

RWANDA RENEWABLE ENERGY FUND PROJECT

*Engaging the private sector in off-grid solar
electrification*

// June 2022

CLIMATE DELIVERY
INITIATIVE SERIES //

Case Study

CIF Program: SREP

TOPICS

- Off-grid electrification
- Financing private sector provision
- Result-based financing

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Design

Art Direction: Andrea Carega

Graphic Design: Karlien Truyens.

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PROJECT DATA

PROJECT TITLE	Rwanda Renewable Energy Fund (REF) project
PARTNER ORGANIZATION/S	Scaling Up Renewable Energy Program (SREP), World Bank
COUNTRY	Rwanda
SECTOR/S	Energy
TOTAL PROJECT COST	USD48.94 million, fully financed from SREP and executed as a World Bank investment project
PROJECT DURATION	Nov 3, 2017 – Sep 30, 2023
DELIVERY CHALLENGES	<ul style="list-style-type: none">• Skill and Human Resource misalignment• Private sector limitations• Unaffordability to target population• Adverse changes to regulations
DEVELOPMENT CHALLENGE	<ul style="list-style-type: none">• Low access to electricity
CASE AUTHOR	Rasmus Heltberg, CIF

· **KEY**
· **MESSAGES**

· Market actors should
· have access to multiple
· sources of financing.

· Subsidies may be
· required to further
· expand solar home
· systems and mini grids
· in population segments
· with low income levels.

· Projects to promote
· private sector
· participation and foster
· market development
· should rely on extensive
· consultations with
· market participants and
· near real-time market
· monitoring.

· Projects to promote
· private sector
· participation and foster
· market development
· need flexible
· mechanisms to respond
· to market developments
· and market participants'
· concerns.

· There is need for
· continued dialogue of
· multilateral development
· banks and government
· to address delivery
· challenges stemming
· from policies and
· regulations and changes
· to these.

EXECUTIVE SUMMARY

This case study examines the first four years of the planned six-year implementation of the Rwanda Renewable Energy Fund (REF) project – the country’s largest off-grid expansion program – with a focus on its delivery challenges and solutions.

The case study aims to provide lessons from the project on how teams have addressed delivery challenges in climate projects. The delivery challenges are the problems that hinder development interventions and prevent practitioners from translating technical solutions into results on the ground. The case study explores the major challenges during implementation, the solutions that the government put in place in response to challenges, how the solutions were arrived at, and key lessons. The Rwanda Renewable Energy Fund (REF) project was selected for a case study because of its innovative design and the proactivity with which the team has addressed the multiple delivery challenges the project encountered.

The project’s design was motivated by the need to accelerate off-grid access to electricity in rural areas. The REF aims to promote private sector-led, off-grid renewable energy (RE) development, by providing lines of credit and creating an enabling environment for off-grid solar electrification. The project was implemented by the Government of Rwanda through the Development Bank of Rwanda (BRD), with management support from the World Bank and financing from the Climate Investment Funds’ (CIF) Scaling Up Renewable Energy Program (SREP).

The project set up a fund for financing private sector engagement in off-grid electrification. The core intervention at the heart of the project lies in the creation of lines of credit in local currency for financial institutions to finance solar home systems and mini-grids, and solar companies offering those solutions. Local financial

institutions were expected to use these lines of credit to finance private solar companies to provide households with off-grid solutions.

This case study traces the delivery challenges the project encountered during its implementation and the government's adaptive management as it identified and addressed the delivery challenges.

CHALLENGE ONE: Skill and Human Resource

Misalignment. Building an effective and qualified project implementation unit (PIU) proved to be more challenging than expected. The BRD were unfamiliar with World Bank procedures, lacked experience in managing off-grid energy projects, and faced some initial capacity issues. The challenge was resolved, and project management improved, after BRD was trained in World Bank procedures, acquired experience, and brought onboard the necessary human capital and instituted weekly calls for monitoring, coordination and problem-solving.

CHALLENGE TWO: Private Sector Limitations. REF's design contained multiple financing windows, as it was based on the idea that solar companies would be free to choose if they wanted to seek financing from savings and credit cooperatives (SACCOs), banks and microfinance institutions, or BRD. One of the credit lines, direct financing through BRD, was initially inactive because the government wanted to develop sustainable sources of domestic financing for the off-grid sector. However, providing credit lines at competitive terms did not sufficiently incentivize Rwanda's financial institutions to lend to the off-grid sector. In fact, the financial institutions showed little interest in lending to the solar companies during the initial years of the project, as they perceived this new business to be risky. Therefore, the movement of funds was limited during the first three years of the project. The solution was to activate the window for direct financing from BRD to the solar companies.

CHALLENGE 3: Unaffordability to Target Population.

Although the strengthened PIU was implementing project activities and the solar companies had better access to finance, they were still not making sales and installations at the targeted rate, because the

intended users could not afford the solar systems. Many of the project's intended end-users are smallholders with few and irregular income sources and lack of cash during the planting seasons. This can make it hard for them to make timely payments on pay-go systems and there were defaults.

A project restructuring in 2020 introduced subsidies to improve the affordability of solar home systems to low-income households. The subsidies, which are results-based, are targeted at low-income households in a progressive fashion. Solar companies are paid for each installation made for eligible customers, upon the verification of the system installation and operation. Extensive monitoring of the market, dialogue with the solar companies, and the existence of a pilot results-based project facilitated this solution.

However, no progress has been made in the area of mini-grids. Essentially, mini-grid electricity tariffs are unaffordable in the absence of grant funding and no grant financing is currently available. Furthermore, the project's financing window to provide a line of credit to mini-grid developers is insufficient.

CHALLENGE 4: Adverse changes in regulations from revisions to off-grid targets and technical guidelines.

In 2021, challenges stemming from revisions to the national off-grid targets and from Rwanda's technical standards for solar home systems affected the project. Although the government's original National Electrification Plan of 2018 had set an off-grid provision target of 48 percent, it updated the plan in the middle of 2021 with a lower off-grid target in light of the faster-than-expected progress with grid expansion and slower-than-expected off-grid uptake.

Periodic updating of national electrification plans is a good practice in general. However, some of the solar companies were concerned that the revision to a lower off-grid target would leave too small a market for solar home systems. A solution was found in the form of an upward adjustment of the new off-grid target, thus making the provision of solar off-grid solutions a financially worthwhile proposition.

The solution was arrived at through constructive policy dialogue between the government and the World Bank.

Another issue emerged surrounding quality standards for solar home systems. The government formulated national quality standards for solar home systems, specified in ministerial guidelines, because it observed that some substandard systems were being imported, with adverse consequences for end-users and companies selling quality products.

However, the guidelines had become more demanding than the international norm, few manufacturers met Rwanda's standards, and imports slowed as the guidelines made it hard to get products through customs. The government resolved the issue by aligning its standards to international norms.

As of 2022, BRD's changes to the project, in response to the challenges, have produced positive effects. Disbursements are up and the project is meaningfully engaging the private sector in selling and installing solar home systems, as well as working with financial

institutions to finance the sector. Five key lessons that may be useful for similar projects are presented below:

- Market actors should have access to multiple sources of financing. Though there were valid reasons for steering the solar companies to borrow from local financial institutions, it proved limiting. Direct lending from the BRD to the solar companies through window 4 turned out to be more effective.
- Subsidies are required to further expand the penetration of solar home systems in population segments with low income levels.
- Projects to promote private sector participation and foster market development should rely on extensive and continued consultations with market participants and near real-time market monitoring.
- Projects to promote private sector participation and foster market development need flexible mechanisms to respond to market developments and market participants' concerns.
- There is need for continued dialogue of multilateral development banks (MDBs) and government to address delivery challenges stemming from policies and regulations and changes to these. MDBs with ongoing sector engagement, policy dialogue, and policy lending in the same sector as an investment project are well-positioned for this dialogue.

LIST OF ABBREVIATIONS

BRD	Rwanda Development Bank
CIF	Climate Investment Funds
EnDev	Energising Development
MDB	Multilateral development bank
MFI	Micro-finance institution
PIU	Project implementation unit
RE	Renewable energy
REF	Rwanda Renewable Energy Fund
SACCO	Savings and credit cooperative
SREP	Scaling Up Renewable Energy Program

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1. INTRODUCTION

Millions of people across Africa have no electricity. It will take many years before electric grids reach all the unconnected households. As such, solar products and mini-grids offer faster and cheaper “off-grid” solutions. Solar home systems are targeted for one household or a micro-business. Mini-grids are off-grid electricity distribution networks that can generate electricity on a small scale. Nonetheless, the question remains: how to best make off-grid solutions available to the typically low-income households who need them?

This case study examines the first four years of the planned six-year implementation of the Rwanda Renewable Energy Fund (REF) project — the country’s largest off-grid expansion program — with a focus on its delivery challenges and solutions. The aim of the project is to increase electricity access and facilitate private sector engagement in off-grid electrification through the establishment of a fund. With financing from the Climate Investment Funds’ (CIF) Scaling Up Renewable Energy Program (SREP), the project was implemented by the Government of Rwanda through the Development Bank of Rwanda (BRD), with implementation support from the World Bank.

The project, which came into effect in November 2017, was restructured in March 2020, though the original objective and end-date of September 2023 remained unchanged. CIF visited Rwanda in March 2022 to collect the data for this case study.

1.1. Rwanda’s Investment Plan

Rwanda’s investment plan for SREP aimed to establish the conditions for growth in off-grid electricity access for households, firms, and institutions.¹ The investment plan was developed under the leadership of the Government of Rwanda, with support from the African Development Bank, the World Bank, and the International Finance Corporation, as well as through consultations with stakeholders in the energy sector.

At the time that the investment plan was finalized (November 2015), the government had set an ambitious target of increasing electricity access from around 22 percent of the households in 2014 to 70 percent by 2018. The government’s Energy Sector Strategy Plan called for 48 percent of the country’s households to be connected to the grid, and 22 percent, or about 550,000 households, to be covered by off-grid solutions.

Though many shops and companies distributed solar products, off-grid coverage was considered to be at a low base; therefore, reaching the electrification target required major investments. The investment plan indicated that private companies were in a better position to deliver off-grid solutions, provided that certain barriers to private sector participation could be addressed. Therefore, it focused on helping the country to meet the 22 percent off-grid electricity



access target through private sector-led off-grid and mini-grids. SREP provided the government with the initial capital for REF — the energy fund it had set up to help finance the necessary investments. REF was the only project to be financed under the investment plan, though other donors provided complimentary support to the sector.

The Rwanda investment plan is aligned with the country's national and energy sector priorities at the time of approval and to date. Vision 2020, adopted in 2000 and revised in 2011, envisages a primary role for the private sector to serve as the engine of growth and poverty reduction for the country. Rural development and reduction of rural poverty are major themes in Rwanda's Economic Development and

Poverty Reduction Strategy II and the current National Strategy for Transformation for 2017–2024.

Rwanda has identified energy as an essential condition for sustainable growth and development, recognizing the importance of providing reliable and affordable energy for all, if the country is to achieve its aspirations. Rwanda's Economic Development and Poverty Reduction Strategy II aimed for 70 percent access to electricity by 2018. Subsequently, the National Strategy for Transformation for 2017–2024 revised the target to 100 percent access — to be achieved through a combination of on-grid and off-grid connectivity. The government also formulated a rural electrification strategy that emphasized private sector participation and the use of solar home systems and mini-grids.

2. CONTEXT

The REF's project development objective is to increase electricity access in Rwanda through off-grid technologies and facilitating private sector participation in renewable off-grid electrification. REF aims to promote private sector-led, off-grid RE development by providing lines of credit and creating an enabling environment for off-grid solar electrification. Essentially, REF is a fund that has been established to provide credit lines to support off-grid electrification. Uganda and Tanzania have set up similar funds, also with World Bank support.

The project design was motivated by the need to accelerate off-grid access to electricity in rural areas. At the time the project was designed, electricity access was rising extraordinarily fast in Rwanda. It grew from about six percent (110,000 households) in early 2009 to 24 percent (600,000 households) by mid-2016, according to the REF's Project Appraisal Document. However, electrification was concentrated among grid-connected urban households in the top income quintile. Achieving the national electrification target would require an aggressive expansion of the market for off-grid systems — an expansion that the government expected would involve both solar home systems and mini-grids.

However, the project design recognized the affordability of off-grid solutions as a major barrier. The off-grid market was nascent in Rwanda. Although the prices of solar systems had come down significantly worldwide, few Rwandan households were able to afford the upfront costs of purchasing solar systems. Some earlier interventions, which had involved the distribution of free systems, produced negative experiences. For example, some households sold their systems. The government and the World Bank also did not want to give the systems away for free because their goal was to involve the private sector in off-grid electrification. Ultimately, the

government and the project preparation team were optimistic about the solar products' growth potential. Spurred by new technologies, the cost of solar systems had come down and new pay-as-you-go business models had emerged.

The project design also reckoned with barriers to the expansion of the private off-grid sector. More than 20 off-grid solar companies were active in the country at the time of designing the project, with more expressing interest. Optimism was expressed in the project document about the private sector's capacity to increase investment, provided that key barriers could be addressed. These barriers consisted of financial and commercial constraints; the nascent state of the off-grid market; inadequate technical standards; capacity constraints, such as a shortage of qualified technicians; and institutional constraints, including the lack of clarity on the geographic area or socioeconomic strata targeted by off-grid services. Mini-grids also came with additional barriers, such as a lack of experienced companies and regulatory barriers, including the lack of clarity regarding the eventual connection to the grid.

The government and the World Bank's project team envisaged the outcomes as contributing to increased access to renewable energy and increased energy security as well as helping create the necessary conditions for Rwanda's off-grid energy markets to take off. This involved removing barriers to private sector participation in the market for solar products. The intent was for the mechanism of REF to continue, even after the close of the SREP-financed project. The project document foresaw follow-on financing to REF from the International Development Association (IDA) — the World Bank's soft loan facility and other development partner contributions — which did materialize.

2.1. Intervention: Lines of Credit

The core intervention at the heart of the project involved the creation of lines of credit in local currency for financial institutions to finance solar home systems and mini-grids for off-grid electrification, and solar companies offering those. Local financial institutions – banks, microfinance institutions, and savings and credit cooperatives (SACCOs) – were expected to use these lines of credit to finance private solar companies to provide customers with off-grid solutions. Prior to the project, banks, microfinance institutions, and SACCOs were not actively lending to the off-grid sector because they preferred lending to traditional sectors with short-term financing needs and readily available collateral (World Bank 2017).

The government expected that the credit lines – essentially dedicated financing in local currency with long tenures and affordable rates – combined with technical assistance to address the financial sector’s lack of experience and understanding of the off-grid market, would overcome these issues. The credit lines were expected to engage the domestic financial sector

in the off-grid sector and thus ensure sustainable financing for the sector even after the close of the project. In the original design, the project was focused on developing the financial sector’s ability and willingness to finance off-grid expansion.

However, due to the continuous lack of interest on part of local financial institutions in lending to the off-grid sector, a credit line for BRD to lend directly to the off-grid sector was subsequently activated. Furthermore, an additional change to the project was introduced: to address a lack of project progress in uptake, subsidies were provided, ensuring the affordability of solar home systems to the targeted low-income households.

The project supported the sales, installation, and after-sales services of solar home systems of good quality (Box 1). Specifically, the project supported Tier 1, or multi-light point solar systems. This was intended to avoid financing substandard solar home systems so as to ensure that customers will have effective access to electricity for a period of time. Companies, which sell these products via two types of contracts (upfront cash purchase and pay-as-you-go), are free to set prices.

BOX 1. Solar home systems and contract types

Supported systems are required to meet the national quality standards, as specified in the government’s ministerial guidelines on the minimum standard requirements for solar home systems. The institution of these standards stemmed from previous experiences with substandard products.

Systems have a minimum of three lights. They can charge a cell phone and may also have an inbuilt radio or a port that would charge it. Larger systems, which can support a TV and a shaver, are sometimes used in village micro-businesses.

Further, the project requires that solar companies have active service agreements with customers. This is to ensure after-sales services, including repairs and maintenance.

The solar companies sell their products via two types of contracts – cash purchase and pay-as-you-go. Relatively new remote technology has enabled pay-as-you-go contracts. In pay-as-you-go models, the customer pays a modest amount upfront, followed by small monthly installments, via the mobile phone. In the case of one pay-go technology, customers receive a token code by text message that they enter into the solar home system, in order to maintain their service. With another kind of technology, the system is equipped with a SIM card that allows it to be switched on and off remotely by the solar company.

Apart from offering affordability advantages to low-income households, pay-as-you-go systems enable the solar companies to foster continuous customer relationships. This is because the same cellphone-based platform used for payments can be used for technical troubleshooting and other after-sales purposes.

Source: Project documents and interviews.

The project was approved with four financing windows. However, a decision was made to start implementation, with one financing window (Window 4) inactive:

Window 1. On-lending through SACCOs to households and micro-enterprises. With Window 1, a wholesale line of credit for on-lending is provided to eligible SACCOs, which would then extend sub-loans to households and smaller businesses for solar systems.

Window 2. On-lending through banks (commercial and microfinance) to households and smaller businesses. With Window 2, a wholesale line of credit for on-lending is offered to eligible commercial and microfinance banks, which would then extend sub-loans to households and smaller businesses for solar systems.

Window 3. Direct financing of mini-grid developers. This window provides direct financing to eligible mini-grid developers to finance up to 75 percent of the construction of RE-based mini-grid systems. The loans were to be used to bring mini-grid projects to commissioning, in the hope that results-based (subsidy) financing would become available from other donor-funded programs. At the time of writing this study, there is no mini-grid that has been financed by REF.

Window 4. Direct financing of solar companies. This window would provide direct financing to eligible, locally registered solar companies offering Tier 1-and-above solar home systems and ongoing maintenance services to its clients through delayed payment options. Essentially, the window would provide working capital assistance in the pay-as-you-go market. Though part of the original REF design, the window was inactive at project inception. The project implementation unit (PIU) activated Window 4 in March 2019.



At restructuring, in 2020, a fifth window was added:

Window 5. Results-based financing for off-grid access. This window offers partial grants for the sale of Tier 1-and-above solar systems to poorer households, pending the verification of installation and after-sales services. The partial grants are targeted for lower-income households.



3. DELIVERY CHALLENGES

The project encountered several different types of delivery challenges — both expected and unexpected — during its implementation:

- 1 | **Skill and human resource misalignment:** Building an effective and qualified PIU proved to be more challenging than expected.
- 2 | **Private sector limitations:** Providing credit lines at competitive terms did not sufficiently incentivize Rwanda’s financial institutions to finance the off-grid sector.
- 3 | **Unaffordability to target population:** Solar off-grid solutions turned out to be largely unaffordable to many of their intended end-users, without grant financing.
- 4 | **Adverse regulatory changes:** Policy and regulatory uncertainties around the national off-grid targets and Rwanda’s technical standards for solar home systems emerged.

The next section examines how the PIU team at BRD addressed these challenges during implementation.

4. TRACING THE IMPLEMENTATION PROCESS

This section examines how the PIU at BRD implemented the project with the World Bank's support. Particular attention is paid to how the PIU addressed and overcame each of the delivery challenges by detailing the solutions and the process of identifying those solutions.

The core project team comprised a project manager and staff in the PIU. A team of World Bank staff and consultants supported the implementation. The World Bank's team leadership changed a few times because of staff rotations. The World Bank handled the changes in team leadership well, via handovers and co-Task Team Leader arrangements.

The project had a slow start. Based on its records, only 2,853 people gained electricity access between November 2017 and March 2020, compared to the targeted rates of 280,000 and 1,800,000 by the second year and the end of the project, respectively. By March 2020, the project had only disbursed 12 percent (USD5.65 million) to BRD.

Electricity connections, disbursements, and other results only picked up after the project team responded to the delivery challenges that emerged by initiating a formal restructuring in March 2020. Subsequently, connections reached 282,543 and 340,704 people in October 2021 and November 2021, respectively.

4.1. Challenge 1: Skill and Human Resource Misalignment

Staffing the PIU, who would be housed at BRD, proved to be more challenging than expected. As this was the first World Bank project BRD had implemented, the World Bank procedures were new to BRD. The

BRD lacked experience with lending to the off-grid sector. There were also some challenges in ensuring adequate project management capabilities of the PIU upon project inception.

Solution 1: Hiring of appropriate skills. The recruitment of a Senior Financial Advisor helped strengthened the project management capabilities of the PIU, though not to adequate levels. The World Bank flagged the project implementation as unsatisfactory and highlighted the risk of not achieving the project development objectives. The BRD resolved these challenges successfully by making some personnel changes, which lent further momentum to project implementation.

Solution 2: Weekly calls for closer project monitoring and communication. Another adaptive management response was to introduce weekly calls between the PIU and the World Bank.

4.2. Challenge 2: Private Sector Limitations

REF's project design relied on the use of a variety of financing windows, based on the idea that solar companies would be free to choose where to seek financing from: SACCOs under Window 1, banks and microfinance institutions under Window 2, or BRD under Window 4. However, though part of the project's original design, was initially inactive. The logic behind having Window 4 closed initially stemmed from the government's wish for domestic financing for the off-grid sector to be sustainable, before tapping into the direct lending option from BRD. The hope was that domestic financing development could be accomplished via the support of Windows 1 Window 2 for SACCOs and banks, respectively, to lend to solar

companies, with the expectation that these sources would continue to finance the off-grid sector after the project's closing.

However, although Windows 1 and 2 were designed to support financial institutions in on-lending for the solar off-grid sector, the financial institutions showed little interest in the initial years. This was because the solar off-grid sector was a new business which the financial institutions perceived to be risky. SACCOs — basic institutions with low capacity — were designed to introduce rural communities to finance by providing access. With regard to Rwandan banks, they tended to lend to traditional sectors, with land and buildings used as collateral. Therefore, neither banks nor SACCOs had experience in lending to the sector, or to small and medium enterprises, without traditional forms of collateral.

Entering the world of off-grid sector financing is a strategic decision that every bank needs to make. The commitment to enter off-grid financing would therefore need to come from the top. Some banks preferred to maintain a more passive approach and wait until another bank succeeds in the sector or the risks and business dynamics of the off-grid sector otherwise become clear before making the decision to enter. Further, once a bank decides to enter, it would also need to develop measures and accommodations relevant to solar companies, which are small enterprises with few years in business and little or no credit history.

Window 1 and 2 moved few funds in the first three years or so. The solar companies, being unable to access finance, could not pay for the necessary stocks to supply customers and time was wasted.

Two lessons can be derived from this experience. The first is that market actors should have access to multiple sources of financing. Though there were valid reasons for steering the solar companies to borrow from local financial institutions, it proved limiting. The second lesson is that there are limits to how much an energy sector project can hope to address with regard to systemic issues in the financial sector. In Rwanda, commercial banks find it hard to on-lend,

in the absence of sufficient collateral in land and real estate. Under Window 4, BRD has piloted the use of receivables as part of the collateral to show the commercial banks that other forms of collateral can be used; yet on-lending from Window 2 remains well below target.

At the same time, there were challenges that had been foreseen and the solutions were, therefore, built into the project design in the form of technical assistance and the direct financing window 4. Another part of the solution was provided through a donor-funded guarantee facility that covered some of the financial institutions' risk from lending to the sector.

Solution 1: Technical assistance. The financial institutions' low interest in financing the off-grid sector was partially foreseen; as such, the project design included the provision of technical assistance to the financial institutions. However, while the project's technical assistance could hope to create awareness and some capacity, for example by training staff in how to handle loan applications, banks tend to be conservative, with a predisposition toward staying in their areas of comfort. The banks in Rwanda did not make the strategic decision to lend to the off-grid solar sector, in part because of the issue of collateral requirements that lie outside the project's scope.

Solution 2: Direct financing vs. on-lending. The project design included a formal milestone one year after project effectiveness to inform the activation of Window 4 in the form of a detailed assessment of the performance of Window 1, 2, and 3, that would trigger a review of the need to activate Window 4. The milestone specified the performance metrics that would be used. The data-driven process helped isolate the decision-making process from other factors. The team showed foresight in including the inactive Window 4 and the milestone for triggering a review of the need to activate Window 4, as part of the original design. These measures thus allowed BRD to activate Window 4 through a technical, data-driven process, without formally restructuring the project.

Once activated by the PIU in March 2019, Window 4 immediately attracted interest from solar companies. Furthermore, the PIU also simplified the operation manual's rather stringent eligibility requirements for solar companies. As a result, the PIU was soon reviewing applications and negotiating loan terms with at least five of the major solar companies.

Many of these changes were made in response to the demand from the companies themselves. Ongoing dialogue between the PIU and the companies, its openness to listening and revising eligibility criteria, along with the regular calls between the PIU and the World Bank, helped the project team to identify these solutions.

4.3. Challenge 3: Unaffordability to Target Population

The project document discussed affordability of off-grid solutions while also pointing to data showing that thousands of systems were being sold and installed in the years prior to the project's start. This data suggested the existence of a large market for solar home systems through pay-as-you-go contracts. The project design's rationale was to address affordability by supporting pay-as-you-go models, which the project did with its focus on expanding solar companies' access to finance.

However, during 2018–20, it became clear that something was not working as expected. At this juncture, the strengthened PIU was implementing project activities, Window 4 was now active, and providing financing to some of the solar companies. Non-project sources also provided an additional means of financing for the other solar companies. Yet sales tapered off and the solar companies were making nowhere near the targeted rate of installations.

The PIU was concerned and studied the issue in dialogue with the solar companies, again supported by the World Bank's team. The PIU concluded that the better-off customer market segment had been saturated and that affordability was now key to

growing the customer base. Dialogue with the solar companies active in the market helped the PIU reach this understanding. Furthermore, many of the areas demarcated for off-grid expansion by the electrification plan were dominated by subsistence agriculture, with the likely implication that weak affordability would remain an issue for a long time.

Solution 1: Subsidy scheme. BRD and the World Bank formally restructured the project in 2020, bringing in the new Window 5 with a subsidy scheme. Whereas Windows 1–4 provided financing, Window 5 offered grants to improve the affordability of solar home systems to benefit end-consumers. The grants are channeled through solar companies, which have to demonstrate that they are passing the grants on to customers. The restructuring kept the project development objective unchanged.

Solution 2: The subsidy scheme was progressive. It was tied to the welfare level of the household (see Box 2 below for further detail).

Solution 3: Results-based model. These grants within the subsidy scheme were results-based. The PIU pays solar companies, upon the verification of system installation and operation, for each installation they make for eligible customers (see Box 2). The project withholds a part of the grant, with the subsequent disbursement to the solar companies subject to the system still being operational two and three years after installation.

Introducing the results-based financing model was a major course correction. While the project focused on financing solar companies before the restructuring, it would, henceforth, both finance solar companies and subsidize the sale and installation of solar home systems (see Box 3 for further detail).

All indications are that the diagnosis of low affordability was correct and that the subsidy scheme has accelerated sales once Window 5 became effective in October 2021. Solar companies interviewed for this case study described the results-based, progressive subsidy as a “game changer” and essential for their ability to make sales to lower-income households.

BOX 2. How the subsidies work

The subsidy levels are progressive, depending on the Ubudehe level of the household. Rwanda's Ubudehe system is a household registry used to classify households according to their welfare level. The system is used, for example, in social protection programs. The project used this system to determine subsidies, because it provided a ready-built way to categorize beneficiary households and determine the subsidy level: the lower the Ubudehe category, the higher the subsidy.

Sales to households in Ubudehe 1 receive a 90-percent subsidy of the cost of the system, followed by 70 percent and 45 percent to Ubudehe 2 and Ubudehe 3 households, respectively. The subsidies are capped, as indicated in the third column below. In practice, this means that the absolute subsidy levels apply to systems with an end-user price of USD120 and above, and that the percentage subsidy levels apply to systems with an end-user price of below USD120. This subsidy design has the effect of making basic systems affordable to poorer households, while making less of a dent in the price of larger systems.

HOUSEHOLD CATEGORY	SUBSIDY %	SUBSIDY CAP, IN \$
Ubudehe 1 (poorest)	90	100
Ubudehe 2	70	80
Ubudehe 3	45	50
Ubudehe 4 (best off)	Ineligible for subsidy	n/a

Substantial dialogue and engagement had paved the way for the pivot to a results-based model.

The World Bank and the government had a broader dialogue on the off-grid sector for several years, also outside the REF project. A pilot results-based project with GIZ/ EnDev (Pro Poor RBF program) showed good results, and later the World Bank supported the government in developing its own version of the pilot model under an energy sector development policy credit. Eventually, they agreed to use REF to finance the results-based model. To make this happen, the PIU needed to restructure the project and design the new Window 5 in collaboration with the World Bank.

BOX 3. How the results-based model work

The project delays part of the subsidy to incentivize after-sales service by solar companies. How the subsidies are delayed depends on the contract types.

For cash sales, the project reimburses companies 80 percent of the subsidy, upon the verification of the sale and installation, and the remaining 20 percent after three years.

For pay-go sales, the project reimburses companies for 45 percent of the subsidy upon the verification of the sale and installation, 45 percent in the second year upon the verification of payment made by the customers, and the final 10 percent after three years upon verification that the system is operational. This disbursement schedule seeks to ensure adequate after-sale services from the companies.

Source: Project documents.

Designing Window 5 required substantial additional technical work.

The PIU had to determine the households' ability to pay based on a study done by the Ministry of Infrastructure, which the government of Rwanda used to decide the subsidy levels in consultation with the World Bank. This work also required understanding Rwanda's system of classifying household's income levels — the Ubudehe system — that the government decided to use for setting the subsidies. The PIU also specified household eligibility criteria; devised reimbursement mechanisms for cash and pay-go contracts; and set up a verification mechanism (see Box 4). The World Bank's energy team and other practices provided support for the PIU's technical work on estimating the necessary subsidy levels and developing the verification tool.

The policy dialogue and troubleshooting process that resulted in the diagnosis of low consumer affordability and the subsidy design took into account multiple perspectives and multiple sources of data and knowledge. According to interviews and the restructuring paper, the following elements

helped project team members to address the affordability delivery challenge:

- The slow progress was clear from the sector's data and the project's data on disbursements and connections.
- Policy dialogue helped the government to recognize the need to address the affordability issue and the development policy credit supported the design of a results-based model.
- A pilot off-grid results-based project in six districts of Rwanda, supported by Energising Development (EnDev), provided proof-of-concept. That project, which involved subsidies, recorded good uptake. The government then tweaked the pilot project's design to arrive at its own model.
- The team had an active dialogue with the solar companies to understand the market perspective.
- Some members of the PIU team also went on an exposure visit to Bangladesh and Nepal, where they learned about those countries' experiences with subsidized off-grid solar electrification.

BOX 4. Verification and the deployment of new technological solutions

Companies can make two claims per quarter. The Energy Development Corporation's (EDCL) off-grid department verifies 100 percent of the claims with desk verification, five percent by phone, and five percent in the field. The service standards are 30 days for claim verification, review, and approval, with payment issued upon approval. Some stakeholders expressed a desire for a more streamlined verification system, possibly by including remote connectivity technology in installed solar systems.

The project has developed an eligibility tool that assists with the verification process. The eligibility tool is a software that is connected to the map of the off-grid designated areas, Rwanda's national ID database that also has the Ubudehe categories, and a database of previously connected off-grid households. CIF's field visit to a random solar company distributor shop showed the tool to be working well: the shop was able to use the tool to verify the eligibility and subsidy level of a potential customer within minutes.

Discussions are held with the companies in the event of verification failures. Companies that fail more than 10 percent of the verifications are issued warnings. They can be disqualified, if they receive two warnings. Some reasons for failing verification include going to the wrong location, serving an ineligible household, making a claim before installation, or listing the ID of a household in a lower Ubudehe category that would entitle the company to a higher subsidy for a particular sale.

Source: Interviews; project restructuring paper.

There are some concerns regarding whether the subsidy scheme's current design gives sufficient incentives for after-sales service and whether it treats cash and pay-go contracts equitably. The project recorded instances where solar companies repossess pay-go customers who fail to make payments. Based on the logic of results-based projects, companies that repossess systems are not supposed to get reimbursed, because the sale has not resulted in a sustainably electrified household. Some stakeholders expressed concern that the risk of subsidy loss could drive companies toward cash contracts and weak after-sales service. This would occur if the company is satisfied with receiving 80 percent of the subsidy; it will then ignore after-care sales and forgot the remaining 20 percent of the subsidy. Stakeholders also raised concerns that some companies may be created solely to take advantage of the program by aiming for the 80 percent subsidy under cash contracts and exiting the market without providing after-sales service. There are also fraud risks, with companies repossessing a system and then claiming the subsidy a second time when they resell the repossessed system.

Issues around the incentive design and a need for continuous tweaks are normal under a results-based financing model. With its commitment to continuous improvement, the PIU will, therefore, review, from time to time, both the subsidies' levels for the different Ubudehe categories and the incentives they give rise to.

In the case of mini-grids, no progress has been made, as they remain financially unviable. Although there is still potential for mini-grids in some remote places in Rwanda, they are rarely economically viable without substantial subsidies. This is, in part, because most mini-grids only support household consumption rather than productive uses in light industries of which there are few in remote areas designated for mini-grids.

At the time of the project design, there was a donor-funded project implemented by EnDev that was providing grants to mini-grid developers, but only upon commissioning. The challenge faced by mini-

grid developers was to access the financing to bring the project to commissioning. Window 3 was intended to provide a line of credit to mini-grid developers, which would act as bridge financing to bring the project to commissioning before grant (subsidy) financing from that project or other sources become available. However, the donor project has since closed. Without those grants, the rationale for Window 3 disappeared, as the mini-grid electricity tariff is unaffordable in the absence of grant funding. At the time of writing, the future of mini-grids in Rwanda, being dependent on grant funding, remains uncertain.

4.4. Challenge 4: Adverse Regulatory Changes

4.4.1. Off-grid electricity targets

Another challenge emerged when the government of Rwanda revised downward the national target for off-grid electricity provision. The original National Electrification Plan from 2018 had set a target of 48 percent for off-grid electricity provision. However, the government updated the plan in the middle of 2021 with a lower provisional target of 10 percent of villages.

Periodic updating of national electrification plans is a good practice in general. The revision was motivated by the government's desire to accelerate electrification and reach 100 percent coverage in 2024. Sources explained that the government observed faster-than-expected progress with grid expansion and slower-than-expected off-grid uptake for reasons discussed above: low affordability of low-income population segments, the banks' risk aversion, and the REF project's slow progress. The government revised the national off-grid target downward because of the grid's fast expansion. However, the downward revision of the targets could discourage solar companies from entering the market to provide off-grid solutions.

Solution: Multi-stakeholder dialogue toward a win-win solution. A process of dialogue and problem-solving ensued. The World Bank's energy team pointed out that the targets were not underpinned by

historical grid expansion performance, that financing for grid electrification was not fully secured, and that it would be risky to jeopardize the off-grid segment amidst ambitious grid expansion expectations. The World Bank's energy team was well-positioned for this dialogue because of its extensive engagement in Rwanda's energy sector and strong relationship with the government. The Technical Working Group on Off-grid Electricity — a forum that brings government and donor partners together— also facilitated the dialogue. Ultimately, the discussions were successful in producing an upward revision of the final off-grid target to 30 percent, while the grid target was set at 70 percent, as of late 2021.

The revised plan gives clarity and a sufficient customer base for the solar companies. The 30-percent off-grid target corresponds to around 1 million households, of which the government reckons around half are already connected. That still leaves more households to connect than the project funds can cover. Moreover, the electrification plan's map of villages targeted for off-grid electrification helps provide clarity to the market. To meet the revised targets, companies will, in fact, need to further accelerate the rate at which they connect new households, beyond the acceleration observed since the project restructuring.

4.4.2. Standards for solar home systems

A different source of regulatory uncertainty also affected the project in 2021. The government formulated national quality standards for solar home systems, specified in ministerial guidelines, because it observed that some substandard systems were being imported, with adverse consequences for end-users and companies selling quality products.

According to the members of the World Bank team, Rwanda's national quality standards for solar home systems, as specified in its ministerial guidelines, had become more demanding than the international norm. Consequently, only a few manufacturers met Rwanda's standards. The import of solar products slowed down because of confusion regarding how customs agents at the border should interpret the ministerial guidelines.

Solution: Data-driven dialogue to align with international benchmarks. The government resolved the issue by aligning its standards to international norms. Data-driven dialogue helped identify the challenge. The project had collected data on the companies' stocks of solar home systems needed by the PIU to administer the companies' credit lines. This data indicated that the stocks of solar home systems were running low, primarily because of the regulatory uncertainty surrounding the imports. Furthermore, the World Bank Group's lighting global team provided technical support to the Rwanda Standards Board to help Rwanda in aligning its national standards to international norms, according to interviews. The issue was resolved as of March 2022: solar companies, interviewed in March 2022, indicated that they were able to import products and had stocks available for installations.

4.5. COVID-19's Impacts

Global supply chain disruptions, triggered by the COVID-19 pandemic, did affect product availability. Domestic travel restrictions and social distancing measures, in response to the COVID-19 pandemic, also slowed down trade.

5. RESULTS

The PIU team faced a number of implementation challenges during the first approximately four years of REF's planned six-year implementation period covered in this case study. At the time of writing, the responses by the PIU team to those challenges are producing positive effects: disbursements are up, and the project is engaging the private sector in selling and installing solar home systems and working with financial institutions to finance the sector. However, since the project will be continuing until September 2023 as planned, this case study provides only interim conclusions and lessons.

The number of people provided with new or improved electricity service from solar home systems rose significantly after Window 5 came into effect in October 2020, reaching 340,704 by November 2021 (see Table 1). A little more than half of these beneficiaries are women. The project has also provided new or improved electricity service to 1,309 enterprises, according to the project's results monitoring. Although the acceleration in results is impressive, the project remains far from achieving its targets of 1.8 million people and 27,500 enterprises.

TABLE 1. People provided with new or improved electricity service from the project

DATE	NEW OR IMPROVED ELECTRICITY SERVICE
June 2017 (baseline)	0
October 2019	2,853
October 2020	3,180
May 2021	114,813
October 2021 (window 5 becomes effective)	282,543
November 2021	340,704
September 2023 (end target)	1,800,000

Source: Project data.

The project covers 30 districts targeted for off-grid solar systems. It has trained 68 SACCOs and lent to 56 SACCOs. Between them, these SACCOs have drawn down USD1,576,880 from Window 1 and on-lent USD317,178 to households and enterprises, as of November 2021. Thirty-five percent of the SACCO on-lending went to women. Under Window 2, the project has lent USD2,722,104 to two commercial banks and two micro-finance institutions (MFIs), which have, in turn, on-lent USD201,215 to households and enterprises. Though the project has reached its target for the number of districts covered and exceeded the target for participating SACCOs, the actual amounts of on-lending delivered by the SACCOs and banks are far below the targets of USD4 million and USD8 million for SACCOs and banks, respectively.

In the case of Window 4, the project has on-lent USD3,344,923 to off-grid solar companies, as of November 2021, with its end-target being almost USD14 million by September 2023. With Window 5, it has provided USD1,333,707 in result-based grant financing against a targeted amount of USD15 million. As mentioned, Window 3 has not financed any mini-grid developer, nor does the prospect look likely for the duration of the project.

REF — as a mechanism for financing private sector involvement in off-grid solar — will outlast the project. A follow-on World Bank IDA-financed project — the Rwanda Energy Access and Quality Improvement Project — came into effect in March 2021, with a planned closing date at end-2026. The project is providing additional finance to REF, which will allow it to continue to provide results-based grants for solar home systems. It also aims to promote clean cooking solutions, among other goals.

6. CONCLUSIONS AND LESSONS

This case study examined the first four years of the planned six-year implementation of the Rwanda Renewable Energy Fund (REF) project — the country’s largest off-grid expansion program — with a focus on its delivery challenges and solutions. As explained below, the project encountered several challenges, both expected and unexpected, which the government addressed proactively in dialogue with the World Bank. The challenges and solutions point to five key lessons that may be useful for similar projects:

- **Market actors should have access to multiple sources of financing.** Though there were valid reasons for steering the solar companies to borrow from local financial institutions, it proved limiting. Direct lending from the BRD to the solar companies through window 4 turned out to be more effective.
- **Subsidies may be required** to further expand the penetration of solar home systems and mini grids in population segments with low income levels.
- Projects to promote private sector participation and foster market development should **rely on extensive and continued consultations with market participants and near real-time market monitoring.**
- Projects to promote private sector participation and foster market development **need flexible mechanisms to respond to market developments and market participants’ concerns.**
- **There is need for continued dialogue of multilateral development banks (MDBs) and government to address delivery challenges stemming from policies and regulations** and changes to these. MDBs with ongoing sector engagement, policy dialogue, and policy lending in the same sector as an investment project are well-positioned for this dialogue.

Engaging the financial institutions in off-grid lending was probably the most expected challenge. The project design, therefore, included Window 4 — direct lending

from BRD to the solar companies — and a milestone for reviewing the need to activate the window.

The first lesson from this experience is that it is better to give the market actors, the solar companies in this case, access to multiple sources of financing and offer choice. It did not prove successful to use a sector intervention, such as REF, to address issues in the financial sector, as the constraints stemmed from collateral requirements and central bank regulations outside the remit of the energy sector. This situation resulted in weak access to finance for the off-grid sector.

Affordability issues were partially foreseen. In the case of mini-grids, the project had envisaged providing financing to mini-grid developers, based on the expectation that other donor-funded programs would provide the necessary subsidies. However, this expectation did not materialize. In the case of solar home systems, the project paper discussed affordability issues while also referencing high sales data, leading to a project design that supported pay-as-you-go models via credit lines to ensure adequate working capital for the solar companies.

Therefore, the second lesson highlights the need for subsidies to further expand the penetration of solar home systems in population with low affordability levels. The project shows that targeted subsidy support to improve affordability can be done by using results-based financing mechanisms, in partnership with the private sector, without undermining private sector-led, off-grid development.

The unexpected challenges the project encountered include the downward revision of its off-grid electrification target in 2021. This change in the off-grid plan could potentially have undermined the REF project, had it not been for the productive technical dialogue involving the World Bank, the technical working group on off-grid electricity, and the

government that resulted in an upward revision of the off-grid electrification target.

Finally, though the initial capacity challenges in the PIU were not foreseen, it is common for entities without prior experience in implementing MDB projects to experience an initial learning curve and to need some capacity strengthening.

The identification of the solutions to these challenges also changed the project's focus in important ways, even while the project objective was maintained. While the original project design had been focused on engaging the financial sector in providing off-grid finance, the more consequential solutions adopted by BRD led to the project's provision of support to the off-grid sector via subsidies and direct lending.

Several factors facilitated the PIU team's adaptive management:

- The PIU and the World Bank worked collaboratively to detect, diagnose, and resolve challenges.
- Active dialogue with companies and financial institutions helped the PIU team to understand the market, its challenges, and the corrective actions needed, so that effective incentives for the corresponding stakeholders could be designed.
- The project's design with separate financing windows also proved to be flexible. BRD could activate direct financing (Window 4) with relative ease and add new results-based grants (Window 5).
- Predetermined formal milestones helped trigger reviews and course corrections. The World Bank and the Government of Rwanda inserted three formal milestones in the project design document because they anticipated the need for learning by doing and course corrections. They included (1) a review of the need to activate Window 4 after 12 months; (2) a review about one-third of the way into project implementation, that is, after two years; and (3) the standard mid-term review. The first two reviews were highly consequential, as they triggered the activation of Window 4 and restructuring, respectively.

- With its agile implementation support, the World Bank was able to pay close attention to the day-to-day implementation details, including the status of the contracts of the individual companies and financial institutions with the project. The World Bank provided implementation support via frequent calls with the PIU team, technical support through staff and consultants, and country visits. It also provided hands-on support to the verification process, while awaiting the hiring of an independent verification agency.

The third lesson, therefore, concerns the need for projects to rely on extensive and continued consultations with market participants and near real-time market monitoring, in order to promote private sector participation and foster market development.

Furthermore, a related lesson — lesson 4 — is the need for flexible mechanisms to respond to market developments and market participants' concerns. In the REF project, the ability to design and adjust incentives and the financing windows' eligibility criteria allowed for that flexibility.²

The project has also revealed the significance of complementarities between project and policy interventions. In this context, the World Bank's broader engagement in Rwanda's energy sector has been helpful for the project, as its dialogue with the government and the donors on the energy sector development have allowed it to engage on issues of policy and strategy beyond what would have been possible had the project been its only engagement in the sector. For example, the energy sector development policy-financing operation supported the development of the results-based financing model that eventually became REF's Window 5.

The final lesson is therefore that there is need for continued dialogue to address delivery challenges stemming from policies and regulations and changes to these. MDBs with ongoing sector engagement, policy dialogue, and policy lending in the same sector as an investment project are well-positioned to help unlock delivery challenges stemming from adverse changes in policy and strategy.

ANNEX 1: LIST OF STAKEHOLDERS INTERVIEWED

NAME	POSITION	ORGANIZATION
Denis Rugamba	Manager Renewable Energy Fund Project	BRD
Alida Ikuzwe	Investment Manager — energy portfolio	BRD
Umesh Prasad Acharya	Renewable Energy Financing Expert	BRD
Uwera Rutagarama	Director, Off-grid and Alternative Energies	EDCL, Rwanda Energy Group
Alex Gready	Finance Manager, BBOXX	BBOXX
Innocent Mitali	Retail Projects Coordinator	BBOXX
Agnes	Shop manager, Musanze	BBOXX
Kayumba Polepole	Director SME finance	CofeBanque
Peace Kaliisa	External links and Donor Coordination Officer, eSWAP Secretariat	Ministry of Infrastructure
Ndayishimiye Dieudonne	Managing Director	BUIM Ltd.
Samuel Bimenyimana	Managing Director	Hello Renewables Ltd
Federico Querio	Task Team Leader (TTL), Senior Energy Specialist	The World Bank
Arun Singh	Energy Specialist	The World Bank
Chiara Rogate	Former TTL, Senior Energy Specialist	The World Bank
Joern Huenteler	Former TTL, Senior Energy Specialist	The World Bank
Sarah Melissa Leitner	Advisor	EnDev

ENDNOTES

CLICK ON ANY NOTE TO GO BACK TO THE REFERENCED PAGE

- 1 CIF, SREP Investment Plan For Rwanda, SREP/SC.14/7/Rev.1, November 5, 2015.
- 2 This lesson mirrors a lesson from EnDev's review of 17 results-based financing projects in the energy sector: "Tune in to the market and the economy. The more a project understands the market and its context, the better it can anticipate market dynamics and the effect a results-based financing project might have on market transformation. That, in turn, makes it more likely that a project will offer the right incentives to the right stakeholders who can stimulate and sustain sector development." https://www.sciencedirect.com/science/article/abs/pii/S1364032116002513?casa_token=-34OyhY9y6UAAAAA:enwE3CTVF8glO2DVfSBij4dvOTLNrLa3acASQ8wKbb3j7j9a18Y-6F41Yvpm7jMdrwIKSfgfk8; and https://endev.info/wp-content/uploads/2021/08/EnDev_RBF-Lessons-Learnt-Report_2021.pdf.

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The Climate Investment Funds
c/o The World Bank Group
1818 H Street NW, Washington, D.C. 20433 USA

Telephone: +1 (202) 458-1801
Internet: www.climateinvestmentfunds.org



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