Climate Compatible Growth

COP29

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How Much Climate Finance do Low- and Middle-Income Countries Need?

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Summary

The international policy debate on climate finance currently centres on the total magnitude of capital needed to support the transition in the Global South. However, an equally important question is how much climate finance individual countries require, and through which types of financial instruments it should be delivered. This policy brief argues that, to estimate power sector financing requirements at the national level, comparing the financing costs of incremental investments between a Net Zero (NZ) and Business-as-Usual (BAU) energy sector investment plan provides a sound conceptual framework. Using the novel MinFin model, this policy brief estimates the power sector financing requirement for two LMICs, Kenya and Ghana, and explores the implications of alternative modes of climate finance delivery. The modalities examined include grants, loans, pay-as-you-go carbon credits, and debt write-offs. The results reveal notable differences in financing needs between countries, driven by variations in their reliance on fossil fuels within the energy mix, as well as differences in their respective costs of capital. The results also indicate that not all financing methods are viable in Ghana and Kenya; loans, in particular, fail to achieve financial breakeven in both cases and are generally unsuitable for long-term investments in this context. This underscores the necessity for tailored strategies within the UNFCCC's New Collective Quantified Goal (NCQG) for climate finance.

Key Policy Recommendations

- The international community should develop broad principles for determining the allocation of climate finance across countries. These principles should respect individual country needs based on differential patterns of costs and benefits associated with the transition, as well as their respective costs of finance.
- National policymakers should equip themselves for negotiation by understanding the incremental costs and benefits of the transition based on a comparison of NZ and BAU futures. They should also explore different modalities of climate finance delivery to ascertain which best fits their particular case.
- Researchers and analysts should use and develop practical modelling tools, such as MinFin, to facilitate the understanding of the financing implications of the climate transition and allow for the simulation and exploration of alternative approaches to climate finance delivery.

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Introduction

The international community has been negotiating the appropriate amount of climate finance that should be provided to the Global South to ease the costs of the climate transition. Discussions at COP29 focused heavily on the UNFCCC's New Collective Quantified Goal (NCQG) for climate finance. This is intended to be a more rigorously determined global financial commitment to supersede the somewhat ad hoc pledge of US$100 billion a year from COP15 [1]. A central challenge in establishing an accurate target for this commitment is that countries have, thus far, struggled to quantify the full scale of climate finance required. However, once such a total is determined, the next question that arises is to determine how this global pot could be fairly allocated across countries, and what would be the most suitable financial channels through which to deliver support.

To address this question, the novel MinFin model has been applied to Kenya and Ghana to estimate the financing needs in the power sector at the national level and to determine the amount of international climate finance required based on a variety of delivery mechanisms. This approach can be applied beyond power to cover other emitting sectors, or even to incorporate adaptation costs.

MinFin

MinFin is a novel open-source Excel-based cashflow model designed to assess the financial feasibility of investment plans for energy transitions. It quantifies and evaluates climate finance gaps, determining where and when these gaps are likely to arise. The tool can then used to explore strategies to address these gaps.

In this context, a country encounters a climate financing gap when the available cashflow, or funding availability, falls short of the amount needed to meet the financing requirements of the climate investment programme. This concept is based on the principle that there can be no financing without funding, as finance is only ever provided when there is proven capacity to repay.

The MinFin model categorises these factors into three pillars, the interaction of which determine the financial feasibility faced by individual countries:

- **Investment needs:** How much capital expenditure in power infrastructure is needed to meet transition goals: the greater the carbon intensity of the current energy system, and the faster the growth in energy demand, the larger the investment required.
- **Financing requirement:** The terms on which the country can secure climate finance: countries with elevated country risk premiums and/or limited access to concessional financing will pay much higher financing costs to implement the given investment plan.
- **Funding availability:** The resources available in the sector to repay financiers: the more limited the public resource envelope, and the weaker the cashflow of energy utilities (both public and private), the more difficult it will be to repay financiers.

Turbines – Kajiado County, Kenya

SIMON-BRANDINTEL, PEXELS

Quantifying the net cost of Net Zero

The Net Zero (NZ) transition requires an unprecedented surge in power sector investment towards mid-century, driven by two primary factors: capital intensity and accelerated replacement. Clean energy technologies, though potentially more cost-effective in the long run, are more capital intensive upfront than fossil fuels, necessitating higher investment. Additionally, to meet mid-century decarbonisation goals, some fossil fuel plants must be retired early, requiring both replacement investments to maintain current energy supply and expansion investments for future demand, adding to the financial burden compared to a Business-as-Usual (BAU) scenario.

Therefore, the difference between country investment plans under NZ and BAU is a useful metric of the financial burden climate targets impose on a country's energy sector. The BAU scenario is defined as the least cost investment plan that countries would have followed in the absence of climate constraints, permitting continued reliance on fossil fuels whenever they present a more economical option compared to renewable energy sources. In contrast, the NZ scenario uses the same baseline inputs but incorporates the additional requirement of achieving net-zero emissions by 2050.

The magnitude of the NZ burden is influenced by several country factors, including the current reliance on fossil fuels, the age profile of existing fossil fuel plants, the availability of renewable energy resources, and the cost of capital available to the country. A comparison between Ghana (**Figure 1**) – which depends on natural gas and faces a

significantly higher weighted average cost of capital (WACC) – and Kenya (**Figure 2**) – which relies heavily on renewable energy such as geothermal and has been relatively successful at capturing concessional finance – is illustrative in this regard.

To capture the present value of these transition costs, the analysis also applies each country's WACC as the discount rate. MinFin indicates that the additional investment burden of the transition to Net Zero is two orders of magnitude higher for Ghana, yielding a discounted gross incremental investment requirement of approximately US$48.09 billion between 2025 and 2050 for Ghana at a WACC of 9.84%, compared to Kenya, which faces an

***Figure 1:** Comparison of discounted financing repayments of NZ versus BAU for Ghana.*

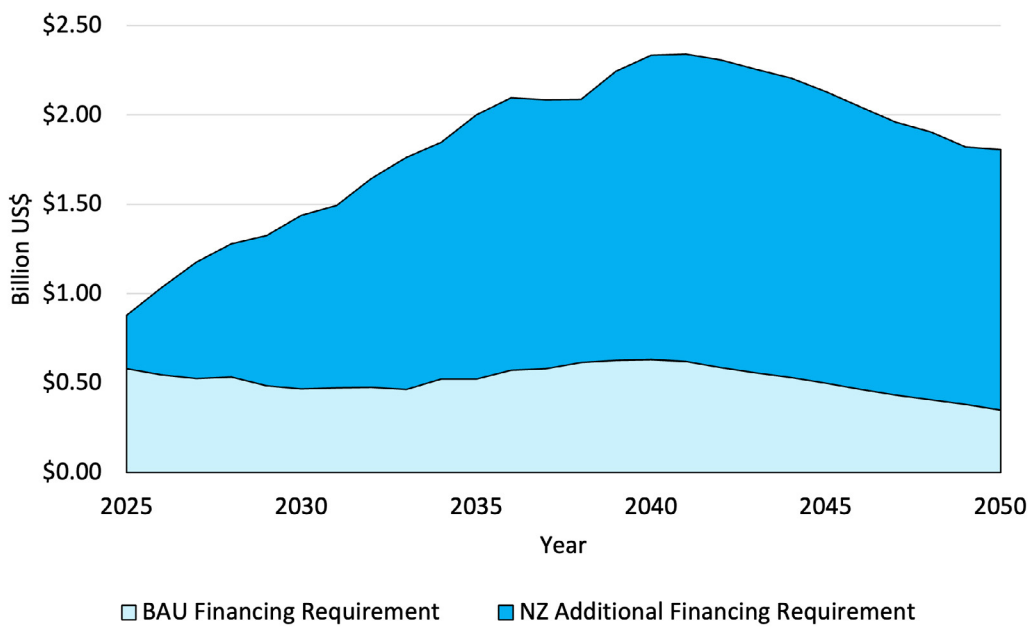
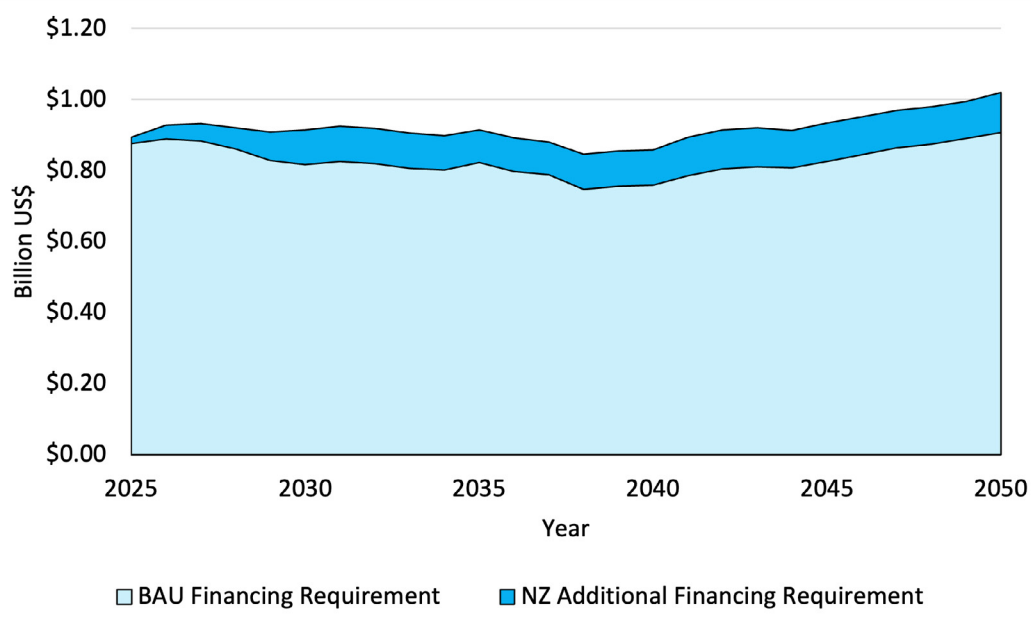


***Figure 2:** Comparison of discounted financing repayments of NZ versus BAU for Kenya.*



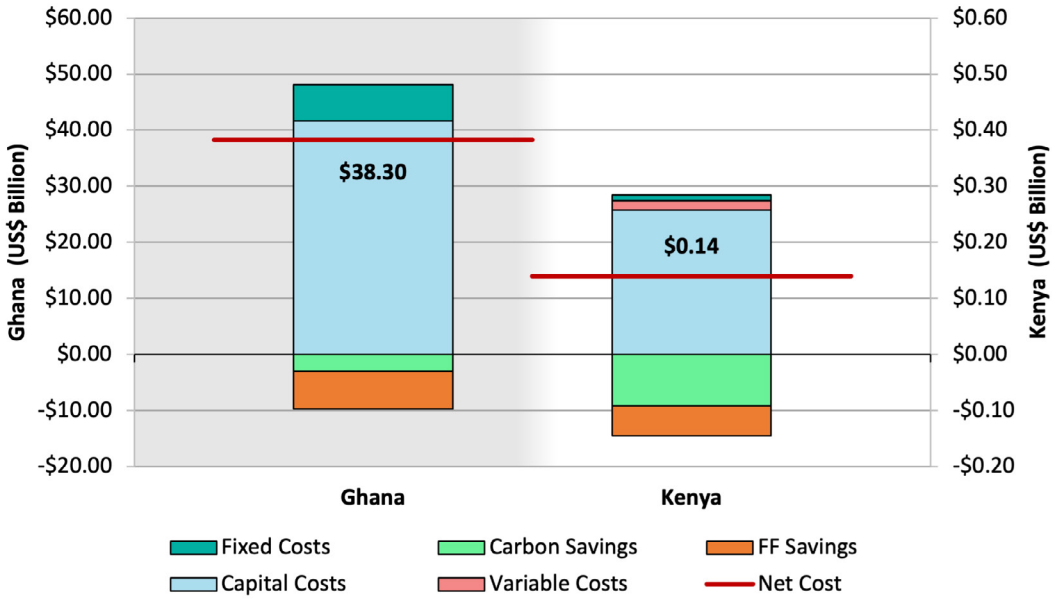
additional cost of US$0.28 billion at a WACC of 5.33% (**Figure 3**).

However, the NZ transition offers benefits beyond the additional investment required, including financial savings and economic gains. Clean energy technologies have lower operating costs than fossil fuels, leading to significant fuel savings, especially for fuel-importing countries, improving their balance of payments and reducing vulnerability to oil price fluctuations [2]. Additionally, the shift to clean energy brings economic benefits, such as carbon savings that can be monetised through carbon markets [3], along with improvements in local air quality and health, though the latter is harder to quantify. MinFin provides a quantifiable way to capture the readily measurable aspects of these two significant benefits of decarbonising.

Fossil fuel expenditure savings are also derived from a comparison of NZ and BAU requirements based on the power system optimisation model. The same model is used to calculate the year-on-year emissions reductions associated with pursuing a NZ trajectory relative to BAU. Carbon savings are then monetised using the value estimated by the High-Level Commission on Carbon Prices. This rate considers an average value between the high and low estimates, with US$75 per ton of CO_2e by 2030 and US$117 per ton by 2050, based on a 2.25% annual growth rate calculated from the known years presented in the report [4].

In the case of Ghana, the benefits of this transition amount to approximately US$9.78 billion, thereby reducing the net additional cost of transitioning to US$38.30 billion (**Figure 3: left-hand axis**). In contrast, Kenya's situation reflects a more favourable outcome, as considering the benefits significantly reduces the overall costs. Specifically, Kenya realises financial and economic savings totalling approximately US$0.15 billion, largely due to the value of carbon credits. As a result, the net loss of the transition is reduced to US$0.14 billion (**Figure 3: right-hand axis**), showcasing how the economic advantages of cleaner energy adoption help mitigate the initial costs.

***Figure 3:** Discounted net costs and benefits of NZ relative to BAU in Kenya and Ghana, 2025–2050. The left side shows Ghana values, and the right side presents Kenya values. Note that the scales used for Ghana and Kenya differ.*



Modalities for delivering climate finance

Given the cost disparity between transitioning to net zero and maintaining a BAU scenario, one approach to understanding a country's climate finance requirements is to consider what volume of finance is necessary. This ensures that the country's power sector remains no worse off under NZ than it would have been under BAU. This framework, which assumes that the international community would bear the additional costs associated with achieving NZ beyond the BAU trajectory, is one possible approach to burden sharing that is used for illustrative purposes in this brief, although alternative approaches could also be simulated. The following section explores six modalities: upfront capital grants, loans, a combination of grants and loans, reducing the weighted average cost of capital (WACC) through increased concessional finance contributions, a pay-as-you-go carbon credit scheme, and debt forgiveness.

***Table 1:** Summary of Methods and Results for all modalities. Values are discounted at the country WACCs and presented in Billion (Bn) US$ and spans the modelling period from 2025 to 2050.*

		Modality	Ghana Results	Kenya Results
Grant	1a	Modality 1a examines the total ***grant*** requirement to cover the incremental investment needed to transition from BAU to NZ, ***without considering savings*** that accrue from fossil fuel expenditure savings and potential carbon credit sales.	US$48.09 Bn	US$0.28 Bn
	1b	Modality 1b limits the ***grant*** component to the portion of the incremental investment that cannot be recovered through ***fossil fuel savings***.	US$41.30 Bn	US$0.23 Bn
	1c	Modality 1c further limits the ***grant*** component to the portion of the incremental investment that cannot be recovered through ***fossil fuels savings plus potential carbon credit sales***.	US$38.30 Bn	US$0.14 Bn
Loan	2a	In this modality climate finance is conceptualised as a ***loan*** that provides the capital to cover incremental investment costs, with repayments derived through ***revenues generated from savings***. For Modality 2a, this revenue comes solely from ***fossil fuel savings***. The net cashflows are used to calculate the ***MIRR***, to ascertain whether the additional NZ investments ***break even*** considering savings.	Infeasible MIRR, on US$216.44 Bn investment and US$27.19 Bn revenue	2.68% MIRR, on US$0.83 Bn investment and US$0.15 Bn revenue
	2b	In Modality 2b, revenues for loans includes ***both fossil fuel and carbon savings***.	Infeasible MIRR, on US$216.44 Bn investment and US$40.56 Bn revenue	3.72% MIRR, on US$0.83 Bn investment and US$0.43 Bn revenue
Combination of grant and loan	3a	In this modality a blended financing approach that combines grants and loans is considered. This method calculates the 2025 ***grant required for the loan to achieve financial breakeven***. This is defined as the point at which the MIRR is equal to, or exceeds, the WACC. In this context, the grant covers the portion of the investment that exceeds what the project can fund through its savings. In this context Modality 3a considers only fossil fuel savings in the revenue stream.	US$45.36 Bn grant, US$216.44 Bn loan and US$27.19 Bn revenue	US$0.23 Bn grant, on US$0.83 Bn investment and US$0.15 Bn revenue
	3b	Modality 3b considers ***fossil fuel savings and carbon savings*** in the revenue stream when assessing the ***grant required*** for the ***loan to achieve financial breakeven***.	US$42.03 Bn grant, US$216.44 Bn investment and US$40.56 Bn revenue	US$0.13 Bn grant, on US$0.83 Bn investment and US$0.43 Bn revenue
Softening financing terms	4	Modality 4 estimates how much ***softer the WACC*** would need to be on the entirety of the NZ investment plan to bring the ***financing repayments into equivalence*** with BAU. Along with the additional concessional funding required from IFIs.	−3.92% WACC to zero delta (i.e., infeasible)	4.14% WACC to zero delta, meaning an 84.89% CONC IFI weighting and an additional capital contribution of US$5.63 Bn
Carbon credits	5	Modality 5 calculates the carbon credit price needed to equalise financing costs between NZ and BAU.	335.11(US$/Ton CO_2e)	108.83(US$/Ton CO_2e)
Debt write-off	6	Modality 6 determines the external debt amount to be forgiven to equalise NZ investment needs with BAU.	US$28.32 Bn	US$0.21 Bn

Note: FF = Fossil Fuel, MIRR = Modified Internal Rate of Return, CONC IFI = Concessional International Financial Institutions.

Discussion

This study examines six financing modalities within the MinFin model to estimate the financial requirements for transitioning to net zero in Kenya and Ghana.

Grants, one such modality, are particularly relevant when fuel and carbon savings do not sufficiently offset the additional investment costs of clean energy technologies. For Ghana, the financial burden remains significant, ranging from US$48.09 to US$38.30 billion (**Table 1: Grant**), despite potential savings from reduced fossil fuel use and carbon emissions. Whereas Kenya benefits from its renewable energy grid and lower WACC, reducing grant requirements to between US$0.28 billion and US$0.14 billion. Although Ghana has greater savings potential, these do not cover the increased capital costs of new technologies. This could be due to the long-term nature of savings, most of which are expected to materialise post-2050.

Loans were also considered for both countries. For loans to be feasible, savings from reduced fuel consumption and carbon emissions must cover the extra investment. However, in both countries, the Modified Internal Rate of Return (MIRR) did not exceed the WACC, making it an unattractive proposition for investors. Kenya's MIRR ranged from 2.68% to 3.72% (**Table 1: Loan**), with a WACC of 5.33%, while Ghana's infeasible MIRR and insufficient revenue prevented the projects from reaching breakeven. This underscores the need for grants to address financing gaps, as loans alone cannot generate sufficient revenue to offset costs.

In instances when the incremental investment cannot be repaid through fuel and carbon savings and the grant requirement is substantial, countries may opt to **combine grants with loans**. Ghana and Kenya both serve as a notable example of where this blended financing mechanism could be appropriate, given the challenges of using savings as revenue sources for repaying the financing burden discussed in the previous section. In this context, grants cover the portion of investment that cannot be funded through savings, making projects financially viable. In Ghana, achieving financial breakeven requires a grant injection of US$45.36 billion into the cashflows in 2025, while in Kenya, the amount needed is US$0.23 billion (**Table 1: Combination**). The scale of grant required in Ghana raises concerns about the feasibility, highlighting the importance of blending multiple mechanisms to facilitate sustainable investments.

Another option is to **soften the overall financing terms** of the NZ investment profile to ensure the financial repayment obligation matches what it would have been under BAU. In Ghana, this would require an unachievable negative interest rate of −3.92%, indicating the necessity of combining financing modalities. In contrast, Kenya's interest rate adjustments are more feasible, requiring a reduction in the WACC to 4.14%. This can be achieved by increasing the share of concessional international finance from 74.38% to 84.89%, meaning a real term additional contribution of US$5.63 billion (**Table 1: Softening financing terms**).

Previous modalities have assumed a rather static world in which the costs and benefits of the energy transition are fully predetermined; in reality many key parameters will evolve in an unpredictable manner, such as capital costs, fossil fuel prices, and **carbon credit** values. To address this, a pay-as-you-go approach could be employed, where carbon credits are purchased as clean energy projects are implemented. In Ghana, achieving this from 2025 to 2050 would require a minimum weighted average carbon price of US$335.11 per ton of CO_2e (**Table 1: Carbon credits**),

a figure that is far from realistic given current economic conditions and market trends. In Kenya, however, the necessary carbon price is estimated at US$108.83 per ton of CO_2e which is more feasible and coincides closely with benchmarks like those set by the High-Level Commission on Carbon Prices, which forecasts a high-end estimate of US$100 per ton of CO_2e by 2030 [4].

Finally, for countries with highly indebted energy sectors, climate finance may be best delivered through **debt write-offs** [5]. Such write-offs could alleviate debt stress, improve financing terms, and facilitate the energy transition. For Ghana, the debt write-off requirement is US$28.32 billion (**Table 1: Debt write-off**), representing approximately 55.43% of Ghana's total current public debt and 89.71% of its external public debt, which are significant burdens [6]. In contrast, Kenya's debt write-off requirements were significantly lower at US$0.21 billion, representing 0.3% of Kenya's total public debt and 0.55% of its external public debt [7].

Conclusions

This brief examines various methods for allocating pledged global climate finance to ensure that countries are not disadvantaged when pursuing Net Zero compared to a Business-as-Usual trajectory. Findings in Ghana and Kenya underscore the importance of tailored strategies within the UNFCCC's New Collective Quantified Goal (NCQG) framework. Specifically, factors such as country-specific economic and financial conditions, energy profiles, and existing infrastructure must be carefully evaluated, to ensure a fair and effective resource distribution that aligns with each nation's challenges.

The results reveal a significant disparity in financing requirements between Ghana and Kenya, with Ghana facing substantially higher financial demands to achieve a net-zero emissions transition due to its heavy reliance on fossil fuels. Although the economic and financial benefits of transitioning to Net Zero can alleviate the overall burden in both countries, they are insufficient to produce a net economic benefit. Notably, not all methods are financially viable; loans, in particular, fail to reach financial breakeven in Ghana and Kenya and are generally unsuitable for long-term investments in this context. However, loans may be viable for some countries, depending on their economic conditions and financing structures. Similarly, carbon credits are more applicable in countries where the internalised cost of carbon emissions aligns with what is economically acceptable and feasible for integration into policy. Consequently, it is essential to explore blended finance mechanisms that incorporate a combination of concessional finance and grants to effectively address these constraints. A combination of these mechanisms may also be necessary to support net-zero financing and will be examined in greater detail in an upcoming academic paper.

The main objective of this policy brief has been to highlight the different magnitudes and time profiles of climate finance requirements for the power sector in two countries. Modelling tools, such as MinFin, can help to quantify climate finance requirements and explore alternative delivery strategies. Once consensus is reached on the NCQG, the next considerations must be the specific climate finance needs of individual countries and the most suitable financial instruments for effective delivery.

MinFin is a novel model developed by CCG researchers at the University of Oxford and Imperial College London. **To find out more** about MinFin, or guidance on implementing the open-source MinFin model in your country, please contact ***hannah.luscombe@ouce.ox.ac.uk.***

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