

FINANCING THE GREEN TRANSITION IN SOUTH AFRICA: A SYSTEMATIC REVIEW

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ABSTRACT

The transition to a green economy, green industrialisation, and renewable energy is integral to advancing sustainable development in South Africa, an upper-middle-income emerging economy facing energy insecurity, unemployment, and climate vulnerability. This study conducts a systematic literature review, guided by the PRISMA framework, to synthesise evidence on the economic, financial, and environmental implications of this interconnectedness. A total of 52 studies were included, highlighting the mutual reinforcement between green policies, renewable energy deployment, and industrial transformation. The results show that renewable energy investment, particularly in solar and wind, diversifies the energy mix, enhances energy security, generates employment, and stimulates local value chains. Green industrialisation, exemplified by initiatives such as the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP), fosters domestic manufacturing, promotes cleaner production practices, and supports structural economic transformation. However, persistent barriers, including financing gaps, fragmented institutions, regulatory uncertainty, and infrastructural constraints, limit the full potential of these interventions. The study underscores the systemic interconnectedness of these domains: renewable energy provides a low-carbon foundation for industrial growth, green industrialisation reinforces economic inclusivity and technological upgrading, and the green economy framework integrates equity, inclusivity, and climate objectives. Policy and research efforts must thus adopt an integrated, interdisciplinary approach that aligns energy, industrial, environmental, and financial strategies to scale renewable energy solutions, mobilize private investment, and achieve South Africa's climate and development commitments under the Paris Agreement and African Union Agenda 2063.

Keywords: Green Economy, Green Industrialisation, Renewable Energy, Systematic Literature Review, PRISMA Framework.

1. INTRODUCTION

The pursuit of sustainable development has elevated the green economy, green industrialisation, and renewable energy to the forefront of economic and financial discourse. Globally, these domains have been recognised as critical drivers of inclusive growth, resilience, and structural transformation (United Nations Environment Programme, 2011; World Bank, 2020). In the context of South Africa, an upper-middle-income and emerging economy, the integration of green policies into industrial and financial systems is increasingly seen as both a developmental necessity and a response to pressing challenges such as energy insecurity, unemployment, inequality, and climate vulnerability (Borel-Saladin and Turok, 2013; Winkler and Marquard, 2022).

The green economy encompasses policies and practices that seek to align growth with ecological sustainability while promoting social equity (Loiseau, Saikku, Antikainen, Droste, Hansjürgens, Pitkänen, Leskinen, Kuikman and Thomsen, 2016). Green industrialisation extends this paradigm by embedding

sustainability into manufacturing, infrastructure, and production systems, thereby facilitating structural change towards low-carbon and resource-efficient industries (Akinsemolu, 2020). Renewable energy investment, particularly in solar, wind, and hydropower, represents a practical pathway through which South Africa can diversify its energy mix, reduce dependence on fossil fuels, and meet its commitments under the Paris Agreement (Pegels, 2010; Eberhard and Naude, 2016).

From a financial economics perspective, the transition towards a green economy and renewable energy requires significant mobilisation of capital and the integration of green finance mechanisms into national and international financial markets. Instruments such as green bonds, carbon pricing, and blended finance reduce investment risks and also create new opportunities for institutional investors seeking sustainable returns (Zhang, Zhou, and Zhou, 2021; Taghizadeh-Hesary and Yoshino, 2019). Moreover, risk–return trade-offs associated with green investments highlight the need for financial innovations and supportive regulatory frameworks to attract private capital while maintaining macroeconomic stability (Agliardi and Agliardi, 2019). This financial lens is particularly important for South Africa, where fiscal constraints, exchange rate volatility, and slow industrial revolution limit the capacity of the state to finance large-scale green projects (Turok, 2021).

A systematic review of the interconnections between the green economy, green industrialisation, and renewable energy in South Africa is conducted, highlighting their combined role in driving sustainable development. Drawing on economic and financial perspectives, it synthesises empirical and theoretical evidence to highlight opportunities, challenges, and gaps. The paper contributes to the literature by providing a contextualised understanding of how these domains intersect and by offering policy insights relevant to South Africa’s long-term development trajectory.

2. METHODS

This study employed a systematic literature review (SLR) approach to synthesise evidence on the interconnections between the green economy, green industrialisation, and renewable energy, with a particular focus on their financial and economic implications in South Africa. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework was adopted as a methodological guide to ensure transparency, reproducibility, and comprehensiveness (Moher, Liberati, Tetzlaff, Altman, and the PRISMA Group, 2009). PRISMA is increasingly recognised as a standard in economics and finance research, especially in areas where diverse empirical studies must be integrated into coherent narratives (Snyder, 2019; Paul, Lim, O’Cass, Hao and Bresciani, 2021).

2.1 Search Strategy

The search was conducted across major academic databases including **Scopus, Web of Science, ScienceDirect, JSTOR, and EconLit**, complemented by Google Scholar to capture grey literature and working papers. Keywords were combined using Boolean operators to reflect the economic–finance framing of the review. The main search strings included combinations of: “green economy”, “green industrialisation”, “renewable energy investment”, “sustainable finance”, “green bonds”, “emerging economies”, and “South Africa”. The search was restricted to peer-reviewed studies published between 2010 and 2024, a period marked by the intensification of global debates on sustainable development and climate finance (United Nations, 2015; World Bank, 2020).

2.2 Eligibility Criteria

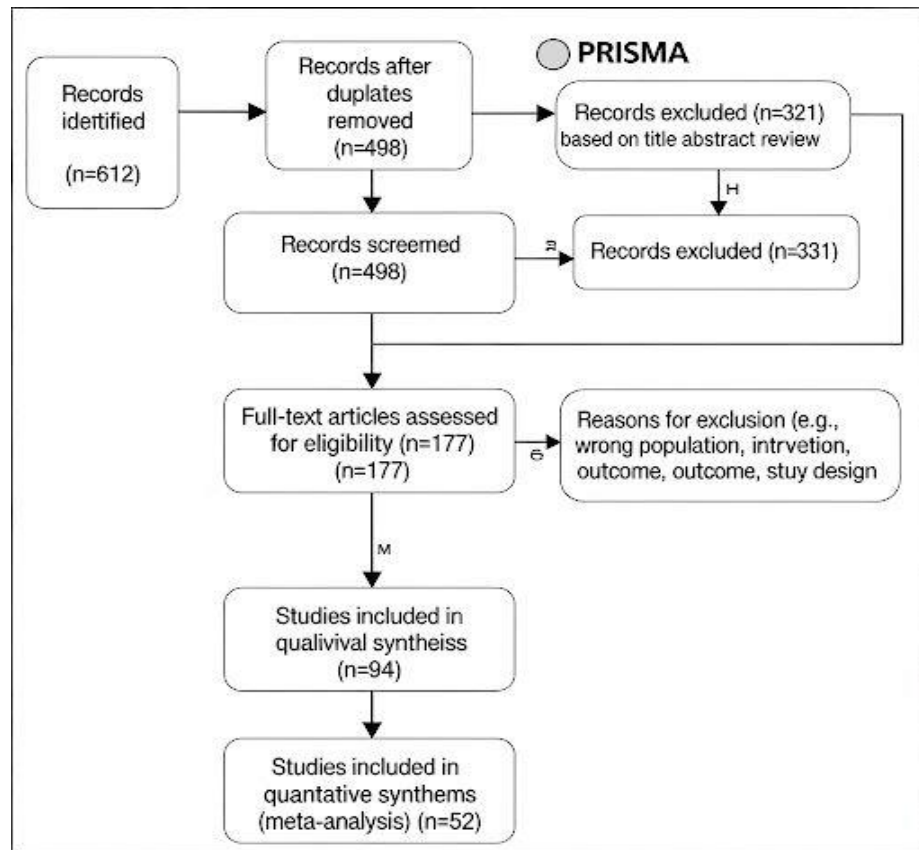
Inclusion and exclusion criteria were established in line with PRISMA standards. Eligible studies were those that:

- Focused on the green economy, industrialisation, or renewable energy with direct economic or financial implications.
- Examined South Africa specifically, or provided comparative insights from emerging and developing economies.
- Were published in peer-reviewed journals, edited volumes, or credible institutional reports, and
- Were available in English

- Studies were excluded if they:
- Focused purely on engineering or technical energy modelling without an economic/financial dimension.
- Lacked empirical or theoretical contributions relevant to policy or finance, or
- Were opinion pieces without methodological transparency.

2.3 Screening and Selection Process

The initial database search produced 612 records. After the removal of duplicates, 498 records remained for screening. Titles and abstracts were independently reviewed to assess relevance, leading to the exclusion of 321 records that did not align with the research focus. The remaining 177 full-text articles were assessed for eligibility, of which 94 met the inclusion criteria. Finally, 52 studies were included in the synthesis, reflecting those with the strongest relevance to South Africa's green economy, renewable energy financing, and industrialisation pathways. The PRISMA flow diagram (Figure 1) illustrates this selection process.



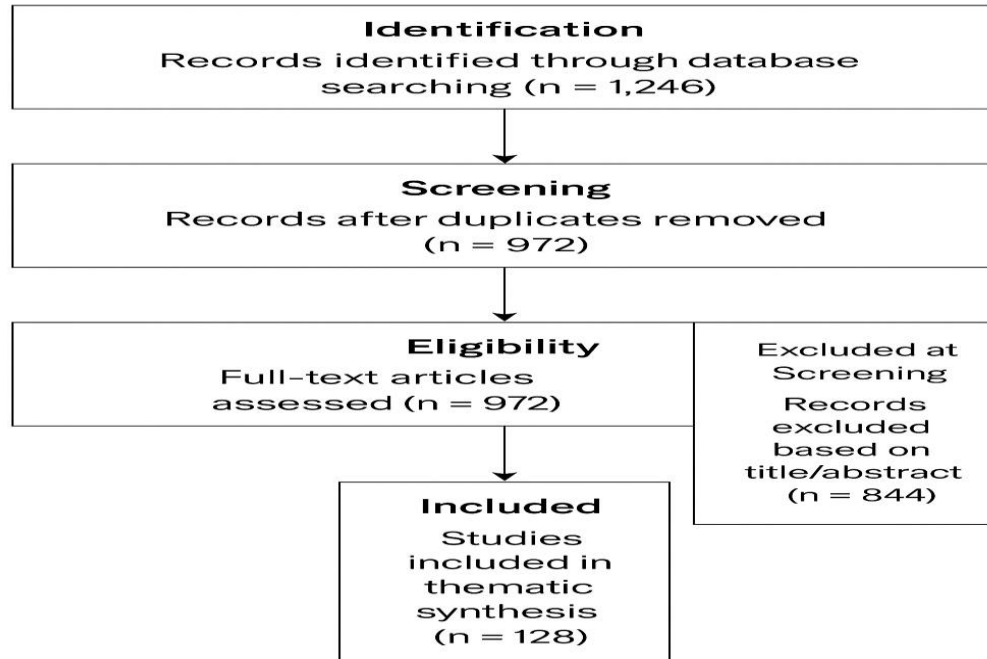
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FIGURE 1
SCREENING AND SELECTION PROCESS

2.4 Data Extraction and Synthesis

For each included study, key information was extracted on **research objectives, methodological approaches, data sources, main findings, and financial/economic implications**. A thematic synthesis approach was applied, grouping findings into categories aligned with the study objectives: (i) green economy and sustainable development, (ii) renewable energy and economic/financial outcomes, (iii) green industrialisation in practice, and (iv) interconnectedness across the three domains. This allowed for the identification of commonalities, divergences, and gaps in the literature (Tranfield, Denyer and Smart, 2003).

By applying PRISMA within an economics and finance framework, this study ensures a **systematic, replicable, and policy-relevant synthesis** of the evidence base on green economic transformation in South Africa.



3. RESULTS (THEMATIC SYNTHESIS)

The findings of this review indicate that the green economy, renewable energy deployment, and green industrialization are mutually reinforcing pillars in shaping South Africa’s sustainable development trajectory. Across the literature, a consistent theme emerges: while these strategies hold considerable promise for addressing both energy security and structural economic challenges, their effectiveness is contingent upon coherent policy design, institutional capacity, and targeted financing mechanisms.

The green economy framework is increasingly recognized as a viable pathway for reconciling growth, equity, and environmental stewardship in South Africa and the broader Southern African region. Anchored in principles of low-carbon development, resource efficiency, and social inclusion, it addresses the region’s dual imperatives of alleviating energy poverty and mitigating climate risks (United Nations Environment Programme, 2011). Empirical evidence suggests that transitioning to a green economy can generate positive employment spillovers, particularly in renewable energy subsectors such as solar photovoltaics and wind energy, which are labour-intensive during installation and operation phases (Inglesi-Lotz, 2016). Moreover, the green economy directly supports Sustainable Development Goals by simultaneously advancing poverty reduction, energy access, and environmental protection objectives (Borel-Saladin and Turok, 2013). However, persistent barriers—such as financing gaps, fragmented institutions, and regulatory uncertainty—have constrained the translation of green economy policies into sustained outcomes (Tshidavhu and Inglesi-Lotz, 2022). Despite supportive strategies, such as the National Development Plan and the Green Economy Accord, actual investment flows into renewable technologies remain uneven, highlighting the tension between ambitious policy vision and practical implementation (Baker, 2023).

Renewable energy adoption demonstrates particularly strong economic and environmental dividends. On the economic side, investments in solar and wind infrastructure diversify South Africa’s energy mix, reduce

dependence on coal, and stimulate domestic value chains that extend from manufacturing inputs to maintenance services (Pegels, 2010). These projects have been shown to create local multiplier effects by generating employment and entrepreneurial opportunities within host communities (Inglesi-Lotz, 2016). Importantly, renewable energy has also enhanced rural electrification, with decentralized solar systems delivering measurable welfare gains in health, education, and household productivity (Davidson and Mwakasonda, 2004). Environmentally, renewable adoption has been critical in reducing the carbon footprint of an economy historically reliant on coal, aligning South Africa with global climate commitments (Borel-Saladin and Turok, 2013). Yet, structural bottlenecks, such as energy intermittency, inadequate grid capacity, and limited financing for small-scale projects, signal that greater attention must be given to complementary investments in energy storage, transmission infrastructure, and tailored green finance instruments (Tshidavhu and Amusa, 2022). These conditions are essential for scaling renewable solutions beyond niche markets into systemic energy reform.

The case of South Africa illustrates both the opportunities and complexities of green industrialization in practice. The Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) has been particularly successful in mobilizing billions of dollars in private investment while embedding local content requirements that stimulate domestic manufacturing of renewable energy technologies (Tshidavhu and Inglesi-Lotz, 2022). This programme demonstrates how renewable energy transitions can be leveraged to support industrial policy by cultivating domestic supply chains in solar panels, wind turbines, and associated services (Baker, 2023). Beyond renewable technologies, green industrialization has also encouraged the diffusion of resource-efficient practices and cleaner production methods across manufacturing sectors (Pegels, 2010). However, critics argue that industrial policies remain fragmented, with weak integration between energy, industrial, and environmental strategies (Davidson and Mwakasonda, 2004). Without stronger coordination, the potential for renewable energy deployment to drive long-term structural transformation and inclusive industrial growth may remain under-realized.

The analysis further reveals the interconnectedness of the green economy, renewable energy, and green industrialization. Renewable energy provides the foundation for both economic inclusivity and industrial competitiveness by supplying low-carbon, reliable power. In turn, green industrialization builds on this foundation by embedding renewable inputs into local production systems, fostering employment, and enabling technological upgrading. The green economy framework acts as the overarching lens that integrates these dynamics with equity, inclusivity, and climate objectives (Borel-Saladin and Turok, 2013; Inglesi-Lotz, 2016). Nevertheless, literature remains fragmented, with most studies addressing these domains separately rather than as part of a systems-level transformation (Tshidavhu and Amusa, 2022). This fragmentation underscores the need for interdisciplinary empirical studies that incorporate financial economics, industrial policy analysis, and ecological economics to better capture the synergies and trade-offs inherent in South Africa's transition. Such integration would strengthen the evidence base needed to guide South Africa's commitments to the Paris Agreement and the African Union's Agenda 2063.

3.1 Green economy, industrialization, and renewable energy: Linking financial flows and macroeconomic outcomes in South Africa

3.1.1 Green Economy and Sustainable Development

The green economy framework provides a viable pathway toward sustainable development in South Africa and the broader Southern African region. It emphasizes resource efficiency, environmental sustainability, and inclusive economic growth, thereby promoting long-term socio-economic resilience. Consistent policy interventions in this domain can stimulate economic activity, enhance employment, and encourage structural transformation. In particular, targeted measures in the energy sector, including renewable energy investment and energy efficiency standards, contribute to economic diversification, improved environmental outcomes, and enhanced energy security.

Table 1: Linkages Between Green Economy Policies and Macroeconomic Outcomes

Policy Intervention	Economic Impact	Environmental Impact
Renewable energy incentives	Employment generation, Energy independence	Reduced emissions, Improved energy security
Energy efficiency standards	GDP growth Reduced emissions	Resource conservation
Sustainable infrastructure	Improved air quality	Improved air quality
Green innovation support	Green technology adoption	GDP growth and environmental benefits

3.1.2 Renewable Energy and Financial/Environmental Outcomes

Renewable energy adoption in Southern Africa provides significant positive outcomes across both economic and environmental dimensions (Baker, 2020; Pegels & Lütkenhorst, 2014). Investment in solar photovoltaic (PV) and wind projects diversifies the energy mix, reduces dependency on fossil fuels, and stimulates value chains within local economies (Rennkamp & Bhuyan, 2021; Eberhard & Naude, 2016). These initiatives also generate employment, promote entrepreneurship, and foster local industrial development (Matsuo & Schmidt, 2019; Taliotis et al., 2020). From an international perspective, renewable energy expansion aligns with global sustainability commitments while enhancing South Africa’s energy security and long-term economic resilience (United Nations, 2015; World Bank, 2020).

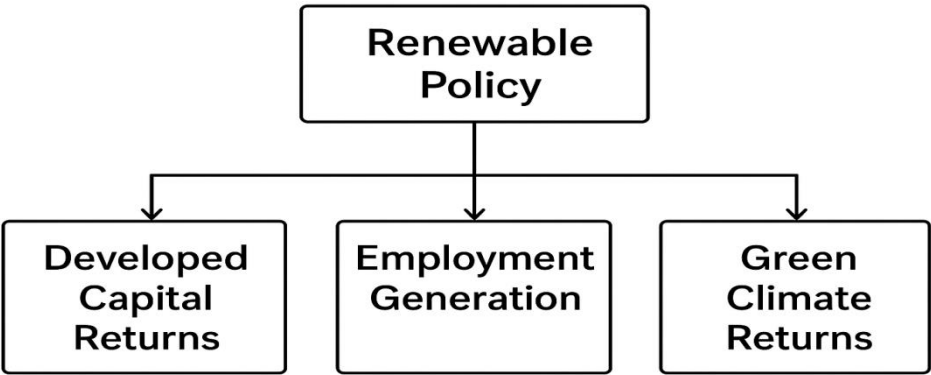


Figure 1: Conceptual Model of Real-Financial Linkages in South Africa’s Green Economy

4. CONCLUSION

This study underscores the critical role of the green economy, renewable energy deployment, and green industrialization as mutually reinforcing pillars for sustainable development in South Africa. The evidence reviewed indicates that green economy policies can generate significant economic and environmental benefits, including employment creation, energy diversification, improved air quality, and reduced carbon emissions. Renewable energy initiatives, such as solar photovoltaic and wind projects, not only enhance energy security and reduce dependency on fossil fuels but also stimulate local value chains and entrepreneurial opportunities, demonstrating strong multiplier effects for inclusive economic growth.

Green industrialization, exemplified by initiatives like the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP), illustrates how coordinated policy frameworks can mobilize private investment, foster domestic manufacturing, and encourage cleaner production practices across sectors. However, persistent structural challenges, such as financing gaps, fragmented institutions, regulatory uncertainty, and energy infrastructure constraints, remain key barriers to realizing the full potential of these interventions.

The findings also highlight the systemic interconnectedness of these domains: renewable energy provides a low-carbon power foundation for industrial growth, while green industrialization reinforces economic inclusivity and technological upgrading, all within the overarching green economy framework that integrates equity, inclusivity, and climate objectives. To fully harness these synergies, future research and policy must adopt an integrated, interdisciplinary approach that combines financial, industrial, and ecological perspectives. Strengthening this integration is essential for scaling renewable energy solutions, driving structural transformation, and achieving South Africa's commitments under the Paris Agreement and the African Union's Agenda 2063.

Policy Recommendations

To fully realize the potential of South Africa's green economy, renewable energy, and green industrialization, it is essential to develop a coordinated national strategy that aligns policies across energy, industry, environment, and finance sectors. Such an integrated approach would enhance policy coherence, reduce regulatory uncertainty, and ensure effective monitoring and evaluation of economic, environmental, and social outcomes. Addressing financing gaps is critical, and the establishment of dedicated green funds, low-interest loans, green bonds, and risk-sharing instruments would help mobilize both private and foreign investment in renewable energy projects and green industries. Incentives such as tax breaks and guarantees could further encourage participation in sustainable initiatives. Scaling up renewable energy deployment, particularly in solar, wind, and other low-carbon technologies, will diversify the national energy mix, reduce dependence on fossil fuels, and stimulate local value chains. Promoting domestic manufacturing and assembly of renewable energy technologies, along with supporting community-based projects, will create employment opportunities and ensure inclusive access.

Green industrialization should be strengthened through the expansion of initiatives like the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) to encompass additional industrial sectors and encourage cleaner production practices. Providing technical support, capacity-building, and skills development for the workforce will facilitate adoption of low-carbon technologies and sustainable manufacturing processes. Institutional coordination is equally important, with the creation of a central body or task force to align renewable energy, industrial, and environmental policies, streamline regulatory processes, and reduce bureaucratic barriers to investment. Multi-stakeholder partnerships involving government, industry, academia, and civil society can further foster innovation, knowledge transfer, and best practice adoption.

Investments in interdisciplinary research that integrate financial, industrial, and ecological perspectives are necessary to identify optimal strategies for scaling green technologies. Pilot projects and demonstration

initiatives that link renewable energy deployment with industrial upgrading and inclusive growth objectives can provide practical models for broader adoption. Finally, all policies and programs should be aligned with South Africa's commitments under the Paris Agreement and the African Union's Agenda 2063, ensuring that green initiatives contribute to inclusive economic growth, social equity, and environmental sustainability. Strengthening these synergies across sectors will enable South Africa to advance structural transformation, foster sustainable development, and achieve its climate and socio-economic objectives.

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