# FMO Policy Paper: Rwanda Microgrid Facility

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**Abstract**

This paper presents the investment case for the Rwanda Microgrid Facility (RMF), a blended finance vehicle designed to aggregate and finance a portfolio of solar-plus-battery mini-grids in rural Rwanda. Despite Rwanda's comparatively strong governance environment, ambitious national electrification targets including a conditional NDC commitment of 68 MW of solar mini-grids by 2030, and a small but proven base of operational mini-grid projects, investment in off-grid rural electrification remains well below the scale required to meet those targets. The binding constraint is financial: mini-grids' front-loaded capital costs, location-specific demand risk, foreign exchange mismatches, and high per-project transaction costs produce a risk-return profile that domestic capital markets cannot currently absorb without structured support. The RMF addresses this market failure directly by pooling multiple sites into a single investable platform, layering concessional first-loss capital alongside senior DFI and commercial debt, and embedding technical assistance and results-based payments to improve bankability at the project level. Drawing on FMO's existing experience in Rwanda's energy sector and a growing ecosystem of local developers, regulatory institutions, and development finance partners, the RMF is positioned to deploy capital into underserved rural communities while functioning as a replicable market-building intervention that generates the performance data, institutional familiarity, and financing precedents needed to crowd in private capital at scale over time.

**Transaction Overview**

This report proposes the case for a Rwanda Microgrid Facility (RMF): a pipeline of bankable, solar-plus-battery mini-grids targeted towards rural communities and designed to contribute to Rwanda’s NDC mini-grid target. The RMF will operate largely through pay-as-you-go (PAYG) style payments, which have a proven, successful track record in rural Rwandan electrification efforts, including the modular solar mini-grids built by Arc Power in Bugesera and Gatsibo.[1]

Over the past decade, Rwanda has pursued expanded electricity access across both urban and rural communities. Its energy plans explicitly identify a target of 68 MW of solar mini-grids in off-grid rural areas by 2030, while its broader development planning has also emphasized universal household access through a combination of on-grid and off-grid connections.[2] More broadly, off-grid electrification already plays a meaningful role in Rwanda’s electricity system: The off-grid share of household connections grew from roughly 14% in 2020 to about 18% in 2021, 22.7% by April 2024, 23.9% by August 2024, and 25.0% as of July 2025 — meaning off-grid solutions now account for roughly one in four Rwandan household connections, up from

[1] https://repp.energy/project/arc-power-rwanda/

[2] Republic of Rwanda Ministry of Finance and Economic Planning. Second National Strategy for Transformation (NST2) 2024–2029. Kigali: MINECOFIN, 2024. https://www.minecofin.gov.rw/fileadmin/user_upload/Minecofin/Publications/STRATEGIES/NST_2/NST2_2024-2029_Abridged.pdf

one in seven just five years earlier. Taken together, these targets and current access patterns indicate that off-grid delivery models are already central to Rwanda's electrification strategy, and represent a growing share of households being reached.

Mini-grids are therefore a key technology in Rwanda's effort to close remaining access gaps while pursuing low-carbon development. By the end of 2019, 84 mini-grids had connected 3,236 households across Rwanda, with a total capacity of approximately 250 kW, demonstrating a financing precedent within the country[3]. Projects financed by ARC Power, Absolute Energy, and ZOLA Electric indicate that private-sector actors are already active in Rwanda's mini-grid market, while the EnDev Village Grid results-based financing program, which provided electricity access to more than 10,000 people between 2013 and 2020, demonstrates Rwanda-specific experience with concessional, performance-linked support mechanisms.[4] Recent years have also seen a growing number of mini-grid transactions, and the Rwanda Energy Group (REG) is currently assessing additional sites for future deployment, indicating continued institutional support for mini-grids within Rwanda's rural electrification strategy.[5]

The RMF is structured around a portfolio-based financing model. To date, many microgrid transactions globally have been financed as isolated projects, and Rwanda has largely followed a similar pattern, with most systems developed as one-off or small-portfolio projects, often supported by grant funding or highly concessional capital.[6] While these structures have helped demonstrate technical and operational feasibility, they are less suited to the scale and consistency of investment required to advance Rwanda's longer-term electrification goals. The next step is therefore not simply to finance more projects individually, but to identify a more stable financing structure capable of supporting deployment at greater scale.

A portfolio approach is also responsive to the core risks associated with mini-grid investment; a portfolio structure can reduce execution risk, since underperformance at one site does not necessarily undermine the viability of the entire facility. Even within one country and one sector, diversification across sites and, where feasible, developers, can reduce idiosyncratic risk and improve overall financeability.

From the perspective of end users, the case for expanded mini-grid deployment is not only financial, but developmental. Existing research suggests that mini-grid electrification is positively associated with greater household electricity uptake, ownership of low-power appliances, and agricultural employment. In the Rwandan context, scaling mini-grid investment

[3] https://epdrwanda.com/energy-sector/mini-grid/
[4] https://repp.energy/project/arc-power-rwanda/
[5] https://www.reg.rw/fileadmin/user_upload/Design_and_implementation_of_Rwanda_s_Electrification_Strategy.pdf
[6] https://www.afdb.org/fr/documents/rdc-green-mini-grid-country-programme-enabling-environment-sefa-appraisal-report

therefore has the potential to support not only electricity access, but also broader rural economic development.[7]

FMO is well positioned to assess and potentially support a transaction of this kind. The institution has experience across renewable energy transactions in emerging and higher-risk markets, including through long-term senior debt, co-financing arrangements alongside other DFIs and commercial lenders, and transactions in environments where policy risks are material. This would also not represent FMO's first exposure to Rwanda's power sector. Most notably, FMO participated in the financing of Gigawatt Global Rwanda's 8.5 MW solar plant, demonstrating both Rwanda's ability to host bankable renewable energy transactions and FMO's existing familiarity with the country's context.[8]

**Why Rwanda?**

Rwanda has, by many conventional governance and investment-climate benchmarks, emerged as a comparatively strong performer in Sub-Saharan Africa. Following the 1994 genocide and civil war — which devastated the country's economic base and core infrastructure — Rwanda pursued a reconstruction model anchored in centralized state capacity under the Rwandan Patriotic Front (RPF), which has governed the country since the end of the conflict. Over this period, Rwanda's gross domestic product increased from roughly US$752 million in 1994 to approximately US$14 billion in 2023 (current US dollars once adjusted for inflation).[9] Rwanda's governance narrative is reinforced by the Chandler Good Government Index 2025 placing the East African nation as the second in the continent.[10] The World Bank's 2025 Business Ready (B-READY) initiative similarly highlights Rwanda as a high-performing reformer — surpassing any other nation in Africa in terms of ease in doing business.[11]

This "investor-friendly" profile can prompt an important question for an MDB/DFI: if Rwanda is comparatively well-governed and reform-oriented, why is blended finance necessary at all? The answer—consistent with framing by the World Economic Forum and the OECD—is that blended finance is justified not by weak governance per se, but by the continued presence of (i) a compelling development rationale, (ii) binding financing constraints that prevent SDG-aligned investments from reaching scale on commercially viable terms.[12]

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[7] Ayhan, S. H., Falchetta, G., & Steckel, J. C. (2022). Evaluating the Impacts of Minigrid Electrification in Sub-Saharan Africa (IZA Discussion Paper No. 15466). Institute of Labor Economics.
[8] https://www.energymatters.com.au/renewable-news/rwanda-solar-farm-em4681/
[9] Kaze, Gaudence. "The Stability and Investment Risks Threatening Rwanda's Economic Miracle." Newlines Institute for Strategy and Policy. February 15, 2024. https://newlinesinstitute.org/political-systems/the-stability-and-investment-risks-threatening-rwandas-economic-miracle/.
[10] Rwanda Governance Board. "Rwanda Ranked Second in Africa in 2025 Chandler Good Government Index." May 15, 2025. https://www.rgb.rw/updates/news-detail/rwanda-ranked-the-second-in-africa-in-2025-chandler-good-government-index.
[11] World Bank Group. Rwanda Country Economic Memorandum: Accelerating Growth for Vision 2050. Washington, DC: World Bank, 2024. https://openknowledge.worldbank.org/server/api/core/bitstreams/b9e09786-66e7-49d6-96cb-3cf093598748/content.
[12] Organisation for Economic Co-operation and Development. OECD DAC Blended Finance Guidance 2025: Principles and Practice for Development Finance. Paris: OECD Publishing, 2025.

**Development Rationale and Financing Gap**

*I: Development rationale*

Rwanda remains a low-income country with material shortfalls across several SDG-linked indicators. The World Bank reports a poverty headcount ratio at US$3.00/day of 38.6% of the country's population. Additionally, stunting among children under five remains significant; international datasets continue to show malnutrition as a persistent constraint on long-run productivity. Basic services also remain incomplete: access to electricity is still not universal, and access to at least basic drinking-water services remains well below full coverage.[13] These indicators support the core premise that public capital can be justified when it mobilizes investment that advances development outcomes beyond what markets would deliver on their own.

Rwanda is also notable for embedding global development objectives into national planning frameworks, which strengthens the policy basis for MDB/DFI engagement. A 2025 SDG costing policy brief prepared with Rwanda's Ministry of Finance and UNDP emphasizes that the SDGs are "fully embedded" in Rwanda's ambitious Vision 2050 and the second National Strategy for Transformation (NST2, 2024–2029), and that NST2 is closely aligned with the SDG agenda.[14] This alignment matters because it gives MDBs/DFIs a clear institutional platform to structure blended finance around defined outcomes.

*II: Financing gap*

Even with strong planning frameworks, Rwanda faces a significant SDG financing gap that cannot be covered by public resources alone. The same SDG costing policy brief finds that Rwanda will require sustained additional resources each year to meet SDG targets, with high investment needs equivalent to up to 14.5% of GDP annually in priority sectors such as energy, health, and education. The brief further notes that, under NST2, up to 43% of total SDG financing is anticipated to be mobilized from the private sector, and explicitly calls for stronger risk-sharing mechanisms and expanded blended finance instruments to improve project bankability and crowd in domestic and international capital at scale.[15] In practice, this creates a clear mandate for an MDB/DFI to deploy blended finance selectively: targeting projects and subsectors where the social returns are high but purely commercial finance would be unavailable.

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https://www.oecd.org/content/dam/oecd/en/publications/reports/2025/09/oecd-dac-blended-finance-guidance-2025_8ea42fde/e4a13d2c-en.pdf.

[13] World Bank. "Rwanda." World Bank Open Data. Accessed April 13, 2026. https://data.worldbank.org/country/rwanda.

[14] Republic of Rwanda Ministry of Finance and Economic Planning and United Nations Development Programme. Policy Brief on SDGs Costing. Kigali: UNDP, 2025. https://www.undp.org/sites/g/files/zskgke326/files/2025-10/policy_brief_on_sdgs_costing.pdf.

[15] Republic of Rwanda Ministry of Finance and Economic Planning and United Nations Development Programme. Policy Brief on SDGs Costing. Kigali: UNDP, 2025. https://www.undp.org/sites/g/files/zskgke326/files/2025-10/policy_brief_on_sdgs_costing.pdf.

**Scope Alignment**

Rwanda is a strong candidate for a blended finance transaction to enable sustainable electrification in off-grid rural communities. First, the government has explicitly identified mini-grids as a pillar of its energy and climate strategy. Rwanda's nationally determined contribution (NDC) includes a conditional target of approximately 68 MW of solar mini-grids in off-grid rural areas by 2030.[16] This makes mini-grids an integral part of the country's planned pathway toward universal access and low-carbon development.

Furthermore, Rwanda's conditional updated NDC (2020) targets a 53% reduction in GHG emissions, and solar directly supports this objective. Rwanda's long-term development plan, Rwanda 2050, as well as the National Strategy for Transformation (2017–2024), also aim to ensure 100% electricity access by 2035.[17]

**End Users**

Consistent with that framing, the proposed Rwanda Microgrid Facility (RMF) focuses on rural communities where mini-grids are expected to be the least-cost option for electrification. End-users in these service areas are households, small enterprises, and local public facilities. The facility is not designed to finance grid-scale generation or national transmission; it focuses on a specific, clearly delineated mini-grid segment that has already been identified as part of Rwanda's strategy.

**Target Geographies**

In practice, the rural electrification landscape in Rwanda is heterogeneous, and RMF is designed to operate within that heterogeneity rather than assume a single "typical" community. Concretely, three types of areas matter for portfolio construction, listed in increasing order of priority:

i. Communities which are already connected to the grid and are gradually seeing improvements in reliability.

ii. Communities which are earmarked for future grid connection but remain unserved or weakly served today.

iii. Communities where mini-grids are likely to be the least-cost option for the foreseeable future, given distance from the grid and high load density.

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[16] International Renewable Energy Agency. Renewable Energy Transition Africa: Country Studies 2021. Abu Dhabi: IRENA, 2021. https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2021/March/Renewable-Energy-Transition-Africa_Country_Studies_2021.pdf.

[17] Republic of Rwanda. Rwanda's 2035 Nationally Determined Contribution: NDC 3.0. Kigali: UNFCCC, 2025. https://unfccc.int/sites/default/files/2025-11/Rwanda%20NDC3.0.pdf.

Rwanda's National Electrification Plan of 2022 outlines the existing electrification per province in Rwanda, including Kigali City. The Eastern Province, with 89 microgrid villages and 2.3% penetration, and the Southern Province, with 70 villages and 2% penetration, represent the most mature mini-grid markets within Rwanda and offer the strongest pipeline of sites with demonstrated demand and some operational precedent. These provinces should anchor the initial portfolio, as they offer lower origination risk and existing developer familiarity. The Western and Northern Provinces, with minimal current microgrid presence but significant SAS (Stand-alone Solar) coverage, represent a secondary opportunity: communities currently served by stand-alone systems may be candidates for mini-grid upgrading as demand deepens, offering a natural pipeline extension as the facility scales.

| Province | Electrification Technology per villages | | | | | | Grand Total |
|---|---|---|---|---|---|---|---|
| | GE & Fill-In | % | Microgrid | % | SAS | % | |
| North | 2461 | 89.7 | 23 | 0.8 | 260 | 9.5 | 2744 |
| South | 3023 | 86.6 | 70 | 2 | 397 | 11.4 | 3490 |
| East | 3236 | 85.7 | 89 | 2.3 | 452 | 12 | 3777 |
| West | 3233 | 90.2 | 17 | 0.5 | 333 | 9.3 | 3583 |
| Kigali City | 1163 | 100.0 | 0 | 0.0 | 0 | 0.0 | 1163 |
| **Grand Total** | **13116** | **88.9** | **199** | **1.3** | **1442** | **9.7** | **14757** |

*Rwanda Energy Group (REG),* Rwanda Electricity Access Development Plan 2018–2024, *updated June 2022.*

**Demonstrated Viability**

Rwanda has already accumulated practical experience with solar mini-grids, but investment remains below what is needed to meet the NDC target. Rwandan developers such as ARC Power, Absolute Energy, and Equatorial Power have implemented mini-grid projects, often with support from concessionally backed, early-stage catalytic instruments including the UK-based Renewable Energy Performance Platform (REPP). ARC Power, for example, has built modular solar mini-grids in Rwandan districts Bugesera and Gatsibo that connect thousands of people and small businesses through pay-as-you-go (PAYG) style payments.[18] Equatorial Power's Gakagati site combines solar generation, storage, and a local distribution network to supply homes, businesses, and public facilities.[19] Absolute Energy's Rutenderi mini-grid, supported by a results-based financing (RBF) program, deploys a solar hybrid system.[20]

[18] Renewable Energy Performance Platform. "ARC Power Rwanda." REPP Energy. Accessed April 13, 2026. https://repp.energy/project/arc-power-rwanda/.
[19] East African Power. "Sawa Energy Project Phase Two." Accessed April 13, 2026. https://www.eastafricanpower.com/copy-2-of-sawa-energy-project-two.
[20] Energising Development. "A New Solar Hybrid Mini-Grid was Officially Launched in Rutenderi, Rwanda." October 24, 2024. https://endev.info/a-new-solar-hybrid-mini-grid-was-officially-launched-in-rutenderi-rwanda/.

These experiences illustrate that the basic technical and operational model, solar generation with battery storage and a local low-voltage distribution network, is workable in Rwandan rural settings.

Taken together, these pilots shift the question from technical feasibility to early-stage demand certainty and affordability in rural markets. As a matter of fact, it has been proven that rural customers do take up electricity services when they are available, even if differently from grid-connected urban customers. RMF's focus on PAYG-compatible commercial structures is therefore meant to support early demand uncertainty and affordability constraints while still enabling a scalable investment model.

## Risk Assessment for the RMF

### Political

*Risk of shifts in state-led electrification planning*

Rwanda's mini-grid market operates within a centrally coordinated national electrification strategy in which public authorities determine, over time, the respective roles of grid extension and off-grid solutions. This is best captured by Rwanda's Vision 2050 long-term development blueprint that focuses on state institutions and national planning priorities, as well as Rwanda's 2025 Energy Policy that commits to universal electricity access by 2030 through a mix of grid and off-grid electrification.[21] While this planning architecture reduces arbitrary policy reversal, changes in state electrification priorities may still affect the long-term viability of mini-grid sites selected under earlier assumptions. For the RMF, this creates a political risk insofar as asset viability remains partly contingent on future public planning decisions. The main risk is not that mini-grids will be abandoned by the government, but optimal planning decisions will change depending on policymaking following least-cost national electrification planning on the regional and site-level.[22]

### Economic

*Mismatch between upfront capital intensity and gradual revenue realization*

Mini-grid projects are characterized by highly front-loaded capital expenditures, including spending on generation equipment, batteries, poles and wires, meters, civil works, and the installation, whereas revenues typically materialize only gradually as households connect and electricity consumption deepens over time. In newly electrified rural areas, early demand is often

[21] World Bank Group. Rwanda Country Economic Memorandum: Accelerating Growth for Vision 2050. Washington, DC: World Bank, 2024. https://openknowledge.worldbank.org/server/api/core/bitstreams/b9e09786-66e7-49d6-96cb-3cf093598748/content.

[22] https://www.mininfra.gov.rw/fileadmin/user_upload/Mininfra/Publications/Policies/Energy/Energy_Policy_Feb_25.pdf

limited to lighting and phone charging, while productive use grows later. That timing mismatch makes early year debt service tight, and it pushes lenders toward short maturities and high pricing that projects often cannot bear.[23] Long-term mini-grid viability depends heavily on finding commercial and productive electricity use. Demand risk is unusually punishing because mini-grids are location specific. If demand in a village is lower than forecast, the developer cannot redeploy the distribution network to another place. A bad demand outcome is not a temporary revenue dip. It can permanently impair the asset. This is a classic case where the private equilibrium underinvests relative to the social benefit of electrification, and it is one reason mini-grid markets struggle to scale on a pure project by project, fully commercial basis.

This challenge is being addressed by one of Energy 4 Impact's programmes, Scaling up Off Grid Energy in Rwanda, that works with developers to conduct a detailed demand assessment prior to the execution of a mini-grid, identifying businesses that can stimulate demand. This program creates more productive use of energy by matching high-energy business in the area with the energy created by the minigrid, stimulating a certain level of revenue for the developer. This thus makes the project more attractive to investors by adding an element of certainty.[24]

However, in their 2016 rural electrification strategy, the Rwandan Ministry of Infrastructure recognized that while mini-grids require high capital costs, they are cheaper than connecting customers to the national network in hard to reach areas, proving that there is sufficient demand to justify this investment.[25]

*Foreign-exchange mismatch between financing and revenue streams*

Currency risk further blocks scale. Mini-grids often need long tenor capital that is available mainly in hard currency, but revenues are in local currency. If the Rwandan franc depreciates, debt service costs rise in local terms even when operations are strong. Long tenor hedging is often unavailable or too expensive at the scale mini-grids need, and local financial markets frequently cannot supply infrastructure style maturities in local currency. This FX mismatch is a structural barrier to commercial scale up. This risk also affects projects where the capital is received in foreign currency, while revenues are earned in the local Rwandan franc.

*Refinancing risk arising from domestic banking constraints*

Local banks may have short term deposit funding, limited experience with mini-grid assets, and little appetite for many small ticket infrastructure loans with high due diligence costs. Even when they are willing to lend to mini-grids, they may offer maturities that are shorter than the economic life of the assets, creating refinancing risk. That produces a gap where early projects

[23] https://endev.info/wp-content/uploads/2022/02/RBFF-Rwanda-Village-Grid-Project-Closing-Report.pdf

[24] Energy 4 Impact. Building Mini-Grid Markets in Rwanda. London: Energy 4 Impact, 2017. https://www.energy4impact.org/resources/building-mini-grid-markets-rwanda.

[25] Energy 4 Impact. Building Mini-Grid Markets in Rwanda. London: Energy 4 Impact, 2017. https://www.energy4impact.org/resources/building-mini-grid-markets-rwanda.

can be built with concessional support, but a repeatable pathway into local senior debt does not materialize quickly. Developers then face repeated bespoke negotiations and rollover risk when early facilities mature.[26]

**Social**

*Fragility of household demand*

In many rural Rwandan mini-grid service areas, household electricity demand is shaped by low and volatile incomes, limited purchasing power, and seasonal fluctuations in expenditure capacity. Even where household connections are achieved, actual consumption and payment behavior may evolve more slowly than projected, thereby weakening the demand base on which project revenues depend. This constitutes a social risk because it is rooted in the socioeconomic characteristics of end users rather than in legal regulations.

**Technological**

*Technological immobility of site-specific infrastructure*

Mini-grid assets are inherently location-specific: once distribution infrastructure has been deployed, it cannot be readily transferred to another site in response to changing demand conditions. This creates a form of technological lock-in whereby poor site selection, unexpected demand shortfalls, or later system redundancy can permanently impair asset productivity. For the RMF, such immobility heightens the importance of accurate demand forecasting and careful spatial planning at the origination stage.

**Legal**

*Site-level regulatory and contractual fragmentation*

Although Rwanda has made progress toward a more enabling framework for mini-grids, project implementation still depends on multiple site-specific approvals and arrangements, including permits relating to generation and distribution, land access, environmental and social compliance, and tariff approval. Because these requirements must often be secured separately for each site, mini-grid portfolios remain exposed to regulatory inconsistency, administrative delay, and elevated transaction complexity. For the RMF, if permitting is slow or unpredictable across many sites, the portfolio accumulates delay risk, which raises interest during construction and pushes out the date when revenues start. That directly weakens debt service capacity even if the underlying technology works.[27]

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[26] World Bank. Myanmar: Progressing with Mini-Grids.

[27] https://africaminigrids.org/wp-content/uploads/2024/02/undp-financial-aggregation-for-distributed-renewable-energy-in-rwanda.pdf

*Uncertainty regarding treatment of mini-grids upon main-grid arrival*

A critical regulatory issue in mini-grid markets concerns the treatment of privately financed assets when the national grid subsequently reaches a project site. In the absence of clear and enforceable rules regarding buyout, asset integration, parallel operation, or conversion into local distribution functions, investors may price in the possibility of asset stranding. For the RMF, the credibility of any framework governing compensation and integration will therefore be central to long-tenor financing.

*Tariff-setting risk and the possibility of revenue suppression*

Mini-grids often face unit costs that exceed those of the main grid, particularly in rural areas because they must recover capital and operating costs over a small customer base, especially in the early years.[28] If tariffs are capped below cost recovery without a transparent mechanism that fills the gap, the result is not just affordability policy. It becomes a revenue suppression risk borne by the project. In regulatory terms, this creates uncertainty over whether the revenue model is sufficiently robust to support debt financing and long-term private participation.

**Environmental**

*Climate-related vulnerability of agriculture-dependent rural demand*

Given that a substantial share of Rwanda's rural population depends on agriculture as its primary source of income, climate-related shocks—including drought, rainfall variability, and other environmental stresses—may materially undermine household purchasing power in mini-grid service areas. In the context of the RMF, this implies that environmental risk affects not only the resilience of physical infrastructure, but also the stability of electricity demand and revenue collection by weakening the agricultural livelihoods that underpin rural consumption.

**Blended Finance Mechanisms to Use in RMF**

In 2017, the Renewable Energy Fund (REF) was established in collaboration with the World Bank, to promote the financial viability of reaching rural households. The REF was part of a financial agreement signed in 2017 amounting to USD 50 million to implement the Scaling-Up Renewable Energy Program (SREP). The REF is a financial intermediary loan (FIL) to the government as the borrower, funded by the SREP Trust Fund. The government has since transferred the funds to the Development Bank of Rwanda (BRD), which administers the facility. The project is structured around a line of credit and direct financing for off-grid electrification, and technical assistance, capacity building, and project implementation support.

[28] https://www.worldbank.org/en/topic/energy/publication/mini-grids-for-half-a-billion-people

The REF provides direct loans to private companies engaged in off-grid electrification, including mini-grid developers and potentially off-grid solar companies. Currently, more than nine private companies are in operation in Rwanda, operating more than 11 mini-grids.

Mini-grid revenue streams consist of connection fees, electricity sales, and grants and subsidies. To date, financial incentives have typically covered up to 70 percent of capital expenditure for mini-grids in Rwanda. The charged connection cost per household for existing and planned projects range from USD 35 to 60, except for MeshPower's solar energy, which does not charge a connection fee.

Post-subsidy tariffs largely fluctuate between USD 0.35 and 0.70 per kWh, depending on the consumer group, subsidy amount, tariff structure, geographic location, and business model. The cost of electricity generated by mini-grids remains higher than national grid tariffs (USD 0.10 for low-demand customers versus USD 0.22 for higher demand customers).

A portfolio based financing model is the simplest way to make rural mini-grids underwriteable at scale. Pooling sites allows lenders to rely on portfolio performance rather than the fate of any single village. It also reduces transaction costs because diligence, documentation, and monitoring can be standardized across many systems. This matters because mini-grids fail to scale partly due to high fixed soft costs per project relative to project size. Portfolio aggregation converts many small, heterogeneous projects into a repeatable finance product.

Furthermore, studies have illustrated the impact of project diversification on cost of capital, suggesting that the optimal number of projects to prioritize in order to maximize cost reductions efficiently is 5-6, given that there are diminishing marginal returns on diversification (Appendix).

In public private partnerships (PPPs) similar to the kind that FMO would participate in, there are numerous ways to structure the transaction. For example, the participation of the private sector can be minimal or extensive. In the latter case, the government would hold an equity stake in the project, but would not be involved in operation or management. PPPs are attractive for many reasons. They allow projects to receive alternative sources of funding that may otherwise be available, and furthermore, participation from the government can reduce many currency and regulatory risks. Even outside of a PPP, the developer will generally include a Direct Agreement with the government to secure the commitment to no harmful policy changes, and a clause for compensation if this is violated.

However, given the many risks we've discussed regarding individual mini-grid projects, one mechanism that can help inform FMO's transaction is a mini-grid pooling facility (MPF). A MPF is a financing structure that aggregates multiple mini-grid projects into a single investment portfolio, essentially merging each rural mini-grid into a diversified platform. One of the benefits of an MPF is reduced transaction costs, as some fixed costs can now be spread across one

portfolio. As the pool of shared fixed costs increases, the marginal benefit of each mini-grid in the portfolio increases. Furthermore, MPFs may be able to attract investors who cannot currently invest in individual mini-grids as they are below their minimum threshold for deployment of capital; these include insurance companies, pension funds, and sovereign wealth funds.

MPFs also offer the opportunity to layer capital into mini-grid projects in more innovative ways. There is a potential to access mezzanine funding, to alter the return profile of mini-grid investments to access other investor classes. Mezzanine capital, structured as unsecured debt or preferred equity with specified repayment terms, can provide an additional layer of financing within the capital stack. This form of capital can help reduce the amount of pure equity required while enhancing the overall return profile for senior investors.

Pooling also allows for innovative applications of philanthropic capital, which can help de-risk a portfolio by holding a first-loss position, for example. An MPF may also open the door to carbon finance.

Rwanda already has partial examples of this portfolio approach. ARC Power Rwanda received equity financing from Renewable Energy Performance Platform (REPP) and private Swedish impact investors for the rollout of a portfolio of interconnected solar mini-grids. REPP's financing structure thus allowed capital to be deployed across multiple rural sites under one platform, helping investors finance mini-grids at a greater scale.[29]

The primary stakeholders in this financing model would be the MPF, impact investors and venture capital (equity), commercial banking institutions (debt), development finance institutions (FMO and others, who would hold either debt, equity, or risk mitigation instruments), institutional investors (debt), government (subsidies, debt, or equity), philanthropic organizations (grants, debt, or equity), technology providers, mini-grid installers, and consumers.

Initially, we propose for most capital to come from philanthropic foundations, venture and impact investors, development finance institutions (DFIs), and government sources. These actors are typically more willing to absorb early-stage risk and tolerate limited operating histories. As the sector matures and mini-grid pooling facilities (MPFs) generate stronger performance data and track records, commercial banks and large institutional investors—such as insurance companies, pension funds, and sovereign wealth funds—are likely to play a larger role as risks lower to an acceptable institutional threshold.

That said, there is precedent for earlier entry by commercial finance. In some cases, Western financial institutions have supported energy access projects even without long operating histories. For example, Bank of America and Merrill Lynch, alongside the Soros Economic Development Fund, ICM, and Novozymes, entered a multi-million-dollar agreement with CleanStar Ventures to develop a bioethanol value chain in Mozambique. Notably, the transaction

[29] https://repp.energy/project/arc-power-rwanda/

was structured around the pre-sale of Certified Emission Reductions rather than an established performance record, demonstrating that innovative financial structuring can crowd in private capital even at relatively early stages.[30]

There are three MPF designs that are possible to implement — Independent, Vertically Integrated Independent, and DFI Managed. In the Independent MPF model, the facility owns the portfolio but outsources installation and O&M to vetted local providers, using performance-based contracts to shift construction and operational risk away from investors. This allows the MPF to focus on financial structuring and portfolio aggregation while maintaining some standardization through centralized revenue management and payment waterfalls. The Vertically Integrated MPF increases control by handling installation and O&M through local subsidiaries, improving standardization and procurement leverage but concentrating construction and operational risk within the facility itself—raising the risk profile unless compensated by higher returns. By contrast, the DFI-Managed MPF leverages the credibility, due diligence capacity, and balance sheet strength of institutions like the FMO. Through instruments such as green bonds, this structure can attract institutional investors earlier by reducing perceived political and performance risk. In short, the independent model prioritizes risk transfer, the vertically integrated model prioritizes control, and the DFI-managed model prioritizes capital mobilization through institutional credibility.

Additionally, RMF should use a layered capital structure because the risks that block commercial lending are concentrated in the downside tail: demand underperformance, regulatory delays, grid arrival outcomes, and FX shocks. A first loss tranche, sized to absorb plausible downside outcomes, protects senior debt and makes longer tenors feasible. Concessional capital can fund that risk absorption and crowd in FMO as senior lender, while the developer retains equity to keep performance incentives aligned. This structure targets the precise market failure: commercial lenders will not be first in line to take rural mini-grid risk, but they will scale once the tail risk is buffered.[31]

Technical assistance should be treated as a core part of the transaction as well. The goal is to improve bankability at the source: stronger site selection, demand stimulation for productive use, better customer onboarding, improved operations and maintenance, and reliable data reporting across the portfolio. TA is also how RMF reduces permitting friction in practice, by building repeatable compliance processes and documentation that can be reused across sites. Beyond operational improvements, TA can also be extended to supporting government entities to ensure the regulatory environment is responsive to insights from the private sector, regarding tariff and product design.

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[30] https://reliefweb.int/report/mozambique/soros-economic-development-fund-and-ifu-invest-millions-food-security-and-clean
[31] Republic of Rwanda Ministry of Infrastructure. Rural Electrification Strategy. Kigali: MININFRA, 2016. https://www.mininfra.gov.rw/fileadmin/user_upload/Mininfra/Documents/Energy_Docs/Rural_Electrification_Strategy.pdf.

Results based payments, top up mechanisms, and guarantees should be used to solve specific revenue and risk problems rather than to subsidize prices indefinitely. Results based payments can cover part of the upfront cost once verified connections or service quality thresholds are met, which directly addresses the early year cash flow gap without weakening long run incentives. However, results based payments may not be enough for high-risk projects as developer equity is junior to all forms of debt. To make projects financially worthwhile for private developers, grants are needed to buffer their high-risk position. Guarantees can be targeted to particular risks that are hard to price, such as payment volatility during ramp up or specific political and regulatory risks, so that they unlock senior debt without replacing it. Existing blended finance programs in Rwanda's off grid sector already use public and concessional capital to improve project bankability, which RMF can align with rather than duplicate.[32]

**Transaction Impact Analysis**

The RMF maximizes impact by intervening where the market is currently breaking down: risk allocation. Mini-grids in Rwanda are not failing because of technology or policy intent, but because their cash flow profile and downside risks do not naturally fit domestic capital markets. Despite ambitious government targets, the lack of correct financing structures and clients is inhibiting these goals from being met. By layering concessional first-loss capital with senior DFI and domestic-bank debt, developer equity, and results-based payments, the RMF restructures that risk in a way that makes a portfolio of mini-grids financeable. The direct result is additional installed solar-plus-storage capacity, new household and enterprise connections, and reliable electricity that displaces kerosene and diesel—contributing to Rwanda's NDC commitments and universal access targets.

However, the RMF transaction is designed to do more than deploy assets. By embedding risk-sharing mechanisms and engaging domestic banks, the RMF links electrification to productive use and local economic activity. Electricity becomes an input into economic growth—milling, refrigeration, retail, agro-processing. At the same time, portfolio aggregation and standardization generate performance data, reduce transaction costs, and build institutional familiarity with decentralized energy finance. In that sense, the RMF functions as a structured market-building intervention: it absorbs early-stage tail risk so that private and domestic capital can scale participation over time, offering a repeatable financing model for Rwanda, and globally.

[32] Republic of Rwanda Ministry of Infrastructure. Rural Electrification Strategy.

**Appendix:**

**Mini Grid Landscape in Rwanda**

FMO's past projects in Rwanda's energy sector as well as the broader landscape of mini-grids in Rwanda demonstrate a positive environment for investment with high potential. The most relevant precedent from FMO's portfolio is a 2014 transaction with Gigawatt Global Rwanda, a project developer. Through FMO's financing ($10.6m USD), Gigawatt Global was able to establish a 8.5 MW solar field in Agahozo Shalom Youth Village, a residential community in rural Rwanda established to house and support orphans.[33] This project increased Rwanda's generation capacity by 6%, and demonstrates that transaction utility-scale renewable energy projects can be successfully financed and executed in Rwanda when development finance institutions play an anchoring role.[34] The project relied entirely on DFI debt and experienced sponsors, with no participation from local capital markets, underscoring both the current limitations of domestic financing and the importance of credible international lenders in first-of-kind transactions. Gigawatt Global estimated an economic output of $9.27m-#10.81m USD per year (0.12%-0.14%), and that 15,000-18,000 households received energy from this grid.[35] For FMO, this deal is particularly instructive because it confirms that Rwanda's regulatory and contractual environment can support bankable grid-connected renewables, and that FMO has already developed the institutional expertise to operate effectively in this context.

Beyond the work from FMO, transactions from other investors into Rwandan minigrids provide valuable insight. Absolute Energy, a private energy developer and Rwanda's largest mini-grid developer.[36] The UK-based developer entered into a Strategic Power Partnership with the Government of Rwanda and used GBP 900,000 in convertible loans from the UK-backed Renewable Energy Performance Platform (REPP), matched by Swedish impact investors, to finance the construction of solar mini-grids across 14 villages in Bugesera and Gatsibo.[37] By March 2023, REPP reported over 10,400 people and 155 microbusinesses connected across the portfolio. Energy is sold on a pay-as-you-go basis to customers who previously relied on kerosene, diesel, and fuel wood, and each modular system is sized to connect between 100 and 600 households or businesses depending on village demand. Once the systems were operational and generating revenue, REPP was able to partially exit in October 2022 through repayment of the outstanding loan balance and partial conversion of accrued interest into equity, demonstrating a credible path from concessional support toward private capital.

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[33] Gigawatt Global. "Rwanda: ASYV 8.5 MW Solar Field." Accessed April 13, 2026. https://gigawattglobal.com/portfolio/rwanda/.
[34] FMO (Dutch Entrepreneurial Development Bank). "Project Detail: Gigawatt Global Rwanda." Accessed April 13, 2026. https://www.fmo.nl/project-detail/31664.
[35] Gigawatt Global. Socioeconomic Impact of the Agahozo-Shalom Youth Village (ASYV) Solar Project: Summary Report. January 2015. https://gigawattglobal.com/wp-content/uploads/2015/01/Socioeconomic-Impact-AYSV-Summary-v4-2-21.docx.
[36] ARC Power. "About Us: Our Mission and Technology." Accessed April 13, 2026. https://arcpower.co/about.
[37] Renewable Energy Performance Platform. "ARC Power Rwanda: Scaling Grid-Connected and Inter-Connected Mini-Grids." REPP Energy. Accessed April 13, 2026. https://repp.energy/project/arc-power-rwanda/.

Equatorial Power's (EP) Gakagati mini-grid in the Nyagatare District, commissioned in February 2021, serves over 1,000 connections in Rwanda's Eastern Province with 120 kWp of solar generation and 125 kWh of battery storage.[38] This project was funded by Facebook, the Shell Foundation, USAID and Endev.[39] What distinguishes Gakagati from other solar minigrids is its technology. EP used ZOLA's Infinity Grid platform, a peer-to-peer alternating current (AC) grid system that couples storage with micro-inverters, which allows capacity to be scaled incrementally as energy demand grows rather than requiring a full system redesign or significant additional capital expenditure each time new connections are added. Most mini-grids are sized at the outset for an assumed peak demand, meaning developers either over-invest upfront or face costly upgrades later. The Infinity Grid's modular, demand-responsive architecture reduces that risk and makes the system better suited to the uncertain and gradually growing demand profiles typical of newly electrified rural communities, such as the ones this transaction hopes to serve in Rwanda.[40]

Absolute Energy's 2018 twin mini-grids in Rutenderi and Gatoki represent one of the earlier structured mini-grid deployments in rural Rwanda. Each system was built by Italian EPC contractor ESI Spa and comprises 50 kWp of ground-mounted solar, 100 kWh of lead-acid battery storage, and a 50 kVA diesel generator as backup.[41] The Rutenderi system connected 457 domestic users, 36 commercial users, and 7 public institutions, and the projects were financed through Absolute Energy Capital's investment platform in partnership with EnDev Rwanda. New businesses emerged following electrification, including refrigeration for food storage, bakeries, and tailoring enterprises, evidencing the development impact that a scaled facility could replicate.

**Partner Landscape in Rwanda**

The mini-grid sector remains nascent, constrained by high capital expenditure requirements, limited proven business models, low end-user consumption, and historically slow regulatory and policy development, though the government has made recent strides in publishing guiding frameworks and tendering sites through the Development Bank of Rwanda.[42] A small but growing number of private developers, including ARC Power, Absolute Energy, Equatorial Power, and Prime Energy, are active in the market, supported by a combination of results-based financing, development finance, and concessional capital that has typically covered up to 70 percent of capital expenditure. Post-subsidy tariffs for mini-grids remain significantly above

[38] Equatorial Power. "Gakagati: Hybrid Solar Off-Grid Rwanda." Accessed April 13, 2026. https://equatorial-power.com/portfolio/gakagati/.
[39] ESI Africa. "The World's First Distributed Mini-Grid Powers 930 Homes in Rwanda." May 31, 2019. https://www.esi-africa.com/energy-efficiency/the-worlds-first-distributed-mini-grid-powers-930-homes-in-rwanda/.
[40] East African Power. "Sawa Energy Project Phase Two." Accessed April 13, 2026. https://www.eastafricanpower.com/copy-2-of-sawa-energy-project-two.
[41] ESI S.p.A. "Gatoki and Rutenderi (Rwanda) Solar Mini-Grids." Accessed April 13, 2026. https://www.esi-spa.com/index.php?option=com_k2&view=item&id=176:gatoki-e-rutenderi-rwanda&Itemid=235&lang=en.
[42] RES4Africa Foundation. Regulatory Review of the Electricity Market in Rwanda. Rome: RES4Africa, 2023. https://res4africa.org/wp-content/uploads/2023/04/RegulatoryReviewoftheElectricityMarketinRwanda.pdf.

national grid tariffs, underscoring the continued need for blended finance structures and risk-sharing mechanisms to attract private investment at scale.

**Governing Institutions in the Electricity Sector**

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| Ministry of Infrastructure (MININFRA) | Government ministry responsible for overall energy and infrastructure policy and strategy formulation, including electrification targets and the positioning of mini-grids relative to future grid expansion. Counterpart for tariff methodologies, service standards, and grid arrival treatment. |
| Rwanda Utility Regulatory Authority (RURA) | Independent regulatory authority responsible for setting tariffs, regulating the electricity market, and issuing licenses and permits. Sets guidelines for implementation of relevant laws while protecting consumer and operator interests. |
| Ministry of Environment (MoE) | Government ministry responsible for environmental conservation, climate resilience, and green growth development strategy. Influences energy projects through compliance with environmental laws and guidelines |
| Rwanda Environment Management Authority (REMA) | Government authority under the Ministry of Environment responsible for national environmental protection, conservation, and management. Provides advisory to the government on all matters relating to the environment and climate change. |
| Rwanda Development Board (RDB) | Government agency responsible for investment promotion and facilitation. Fast-tracks development activities, promotes local and foreign direct investment, and supports the creation and development of |

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| | private enterprises in Rwanda. |
| Ministry of Finance and Economic Planning (MINECOFIN) by | Government ministry responsible for the fiscal framework and development partner relationships at the sovereign level. Key counterpart for agreeing on use of concessional resources, sovereign-backed guarantees, and channelling of climate finance into junior tranches or results-based payments. |

**Market institutions**

| | |
|---|---|
| Rwanda Energy Group (REG) | State-owned energy group and parent entity of EUCL and EDCL, mandated to develop and provide reliable and affordable energy. Key counterpart on grid expansion planning, grid arrival rules, and technical standards for mini-grid integration. |
| Energy Utility Corporation (EUCL) | State-owned vertically integrated utility responsible for generation, transmission, distribution, and retail of electricity. Executes power purchase and sales agreements with IPPs and regional utilities for electricity import and export. |
| Energy Development Corporation Limited (EDCL) | State-owned corporation responsible for developing new energy generation projects and implementing electricity access programs, including the Electricity Access Rollout Program. Tracks off-grid connections and provides investment guidance through the National Electrification Plan. |
| Absolute Energy Africa | Independent power producers focused on renewables and rural electrification. Operates a solar hybrid mini-grid in Rutenderi implemented with EnDev under a |

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| | results-based financing scheme, and is backed by a broader energy transition fund. |
| Prime Energy PLC | Independent power producer focused on hydropower, currently operating several micro-hydropower plants in Rwanda with approximately 8 MW of capacity. Experience in small-scale power generation and project development within Rwanda's regulatory and financial context. |
| ARC Power | ARC PowerUK-based solar mini-grid developer operating under a strategic partnership with the Government of Rwanda. Builds modular mini-grids using a pay-as-you-go model with support from REPP and other impact investors, operating a portfolio of sites across several villages |
| Equatorial Power | Mini-grid developer and operator that has implemented the Gakagati mini-grid in Rwanda, combining solar generation, storage, and distribution for households, businesses, and public facilities, with an emphasis on productive use of energy |

**Financial Institutions**

| | |
|---|---|
| I&M Bank | Commercial bank operating in Rwanda with an existing relationship with FMO, including MSME lending expansion under a portfolio guarantee and technical assistance program. Potential partner for loans to small businesses and households in mini-grid-served areas |
| Ireme Invest | Green investment institution powered by the Rwanda Green Fund and BRD, offering loans and credit guarantees for climate-related investments with ticket sizes up to |

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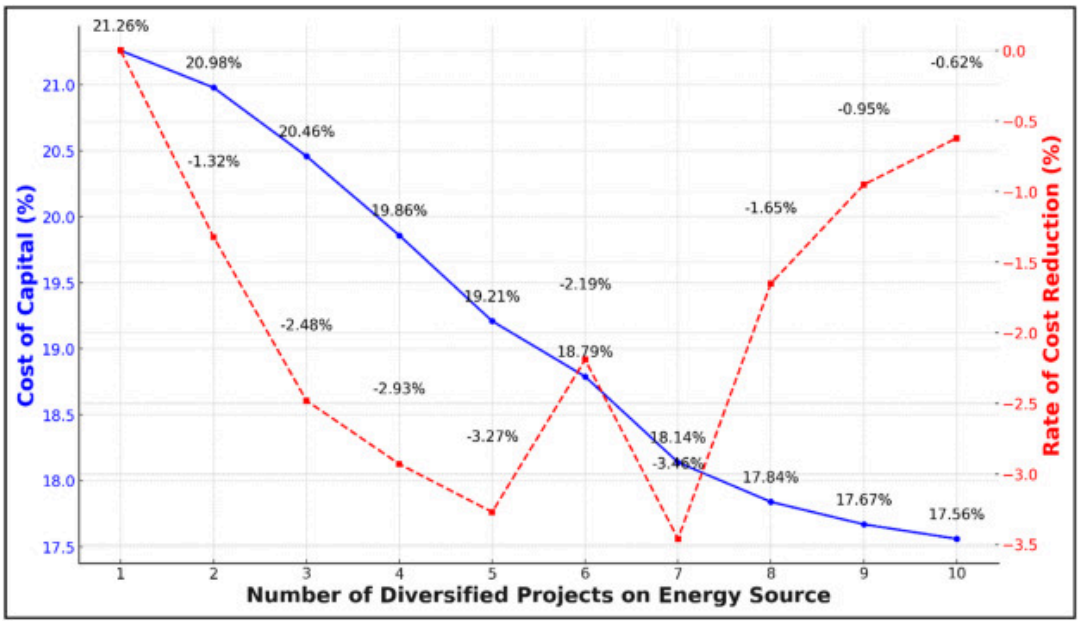
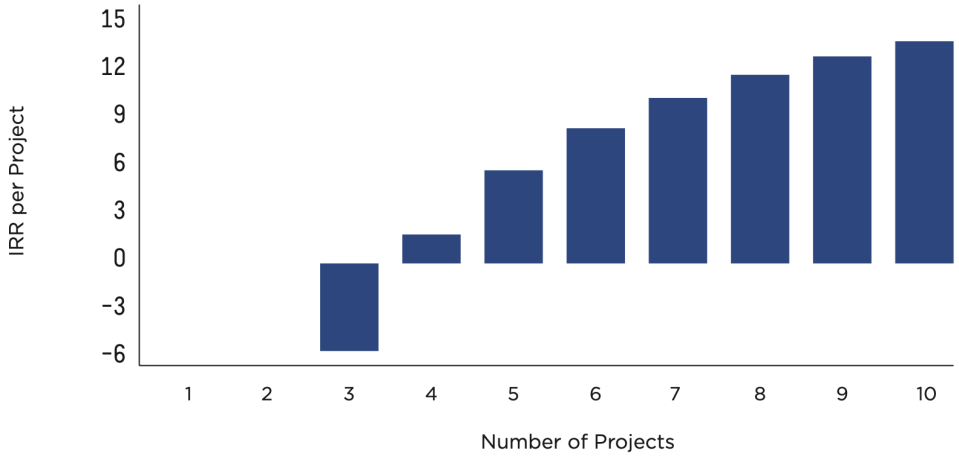
| | approximately RWF 300 million. Potential provider of partial guarantees on loans to mini-grid platforms and local enterprises |
| Development Bank of Rwanda | State-owned development finance institution providing short, medium, and long-term loans across priority sectors including energy. Administers the Renewable Energy Fund (REF), a USD 50 million World Bank-backed facility providing local currency financing to mini-grid developers. Potential co-lender, facility host, or on-lending partner alongside FMO |
| Emerging Africa Infrastructure Fund (EAIF) | Infrastructure-focused fund that co-financed the Gigawatt Global solar plant in Rwanda alongside FMO. An FMO client with experience in African infrastructure and blended finance structures, making it a plausible co-lender or co-investor in a structured mini-grid facility |
| EnDev | Multi-donor partnership that has supported mini-grids and micro-hydro plants in Rwanda, including the Rutenderi hybrid mini-grid. Has deployed results-based financing schemes to incentivise new connections and performance, and provides technical assistance and monitoring for off-grid projects |

**Impacts of Portfolio Diversification**




Aluko, Timothy O., Nonjabulo C. Ngcobo, and Adeyemi Adebayo. "Mini-grids and Private Investment in Rural Electrification: Insights from Rwanda's Emerging Market." Scientific African 28 (May 2025): e02341. https://doi.org/10.1016/j.sciaf.2025.e02341.

**Average IRR Per Individual Project with Mini-Grid Pooling Facility (MPF)**




CrossBoundary Energy, United Nations Environment Programme, University of California Berkeley, and Stanford University. Increasing Private Capital Investment into Energy Access: The Case for Mini-grid Pooling Facilities. Nairobi: UNEP, 2017.