BRICS and the Green Industrialization of the Future

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SUMMARY

EXECUTIVE SUMMARY

The global green transition is unfolding along deeply unequal lines. Many countries in the Global South confront the **triple challenge of decarbonizing their economies, adapting to intensifying climate impacts, and advancing inclusive development**—often without access to affordable technologies or strong domestic capabilities. **Green technology transfers are essential** to closing this gap. Yet, traditional North–South transfers have too often reinforced dependency and failed to build lasting industrial capacity.

BRICS countries[1] have an opportunity to chart a different path. By combining public investment, industrial policy, and South–South cooperation, they are already reshaping how green technologies flow, adapt, and scale in the Global South. From China's leadership in electric vehicle (EV) manufacturing, to Brazil's biofuels, to Indonesia's strategic use of critical minerals for domestic upgrading, BRICS countries are no longer passive recipients—they are active **agents of green globalization.**

But outcomes remain uneven and reveal a key lesson: green technology transfer only delivers when embedded in coherent national strategies, supported by the appropriate institutions, and oriented toward long-term upgrading—not just short-term investment.

As geopolitical fragmentation intensifies, green industrial policy is being weaponized. Export controls and supply chain restrictions—especially in critical minerals and battery technologies—are turning cooperation into competition. In this fractured context, **BRICS countries must seize the moment to build a more equitable model of global green development.** South–South partnerships can offer regionally embedded alternatives that prioritize co-production, local training, and sovereign capacity-building—breaking with the extractive logic of the past.

To realize this vision, BRICS countries must act. The imperative is not just to attract green investment, but to shape the rules of engagement. This means using policy tools strategically: local content requirements, joint ventures, targeted public financing, technology training programs, and green public procurement must all be deployed to maximize local value capture.

1. By BRICS countries we refer to the original members of this group—Brazil, Russia, India, China and South Africa— as well as the additional members admitted in 2024 and 2025: Egypt, Ethiopia, Indonesia, Iran, and the United Arab Emirates.

We recommend two priority actions

1. Strengthen South–South cooperation and BRICS-led platforms as vehicles for green technology transfer

BRICS countries should scale joint research, technical training, and co-development initiatives that deepen local capabilities and shift away from dependency-driven models. Partnerships should include domestic industry (including downstream suppliers), development banks, and innovation agencies to ensure long-term impact.

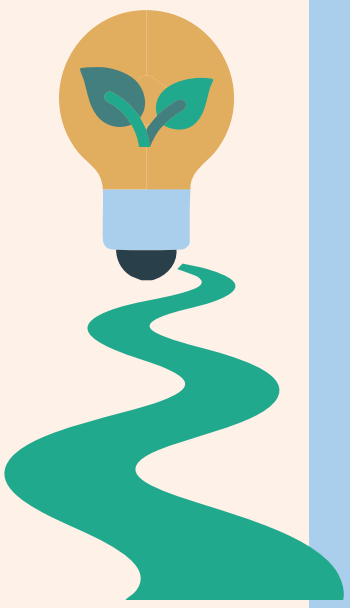
2. Advance BRICS institutional coordination to counter geopolitical fragmentation and restrictive intellectual property regimes

Institutions such as the New Development Bank, the BRICS Energy Research Cooperation Platform, and national development banks must lead in financing green technology flows, supporting joint research and development, and enabling inclusive industrialization across the bloc.

BRICS countries stand at a crossroads. As both importers and, increasingly, exporters of green technology, they have a unique opportunity to shape a more inclusive and resilient green globalization. But this future will not emerge automatically. It must be built—through deliberate policy, coordinated action, and a shared commitment to development that is both climate-aligned and socially just.

Keywords: BRICS, Green Industrialization, Green Technology Transfer, South-South Cooperation

1. GREEN TECHNOLOGY TRANSFERS: NECESSITY AND POTENTIAL FOR THE GLOBAL SOUTH



Green technology transfers — whether in renewable energy, electric mobility, battery storage, or low-carbon industrial processes — offer a pathway to enable the Global South to navigate the triple challenge of mitigating the effects of climate change, adapting to its escalating physical impacts, and simultaneously achieving higher levels of development. Such transfers can enable the Global South not only to decarbonize but to industrialize more inclusively, leapfrogging carbon-intensive development paths through local innovation[2,3]. Indeed, without timely and effective technology transfers, the Global South risks excessively relying on polluting sectors or being relegated to extractive roles in the emerging global green economy[4,5].

Yet such technology transfers are rarely automatic or equitable. The way they have historically been realised — transfers going from the Global North to the Global South — has often reinforced dependency rather than fostered autonom[6,7],. Northern firms and governments have tended to retain control

2. Fu, Xiaolan, and Jing Zhang. 2011. "Technology Transfer, Indigenous Innovation and Leapfrogging in Green Technology: The Solar-PV Industry in China and India." *Journal of Chinese Economic and Business Studies* 9 (4): 329–47. https://doi.org/10.1080/14765284.2011.618590.

3. Weko, Silvia. 2024. "Is Clean Technology Transfer an Empty Promise?" *SDG Action* (blog). July 10, 2024. https://sdg-action.org/is-clean-technology-transfer-an-empty-promise/.

4. Hochstetler, Kathryn. 2025. "The Green Economy and the Global South." *Regulation & Governance* 19 (2): 515–19. https://doi.org/10.1111/rego.70008.

5. UNCTAD. 2023. *Technology and Innovation Report 2023: Opening Green Windows – Technological Opportunities for a Low-Carbon World*. United Nations. https://unctad.org/publication/technology-and-innovation-report-2023

6. Athreye, Suma, Vinish Kathuria, Alessandro Martelli, and Lucia Piscitello. 2023. "Intellectual Property Rights and the International Transfer of Climate Change Mitigating Technologies." *Research Policy* 52 (9): 104819. https://doi.org/10.1016/j.respol.2023.104819.

7. Chang, Ha-Joon, and Ilene Grabel. 2004. *Reclaiming Development*. London: Zed Books.

over intellectual property, dictate licensing terms, and extract value through global value chains that marginalize local innovation systems[8]. As a result, many developing countries have encountered obstacles in converting technology imports into long-term industrial capabilities[9].

This pattern is not inevitable. Emerging South–South cooperation, particularly among BRICS countries, offers a potentially more balanced model of technology exchange — one that emphasizes mutual benefit, local adaptation, and developmental spillovers[10]. Several BRICS countries have already drawn on technology transfers to accelerate their industrialization — especially China in solar and EV manufacturing — and some are now in a position to become green technology exporters in their own right[11].

8. Goldthau, Andreas, Laima Eicke, and Silvia Weko. 2020. "The Global Energy Transition and the Global South." In *The Geopolitics of the Global Energy Transition*, edited by Manfred Hafner and Simone Tagliapietra, 319–39. Springer International Publishing. https://doi.org/10.1007/978-3-030-39066-2_14.

9. UNCTAD. 2023. Technology and Innovation Report 2023: *Opening Green Windows – Technological Opportunities for a Low-Carbon World*. United Nations. https://unctad.org/publication/technology-and-innovation-report-2023

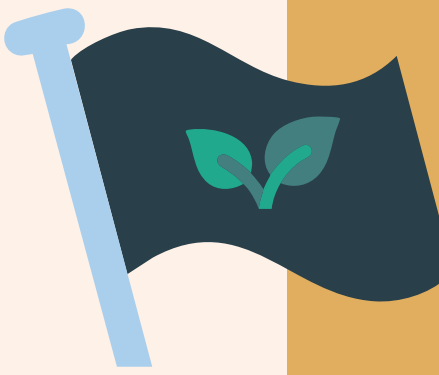
10. Chuanhong, Zhang, and Lin Haisen. 2024. "China's Climate and Energy Partnerships in the Global South." *SAIIA Policy Briefing* (blog). 2024. https://saiia.org.za/research/chinas-climate-and-energy-partnerships-in-the-global-south/.

11. Goldthau, Andreas, Laima Eicke, and Silvia Weko. 2020. "The Global Energy Transition and the Global South." In *The Geopolitics of the Global Energy Transition*, edited by Manfred Hafner and Simone Tagliapietra, 319–39. Springer International Publishing. https://doi.org/10.1007/978-3-030-39066-2_14.

2. BRICS AS STRATEGIC ACTORS IN GREEN TECHNOLOGICAL DEVELOPMENT

The BRICS countries stand out as pivotal players in the evolving global green industrial landscape. Historically, each has harnessed international technology transfers to accelerate industrial development, often through a strategic combination of foreign direct investment (FDI), public Research and Development (R&D) investment, and selective protectionist measures to build domestic capacities[12]. Their experience reflects a broader principle: the successful use of green technology transfers is neither automatic nor neutral — it is mediated by institutional choices and political priorities by the country seeking the transfer.

Although not the only Global South country involved in green technology transfers, China's engagement is the most prominent case. Its firms are now key players in South–South green technology flows, exporting solar, wind turbine and EV technologies across Latin America, Africa, and Southeast Asia, often backed by Chinese development finance[13]. In order for China to achieve technological superiority and globally diffuse its innovations, long-term state planning was essential: firms such as BYD, CATL, and LONGi were nurtured through coordinated industrial policies, including public procurement, export discipline, joint ventures, and local content requirements[14]. Once these firms were able to compete globally, they also started forming partnerships with other firms around the world that involved technology transfers for mutual benefit.



12. Fu, Xiaolan, and Jing Zhang. 2011. "Technology Transfer, Indigenous Innovation and Leapfrogging in Green Technology: The Solar-PV Industry in China and India." *Journal of Chinese Economic and Business Studies* 9 (4): 329–47. https://doi.org/10.1080/14765284.2011.618590.

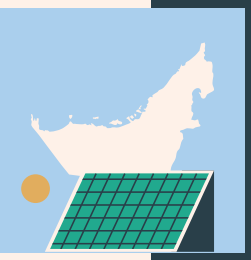
13. Chuanhong, Zhang, and Lin Haisen. 2024. "China's Climate and Energy Partnerships in the Global South." *SAIIA Policy Briefing* (blog). 2024. https://saiia.org.za/research/chinas-climate-and-energy-partnerships-in-the-global-south/.

14. Shepherd, Christian, and Jinpeng Li. 2025. "How China Came to Dominate the World in Renewable Energy." *The Washington Post*, March 3. https://www.washingtonpost.com/climate-solutions/2025/03/03/china-renewable-energy-green-world-leader/.

Of course, China is not alone in leveraging domestic innovation to foster deeper ties with the Global South and diffuse green production capabilities.

Brazil, drawing on decades of public investment in the Brazilian Agricultural Research Corporation (Embrapa) and the majority state-owned oil company Petrobras, has become a global benchmark in ethanol production and flex-fuel vehicle technology[15]. Its biofuel expertise is now actively exported to Sub-Saharan Africa and Southeast Asia, where similar agro-climatic conditions might enable technological adaptation[16].

Indonesia — the world's largest producer of nickel, a critical input for EV batteries — is now using its resource endowment to drive industrial policy. By imposing export restrictions on raw nickel and requiring in-country processing, the government has incentivized FDI into domestic refining and battery production, particularly from Chinese and South Korean firms[17].



The United Arab Emirates (UAE) and Saudi Arabia, while traditionally fossil-fuel exporters, are investing heavily in solar energy, green hydrogen, and smart grid infrastructure. For instance, Masdar, an UAE state-owned renewable energy company, has become a major international renewables investor, with projects across Egypt, South Africa, Indonesia, and several small island developing states.

15. Losekann, Luciano, and Amanda Tavares. 2021. *Potential for Cooperation in Green Technology Transfer Between BRICS Countries*. IPEA Repositório. https://repositorio.ipea.gov.br/bitstream/11058/15558/1/en_PRB74_Potential_for_cooperation.pdf

16. Rotberg, Robert. 2016. "Brazil Boosts Africa's New Future." *Africa and Asia: The Key Issues* (blog). March 31, 2016. https://robertrotberg.wordpress.com/2016/03/31/brazil-boosts-africas-new-future-2/.

17. Walker, Robert, and Hilman Palaon. 2025. "The Future of Indonesia's Green Industrial Policy." Lowy Institute. 2025. https://www.lowyinstitute.org/publications/future-indonesia-s-green-industrial-policy.

As these cases suggest, there is unlikely to be a one-size-fits-all approach to technology transfers, as these invariably depend on the peculiar domestic characteristics of the countries. Not all countries, for instance, possess abundant natural resources — such as Indonesia's nickel reserves — or enjoy access to ample financial resources — as in the case of the UAE. This means that the modalities of the global diffusion of green technological innovations will be inevitably varied.

More broadly, these examples illustrate that **BRICS countries are no longer merely recipients of green technologies.** They are reshaping global green value chains through outbound investment, technology export, and strategic industrial partnerships[18]. Their experiences point to an emerging model of South-led green globalization — one that differs from top-down, North-led frameworks and instead centers strategic agency in the Global South. BRICS countries now occupy a dual role: as beneficiaries of past technology transfers and as brokers of a more multipolar green technology order. Realizing this potential will depend on the institutional infrastructures they build to absorb, adapt, and diffuse these technologies at scale.

18. UNCTAD. 2023. *Technology and Innovation Report 2023: Opening Green Windows – Technological Opportunities for a Low-Carbon World.* United Nations. https://unctad.org/publication/technology-and-innovation-report-2023

3. INSTITUTIONAL PRECONDITIONS, GEOPOLITICAL FRAGMENTATION, AND THE FUTURE OF TECHNOLOGY TRANSFERS

The mere existence of green technologies does not necessarily translate into local development. What matters is whether recipient countries can extract knowledge spillovers, build linkages to domestic firms, and upgrade their position within global value chains. This requires robust institutional infrastructures — public R&D systems, strategic industrial policy, local content rules, innovation financing, and absorptive capacity in firms and training institutions. Countries that merely import green technologies without accompanying investments in domestic innovation systems or targeted industrial policy tend to remain locked in low-value-added assembly or resource extraction roles[19]. This can have direct socio-environmental negative spillovers, particularly for local communities and indigenous peoples[20]. Conversely, when countries combine technology inflows with policy instruments such as R&D tax incentives, directed credit, and public procurement, they are better able to foster technological upgrading and innovation diffusion. The cases of solar photovoltaics (PV) in China and biofuels in Brazil both illustrate how technology transfers, when embedded in supportive institutional ecosystems, can lead to globally competitive green industries.

For BRICS countries, building green technology ecosystems means investing in policy instruments that go beyond market liberalization. In China, for example, the South–South Climate Cooperation Fund, launched in 2015 and supported by $3.1 billion in pledged finance, aimed to deliver low-carbon infrastructure in partner countries and to create platforms for technology demonstration, training, and co-development[21]. Projects implemented under this framework —

19. Fu, Xiaolan, and Jing Zhang. 2011. "Technology Transfer, Indigenous Innovation and Leapfrogging in Green Technology: The Solar-PV Industry in China and India." *Journal of Chinese Economic and Business Studies* 9 (4): 329–47. https://doi.org/10.1080/14765284.2011.618590.

20. King, Nathan W. 2024. "A Less Rosy Green Energy Transition: How Indigenous Communities Are Being Ignored." *ClimaTalk* (blog). September 9, 2024. https://climatalk.org/2024/09/09/green-energy-projects-just-transition/.

21. Khor, Martin. 2016. "China's Boost to South-South Cooperation." The South Centre. 2016. https://www.southcentre.int/question/chinas-boost-to-south-south-cooperation/.

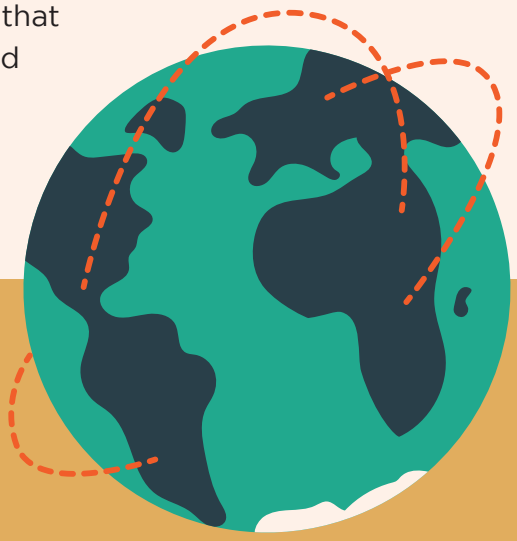
such as solar lighting systems in Ethiopia and hybrid power systems in Tonga — showcase how Chinese green technology is gradually being internationalized through institutionalized channels of cooperation and knowledge sharing. These examples demonstrate that the strategic use of public institutions can structure how foreign and domestic green technologies are absorbed and adapted.

The development of the institutional preconditions for green industrial upgrading relies not only on domestic factors, but also on the broader geopolitical environment. The latter is becoming increasingly volatile, thus altering the conditions under which green technology transfer can occur. The intensifying U.S.–China tech rivalry has already curtailed cross-border collaboration in key green sectors, with restrictions on semiconductors, batteries, and advanced manufacturing equipment now shaping the flow of capital and know-how[22]. This context exacerbates the challenges from global intellectual property regimes that constrain the Global South's ability to adapt and diffuse low-carbon technologies. Calls for reform under the United Nations Framework Convention on Climate Change's Technology Mechanism and Trade-Related Aspects of Intellectual Property Rights (TRIPS) flexibilities have so far not led to significant progress. Compounding these challenges is the weaponization of global supply chains — particularly in critical minerals and battery technologies — where export restrictions and security-driven controls are increasingly common. These dynamics reflect a broader trend toward fragmentation, where green industrial policy is used to further strategic competition rather than cooperation.

22. Bateman, Jon. 2022. "U.S.-China Technological 'Decoupling': A Strategy and Policy Framework." Carnegie Endowment for International Peace. 2022. https://carnegieendowment.org/research/2022/04/us-china-technological-decoupling-a-strategy-and-policy-framework?lang=en.

In this fractured context, South–South cooperation and BRICS-led initiatives point to a different approach. **BRICS countries can serve as bridges between global innovation hubs and the developmental needs of emerging economies.** They have the potential to expand green technology partnerships that prioritize co-production, local training, and long-term capacity-building — challenging the extractive and asymmetric nature of many North–South transfers. These efforts can open new pathways for decentralized, regionally embedded models of green development.

At a time when multilateralism is fraying, the BRICS bloc can offer alternative architectures for knowledge exchange, regional value chains, and climate-aligned development finance. The New Development Bank and initiatives such as the BRICS Technology Transfer Center Network[23] underscore the bloc's potential to institutionalize cooperation outside the traditional donor-recipient paradigm. This policy brief explores these issues through three in-depth case studies that illuminate different aspects of BRICS-led green technology transfers.



23. The BRICS Technology Transfer Center Network brings together technology transfer agencies from BRICS countries to support cooperation, capacity building and joint ventures. For further information, please refer to https://www.stdaily.com/web/English/2024-10/24/content_246203.html and https://en.most.gov.cn/pressroom/202206/t20220622_181227.htm.

4. CASE STUDIES

4.1. China's Green Technology Investments Open the Possibility for Technology Transfer

In recent years, China has invested heavily in green technologies across the Global South—an activity primarily embedded in business decisions and strategies of Chinese firms, rather than aimed at simply transferring technologies to other economies per se. Nevertheless, China's global expansion in green technology industries is transforming the possibilities for technology transfer and industrial cooperation—especially for BRICS and other Global South countries. In key sectors such as EVs, batteries, PVs, and wind turbines, Chinese firms are no longer merely low-cost manufacturers. They are increasingly leaders in design, engineering, and large scale manufacturing.

As one recent Carnegie Endowment report described, "Chinese firms produce nearly 60 EVs, 70 percent of wind turbine nacelles, and 80 percent of solar modules, battery cells, and key processed minerals, and they have a significant lead on new nuclear power and green hydrogen."[24] These firms are now reshaping global green value chains—not only through exports, but through foreign direct investment, joint ventures, and localized production. For BRICS countries, this offers a unique opportunity to engage with green industrialization on more favorable terms, but realizing this potential depends on whether China and its trading partners put in place institutional frameworks that enable value creation and local upgrading.

The phenomenon of Chinese firms expanding abroad has been, in part, shaped by China's domestic macroeconomic conditions. The country's model of investment-driven growth, paired with slowing domestic demand and intensifying global scrutiny, is compelling many firms to "go out" in search of new markets.[25] For green tech sectors—especially capital-intensive ones

24. McBride, Milo. 2024. "Catching Up or Leaping Ahead? How Energy Innovation Can Secure U.S. Industrial Stature in a Net-Zero World." Carnegie Endowment for International Peace. September 19. https://carnegieendowment.org/research/2024/09/energy-innovation-us-industrial-stature?lang=en

25. Liu, Zongyuan Zoe. 2024. "China's Persistent Global Influence Despite Economic Growth Challenges." China Leadership Monitor. August 31. https://www.prcleader.org/post/china-global-influence

such as EVs and solar—access to international markets is no longer optional, but necessary to gain the required scale to afford such capital intensity. Increasingly, Chinese firms need to navigate tariffs, regulatory barriers and reputational concerns while securing overseas demand.

Prominent in this landscape is the privately-owned BYD, which has risen from a mid-1990s battery manufacturer to become the world's largest EV producer, with deep vertical integration in batteries, chips, and vehicle assembly. In recent years, BYD has moved aggressively into foreign markets. It is building or planning plants in Thailand, Brazil, Mexico, Turkey, and Hungary—often with a greater degree of local production than Western competitors.[26] In Brazil, BYD's USD 1 billion investment (5.5 billion in Brazilian Reais) in Bahia has promised to generate 10,000 jobs in auto manufacturing[27], and eventually include lithium iron phosphate (LFP) battery manufacturing. In addition, the company plans to build a dedicated research and development complex for up to 2,000 local engineers[28] suggests a greater potential for technology spillovers. BYD also has a bus factory in São Paulo state that supplies bus operators in municipalities across the country, though largely in the city of São Paulo. It also signed an agreement to supply buses to the city of Cape Town, South Africa[29].

However, this is not only a BYD story. CATL—the world's leading EV battery maker—is expanding battery production in Europe (Germany and Hungary), Southeast Asia, and, most recently has begun exploring production in Latin America[30]. Although primarily export-oriented, CATL's regionalization strategy increasingly includes partnerships with local firms and governments, which may open channels for skills development and technology adaptation[31]. In the solar PV sector, LONGi Green Energy, a leading global solar wafer and module

26. Henry, Ian. 2025. "BYD: steady progress on global production network." *Automotive World*. March 3. https://www.automotiveworld.com/articles/byd-steady-progress-on-global-production-network/

27. Government of Brazil. 2024. "President Lula welcomes BYD CEO for the Americas, Stella Li." December 2. https://www.gov.br/planalto/en/latest-news/2024/12/president-lula-welcomes-byd-ceo-for-the-americas-stella-li

28. Olmos, Marli. 2024. "BYD plans tailor-made car design for Brazil." *Valor International.* December 9. https://valorinternational.globo.com/business/news/2024/12/09/byd-plans-tailor-made-car-design-for-brazil.ghtml

29. Venter, Irma. 2025. "Golden Arrow rolls out first 20 electric buses, remaining 100 to follow by end-2025." *Engineering News.* March 17. https://www.engineeringnews.co.za/article/golden-arrow-rolls-out-first-20-electric-buses-remaining-100-to-follow-by-end-2025-2025-03-17

30. Mazzocco, Ilaria, Ryan C. Berg, and Rubi Bledsoe. 2024. "Driving Change: How EVs Are Reshaping China's Economic Relationship with Latin America." Center for Strategic and International Studies. September 19. https://www.csis.org/analysis/driving-change-how-evs-are-reshaping-chinas-economic-relationship-latin-america

31. Gagyi, Agnes. 2024. "CATL, capitalist strategies and emerging state-capital alliances: The case of CATL in Hungary." The Transnational Institute. November 7. https://www.tni.org/en/article/catl-capitalist-strategies-and-emerging-state-capital-alliances

producer, is also internationalizing. It has opened manufacturing sites in Malaysia, Indonesia, and Vietnam, and has signaled interest in other emerging markets[32]. These investments rarely include explicit provision for technology transfer. While these investments have largely followed an export logic with only later-stage assembly overseas, they create physical infrastructure and logistical channels that could be harnessed for local industrial development—provided recipient countries have clear strategies in place.

More explicitly state-linked firms are also part of this internationalization wave. BAIC and SAIC, both major state-owned automakers, have historically respected the Chinese state's caution over outbound technology. To the extent that they have looked abroad, it has largely been for final assembly purposes only. Still, as EV markets saturate in China, these firms are increasingly exploring global partnerships and local joint ventures. SAIC, for instance, is scaling up exports through its MG brand, with growing sales in Europe and Latin America, and has opened production facilities in India[33] and Indonesia[34]. In wind energy, firms such as Goldwind and Envision Energy have built wind farms or component plants abroad, often in partnership with local developers and governments. These expansions are not driven solely by state mandate but by commercial logic tied to market access, regulatory arbitrage, and long-term viability.

Crucially, this need for overseas expansion introduces a tension between state policy and firms. While the Chinese government has publicly warned firms against excessive technology transfer, particularly in sensitive sectors such as autos, many companies regard selective transfer as a strategic tool. For instance, local production and even partial technology sharing can help firms win procurement deals, benefit from access incentives, and secure local legitimacy.

This tension is not new. China itself climbed the industrial ladder in part through mandatory joint ventures and technology transfer from foreign automakers in the 1990s and 2000s. Auto firms have a long history of localization as they seek to gain footholds in regulated or protected markets. Chinese firms understand this dynamic well, to the extent that early Chinese auto firms in the 1980s and 1990s sought to learn from Brazil's experiences in localizing auto manufacturing

32. Jackson, Lewis, Phuong Nguyen, Colleen Howe, and Nichola Groom. 2024. "Chinese solar firms go where US tariffs don't reach." *Reuters.* November 4. https://www.reuters.com/business/energy/chinese-solar-firms-ever-nimble-go-further-afield-where-us-tariffs-dont-reach-2024-11-03/

33. Khalaf, Roula, Robin Harding, John Reed, and Chris Kay. 2024. "Indian steelmaker JSW to launch own EV brand." *Financial Times.* December 2. https://www.ft.com/content/a730b0b8-b009-4b19-a83c-fc4f54e68f1f

34. Kurniawan, Harso. 2025. "MG Motor's Indonesia Operations Gain Momentum." *Jakarta Globe*. January 17. https://jakartaglobe.id/business/mg-motors-indonesian-operations-gain-momentum

in the second half of the twentieth century[35]. Though the precise parameters of these investments abroad today are still not wholly known, there is good reason to expect that some Chinese firms may be more open to adaptive forms of South-South cooperation than Western multinationals, which have tended to protect proprietary knowledge fiercely. For example, Brazilian auto parts engineers report to us in original interviews in April 2025 that BYD is incorporating locally-developed sensors, chips, and accompanying software for critical components of car motors.

Even so, technology transfer is not automatic. The developmental payoff of Chinese green tech investment depends on the institutional capacity and strategic intent of host countries. Without industrial policies that mandate local content, support supplier development, and foster research and development ecosystems, investments risk becoming enclaves—nodes of assembly or resource extraction rather than drivers of technological upgrading.

Chinese investment also brings geopolitical complexity. Amid escalating U.S.–China tensions, Western countries are attempting to wall off parts of their green tech ecosystems. Restrictions on Chinese solar panels, EVs, and batteries—driven by national security and industrial strategy concerns—are reshaping global trade in low-carbon technologies. In this environment, South-South cooperation becomes more than a development tool; it is a strategic necessity. **For BRICS countries, engaging with China is not simply about importing cheap green tech, but about building co-investment frameworks that enhance autonomy in a fractured global economy.**

Overdependence on Chinese firms may recreate patterns of peripheralization, where Global South countries are locked into resource supply roles or low-value assembly. The challenge is to leverage Chinese investment as a stepping-stone, not a substitute for endogenous industrial capacity. Development banks, innovation hubs, and policy coalitions within BRICS can help coordinate this process. Cross-BRICS collaboration on technology standards, patent pools, and procurement could also reduce dependency and encourage mutual upgrading. For BRICS countries, the key lies in recognizing that technology transfer is not a gift, but a negotiated outcome, shaped by domestic policy choices and regional collaboration.

35. Chin, Gregory. T. 2010. *China's Automotive Modernization: The Party-State and Multinational Corporations.* Palgrave Macmillan (International Political Economy Series).

4.2. Comparing the Role of Technology Transfer in the Automobile Sector in Brazil and South Africa

The cases of Brazil and South Africa and their respective automobile sectors illustrate how a broader national political economy of energy shapes the possibilities and limitations of green technology transfer. Both countries have sizable automotive sectors and long histories of foreign direct investment, yet their experiences with EV transitions diverge sharply. South Africa's deep entanglement with coal—both as an energy source and a political-economic interest—has undermined its ability to attract meaningful EV investment and shift toward greener value chains. In contrast, Brazil's clean energy matrix, combined with institutional legacies from decades of biofuel innovation, has positioned it as a more viable destination for electric mobility investments. This comparison highlights how fossil fuel incumbency constrains green industrialization—not only by raising the carbon intensity of production, but by shaping institutional priorities, engineering capabilities, and the scope of state coordination. Green technology transfer, in short, depends as much on energy regimes and political alignments as it does on industrial policy.

The automobile sector is a particularly useful case through which to understand the role of technology transfer. It is one of the most globalized industrial sectors, with both highly distributed supply chains and a tendency to localize as firms expand to new markets. It is precisely for these reasons that Brazil and South Africa emerged over the last half century as significant production sites — and with significant exports — for major Western, Japanese, and Korean firms. In 2023, Brazilian automobiles and auto component exports accounted for 1.4% of the country's total exports by value, with total auto production reaching 2,324,838[36]. In the same year, South African automobiles and auto component exports accounted for nearly 15% of the country's total exports by value, with total auto production reaching 633,332[37].

36. Observatory of Economic Complexity. 2025. "Cars in Brazil." https://oec.world/en/profile/bilateral-product/cars/reporter/bra

37. National Association of Automotive Manufacturers South Africa. 2025. "Automotive exports surge 19% to new highs." May 8. https://naamsa.net/automotive-exports-surge-19-to-new-highs/

More recently, both countries have each pursued strategies to green their industrial bases, with a particular emphasis on the automotive sector. Both possess significant automotive manufacturing capacity, substantial domestic markets, trade links to other large markets, and long histories of foreign direct investment in this sector. Their efforts to harness green technology transfers, with respect to those technologies critical to the transition, from internal combustion engine vehicles to EVs, have produced mixed results. While Brazil is beginning to attract green investments with real prospects for local upgrading, South Africa has faced challenges to move beyond prior path dependencies. This divergence cannot be explained by policy alone. It reflects profound differences in sectoral legacies, incumbent interests in each country's energy matrix, and consequent technological capacities. Taken together, these factors shape the ability of individual countries to turn foreign green technology into domestic development.

4.2.1. South Africa: Green Industrial Ambitions Under Coal Incumbency

South Africa's automotive industry is among the most export-oriented on the African continent. Through successive industrial policy frameworks such as the Automotive Production and Development Programme (APDP) and the Automotive Master Plan — coordinated through the Ministry for Trade, Industry and Competition — the country has maintained a strong presence of foreign automakers, such as Volkswagen, BMW, Ford, Toyota, Mercedes-Benz, and Stellantis. Thus far, these investments have yielded limited technological spillovers or instances of local upgrading with respect to EVs. Notably, South Africa has been unable to attract the transfer of key technologies to enable its auto sector transition from combustion engine vehicle to EV production, thereby producing existential concern for the nearly half a million jobs associated with the country's auto sector.

A key explanation lies in the country's energy incumbency. Coal generates over 80% of South Africa's electricity38, and the state-owned utility, Eskom, is financially and operationally bound to an aging, carbon-intensive grid. This high-emissions profile deters EV investment, particularly from firms aiming to meet low-carbon supply chain standards. Without a decarbonized grid, EV production in South Africa encounters obstacles to qualify as "green" in key export markets, creating a disincentive for both automakers and foreign governments to prioritize local investment39.

38. Climate Action Tracker. 2025. "South Africa." https://climateactiontracker.org/countries/south-africa/policies-action/

39. Net Zero Tracker. 2025. "Carbon Competitiveness: South Africa At The Net Zero-Trade Nexus." Energy & Climate Intelligence Unit, New Climate Institute, Oxford Net Zero, and Data-Driven EnviroLab. https://zerotracker.net/analysis/south-africa-net-zero-trade-nexus

This fossil lock-in is not only technical; its political effects are even more consequential. The coal sector enjoys deep ties to public institutions, labor unions, and legacy industrial firms. Attempts to advance green industrial policy often face resistance or fragmentation, particularly across ministries responsible for energy, minerals, and trade. As a result, South Africa has so far failed to develop a coherent national strategy for EV production, public procurement, or charging infrastructure. Chinese firms like BAIC have entered the market through joint ventures, but these largely reproduce internal combustion engine (ICE) platforms without contributing to local electrification. An EV White Paper, largely drafted by the National Association of Auto Manufacturers South Africa (NAAMSA), languished within the Ministry of Trade, Industry and Commerce for two years before it was finally approved in 2024[40]. The Just Energy Transition Partnership, an agreement between Western national governments and South Africa to finance the decommissioning of coal power and green industrial priorities (especially the EV sector), has come under withering attack from within the South African government by politicians aligned to the coal sector[41].

Another key constraint lies in technological capabilities. South Africa's engineering talent has historically been concentrated in the mining sector, where innovation is geared toward extraction technologies, logistics, and geotechnical systems[42]. While world-class in some areas, this knowledge base is poorly aligned with the systems integration and software engineering required for EV or battery production. The lack of deep industrial linkages between mining and manufacturing also limits the potential for localized green tech development—even in areas like battery minerals, where South Africa holds significant reserves.

40. Venter, Irma. 2023. "Naamsa proposes purchase subsidy as the 'most appropriate' EV incentive model." *Engineering News.* February 20. https://www.engineeringnews.co.za/article/naamsa-proposes-purchase-subsidy-as-the-most-appropriate-ev-incentive-model-2023-02-20

41. Sguazzin, Antony, and Paul Burkhardt. 2023. "How 60 Million South Africans Are Being Failed by Global Climate Politics." *Bloomberg.* April 25. https://www.bloomberg.com/news/features/2023-04-25/load-shedding-today-south-africa-green-energy-plan-fails-first-test

42. Andreoni, Antonio, Lauralyn Kaziboni, and Simon Roberts. 2021. "Metals, Machinery, and Mining Equipment Industries in SouthAfrica: The Relationship between Power, Governance, and Technological Capabilities" In *Structural Transformation in South Africa: The Challenges of Inclusive Industrial Development in a Middle- Income Country.* Ed. Antonio Andreoni, Pamela Mondliwa, Simon Roberts, and Fiona Tregenna. Oxford University Press. Pp. 53-77.

4.2.2. Brazil: Developmental Alignment from Ethanol to EVs

Brazil's industrial and energy context presents a different story. While its automotive sector has faced volatility and external dependence, the current political and institutional environment is more conducive to localized green upgrading. This has enabled the possibility of meaningful transfer and localization of EV technology from world-leading firms based in China. BYD's recent decision to build a major EV and battery complex in Bahia, along with Great Wall Motors' new factory complex in Iracemápolis in the state of São Paulo, are emblematic of the South-South dynamics playing out in the sector.

Part of this stems from Brazil's clean energy matrix. Over 80% of its electricity comes from renewable sources, primarily hydropower but also wind and growing shares of solar[43]. This positions Brazil as an attractive site for low-emissions manufacturing—and helps green the value chains of foreign investors concerned about carbon leakage or EU carbon border adjustment mechanisms.

Equally important, however, is the institutional memory and human capital generated by Brazil's decades-long engagement with alternative fuels—most notably ethanol. Since the global oil crisis of the 1970s, Brazil has developed one of the most advanced and large-scale biofuels programs in the world. The sugar cane-based ethanol sector created a domestic ecosystem of engineering expertise, supply chain integration, and public-private collaboration. Over the last three decades, this ecosystem has coalesced around so-called "flex-fuel" engine technologies, which can use both gasoline and ethanol[44]. This legacy has seeded a cadre of engineers, firms, and public research institutions with the ability to adapt and absorb foreign technologies—skills that are now being repurposed for the EV transition.

This is of critical importance for technology transfer. When foreign firms such as BYD invest in Brazil, they are engaging with a technically competent set of local actors accustomed to innovation in propulsion systems, regulatory frameworks for low-carbon mobility, and industrial upgrading. In contrast to South Africa's mining-dominated engineering base, Brazil's automotive-centered technological ecosystem is better aligned with the capabilities required for EV manufacturing, battery chemistry adaptation, and software-hardware integration.

43. International Energy Association. 2023. "Energy System of Brazil." https://www.iea.org/countries/brazil

44. Eaglin, Jennifer. 2022. *Sweet Fuel: A Political and Environmental History of Brazilian Ethanol.* Oxford University Press.

Institutionally, Brazil has taken clearer steps to coordinate green industrial development. The Brazilian National Development Bank (BNDES, in its Portuguese initials), industrial ministries, and subnational governments have reengaged in developmental planning—offering infrastructure, financing, and regulatory certainty to green investors. The current Lula administration has explicitly framed decarbonization as an opportunity for reindustrialization and national sovereignty, creating political momentum for green industrial policy even amid fiscal constraints.

These initiatives strengthen Brazil's ability to negotiate with foreign firms on more equal terms—whether through local content requirements, co-development agreements, or strategic procurement. For example, BYD's investment has been accompanied by commitments to partner with engineering faculty at local universities to further develop a domestic corps of engineers that can work with new EV-related technologies[45]. As a result, technology transfer in the sector can be understood as something akin to a structured process.

4.2.3. Comparative Takeaways: What Can We Learn From Existing Cooperation?

The Brazil–South Africa comparison underscores a broader insight: the absorptive capacity of technology transfer depends not just on policy intent, but on the structure of incumbent sectors and the sectoral distribution of technological capabilities.

In South Africa, the dominance of the coal sector — both in the country's energy matrix and its politics — and the historic concentration of engineering expertise in mining have created structural headwinds for green industrialization. Foreign investors face a carbon-intensive grid, limited policy direction, and a misaligned technical base. The result is a pattern of final assembly-oriented investment with little local upgrading.

In Brazil, by contrast, a clean energy matrix and a legacy of innovation in ethanol and flex-fuel technologies have created more fertile ground for green tech localization in the auto sector. State institutions have begun to revive their capacity to steer investment, and engineering capabilities in the automotive sector give Brazil a stronger hand in absorbing and adapting foreign technologies.

45. Gaier, Rodrigo Viga. 2025. "Rio de Janeiro tenta tirar da Bahia centro de pesquisa da BYD." *Folha de São Paulo*. March 20. https://www1.folha.uol.com.br/mercado/2025/03/rio-de-janeiro-tenta-tirar-da-bahia-centro-de-pesquisa-da-byd.shtml

The lesson is not that Brazil has "solved" green industrialization, but that it has a comparatively more coherent platform from which to pursue it. For BRICS countries more broadly, the implication is clear: **green technology transfer will succeed where it aligns with national capabilities and displaces rather than entrenches incumbent interests,** such as coal in the case of South Africa. The challenge is to identify these capabilities and develop strategies to counter such incumbents.

4.3. South–South and BRICS Cooperation in Clean Energy Technologies and Critical Minerals

BRICS nations and other Global South partners have increasingly collaborated over the past decade on renewable energy, battery technology, and critical mineral value chains. These South–South partnerships are driven by shared goals of sustainable industrial development and energy security, and they leverage complementary strengths — from vast mineral resources to manufacturing prowess. These partnerships rely on a wide variety of institutional arrangements, each of which can have major impacts on whether and how technology transfer takes place. These institutional arrangements are examined in turn below.

4.3.1. Bilateral Partnerships and the Role of the State

Technology transfer through bilateral partnerships is often driven by strategic interests and facilitated through state institutions and national development banks. These partnerships are critical in aligning industrial policy objectives with long-term technology goals in the Global South. In this context, national governments play a pivotal role in forging South–South energy and technology cooperation. High-level bilateral agreements set the groundwork for joint projects and technology exchange. For example, in 2025 India and Argentina committed to cooperate in lithium exploration and mining — a strategic partnership linking India's EV battery ambitions with Argentina's resource endowment[46]. The agreement, backed by India's Ministry of Mines and the provincial government of Catamarca in Argentina, provides for joint

46. Press Information Bureau (PIB), Government of India. 2025. "India and Argentina Strengthen Cooperation in Lithium Exploration and Mining with a MoU." February 19. https://www.pib.gov.in/PressReleasePage.aspx?PRID=2104761

ventures, knowledge-sharing on sustainable mining, and Indian investment in Argentina's lithium sector. This initiative is expected to field benefits for both partners: India may enhance resource security in its battery industry, while Argentina could further develop its capacity in the exploitation and processing of critical minerals[47].

State-led cooperation also extends to long-standing partnerships within the BRICS framework. For example, Brazil and South Africa collaborate through their development banks, BNDES and IDC. These institutions exchange technical knowledge and co-finance green energy and industrial projects, including in renewable energy generation and clean automotive components.[48] Similarly, India, Brazil and South Africa cooperate on solar energy already since 2010.[49] These examples underscore how bilateral agreements and political commitments set the stage for deeper technological cooperation across the South.

4.3.2. Joint Research, Development and Innovation Platforms

Joint research and development platforms help to anchor technology collaboration in formal institutional arrangements. The BRICS Science, Technology and Innovation Program, a landmark initiative launched in 2015, seeks to fund collaborative research projects of consortia where at least three BRICS countries are represented[50]. These joint projects enable knowledge co-creation while reducing dependence on Northern intellectual property regimes. For example, partnerships between India, Russia and China under this framework have focused on battery innovations[51], while Chinese and Brazilian cooperation lead to expansion of smart electricity grids[52].

47. S&P Commodity Insights. 2025. "India, Argentina's Catamarca Province Boosting Lithium Collaboration." February. https://cilive.com/commodities/metals-mining/news-and-insight/022025-india-argentinas-catamarca-province-boosting-lithium-collaboration

48. IDC. 2013. "IDC and Brazil Enhance Trade Ties." March 27, 2013. https://www.idc.co.za/idc-and-brazil-enhance-trade-ties/.

49. Government of India. 2010. "MoU among the Government of the Federative Republic of Brazil, the Government of the Republic of India and the Government of the Republic of South Africa on Cooperation in of Solar Energy." 2010. https://mnre.gov.in/en/document/mou-among-the-government-of-the-federative-republic-of-brazil-the-government-of-the-republic-of-india-and-the-government-of-the-republic-of-south-africa-on-cooperation-in-of-solar-energy/.

50. BRICS STI Framework. 2025. "BRICS STI Portal." http://brics-sti.org/

51. BRICS STI. 2024. *BRICS STI Bulletin 1.* http://brics-sti.org/files/BRICS_bulletin_1_2024.pdf

52. OECD. 2015. *Energy Investments and Technology Transfer Across Emerging Economies: The Case of Brazil and China.* OECD Publishing. https://www.oecd.org/content/dam/oecd/en/publications/reports/2015/12/energy-investments-and-technology-transfer-across-emerging-economies-the-case-of-brazil-and-china_g1g5f48b/9789264247482-en.pdf

This kind of cooperation has intensified in more recent years. A landmark step was the creation of the BRICS Energy Research Cooperation Platform (ERCP) in 2018[53]. This platform brings together experts, industry, and research institutes from all five countries to coordinate research in priority energy technologies and policies. The ERCP has helped highlight strategic areas for joint development of sustainable energy, such as advanced biomass and biofuel technologies, battery storage (lithium-ion and beyond), next-generation solar PV with higher efficiency, and integration of renewables with energy storage, smart grids and grid automation[54]. By pooling expertise in these fields, the ERCP is meant to accelerate collective innovation and knowledge-sharing among BRICS. To this end, under the Brazilian BRICS presidency, a new Roadmap for BRICS Energy Cooperation was agreed in May 2025 that laid out ambitions to support pilot projects, joint research and technical workshops, as well as coordinate and scale up financing, including through expanded cooperation with the New Development Bank[55].

Outside the BRICS bloc, broader South–South technology cooperation platforms also exist. India's leadership in the International Solar Alliance (ISA) (with over 100 mostly developing country members) provides training, R&D collaboration, and technology demonstrations to spread solar power adoption in Africa and Asia[56]. China has established joint research centers in partner countries (for instance, agriculture research in Africa[57]) as part of its foreign aid science and technology programs. While these efforts are relatively nascent, they represent a conscious move by emerging economies to build local R&D capacity and reduce reliance on Western intellectual property by co-developing solutions tailored to developing-world needs.

53. Losekann, Luciano, and Amanda Tavares. 2021. *Potential for Cooperation in Green Technology Transfer Between BRICS Countries.* IPEA Repositório. https://repositorio.ipea.gov.br/bitstream/11058/15558/1/en_PRB74_Potential_for_cooperation.pdf

54. BRICS India. 2021. BRICS Energy Technology Report. https://yeabrics.org/wp-content/uploads/2022/02/getdocu-40.pdf

55. BRICS Brazil. 2025. *Roadmap for BRICS Energy Cooperation 2025–2030.* http://brics.br/pt-br/documentos/meio-ambiente-clima-e-gestao-de-desastres/roadmap-for-brics-energy-cooperation-2025-2030.pdf

56. International Solar Alliance. 2025. "About ISA/USS." https://isa.int/about_uss

57. Sino-Africa Joint Research Center. 2025. "About SAJOREC." http://www.sinafrica.cas.cn/English/About/Introduction/

4.3.3. Local Content Regulations and Industrial Policy

Several BRICS and other developing countries have implemented local content requirements and related industrial policies to ensure that cooperation projects contribute to domestic industry. A linked goal — albeit one that has occasionally proven elusive[58] — is to ensure that foreign investment and technological engagement spurs benefits for local communities and economies. In the renewable energy sector, Brazil, India, and South Africa all mandated local content in large-scale solar and wind power projects in the past decade[59]. For example, Brazil's BNDES made financing for wind farms conditional on using a high percentage of locally made turbines and components[60]. This encouraged foreign firms to localize — China's Goldwind built a wind turbine factory in Brazil to fulfil these rules[61], and several Chinese solar PV manufacturers formed joint ventures in Brazil in response to local-content rules[62]. Similarly, India's National Solar Mission reserved a share of projects for domestically manufactured panels, leading to growth of Indian module makers[63].

Local content requirement policies have had important positive outcomes, but work best when embedded in a broader enabling policy ecosystem. Indeed, such policies can spur much initial investment in local manufacturing. For example, India's solar module capacity has steadily increased in recent years, and domestic companies gained experience across the project value chain[64]. In South Africa, new factories for wind towers and solar panels opened when

58. Teixeira, Fabio, and Diana Baptista. 2023. "Wind Turbines in Brazil Stir Conflict with Indigenous Rights." Context News. July 12. https://www.context.news/net-zero/wind-turbines-in-brazil-stir-conflict-with-indigenous-rights

59. Bazilian, Morgan, Victoria Cuming, and Thomas Kenyon. 2020. "Local-content rules for renewables projects don't always work." *Energy Strategy Reviews* 32: 100569. https://www.sciencedirect.com/science/article/pii/S2211467X2030122X

60. Santos, Julio. 2020. "Analysis: Local Supply Chain Focus as Manufacturer Compliance Evolves." Windpower Monthly. August 28. https://www.windpowermonthly.com/article/1361474/analysis-local-supply-chain-focus-manufacturer-compliance

61. Morais, Lucas. 2024. "Goldwind Inaugurates Factory in Brazil's Bahia, 1st Outside China." Renewables Now. August 28. https://renewablesnow.com/news/goldwind-inaugurates-factory-in-brazils-bahia-1st-outside-china-867206/

62. Macao News. 2023. "Chinese and Brazilian manufacturers plan to collaborate on solar energy." February 27. https://macaonews.org/news/lusofonia/semp-tcl-solar-photovoltaic-brazil-china/

63. Bazilian, Morgan, Victoria Cuming, and Thomas Kenyon. 2020. "Local-content rules for renewables projects don't always work." *Energy Strategy Reviews* 32: 100569. https://www.sciencedirect.com/science/article/pii/S2211467X2030122X

64. Ibid.

the renewables program became active, creating a nascent green industry supply chain[65]. However, local-content requirements alone are not adequate to support the development of a globally competitive domestic manufacturing sector[66]. Appropriate governance arrangements can ensure that local content requirements unfold within predictable policy environments and do not lead to unintended high costs for projects. Developers in BRICS countries reported initial cost increases and administrative burdens to comply with local content requirements (e.g. finding qualified local suppliers, paperwork), which, in some cases, have resulted in higher electricity tariffs or project delays[67].

These policies' success also depends on complementary measures at the national level. These include investment in workforce skills, gradual phase-in to allow local firms to scale up, and a credible long-term market signal from governments. Brazil has recognized this, pairing local content rules with initiatives like tax incentives and financing for equipment manufacturers[68]. China, on the receiving end of some local content requirements in partner countries, has often responded by transferring assembly work locally (as seen with BYD and Goldwind in Brazil) to maintain market access[69]. The net effect is that South–South cooperation projects increasingly feature local manufacturing or technology transfer components.

65. Republic of South Africa. 2022. "South African Renewable Energy Masterplan." https://greencape.co.za/assets/SAREM-Draft-March-2022.pdf

66. Bazilian, Morgan, Victoria Cuming, and Thomas Kenyon. 2020. "Local-content rules for renewables projects don't always work." *Energy Strategy Reviews* 32: 100569. https://www.sciencedirect.com/science/article/pii/S2211467X2030122X

67. Ibid.

68. Cardim de Carvalho, João; et al. 2022. "Why Brazil Sought Chinese Investments to Diversify Its Manufacturing Economy." *Carnegie Endowment for International Peace*, October. https://carnegieendowment.org/research/2022/10/why-brazil-sought-chinese-investments-to-diversify-its-manufacturing-economy?lang=en

69. Hiratuka, Celio. 2022. "Why Brazil Sought Chinese Investments to Diversify Its Manufacturing Economy." *Carnegie Endowment for International Peace*, October 18. https://carnegieendowment.org/research/2022/10/why-brazil-sought-chinese-investments-to-diversify-its-manufacturing-economy?lang=en

4.3.4. Regional Value Chains

An important aspect of South–South cooperation is structuring projects so that they leverage the complementary strengths of different countries, creating cross-border value chains. The BRICS group includes both resource-rich economies and technology/export powerhouses, making it theoretically possible to establish a regional value chain that spans mining, processing, manufacturing, and deployment across member countries. In other words, regional value chains are emerging as a framework for South–South technology cooperation, offering an alternative to purely national or North-led integration models.

Critical minerals offer a clear example: the BRICS collectively control a substantial share of the world's reserves of key energy-transition minerals (lithium, cobalt, rare earths, platinum group metals, and so on)[70]. Brazil holds significant reserves of lithium and graphite and is the world's leading producer of niobium, a key component in high-strength alloys. South Africa ranks among the top producers of platinum and manganese, both essential for catalytic converters and battery-related chemicals. China maintains a dominant position in the rare earth elements sector, accounting for more than 60% of global production and over 80% of refining capacity. India, although currently reliant on mineral imports, is actively expanding its resource portfolio through joint exploration projects overseas—such as lithium in Argentina—and through recent domestic discoveries.

Harnessing this complementary resource endowment has been a focus of BRICS dialogues. For instance, in 2025 BRICS energy ministers identified hydrogen as a promising area for integration[71]: countries with more advanced industrial bases—such as China and Russia—could supply technology and capital, while those with abundant solar resources, land or biomass—such as Brazil, India, and South Africa— could produce green hydrogen for export[72]. A collaborative hydrogen value chain would involve renewable generation and electrolyzer

70. Singha, Sutandra. 2025. "BRICS and the Critical Minerals Imperative: Securing the Future of Clean Energy." Eurasia Review. June 9. https://www.eurasiareview.com/09062025-brics-and-the-critical-minerals-imperative-securing-the-future-of-clean-energy-analysis/

71. BRICS Brazil. 2025. *Roadmap for BRICS Energy Cooperation 2025–2030*. http://brics.br/pt-br/documentos/meio-ambiente-clima-e-gestao-de-desastres/roadmap-for-brics-energy-cooperation-2025-2030.pdf

72. Press Information Bureau (PIB), Government of India. 2021. "NTPC anchors two day BRICS Green Hydrogen Summit." June 23. https://www.pib.gov.in/Pressreleaseshare.aspx?PRID=1729630

facilities being developed in the latter group with technical support from the former, potentially creating new export industries— such as clean fuel— for some, while addressing clean energy requirements for others[73].

Beyond BRICS, a number of Global South countries are engaging with BRICS members to integrate into critical mineral and battery supply chains. China–Africa cooperation is notable: China has heavily invested in African mining (from cobalt in the DRC to bauxite in Guinea), and now African governments are currently advocating for greater local refining and value-added processing rather than just raw ore exports[74]. For example, Zambia and the DRC — which together produce the bulk of the world's cobalt — signed a cooperation agreement in 2022 to develop a regional battery metals value chain[75]. The aim is to use local cobalt and copper to manufacture battery precursor materials in Africa, potentially with technology and funding from Chinese partners who are active in both countries[76]. While significant challenges remain — such as energy supply, skilled labor, investment— , this illustrates the broader trend in the Global South of seeking to move up the value chain through partnership rather than remaining solely as exporters of raw materials.

73. BRICS Brazil. 2025. *Meetings of the BRICS National Standards Bodies during the Brazilian presidency – Issue Note.* https://brics.br/pt-br/documentos/economia-financas-comercio-e-infraestrutura/issue-note-abnt-brics-2025-ostensivo.pdf

74. van Staden, Cobus. 2024. "What Does Emerging China–Africa Minerals Consensus Mean for US Initiatives?" United States Institute of Peace, September 12. https://www.usip.org/publications/2024/09/what-does-emerging-china-africa-minerals-consensus-mean-us-initiatives

75. UNECA. 2022. "Zambia and DRC Sign Cooperation Agreement to Manufacture Electric Batteries." April 29. https://www.uneca.org/stories/zambia-and-drc-sign-cooperation-agreement-to-manufacture-electric-batteries

76. Benabdallah, Lina. 2024. "China's Role in Africa's Critical Minerals Landscape: Challenges and Key Opportunities." *Africa Policy Research Institute,* September 6. https://afripoli.org/chinas-role-in-africas-critical-minerals-landscape-challenges-and-key-opportunities

5. CONCLUSION: STRATEGIC PATHWAYS FOR A GREEN TECHNOLOGY FUTURE IN THE BRICS

The global green transition requires technology transfers so that countries in the Global South can meet their dual goals of development and decarbonization. In pursuit of these goals, multi-faceted initiatives and programs of BRICS countries show a way for technological diffusion that is pursued in an equitable way. However, as our case material shows, technology transfers are not enough on their own — they depend on institutional context and political coalitions that shape how such technologies are acquired, adapted, and deployed. This is where political agency is necessary for these transfers to reach their full potential of not only facilitating innovation and industrial upgrading, but doing so in a socially equitable way.

Most notably, China's export orientation for its green industries has reshaped the global landscape of low-carbon technologies, opening new possibilities for South–South flows of hardware, finance, and expertise. Yet, these flows will only lead to durable developmental benefits where host countries mobilize coordinated policies to ensure local upgrading. Brazil's experience suggests how existing institutional memory and technological capabilities—nurtured over decades in alternative fuel development—might be redeployed to support new green industries. In contrast, South Africa's struggles illustrate the formidable obstacles posed by fossil fuel incumbents and the misalignment between inherited industrial capabilities and the demands of green manufacturing.

For the BRICS bloc, the imperative is clear. If these countries are to leverage green technology transfers for inclusive development, they must move beyond a reactive posture toward a proactive and coordinated agenda. This includes not only attracting green investment, but also shaping the terms of engagement: deploying tools like local content requirements, joint ventures, targeted financing, technology training programs, and public procurement strategies that create pathways for domestic firms and workers to participate in and benefit from the green transition.

South–South cooperation is increasingly central to this emerging landscape. Whether through bilateral agreements, joint research and development platforms, local content policies, or regional value chains, BRICS countries are building new frameworks for technology exchange that differ from the historically extractive patterns of North–South transfers. These arrangements—when aligned with strategic industrial policy—can deepen domestic capabilities, enhance energy security, and support more autonomous development pathways. As the U.S.–China rivalry intensifies and intellectual property regimes remain restrictive, the space for cross-border technological cooperation is narrowing. In this geopolitical environment, BRICS coordination is not just beneficial—it is necessary.

Against this backdrop, this policy brief offers two key policy recommendations to enhance BRICS initiatives and South–South green technology transfers in support of inclusive and sustainable development:

1. **Promote and expand South–South cooperation and BRICS-led initiatives as strategic platforms for green technology transfer.**

BRICS countries should leverage their unique position as intermediaries between global innovation hubs and emerging economies to foster partnerships that emphasize co-production, local workforce training, and long-term capacity building. Encouraging trilateral collaborations involving technology providers, public financiers, and domestic industries can help develop decentralized, regionally embedded models of green development that move beyond the traditional extractive North–South transfer paradigm.

2. **Strengthen BRICS institutional coordination to overcome geopolitical fragmentation and restrictive intellectual property regimes.**

Institutions like the New Development Bank, the BRICS Energy Research Cooperation Platform, and national development banks should play a more proactive role in facilitating green technology flows aligned with regional development objectives, supporting joint research and development, and creating strategic industrial frameworks that promote autonomous and inclusive green industrialization.

The BRICS countries now occupy a dual role: they are both importers of green technologies and, increasingly, sources of them. It is precisely this dual role that equips BRICS countries uniquely to craft a more equitable framework for global green development. Ultimately, green technology transfer is not a one-time transaction, but a long-term political and institutional project. For the BRICS, the task ahead is to turn fragmented cooperation into coherent strategy—building the policy tools, institutional linkages, and political coalitions necessary to realize the promise of strategic green industrialization in the Global South.

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The views and opinions expressed in this Policy Brief are those of the authors and do not necessarily reflect the official position of Plataforma CIPÓ.