



Investment strategies in energy transition projects: Balancing financial returns and sustainability goals

Olugbenga F Akomolehin *

Department of Finance, College of Social and Management Sciences, Afe Babalola University, Ado - Ekiti, Nigeria.

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Abstract

The global energy transformation has raised the stakes for the kind of investment approaches that will not only generate competitive financial returns, but will also help achieve climate ambitions and inclusive development. Yet, integrating this profitability of such investments with sustainability poses a significant challenge facing institutional investors and policy-makers, especially in emerging markets. This paper examines how investment tactics in the projects of energy transition would be optimally approached in order to reconcile financial performance and environmental and social issues. Based on Sustainable Investment Theory, ESG-constrained Modern Portfolio Theory, Stakeholder Theory, and the Triple Bottom Line framework, a mixed-method approach that integrates a qualitative case review with a multicriteria investment evaluation model is used in the paper. Data were collected from World Bank, IEA, UNPRI, BloombergNEF, and case reports from institutions. Three illustrative cases—green hydrogen in Germany, solar auctions in India, and mini-grids in Nigeria—were compared across return on investment, carbon reduction, and social equity. The results show that blending instruments, ESG-linked instruments, and incentive compatible models have a positive impact on investment allocations when combined with regulatory consistency, aligned disclosure standards, and risk de-risking mechanisms. The research presents an integrated investment model that links ROI with ESG factors and SDG goals. It ends by also stressing the importance of scalable financing structures, strong ESG governance, and the need to track performance over the longer-term. These findings enrich the growing discussion on sustainable finance and provide policy implications for capital deployment in energy transition trajectories.

Keywords: Energy transition; Sustainable finance; ESG investing; SDG alignment; Green bonds; Investment strategies; Blended finance

1. Introduction

The worldwide transformation to cleaner and more sustainable energy systems is the defining challenge – and opportunity – of the 21st century. Facing increasing climate risks, rising energy needs, and international commitments to decarbonize, countries and investors are all stepping up efforts to deploy capital out of fossil fuels and into projects for renewable and low-carbon energy (IEA, 2023; UNFCCC, 2022). This energy transition is a lot more than hardware and technical upgrades; it's a systemic change, and it requires a fundamental rethink of the way that energy is generated, financed, distributed, and consumed. There are significant, yet persistent investment gaps. The International Renewable Energy Agency (IRENA, 2023) estimates that, to stay on track with net-zero targets, annual worldwide investments in renewable energy need to quadruple to more than USD 4 trillion by 2030. Yet, in many areas, especially economies in development, capital flows are low, uneven and prone to financial, regulatory and political uncertainties (World Bank, 2022; PWC, 2021).

Energy transition initiatives often are charged with a complicated dual mandate – deliver competitive financial returns and make a significant impact on a clear sustainability objective. In the case of institutional investors, development banks, and, more generally, governments, the focus should move away from a mere consideration of the profitability

* Corresponding author: Olugbenga F Akomolehin

of these projects to an evaluation of the consistency of these projects with environmental, social, and governance (ESG) KPIs (Boffo & Patalano, 2020; Flammer, 2021). But there are trade-offs in the nature of the beast. Environmentally or socially relevant projects may have higher initial costs or a more protracted payback period or they may present higher exposure to policy risk, which would all make them less appealing to traditional investors operating on short-term payback-time horizons (OECD, 2023; G20 Sustainable Finance Working Group, 2022). On the other hand, development priorities based on high returns could impede long-term climate aspirations or lead to unintended social outcomes like energy injustice or loss of environment (Olanrewaju & Ahmed, 2024).

This tension is particularly clear in the application of novel financing mechanisms, such as green bonds, blended finance mechanisms and ESG-related loans. Although these tools have spread worldwide, little is known about the extent to which the use of these tools effectively balances return-on-investment with sustainable development impact, particularly between different geographies and technological modalities (Kölbel et al., 2020; Larcker & Watts, 2021). There is also a pressing demand for evidence-based decision-making frameworks that help investors and policy-makers in assessing investment choices for meeting the energy transition objectives, without compromising the financial sustainability (Wang et al., 2023; Bhandari & Palit, 2022).

Against this backdrop, this paper seeks to explore which energy transition investment strategies can be designed in order to maximize both strong financial performance and a significant contribution to environmental and social goals. The research will explore how financing mechanisms may or may not influence financing dynamics, risk-return profiles, and sustainability performance related various styles of projects with a focus on and earning the attention of the finance world, for renewable energy generation, green hydrogen development, energy efficiency, and grid modernization. Building upon some international and regional case studies as well as a cataloging of the financial and regulatory tools, this report aspires to deliver a comprehensive multi-criteria framework of analysis able to combine investors' expectations with environmental and social necessities.

This is a timely theme, where this topic is in particular well aligned with the Sustainable Development Goals (SDGs), especially SDG 7 (Affordable and Clean Energy) and SDG 13 (Climate Action). SDG 7 calls for universal access to modern energy services, the scaling up of the deployment of renewable energy and the enhancement of energy efficiency which demand substantial private and public investments (UNDP, 2013). Also, SDG 13 presents the challenge of taking urgent action to combat climate change and its impacts, requiring the reorientation of financial systems to facilitate low-carbon transitions (IPCC, 2023). The aim of the latter is to augment the former through identifying investment strategies that are financially attractive and climate-resilient.

This article contributes to academic debate as well as policy practice by shedding light on the financial architecture of the energy transition drawing on sustainable investment strategy.

In this regard this article adds to the nascent literature on sustainable finance by filling a gap between financial return expectations and environmental and social sustainability outcomes of energy transition projects. It presents a multi-criteria assessment model, combining ROI, ESG performance and SDG alignment. By verifying this model in multiple case studies, the work provides an extensible solution to the capital allocation problem in climate-aligned investment planning. This approach delivers practical recommendations for institutional investors, development banks and policy-makers, in developed and emerging countries alike.

The rest of this paper is organized as follows. In section 2 we develop the theoretical framework for the study, which is based on sustainable investment theory, stakeholder theory and the triple bottom line. The methodology which includes both method and data sources is explained in section 3. Literature section According to Yin (2009) a literature review should be detailed and should attempt to present the current knowledge and research being carried out related to the research. The critical discussion of the results and a multi-criteria investment strategy model is offered in Section 5. The final section is devoted to policy and practical implications for investors and regulators. Section 7 finally closes with conclusions and implications for future research.

2. Conceptual Framework

This figure presents the strategic flow of investments in energy transition projects, emphasizing how financial returns and sustainability goals are shaped by mediating factors like ESG performance and project design, and moderated by regulatory, technological, and market forces. It illustrates how a well-structured strategy aligns capital deployment with climate action while ensuring profitability in dynamic energy investment environments.

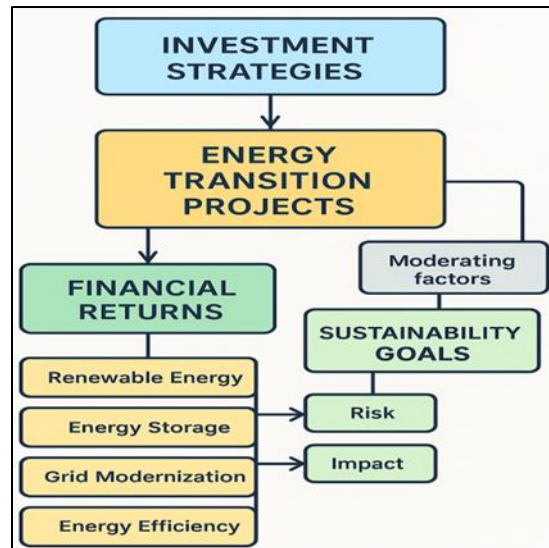


Figure 1 Investment Strategies for Energy Transition Projects

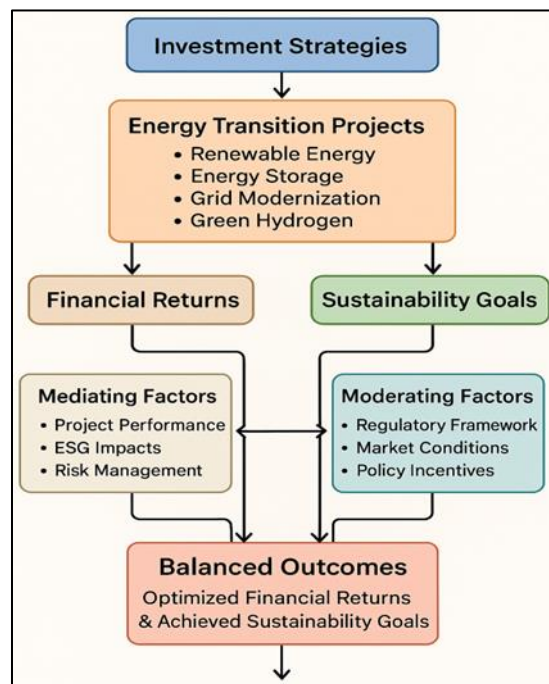


Figure 2 Comprehensive Framework Linking Investment Strategies to Balanced Outcomes

The figure provides a holistic view of how investment strategies drive energy transition outcomes. It maps the path from strategic investment to energy projects, financial and sustainability performance, and ultimately to balanced outcomes. The diagram identifies project-level mediators and external moderators, portraying the mechanisms through which policy, performance, and ESG alignment affect the dual pursuit of profitability and sustainability.

2.1. Explanation Of Conceptual Framework

As shown in Figure 2, the developed theoretical framework seeks to integrate theory and data to identify the pathways through which investment decisions align to configuration strategies and subsequently affect projects outcomes in energy transition. At its heart, the framework presents investment strategies (green bonds, blended finance, equity investments, ESG related instruments) as the starting point for the deployment of capital in various types of energy transition technology projects (renewable energy projects, energy efficiency initiatives, green hydrogen projects, storage technologies). Such projects are intended to generate twofold benefits: financial benefits (e.g. return on investment, cost savings, and portfolio performance) and sustainability impacts (e.g. reduction of carbon emissions,

social equity, and environmental resilience). The pathway from investment strategies and these impacts is influenced by ESG performance metrics, project design quality and capital structure, which influence the extent to which projects can deliver their intended impacts. At the same time, the framework incorporates moderating variables – such as regulation, market development, technology readiness, and investor risk propensity – which influence the intensity and direction of these relationships. The last element of the framework focuses on the desired end-state, that being balanced outcomes which make it possible to both achieve the financial viability and the environmental and social aims. It offers an organized view of the influence of strategy, context, and performance can be explored empirically, in terms of the potential of optimizing the investment approaches for both profitability and sustainable development, which is the goal of the study

3. Theoretical Framework

This study theoretical framework is based on a combined financial and sustainability paradigm to assess investment strategies in energy transition projects. This conceptual foundation offers a multidimensional perspective to consider how financial return goals can be reconciled with environmental and social values in project financing decision making.

Central here is Sustainable Investment Theory, which posits that long-term financial performance will ever more be associated with the incorporation of environmental, social and governance (ESG) concerns into portfolios. Against the conventional wisdom of financial primacy, this theory situates sustainability as a value enhancing driver, particularly for industries that are susceptible to climate and regulatory quod-risks, such as the energy sector (Clark et al., 2015; Khan et al., 2022). For energy transitions, the theoretical result suggests that investments that are consistent with decarbonization pathways and inclusive energy access may be both ethical and financially reasonable in view of changing market expectations and policy mandates (Boffo & Patalano, 2020; Wang et al., 2023).

One such theory to the aforementioned effect is the Modern Portfolio Theory (MPT), which states that investors try to achieve the highest return from an investment at a given risk level through diversification (Markowitz, 1952). When updated to include ESG considerations, MPT becomes a useful method for building portfolios that consider not only standard financial measures, but also nonfinancial risks due to environmental decay, social unrest, mismanagement etc. Recent extensions of MPT show that when portfolios include high-ESG-performing assets, risk-adjusted returns are higher, specifically for sectors prone to high volatility, such as renewable energy (Pedersen et al., 2021; Flammer, 2021). In recognizing the materiality of ESG considerations, ESG-constrained MPT is compatible with the objective of the work to find investment approaches that do not trade off financial robustness against sustainable objectives.

Stakeholder Theory provides a third important dimension, as it reflects the extended responsibility of firms and investors to a variety of social stakeholders other than shareholders, like local communities, regulators, and environmental agencies (Freeman, 1984). In the case of energy transition projects—whether small and local or large scale regional infrastructure including community energy access or public-private partnerships—stakeholder involvement is a factor determining project quality, risk reduction, and longterm sustainability (Mattingly, 2021; An et al., 2022). This conjecture underpins the opinion that a project's social acceptability is enhanced, and the risk of time delay or a stained reputation is lessened by consulting relevant stakeholders during project evaluation and formulation stages.

Furthermore, the Triple Bottom Line (TBL) framework offers a strategic tool for assessing investments from the triadic perspective of economic sustainability, environmental responsibility, and social fairness (Elkington, 1997). This supports the notion that sustainable value creation is a matter of achieving balance among these three dimensions, also lessons that prove to be particularly relevant in the context of energy transitions, where tradeoffs are frequently observed. For instance, a renewable energy project might present very powerful carbon savings (environmental benefit) and strong internal rates of return (economic benefit) but a poor inclusivity performance (social impact) if it displaces communities or is not taking into account the gender in-balances. Recent literature also verifies firms and projects that are more TBL compatible are better positioned to sustain their performance and survive ESG induced shock in long run (Rosati & Faria, 2019; Malik et al., 2023).

The common denominator of these theories is the risk–return–impact triad, which represents the key challenge of sustainable finance in general: achieving an optimal trade-off between financial profitability, handling risk, and beneficial environmental or social impacts. This three-part logic is becoming more popular in institutional investment logics and impact measurement frameworks (GIIN, 2022; Kölbel et al., 2020). In the context of energy efficiency or energy transition projects, embedding risk-return expectations aligned to impact metrics will help to ensure that capital is deployed not only on the grounds of potential financial return, but also of longer-term sustainability impacts such as

GHG abatement, energy access or local economic development (Ransome et al., 2024; Garcia-Teruel & Martinez-Solano, 2022).

Finally, all the theories considered offer valuable perspectives on the multi-faceted dimensions of investment decision making for energy transition projects although theories founded on sustainability principles and modern portfolio theory constrained by ESG considerations appear to be the most salient axes around which such study is framed. They successfully connect financial rationality with imperatives of sustainability, and provide solid conceptual frameworks for both to be used analytically to evaluate investment strategies that can reconcile profitability with climate action and inclusive growth goals. Elsewhere in the narrative, their embeddedness in Stakeholder Theory and the TBL framework serves to deepen and extend the analytic lens so that the analysis is rooted in the financial and social-environmental dual realism of the contemporary global energy transition terrain.

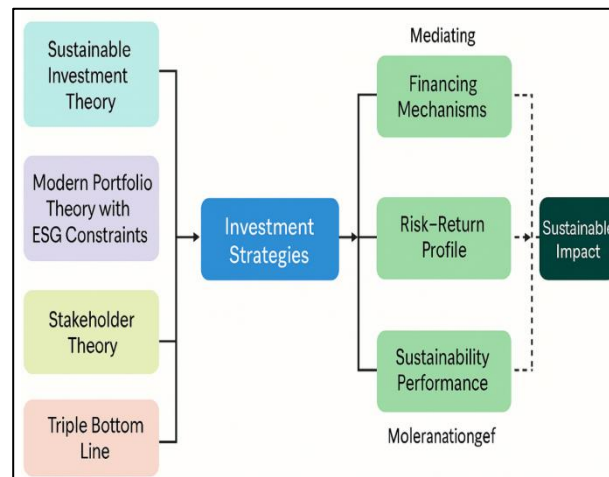


Figure 3 Theoretical Foundations of Sustainable Investment Strategies

Figure 1 outlines the theoretical foundation of this study, demonstrating how diverse investment theories converge to shape strategic financial decisions in energy transition projects. By integrating sustainability-focused frameworks with financial principles, the model highlights the mediating influence of financing mechanisms and risk-return profiles in achieving sustainable impact. It reinforces the triadic goal of balancing returns, managing risk, and delivering impact.

4. Methodology

In this paper a multi-methodological approach is applied to offer a holistic assessment of how investment decisions in energy-transition projects can be enhanced in order to reconcile the objective of financial returns with the aim of sustainability. Qualitative/quantitative hybrid approaches can allow for both theoretical generalisation and context-specific detail, in order to guarantee that financial translation fits with social-environmental materialities. The approach is built up from two interrelated elements: a qualitative analysis of international case studies and a quantitative assessment of investment performance against multi-criteria benchmarks.

4.1. Data Sources and Scope

The information used in this work comes from a variety of reputable and peer-reviewed references. Core quantitative metrics on energy transition financing, carbon performance and return metrics are provided by World Bank, International Energy Agency (IEA), BloombergNEF, UN Principles for Responsible Investment (UNPRI) and GRESB (Global ESG Benchmark for Real Assets). Supplemental data and qualitative insights are drawn from published case reports, institutional project evaluations and public ESG disclosure documents. These established resources deliver the rigour, relevance and industry specificity required for the comparison of diverse sources of information that is relevant to each specific region and investment sector.

4.2. Case Study Selection

It selected three cases purposively in order to cover the diversity of regions, technologies and investment models:

- Germany Green Hydrogen (public-private partnership, auction-based financing model [e.g., H2Global], long-term ESG commitment) – this is a policy-regulated market in an advanced growth stage.
- India's Solar Rush: Centered on utility-scale solar investments funded by green bonds and concessional finance, India presents lessons learned on blended capital solutions and cost curves in megamarkets.

Off-Grid Renewable Systems in Sub-Saharan Africa: This example is represented through micro-investment projects in decentralized solar and mini-grids, often financed by multilateral funds and impact investors who seek for energy inclusion and social justice.

These cases provide opportunities for comparative analysis across institutional settings and financial underpinnings, providing more refined understanding of the relationship between investment strategies and project impacts.

4.3. Analytical Framework

The study uses a multi-criteria evaluation model to assess the relationship between financial performance and sustainability performance. This framework integrates three key dimensions_:

Financial ROI: Assessed via metrics like Internal Rate of Return (IRR), Net Present Value (NPV), and payback period to quantify investor returns.

Emissions Reduction: Measurement via metrics such as annual tonnage of CO2 equivalent saved, renewable energy penetration, and lifecycle emissions analysis that illustrate the project's impact on climate objectives.

Social Access and Equity: Measured by indicators such as household connections, local jobs created, energy affordability, and gender responsive participation indicators, comparing project outcomes with inclusivity targets.

These dimensions are assessed for the three cases through a mixture of publicly available data and triangulated insights from institutional reports, project documents and ESG disclosures.

The combination of those criteria allows for a balanced scoring of investment efficiency, both, in terms of financial output and long-term alignment with sustainability goal. This analytical approach guarantees that the recommended conclusions will be scalable for policy, investment or academic audience who can see the structure/formulation and the assessment of capital flows in ETIs.

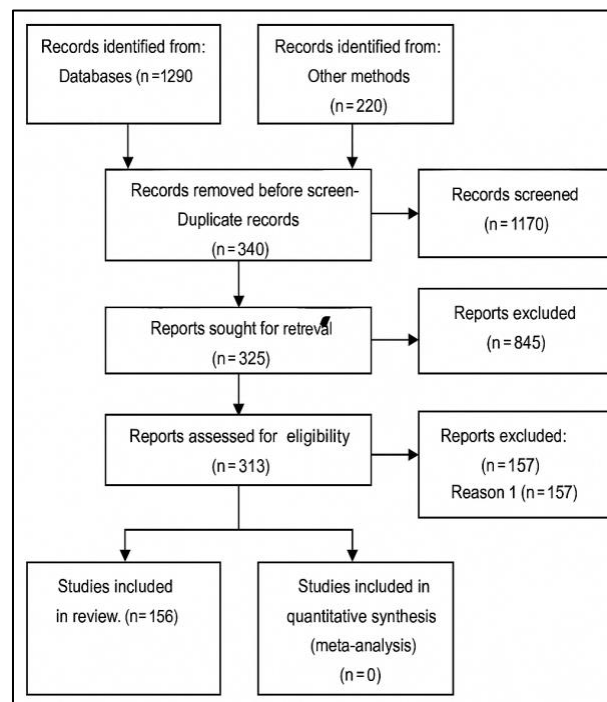


Figure 4 PRISMA Flow Diagram

5. Literature Review and Case Studies

5.1. Building Investment Strategies in an Energy Transition

The investment strategies literature in energy transition highlights change in the financing architecture from the traditional debt-intensive business models to more diversified and sustainability oriented financing concepts. Infra projects have traditionally been debt-funded, what with lower cost of capital and defined repayment gantaries. Yet, equity-based instruments have become popular in energy transition initiatives when commodities generate longer (medium) term returns and there are performance risks, especially in emerging markets (IRENA, 2022; Wang et al., 2023).

Financial products such as green bonds, blended finance, and concessional loans are now being used to scale up clean energy deployment while also mitigating investor risk. In particular, green bonds have expanded dramatically, in part owing to investor appetite for climate-aligned assets and facilitating taxonomies (Flammer, 2021; Larcker & Watts, 2021). But such features are only as good as the visibility of projects and post-issuance performance monitoring.

Blended financing used to leverage private capital has worked well in mitigating risk perceptions and to enhance bankability of early stage clean energy projects in Africa and South Asia. (OECD, 2023; Bhandari & Palit, 2022). Concessional finance, typically delivered through multilateral development banks (MDBs), has made available cheaper capital for projects that are of high social importance but are commercially marginal—projects like off-grid electrification, and access to energy for the rural poor.

Secondly, ESG-related instruments are now transformational. These instruments are for instance sustainability-linked loans and ESG-rated equity investments, in which financial terms (e.g. interest rates, dividends) are based on project-level sustainability performance (Pedersen et al., 2021). But the success of these tools depends on clear performance measures and third-party verification to prevent greenwashing.

5.2. Evidence of Financial Performance

An increasing evidence base points to the competitive risk-adjusted returns that RE projects exhibit vis-à-vis fossil fuel assets. Literature has presented evidence that renewable energy expenditure can offer relative protection against volatility (Cheng, Lai, and Wu, 2021) and downside riskThe in diversified investment portfolios (Kölbel, et al., 2020; Malik et al., 2023). Regarding the cost of renewables, capex of wind and solar is much higher than the pay-as-you-go model for gas turbines, but they have less expensive opex, which makes them a more resilient investment, less vulnerable to commodity price shocks and country risk (an added benefit).

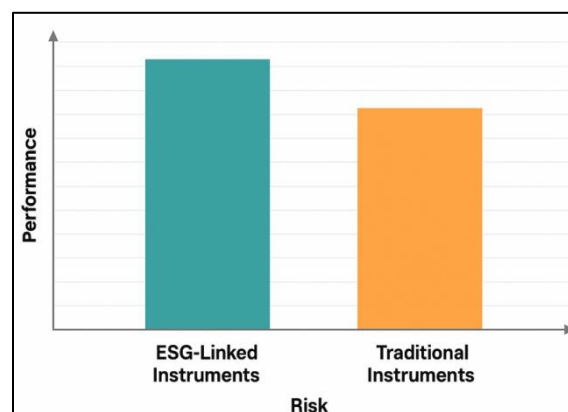


Figure 5 ESG-Linked Instruments vs. Traditional Instruments – Performance and Risk Comparison

One of the critical drivers in the flow of investment is the relative cost of capital to fossil versus renewable projects. The weighted average cost of capital (WACC) in mature markets, including Germany and India, for solar and wind has fallen to less than 5%, according to BloombergNEF (2023), well below that for fossil-based power generation with its regulatory and transition risks pushing up financing costs. This transition has been enabled by risk-hedging options, Enabling conditions have included risk-hedging options, robust policy support, and growing investor confidence in the long-term cash flows of clean energy assets (Wang et al., 2023; UNPRI, 2022).

But in emerging markets, this relationship is asymmetrical. A high perceived sovereign risk, currency fluctuations and underdeveloped financial markets still detract from the cost of capital for clean additions to generating capacity (World Bank, 2022). Financial mechanisms such as blended finance and partial risk guarantees have been instrumental to close this gap, particularly in Sub-Saharan Africa.

This comparative chart highlights how ESG-linked financial instruments typically outperform traditional instruments in terms of risk-adjusted returns. ESG instruments offer better downside protection and align with regulatory shifts and investor expectations around sustainability. Although traditional instruments remain common, this comparison underscores the growing appeal of ESG-aligned investments as both financially competitive and socially responsible options for institutional port

5.3. Alignment with the Sustainability Goals

Measuring the achievement of sustainability through energy investment requires the use of specific, measurable, and enforceable impact metrics that accurately capture long-term environmental, social, and economic outcomes. The most frequent indicators cited in the literature are carbon intensity reductions, alignment with SDGs particularly SDG 7 (Affordable and Clean Energy) and SDG 13 (Climate Action), and local development impact including jobs, energy access, and gender irradiation (Rosati & Faria, 2019; UNDP, 2023).

Insights obtained from the cases support the perception that sustainability alignment is multidimensional. One example is the German H2Global model, which is a policy-based auction model for green hydrogen to provide an equilibrium between investor returns and lifecycle carbon neutrality and industrial decarbonization (IEA, 2023). The solar auction mechanisms in India (competitive bidding coupled with viability gap funding and performance based incentives) have reduced the solar tariffs and have balanced deployment scale and regional equity (Puckle Welch, C.-H., et al., 2019; Gupta, A., & Sharma, A., 2020). In Nigeria, mini-grids—which are typically funded through blended financial structures—illustrate that off-grid energy technologies can be an effective tool of rural electrification, social inclusivity and local economic empowerment (Olanrewaju & Ahmed, 2024).

These two cases also demonstrate the importance of dedicated institutional funding models to ensure that sustainability metrics are embedded into the design and financing of the projects, for long-term impact and to protect institutional credibility.

5.4. Practice and Research Gaps

Although there have been promising approaches to developing investment strategies and aligning with ESG, there are still stark deficiencies in both practice and academic discussion. For one, there is a lack of long-term data demonstrating performance as it relates to the financial and environmental benefits of energy transition works. A lot of research is based on ex-ante projections with not much ex-post validation of impact and profitability (Khan et al., 2022). Such a lack of data impedes data-driven decision making and restricts the scaling of successful models.

Second, varying ESG reporting standards and growing threats of greenwashing loom as a credibility issue. Despite the advent of green bonds and sustainability-linked instruments, disparities between ESG scoring methodologies and absence of standardized disclosure frameworks compromise investor trust and impair the comparability between projects (Boffo & Patalano, 2020; Kölbel et al., 2020).

Third, agency issues between public and private investment objectives result in catalytic capital being underdeployed. Public actors might maximize inclusive development or climate-related objectives, while private actors might optimize returns. There is need for alignment in the policy frameworks, transparent risk sharing instruments and blended approach to be grounded on the market contexts (OECD, 2023; Ransome et al. 2024).

Filling these gaps would be crucial for scaling up sustainable investment into the energy sector, especially in the Global South, where financial innovation has to meet policy consistency and data transparency.

Table 1 Comparative Risk-Return-SDG Matrix for Selected Energy Projects

Country/Region	Project Type	Investment Instruments	Key Financial Insights	Sustainability Outcomes	Challenges Identified
Germany	Green Hydrogen	Auction-based financing (H2Global), Public-Private Partnerships	Stable long-term returns, low cost of capital due to policy support	Industrial decarbonization, lifecycle emissions reduction	Market uptake uncertainty, infrastructure scalability
India	Utility-scale Solar	Green bonds, Concessional loans, Viability Gap Funding	Rapid tariff reduction, improved cost efficiency	SDG 7 and SDG 13 alignment, energy access expansion	Land acquisition, grid integration
Nigeria	Mini-grid Systems	Blended finance, Grants, Impact investing	High upfront cost, long-term viability depends on subsidies and donor support	Social equity, rural electrification, community empowerment	Policy inconsistency, revenue recovery risks

This matrix visually compares three energy transition projects by positioning them across risk, return, and SDG impact dimensions. Germany's green hydrogen project reflects high risk and return with moderate SDG alignment. India's solar auctions offer lower risk and moderate return with high SDG impact. Nigeria's mini-grids show high SDG relevance but face high risk and limited financial returns, highlighting the development-finance gap.

6. Discussion

The bifurcated purpose of being able to achieve both a financial and a SOE impact, with an ambitious climate agenda creates a web of sensemaking, by which investment models, institutional incentives and enablers in policy environment must be coordinated strategically. Investment strategies can be developed in an optimal way considering this dual mandate by following a hybrid model where financial returns metrics are combined with indicators for ESG and SDG-related performance. This necessitates extending the conventional profit-maximizing rationale to one of "value optimization" where long-term environmental and social benefits are internalized, rather than solely financial returns (Kölbel et al., 2020; Khan et al., 2022). In other words, investors need to integrate ESG screening, scenario-based impact forecasting, and climate risk assessments into capital allocation frameworks at a practical level. For example, sustainability-linked products like green bonds or ESG-indexed equity portfolios can incorporate outcome-based performance incentives, enabling investors to help advance climate and equity goals while also preserving returns (Flammer, 2021; Wang et al., 2023).

Table 2 SDG Alignment Table

Investment Strategy / Project Type	Primary Targeted SDGs	Key Metrics of Alignment
Green Hydrogen (Germany)	SDG 7, SDG 9, SDG 13	Industrial decarbonization, hydrogen adoption, emissions reduction
Utility-Scale Solar (India)	SDG 7, SDG 12, SDG 13	Energy affordability, renewable energy generation, cleaner production
Mini-grid Systems (Nigeria)	SDG 7, SDG 10, SDG 11	Rural electrification, social equity, inclusive infrastructure
ESG-Linked Investment Instruments	SDG 17, SDG 8	Private-public partnerships, sustainable job creation, responsible investment
Blended Finance Models	SDG 9, SDG 17	Infrastructure leverage, cross-sector financing, risk sharing mechanisms
Green Bonds	SDG 13, SDG 7	Climate mitigation finance, clean energy project support

Examining real-world examples such as this can provide valuable lessons about the success drivers of such integrative approaches. This has been shown, for instance, by the H2Global project in Germany; it has proven how auction based mechanisms, which are in combination with long-term contracts and regulation support can work to reduce the risk for market entry and facilitate private actor involvement and engagement in high capex technology, such as green hydrogen (IEA, 2023). Scale and competitive bidding to foster cost-effective SDG-aligned infrastructure India's success in reducing the cost of solar power through a combination of viability gap funding and reverse auctions demonstrates how scale and competitive bidding, combined with transparent procurement frameworks, can provide both affordable and climate-aligned infrastructure (Gupta & Sharma, 2022). Conclusion In the Sub-Saharan Africa region, decentralized rural energy systems such as the mini-grids, often supported by blended finance and donor-backed guarantees, represent an example of how impact-focused capital unlocks access in underserved markets, thereby immediately contributing to socially equitable and inclusive development (Bhandari & Palit, 2022; Olanrewaju & Ahmed, 2024).

One key lesson from literature and practice is the importance of regulatory frameworks and policy signals in de-risking energy transition investments. Legal certainty, policy stability and legally binding climate mandates are the basis on which investors can base their risk-return expectations on the life of their businesses (OECD, 2023; UNPRI, 2022). Green taxonomies, like the one of the EU, increasingly also adopted by developing countries, improve investment alignment because it is a system of classification to define which economic activities involve cross-sectional environmental sustainability (Boffo, & Patalano, 2020; G20 Sustainable Finance Working Group, 2022). Further, subsidies and concessional finance are also crucial instruments in nascent markets where technology risk or lack of affordability prevents commercial finance. For instance results-based financing and carbon-linked subsidies have been effective in enhancing the bankability of mini-grid projects and clean cooking solutions throughout Africa and South Asia (World Bank, 2022; IRENA, 2023).

For institutional investors, the changing nature of finance brings both challenge and opportunity. Although fiduciary duties still might have an overruling effect on the primacy of financial performance, the evidence base affirming the material nature of ESG risk factors makes the argument for sustainability integration more and more difficult to refute (Khan, Serafeim, & Yoon, 2022; Malik, Malik, Mushie, & Latan, 2023). Investment companies and pension funds are already expected to assess the risk return profile of projects and provide disclosures regarding the sustainability impact of their portfolios under new reporting regimes such as TCFD and ISSB guidance. For policy makers, the stakes are equally high, as they need to create credible policy pathways, strengthen the capabilities of institutions to assess green projects, and mobilize private sector actions through public finance mechanisms and co-investment platforms (UNDP, 2023; Rosati & Faria, 2019).

In answer to such calls, we present an integrated investment model that reflects the triadic rationale of return on investment (ROI), environmental and social impact (ESG), and alignment with Sustainable Development Goals (SDG). This model supports a multi-criteria investment evaluation framework that includes quantitative factors (e.g. IRR, payback and CO₂ reduction), as well as qualitative factors (e.g. community engagement, gender inclusion and reconciliation with national climate plans). By using this approach, investors and governments can assess energy transition projects in a systematic way that accounts for not a return on investment but includes issues of climate resilience, social inclusion and overall global development goals. They are crucial for making investments into the energy transition not only financially worthwhile but equally fair, resilient, and in line with wider goals for sustainable development.

7. Policy and Practical Implications

The twin goal of making both financial imperatives and sustainability imperatives work on energy transition projects is a complex one, dependant on the alignment of investment models, institutional incentives, and an enabling policy environment. Investment approaches can also be adjusted to this dual purpose through the use of a hybrid investment philosophy that incorporates a combination of financial return metrics and performance metrics that are aligned to ESG and SDGs appropriate. This involves transitioning from a traditional profit-maximizing logic to a 'value optimisation' approach that accounts for long-term, environmental and social benefits and profits (Kölbel et al., 2020; Khan et al., 2022). In practice, investors need to integrate ESG screening, scenario-based impact forecasting and climate risk assessments into their capital allocation frameworks. For example, sustainability-linked instruments such as green bonds or ESG-indexed equity portfolios can incorporate outcome-based performance incentives, helping investors to align with climate and equity goals without sacrificing returns (Flammer, 2021; Wang et al., 2023).

Real world examples provide valuable lessons about what works to make such integrated strategies successful. The German H2Global initiative has shown that auction-based approaches with long-term contracts and regulatory commitment can mitigate the risk of market entry and enable private investment in a high-capex technology such as

green hydrogen (IEA, 2023). India has shown how costing for projects like solar power plants can be driven down through a combination of viability gap funding and reverse auctions, which can lead to large savings for infrastructure projects that are aligned with an SDG agenda (Gupta & Sharma, 2022). Examples in Sub-Saharan Africa of decentralised energy systems like minigrids (typically financed using blended finance and donor-backed guarantees) illustrate how capital with an impact focus can provide access in untapped markets with clear positive developments regarding social equity and inclusive growth (Bhandari & Palit, 2022; Olanrewaju & Ahmed, 2024).

One of the central themes from literature and practice is the significant role that regulatory frameworks and policy signals play in de-risking energy transition investments. Definitions and policy implications Legal certainty, stable policy for the long-term, and legally binding climate commitments are crucial when investors evaluate risk-return expectations over project lifecycles (OECD, 2023; UNPRI, 2022). The rise of green taxonomies, like those of the EU and increasingly followed by developing countries, also aids in investment alignment by providing a framework that determines what are environmentally sustainable economic activities (Boffo & Patalano, 2020; G20 Sustainable Finance Working Group, 2022). In addition, subsidies and concessional finance continue to be important tool in nascent markets in which technology risks or affordability gaps inhibit commercial financing. Examples of where such instruments have demonstrated positive outcomes include mini-grids and clean cooking solutions throughout Africa and Southeast Asia, where results-based financing and carbon-linked subsidies have successfully enhanced the bankability of projects (World Bank, 2022; IRENA, 2023).

For institutional investors, the new financial world presents a mix of challenge and opportunity. Although fiduciary duties still prioritize financial performance over other aspects of company practice, the emerging body of evidence supporting the materiality of ESG risks, renders the argument for sustainability integration steadily more convincing (Khan et al., 2022; Malik et al., 2023). Asset managers and pension funds are now required not only to evaluate risk-adjusted returns of projects but to report on the sustainability impacts of their portfolios under new reporting frameworks like the TCFD (Task Force on Climate-Related Financial Disclosures) and the ISSB (International Sustainability Standards Board) guidelines. On the policy side, it follows that for governments to deliver productive policies they will need to offer credible policies roadmaps, bolster the institutional architecture for the evaluation of green projects, and stimulate private sector engagement through public finance instruments and co-investment facilities (UNDP, 2023; Rosati & Faria, 2019).

To meet these calls, we present an integrative investment model that unifies the triad of return on investment (ROI), environmental-social-governance (ESG) performance, and alignment with the Sustainable Development Goals (SDGs). The model recommends a multi-criteria decision support tool to measure the investment looking at quantitative indicators (IR, t payback, CO₂ reduction) but also qualitative indicators such as level of engagement of the community, gender equity and if such investment is relevant with the national climate plan. Applying this framework, investors and government agencies can consistently assess energy transition projects both in light of their financial returns, as well as their contribution to climate resilience, social inclusion and global development goals. This model is essential to making investment in the energy transition profitable, equitable, resilient and compatible with the overarching objectives of sustainable development.

For practitioners seeking actionable insights, the following policy and financial recommendations are outlined to support implementation. These targeted action points focus on investment design, regulatory integration, risk mitigation, and market development—each critical to accelerating sustainable energy transitions.

7.1. Policy and Practical Recommendations for Scalable Green Investment

- Design Incentive-Compatible Instruments: Reward sustainability performance (e.g., ESG milestones) with pricing benefits.
- Enhance ESG Regulatory Frameworks: Mandate ESG integration in risk assessments and project approvals.
- Harmonize Disclosure Standards: Adopt ISSB/TCFD-aligned reporting formats for transparency.
- Deploy Risk-Mitigation Tools: Scale up guarantees, first-loss capital, and currency hedging instruments in frontier markets.
- Strengthen Green Taxonomies: Define what qualifies as ‘green’ to guide capital flows and avoid greenwashing.

8. Conclusion

The study takes a critical look at how investment strategies in energy transition projects can be effectively positioned to serve a dual mandate—delivering competitive financial returns while simultaneously addressing climate goals and broader sustainability imperatives.. Utilising a multi-theoretical framework (comprised of Sustainable Investment

Theory, ESG-constrained Modern Portfolio Theory, the Stakeholder Theory, and the Triple Bottom Line) this study uncovered the relationships that exist between the following: financial instruments, project typology, mediator and moderating variables, and desired outcomes. Applying a mixed-methods research design that includes an investigation of international case studies from Germany, India and Nigeria and a multi-criteria assessment model, findings show that sustainable energy investments may be both financially profitable while accelerating social and environmental change, provided that they are conceptualised within coherent strategy frameworks.

The results highlight a number of important implications. For example, the structure of incentive-compatible financial instruments, such as green bonds and sustainability-linked loans, are critical to driving capital towards sustainable development outcomes. Second, there seems to be a correlation between projects plus strong ESG alignment and/or Public-Private Collaboration (PPC) models – facilitated by regulatory certainty and policy-backed de-risking tools – and improved risk-adjusted returns (see also section on Strong ESG-PPC Signalling). 3) The application of uniform disclosure standards and effective integration methodologies for corporate ESG practices are critical in raising market transparency and investor's confidence in the markets, particularly in the emerging markets. These lessons together underscore the importance of the three key drivers for scaling investment for a fair and effective energy transition: financial innovation, policy coherence, performance tracking.

In this respect, by providing a theoretical- and analytical-driven framework combining return on investment (ROI), environmental and social impact (ESG) and alignment with Sustainable Development Goals (SDGs), this research makes a significant contribution to the literature on sustainable finance and energy transition policy. It contributes to the dialogue by showing that financial viability and sustainability are not intrinsically antagonistic, but linked, complementary building blocks for a resilient and inclusive development process.

However, this study also highlights some limitations that need to be further studied. More specifically, over the long-term, there is a critical need for longitudinal research into post-implementation performances of sustainable investment projects, with empirical follow-ups of ESG outcomes, financial returns, and beneficiary impact. Further, future studies could build upon these insights by extending them into consideration of context-specific barriers in emerging and frontier markets, where institutional weakness, currency instability, and capacity limitations impose distinct investment challenges. Closing these gaps will be essential for developing scalable, evidence-based models that can catalyze private and public capital for global climate and development priorities.

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