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South Africa's Just Energy Transition: Issues and Prospects¹

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Abstract

South Africa is the one of leading African economies and the one of the major global greenhouse gas emitters. Actively participating in international climate and energy frameworks, South Africa sets an ambitious goal of achieving net zero emissions by 2050. The climate agenda is a sphere of crucial importance for South Africa due to explicit systemic vulnerabilities of the national economy in the face of expected changes. This article analyzes problems and prospects in achieving South Africa's climate policy goals, as well as the availability of resources necessary to achieve these goals.

The analysis finds that South Africa does not possess the resources to achieve its climate goals. South Africa remains dependent on polluting fossil fuels, especially coal, due to enormous available natural deposits. Climate financing covers only a portion of necessary financial placing. In the long run, established international agreements may aggravate the country's international debt problem. South Africa's leaders recognize the necessity of climate-related policy measures, but such measures cannot be characterized as the main drivers of the country's development.

Key words: South Africa, climate policy, green transition, carbon neutrality

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Introduction

South Africa is one of the most developed African economies with gross domestic product (GDP) reaching \$405 billion (38th in the world and 0.6% of global GDP) [World Bank, 2022] and also one of the top 20 global greenhouse gases emitters. In 2022, the country's total amount of polluting gases emissions reached 411 million tonnes (about 0.99% of the global capacity) [EC, 2023]. South Africa's emissions increased from 2000 until the COVID-19 pandemic in 2020–21; by 2017, emissions had grown by 17% compared with the baseline (2000) [Paul, 2021].

South African officials were widely criticized for their quite passive stance regarding climate policy. Jacob Zuma's administration (2009–18) claimed to support “extraordinary” climate actions [Gerber, 2017] and in 2011 hosted the 17th UN Climate Change Conference in Durban [United Nations Climate Change, 2011]. However, conceptualization and implementation of climate policy measures faced numerous constraints, including over-bureaucratization, and thus were usually delayed or postponed [Climate Action Tracker, n.d.a]. Cyril Ramaphosa's administration, which

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followed Zuma's in 2018, almost immediately declared its adherence to energy transition policy and presented the Integrated Resource Plan for public consideration [Government of ZA, 2018a]. At least 45% of the respondents in South Africa acknowledge climate changes as a major threat to the country, at least partially explaining the formal adherence of the country's administration to the global climate policy agenda [Stokes, Wike, Carle, 2015].

Presented in 2015 [UNFCCC, 2022], the first version of South Africa's nationally determined contribution (NDC) was renewed in 2021 [Government of ZA, 2021b]. The country set the goal to achieve carbon neutrality by 2050. To achieve this goal, the country plans to lower the emissions amount to 398–510 MtCO₂e in 2021–25 and to 350–420 MtCO₂e in 2026–30. Compared to the NDC first version, the upper limit of the target indicator was lowered by 17% for the period until 2025 and by 32% for the period until 2030. The spread between the highest and the lowest estimated target amounts significantly dropped as well—from 216 to 112 MtCO₂e until 2025 and to 70 MtCO₂e until 2030. Further, South Africa plans to reach a volume of secured climate financing of no less than \$8 billion annually by 2030.

Besides the United Nations (UN)-led climate frameworks, South Africa presents its interests within the BASIC grouping (Brazil, South Africa, China, and India) and the Group of African States.

Against the background of South Africa's public support for the climate agenda and its ambitious national strategic goals, the country's undeniable dependency on energy coal consumption cannot be ignored. Together with economic constraints and the estimated amount of necessary climate financing to facilitate the green transition, the soundness of South Africa's climate policy is an issue worth being scrutinized.

The article's goal is to examine South Africa's climate policy objectives in the context of the energy transition taking into consideration available financial and technological resources. It also considers the role of international climate partnerships in the fulfilment of South Africa's climate goals, as well as the adequacy of the country's strategic documents and legislation to manage the obstacles in the way to energy transition. The article presents the results of analysis on South Africa's energy sector condition, hydrogen fuel, and the development of carbon capture and storage technologies.

South Africa on the Trail to Carbon Neutrality and Just Energy Transition: Challenges Ahead

While a relatively small economy (on the global scale), South Africa has been one of the major greenhouse gas emitters for many years. Considerable emissions arise due to South Africa's dependency on coal. The country possesses huge explored natural deposits of coal—eighth in world, more than 35 mln tonnes (2016)—and ranks seventh among the top coal producers. At least 80% of energy is produced by use of coal, which the most accessible and cheap type of fuel. Further, coal is an important export commodity, behind gold and platinum. Eskom, the country's major energy producer, employs more than 40,000 people and operates energy facilities of 40 gigawatts total capacity. Steady depreciation of energy aggregates causes continuous electricity shortages—in 2022, the electricity was off for more than 10,000 gigawatts-hours; this is four times higher than in 2021 and almost 100-times more than in 2018 [Civillini, 2023]. By 2030, Eskom plans to stop exploitation of a small fraction of the total coal-based energy capacity, about 12 gigawatts; by 2050, about 87% of polluting energy objectives are planned for decommissioning.

The energy sector is the key greenhouse gas emitter in South Africa's economy, producing 55% of the total amount. Industry and transport combined produce about 25%, while construction and agriculture emit 5 and 2%, respectively.

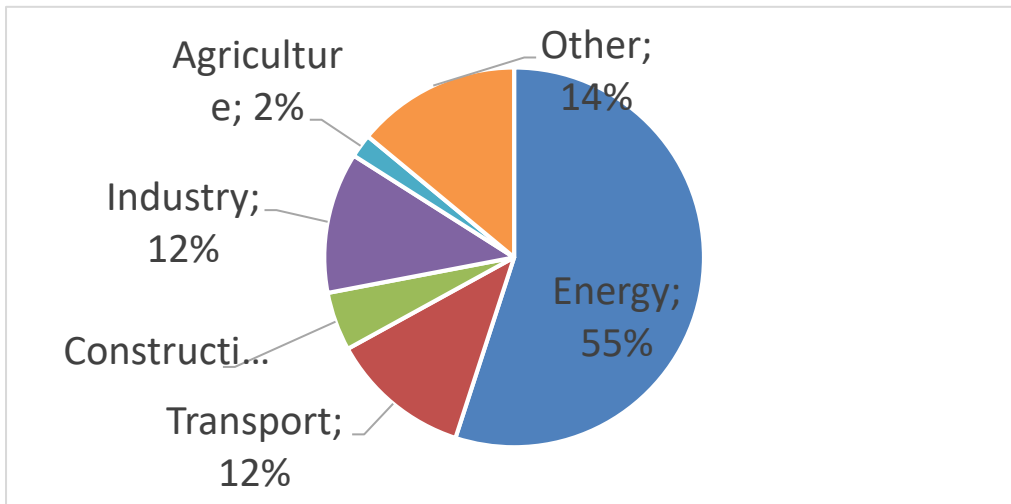


Fig. 1. South Africa's Structure of Greenhouse Gases Emissions, by sector, 2021

Source: Compiled by the author based on Climate Transparency [2021].

Coal is the main source of power in South Africa (80.1%). Renewable energy, including hydropower, are responsible for 13.7% (6.2 gigawatts). The remaining 6.3% is distributed between diesel (1.6%) and nuclear power (4.6%) produced on the Koeberg nuclear plant, the only such plant in the country.

In 2022, the share of solar power declined for the first time after a long period of growth, despite the commissioning of new facilities with 75 megawatts total capacity. In 2022, coal power added 720 megawatts; 419 megawatts were commissioned in the wind power segment [Pierce, Le Roux, 2023].

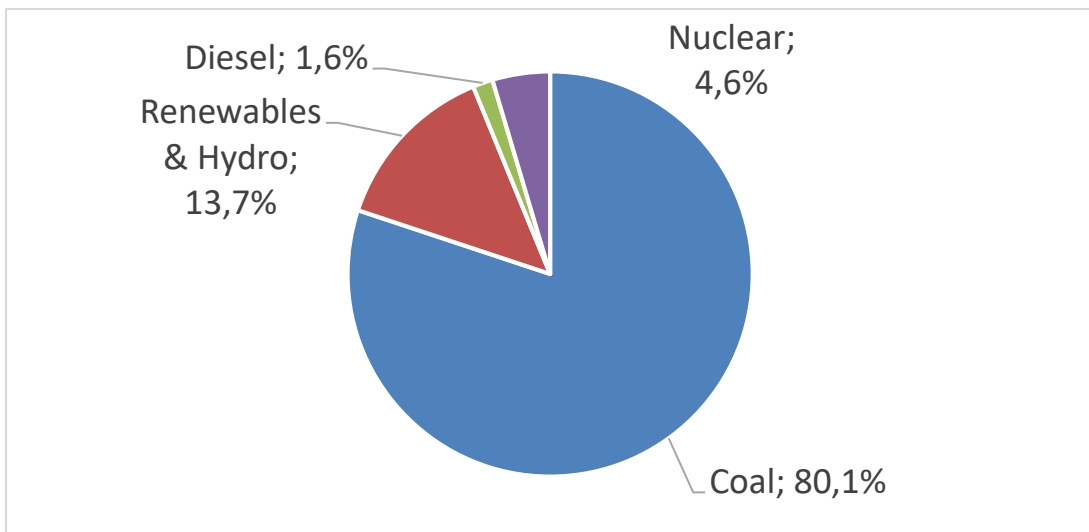


Fig. 2. South Africa's Main Power Sources, 2022

Source: Compiled by the author based on ITA [2023].

The weight of coal and burn fuel in the country's energy balance defines South Africa's ranking among the major global emitters of polluting substances despite the relatively small size of its economy.²

South Africa's industry is vulnerable to expected energy sector transformations. The country's real sector is energy-intensive, surpassing the global average by 40% (7 megajoules compared to 5 megajoules). South Africa's score is also the highest among the Group of 20 (G20) [Climate Transparency, 2022].

Climate change already affects the local ecosystem and economy. The process illustrates the growing number of droughts and water shortages in some regions. The changes taking place now would inevitably result in overload on public healthcare, infrastructure, and emergency services. Urban communities may face the issue of extended periods of very hot days with average temperatures over 35°C. In 2021–50, in most of the country's regions, the period of hot days may extend by 40–60 days per year. By the end of the century, the average number of hot days may grow to 80 per year [Engelbrecht, 2019].

For South Africa, climate change poses a grave danger to agriculture. Due to limited access to surface water basins in most of the country's regions, local agriculture depends on rainfall. Climate change affects the rainfall geography and its intensity, which endangers local communities in arid and semi-arid regions. Only 14% of the country's area is fully irrigated, with 20% possessing agricultural potential [Government of ZA, 2018d]. More than 55% of the country's population lives under the poverty line according to the World Bank [2020], and thus is insecure against the impact of climate change. In most cases, low income and rural communities carry on extensive agriculture methods that badly affect the local ecosystem, especially referring to topsoil.

Agriculture produces about 49% of methane; 40% of methane emissions come from landfill dumps. In 2021, South Africa decided to abstain from the Global Methane Pledge adopted in Glasgow that sets the goal of reducing methane emissions by 30% by 2030 compared to the 2020 baseline [GMI, n.d.].

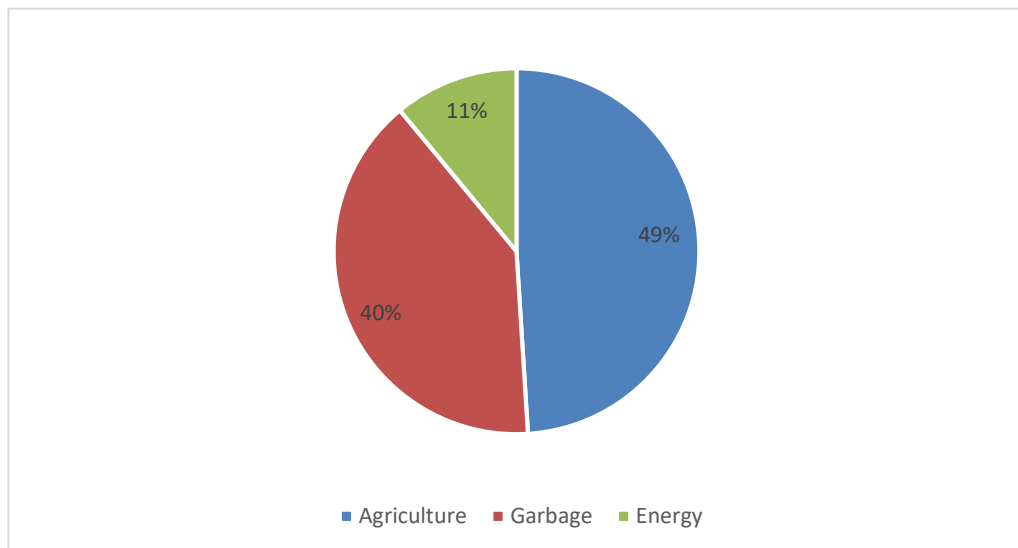


Fig. 3. South Africa's Main Sources of Methane

Source: Compiled by the author based on Climate Transparency [2021].

² Compared with the other major emitters.

Some experts claim that climate change may positively affect South Africa's economy. Increasing average temperatures could increase crop yield of tropical cultures like sugar cane by 11–14%, although at the expense of decreasing crop quality measured by quantity of sucrose [Jones et al. 2018]. As a countermeasure local farmers may embark on wider usage of fertilizers and agricultural chemical substances to force a “second ripening;” however, fertilizing might be too expensive for local agricultural communities that are already burdened by insufficient access to irrigation infrastructure (in some regions).

South Africa's forestry is relatively less vulnerable to climate change impact. According to the World Bank, in 2020 the forest area in South Africa was 14.1%, marking a 0.9% decrease compared with 1990 (15%) [n.d.]. A 59% decrease in forest area in 2013–22 was the result of the cultivable area's extension.

The commercial wood market in South Africa is mostly made up of pines (49%) and eucalyptus (40%). According to recent estimations, eucalyptus production would not be affected by climate change in next few decades. Some concerns arise regarding pine production in the West Cape, Limpopo, and Mpumalanga provinces, where soil would become less suitable for pines in next 40 years.

Along with agriculture, some worries about the country's food security are associated with climate change impact on fisheries. Fish and seafood production are extremely important to South Africa's sustainable food provision. The major risks here are rising sea levels, local rivers' water overfall change, and the increasing frequency of sea storms. Some fish species might be negatively affected by changing rainfall patterns along with declining overall industry production [Augustyn et al. 2017].

In September 2020, the South African government set the goal of carbon neutrality by 2050 [Lo, 2020]. Taking into account all the risks, this strategy seems very ambitious. However, the country possesses institutional capacity and a set of climate policy instruments with the draft Climate Change Law, in the final stage of approval, at its centre.

South Africa's Climate Policy Institutional and Normative Framework

In last 15–20 years, South Africa has developed and implemented several nation-wide and industry-specific strategies and action plans aimed at the fulfilment of its climate policy goals. Some of them worth mentioning here: the regularly updated Industrial Policy Action Plans [Government of ZA, 2018c]; the National Climate Change Response White Paper [Ibid., 2011a]; the National Energy Efficiency Strategy [Ibid., 2016]; the Green Transport Strategy [Ibid., 2017a]; and the Integrated Resource Plan [Ibid., 2019a]. The National Development Plan 2030 [Ibid., 2012] touches upon the climate change adaptation and mitigation issues that are also stated as key strategic priorities.

The Low Emissions Development Strategy 2050 [Government of ZA, 2020b] presents the most detailed overview of the country's policy toward carbon neutrality. This strategy combines all the abovementioned documents. Its goal is to lower carbon emissions to 212–428 MtCO_{2e} equivalent, or by 21–59% compared with 2010, by 2050. Measures implemented to reach this goal include the nation-wide introduction of energy efficiency certificates including residential and commercial buildings and transport; operationalization of 30,000 megawatts of combined power capacity to be produced from alternative and renewable sources (solar, hydro, wind) in order to substitute coal; implementation of a mandatory reporting system for all businesses whose activity produces more than 0.1 MtCO_{2e} equivalent of emissions, or their power consumption surpass this threshold; and several other measures.

The draft Climate Change Law, presented for parliament discussion in early 2022, deserves special attention [Parliament of ZA, 2022]. The law is designed to “enable the development of an effective climate change response and a long-term, just transition to a low-carbon and climate-resilient

economy and society for South Africa in the context of sustainable development; and to provide for matters connected therewith.” Following the law’s wording, a special commission is to be established under the president’s supervision to tackle issues related to climate change policy. The law provides special requirements regarding actions to be taken at provincial and municipal levels, as well as fines and penalties for violating the rules concerning presentation of industrial statistics.

At the time of writing, the draft law awaits promulgation from the National Assembly. If the draft is approved, representatives of all nine provinces will vote, with the president’s formal signing coming after. Taking into account that the draft was mostly positively recognized during the public hearings (53% voted in favour; 9% – against; and 38% abstained until further comments are received/the draft is amended) [Parliament of ZA, 2023], it is very likely that the law will come into force in 2024– 25.

South Africa’s Climate Policy Instruments and Potential

In 2017, South Africa introduced the Greenhouse Gas Emissions Reporting System (SAGERS). Following the governmental decree [Government of ZA, 2017b], respective businesses were obligated to submit data on greenhouse gas emissions arising from their economic activities. Among the industries, the regulation covers energy, metallurgy and machinery, mining, the clothing and footwear industry, certain transportation segments, electronics, and recycling. The relevant information must be provided at the end of each calendar year by 31 March of the following year.

The introduction of SAGERS laid the foundation for the carbon tax to become effective from 1 June 2019 [Government of ZA, 2019b].

The law provides legal basis for collecting a special payment from businesses that surpass the non-taxable minimum in terms of produced greenhouse gas emissions. It became effective in two phases: the first starting from 1 June 2019 until 31 December 2022; the second starting from 2023 until 2030. The system provides tax incentives and exceptions for companies actively reducing emissions.

For most of the emitters, the non-taxable minimum is set at 10 megawatts of produced electricity equivalent. In some cases, special requirements are put in place based on amount of produced goods. For instance, production of building materials has the minimum set on 4 million produced bricks. It worth mentioning that all livestock industries, including cattle, are fully exempt from the tax; the main burden is borne by fuel-producing industries.

At first the “price” per tonne of emitted CO₂ over the minimum was set at 120 rand (\$6.5). Until the end of 2022, the tax levy was increased by 2%; by the end of Phase 1 (2019–22) the rate was 144 rand (\$7.87). If all the discounts are applied, the tax rate might be lowered to 6 rand (\$0.33). Without discounts, by 2030 the tax rate might reach 462 rand per tonne (\$25.2) [Deloitte, 2023].

In 2022 the tax authorities reported 1.6 billion rand [Deloitte, 2023] of collected tax (\$83.5 million); in 2021 this amount was 1.3 billion rand [Steencamp, 2022] (\$68 million). After 2026, the amount of collected tax will increase significantly as the discount system will be phased out.

For the first time, in 2012, the government issued green bonds as an additional source of climate financing. Initially, bonds worth \$1 billion were put into circulation; in 2014–18 this amount dropped to \$100 million. In 2019 additional bonds were put on market (\$800 million in total) followed by decline to \$400 million in 2020–21 [Bouille, 2021].

South Africa demonstrates a great variety of issuers in the case of green bonds. Among the borrowers are local investment groups and major cities. In 2018, Cape Town issued green bonds worth 1 billion rand (\$83 million) to finance solutions to the problem of water shortages [Environmental Finance, 2018; Global Infrastructure Hub, 2021].

According to available estimates, the main problem with the development of the green bond market in South Africa in the context of the energy transition is that the key emitters do not use this instrument, which can be seen as a sign their unwillingness to fully participate in the implementation

of nationally set climate targets. The phenomenon of greenwashing raises legitimate concerns among potential investors in South African green bonds—the financing raised may end up making little or no difference to the overall situation in a country where renewable and other green energy sources are still seriously outcompeting coal.

In March 2022, the Green Taxonomy was presented in South Africa, paving the way for more climate financing in future [Government of ZA, 2022a].

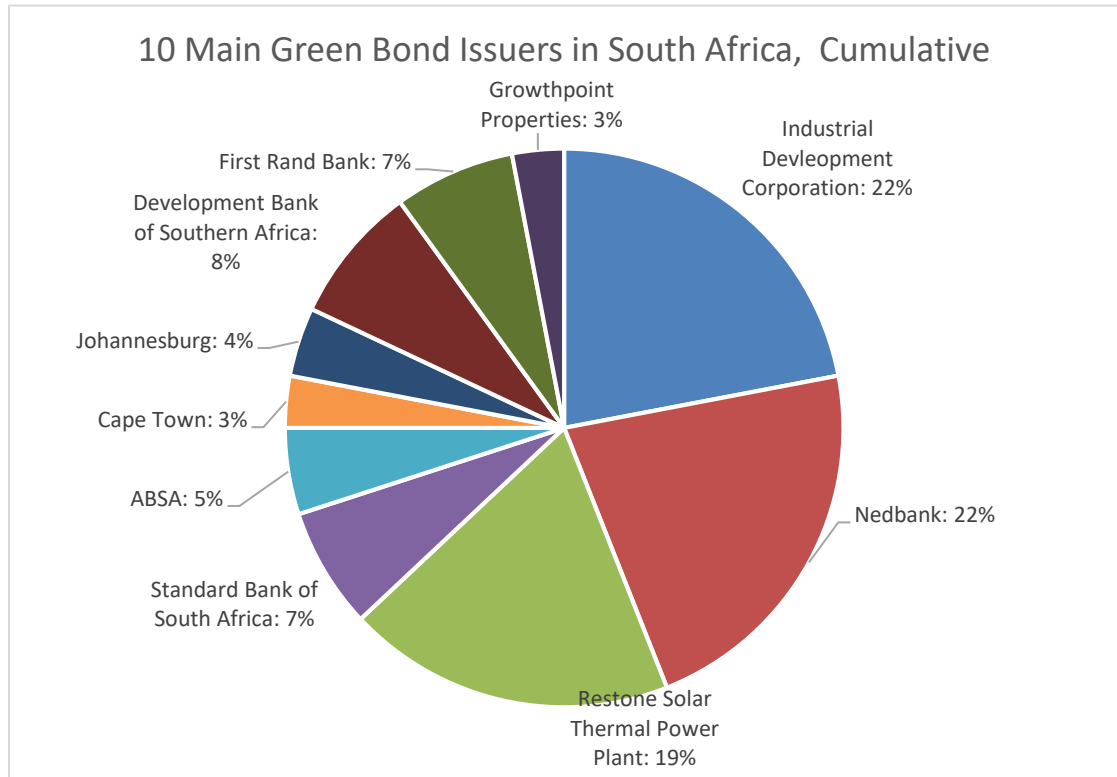


Fig. 4. 10 Main Green Bond Issuers in South Africa, cumulative

Source: Compiled by the author based on Climate Bonds Initiative [2021].

In 2011, the Renewable Energy Independent Service Provider Support Program (REI4P) was launched in South Africa [Government of ZA, 2011b]. As of 30 March 2022, the government has provided funding through public procurement under the programme to the tune of 209.6 billion rand (\$11.4 billion), with a total renewable electricity generation of 74,805 gigawatts. A total of 92 projects have been supported since 2011.

Under round five of the competition (2022–23), the winning contractors are expected to generate at least 2,600 megawatts of electricity from renewable sources, with at least 1,600 megawatts from wind farms and at least 1,000 megawatts from solar plants.

Under the Carbon Dioxide Offsets Programme [Government of ZA, 2022b], businesses whose operations emit carbon dioxide into the atmosphere can receive tax credits if they provide funding for projects that will help South Africa achieve its stated climate policy goals.

The project establishes requirements, criteria for selection, evaluation, and approval of national standards to be applied on a par with the three main international standards for certification of carbon

emission reductions.³

The project will allow issuing companies to receive credits that can be used to account for emission reductions by the company itself or can be sold on a specialized trading platform. In general, the presented programme is focused on the qualitative development of the local carbon market in accordance with international practices.

Hydrogen as a Source of Energy

As of now, hydrogen as an energy source is poorly represented on the South African market and does not appear in analytical works devoted to the country's energy balance. This phenomenon should be considered a consequence of the existing dominance of coal as an available and cheap source of energy; without direct state support, green hydrogen loses in price competition.

Nevertheless, the use of hydrogen as a fuel source in the case of South Africa is a promising solution. One analytical paper notes that South Africa has a number of advantages: the extensive experience of local producers of synthetic liquid fuels in practical application of the Fischer-Tropsch process; significant reserves of necessary mineral raw materials, in particular platinum ores, most of which are now exported; and suitable transportation and production infrastructure [Salma, Tsafos 2022].

The country's priorities in the field of hydrogen energy development are reflected in the Hydrogen Society Roadmap for South Africa published in 2021 [Government of ZA, 2021a]. Based on the above-mentioned advantages, the government aims to develop the industry and strengthen its own position in the market of green hydrogen fuel. It plans to achieve the production of green hydrogen in the amount of 500 kilotons per year by 2030, which will also create between 20–30,000 new jobs annually until 2040 [NBI, 2021]. South Africa could reduce the cost of green hydrogen to \$1.6 per kilogram by 2030, substantially lower than the cost of grey hydrogen produced in South Africa from natural gas at approximately 300 rand (\$21.17) per kilogram (as of February 2021).⁴

One of the key elements of the road map is the implementation of the Platinum Valley Initiative (PVI). Platinum can significantly improve the efficiency of hydrogen production despite its high cost; in the long term, the cost of hydrogen produced is significantly reduced by increasing the current density in the electrolyzer [Metallurgprom, 2020]. The government considers linking three important production and infrastructure hubs—mines in Limpopo Province, industrial facilities in Johannesburg, and the port in Durban—into a so-called "hydrogen corridor," within the framework of which supply will be provided by hydrogen-powered freight transport. In this way, the government intends to stimulate the growth of demand for hydrogen.

Three other projects under the road map—the COALCO2-X project in Mpumalanga Province, the Green Hydrogen Cluster project in Northern Cape Province, and the Sustainable Aviation Fuels project—are expected to contribute to the growth of green hydrogen production using existing capacity. For example, the COALCO2-X project is based on the production of hydrogen using captured volatile gases from coal-fired thermal power plants in the target region, while the Eastern Cape hydrogen cluster project involves the establishment of greenfield production facilities based on the logistical capabilities of the Boegoebaai port. The Sustainable Aviation Fuels project is supported by Sasol and also involves the establishment of new production facilities to meet fuel demand from local air carriers. The project will create additional capacity to expand export supplies [Baker McKenzie, 2022].

The implementation of these initiatives requires a significant financial injection. Overall, it is estimated that South Africa will need at least 8.9 trillion rand (\$462 billion) to finance all necessary climate actions [Cassim et al., 2021]. Even with the steps taken and funding provided, which will be

³ The Clean Development Mechanism, the Verified Carbon Standard, and the Gold Standard are mentioned.

⁴ Estimation given by Air Products South Africa [Philips, 2021].

described below, the gap between the estimated need and the actual resources available is enormous. To date, the South African government has established a special green fund with assets of 800 million rand (about \$45 million), and an agreement has been reached between the state-owned Public Investment Corporation and Anglo American Platinum to raise \$200 million to develop platinum-related projects. In 2022, a special green fund with 800 million rand (\$45 million) in assets was concluded. In 2022, an agreement was signed with the German Ministry of Economic Cooperation and Development to provide 12.5 million euros for technology development and green hydrogen production in South Africa. The German bank, KfP, on behalf of the German government has entered into an agreement to provide financing in the amount of 200 million euros for the development of hydrogen production in South Africa on concessional financing terms [CSIR-Meridan Economics, 2021]. South Africa may also receive additional financing under the UK-PACT programme launched by the UK, under which the British government intends to invest 60 million euros in the development of green hydrogen. Certain hopes are associated with the prospect of growing demand for green hydrogen produced in South Africa on foreign markets, in particular, in Japan [Patel 2020].

Carbon Capture and Storage Technologies (CCS)

CCS technologies are relatively new to South Africa and are yet to be widely used, even though the first attempts to evaluate the country's potential in storing carbon were taken in 2004. In 2009, the government established a designated body to tackle issues related to implementation of CCS technologies. In 2010, the Atlas on the Geological Storage of Carbon Dioxide in South Africa was presented. For 2017–20, there was a plan to launch the first CCS zone with capacity of 100,000 tonnes of CO₂ per year. According to the general plan, after 2025 the national CCS capacity would surpass 1 million tonnes CO₂ per year [Beck et al., 2013].

The first CCS site was established in 2021 near the town of Leandra in the Mpumalanga province in the northwest of the country. The region is characterized by a large concentration of coal-fired power plants, including the world's largest coal-based liquid fuel plant, operated by Sasol. The carbon storage facility is located at a depth of approximately 1 km and is expected to inject between 10,000 and 50,000 tons of CO₂ per year starting in 2023. Available estimates suggest a cumulative carbon storage potential of up to 150 gigatons in South Africa, mostly represented by offshore facilities [Roelf, 2021]. The construction of the storage facility was financed by a \$23 million grant from the World Bank under an agreement concluded in 2018 [Government of ZA, 2018b].

South Africa's desire to further develop CCS technologies and infrastructure is twofold. On the one hand, it certainly contributes to achieving the stated climate goals and reduces the amount of hazardous pollutants released into the atmosphere. On the other hand, South Africa's CCS development strategy can be seen as a tool that the local leadership is using to slow the process of abandoning coal as a fuel source, relying on the abundance of available and cheap raw materials.

Just Energy Transition Partnership (South Africa, France, Germany, the U.S., the United Kingdom, and the EU) (2021/2023-27)

On 2 November 2021, a six-party project was launched to support financing for South Africa's energy transformation and decarbonization programmes for one of Africa's largest economies. The first stage of the joint project will attract \$8.5 billion in grants, soft loans (up to 90% of the allocated amounts) and investments. The use of risk-sharing instruments is expected to make the project attractive to private investors. Implementation of the project should lead to a reduction in emissions by 1–1.5 gigatonnes over the next 20 years. The main objective is to eliminate the use of coal as an energy source in South Africa in accordance with sustainability principles [EC, 2021].

The Multilateral Agreement Implementation Plan (JET-IP) was presented at the meeting of

signatories to the Paris Climate Agreement in Sharm El Sheikh (COP27) in November 2022 [PCC, n.d.]. According to the plan, the funding target was to increase more than 10-fold to \$98 billion. The funds received will be used to implement the planned activities in the field of electric power, new modes of transportation, and implementation of solutions based on green hydrogen [Kramer, 2022]. The implementation period of the project is five years (2023–27) [COP, 2021].

South Africa has established a Presidential Working Group on Climate Finance to coordinate the steps being taken. The Partnership Secretariat plans to establish five working groups: two cross-sectoral working groups (finance and general issues of implementation of agreements) and three specialized working groups (energy generation, green hydrogen, and low-emission transport) [Climate Action Tracker, n.d.b].

Despite the significant amount of funds provided by foreign partners, South Africa's participation in the partnership has a downside. Moving away from coal as the main source of energy in this context will come at the cost of a significant increase in South Africa's external debt due to the fact that the funds allocated under the partnership are in the form of a loan rather than a development grant, as was the case, for example, in the agreement between South Africa and the International Bank for Reconstruction and Development (IBRD) to finance the country's first underground storage of carbon.

At the same time, the Presidential Climate Commission, at the stage of discussing the country's participation in the JET-IP, also identified many problems related to the implementation of the provisions of the agreement at the stage of public discussion. Justified criticism was voiced by professional associations of coal mining workers in South Africa, who fear job losses due to the abandonment of coal as a fuel and privatization of the country's energy sector. Representatives of local communities drew attention to the insufficient coverage of human development, health, and energy poverty issues in the partnership implementation plans. Finally, representatives of civil society organizations expressed doubts about the need to prioritize the use of vehicles using new fuels and green hydrogen [PCC, 2023].

The situation with South Africa's participation in the partnership reflects the key problem of the entire list of the country's stated priorities for achieving carbon neutrality—their implementation seems impossible or very unlikely, without attracting funds from developed countries, which puts the country in a dependent and vulnerable position. Understanding this explains the desire of the South African leadership to preserve part of its own energy potential, which is tied to the use of local coal. Hence the criticism of South Africa's climate policy as "not ambitious enough" and as insufficient to achieve carbon neutrality by 2050.⁵

Transformation/Change of Priorities or Objectives in the Context of the 2020-23 Crises

At the level of strategic goals for energy transition in 2022–23, no significant changes were recorded. Certain relaxations were adopted within the framework of national legislation regarding requirements for energy infrastructure facilities; for example, in January 2023, the government simplified the requirements for the degree of localization of equipment necessary for the operation of solar power plants (30% under the new rules compared with 100% previously) [Naidoo, 2023]. The changes are related to the increasing frequency of rolling blackouts to prevent overloading the infrastructure. The rolling blackouts are part of the policy of the key electricity supplier in the country, Eskom, which seeks to reduce the load on the system. The current crisis in South Africa is not directly related to the situation on the world market of energy raw materials, according to expert estimates [Proctor, 2023]. Eskom has been experiencing similar problems since 2007, and the volatility of energy prices in 2022–23 can only be seen as an aggravating, but not a key, factor.

⁵ See Climate Transparency [2022].

Conclusion

South Africa is experiencing serious difficulties related to the implementation of the green energy transition strategy. Climate policy in the case of South Africa is critical—the expected changes threaten the sustainability of agriculture and the existence of small farms, the fishing industry, and forestry. At the same time, the country's energy sector is quite dependent on coal as a fuel and is unable to completely abandon its consumption in the foreseeable future. The plans to reach carbon zero imply incomplete abandonment of coal as a source of fuel, and most of energy infrastructure facilities that are key emitters of greenhouse gases, including power plants that have almost reached the end of their operational life, will continue to operate for a long period of time.⁶

The steps taken by the South African leadership to improve the legal and regulatory framework for green energy policy, in particular the introduction of the carbon tax and the development of its own green taxonomy based on international experience, are ideologically consistent with the objectives of the energy transition. South Africa has also provided a strategic framework for the energy transition and has launched a pilot project on carbon sequestration. However, the challenges facing the country far outweigh the available resources. It is obvious that the ambitious goals set, dictated, among other things, by the influence of foreign partners, do not correspond to the real capabilities of South Africa.

The fundamental problem of South Africa is the lack of financing. With the estimated cost of the green transition for the country's economy estimated at more than \$400 billion, the funds provided through international partnerships cover less than 25% of this amount, and these funds are on borrowing terms, exacerbating the international debt problem and undermining the long-term sustainability of the South African economy. South Africa's domestic resources, including additional taxes on major greenhouse gas emitters, provide insufficient funds.

Together, these factors lead to a situation in which South Africa's long-term development strategy takes into account, but does not prioritize, the green transition. The steps taken and planned in the conditions of lack of funding are limited and, under the best of circumstances, can only partially reduce emissions and somewhat green the country's economy, which is not equal to a full-fledged energy transition. A way out of this situation is possible if there is a fundamental paradigm shift in the participation of developed countries in financing the energy transition on terms that do not jeopardize the long-term development prospects of the recipient country's economy.

⁶ It is worth mentioning that at the August 2023 BRICS summit in Johannesburg, South Africa and China reached an agreement whereby China will assist in extending the life of Eskom-run coal-fired power plants to address the problem of rolling blackouts [Mukherjee, 2023].

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