

The BRICS countries collectively play a crucial role in the global push towards sustainable energy, given their economic strength and resource diversity. Their collaboration has led to significant strides in renewable energy, especially through large-scale projects and joint research initiatives. China's dominance in solar and wind energy production stands out, driven by its manufacturing strength and cost-cutting strategies. India's efforts in solar energy expansion highlight its commitment to clean energy, supported by national initiatives like the National Solar Mission. Brazil's extensive use of biofuels and hydropower aligns with its sustainability goals, while Russia's focus on nuclear energy provides a key low-carbon energy alternative. South Africa's focus on wind and solar energy projects further contributes to this collective effort.

However, the journey towards fully sustainable energy systems within BRICS faces various hurdles. A key issue is the disparity in economic development, with wealthier nations like China able to allocate significant resources to advanced technologies, while developing countries like South Africa struggle with limited budgets. Additionally, differences in regulatory frameworks among BRICS countries pose challenges for collaboration, especially regarding standards and private sector incentives. Geopolitical tensions also create obstacles, as diplomatic conflicts or trade issues can disrupt technology transfers and hinder the successful

implementation of joint initiatives. These challenges require tailored strategies and close cooperation to maintain the momentum of renewable energy development within BRICS [22].

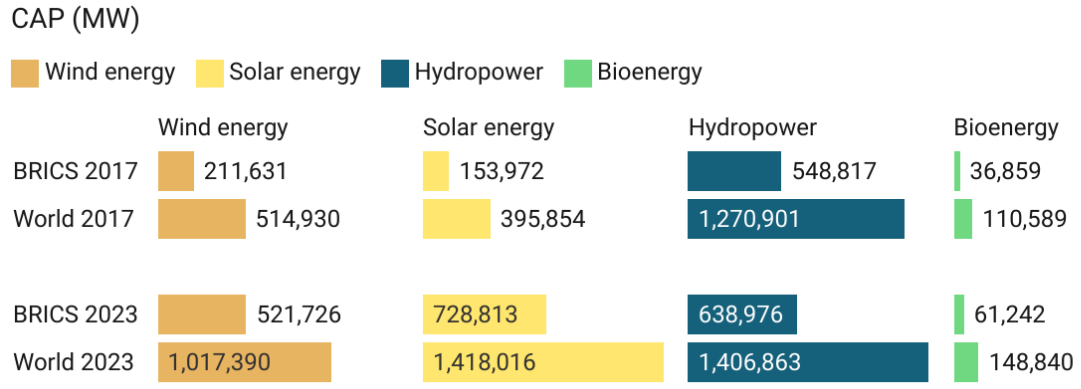


	Wind energy	Solar energy	Hydropower	Bioenergy
Brazil 2017	12,304	1,207	100,339	14,575
Brazil 2023	29,135	37,449	109,903	17,597
Russia 2017	11	225	51,702	1,373
Russia 2023	2,518	2,170	51,927	1,373
India 2017	32,848	18,257	49,521	9,417
India 2023	44,736	73,109	52,122	10,752
China 2017	164,374	130,832	343,775	11,234
China 2023	441,895	609,921	421,540	31,255
South Africa 2017	2,094	3,451	3,480	260
South Africa 2023	3,442	6,164	3,484	265

Figure 4. Renewable Energy by Sources

Source: created by Daniyal Ranjbar Meshkin, Elizaveta E. Mogileva based on data from International Renewable Energy Agency [21].

According to the Figure 4 and Figure 5, overall, the BRICS countries are increasing their share of wind and solar energy, with both sectors seeing an increase in 2023 compared to 2017. Hydropower remains a consistent source of renewable energy in the BRICS countries, slightly increasing, while globally, hydropower remains the dominant source. Bioenergy is growing in the BRICS nations, but the gap between BRICS and the global average is narrowing at a slower rate compared to wind and solar.



	Wind energy	Solar energy	Hydropower	Bioenergy
BRICS 2017	211,631	153,972	548,817	36,859
World 2017	514,930	395,854	1,270,901	110,589
BRICS 2023	521,726	728,813	638,976	61,242
World 2023	1,017,390	1,418,016	1,406,863	148,840

Figure 5. Comparison of the BRICS and the World Renewable Energy by Sources

Source: created by Daniyal Ranjbar Meshkin, Elizaveta E. Mogileva based on data from International Renewable Energy Agency [21].

In essence, the BRICS countries are making notable strides in diversifying their renewable energy. However, they are still heavily reliant on bioenergy and hydropower, and the global trend continues to focus more on wind and solar power in recent years.

As illustrated in Figure 6, is focused on the four primary renewable energy sources: wind energy, solar energy, hydropower, and bioenergy. The data reveal notable shifts in the renewable energy landscape within the BRICS countries between 2017 and 2023. While wind energy remains the dominant source of renewable energy within the BRICS nations, solar energy has experienced significant growth, aligning the BRICS share with the global proportion by 2023. Hydropower remains a crucial source of renewable energy for the BRICS countries, though its share has seen a slight decrease relative to global increases. Bioenergy has maintained a stable share in both BRICS and global renewable energy mixes. The overall trend indicates a gradual diversification and balancing of renewable energy sources in the BRICS countries, reflecting broader global efforts to transition towards more sustainable energy systems.

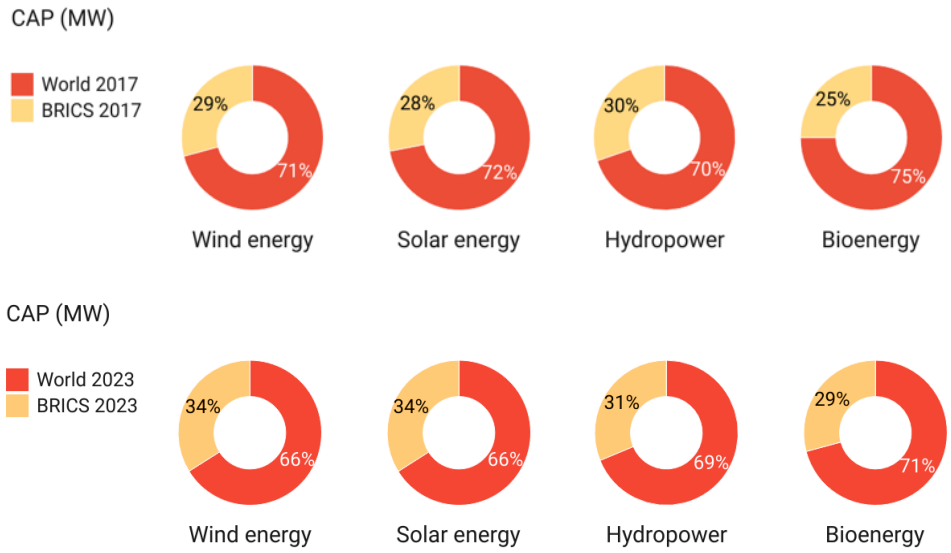


Figure 6. Comparison of the BRICS and the World Renewable Energy by Sources

Source: created by Daniyal Ranjbar Meshkin, Elizaveta E. Mogileva based on data from International Renewable Energy Agency [21].

Additionally, it is important to don't forget about new members of BRICS. The BRICS group, originally composed of Brazil, Russia, India, China, and South Africa, has evolved to include additional nations, often referred to as BRICS+. On January 1, 2024, four countries Iran, United Arab Emirates, Egypt and Ethiopia joined the alliance. Indonesia joined in January 2025. The BRICS Plus countries also generate 26.83% of all global gross domestic products [23]. This expansion reflects a growing recognition of the need for a more inclusive approach to global governance and cooperation, particularly in addressing pressing issues such as energy transition and sustainable development.

By sharing technology, investing in renewable resources, and advancing sustainable practices, these nations can ensure a more secure and environmentally friendly energy landscape. Particularly, there is a burgeoning interest in expanding renewable energy projects, enhancing energy efficiency,

and advancing nuclear energy — a sector where BRICS nations like Russia and China are already leaders.

As the world grapples with the intertwined challenges of energy security and climate change, collaborations such as those forged within BRICS offer a beacon of hope for the future. By fostering cooperative initiatives, promoting shared innovations, and prioritizing sustainable development, BRICS nations are uniquely positioned to play a transformative role in enhancing global energy security and advancing sustainability on a broader scale.

SWOT-Analysis

Strengths. Together, BRICS nations represent a significant portion of the global population and economy, providing a large market for renewable energy products and technologies. China has already established itself as a global leader in renewable energy investment, with companies like Longi Green Energy and Trina Solar leading the charge in solar technology [24]. India is actively seeking foreign investment in its renewable sector, offering incentives and regulatory support to attract international players [25]. Brazil is expanding its wind and solar markets, creating opportunities for investment in infrastructure development [26].

The collective political weight of BRICS can facilitate negotiations on international energy policies and climate agreements. Emphasizing the need for developed countries to take greater responsibility for historical emissions while supporting developing nations in their transition to sustainable energy. Creating platforms for exchanging knowledge and experiences related to climate adaptation and mitigation strategies.

There is a growing renewable energy capacity according to the Figures 1–3. Many BRICS countries are investing heavily in renewable energy infrastructure, contributing to global sustainability goals. By sharing best practices and technologies among themselves, BRICS countries can develop innovative solutions to common energy challenges and promote sustainable development.

Weaknesses. Economic differences among BRICS nations can lead to varying priorities and capabilities in energy investment and sustainability initiatives. China has the largest economy among BRICS nations, with a rapid growth rate that allows for substantial investments in renewable energy technologies. In contrast, Brazil and South Africa face economic challenges that can limit their financial capacity for large-scale energy projects. India, while experiencing robust growth, still grapples with poverty and energy access issues, necessitating a balanced approach to energy investment. The industrial composition of each BRICS nation shapes its energy needs and sustainability priorities. China's heavy industrial base drives demand for energy-intensive production, prompting aggressive investments in both renewable energy and energy efficiency technologies. India's economy is more diversified but still heavily reliant on coal, which complicates its transition to cleaner energy sources.

Political tensions between member states (e.g., India-China relations) may hinder collaboration on energy projects. The longstanding border disputes and geopolitical rivalry between India and China create an atmosphere of distrust that can hinder joint energy initiatives. For instance, both countries are competing for influence in the Asia-Pacific region, and this competition can spill over into energy

collaboration, where each nation may prioritize its own strategic interests over cooperative projects [27].

Some BRICS countries face significant infrastructure deficits that can impede the development of sustainable energy solutions. Countries like India and South Africa have made strides in renewable energy generation, but they still face challenges in scaling up capacity. Insufficient solar farms, wind turbines, and hydroelectric plants can limit the ability to meet growing energy demands sustainably [28]. The vast geographic areas of countries like Brazil and Russia can complicate the establishment of a cohesive energy distribution network. Remote regions may lack access to the grid, making it difficult to harness local renewable resources effectively.

There is still dependence on fossil fuels. Several BRICS nations still rely heavily on fossil fuels, which can slow the transition to sustainable energy sources. Many BRICS countries, such as Russia and Brazil, have economies that are heavily reliant on fossil fuel exports. For instance, Russia is one of the world's largest producers of oil and natural gas, and its economy is significantly influenced by these resources. This reliance creates a reluctance to transition away from fossil fuels, as it could jeopardize national revenue and economic stability.

Opportunities. Technological collaboration that provides joint research and development initiatives can lead to breakthroughs in energy efficiency, renewable technologies, and smart grid solutions. By collaborating on renewable energy projects, BRICS nations can diversify their energy portfolios. For example, countries with abundant sunlight (like India) can work with those with strong wind resources (like South Africa) to develop hybrid systems that optimize energy generation. Establishing platforms for knowledge exchange can facilitate the sharing of research findings, technological advancements, and operational experiences.

Finances opportunities on the base of Development Bank. Increased investment in renewable energy projects can create jobs, stimulate economic growth, and improve energy security. By providing initial funding and guarantees, development banks can attract private investors to renewable energy projects. This leverage effect amplifies the total investment in the sector. For example, when a development bank commits funds to a project, it often encourages private equity firms and commercial banks to invest alongside them due to reduced perceived risk.

By taking proactive steps toward sustainability, BRICS nations can position themselves as leaders in global climate initiatives. By actively participating in global climate discussions, such as COP meetings and G20 summits, BRICS nations can advocate for equitable climate policies that consider the needs of developing countries. Their collective voice can push for greater financial support for climate adaptation and mitigation efforts in vulnerable regions.

Strengthening energy trade among BRICS countries can enhance energy security and reduce reliance on external markets. Strengthening energy trade allows BRICS nations to optimize their energy mix by importing the most suitable resources for their specific needs. For example, India could import solar technology from China while exporting its renewable energy expertise to Brazil. This mutual exchange can lead to a more balanced and resilient energy landscape across the bloc.

Threats. The development of renewable energy depends on climate change impacts. Extreme weather events and climate-related challenges can disrupt energy production and supply chains across member countries. Climate change alters

the availability of natural resources essential for renewable energy production. For instance, shifting rainfall patterns can impact hydropower generation, while increased temperatures may reduce the efficiency of solar panels. These changes necessitate a reevaluation of resource management strategies and energy planning.

Economic downturns or fluctuations in global energy prices can affect investments in sustainable energy projects. For instance, if oil and gas prices drop significantly, fossil fuels may become more economically attractive, leading to a slowdown in investments in renewable technologies. This is particularly relevant in countries where fossil fuel subsidies exist, as they can distort market dynamics and hinder the growth of sustainable energy.

Other regions or countries may advance their own energy security and sustainability initiatives, potentially overshadowing BRICS efforts. Competitor nations often implement strong policy frameworks that promote renewable energy development through incentives, subsidies, and regulatory support. For example, the European Union's Green Deal aims to make Europe the first climate-neutral continent by 2050, which includes substantial investments in green technologies [29]. If BRICS countries do not adopt similarly ambitious policies, they risk lagging behind.

Conclusion

Varying regulatory environments and standards among BRICS countries can complicate collaboration on energy projects. Each BRICS country has its own set of regulations governing energy production, distribution, and consumption. These differences can complicate the design and deployment of cross-border projects, as equipment may need to be modified or certified to meet varying requirements.

The BRICS nations have a unique opportunity to leverage their collective strengths and address their weaknesses in the pursuit of enhanced global energy security and sustainability. By capitalizing on opportunities for collaboration and innovation while remaining vigilant against potential threats, they can make significant strides toward a more sustainable future.

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Роль БРИКС в глобальном энергетическом переходе

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Финансирование. Настоящее исследование не получало внешнего финансирования.

Аннотация. В статье анализируется эволюция роли стран БРИКС в глобальном энергетическом переходе в условиях расширения состава объединения и роста его геополитического влияния. После присоединения Египта, Эфиопии, Ирана, ОАЭ и Индонезии группа БРИКС охватывает около 45 % мирового населения, 28 % мирового ВВП и 42 % мировой добычи нефти, что делает ее значимым актором в формировании глобальной энергетической политики. В исследовании используются методы статистического анализа энергетических показателей за 2017–2023 гг., а также

Заявление об информированном согласии: информированное согласие было получено от всех участников исследования.

Вклад авторов. Все авторы внесли равный вклад в подготовку публикации. Все авторы прочли и одобрили окончательную версию рукописи.

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SWOT-анализ для оценки текущего энергетического ландшафта и траекторий перехода стран-участниц. Результаты показывают значительное разнообразие национальных энергетических профилей: Китай лидирует по установленным мощностям возобновляемой энергетики, но остается существенно зависимым от угля; Индия демонстрирует быстрое развитие солнечной энергетики с целевым показателем безуглеродной генерации 50 % возобнавляемых источников энергии к 2030 г.; Бразилия опирается на гидроэнергетику, одновременно расширяя другие виды возобнавляемых источников энергии; Россия и Южная Африка показывают более медленные темпы перехода к чистой энергетике. В совокупности страны БРИКС почти удвоили свои мощности возобновляемой энергетики с 2017 г., уделяя все больше внимания ветровой и солнечной генерации, хотя ископаемое топливо по-прежнему доминирует в их энергобалансе. В результате можно заключить, что, несмотря на существующие вызовы — экономические диспропорции, политические напряженности и дефицит инфраструктуры, — БРИКС обладает значительным потенциалом для ускорения глобального энергетического перехода за счет углубления сотрудничества, обмена технологиями и использования коллективного экономического веса для привлечения необходимого финансирования, при условии соблюдения баланса между национальными особенностями и общими климатическими обязательствами.
Ключевые слова: БРИКС, энергетический переход, возобновляемая энергетика, устойчивое развитие, энергетическая безопасность, климатическая политика

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