BRICS YEA

BRICS YOUTH ENERGY 2024 OUTLOOK

BRICS YEA

Introducing

BRICS YOUTH ENERGY 2024 OUTLOOK

The fifth edition of the leading international research on energy development of BRICS countries prepared by young researchers, scientists and professionals

INITIATIVE APPROVED
BY BRICS ENERGY MINISTERS

supported by

ROSATOM

MELNICHENKO FOUNDATION

BRICS YOUTH ENERGY AGENCY
YOUNG EXPERT GROUPS

Slavyanskaya Square, House 2/5, Moscow
109240, Russian Federation

T +7-967-139-72-59
E info@yeabrics.org

www.yeabrics.org

BRICS 2024 RUSSIA

BRICS 2024 RUSSIA

BRICS POWERED. YOUTH DRIVEN.

Inside the Outlook

Welcome _

Message from the Chairperson

This year's Outlook is special. Along with welcoming the five nations to the BRICS family, we have carefully rethought how we develop our flagship edition. The eight Young Expert Groups created under BRICS Youth Energy Agency will consolidate the vision and perspective of the BRICS younger generation in the energy sector.

This edition highlighted the major topics in our global energy discourse, and young people have become active participants of these high-level discussions. We have observed that today's international organizations and mechanisms, along with BRICS, tend to listen to young people and take their opinion into consideration. This is a massive change. The matters of just energy transition, resource management, climate change, agrifood systems, green skills and jobs, nuclear technologies along with energy partnerships and youth-led businesses are pivotal for us, BRICS Youth, and these areas are most likely for young people to focus their efforts in the near future.

The BRICS Youth Energy Outlook 2024 is a fifth edition which has been rethought for the better and broader engagement of young people in primary and related energy cooperation. We have managed to persuade the leaders that the outlook is a well thought strategic document that must be reviewed and guide our countries in the long-term energy planning.

In the next year, the BRICS Youth Energy Agency celebrates its 10th anniversary, and it is going to be 7 years since the first outlook has been ever published. Our team has grown beyond BRICS to the Global South where it gained a committed community and became known in the Global North where it proved a reputable partner. We see a bright future ahead where our members are not only driving ambition today but also steadily taking their seats at the decision-makers' tables to ensure that the mission is complete.

Alexander Kormishin
Chairperson
BRICS Youth Energy Agency

Preface _

#9

Over almost 10 years, the BRICS Youth Energy Agency has been embarking on a transformative journey to amplify the voices of young professionals across the BRICS countries in shaping the future of energy. What began as a vision to engage youth in addressing key energy trends has now evolved into an influential platform where emerging leaders come together to research, innovate, and collaborate. In 2024, we build upon our past accomplishments, launching the latest edition of the BRICS Youth Energy Outlook with renewed passion and a deeper commitment to fostering meaningful dialogue.

This Outlook is more than just a research document — it's a statement of youth-driven ambition in a world facing complex energy challenges. The ten BRICS nations, each with their own distinct energy landscapes, remain at the forefront of global efforts to innovate, diversify, and transition to more sustainable energy systems. The convergence of their resources, technological advances, and geopolitical roles offers unparalleled opportunities for collaboration. As energy consumers, producers, and innovators, BRICS countries are uniquely positioned to contribute to global energy security and sustainability.

Our shared mission remains clear: to engage youth as active participants in shaping the future of energy within BRICS and beyond. This year's edition of the Outlook reflects a diverse range of perspectives from over 120 young researchers, students, and experts from across the Global South. Together, they have examined some of the most critical energy issues of our time within 8 Young Expert Groups, which are as follows — International Partnerships and Policy Advocacy, Just and Sustainable Energy Transition, Nuclear Energy and Technologies, Resource Management and Critical Minerals for Energy Transition, Sustainable Agrifood Systems, Climate Change, Green Jobs and Skills for Energy Transition, and Business in Energy Sector. By uniting the visions of young researchers and established experts, this document presents bold ideas and thoughtful analysis, fostering greater understanding of the unique challenges and opportunities that BRICS countries face.

As we stand at a pivotal moment in global energy transformation, the collaboration within BRICS takes on an even greater significance. This year's edition of the Outlook not only reflects on the past but also looks ahead, addressing the urgent need for sustainable solutions, energy equity, and technological innovation. The youth's perspective in this dialogue is crucial, as the decisions made today will shape the energy future they will inherit. We are proud to see BRICS Youth stepping up as thought leaders and contributing to these critical discussions.

As the Director for Research Initiatives of BRICS Youth Energy Agency, I would like to express my deepest gratitude to all the contributors, editors, and supporters who made this year's Outlook possible. Your dedication to thorough research, your passion for sustainability, and your unwavering belief in the power of youth are reflected on every page of this report. We hope that this Outlook serves not only as a resource but as a catalyst for continued dialogue, innovation, and cooperation across the BRICS nations and the global energy community.

We invite you to delve into the BRICS Youth Energy Outlook 2024 and explore the ideas, analyses, and visions presented by the young minds shaping the future of energy. Enjoy the journey, and together, let us drive forward towards a more sustainable, resilient, and energy-secure future.

Irina Kulinenko

Director, Research Initiatives —
Head of BRICS Youth Energy Outlook 2024

Acknowlegments _

#11

This year's BRICS Youth Energy Outlook 2024 is a result of ambitious effort delivered for the first time in the updated procedure through Young Expert Groups of BRICS Youth Energy Agency, which unite developers from all over the globe with invaluable support of governments, institutions and organizations. The Outlook 2024 was prepared by a team led by Head of Research Division Ms. Irina Kulinenko (BRICS YEA) who served as task team leader of the project and coordinated activities at different stages of the Outlook's development. The overall guidance was provided by Chairperson Mr. Alexander Kormishin (BRICS YEA). We also acknowledge the contribution of Mr. Ilya Zabrin who has also took over the design and typographic formatting of the present edition with support of the Mission Impact, Rosatom's Human Potential Development Programme. The present Outlook 2024 has been developed pro-bono and the printing expenses have been covered by the Andrey Melnichenko Charity Foundation.

The core team was composed of chief experts Hoor Ahli (UAE), Dr. Abdulrahman Bin Jumah (KSA), Soumojit Mukherjee (India), Janaina Fonseca Nolasco (Brazil), Athira Aji (FAO), Mpendulo Dlamini (South Africa), Olga Kelebogile Mmelesi (South Africa) and Yomna El-Awamri (Egypt), who served as editors of their respective chapters under the Outlook 2024, executed communication, run the meetings and submitted research papers. The chief experts were assisted by secretaries, including Cataleya (Xinyue) Han (China), Anastasia Shirokograd (Russia), Milana Ozerina (IAEA), Anna Loginova (Russia), Regina Chukova (Russia), Milana Gomeniuk (Russia), Ali Alnajim (KSA) and Sonam Maheshwari (India), who ensured that deadlines were met, and members were well informed about the development. The Outlook 2024 enjoyed a media coverage which was delivered by The Geostrata, our strategic partner in media space.

The execution of this project is not possible without associate professors, docents, students and professionals who represent 35 universities and organizations from BRICS countries and beyond making our report a globally focused. This year, we would also like to acknowledge the information and guidance shared by IAEA and FAO for their relative topics. Especially, we would like to acknowledge our traditional partners, including the JIS College of Engineering, Thapar Institute of Engineering and Technology (India), University of Pretoria, Senamile Masango Foundation (RSA), University of São Paulo (Brazil) for their commitment to the project as many-year participants. We also acknowledge the contributions and guidance received from the Russian Energy Agency of the Ministry of Energy of the Russian Federation, and in particular Ms Olga Yudina, for her support commitment to ensuring the role of youth in the BRICS energy cooperation.

Also, the core team is grateful to the research groups who represent the other universities and who completed their studies in accordance with the provided methodology that made possible to provide scenario- and strategy-based recommendations: University of Johannesburg, Oxford Institute for Energy Studies (OIES), Federal Fluminense University, University of Pretoria, Moscow Lomonosov University, University of São Paulo, University of Florence, Tsinghua University, University of South Africa, University of Brasília, University of Witwatersrand, University of Edinburgh, Higher School of Economics, Saint Petersburg National Research University of Information Technologies, Mechanics and Optics (ITMO University), National Autonomous University of Mexico and Indian Institute of Science.

The Outlook 2024 as a leading energy study for and in the interests of the BRICS nations has been acknowledged by energy and youth policy state authorities. We acknowledge the endorsement of the initiative by the BRICS Energy Ministers following their annual meetings and the Heads of State following their BRICS Summit in Johannesburg. We are grateful to the Ministry of Energy of the Russian Federation and the Department of Mineral Resources and Energy of the Government of the Republic of South Africa who actively participated in the preparations of the Outlook 2024 at various stages. The team also benefited from endorsement of the Russian BRICS Chairmanship 2024 coordinated by the Ministry of Foreign Affairs of the Russian Federation.

We would like to acknowledge a growing support for the project from various stakeholders representing BRICS companies and public organizations who have pronounced their interest in the project and considered cooperation in the years to come, and we are looking forward to it.

Finally, the team apologizes to any individuals or organizations that contributed to this Report but were inadvertently omitted from these acknowledgments.

#145

08

BUSINESS IN ENERGY SECTOR

MEMBERS OF THE YOUNG EXPERT GROUP:

Yomna El-Awamri, *Chief Expert, The Carbon Impact Lab*
Sonam Maheshwari, *Secretary, MESO Constructivist LLP*
Yolanda Dolly Nxumalo, *Member, YaAzi*
Nonoho Monyatsi, *Member, Transnet Fright Rail and PL Alumni NPO*
Chizoba Nzeakor, *Member, Saint Petersburg National Research University of Information*
Technologies, *Mechanics and Optics (ITMO University) Russia*
Rodrigo Munoz Sanchez, *Member, National Autonomous University of Mexico*
Mlungisi Plaatjies, *Member, Rebaiteredi Co-operative*
Eloísa Cristina Fernandez, *Member, Brazilian Association of Energy Service Companies (ABESCO)*
Caroline Njama, *Member, Climate Change and Sustainable Energy*
Tshegofatso Maja-Ohonba, *Member, South African National Energy Association*
Rainy Putri, *Member, New Energy Nexus*
Zwelakhe Gila, *Member, New Energy Nexus*
Mohammad Ghadieh, *Member, Eco-innovate International*
Disha Dinesha Lagadamane, *Member, Indian Institute of Science*
Kaidi Ru, *Member, SnT Consulting, China*
Kwethaba Nyaba, *Member*

Shanghai, China

Editorial Summary

BUSINESS IN ENERGY SECTOR

BRICS International School by BRICS IS

INTRODUCTION: THE VITAL ROLE OF THE PRIVATE SECTOR IN A JUST ENERGY TRANSITION

The global landscape is rapidly evolving, with the energy sector at the forefront of this transformation. As the world grapples with the dual challenges of climate change and sustainable development, it has become increasingly evident that the private sector must not only participate in but also lead the charge towards a just transition. The industrialization that once fueled unprecedented economic growth is now being reimagined to align with the principles of sustainability and equity. However, this transition is complex and fraught with challenges, particularly in emerging economies where industrialization is still a key driver of development.

Businesses, especially in the energy sector, hold the keys to unlocking a sustainable future. Their ability to innovate, scale, and influence policy makes them critical players in achieving global climate goals. But the question remains: will the private sector rise to the occasion? The answer lies in the hands of the next generation of entrepreneurs—young people who are increasingly stepping into leadership roles with a sense of urgency and commitment that reflects the stark reality of their future. This generation understands that the stakes are high; their futures, and the futures of generations to come, depend on the actions we take today.

The intergenerational equity issue underscores the importance of engaging young entrepreneurs in the energy sector. These leaders are not only more attuned to the challenges of climate change but are also more willing to challenge the status quo. Their innovative approaches and fresh perspectives are essential for driving the private sector towards a just transition. As such, the role of energy startups in BRICS+ nations becomes a critical focus area, as these nations are home to vast resources, burgeoning markets, and a growing pool of young talent eager to make a difference.

That is why for the Business in Energy Youth group, we decided to focus on innovative energy startups and their role in achieving a Just Transition for all.

INNOVATIVE ENERGY STARTUPS IN BRICS+ NATIONS: A CATALYST FOR SUSTAINABLE DEVELOPMENT

Entrepreneurship has long been recognized as a driver of economic growth, innovation, and structural transformation. With over 582 million entrepreneurs globally, and this number expected to grow by 15% by 2024, the rise of young entrepreneurs is shaping the global economy. In the BRICS+ nations, this entrepreneurial spirit is particularly evident in the energy sector, where startups are at the forefront of addressing the dual challenges of energy access and climate change.

THE ENTREPRENEURSHIP LANDSCAPE IN BRICS+ NATIONS

The BRICS+ region presents a varied yet promising environment for entrepreneurship. Countries like the United Arab Emirates and Saudi Arabia rank high on the National Entrepreneurship Context Index, reflecting favorable conditions for startups. India and China follow closely, offering cost-effective and supportive environments for new businesses. Even in countries like Brazil, where progress has been slower, there are continuous improvements, and in Egypt, the active startup ecosystem is expected to double in size within five years due to government support and an expanding middle class.

Entrepreneurship in these regions is not just about economic growth; it is a key component in achieving energy access and driving the global climate agenda. The International Renewable Energy Agency (IRENA) estimates that BRICS nations will need an investment of USD 1.3 trillion annually in clean energy by 2030 to meet their climate goals. Investing in innovative energy startups is crucial for unlocking sustainable growth and job creation in these emerging markets.

KEY TRENDS SHAPING THE ENERGY STARTUP ECOSYSTEM

1. The Rise of the Global South and New BRICS Members The inclusion of new countries like the UAE, Egypt, Iran, and Saudi Arabia into BRICS signifies a shift in global economic dynamics. This expansion brings a new focus on the Global South, particularly in the energy sector. These Middle Eastern countries are moving away from oil dependency, leveraging their BRICS membership to diversify their economies and integrate more deeply into global trade networks. Similarly, the addition of Ethiopia and Egypt to South Africa forms a new African bloc within BRICS, offering immense potential for energy startups, particularly in geothermal and solar energy sectors.

2. Energy Access and Social Entrepreneurship A significant portion of the population in BRICS+ nations still lacks access to reliable energy. Social entrepreneurs are playing a crucial role in addressing these challenges, particularly in rural and underserved communities. Startups are deploying innovative business models and technologies to provide affordable

Raising the Bar, SMARTIES™ APAC 2023 Showcases the Great Minds of Marketing at the 12th Anniversary Event

and sustainable energy solutions. For example, India's Women in Energy Entrepreneurship (WEE) program empowers women-led startups in renewable energy, while initiatives in Uganda and Indonesia are addressing energy poverty through localized, sustainable solutions.

3. Challenges Facing Energy Startups Despite the promising landscape, energy startups in BRICS countries face significant challenges. Regulatory complexities, market access barriers, and financial constraints are common across the region. For instance, startups in Brazil face stringent environmental regulations and bureaucratic delays, while those in Russia and India struggle with navigating complex regulatory processes and accessing financing. Addressing these challenges requires coordinated policy efforts and innovative financing mechanisms.

4. Financing Energy and Climate Enterprises Financing remains a major hurdle for energy startups in BRICS nations. While development banks like Brazil's BNDES and China's state-owned banks have played a significant role in funding large-scale energy projects, there is a need for more targeted support for startups. Innovative financial instruments such as green bonds and carbon credit markets are emerging as vital tools for mobilizing capital. For example, China leads the world in green bond issuance, while South Africa and Egypt are developing their own green finance markets.

5. Cross-Border Ventures and Collaborations The BRICS+ nations are increasingly engaging in cross-border energy collaborations. These partnerships are not only fostering technological innovation but also enhancing energy security and sustainability across the region. Memorandums of understanding (MoUs) between BRICS countries are paving the way for joint ventures in renewable energy, nuclear power, and clean technology. However, the success of these collaborations will depend on the political will and the ability to overcome infrastructural and regulatory challenges.

6. Emerging Technologies and Business Models Emerging technologies like Artificial Intelligence (AI), Blockchain, and green hydrogen are opening new frontiers for energy startups in BRICS nations. AI is being used to optimize energy distribution and predict equipment failures, while Blockchain is enabling secure and transparent energy transactions. Green hydrogen, seen as the fuel of the future, is particularly promising in countries like Brazil and India, where there is significant potential for renewable energy production. However, the adoption of these technologies requires substantial investment in research and development, as well as supportive regulatory frameworks.

THE WAY FORWARD: HARNESSING THE POTENTIAL OF ENERGY STARTUPS

The future of energy startups in BRICS+ nations is bright but hinges on the ability of these countries to address the existing challenges. Governments need to simplify regulatory frameworks, provide consistent policy support, and create an enabling environment for startups to thrive. At the same time, there is a need for more innovative financing mechanisms to ensure that startups have access to the capital they need to scale.

Collaboration is also key. BRICS+ nations should continue to foster cross-border partnerships and knowledge exchange to accelerate the development and deployment of clean energy technologies. Moreover, the private sector, particularly young entrepreneurs, must be at the forefront of this transformation, driving innovation and sustainability in the energy sector.

As we look to the future, the role of energy startups in BRICS+ nations will be critical in achieving a just transition. These startups are not only providing solutions to some of the most pressing energy challenges but are also creating new opportunities for economic growth and development. By harnessing the potential of these startups, BRICS+ nations can lead the way in the global energy transition, ensuring a sustainable and equitable future for all.

1. INNOVATIVE ENERGY STARTUPS IN BRICS+ NATIONS

Approximately one in four young people globally are becoming entrepreneurs, with the total number of entrepreneurs worldwide exceeding 582 million. This figure is expected to increase by 15% by 2024, highlighting a significant growth in entrepreneurial activity. (Global Entrepreneurship Monitor, 2023/2024).

However, this surge in the number of young people embracing entrepreneurship globally offers opportunities not only for them but for the global economy as a whole. Entrepreneurs bring new products and technologies to the market, hasten structural changes in the economy by regulating industries and resources, and in turn, drive forward productivity and raise living standards across the economy. Hence, Entrepreneurial activity is a key component in the process of economic development.

In the BRICS region, countries show varied but promising environments for entrepreneurship. For example: the United Arab Emirates and Saudi Arabia rank high on the National Entrepreneurship Context Index, suggesting favorable conditions for startups. They are followed by India and China who provide a cost-effective and supportive environment for new businesses. Brazil, on the other hand, shows slower progress but continuous improvement, and Egypt despite its recent economic challenges, its active startup ecosystem is expected to double in size within five years, bolstered by government support and an expanding middle class (Global Entrepreneurship Monitor, 2023; Amin, 2023).

In turn, entrepreneurship can play a large role in providing energy access, achieving a just transition, and achieving the climate agenda. The International Renewable Energy Agency (IRENA) estimates that the BRICS nations require an investment of USD 1.3 trillion annually in clean energy by 2030 to achieve their climate goals, and investing in innovative startups in this sector is crucial for unlocking sustainable growth and job creation.

2. MAJOR TRENDS

Trend 1: Entry of New Countries in BRICS: Rise of the Global South

Western countries have maintained hegemonic domination for over a century and a half, often framing global narratives and policies through a lens of colonialism and imperialism. This perspective tends to downplay Eastern initiatives and anti-colonial movements, presenting the global liberal order as “dynamic, multidirectional, and decentralized” (Stuenkel, 2018). Post-World War II institutions initiated by the West are celebrated as engines of global development, whereas Eastern-led initiatives like OPEC and BRICS+ are viewed with suspicion for challenging Western economic dominance.

The so-called 'liberal order' is frequently criticized for failing to prioritize peace, as evidenced in proxy wars. Established with a Western-centric approach, it has long marginalized the interests of developing countries. The creation of the New Development Bank (NDB) by BRICS in 2015 marked a significant shift, emphasizing renewable and nuclear energy. Despite skepticism from traditional financial entities like the IMF, the NDB committed $7.2 billion to priority projects in 2022, bringing its total approvals to $32.8 billion (New Development Bank, 2022). This demonstrates BRICS’s commitment to fostering South-South relations and challenging the existing global order, despite resistance from Western powers reluctant to relinquish their hegemonic positions.

The rise of the Global South, driven by new generations and entrepreneurs, is reshaping international policies and economic strategies. With the introduction of 5 new countries into BRICS, two new groups have emerged: A Middle Eastern one: UAE, Iran, Egypt, and potentially, Saudi Arabia, and an African one: Ethiopia, Egypt, and South Africa. This expansion signifies its commitment to the Global South.

A New Middle East

The inclusion of Middle Eastern countries like the United Arab Emirates (UAE), Egypt, Iran, and Saudi Arabia into BRICS marks a significant geopolitical shift, influencing economic and entrepreneurial landscapes, particularly in the energy sector and among youth-led businesses in the Global South.

Saudi Arabia and the UAE, traditionally reliant on oil revenues, are steering their economies towards less resource dependence, leveraging BRICS membership to diversify and integrate more deeply into global trade networks. (Al Jazeera, 2023). Egypt looks to rejuvenate its economy and expand its global trade relationships, which could stimulate its burgeoning startup ecosystem and encourage investments in renewable energy projects. (Middle East Eye, 2023; Modern Diplomacy, 2023).

The integration of these Middle Eastern nations into BRICS could significantly impact youth-led businesses and startups. The increased focus on digitalization, regulatory reforms, and financial investments aimed at fostering entrepreneurship could lead to a surge in innovative energy startups in the region. (Wamda, 2023).

The Rise of Africa

With the addition of Egypt and Ethiopia to South Africa, a new African block within BRICS is formed, bringing the potential for the rise of Africa after years of battling colonization and wars. This inclusion could be a game-changer for energy startups in the bloc. These countries bring a unique blend of resources, talent, and strategic location to the table; Ethiopia boasts vast geothermal potential (BP Statistical Review of World Energy, 2023) and Egypt and South Africa hold significant solar reserves (International Energy Agency, 2022), in addition to Egypt‘s significant natural gas reserves and South Africa’s strong mining sector. However, infrastructure limitations hinder full utilization.

On the other hand, Africa's youthful population (24% of the world's youth in 2020) (United Nations DESA) presents a vast market and a pool of potential entrepreneurs and in turn, all these nations are actively promoting entrepreneurship and innovation. Egypt has established a thriving startup ecosystem in Cairo, while Ethiopia's ICT sector is experiencing rapid growth. South Africa is a regional leader in technological innovation and they are geographically positioned as crucial trade and energy corridors. Their connection to established BRICS economies can create a network for knowledge exchange, technology transfer, and market access for energy startups.

A Changing World Order

All in all, the inclusion of Ethiopia, Egypt, Iran, UAE, and Saudi Arabia in BRICS presents a unique opportunity to propel energy entrepreneurship. By leveraging their resources, talent, and strategic location, these countries can contribute significantly to the bloc's technological advancement. Overcoming infrastructural hurdles and fostering knowledge exchange within BRICS will be crucial to unlocking the full potential of this collaboration. If successful, this partnership can illuminate the path towards a more sustainable and secure energy future for all.

Trend 2: Energy Access and Social Entrepreneurship

A significant portion of rural households, particularly those within difficult-to-reach areas, are still lacking access to energy. This situation poses a threat to their socio-economic conditions and diminishes their resilience to break free from the harsh circle of poverty. One of the key challenges in expanding access to power grid connectivity is the lack of education and awareness about its benefits, particularly in societies not exposed to urbanization or are unfamiliar with new technological innovations. This lack of education can lead to suppressed demand, resulting in either unaffordable power costs and/or inadequate infrastructure. This, in turn, can cause poor reliability and grid disruptions. In areas with high rates of theft, access to utilities or energy is often associated with high criminality and poor quality services, which can further erode trust between communities and service providers (Moreno & Bareisaite, 2015).

Social entrepreneurs play a crucial role in addressing energy access challenges, particularly in ensuring that energy is affordable and utilized effectively across urban and rural regions. By leveraging entrepreneurship and innovative business models, startups are at the forefront of deploying solutions that cater to the specific needs of communities.

They focus on diversifying energy sources to generate electricity in an environmentally friendly manner, incorporating the latest technological advancements. Startups have designed unique approaches and strategies to address gaps in energy access and productive use of energy. For instance, introducing integrated payment options, tariff reforms, and incentives that are suitable for communities while also taking into account the nation's utility cost-recovery needs (Mikkonen et al., 2020; Agence Française de Développement, 2023; Sharma, 2019; Energy for Growth Hub, 2022).

In India, the Women in Energy Entrepreneurship (WEE) program, facilitated by Climate Collective, empowers women-led startups in the renewable energy sector. AgriViJay, one of its supported startups, provides a range of renewable energy solutions through an e-commerce platform, mobile app, and village-level 'Renewable Energy Stores.' Serving over 200 farmers, it not only offers products like solar panels, biogas units, and wind energy equipment but also enhances rural livelihoods by providing clean cooking solutions and solar-powered irrigation, which has mitigated over 73,000 kgs of post-harvest losses and reduced CO2 emissions by 10,000+ tonnes (AgriVijay, 2022).

Moving to another country in the Global South, merely 19% of rural areas in Uganda currently have access to electricity, with less than 2% equipped with modern cooking facilities. The Collaborative Coalition Against Community Challenges (CCACCH) has taken the initiative to facilitate clean energy transition in the Ntungamo district of Western Uganda by providing Women and Youth with clean energy cooking fuel briquettes, enhanced cook stoves, and pico solar lanterns. They have successfully sold 130 enhanced cookstoves, 500 kilograms of clean energy briquettes, and 40 pico solar lanterns, which has contributed to diminishing reliance on firewood and other traditional means of cooking (New Energy Nexus Uganda, 2022).

On the other hand, Indonesia has made strides in electrification, yet remote households situated far from the urban centers still lack access to electricity, and there are no immediate plans to connect them. About 500,000 households in East Nusa Tenggara still rely on kerosene and live below the poverty line, earning less than 62 cents a day. Sumba Sustainable Solutions (3S), in partnership with PowerWells, is addressing this gap by using recycled electronic waste to create solar home systems in rural areas. This initiative not

only empowers local women and children by providing them with more productive hours but also supports roughly 2,900 households and generates local jobs, with women making up over half of the management team. These efforts include establishing solar-powered centers that serve as community hubs, enhancing local livelihoods (New Energy Nexus Indonesia, 2021).

These case studies demonstrate the critical role of social entrepreneurship in expanding energy access and driving sustainable development across BRICS and other developing regions.

Trend 3: Challenges Facing Energy Startups in BRICS Countries

Regulatory Complexities and Market Access Barriers

In Brazil, stringent environmental regulations and bureaucratic delays hinder project implementation and increase operational costs (da Silva, Castelo Branco, Magrini, & Tolmasquim, 2019). Similarly, Russian startups face hurdles in obtaining permits and navigating complex regulatory processes (Boyko & Patueva, 2018). Indian and Egyptian energy startups encounter regulatory hurdles, bureaucratic red tape, and limited access to financing and infrastructure. Market access issues further compound these challenges, with South African startups facing limited access to financial resources, insufficient infrastructure, and fierce competition from established energy corporations (Ogujiuba et al., 2023). In China, energy startups struggle to compete with state-owned enterprises and face challenges in securing contracts and accessing financing (Luo & Rui, 2009). The situation is similar in South Africa, where policy barriers and institutional obstacles hinder startups (Todd & McCauley, 2021).

Financial Barriers

The biggest challenge is funding for energy access initiatives in BRICS countries. The BRICS New Development Bank plays a crucial role in financing capital-intensive energy projects, mitigating debt crisis obstacles, and promoting sustainable development (Birol, 2022). However, accessing funding remains a challenge for many startups. Bridging this gap requires innovative financing mechanisms, such as public-private partnerships, impact investment funds, and facilitating access to credit for young entrepreneurs engaged in micro- and small businesses. This approach aims to bolster their expansion and generate employment opportunities, solidifying macroeconomic resilience and financial stability for improved livelihoods.

Trend 4: Financing Energy and Climate Enterprises

Overview of the financial landscape for energy Startups

In Brazil, energy startups thrive in a renewable energy market bolstered by hydropower, solar, and wind power. Government measures like feed-in tariffs and tailored financing attracted $3.8 billion in clean energy investments in 2022 (BNamericas, 2021; ABVCAP, 2023). Renewables account for over 80% of Brazil's energy mix, with solar capacity projected to reach 54 GW by 2024 (EPE, 2023; ABSOLAR, 2023). Similarly, India's ambitious target of 450 GW of renewable energy by 2030 creates vast opportunities for startups in solar, wind, and other clean solutions. Government incentives attracted $14.5 billion in investments in 2022 (MNRE, 2023; Mercom Capital India Research, 2023), with renewable energy capacity surpassing 175 GW in 2023 (CEA, 2024; Shakti Sustainable Energy Foundation, 2022). China's push for carbon neutrality by 2060 has also created a robust market for startups in solar, wind, and clean technologies. Government incentives facilitated a record $80 billion venture capital investment in 2022 (CVCRC, 2023; NBS, 2024), with China leading globally in renewable energy capacity, targeting 1,200 GW by 2030 (China Daily, 2021).

In contrast, other BRICS nations face more significant challenges. Russia's modernization efforts offer opportunities for startups in smart grids and energy efficiency, but government support is limited compared to other BRICS nations. Renewables contribute around 6-7% to Russia's energy mix, with a goal of 10% by 2030 (Rostec Corporation, 2023; Ministry of Energy of the Russian Federation, 2022; Baker & McKenzie, 2023; REN21, 2023). South Africa's energy crisis drives a focus on renewable energy, with government incentives fostering innovation. However, renewable energy only contributes 12%

to the energy mix, with $2.3 billion in investments in 2022, and the government aims for a 30% renewable share by 2030 (DMRE, 2023; SAREIA, 2022; BP Statistical Review of World Energy, 2023; Mercom Capital India Research, 2023). Egypt is advancing towards renewable energy, particularly solar, to meet rising demand, with renewables contributing 20% to the electricity mix and targeting 42% by 2030 (Egypt Today, 2023; The Ministry of Electricity and Renewable Energy, 2022).

Ethiopia's hydropower potential and supportive policies are promising, but political instability and infrastructure challenges persist. Over 90% of electricity is from hydropower, with a goal of universal access by 2030 (The World Bank, 2023; Ethiopian Electric Power, 2021). Iran's geographical advantages for solar and wind energy are offset by US sanctions and fossil fuel subsidies. Renewables contribute less than 10% to the energy mix, targeting 20% by 2025 (Tehran Times, 2023; Iranian Ministry of Energy, 2022). The UAE aims for a 50% clean energy contribution by 2050, with $10 billion invested in 2022 in solar, nuclear, and hydrogen projects (Dubai Media Office, 2022; Wamda, 2023).

Role of Traditional Investment Channels

In BRICS nations, development banks are the primary financiers for energy startups and renewable energy projects. The Emirates Development Bank (EDB) supports small and medium renewable projects in the UAE as part of the UAE's Net Zero Economy plan (EDB, n.d.). Brazil's national development bank, BNDES, has been a major global financier, providing over $35 billion in loans over the last 20 years. BNDES has also partnered with the Asian Infrastructure Investment Bank (AIIB) to explore renewable energy and climate mitigation projects, potentially laying the groundwork for a BRICS sustainable finance fund (Bnamericas, n.d.). In contrast, China's development banks did not offer green energy finance in 2021/2022 due to the dominance of state-owned enterprises, which have easy access to domestic funds (Reuters, 2023; Bennett & Le Marois, 2021).

Private venture capital (VC) also plays a crucial role but has struggled since the pandemic. For instance, India's VC sector was valued at $3.5 billion in 2020, a 30% decrease from 2019 (Fitch Ratings, 2023). In Africa, early-stage and equity financing are scarce due to public capital constraints and perceived high risks by private investors (IEA, 2023).

The BRICS New Development Bank (NDB) is expanding to include new member countries like Saudi Arabia. While the NDB has financed renewable energy projects in collaboration with BNDES in Brazil since 2016, there remains significant untapped potential for further investments (NDB, 2023).

Role of New Channels: Green Bonds and Carbon Credit Markets

In BRICS nations, innovative financial instruments like green bonds and carbon credit markets are emerging alongside traditional financing methods to support clean energy projects. Green bonds, which fund environmentally friendly projects, are gaining traction. China leads in green bond issuance with over USD 1.2 trillion issued in 2022 (Climate Bonds Initiative, 2023). India issued its first sovereign green bond for USD 1 billion in 2022 (The Hindu BusinessLine, 2022), while South Africa promotes green bonds through a dedicated segment launched by the Johannesburg Stock Exchange in 2017 (JSE, 2023). Finally, in 2020, Egypt became the first country in the MENA region to issue sovereign green bonds, which later entered the Sustainable Bond Market on the London Stock Exchange (The Egyptian Exchange, 2020; Egyptian British Enterprise Association, 2023).

Carbon credit markets, which trade emission allowances to incentivize emission reductions, are also developing. China launched its national carbon emissions trading scheme in 2021, the largest globally (Reuters, 2021). India is piloting carbon trading schemes with plans for a nationwide scheme (The Economic Times, 2023). While carbon credit markets in Iran, Ethiopia, and the UAE are still nascent, efforts are being made to establish them, such as the Dubai Multi Commodities Centre's regional carbon trading platform launched in 2022 (DMCC, 2022) and Egypt's voluntary carbon market launched at COP27 (The Egyptian Exchange, 2022).

Trend 5: Cross-Border Ventures and Collaborations

The BRICS+ nations have taken significant steps to enhance energy cooperation and investment. The BRICS Energy Cooperation Roadmap up to 2025 aims to create a unified approach to energy challenges and opportunities through policy coordination, trade, investments, and technological cooperation. In 2021, the group attracted $13 billion in foreign direct investment in the energy sector, with renewable energy, industrial real estate, and petrochemicals receiving the largest inflows (UNCTAD, 2023). BRICS members are major energy exporters and importers, accounting for 42% of global oil production and 35% of global oil consumption. The expansion of BRICS is expected to increase intra-BRICS energy trade, foster greater policy coherence, and create more favorable market conditions (EIA, 2023; Griffin, 2024; Kazelko & Semeghini, 2024). The BRICS+ alliance is also committed to transitioning to clean energy, with estimates suggesting that it will meet 80% of its electricity needs from renewable sources by 2050 (Nitter Havro & Selvaraju, 2023).

Increased cooperation and investment in the energy sector are also evident in the group's growing number of memorandums of understanding (MoUs)in 2023 and 2024 only. Notable examples include a Russian-Indian MoU between Novatek and Deepak Fertilisers for the supply of LNG and low-carbon ammonia and a South African-Russian MoU between Necsa and TVEL Fuel Company focusing on nuclear fuel production and related components. The Emirates Nuclear Energy Corporation and China National Nuclear Corporation signed an MoU to explore co-investment opportunities in new international nuclear power plants. Lastly, the Ethiopian Electric Utility and Huawei signed an agreement to provide solar energy access to off-grid communities in Ethiopia.

However, the challenge is whether those memorandums of understanding and deals will be implemented and achieve the desired outcomes or will fail to do so as in the case of the South Africa-Russia nuclear deal. The deal, proposed in 2014, was a significant energy collaboration within the BRICS+ framework that ultimately did not materialize. It involved Russia's Rosatom State Atomic Energy Corporation providing South Africa with up to eight nuclear reactors, which would have contributed significantly to the country's energy mix. However, the deal was met with widespread criticism and legal challenges, leading to its cancellation. This deal was estimated to cost around $76 billion, a mammoth investment that raised concerns about its impact on South Africa's economy and debt-to-GDP ratio (Karyn & Pearson, 2022). The negotiation process was criticized for lacking transparency, with allegations of bypassing proper procurement procedures and potential corruption (Karyn & Pearson, 2022). There was significant public opposition from opposition political parties to the deal, including protests and legal challenges from civil society groups concerned about environmental risks and financial implications (Mpungose, 2019). At the time, South Africa had surplus energy capacity, and the additional power from nuclear energy was not deemed necessary (Eberhard, 2017).

But how does this translate to startups and youth? The expansion of BRICS nations offers tremendous opportunities for startups and small business owners. Russia for example has seen a 25.6% annual increase in the rate of new businesses that are being created going from 1.3mil in 2006 (UHY, 2010) to 3.2 million new businesses registered in 2010. This signifies their commitment to build a conducive environment for startups to thrive. The information available however speaks of high concentrations of business opportunities amongst the state-owned entities, government agencies, and multinational corporations.

One notable example that could be replicated between BRICS countries in the energy sector is the Scale Out For Impact (SOFI) programme, a joint initiative between South Africa and the United Kingdom. Funded by Innovate UK, Newton Fund, and the Technology Innovation Agency (TIA) of South Africa, and supported by the Black Business Council and the Department of Science and Innovation (DSI), the program focused on addressing challenges exacerbated by the COVID-19 pandemic through an immersive six-week initiative that engaged 38 innovators (Technology Innovation Agency, 2021).

These partnerships facilitate the exchange of knowledge and technology, reflecting the cultural and contextual nuances of the regions involved. They serve as models for cross-border ventures in the energy sector. The Council for Scientific and Industrial Research (CSIR, 2022) emphasizes the importance of such frameworks in empowering SMEs by providing them with the necessary skills, technical expertise, and innovative platforms, supporting SMEs in the energy market and promoting sustainable economic activities crucial for the energy transition.

Recently BRICS countries have started pushing similar initiatives. India launched a BRICS startup forum in 2023. (Goyal; 2023). This is the first step by the BRICS nations in realizing the need to create a conducive and inclusive startup environment that will ensure that youth and women-led businesses get access to funding and opportunities of trade amongst the BRICS Nations. That said there is limited information on successful case studies for startups that can be mentioned at this point.

Trend 6: Emerging Technologies and Business Models

Artificial Intelligence

Despite its transformative potential, AI adoption in the energy sector faces resistance due to concerns over explainability and a knowledge gap hindering widespread integration (Rozite et al.). Successful AI applications demonstrate its value, such as optimizing renewable energy storage and distribution, predicting equipment failures, and enhancing demand forecasting across complex grids. Responsible AI development and training datasets are crucial to building trust in these technologies (Sankarananth et al.).

BRICS' evolving digital landscape presents a unique opportunity for youth and entrepreneurs. The global AI energy market is projected to reach $7.78 billion in 2024 (Statista, 2023). Currently, AI increases energy production efficiency by 10%-15% and reduces carbon emissions through AI-driven management of energy production and market demand prediction (S&P Global, 2023).

However, BRICS startups must consider limitations such as outdated software architecture (Cohen, 2023). Given the significant development costs for proprietary AI models, startups must prioritize leading AI functions, including service operations, product/service development, and marketing and sales (Statista, 2024). Startups should focus on AI-powered demand forecasting, predictive maintenance for distributed energy systems, and optimization tools tailored to microgrids. Collaborations with research institutions or leveraging open-source AI frameworks could offer cost-effective entry points.

Blockchain Technology (BCT)

Blockchain Technology (BCT) holds significant potential for energy startups led by youth and entrepreneurs in BRICS countries by enabling energy trading, market operations, local energy market adoption, microgrid automation, secure data transfer, and resource sharing while eliminating third-party intermediaries (Svetec et al., 2019; Andoni et al., 2019). BCT can also integrate with technologies such as Machine Learning and IoT (Mololoth et al., 2023), facilitating simple billing systems for EVs, thereby providing widespread access to charging stations (PwC, 2016). The adoption of BCT is expected to lead to new business models within the energy sector, creating ample opportunities for young entrepreneurs.

A survey by Andoni et al. (2019) classified 140 blockchain projects in energy into various applications, demonstrating the technology's versatility. Since its inception by Satoshi Nakamoto in 2008, BCT has been considered disruptive across multiple sectors, including energy (Nakamoto, 2008). PwC (2017) identified BCT as the biggest digital disruptor expected in the next half-decade. A survey by the World Energy Council and PwC New Zealand found that 14 out of 15 energy companies anticipate BCT will drive decentralization and decarbonization in the energy industry (World Energy Council, 2018).

BCT is projected to boost global GDP by USD 1.76 trillion (1.4% of global GDP) by 2030, with 10-15% of global infrastructure expected to utilize BCT (PwC, 2020). The estimated GDP contributions by 2030 for China, India, and UAE are USD 440 billion, USD 62 billion, and USD 6 billion, respectively, with job creation figures of 11.4 million, 3.2 million, and 0.086 million (PwC, 2020). This economic boost presents significant opportunities for young entrepreneurs in BRICS countries to innovate and lead new energy startups.

BCT's application in the energy market is promising, with market values projected to grow significantly. IMARC (2023) forecasts the energy market value to increase from USD 1.3 billion in 2023 to USD 20.16 billion by 2032, with a CAGR of 34.38%. Persistence Market Research Group (2024) projects an increase from USD 6.4 billion in 2023 to USD 31.73 billion by 2030, with a CAGR of 25.6%. Despite its potential, BCT faces challenges that must be addressed to fully harness its capabilities.

Green Hydrogen

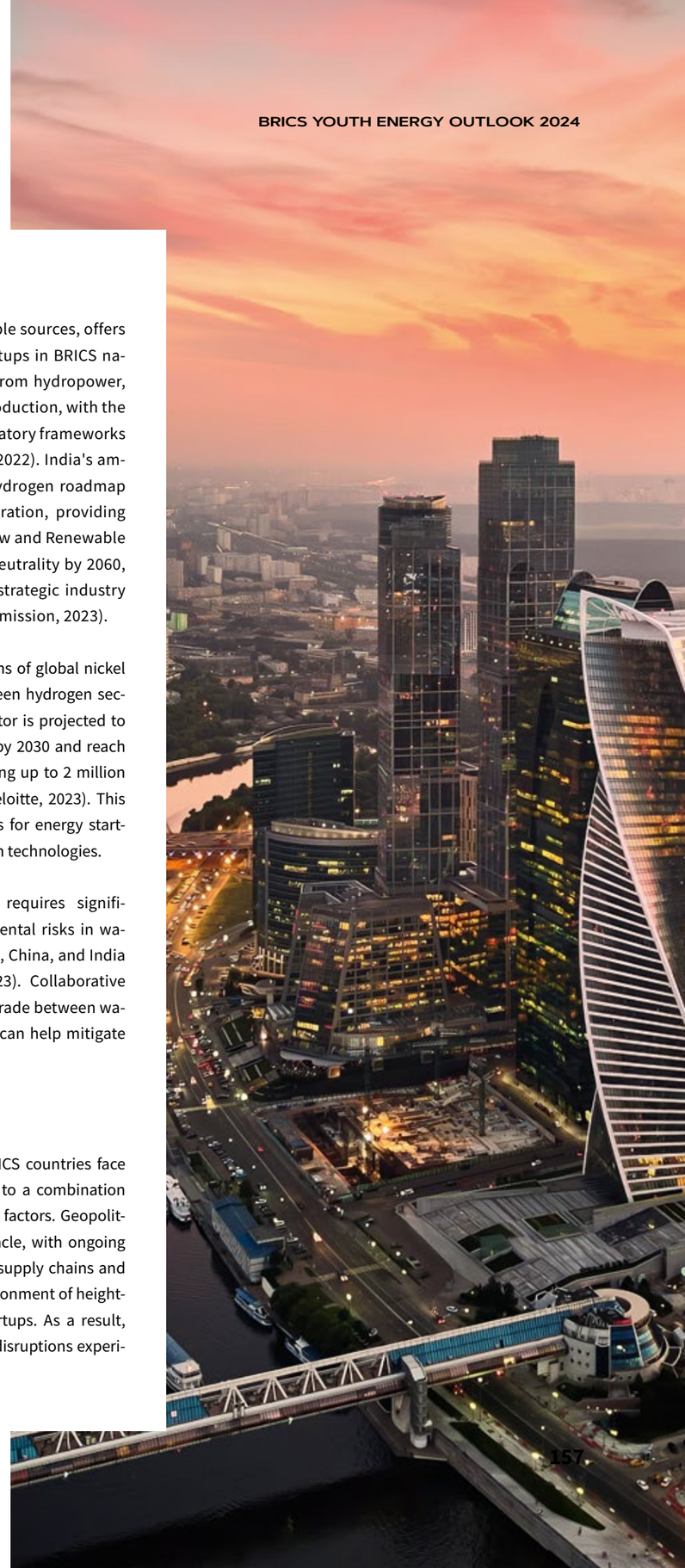
Green hydrogen, produced from renewable sources, offers significant opportunities for energy startups in BRICS nations. Brazil, with 60% of its electricity from hydropower, is well-positioned for green hydrogen production, with the government developing supportive regulatory frameworks (Brazilian Ministry of Mines and Energy, 2022). India's ambitious renewable energy targets and hydrogen roadmap emphasize solar and wind power integration, providing fertile ground for startups (Ministry of New and Renewable Energy, 2023). China, targeting carbon neutrality by 2060, has identified green hydrogen as a key strategic industry (National Development and Reform Commission, 2023).

BRICS countries control significant portions of global nickel and PGM production, essential for the green hydrogen sector (de Bolle, 2023; Geeks, 2024). The sector is projected to surpass the value of the liquid gas trade by 2030 and reach US$1.4 trillion annually by 2050, supporting up to 2 million jobs per year between 2030 and 2050 (Deloitte, 2023). This growth presents substantial opportunities for energy startups to innovate and lead in green hydrogen technologies.

However, green hydrogen production requires significant energy and water, posing environmental risks in water-scarce regions like Egypt, South Africa, China, and India (Inter-American Development Bank, 2023). Collaborative efforts, such as energy and virtual water trade between water-scarce and renewable-rich countries, can help mitigate these risks.

Scenario Analysis

Negative: By 2050, energy startups in BRICS countries face persistent and escalating challenges due to a combination of political, economic, and environmental factors. Geopolitical instability remains a significant obstacle, with ongoing regional conflicts. These conflicts disrupt supply chains and deter foreign investment, creating an environment of heightened uncertainty and risk for energy startups. As a result, many startups close down, similar to the disruptions experienced during the COVID-19 pandemic.



Young Awards Winners from the 2019 BRICS Youth Energy Summit by BRICS YEA

Regulatory complexities and bureaucratic delays persist in countries like Brazil, Russia, India, and South Africa. These hurdles increase operational costs and delay project implementation, stifling innovation and growth in the energy sector. The BRICS+ collaboration efforts, aimed at enhancing policy coordination and joint investments, fail to gain significant momentum due to geopolitical tensions and internal competition among member nations. Divergent interests and varying levels of development within the group hinder the formation of a unified policy framework, limiting the global influence and effectiveness of BRICS+ initiatives.

Economically, the global outlook remains bleak with slow growth and persistent high inflation. The global economy struggles to recover from the recent recession, and hyperinflation continues to affect consumer spending and investor confidence. These conditions deter investment in energy startups as investors seek safer, more stable returns. High interest rates and economic uncertainties create a challenging investment climate, resulting in a scarcity of funds for innovation and expansion. Many startups find it difficult to survive, let alone scale their operations, as the financial barriers remain insurmountable (IMF, 2023; J.P. Morgan, 2024).

Environmental challenges exacerbate the situation. The BRICS nations continue to experience severe impacts of climate change, including more frequent and intense natural disasters. These events cause significant economic and social disruptions, further straining already limited resources and hindering the development of sustainable energy solutions. Water scarcity becomes a critical issue, particularly in Egypt, South Africa, China, and India. The high water requirements for green hydrogen production and other renewable technologies exacerbate existing shortages. (Inter-American Development Bank, 2023).

The adoption of emerging technologies such as Artificial Intelligence (AI), Internet of Things (IoT), and Blockchain remains limited due to high costs and a lack of skilled workforce. BRICS countries struggle to keep pace with advancements, and the lack of comprehensive legal frameworks and data protection regulations further impedes the implementation of these technologies (Cohen, 2023; PwC, 2016).

The unsustainable development trajectory experienced by the Global North, built upon the reckless use of non-renewable resources, has placed a disproportionate burden on the Global South. The Global South's minimal historic contribution to climate change juxtaposes the significant environmental challenges it faces today. The Paris Agreement, signed in 2015, highlighted the urgency of addressing climate change, but by 2050, the BRICS+ nations find themselves grappling with the consequences of inadequate action (UNFCCC, 2015). The addition of five countries to the BRICS group has increased cooperation among rapidly developing economies, but a lack of unified voice and effective collaboration limits the group's scope and visibility on the global stage.

Despite initial efforts, the BRICS+ collaboration fails to gain significant momentum due to geopolitical tensions and internal competition among member nations. Divergent interests and varying levels of development within the group hinder the formation of a unified policy framework, limiting the global influence and effectiveness of BRICS+ initiatives. These conditions create a challenging environment for energy startups, making it difficult to attract investment and scale their operations. The lack of political will to phase out fossil fuels results in a persistent reliance on traditional energy sources, stifling innovation in renewable technologies. The financial barriers, regulatory complexities, and geopolitical instability create a scenario where energy startups struggle to survive, let alone thrive.

Conservative: By 2050, energy startups in BRICS countries navigate a landscape where incremental progress combats enduring challenges. Political instability disrupts supply chains and deter investments. Regulatory complexities and bureaucratic inertia in Brazil, Russia, India, and South Africa elevate operational costs, slowing project implementations. The economic climate shows cautious optimism post-recession, with moderate investment flow toward energy startups amid high inflation and economic uncertainties. The BRICS New Development Bank (NDB) continues to play a crucial role in financing capital-intensive energy projects, promoting sustainable development, and mitigating debt crisis obstacles. However, accessing funding remains a challenge for many startups.

This results in a conservative pace of innovation and expansion for startups, struggling to scale operations. Environmentally, the severe impacts of climate change, such as increased natural disasters, strain resources and disrupt economic activities. Water scarcity, especially critical in Egypt, South Africa, China, and India, complicates the sustainable scaling of green hydrogen and other renewable technologies.

Despite these challenges, the decline in clean energy technology costs opens growth avenues. Renewable energy investments in BRICS, led by Brazil, India, and China, have moderately increased by 20% from 2020 levels. Saudi Arabia and the UAE make substantial investments in renewable energy, reducing reliance on fossil fuels and boosting their global energy leadership.

In terms of sector-specific growth, solar and wind energy startups see the most significant advancements, driven by falling technology costs and supportive government policies. Solar power capacity in BRICS nations reaches a combined

total of 1,200 GW by 2050, while wind energy capacity hits 800 GW, marking a substantial increase from 2020 levels (International Energy Agency, 2022). The number of energy startups in these sectors grows by 30%, with many achieving significant market penetration due to technological advancements and increased investor confidence.

However, sectors like green hydrogen and biomass face slower growth due to technological and infrastructural challenges. Green hydrogen sees moderate growth, primarily in Brazil, India, and China, where significant investments are made in production facilities. However, water scarcity and high production costs limit its widespread adoption. By 2050, green hydrogen accounts for 5% of the energy mix in these countries, with energy startups focusing on innovative solutions to overcome production challenges. Biomass energy startups face challenges in scaling up due to the complexities of sourcing and processing organic materials sustainably.

Emerging technologies like AI, IoT, and Blockchain enhance energy efficiency and grid management, integrated into 50% of new energy projects by 2050. Electric vehicles (EVs) see significant growth in China and India, fueled by supportive policies and consumer demand, leading to a 50% increase in EV startups.

In Africa, South Africa leads the way, achieving a 35% increase in renewable energy startups by 2050. Government initiatives and international partnerships drive investments in solar and wind energy, pushing installed capacities to 70 GW and 30 GW respectively. In Egypt, despite water scarcity challenges, solar energy investments grow by 25%, supported by technological advancements and foreign investments. Ethiopia, although hampered by political instability, sees progress in geothermal energy projects, increasing capacity to 5 GW. However, the broader African continent continues to struggle with infrastructure and investment challenges, limiting the overall growth of energy startups.

Innovative: By 2050, energy startups in BRICS countries navigate a dynamic landscape, characterized by remarkable innovation and robust collaboration. While political challenges remain, it has significantly improved, with economic interests and diplomatic efforts reducing conflicts in regions like Ethiopia and easing tensions between Egypt and Ethiopia over the Grand Renaissance Dam. This stability fosters a favorable environment for international investments and partnerships. The inclusion of additional Global South countries into the BRICS+ coalition, such as Nigeria, and Indonesia, further strengthens the group's influence.

A key driver of this transformation is a newly established BRICS unified currency, facilitating efficient trade among BRICS nations. This currency innovation enhances economic stability and reduces transaction costs, boosting investor confidence and increasing cross-border investments in energy projects. This contributes to an annual growth rate of 6% in renewable energy investments across BRICS nations, totaling $1.8 trillion by 2050.

Knowledge transfer initiatives play a crucial role in the rise of the Global South as a leader in the energy sector. Collaborative programs between BRICS countries lead to significant advancements in research and development (R&D) and technology deployment. It resulted in a 40% cost reduction in green hydrogen technology, making it a viable energy source accounting for 20% of the energy mix in BRICS countries, with production facilities widespread across Brazil, India, South Africa, Russia, China, Egypt, and UAE.

The BRICS New Development Bank (NDB) funds over $500 billion in renewable energy projects, focusing on solar, wind, green hydrogen, biomass, and carbon sequestration technologies. These investments drive a 50% increase in renewable energy capacity across BRICS nations, with solar power capacity reaching 2,000 GW and wind energy capacity hitting 1,500 GW by 2050. Economically, the outlook for BRICS countries is highly positive. The rise of the Global South balances global power dynamics, with BRICS nations becoming major exporters of clean energy to the Global North, reaching a 60% energy exports increase, significantly boosting their GDP.

Green bonds and carbon credit markets have matured, providing startups with new financing mechanisms. The global green bond market is projected to reach $5 trillion by 2050, with BRICS countries contributing $1.5 trillion. This influx of capital has enabled startups to scale rapidly, innovate, and compete globally.

In terms of sector-specific growth, solar and wind energy startups see the most significant advancements, driven by falling technology costs and supportive government policies. Solar power capacity reaches a combined total of 2,000 GW by 2050, while wind energy capacity hits 1,500 GW. The number of energy startups in these sectors grows by 50%, with many achieving significant market penetration due to technological advancements and increased investor confidence. Biomass energy startups also experience growth, particularly in Brazil and India, where agricultural waste and other organic materials are abundant.

The integration of advanced technologies like Artificial Intelligence (AI), Internet of Things (IoT), and Blockchain revolutionizes energy management and efficiency. AI and IoT are integrated into 80% of energy projects, optimizing energy distribution and reducing wastage by 30%. Blockchain technology ensures transparent and secure energy transactions, fostering trust and boosting market participation.

By 2050, Saudi Arabia, the UAE, Egypt, Iran, and Ethiopia make significant strides in renewable energy adoption and startup growth. Saudi Arabia and the UAE leverage substantial financial resources to invest heavily in solar and wind energy, hydrogen production, and advanced battery storage, diversifying their economies and reducing dependence on fossil fuels. This positions them as leaders in the global energy transition, with energy startups in these countries growing by 35% due to supportive policies and significant capital influx. Egypt emerges as a solar energy hub, reaching 50 GW in solar capacity, driven by favorable policies and international investments. Iran harnesses its vast solar and wind potential, with renewables constituting 20% of its energy mix. Ethiopia capitalizes on geothermal and hydroelectric resources, becoming a leading clean energy exporter in Africa.

3. RECOMMENDATIONS FOR POLICY MAKERS

1. Political Stability and Diplomatic Efforts

- **Promote Diplomatic Resolutions:** Encourage diplomatic initiatives to resolve ongoing conflicts and geopolitical tensions.
- **Strengthen Regional Cooperation:** Foster regional cooperation through regular BRICS summits focused on conflict resolution, economic collaboration, and environmental sustainability. Organizing annual BRICS Energy Summits to discuss and resolve geopolitical issues affecting energy projects can enhance stability and collaboration.
- **Establish a BRICS Peace and Stability Fund:** Create a fund to support peace-building initiatives and stability projects in conflict-prone areas, ensuring a conducive environment for energy startups.

2. Regulatory and Policy Support

- **Simplify Regulatory Frameworks:** Streamline regulatory processes across BRICS nations to reduce bureaucratic delays and operational costs for startups. For instance, India can share its experience in simplifying startup regulations with Brazil, South Africa, and Russia, fostering a more startup-friendly environment.
- **Implement Consistent Policies:** Develop consistent policies that promote renewable energy investments, such as standardized feed-in tariffs, tax incentives, and subsidies. A unified BRICS feed-in tariff policy can encourage investment in renewable energy across all member nations, similar to South Africa's successful feed-in tariff system.
- **Enhance Policy Coordination:** Establish a BRICS Policy Coordination Committee to ensure alignment of national policies with regional goals and facilitate joint investments in energy projects. This committee can coordinate initiatives like the solar power expansion seen in China and India, ensuring consistent support across nations.

3. Economic and Financial Mechanisms

- **Establish a BRICS+ Unified Currency:** Implement a unified currency to facilitate efficient trade and reduce transaction costs, boosting investor confidence and cross-border investments. A BRICS digital currency, modeled after the Euro, can help reduce transaction costs and exchange rate volatility.
- **Create a BRICS+ Green Investment Fund:** Develop a fund dedicated to financing renewable energy startups, focusing on solar, wind, green hydrogen, and biomass projects. Contributions from Saudi Arabia and UAE can help finance

renewable energy startups across BRICS nations, similar to their investments in global clean energy projects.

- **Expand Green Bonds and Carbon Credit Markets:** Promote the issuance of green bonds and the development of carbon credit markets to provide startups with new financing mechanisms. China's successful green bond market can be expanded to other BRICS nations, with the support of the BRICS New Development Bank.

4. Infrastructure and Market Access

- **Invest in Renewable Energy Infrastructure:** Allocate funds for the development and upgrading of renewable energy infrastructure, including grid expansion and modernization. A BRICS infrastructure development program, modeled after China's Belt and Road Initiative, can focus on renewable energy projects like solar farms and wind parks in Brazil and South Africa.
- **Support Decentralized Energy Solutions:** Encourage the deployment of decentralized renewable energy systems, particularly in rural and underserved areas. Promote the deployment of microgrids in rural areas of India and Africa, leveraging successful models from startups like Husk Power Systems in India.
- **Facilitate Market Access:** Develop supportive ecosystems that include distribution networks, logistical support, and market access for energy startups. Create a BRICS Renewable Energy Marketplace, an online platform where startups can showcase their technologies and connect with investors and customers across BRICS countries.

5. Technological Innovation and Knowledge Transfer

- **Promote R&D Collaborations:** Foster collaborative research and development programs between BRICS+ countries to drive advancements in renewable energy technologies. Establish joint research centers for renewable energy technologies in universities across BRICS nations, similar to the collaboration between China and Brazil on satellite technology.
- **Support Emerging Technologies:** Encourage the adoption of AI, IoT, and Blockchain in energy management and distribution, providing grants and subsidies for startups developing these technologies. Provide grants for startups developing AI-driven energy solutions, such as predictive maintenance tools used by energy startups in India and China.
- **Create Innovation Hubs**: Establish innovation hubs and tech parks to provide startups with access to cutting-edge technologies, mentorship, and networking opportunities. Set up innovation hubs in major cities like São Paulo, Johannesburg, Cairo and Beijing, offering co-working spaces, mentorship programs, and access to funding for energy startups.

6. Educational and Training Programs

- **Develop Training Programs:** Collaborate with academic institutions to create educational programs focused on renewable energy technologies and entrepreneurship. Collaborate with top universities in India and China to create specialized courses in renewable energy technologies, tailored for entrepreneurs from BRICS nations.
- **Offer Scholarships and Grants:** Provide scholarships and grants for students and young entrepreneurs pursuing studies in renewable energy and related fields. Establish BRICS+ scholarships for students pursuing degrees in renewable energy, funded by contributions from member nations' education ministries.

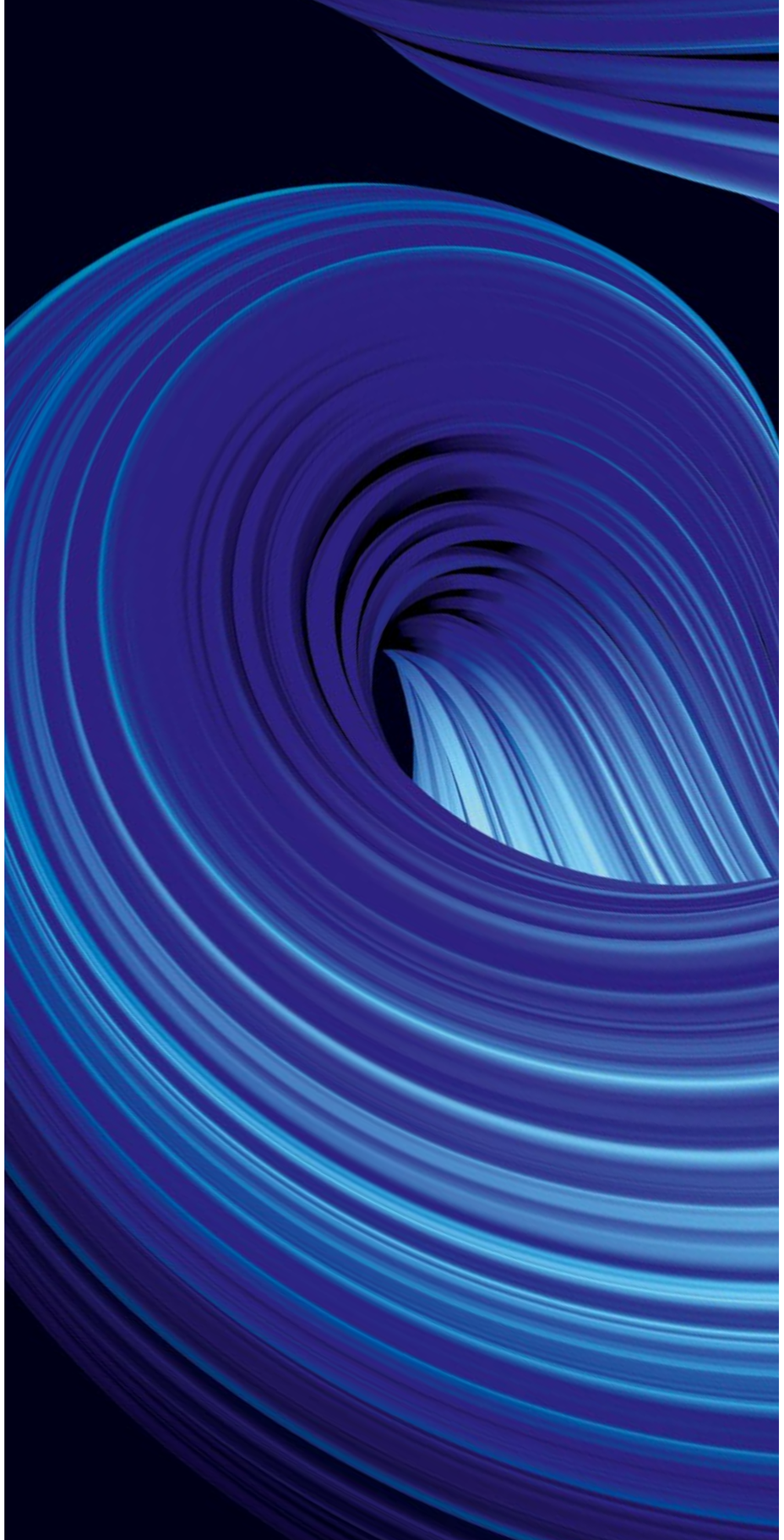
7. Social Entrepreneurship and Community Engagement

- **Encourage Social Entrepreneurship:** Support startups that focus on addressing social challenges related to energy access, particularly in underserved communities. Support startups that provide affordable solar solutions to rural communities in India and Africa, similar to the business model of d.light.
- P**romote Community-Based Projects:** Facilitate partnerships between energy startups and local NGOs to implement community-based renewable energy solutions. Partner with NGOs to implement solar and wind projects in underserved regions, leveraging the success of community solar projects in Brazil and South Africa.
- **Create Community Impact Funds:** Establish funds to support startups providing affordable and sustainable energy solutions to marginalized populations. Establish a BRICS Community Impact Fund to finance startups working on sustainable energy solutions for marginalized communities, similar to the approach of social impact investors in the Global North.

Links & resources _

The BRICS Youth Energy Agency is committed to reducing its environmental foot-print. In support of this commitment, we leverage electronic publishing options and print-on-demand technology. Together, these initiatives enable print runs to be lowered and shipping distances decreased, resulting in reduced paper consumption, chemical use, greenhouse gas emissions, and waste.

As long as we cannot refuse to print this annual edition of the BRICS Youth Energy Outlook 2024, we decided to allocate all the sources of informations, i.e. lists of references, figures and tables, which follow the main content at our web server. You can access the data by scanning the QR code below.



BRICS YOUTH ENERGY 2024 OUTLOOK

Disclaimer _

BRICS Youth Energy Outlook 2024
by BRICS Youth Energy Agency

This publication reflects the views of the developers' teams but does not necessarily reflect those of individual BRICS member countries, neither the BRICS Secretariat or BRICS YEA. BRICS YEA makes no warranties or representations, express or implied, as to its accuracy, currency or comprehensiveness and assumes no liability or responsibility for any error or omission and shall not be responsible for any use of, or reliance on, the publication.

The BRICS Youth Energy Outlook contains forward-looking statements which involve risks and uncertainties because they relate to events, and depend on many circumstances, that will or may occur in the future. Actual outcomes may differ depending on a variety of factors and BRICS YEA disclaims any obligation to update this presentation.

All material presented in figures and tables is derived from data and analysis taken from indicated in references sources.

This publication and any map included herein are without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

The Outlook itself is not a part of collaboration with any of the institutions mentioned but individuals who are from those institutions.

Report citation:

BRICS Youth Energy Agency (BRICS YEA). BRICS Youth Energy Outlook 2024. September 2024. Available from: www.yeabrics.org

BRICS Youth Energy Outlook 2024 is an international annual project by the BRICS Youth Energy Agency aimed at delivering a view of young people on the energy challenges that BRICS countries will be facing in the nearest future. The Outlook is developed by teams of researchers, who are students, assistant researchers or young professionals representing leading universities and energy-related organizations from BRICS countries. The Outlook has gained much authority and recognition by the BRICS Energy Ministries as it reflects the view of the new generation of the industries' leaders and professionals.

BRICS YOUTH ENERGY AGENCY
YOUNG EXPERT GROUPS

Slavyanskaya Square, House 2/5, Moscow
109240, Russian Federation

T +7-967-139-72-59
E info@yeabrics.org

www.yeabrics.org