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Scaling Institutional Capital for Green Jobs in South Africa

G20: PIC Perspectives

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EXECUTIVE SUMMARY

South Africa is at a critical juncture in its green transition, with the potential to unlock substantial economic, social, and environmental benefits through increased institutional investment in green jobs. This paper, authored by the Public Investment Corporation (PIC) in collaboration with the University of Oxford, presents the case for tripling annual green investment in South Africa by 2030. This effort could generate more than 70 000 new jobs each year and drive inclusive, sustainable growth.

The analysis shows that green investments in South Africa can offer attractive risk-adjusted returns and can outperform global benchmarks. These investments also produce more economic value and create more jobs per rand compared to traditional sectors, while supporting climate resilience and social benefits.

Drawing on the PIC's investment experience, the paper outlines practical considerations for investors to enhance green job projects. These include co-investment models, environmental and social safeguards, and development impact approaches that align financial returns with development goals.

Despite the strong potential, several challenges limit the flow of institutional capital into green jobs. These include policy and regulatory uncertainty, grid and infrastructure limitations, and gaps in workforce readiness. The paper proposes actionable solutions, such as streamlined permitting, multi-stakeholder coordination, national human capital strategies, localisation and incentives for investors to overcome these barriers. The document also explores opportunities across emerging, scaling, and mature technologies, highlighting the role of sustainable finance instruments in mobilising capital.

Ultimately, the paper calls for coordinated action between public and private stakeholders to expand green investment, strengthen local value chains, and ensure a just and inclusive transition. With the right enablers, South Africa can become a continental leader in green finance and job creation, delivering both strong financial returns and transformative socio-economic impact.

1. INTRODUCTION

This paper makes a simple case: South Africa's green investments combine attractive, institutional-grade returns with the creation of green jobs that drive the economy. It provides the analytic foundation for proposed resolutions, endorsed by domestic and international asset managers, **to triple annual green investment in Africa by 2030**. It demonstrates that doing so could add **an additional 70 000 jobs per year.**

1.1 PURPOSE AND SCOPE

Drawing on the Public Investment Corporation's (PIC) successes, this paper illustrates pathways for institutional investors to originate and steward green-job-rich assets through co-investment structures, positive community impact, and partnerships with other financiers. It further sets out guiding frameworks to strengthen investor principles and safeguards, return discipline and development value that reduce execution risk and support scale.

Four observations on South Africa's green jobs potential and climate finance conditions are presented:

1. **Risk-Adjusted Returns: South Africa's green assets can outperform international peers,** delivering attractive risk-adjusted returns despite broader macro headwinds. Today's opportunity set is bigger and more mature: contracted, inflation-linked cash flows and creditworthy offtakers cushion the downside, while dislocations and multiple expansion drive upside.
2. **Economic Value: Green investments can generate ~60% more jobs per rand and ~140% more long-term economic value** than traditional options, while deepening skills, improving job quality, and strengthening climate-resilient infrastructure.
3. **Social Uplift:** Academic evidence shows that green jobs are a powerful engine of shared social value. In South Africa, this is borne out by the PIC experience as documented in this paper.
4. **Barriers to Investment are Diminishing:** Although constraints to scaling green investment exist, there are immediately actionable pathways to address them. The aim is to unlock larger private, domestic, and international capital flows into sustainable infrastructure in South Africa, and across the continent.

Figure 1. Khi Solar One Plant (Source Cox Energy, n.d.)

Unless otherwise stated, all projects depicted in figures 1, 3, 5, 6, 10, 11, 13, 16, 20 and 21 are ones in which PIC has invested directly or indirectly.

DEFINING GREEN INVESTMENT AND JOBS

The United Nations Environmental Programme (UNEP) defines green jobs as those that contribute "substantially to preserving or restoring environmental quality", including decarbonisation and reductions in pollution, energy and materials use. This refers to a country's direct, indirect, and induced jobs. Using this definition, a recent study finds that roughly 13.8% of South African jobs are classifiably green (and are related to preserving or restoring environmental quality) (Njokwe *et al*., 2025). With 16.7 million people employed, that amounts to around 2.3 million green jobs; under a stricter definition, the figure is closer to 0.9 million. This paper suggests that South Africa has the institutional capacity, capital markets depth, and policy architecture to scale green jobs and crowd in regional follow-on investment.

1.2 GUIDING INVESTOR PRINCIPLES

Scaling institutional capital into green, job-rich projects works best with alignment on a few ground truths that reliably reduce friction, broaden investor appetite, and protect value.

- **Return and risk discipline:** Projects need to clear risk-adjusted hurdles with structures that preserve investment quality. To achieve scale, this means bankable cash flows with creditworthy counterparties and proven operators, execution certainty supported by a stable political environment, and fit-for-purpose risk mitigation tools and instruments.

- **Environmental Social and Governance (ESG) safeguards:** Portfolio-wide ESG safeguards are essential to protect investments, accelerate underwriting and sustain a social licence to operate. Priority measures include standardising high integrity and anti-corruption controls; risk-based supply chain due diligence for labour and human rights; climate, nature and water impact assessment and appropriate environmental and social monitoring, assurance and reporting. These ESG guardrails reduce regulatory, reputational and execution risk and improve bankability across the portfolio.

- **Development impact:** Some investors, including the PIC, are mandated to pursue development impact, or other outcomes, alongside their fiduciary responsibilities to deliver financial returns. Beyond explicit mandates, creating material, verifiable local benefits can strengthen social licence to operate, commercial partnerships, and reduce exit frictions. Job creation is one of the most effective pathways to advance development, especially if jobs are high-quality, aligned with community priorities, and supported by appropriate training.

2. THE INVESTMENT CASE FOR GREEN GROWTH IN SOUTH AFRICA

South Africa offers institutional-grade opportunities in the global shift to low-carbon growth, with bankable pipelines in renewables, grid modernisation, water and circular manufacturing. Recent policy reforms are converting plans into shovel-ready projects. Green value chains are creating jobs at scale, strengthening energy security and resilience, and delivering competitive performance, which suits long-term capital. With anchors such as the PIC demonstrating co-investment pathways that accelerate localisation and skills development, green growth in South Africa aligns fiduciary duty with developmental impact, positioning investors to earn attractive risk-adjusted returns while advancing an inclusive just transition.

2.1 ATTRACTIVE RISK-ADJUSTED RETURNS

The global shift toward a low-carbon and sustainable economy is no longer a future aspiration, it has become a defining investment theme of this decade. For international sovereign wealth funds and other long-term investors such as the PIC, this shift offers a unique convergence of fiduciary responsibility and developmental impact. Green value chains, including renewable energy, grid modernisation, and circular economy manufacturing, are leading investor value creation and generating millions of jobs globally.

South Africa's green economy is already delivering a risk/return profile suited to institutional investors and is doing so at scale.

- **Market depth:** For the period 2015-2025, private-equity investments alone contributed $5.6 billion to green sectors in South Africa, with a clear acceleration from 2021 onward (Figure 2) (Preqin, 2025). Consumer Price Index (CPI) counted $1.9 billion in 2023 across institutional investment classes.
- **Marked returns:** For renewables-focused funds with 2015–2022 vintages, Africa shows a Residual Value to Paid-In (RVPI) of 1.11x versus 0.80x in the Americas, 0.96x in Europe, and a 0.96x global average (Table 1) (Preqin, 2025) - signalling stronger net asset values and cycle-resilient performance over the period (recognising RVPI reflects unrealised value and can move with exits).
- **Realised returns:** Looking at realised outcomes, as outlined in a paired paper, liquidated Africa-focused Private Equity (PE) funds concentrating on industrialisation, including green industrialisation, have historically achieved average Internal Rate of Returns (IRRs) of 21.3% and Multiple on Invested Capitals (MOICs) of 2.1x (Preqin, 2025).

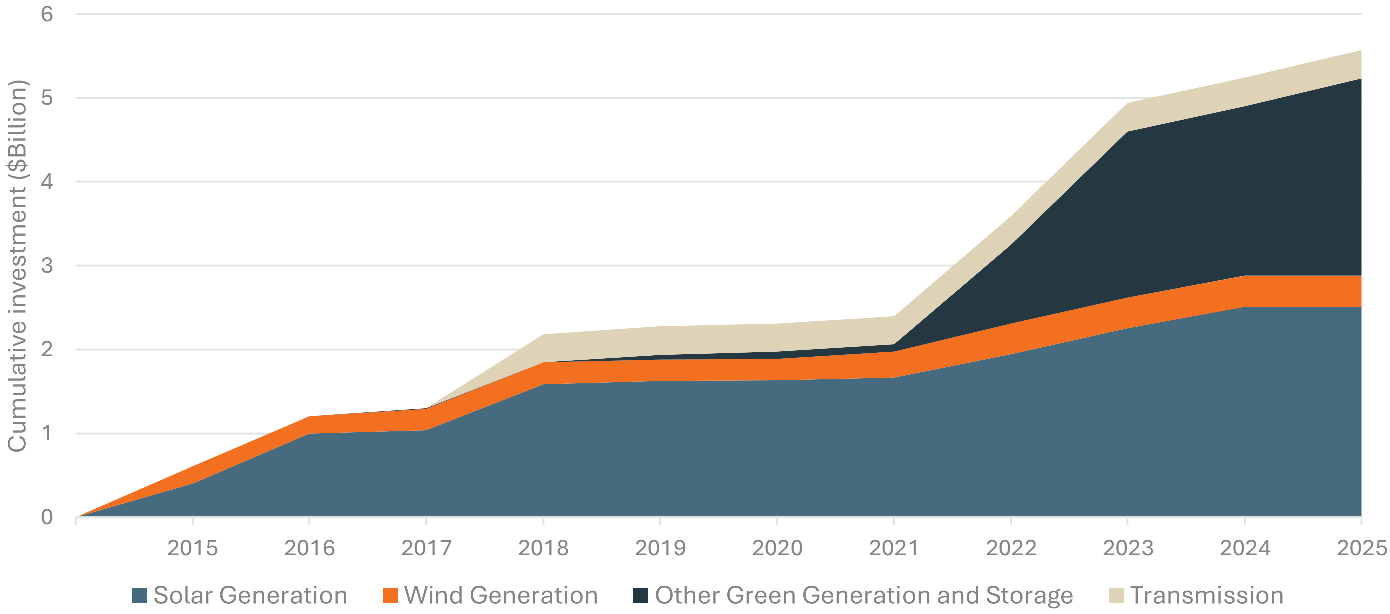

Figure 2. Cumulative Private Equity Investment in Green Sectors in South Africa 2015-2025 (Source: Preqin, 2025)[1]

The investment story of South Africa's green economy is a compelling one, grounded in real, recent capital formation and performance. The opportunity is driven by some of the following factors:

- **Structural demand is durable.** Chronic power challenges, grid constraints, water stress, and rising transport needs create non-cyclical demand, reinforced by a growing population and an economy bursting with potential.
- **Cash flows are predictable.** Power from large-scale power projects is sold under long-term contracts to utilities, cities and businesses. Grid and water projects are paid for availability. E-bus depots and freight charging are paid per use, typically inflation-linked. Together, these structures create long-duration, dependable income for investors.
- **Policy has assisted in turning intent into deal flow.** Public programmes and market reforms have moved projects from plan to construction. A healthy secondary market supports exits and refinancing. The planned grid build-out will further expand the pipeline across generation, storage, and wheeling. That said, additional policy improvements, outlined later in this paper, are still needed to accelerate grid connections, shorten permitting timelines, and unlock private capital at scale.
- **Clear entry lanes for institutions.** Opportunities include acquiring operating platforms, funding brownfield upgrades that de-risk core assets, providing private credit against contracted portfolios, investing in regulated grid and water concessions, and co-investing with domestic anchors like the PIC.
- **Risks are managed; upside remains.** Bankable contracts, proven risk tools and accessible foreign exchange solutions limit downside risks, and institutional stability anchors returns. Upside risks come from indexation, rising utilisation, efficiency gains and potential multiple expansion.

[1] "Other Green Generation and Storage" refers to a financing platform that includes multiple technologies with predominantly solar and wind-related energy.

Table 1. RVPI Infrastructure and Private Equity Funds of Vintage 2015-2019.

Country	RVPI
Africa	1.11x
Americas	0.80x
Asia	1.00x
North America	0.99x
Europe	0.96x
Diversified Multi-Regional	0.72x
Average	**0.96x**

Note: Analysis based on a small sample size of funds in Africa over the reporting period.

Although Africa possesses unique competitive advantages across various green sectors, Sub-Saharan Africa currently attracts only 2.4% of global climate finance (Climate Policy Initiative, 2025). The latter is primarily concentrated in East Asia, Western Europe and North America. Such disparities limit Africa's ability to fully leverage emerging opportunities in the sector.

There are also asymmetries in the composition of climate finance within Africa itself. In South Africa, 91% of tracked climate finance is domestically sourced (2019–2021), with private actors providing 86% of total flows and commercial banks and institutional investors accounting for 78% of those flows (de Aragão Fernandes *et al*., 2023). By contrast, across Africa in 2021/22, ~87% of climate finance came from international sources. The pathways to improving the landscape of climate finance for these regions will therefore be different.

In South Africa, the PIC has identified and pursued green-sector investments that advance its dual fiduciary and development mandates, acting decisively with significant strategic commitments and deploying capital. The PIC invests across diverse climate technologies such as green hydrogen, wind, and utility-scale solar. Together, these create considerable clean energy capacity and thousands of green jobs.

Through strategic investments, such as its commitment to the SA-H2 Fund and participation in South Africa's Renewable Energy Independent Power Producer Procurement Programme (REIPPPP), the PIC is enabling the development of large-scale, low-carbon and sustainable infrastructure, helping South Africa attain energy security and resilience. These investments also play a critical role in supporting the country's decarbonisation objectives and stimulating socio-economic development, including mobilising long-term capital, for a just and equitable energy transition.

Figure 3. Roggeveld Wind Farm (Source: Roggeveld Wind, n.d.)

2.2 ACCELERATED JOB CREATION AND ECONOMIC IMPACT

Investing in green jobs may be both quantitatively and qualitatively better than investing in traditional alternatives. That is because green investments can help promote high-impact feedback-loops that support economic development, offer better quality jobs, reduce inequality, improve air quality, and contribute to a more sustainable and affordable energy supply.

According to modelling by Vivid Economics, **green investments consistently generate more jobs than fossil fuel activities over a 20-year horizon, per unit of investment** (O'Callaghan *et al*., 2021). They estimate that in South Africa, “green spending could bring up to 60% more jobs in the short term and around 140% greater economic value in the long term, compared to traditional alternatives.” In the transport sector, for instance, the number of jobs created per rand spent in green solutions is almost double what it would be for traditional alternatives (Figure 4).

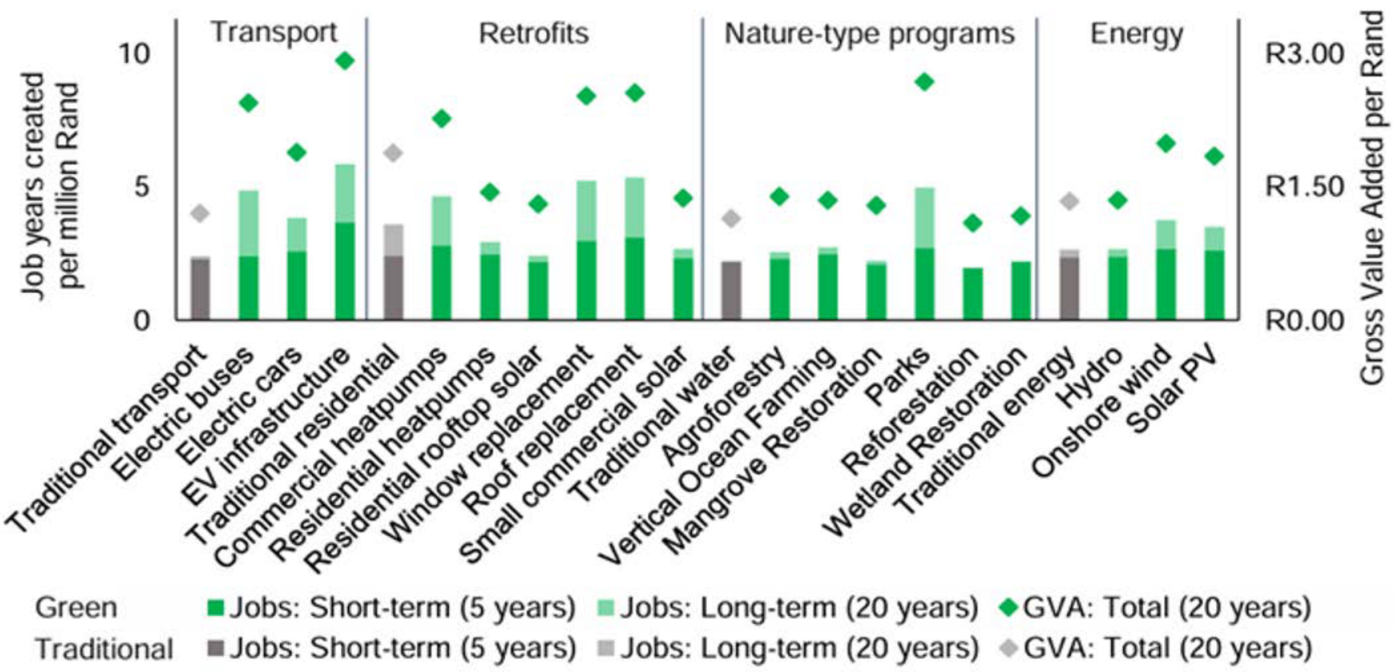

Figure 4. Job and Gross Value Added (GVA) impacts of green spending compared to traditional spending in South Africa for all modelled policies. Modelling output from Vivid Economics in O’Callaghan *et al.,* 2021

Nature-based programmes (e.g., agroforestry, park restoration) and building retrofits appear to outperform roads, housing, or coal infrastructure in job creation per rand invested. Private and public investment in green jobs tends to spill over into the rest of the economy, helping South Africa not only meet its Nationally Determined Contributions (NDCs) but also develop a stronger and faster-growing economy. **Green jobs can further help address gender and racial segregation in the country,** where men still make up the bulk of the roughly 16.7 million South Africans in the labour force (Statistics South Africa, 2025b). Meanwhile, the unemployment rate for black South Africans stands at around 36.9%, for coloured South Africans it is 23%, and for South Africans of European descent it is 9.2%. These inequalities carry through to the distribution of green jobs. South Africans of European descent, for instance, tend to be over-presented in green jobs (C40

Cities, 2021). Women are also consistently underrepresented in green jobs, at about one-third the rate of men (Mosomi & Cunningham, 2024).

Any transition that is not inclusive risks deepening these structural and systemic barriers. On the other hand, a transition that foregrounds targeted skills training programmes, is geographically focussed in under-resourced areas, and is sensitive to South Africa's legacy of racial and gender inequality, can significantly help ameliorate them.

A C40 report found that green interventions can support more female employment than the current aggregate workforce distribution (C40 Cities, 2023)[2]. There are indications that this could extend to addressing South Africa's racial inequalities. Already, the REIPPPP has brought $6.12 billion aligned with South Africa's Broad-Based Black Economic Empowerment strategy (74% of total procurement), with 38.1% of black South African shareholding in operational projects (DMRE, 2024). However, there remains room to improve how benefits reach communities, as project cash flows are typically prioritised for core obligations before distributions to community trusts. Nonetheless, stronger labour and environmental diligence improves outcomes, strengthening social licence to operate and timetable certainty while preserving risk-adjusted returns. **Green investment not only promises to deliver a greater number of jobs per rand spent, but higher quality jobs too.**

While many new green jobs are likely to support semi- to highly skilled workers, the National Business Initiative (NBI) estimates that over a quarter of new green jobs in South Africa are likely to be low or semi-low skilled jobs (NBI, 2024). Capitalising on these opportunities will require significant skills training programmes.

Figure 5. Jasper Solar Power Plant Panel Installation (Source Jasper Power, n.d.)

Further, according to FSD Africa, Shortlist and the Boston Consulting Group, specialised and general administrative jobs already make up 50% of the total green jobs in Africa, and this is unlikely to change drastically in the future (FSD Africa, 2024). These jobs often come with more stable contracts, higher pay and better benefits (FSD Africa, 2024). Preparing for the just transition means prioritising skills training programmes, as outlined in the Just Energy Transition Skilling for Employment Programme (JET SEP), so that individuals can access sustainable, high-quality jobs that are transferable across sectors and located in the areas that need them most (NBI, 2024).

Investment in green jobs also plays a critical role in addressing the air pollution crisis. Currently, air pollution-related deaths in Africa are about 80% higher than the global average (155 deaths/100,000 people compared to the global average of 85.6

[2] "As a whole, these interventions seem to support a higher proportion of female employment (28%) than the current aggregate workforce distribution, meaning that new jobs created through the transition could improve gender equity" (C40, 2023).

deaths/100,000 people) (HEI, 2022). That makes it the second-leading cause of mortality on the continent (Igamba, 2023).

Air pollution in South Africa contributed to the deaths of around 25 800 people and cost the country about $5.4 billion in 2019 alone (HEI, 2022). A recent study by the Clean Air Fund that focussed on Accra, Cairo, Johannesburg, Lagos and Nairobi found that, by following their current energy production trajectory, pollution could cost these cities around $138 billion in premature deaths and worker absenteeism by 2040 (Clean Air Fund, 2023). That amounts to around 8% of Gross Domestic Product (GDP).

Green investments, particularly those that target air quality, such as transport, biomass fuels, waste management, agricultural techniques and energy supply (industrial and power plant emissions), could save these cities around 109 000 lives (Clean Air Fund, 2023). Johannesburg is already conducting air quality monitoring with private companies, and a more integrated, national approach, as provided by the South African National Framework for Air Quality Management, is also underway.

The belief that green investments in South Africa are high risk seems to stem from a lack of available data in certain sectors, such as water conservation, agriculture, forestry and fisheries (de Aragão Fernandes *et al*., 2023). But it is also a result of an unstable policy environment and a lack of pre-existing infrastructure (such as roads, ports, or stable energy grids) that might help support the development of other green projects.

Scaling up risk-sharing mechanisms, such as partial guarantees and first loss facilities, together with policy support, capacity building, and new and innovative finance solutions may be part of solving the issue along with better and more transparent data and coverage of these sectors (de Aragão Fernandes *et al*., 2023). **Shifting the public narrative is crucial.** As already shown in this paper, **there are good financial incentives to invest in the green economy.**

Green investments are also valuable for building a more resilient economy that is able to withstand climatic shocks. Estimates vary widely, but it is conceivable that over $2,300 trillion of global economic product is at risk through to the year 2100 from climate-related system changes (such as productive land loss due to extreme weather events) (Climate Policy Initiative, 2024). Half of this cost could be curbed if climate finance needs are met. If supported by consistent due diligence frameworks alongside innovative, adaptable and future-proof construction techniques, even more could be saved.

Figure 6. Rural Amalooloo sanitation system. (SA Inclusive, n.d.).

2.3 SOUTH AFRICA'S GREEN JOBS EXPERIENCE

Against the backdrop of South Africa's elevated unemployment (33.2% in Q2 2025) and intensifying climate imperatives, the country is at an inflection point. Scaling green jobs can help harness green industries for large-scale employment while addressing environmental challenges and advancing inclusive growth (Statistics South Africa, 2025).

South Africa remains largely reliant on coal for its energy production. Coal constitutes roughly 80% of electricity supply in the country (AfDB, 2023) and still commands a large workforce (according to the Energy Council of South Africa, around 110 000 workers, 2025). Most of these workers will need to be reskilled. In Mpumalanga alone, ~80 000 coal workers will need to be moved and reskilled (roughly the equivalent of the total green jobs created by the REIPPPP) (O'Callaghan *et al*., 2021).

If not thoughtfully planned and executed, the transition could leave many South Africans behind. Any "just" transition would have to prioritise inclusive skills transfer training, upskilling, ancillary sustainability investments and climate awareness education, all of which are the focus of the JET SEP (NBI, 2024). But the JET SEP, as with South Africa's broader climate financing objectives, contends with a slowing domestic GDP growth rate, a high unemployment rate, often precarious work contracts for those in unskilled employment, continued inequality and volatile energy infrastructure (NBI, 2024; AfDB, 2023). **This is why private climate investment has become a crucial factor in these discussions.**

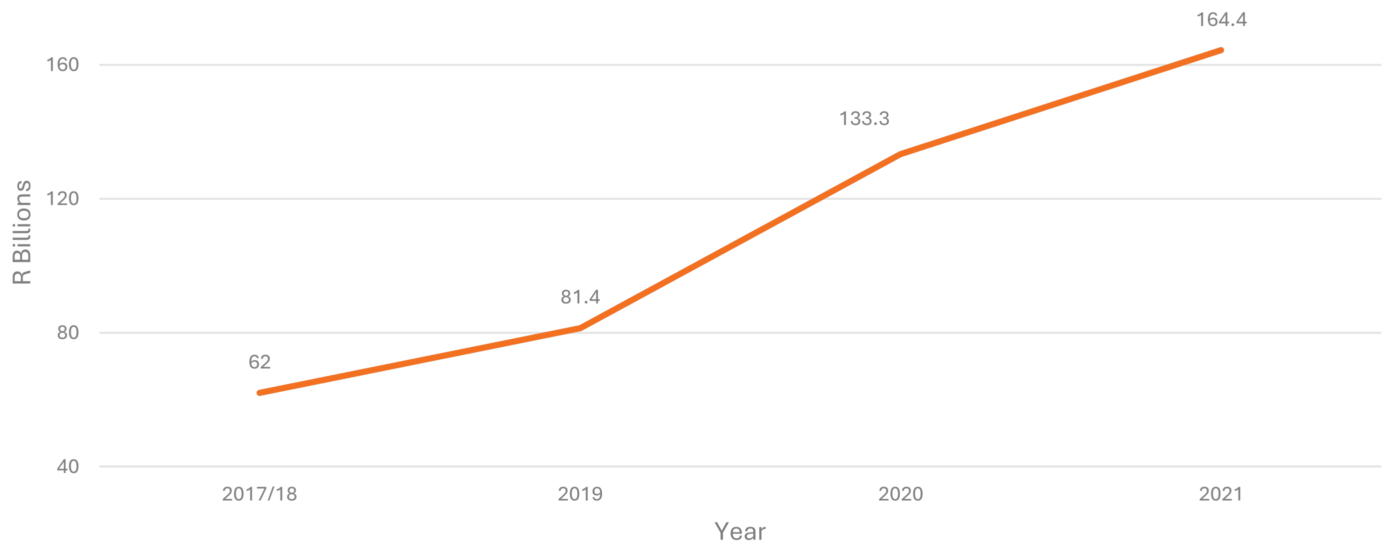

Figure 7. Tracked annual South African Climate Finance flows 2017-2021 (R billion) (CPI, 2025)

South Africa's REIPPPP is an auction-based scheme that contracts independent power producers (IPPs) to deliver renewable electricity under long-term agreements. It expands clean generation, attracts private capital, and advances national renewable energy targets. Beyond adding capacity, the programme has catalysed local supply chains and created jobs across construction and operations, with localisation measures supporting emerging manufacturing activity.

To date, the PIC has helped create over 4 000 jobs through the REIPPPP across its 40 different green investment projects. The Presidential Climate Commission (PCC) estimates that, since 2017/2018, there has been a tripling of annual climate financing in the country (de Aragão Fernandes *et al*., 2023) (see graph above).

Although the REIPPPP remains a popular and lucrative investment option, evidenced by its 4 rounds of oversubscribed bid windows since 2011, and despite these promising signs from the PCC, there remains room to scale up (O'Callaghan *et al*., 2021). As detailed in Section 2.4, tripling green institutional investment in **South Africa could generate over 250 000 new green jobs by 2030.** This would reflect private capital working in collaboration with public finance institutions such as the PIC.

South Africa already presents a compelling prospect for green capital investment. New government reforms, such as the Electricity Regulation Amendment Act and streamlined permitting through the Energy One Stop Shop, help simplify licensing, stabilise tariffs, and accelerate grid access. There are, however, areas in which the government could further increase policy certainty by doubling down, as detailed later in this paper.

South Africa also boasts a considerable comparative advantage in renewable energy in the region. It is endowed with abundant solar and wind resources. This has been essential to the success of the REIPPPP in securing over 6 GW of capacity.

South Africa has already succeeded in establishing foreign markets, attracting international investment and playing the role of regional leader. It is also actively pursuing a just energy transition that prioritises job creation, reskilling, and inclusive growth, including frameworks for workforce development across renewables, green hydrogen, and electric vehicle (EV) industries.

Africa remains a vital player in the climate change conversation, and without its close participation, there is little hope of maintaining a safe long-term global climate. South Africa is already a regional leader and is expected to remain such for the decades ahead. South African institutions, including the PIC, have proven themselves capable of mobilising funds at a continent-wide level, upskilling workers, and initiating international green energy resolutions. They have also demonstrated through public-private partnerships how investment in green energy can deliver attractive financial and developmental returns. By drawing in both international and local institutional investors, South Africa can massively scale green investment and unlock a wave of new green jobs in the years ahead.

Figure 8. South Africa's strengths in renewable energy

CASE STUDY: ADVANCING A LOW-CARBON AND RESILIENT ECONOMY THROUGH RENEWABLE ENERGY INVESTMENTS

The PIC continues to support South Africa's energy transition with strategic investments from several vehicles, including its unlisted portfolio. The portfolio spans diverse renewable energy technologies, creating jobs and driving broader socio-economic development along the way. Early large-scale investments have catalysed clean power and laid the groundwork for South Africa's sustainable energy future.

TRENDS IN RENEWABLE ENERGY INVESTMENTS AT THE PIC

Most of the PIC's renewable energy investments are anchored in Photovoltaic (PV), Concentrated Solar Power (CSP), and wind energy projects. The PIC has enabled over 1 800 MW of installed capacity across technologies, directly supporting South Africa's goals of diversifying its energy mix, enhancing energy security, and reducing greenhouse gas emissions. Many of these investments closed in the early REIPPPP bid windows, with **the PIC stepping in as a strategic financier** while **the industry was still** taking shape. In total, the PIC has deployed over $300 million in debt financing and over $100 million in equity.

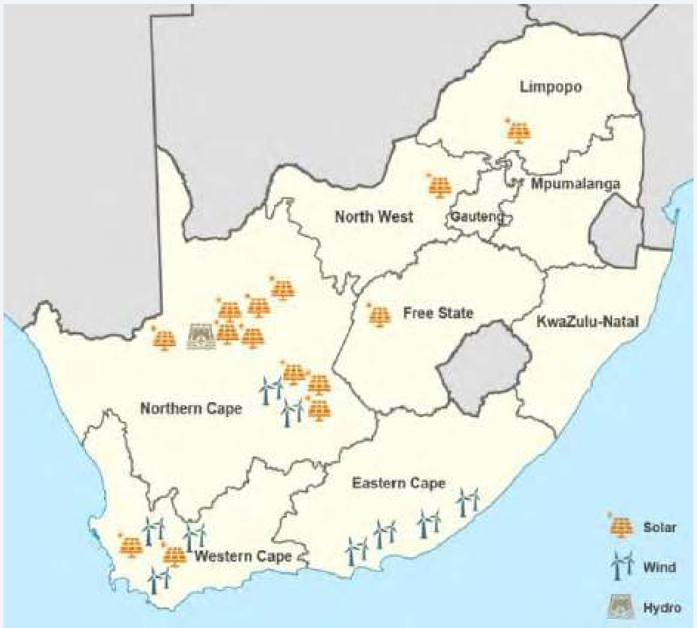

Figure 9. PIC-Backed REIPPPP Project Locations in South Africa

This reflects a balanced and deliberate approach to enabling the financial viability of large-scale renewable energy infrastructure and has yielded broader systemic benefits. By backing projects in the initial stages of REIPPPP, **the PIC contributed to building critical industry knowledge, derisking the sector for future investors, and scaling up the renewable energy market in South Africa.** This helped establish the foundations for a steadily growing industry that continues to attract domestic and international capital. Additionally, **PIC's early investments provided critical capital that helped REIPPPP projects reach financial close,** facilitating successful execution and signalling investor confidence that helped overcome early market uncertainty.

SOCIO-ECONOMIC IMPACT

Under the REIPPPP, IPPs must allocate a share of project revenues over their 20-year operational life to Socio-Economic Development (SED) and Enterprise Development (ED) in host communities, generally within a 50 km radius of the project site. The minimum SED contribution is 1% of revenue (with a 1.5% target), and the ED contribution is 0.6% of revenue. By 30 September 2023, cumulative contributions totaled R2.5 billion for SED and R764.9 million for ED, with reported spend concentrated in education and skills (~49.8%), followed by enterprise development (~22.2%), social welfare (~13.7%), general administration (~12.3%) and healthcare (~2.1%) (DMRE IPP Office, 2023).

Figure 10. Jasper Solar Power Plant Early Childhood Development Centre (Source Jasper Power (n.d.)

In addition, the REIPPPP requires local community equity participation, typically ≥2.5%, through community trusts, which receive dividends that can be reinvested in SED/ED priorities identified in local plans and formalise community participation in the governance of benefits. Through the REIPPPP, the PIC's investments have supported local job creation and skills development through ED and SED programs, with contributions exceeding $10 million in 2024 alone. The PIC has also provided over $20 million of funding to finance community-trust shareholding across seven REIPPPP projects. This has helped play an active role in supporting the participation of black-owned partners, thereby advancing inclusive ownership, Broad-Based Black Economic Empowerment (B-BBEE), and local equity participation.

In total, **the PIC has helped enable $11 billion in infrastructure investment within Bid Windows 1 through 4. The PIC's investments have also facilitated the creation of over 4 000 jobs, more than 2 000 of which are permanent roles that sustain long-term operations and maintenance.** Demographically, male employees still dominate the workforce, holding 71.5% of the jobs, while women account for a notable 28.5%.

FINANCIAL RETURNS: JASPER SOLAR POWER PLANT

One of the PIC's standout investments under the REIPPPP is the Jasper Solar Power Plant, a 96-megawatt (MW) photovoltaic facility near Postmasburg in the Northern Cape. The plant spans approximately 150 hectares and comprises more than 300 000 photovoltaic modules. It reached commercial operation in 2014 as part of Bid Window 2. **To date, the investment has delivered a 4.5× MOIC and a 27% IRR.** The facility employs more than 100 permanent staff, has contributed over $500 000 to ED and SED initiatives in 2024, and is estimated to avoid ~200 000 tonnes of carbon-dioxide equivalent (tCO_2e) per year. The Jasper Plant's performance reflects the bankable design of the REIPPPP when coupled with a disciplined delivery by a competent asset manager and operations and maintenance team. Further, a 20-year, rand-denominated Power Purchase Agreements (PPAs) with Eskom, underpinned by a government Implementation Agreement (sovereign support), provides predictable revenues that support long-tenor. The equity structure brings together local and international investors, B-BBEE partners, and a 7.5% community trust, aligning financial returns with local impact and mandated ED and SED commitments.

Figure 11. Jasper Solar Power Plant (Source Jasper Power (n.d.)

EMERGING INSIGHTS AND OPPORTUNITIES

Looking ahead, the PIC's focus on emerging technologies, including hydrogen fuel cells and green hydrogen production, underscores its commitment to both innovation and growing South Africa's green economy. As an anchor commercial investor, the PIC has already committed $17 million to the SA-H2 Fund's equity tranche, leading local institutional participation to accelerate development of the country's green-hydrogen value chain. These forward-looking investments not only reinforce the PIC's role as a strategic financier but also as a long-term partner in shaping South Africa's just transition.

2.4 SCALING GREEN INVESTMENT TO CREATE 70 000 JOBS ANNUALLY

The intrinsic value of greening South Africa's economy is difficult to overstate. The energy and transport sectors provide ~$15 billion and ~$32 billion of annual economic value, respectively, both of which must keep growing to support a rising population and an economy at a developmental inflection point (DoT, 2023; Statistics South Africa, 2023a; Statistics South Africa, 2023b). It is not only feasible, but economically imperative, for South Africa to meet its 2030 emissions targets on a path to net zero by 2050. The Climate Policy Initiative finds that doing so requires lifting climate-aligned finance from roughly $7.15 billion per year to $18.37 billion per year (de Aragão Fernandes *et al*., 2023).

Tripling institutional finance would require an extra R66 billion per year (to R99 billion per year), or US$3.7 billion (to US$5.6 billion). This step-up is expected to drive substantial job creation. The incremental investment is assumed to broadly match the sectoral profile in South Africa's Just Energy Transition Partnership Investment Plan (JET-IP) (JET IP, 2022), with adjustments for technological progress and the assumption that each incremental rand of institutional investment "crowds-in" additional capital from other sources, creating a meaningful multiplier that varies by sector. Considering historical examples (O'Callaghan *et al*., 2021), total expected job years and jobs created per sector are calculated below (Figure 12).

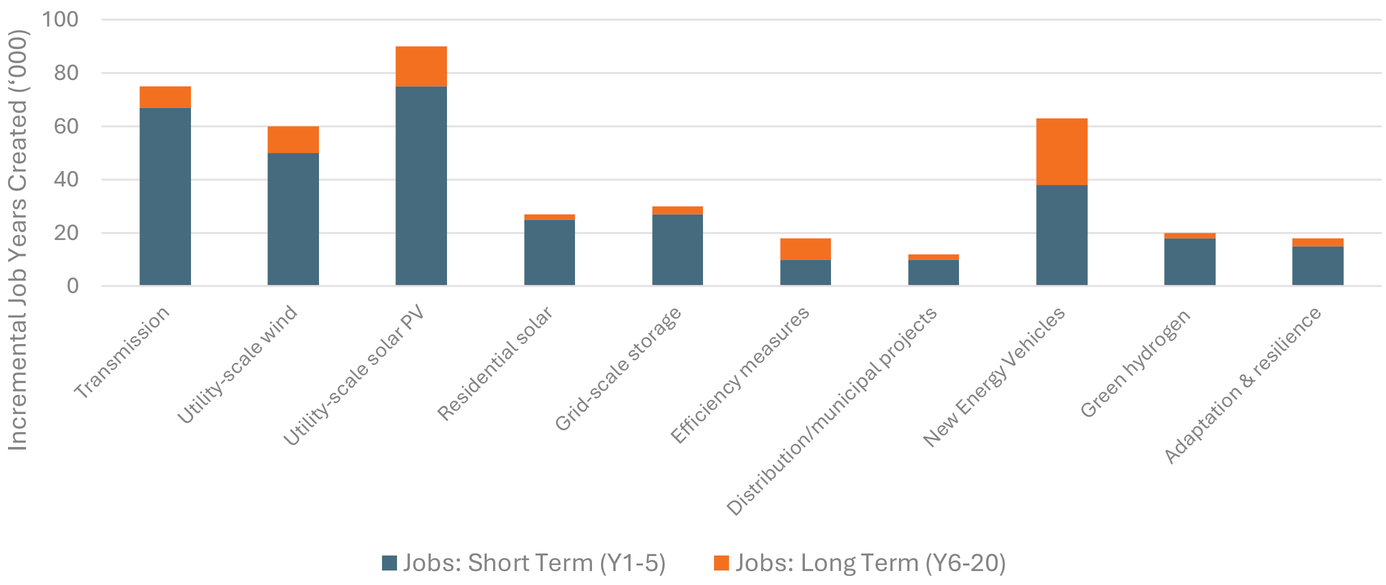

Figure 12. Total incremental job years created annually by tripling green institutional investment (Source O'Callaghan *et al*., 2021).

Tripling institutional investment is projected to create 71 100 new jobs annually and, if accelerated, nearly 250 000 jobs by 2030. This broadly aligns with the estimates of NBI, that suggest 120 000-200 000 green jobs could be created through 2030, based solely on "current project pipeline and demand" (NBI, 2024). All else equal, tripling institutional green investment could reduce South Africa's unemployment rate by over 100 basis points, directly supporting the welfare and upward mobility of over a million people.

3. WHY IS INSTITUTIONAL CAPITAL NOT FLOWING TO GREEN JOBS?

In addition to persistent structural barriers such as policy and regulatory uncertainty, distribution infrastructure bottlenecks and grid capacity limitations, South Africa also faces critical gaps in workforce readiness, technical skills, and local industrial capacity. Addressing these barriers is essential to scaling-up institutional green investment. Solutions must involve policies that help reduce risk premiums, improve project bankability and investor confidence, and ensure that South Africa's energy transition delivers on its promises of inclusive economic growth, employment creation, and climate resilience. This section examines some of the barriers obstructing green capital flows into South Africa, and how they might be overcome.

3.1 BARRIER 1: POLICY AND REGULATORY UNCERTAINTY

For institutional investors, policy uncertainty, such as unpredictable shifts in carbon pricing or renewable energy procurement, makes it difficult to assess long-term project risks. This can increase the cost of capital and may hinder investment in green infrastructure (World Economic Forum, 2024).

Even in developed markets, policy reversals have had long-lasting effects on investor confidence. The sudden rollback of solar subsidies in one European market, for instance, led to a pronounced collapse in new deployments and a wave of litigation (Sánchez *et al*., 2018). In emerging markets, similar uncertainties can have an even deeper and more lasting impact on capital markets. Limited regulatory capacity, fragmented policy frameworks, and slow project implementation (mostly due to frictions navigating policy) remain significant obstacles to scaling clean energy investment on the continent (Pereira *et al*., 2025).

South Africa's track record on regulatory clarity has been mixed (IDC/DBSA/TIPS, 2011; Njokwe *et al*., 2025). For instance, while early bid windows (2011–2015) for the REIPPPP built strong investor momentum, subsequent rounds were marked by delayed timelines, shifting bid requirements, and uncertainty around future capacity allocations (IDC/DBSA/TIPS, 2011).

These issues were exacerbated between 2015 and 2019 by the state electricity utility provider's hesitance to sign power purchase agreements with IPPs (Kruger, 2023). Both factors led to gaps in project pipelines, discouraging capital commitments from institutional investors seeking predictable deal flow. Similar trends around shifting deadlines and delayed market operator decision-making are not unique to South Africa, of course, having been observed in many international markets in recent years, including North America.

Uncertainty around local content requirements and industrial policy in South Africa have also inflated risk premiums for investors. Again, there are parallels to shifting manufactured content requirements in North America. Although South Africa has stated ambitions to build local manufacturing capacity for renewable energy components, for example, projects can be caught between complicated and changing local sourcing rules and global supply constraints (Marema *et al*., 2023). Regulatory uncertainty can translate into risk premiums on infrastructure debt and equity, extended holding periods, and more conservative underwriting.

The absence of a unified framework for tracking green jobs and outcomes presents a further challenge. Njokwe *et al*. (2025) note that without a standardised reporting structure for "green jobs," it is difficult to evaluate the labour market impact of green investments or design incentives tied to employment outcomes. This lack of alignment makes it harder for investors to demonstrate the social impact of their capital, an increasingly important criterion for ESG-driven funds. Again, this is hardly unique to South Africa, but it does require attention.

POTENTIAL SOLUTIONS

Predictable procurement pipelines, harmonised permitting, and a clear national strategy for local content and job metrics are all critical to overcoming policy uncertainty. Partnerships between government, utilities, and investors can help move these reforms from design to delivery. A critical step is the establishment of clearer, streamlined mandates and improved coordination between key institutions such as the National Energy Regulator of South Africa (NERSA), Department of Mineral Resources and Energy (DMRE), environmental regulators, and investment agencies. This can help reduce fragmented decision-making and strengthen investor confidence. Aligning policy incentives with effective risk management tools, such as guarantee schemes and blended finance, is essential for building a robust green finance ecosystem in emerging markets (Bakare *et al*., 2024). In the South African context, targeted subsidies such as viability gap funding, tax incentives for renewable energy generation, and capital support for storage and grid infrastructure would significantly enhance project bankability. When combined with stable policy frameworks and well-sequenced procurement pipelines, these reforms can help unlock capital at the pace and scale required to meet both climate goals and socio-economic development priorities.

Figure 13. CPV Power Plant No .1.

It is also imperative that eliminating human exploitation is treated as foundational and embedded across the investment lifecycle, from sourcing and underwriting to ownership and exit. It must be non-negotiable. Government's role is to set clear, predictable rules and remedies (e.g., harmonised due-diligence requirements, import controls, public procurement standards, whistle-blower protections, and capacity support for compliance). Investors also have a central role, using due diligence, voting, engagement, shareholder resolutions and clear escalation protocols to uphold minimum ESG standards. In practice, institutionalising this means:

i. Contractual supplier codes with a zero-tolerance stance and defined remediation;
ii. Risk-based audits complemented by worker-voice channels;
iii. Corrective-action plans with escalation protocols;
iv. Board-level oversight; and
v. Concise Key Performance Indicators (KPIs) reported annually.

3.2 BARRIER 2: DISTRIBUTION INFRASTRUCTURE AND GRID CAPACITY CONSTRAINTS

The capacity and condition of power systems, such as distribution lines, substations, and interconnection facilities that deliver electricity from generation points to consumers, have a significant impact on capital flows into green jobs. As evidenced by North America, where insufficient bulk-power grid capacity delayed hundreds of gigawatts of renewable energy projects, even well-financed renewable energy projects can face delays or cancellation due to an underdeveloped or congested grid (Manocha *et al*., 2024).

In the case of South Africa, the national grid is facing significant capacity constraints due to rapid growth in renewable energy development and years of underinvestment in both transmission and distribution infrastructure. Eskom's 2023 and 2024 generation connection capacity assessments show that grid access is fully booked through 2030, with no remaining capacity in key renewable energy zones such as the Northern Cape, Western Cape, Eastern Cape, and parts of the Free State (Eskom, 2024).

Transmission bottlenecks have forced developers to compete for limited substation capacity, often in lower-resource or harder-to-develop regions. While limited grid capacity is available in provinces like Mpumalanga and Limpopo, developers face lower resource potential and must demonstrate construction readiness to secure access under Eskom's "first-ready, first-served" approach.

To accommodate large-scale renewable energy generation, particularly from wind and solar-rich regions, Eskom requires an estimated $21 billion in investment over the next decade (Cocks, 2024). Yet, with a debt load of over $21 billion and continued liquidity challenges, Eskom's balance sheet limits its ability to finance or co-finance this critical infrastructure (Cocks, 2024). While tariff reforms have been introduced, they have not significantly improved the utility's financial position.

Underinvestment in transmission has bottlenecked deployment, limited grid access, and constrained execution and the evolution of offtake profiles, leaving technically sound, bankable renewables unable to advance in many instances. While REIPPPP sovereign back-stops remain in place, limited fiscal space is steering new solutions (e.g., non-sovereign credit guarantees) for the transmission programme. A national grid plan exists (National Transmission Company South Africa (NTCSA's) Transmission Development Plan (TDP) and Generation Connection Capacity Assessment (GCCA), but delivery capacity, permitting and funding remain constrained. Relying solely on de-risking mechanisms like blended finance or guarantees may not be sufficient. Broader structural reforms are needed too. Distribution network weaknesses, particularly in municipalities, have further undermined grid reliability and limited the ability to wheel electricity to high-demand areas. The lack of reliable distribution infrastructure also discourages buyers from signing PPAs, as reduced energy availability can make take-or-pay contracts financially unattractive (GreenCape, 2025).

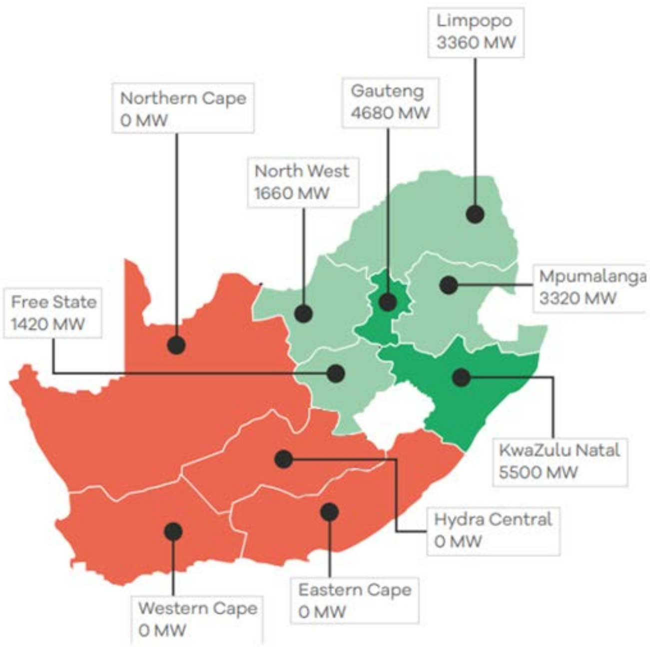

Figure 14. Eskom supply area grid capacity at provincial level up to 2030 (GreenCape, 2025)

POTENTIAL SOLUTIONS

Wheeling provides a pragmatic bridge to current constraints by enabling renewable generators to deliver power to off-site consumers over existing transmission and distribution networks; however, it is a complementary measure, not a comprehensive fix. Rather than requiring a direct connection between the generator and the end user, wheeling allows power, such as from a solar farm in the Northern Cape, to be sold to a corporate buyer in Gauteng through the Eskom or municipal grid.

Wheeling enables the transmission of renewable energy from high-resource regions like the Northern, Western, and Eastern Cape, where grid saturation has limited new connections. By enabling the use of underutilised capacity in other areas and allowing private generators to access the grid, wheeling creates more flexibility in project siting and expedites the deployment of clean energy without waiting for extensive new grid build-out (Eskom, 2025).

For investors and IPPs, wheeling can improve the bankability of renewable energy projects by opening new market opportunities and diversifying offtake arrangements. Importantly, wheeling also supports the financial sustainability of the electricity network, as Eskom and municipalities are still compensated through use-of-system and administrative charges. With the removal of licensing requirements for embedded generation projects up to 100 MW and the growing adoption of standardised wheeling frameworks, wheeling is emerging as a scalable mechanism to accelerate renewable energy uptake and align with national decarbonisation and energy security goals (Eskom, 2025).

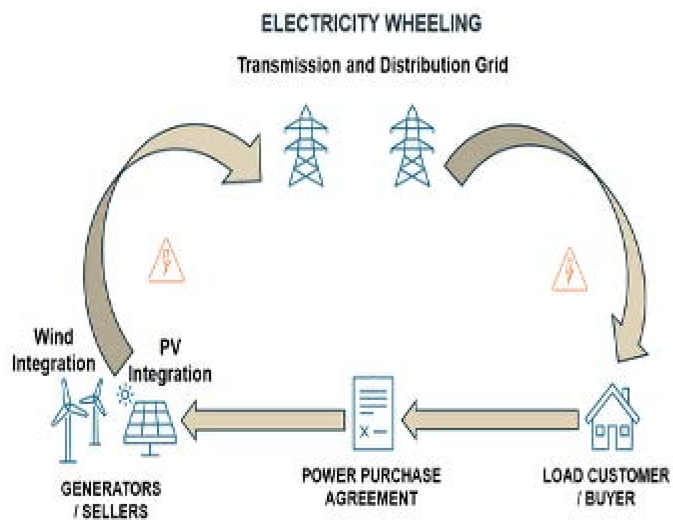

Figure 15. Eskom's wheeling structure (Source: Eskom, 2025)

Wheeling can also help **generate new jobs in South Africa** (Renaud *et al.,* 2020). It drives demand for specialised skills in areas like metering, energy trading, and grid management (Oladejo, Shava & Ndebele, 2025). By broadening the customer base for renewable projects through "willing buyer, willing seller" models, wheeling can enhance project bankability and sustain employment for contractors and service providers (Moodliar *et al*., 2023).

Furthermore, it enables regional diversification of renewable projects, spreading economic benefits and hiring into new areas (Creamer, 2022). Finally, wheeling contributes to the just transition by creating roles that can absorb and reskill workers from declining coal sectors, strengthening the overall employment impact of the energy transition (Sebele, 2024).

3.3 BARRIER 3: SKILLS SHORTAGES, WORKFORCE READINESS AND INDUSTRIAL CAPACITY GAPS

Education and training systems have struggled to keep pace with the needs of South Africa's low-carbon transition. A skills gap persists, particularly in the technical and operational demands of the green economy. This misalignment hinders both the execution of projects and the realisation of their job creation potential (Njokwe *et al*., 2025; Marema *et al*., 2023).

The skills gap impacts multiple sectors:

- **Technical roles in renewable energy** - South Africa needs a surge of electricians, engineers, and technicians to install, operate, and maintain solar, wind, and storage infrastructure. Emerging sectors such as green hydrogen and electric vehicle (EV) manufacturing are unlocking entirely new value chains, each demanding highly specialised expertise.
- **Management and compliance skills** – Institutional capital often requires rigorous reporting against ESG and impact frameworks, which is currently constrained by the shortage of professionals who can manage reporting, certification, and compliance for green projects.

Skills shortages also undermine one of the primary rationales for institutional investment in green sectors: green job creation. Without alignment between training systems and sectoral growth, the full employment dividend of green investment cannot be realised (Njokwe *et al*., 2025).

This is particularly critical for local manufacturing and industry. South Africa's industrial base is not yet prepared to supply the green economy at scale. The country's manufacturing competitiveness has continued to decline, with a growing dependence on imports of high-value green-technology components such as solar panels, lithium-ion batteries, and inverters (Montmasson-Clair, 2024). This has two implications:

- **Economic leakage** – When key technologies are imported, much of the value chain (and its associated jobs) is captured offshore, dampening the multipliers associated with investing in green jobs and compromising ESG mandates.
- **Project risk and cost volatility** – Heavy import dependence exposes investors to currency fluctuations, shipping disruptions, and global price cycles, which can derail project economics.

POTENTIAL SOLUTIONS

Solutions require multi-stakeholder coordination. National human capital strategies must be tightly integrated with sectoral growth plans and could include co-financed reskilling programmes.

Importantly, localisation plays a significant role in overcoming the skills gap. The CSIR's modelling suggests that renewable energy job multipliers rise significantly when local content requirements are met, because manufacturing, assembly and maintenance roles are created domestically (Marema *et al*., 2023). However, localisation strategies have also faced challenges such as fragmented incentives, inconsistent enforcement of local content rules, and a lack of industrial development roadmaps for critical technologies.

From an institutional investment perspective, weak localisation means fewer bankable projects with strong domestic linkages. Projects that align with government industrial strategies and create measurable local impact are less exposed to political risk and often qualify for concessional co-financing.

Targeted industrial policies and supply-chain investments, including designated zones for renewable manufacturing, incentives for technology transfer, and partnerships between institutional investors and development finance institutions to fund early-stage local suppliers, can accelerate localisation. Without such measures, the green transition risks becoming an import-heavy transition, limiting both the economic and social returns on institutional capital.

3.4 OVERCOMING THESE BARRIERS

Unlocking institutional capital for South Africa's green transition will depend on more than just market interest; it will require deliberate system-wide alignment. For the PIC, this presents a chance to help shape a more resilient green finance ecosystem by supporting high-impact infrastructure, driving localisation efforts, and backing human capital development.

Addressing these issues will not only improve the bankability of renewable energy and green economy projects, reducing risk and increasing returns for investors, but will also ensure that investment flows deliver tangible benefits in terms of employment, industrial growth, and long-term energy security. With the right enablers, institutional investors can move from being reactive participants to proactive drivers of South Africa's low-carbon transformation.

Simple tax breaks/credits for clean projects, fast-tracked permitting processes, standard long-term contracts at known prices, easier grid access and fair grid fees are just a subset of appealing solutions. More demand can be created if government purchases of green goods are coupled with training and wage support. By leveraging international partnerships and aligning public and private finance with national development priorities, South Africa can accelerate the creation of green jobs and ensure that the climate transition is socially inclusive and economically transformative.

4. WHAT OPPORTUNITIES ARE ACTIONABLE?

In South Africa, domestic flows should be complemented with catalytic international capital to mobilise private balance sheets in harder-to-finance segments. Guarantees and other risk-transfer instruments can help initiate this and ensure South Africa is not too heavily reliant on domestic leverage. **Across the rest of Africa, attention should be given to deepening domestic savings pools and building local-currency financing channels.** This can help reduce the region's dependence on USD-denominated external flows. It would also mitigate foreign-exchange and donor-cycle vulnerabilities and enhance project bankability. This section offers some pathways to realising these goals.

Global climate investment reached $1.9 trillion in 2023 and likely surpassed $2 trillion in 2024, while international flows to Emerging Market and Developing Economies were about $196 billion in 2023 (Climate Policy Initiative, 2025). Africa remains significantly underrepresented in these flows, receiving only 3% of global climate finance (2021/22), even though its mineral endowments and renewable energy potential position it to be the engine of many of the technologies driving global investment.

There is ample opportunity for green investment in South Africa, and Africa more broadly, from renewable energy buildouts, grid modernisation and climate-smart agriculture to green manufacturing and circular economy initiatives. Far from being limited to wind farms and solar parks, the pipeline of investable projects on the continent now stretches across water recycling, waste-to-energy, ecosystem restoration, and clean transport, each carrying high employment multipliers.

One channel for scaling capital flow has been sustainable finance instruments, including green, social, sustainability and sustainability-linked debt (often referred to as GSS+). Globally, these tools have helped mobilise private balance sheets and, where policy and disclosure frameworks are credible, helped reduce funding costs and extend tenors (Climate Policy Initiative, 2025; Climate Bonds Initiative, 2025). In Africa, they have supported a growing, though still modest, pipeline through bank, municipal and corporate issuance on local exchanges.

To date, labelled issuance has complemented rather than transformed the continent's climate finance mix, signalling substantial headroom if project pipelines, credit enhancement and local currency solutions are expanded (FSD Africa, 2025; ING, 2025; Climate Bonds Initiative, 2025). To support climate financing momentum into green jobs at scale, **instrument choice should match each project's purpose and maturity.**

Figure 16. Hive Hydrogen's Green Ammonia Export Hub envisaged at the port of Coega

Figure 17 illustrates a practical "universe" of sustainable financial instruments related to sustainable development, for instance:

- Use-of-proceeds debt (green, social, sustainability) and performance-linked debt (KPI-/transition-linked) alongside equity/ PE/Venture Capital (VC).
- Risk/credit-enhancement (guarantees, climate-risk insurance) and mixed/alternative mechanisms (blended and project finance).
- Carbon offsets and payments for ecosystem services, with grants where markets are not yet commercial.

Although these are by no means prescriptive, the diagram provides a useful menu that maps across green and social end-uses.

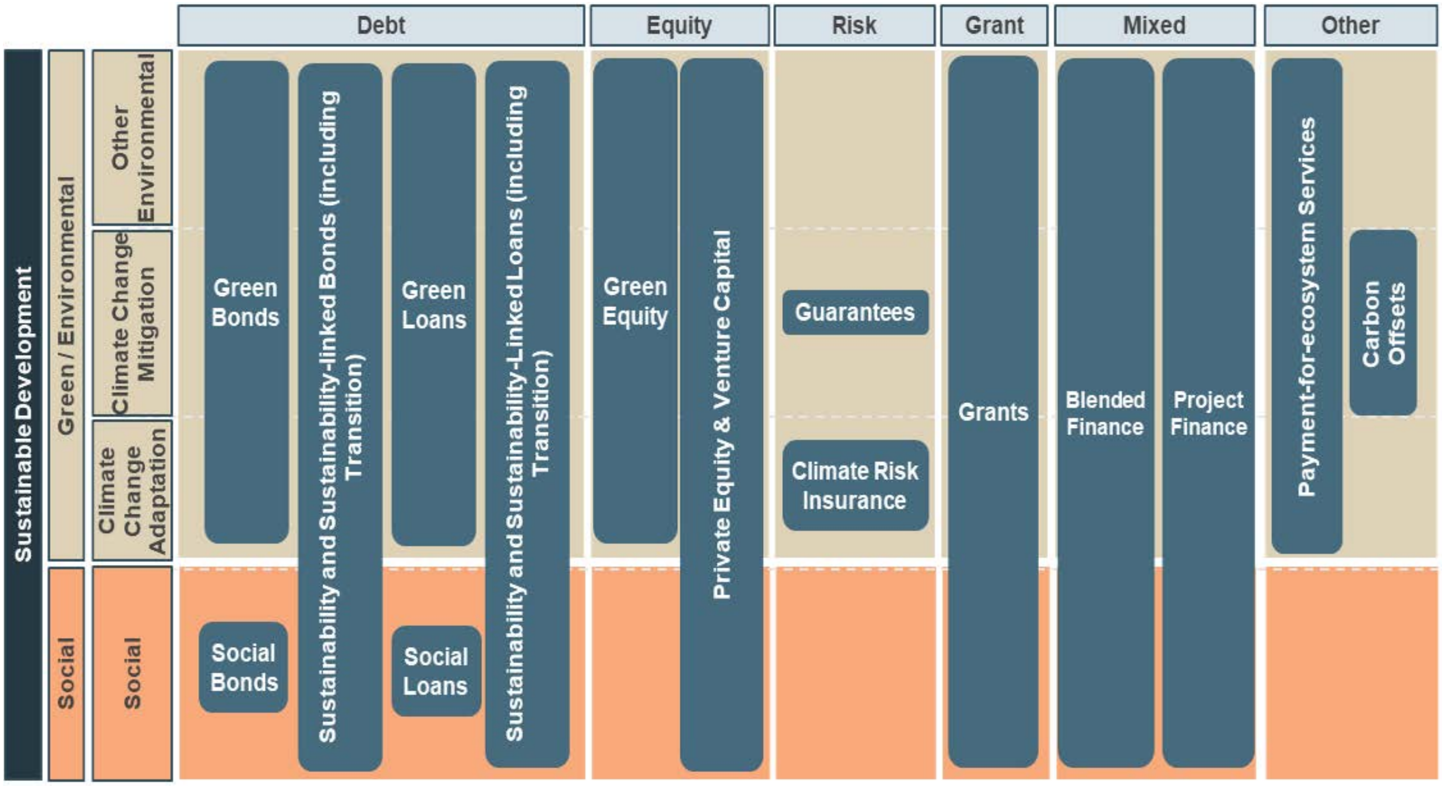

Figure 17. Sustainable finance instruments and sustainable development end-uses. Source Adapted from Onyango (2025, slide 21)

In practice, use-of-proceeds bonds/loans are typically the workhorses for shovel-ready, employment-intensive projects, provided they finance new pipelines. KPI-linked instruments can hard-wire just-transition outcomes (local hiring, training, supplier inclusion) alongside emissions KPIs. Blended finance and guarantees can crowd in private capital for earlier-stage or higher-risk/foreign exchange-exposed deals. Project finance and PE/Venture Capital (VC) help scale industrialisation and local manufacturing. Offsets and Payments for Ecosystem Services (PES) complement resilience and nature jobs.

Labelled financial instruments, such as green, social and sustainability-linked bonds, combine competitive yields with strong market credibility and alignment to global capital flows. Such instruments can diversify portfolios, signal alignment with international best practice, and provide access to sectors well-positioned for long-term growth. Some of the main examples include:

- **Green Bonds**: Offering exposure to the fast-growing clean energy and infrastructure markets. Green bonds predominantly finance renewable energy, energy-efficient buildings, and clean transport.

- **Social Bonds:** Helping finance essential services, such as affordable housing and basic infrastructure. Social bonds give investors a way to tap into stable, government- and development-backed sectors with long-term demand.

- **Sustainability Bonds**: By combining green and social categories, sustainability bonds give investors diversified exposure across energy efficiency, transport, water and housing, making them a versatile instrument for pursuing balanced, risk adjusted returns.

- **Sustainability-Linked Bonds (SLBs)**: Unlike use-of-proceeds bonds, SLBs provide issuers with general-purpose funding, while investors gain upside from issuers' commitments to meet key performance targets (such as reducing emissions). This structure links returns to measurable corporate performance improvements.

- **Sustainability-Linked Loans (SLLs)**: Popular across industries including utilities, industrials, and financials, these can incentivise companies to improve their sustainability metrics, while offering investors access to high-quality borrowers and diversified credit opportunities.

Aligned issuance reached $1.05 trillion in 2024: green bonds were at $672 billion, sustainability bonds at $206 billion, social bonds at $168 billion, and a smaller SLB market reached $7.9 billion.

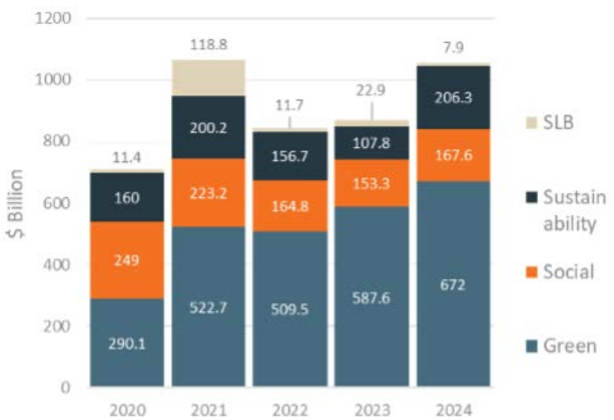

Figure 18. Global sustainable-debt issuance since 2020 (Source: Climate Bonds Initiative (2020; 2021; 2023; 2025).

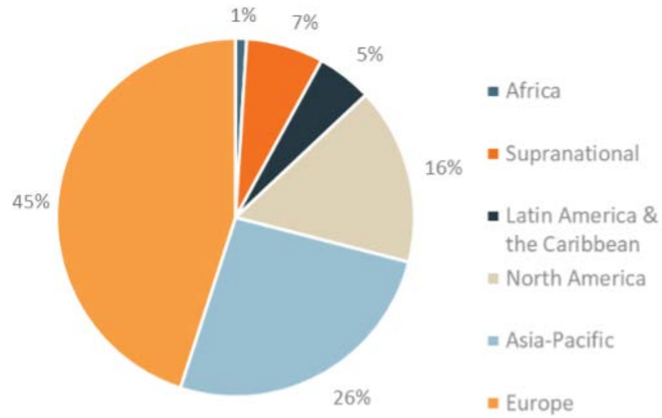

Figure 19. Regional share of aligned sustainable-debt issuance, 2024 (Source: Climate Bonds Initiative (2025).

Beyond capital volumes, there is growing evidence that labelled instruments are associated with employment gains, as is the case in the Maharashtra Climate Resilient Agriculture project in India that reported 3 800 jobs created, supported by IBRD Green Bond–financed activities (World Bank Treasury, 2024). Additionally, impact-reporting standards for social and sustainability bonds now explicitly include employment generation as a core indicator, which is now widely used by many sovereign issuers (ICMA, 2024).

Alongside GSS+ debt, **African governments can further accelerate green job creation by introducing measures to close the disaster-risk protection gap and treat adaptation as investable infrastructure and social protection**. About 62% of global disaster losses are uninsured. A practical approach is a layered disaster-risk financing stack that uses budget buffers for frequent shocks, parametric or sovereign insurance and reinsurance for mid-range events, and catastrophe bonds to transfer extreme tail risk to global investors (OECD, 2025).

Blended finance, policy-based lending, and Public Private Partnerships (PPP) risk-sharing can also price climate risks upfront. These options can make resilience projects bankable, while embedding adaptation criteria in disclosures and transition plans, encouraging investors to better value resilience (OECD, 2024a; OECD, 2025).

Further, to scale efficiently, consideration should be given to adopting common standards, programmatic approaches, and country platforms to cut transaction costs and crowd in private balance sheets (OECD, 2025). This can unlock job creation, from Construction and Operations and Maintenance (O&M) of resilient infrastructure to nature-based restoration, risk analytics, and insurance services that can reinforce the employment multipliers already evident in clean-energy value chains (ICMA, 2024; IRENA & ILO, 2024).

It is also important to note that green technologies sit on a continuum of maturity, and their success can depend on what instruments are being utilised and at what stage. At one end are pilot-stage, frontier innovations that are still risky but hold immense strategic value for Africa's competitiveness. In the middle are technologies moving from demonstration to scale. At the other end are mature solutions that are already absorbing labour and capital at speed. For each of these three stages, the mix of financiers, instruments, and job impacts can be different, and for each, South Africa's critical mineral wealth (PGMs, vanadium, manganese, copper) is an underlying enabler, linking the country's resource base directly to global clean tech supply chains. The next three sections examine how to capitalise on the opportunities presented at each of these stages.

4.1 PILOT-STAGE TECHNOLOGIES AND OPPORTUNITIES

Pilot-stage technologies represent the frontier of green innovation. Although these early-stage solutions are still proving their feasibility, they could be major drivers of South Africa's long-term industrial competitiveness. Green hydrogen, for example, is already being piloted in Mpumalanga and Limpopo as a fuel for heavy industry. Projects like HySHiFT and Anglo American's NuGen hydrogen haul truck are emblematic of this phase. They are high-cost, high-risk, but they also establish South Africa as a potential leader in an industry that the International Energy Agency expects to be worth hundreds of billions of dollars globally by 2050 (IEA, 2022).

Importantly, both strategies underscore the job creation potential of these pilots, projecting that green hydrogen could support tens of thousands of skilled and semi-skilled jobs across engineering, construction, operations, and associated value chains over the coming decades (DSI, 2021; DTIC, 2024). To that end, South Africa developed the Hydrogen Society Roadmap (HSRM) and the Green Hydrogen Commercialisation Strategy (GHCS) to leverage these technologies for the purposes of industrialisation (DTIC, 2024). Pilot-stage technologies beyond green hydrogen, spanning storage, grid digitalisation, industrial heat, advanced mobility, circular economy and water reuse, map onto South Africa's end-use/instrument matrix and can provide near-term, job-rich pipelines when paired with bankable offtake and blended-finance de-risking.

The pilot stage is also deeply intertwined with critical minerals. Hydrogen production technologies rely on platinum group metals (PGMs) for fuel cells and electrolysers, a domain where South Africa holds over 75% of global reserves (DMRE, 2024). This means that **every pilot hydrogen project is not just an energy initiative but also a minerals industrialisation story.** Similarly, early-stage Direct Air Capture (DAC) technologies depend on speciality sorbents and catalysts, many of which require rare minerals sourced in Africa.

Supporting these pilots is therefore not just about future fuels, it's about anchoring value chains that connect South African and African mines and metallurgical know-how to the global low-carbon economy. **At the pilot stage, concessional and blended capital, guarantees and performance-linked debt are the primary tools. As technologies de-risk, a shift to use-of-proceeds bonds/loan and project finance enable institutional investors to scale exposure.**

PIC Contribution and Impact

Since 2018, the PIC has played an important role in supporting the foundations of South Africa's emerging hydrogen economy. Over this period, the PIC committed more than $100 million to hydrogen technologies at varying maturities across the upstream–midstream–downstream value chain, supporting the growth of the hydrogen economy in South Africa and globally. These investments span breakthrough innovations and practical applications, including:

- Storage and transport solutions using liquid organic hydrogen carriers to safely move hydrogen across supply chains (e.g. Hydrogenious LOHC Technologies);
- Design and manufacture of hydrogen fuel cell systems that provide reliable backup power for critical infrastructure (e.g. Bambilli Energy);
- Hydrogen-based water treatment technologies to support sustainable resource management (e.g.MatiTech Solutions); and
- Hydrogen-electric propulsion engines for retrofitting existing aircraft (e.g. ZeroAvia Inc).

As part of efforts to fast-track South Africa's just energy transition (JET) and position the country at the forefront of the global green hydrogen economy, the PIC, together with the Industrial Development Corporation (IDC) and the Development Bank of Southern Africa (DBSA), have pledged approximately $ 37 million to the newly established SA-H2 Fund. The fund is designed to catalyse projects across the green hydrogen value chain, fostering inclusive economic development, spurring job creation, towards a low-carbon future. Through these strategic investments, the PIC is not merely funding innovation, it is actively shaping an integrated hydrogen value chain, fostering localisation opportunities, and laying the groundwork for new industries and job creation.

Figure 20. Bambili Energy fuel cell system

4.2 MID-STAGE TECHNOLOGIES AND OPPORTUNITIES

Mid-stage climate technologies occupy the critical "valley of death" between successful demonstration and bankable first-of-a-kind commercial deployment. They have moved well beyond the lab but remain insufficiently de-risked or affordable for conventional project finance without targeted support (e.g., concessional, guarantees, or offtake). Examples include advanced waste-to-energy (gasification/pyrolysis), long-duration energy storage (e.g., flow batteries), next-generation smart-grid platforms (distributed energy resources) and heavy-duty EV charging and Vehicle-to-grid (V2G) platforms.

These technologies are crucial because they drive system-wide transformation. Long-duration, large-scale batteries, including vanadium redox flow batteries (VRFBs), help stabilise grids with rising renewable penetration and are progressing through early commercial deployments. At the transport edge, the mid-stage opportunity sits in heavy-duty megawatt charging and V2G platforms, which link cleaner power to decarbonising traditional transport mobility. Additionally, public fast-charging networks (for example, GridCars in South Africa) show how corridor build-out for mainstream EVs is already advancing while next-gen capabilities mature.

Battery supply-chain investments are also moving beyond concepts. With South Africa's vanadium, Botswana's nickel, and Zimbabwe's lithium base, the region is increasingly positioned for early-commercial efforts in cathode and electrolyte production. The Africa Green Minerals Strategy (AGMS) envisions shifting from raw exports to regional value-addition and manufacturing (including storage components such as VRFB electrolytes), enabling industrialisation and significant job creation across processing, engineering, and assembly.

Further, mid-stage solutions extend beyond energy, such as high-efficiency sanitation retrofits together with carbon removal and storage projects that are scaling from pilots to early commercial projects. Climeworks' Orca (and now the larger Mammoth) plant in Iceland illustrates direct air capture moving from demonstration toward bankability, albeit with costs still trending down. In South Africa, Carbon Capture, Utilisation, and Storage (CCUS) is advancing through pilot and feasibility phases through the Council for Geoscience and Sasol's collaboration at the Leandra CCUS research site, which is aimed at enabling future capture from industrial sources. Here too, critical minerals are the invisible scaffolding. Large-scale energy storage projects depend on resources that the African continent provides.

Scaling these technologies is therefore not just about generating clean electrons or building EV highways, it is about embedding mid-stage infrastructure into Africa's mineral beneficiation strategy and creating thousands of construction, engineering, maintenance, and high-tech manufacturing jobs. By supporting these mid-stage technologies, South Africa and its neighbours are not only laying the groundwork for a low-carbon economy but also building employment pathways that can anchor the just energy transition in real, long-term livelihoods.

At the mid-stage, capital stacks typically combine concessional and commercial tranches with guarantees and revenue-backed contracts. Once offtake and performance are proven, non-recourse project finance allows banks and institutional investors to scale exposure. Some instruments that fit this phase include blended finance and guarantees to de-risk first waves, performance-linked loans for incumbents, and use-of-proceeds bonds and project finance for assets with defined capex and cash flows.

PIC Contribution and Impact

Within the water sector's mid-stage technology pipeline, innovative sanitation solutions are bridging the gap between pilot concepts and large-scale deployment. An example of this is the PIC's ~$ 10 million investment into Amalooloo, a dry sanitation and low water solutions provider, which has contributed to the development of holistic and sustainable sanitation systems for water-scarce and underserved communities. Amalooloo's solutions have now moved beyond the mid-stage technology phase to commercial offerings that are deployed in South Africa.

Assuming ~5 flushes/person/day in a 3.2-person South African household, this equates to roughly 26–44 KL of water saved per household per year, while the non-sewered design supports safe, hygienic management consistent with ISO 30500 principles (Amalooloo n.d.-a; Amalooloo n.d.-b; Geberit n.d.; Statistics South Africa 2024; US EPA 2025; ISO 2018). Additionally, Amalooloo employs more than 100 people and looks to address the global sanitation crisis by deploying low-water, high-hygiene sanitation solutions that are well-suited to rural South African communities where access to safe water and sanitation remains constrained. In these settings, dry sanitation technologies represent more than just environmental innovation, they are part of an infrastructure build-out that creates local jobs in manufacturing, installation, maintenance, and community outreach, while reducing pressure on fragile water systems.

Figure 21. Amalooloo School Sanitation Documentary (Amalooloo, n.d.).

4.3 MATURE TECHNOLOGIES AND OPPORTUNITIES

Mature technologies are the workhorses of South Africa's green transition. These technologies are fully proven, commercially bankable, and capable of creating jobs at scale, right now. These include onshore wind, utility-scale solar PV, rooftop solar, green buildings, and municipal water and waste systems. Together, they represent the "low-hanging fruit" of decarbonisation with solutions that don't require years of research and development or policy experimentation, but rather, predictable investment and efficient rollout.

Programmes such as the REIPPPP have already demonstrated this potential, with most debt provided by commercial banks and supplemented by pension and insurance funds, using project finance as the dominant structure and subsequent green-bond refinancings in some cases.

At this mainstream stage, critical minerals continue to play a central role. Solar and storage supply chains draw on South Africa's manganese, copper and aluminium base, presenting an opening for domestic processing and component manufacturing that multiplies employment effects beyond installation and O&M into fabrication and logistics. In this sense, mature technologies offer more than labour absorption, they provide a strategic pathway to re-industrialise around clean-tech supply chains and align industrial policy with renewable expansion.

At the mature stage, capital is predominantly commercial and non-recourse project finance anchors new build, while labelled bonds (e.g., municipal and corporate green bonds) and bank loans refinance and scale operating portfolios. South Africa already has a history of municipal green bonds (Johannesburg, Cape Town) and an established JSE sustainability/green segment, which together lower issuance friction for proven assets with clear use-of-proceeds.

On the demand-side, corporate PPAs and decentralised energy models are expanding, supported by regulatory evolution and cost declines. For buildings and water, energy/water performance contracts (EPCs) and on-bill financing allow retrofits to be funded against verified savings, with 12L tax allowances historically accelerating uptake. Securitisation or pooled vehicles can then recycle capital and improve fit for pensions and insurers by adding liquidity and diversification.

As portfolios scale, consumer and SME products (energy-efficient mortgages, rooftop-solar loans, SLLs, green working capital) broaden participation and deepen local-currency flows, as shown by South African bank programmes and targeted credit lines that combined concessional funding with commercial lending.

PIC Contribution and Impact

The PIC has been a supporter of the REIPPPP since its inception and continues to support the green economy by allocating capital to projects such as onshore wind farms, utility-scale solar PV, and water infrastructure. Its continued involvement in these mature, proven technologies is pivotal for sustaining momentum in South Africa's energy transition, ensuring that capital flows into projects that are bankable, scalable, and capable of delivering immediate impact. By channelling long-term investment into these technologies, the PIC is not only helping expand clean energy generation but also driving widespread employment opportunities for technicians, electricians, construction crews, and operations teams. These projects form the backbone of South Africa's just transition, creating jobs at scale, stabilising the grid, and reducing reliance on carbon-intensive power sources.

CONCLUSION

South Africa's green economy is at an inflection point. It has already proven it can deliver predictable cash flows, outperform its global peers, and provide investable projects across energy, water, transport, and industrial platforms. Although investment has not yet reached the necessary scale and some barriers still persist, strong structural demand, demonstrated financial performance, and a solid pipeline of bankable projects combine to make this an opportunity that is both substantial and investable. Moreover, there are definitive pathways to clear the remaining barriers. Green investments in the country have already delivered returns ahead of global benchmarks, and the next wave across renewables, grids, water, transport and green industrialisation is expected to deliver resilient cash flows with strong upside potential. This upside potential is a differentiator for green investment in South Africa, and Africa more generally. If South Africa triples institutional green investment by 2030, it could add over 70 000 jobs annually, deepening skills and setting the conditions for long-term growth.

The opportunity is actionable now: with the PIC standing by this thesis and ready to anchor and co-invest, international institutions can deploy capital at scale into job-rich assets while preserving disciplined returns. To sustain performance and social licence, and to respect human rights, investors must embed portfolio-wide safeguards and due diligence protocols into upstream supply chains with continuous monitoring. These measures protect people while also shortening underwriting and de-risking cash flow, making the case for tripling institutional investment by 2030 both achievable and prudent. For institutional investors driving the green transition, South Africa offers a rare combination of attractive risk-adjusted returns and large-scale job creation delivered with disciplined ESG standards.

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