

# DESIGNING PUBLIC FUNDING MECHANISMS IN THE OFF-GRID SOLAR SECTOR

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**LIGHTING  
GLOBAL**  
*Catalyzing markets for modern off-grid energy*

AN INNOVATION OF



**WORLD BANK GROUP**  
THE WORLD BANK IFC International Finance Corporation

**ESMAP**  
Energy Sector Management Assistance Program

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## ABBREVIATIONS

ARPU	average revenue per user
BGFA	Beyond the Grid Fund for Africa
BRD	Development Bank of Rwanda
DBE	Development Bank of Ethiopia
DSS	demand-side subsidies
ESMAP	Energy Sector Management Assistance Program
GEP	Global Electrification Platform
GOGLA	Global Off-Grid Lighting Association
IDCOL	Infrastructure Development Company Limited
IEC	International Electrotechnical Commission
KOSAP	Kenya Off-Grid Solar Project
MFI	microfinance institution
MTF	Multi-Tier Framework
non-QV	non-quality-verified
OGS	off-grid solar
PAYG	pay-as-you-go
PFI	participating financial institution
PVoC	pre-verification of conformity
QV	quality-verified
RBF	results-based financing
REA	rural electrification agency
ROGEAP	Regional Off-Grid Electricity Access Project
SACCO	savings and credit cooperative society
SDG 7	Sustainable Development Goal 7
SHS	solar home systems
SIDA	Swedish International Development Cooperation
SSP	solar service provider
UNOPS	United Nations Office for Project Services
USAID	US Agency for International Development
VAT	value-added tax
Wp	watts peak

All currency is in United States dollars (US\$, USD), unless otherwise indicated.

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**Lighting Global** is the World Bank Group's initiative to rapidly increase access to off-grid solar energy for the 789 million people living without electricity world-wide. Managed by the Energy Sector Management Assistance Program (ESMAP), we work with governments, the private sector, development partners, and end-users, continually innovating to unlock key market barriers and enable access and affordability to those that would otherwise be left behind. Our support has expanded to technologies that go far beyond lighting, including systems to power the needs of households, businesses, schools, and health centers. We operate with funding gratefully acknowledged from ESMAP and their donors.

The **Energy Sector Management Assistance Program** (ESMAP) is a partnership between the World Bank and [24 partners](#) to help low- and middle-income countries reduce poverty and boost growth through sustainable energy solutions. ESMAP's analytical and advisory services are fully integrated within the World Bank's country financing and policy dialogue in the energy sector. Through the World Bank Group (WBG), ESMAP works to accelerate the energy transition required to achieve [Sustainable Development Goal 7](#) (SDG7) to ensure access to affordable, reliable, sustainable, and modern energy for all. It helps to shape WBG strategies and programs to achieve the WBG Climate Change Action Plan targets.

## EXECUTIVE SUMMARY

This report provides guidance to governments and their development partners on how public funding can be used to provide energy access to households through off-grid solar (OGS) solutions, such as solar lights, solar home systems (SHS), and related appliances.

The report explores how public funding mechanisms can be deployed—on the supply side, the demand side, or both—to provide energy access through OGS. Funding mechanisms are defined as supply side when funding goes to companies or investors to reduce the cost or risk of supplying products to end users, and are demand side when the funding mechanism is designed to make OGS more affordable to end users.

**OGS has a key role to play in achievement of Sustainable Development Goal 7 (SDG 7): universal access to affordable, reliable, sustainable, and modern energy for all by 2030.** Governments are increasingly adopting integrated electrification strategies, which combine grid, mini-grid, and off-grid solutions to achieve universal access. OGS represents the fastest and most cost-effective way to reach a significant proportion of the population lacking access, particularly lower-income households and more remote communities. The emergence of pay-as-you-go (PAYG) technologies and business models, which enable customers who cannot afford to pay for a product upfront to pay over time in small, affordable instalments, has helped to overcome affordability challenges. They are enabling increasing numbers of OGS customers to access “Tier 1” electricity services or above.<sup>1</sup>

**Governments and their development partners are increasingly taking advantage of the opportunities that OGS offers.** By working with businesses in the OGS market, governments leverage private-sector capacity and co-investment to help achieve their energy access goals. OGS companies are already present in most countries that have a significant population without access, but public funding is needed to help them enter more remote areas, serve lower-income customers, and provide existing customers with a higher level of service. Public funding can also safeguard the quality of products and services to protect consumers.

**OGS companies require equity, debt, and grant financing for a range of purposes at different stages of their growth, and all have significant working capital needs.** They deploy a range of business strategies, with some taking more risk in the pursuit of scale, and others taking less risk and targeting lower rates of growth. PAYG is a more capital-intensive model than cash sales, since once products are sold it can take 12-36 months to recover the capital deployed. When designing public funding to support the OGS sector, it is important to keep in mind the overall financing needs of the OGS sector and ensure companies have sufficient access to all kinds of capital, to avoid bottlenecks that inhibit growth.

## PREPARING TO DESIGN A PUBLIC FUNDING PROGRAM

The starting point when designing a public funding program to support the OGS market is to ensure that **OGS is integrated into the national electrification plan.** Geospatial, least-cost electrification planning tools, such as the Global Electrification Platform (GEP), can provide a guiding framework for the role that OGS can play in achieving universal electricity access. If integrated electrification plans are already in place, it is important to ensure they are up to date.



The second step is to consider the use of **Multi-Tier Framework (MTF) surveys** to gain deep insights into energy access, addressing electricity quantity, availability, quality, reliability, convenience, affordability, and safety. MTF surveys allow for the nuanced tracking of SDG 7 targets, and help governments fine-tune their policies and approaches for reaching them.

The third step is a comprehensive **market assessment**, which provides a thorough understanding of the role of key actors in the market, the size of the current and potential market and affordability levels, the enabling environment, the demand and supply dynamics, and the local sector's funding needs.

When designing the program, the **role of the lead agency**, such as a rural electrification agency or the ministry of energy, needs to be taken into account. If the lead agency lacks capacity, an independent fund manager could be considered, or if a finance skillset is needed, financial institutions such as development banks could be considered. Ideally, all implementing partners should have deep knowledge of the OGS sector and the country context.

In parallel with public funding, **complimentary interventions** might prove to be necessary to create a robust enabling environment. They may include consumer awareness, technical assistance, quality standards, and market intelligence studies.




## **PUBLIC FUNDING MECHANISMS**

The report presents and analyses seven public funding mechanisms, including **supply-side mechanisms**, which go directly to companies or investors to reduce the cost of supplying the products to end users and/or reduce the risk of the investment (for example to subsidize development of supply chains in new regions), and **demand-side mechanisms**, which are designed to make OGS more affordable to end users (see Figure ES.1).

The **most appropriate funding mechanism, or combination of mechanisms, depends on a number of factors, including the objectives of the program, market characteristics, the time available, and the implementing capacity of the lead agency as well as any potential partners.** Upfront business grants and technical assistance, for example, are likely to be needed in nascent markets, while results-based financing is likely to be more appropriate as markets mature. Credit lines and risk mitigation instruments may also be needed at that stage, to ensure that companies have sufficient access to debt for working capital. Tax exemptions can help to address affordability and support growth at any stage of a market's development. In most settings, supply-side mechanisms should be considered before demand-side mechanisms since they can reach more people at lower cost, but if affordability is a major constraint they can also be developed in parallel. In situations where market-based solutions are not viable or suitable, a public procurement approach can be considered.

**A holistic approach that combines more than one public funding mechanism with other interventions is usually needed.** If the objective is to support nascent markets, or expand them into underserved areas, a combination of upfront grants and results-based financing can work well. While credit lines have been the starting point of many public funding programs, their appropriateness relies on the capacity and willingness of the financial sector to provide loans to OGS companies, which is often lacking in the early stages of markets. Demand-side subsidies need to be preceded or accompanied by supply-side interventions to make sure that OGS products are available in target areas.

**FIGURE ES.1: OVERVIEW OF PUBLIC FUNDING MECHANISMS: WHEN THEY ARE MOST SUITABLE, THEIR ADVANTAGES AND LIMITATIONS, AND DESIGN CONSIDERATIONS**

				SUPPLY SIDE		
				Upfront grants	Results-based financing	Tax exemptions
	<b>Overview</b>			<i>Non-repayable funds from public sector and donors to help solar companies expand into new markets and products</i>	<i>Payments to service providers upon achievement and verification of predefined results</i>	<i>The removal of VAT and/or import duty for qualifying solar products or components to make them more affordable</i>
	<b>Advantages</b>			<ul style="list-style-type: none"> <li>• Can have a catalytic role in nascent markets;</li> <li>• Can accelerate product or business model R&amp;D;</li> <li>• Can incentivize companies to enter high-risk markets.</li> </ul>	<ul style="list-style-type: none"> <li>• Can meet a wide range of objectives;</li> <li>• Can address financial bottlenecks along the value chain;</li> <li>• Financial risk lies with the recipient company;</li> <li>• Lower risk of funds misuse;</li> <li>• Can foster competition.</li> </ul>	<ul style="list-style-type: none"> <li>• Helps to attract companies and investors into a market;</li> <li>• Improves affordability and accelerates market growth;</li> <li>• Can help quality-verified products to compete on price with non-quality verified products.</li> </ul>
	<b>Disadvantages</b>			<ul style="list-style-type: none"> <li>• May result in “picking winners”;</li> <li>• Can be difficult to support both larger and smaller companies;</li> <li>• Risk of misuse of funds;</li> <li>• Risk of poor performance lies with grant maker;</li> <li>• May not be large enough, or long enough, to enable companies to access private capital.</li> </ul>	<ul style="list-style-type: none"> <li>• Not appropriate for smaller products;</li> <li>• Challenging to support smaller companies;</li> <li>• Determining the “right” level can be challenging;</li> <li>• Tracking, verification, disbursement, and reporting may be challenging;</li> <li>• May have a limited impact if companies are capital-constrained.</li> </ul>	<ul style="list-style-type: none"> <li>• Quality-linked importation and taxation processes can be challenging;</li> <li>• Can be politically contentious, with a risk of change at short notice;</li> <li>• Governments may be concerned about loss of government revenue.</li> </ul>
	<b>When are they suitable?</b>			<ul style="list-style-type: none"> <li>• Nascent markets;</li> <li>• Young and innovative companies;</li> <li>• Companies lack a track record to attract investment;</li> <li>• Need to incentivize established companies to enter a new market.</li> </ul>	<ul style="list-style-type: none"> <li>• High costs prevent companies from entering an under-served area;</li> <li>• Need to rapidly scale up the number of people reached.</li> </ul>	<ul style="list-style-type: none"> <li>• Necessary political support is in place;</li> <li>• Affordability is not viewed as a barrier;</li> <li>• Need to promote quality-verified OGS;</li> <li>• Revenue and customs authorities are able to implement quality-linked tax exemptions;</li> <li>• Can remain in place for a reasonable length of time.</li> </ul>

Source: ECA.

	SUPPLY SIDE		DEMAND SIDE	
	Credit lines	Risk mitigation	Demand-side subsidies	Public procurement
Overview	<i>Funding to address liquidity issues in banking sector and provide acceptable borrowing terms for OGS companies</i>	<i>Risk-sharing between commercial lenders and donors when risk perception is high and/or OGS sector is not well developed</i>	<i>Subsidies provided to end users that aim to reduce the financial hardship associated with accessing OGS products</i>	<i>Government agencies purchase systems through an organized bid and distribute the systems to end users directly</i>
Advantages	<ul style="list-style-type: none"> <li>• Enable financial institutions to select companies to invest in;</li> <li>• Play a critical role in providing working capital upfront;</li> <li>• Can be used to improve access to finance.</li> </ul>	<ul style="list-style-type: none"> <li>• Helps to mitigate risk and encourage lending;</li> <li>• Helps to move the market towards commercial working capital financing;</li> <li>• Can reduce borrowing costs.</li> </ul>	<ul style="list-style-type: none"> <li>• If prices go down, demand increases significantly;</li> <li>• Can help to reduce default rates on PAYG sales;</li> <li>• Supports more vulnerable households to gain access to electricity.</li> </ul>	<ul style="list-style-type: none"> <li>• Appropriate solution for poor, remote or isolated communities, or for humanitarian settings;</li> <li>• Central government purchasing can reduce costs;</li> <li>• Can be used to reach large numbers of people quickly.</li> </ul>
Disadvantages	<ul style="list-style-type: none"> <li>• Can “crowd-out” commercial investment;</li> <li>• Banks may remain unwilling to lend;</li> <li>• Need to be carefully designed to support smaller companies;</li> <li>• Can take time to set up;</li> <li>• Can be slow to adapt to rapidly changing market dynamics.</li> </ul>	<ul style="list-style-type: none"> <li>• Partial risk guarantees are sometimes insufficient;</li> <li>• Risk of high transaction costs, administrative burden, and disbursement delays.</li> </ul>	<ul style="list-style-type: none"> <li>• High market distortion risks;</li> <li>• Targeting, setting of appropriate subsidy amounts, verification, and exit strategy can all be challenging.</li> </ul>	<ul style="list-style-type: none"> <li>• Requires capacity for long-term operation and maintenance;</li> <li>• Requires long-term financing;</li> <li>• Can be challenging to adapt to evolving needs;</li> <li>• Potential to disrupt existing commercial market.</li> </ul>
When are they suitable?	<ul style="list-style-type: none"> <li>• Companies require working capital and are close to meeting lender requirements;</li> <li>• Domestic financial sector is close to having the willingness and capacity to lend to the OGS sector;</li> <li>• Financial institutions are willing to lend but lack liquidity.</li> </ul>	<ul style="list-style-type: none"> <li>• Companies require working capital and are close to meeting lender requirements;</li> <li>• Lenders have liquidity but are reluctant to lend;</li> <li>• Lenders lack experience of lending to the sector;</li> <li>• Bank systems and processes disincentivize lending to OGS.</li> </ul>	<ul style="list-style-type: none"> <li>• Despite other efforts, households are unable to afford OGS products</li> </ul>	<ul style="list-style-type: none"> <li>• A market-based solution is not viable because target population is too poor, too remote, too few, or too dispersed.</li> </ul>

## CONCLUSIONS

While there is no one-size-fits-all public funding solution that meets the evolving needs of diverse off-grid energy markets at different stages of development, the following key principles for designing a public funding program have been identified:

- **Flexibility:** Public funding mechanisms need to be flexible so that they can adapt to changes in the market, respond to emerging challenges and opportunities in a timely fashion, and rapidly apply lessons learned from implementation experience. In this regard, close monitoring of developments in the market is essential.
- **Targeting:** Targeting is important to maximize the effectiveness of a program in reaching its energy access goals while minimizing the use of public resources. Efficient targeting can be achieved with the use of digital platforms, which can help segment end users according to location, income level, and other metrics.
- **Proportionality:** The level of funding should be adequate to compensate companies for the costs and risks they will face and ensure sufficient company participation in the funding scheme, without compromising efficiency in the use of public funds.
- **Efficient fund management using digital technology:** In recognition that delays in disbursement of public funding pose a major challenge for capital-constrained OGS companies, the automation and digitalization of fund management systems and processes can reduce transaction costs and risks of delay. Digital technologies can also be used to collect consumer and company data and track progress towards program objectives.
- **Verification:** Verification of results is essential to managing fiduciary risks, ensuring programs achieve their objectives and public funding is being used appropriately.
- **Sustainability:** Carefully designed phase-out strategies are essential for ensuring the sustainability of the OGS market.

# 1: THE CASE FOR PUBLIC FUNDING IN THE OFF-GRID SOLAR SECTOR

**This report provides guidance to governments and their development partners on how public funding can be used to provide energy access to households through off-grid solar (OGS) solutions.** It is intended for policy makers and other stakeholders involved in the design and implementation of off-grid electrification strategies and programs.

**It focuses on domestic solar solutions such as solar lights, solar home systems, and related appliances.** A wide range of solutions is needed to achieve universal electricity access, including on-grid, mini-grid, and off-grid electrification. In off-grid settings, solutions are needed for both domestic and productive use of electricity, as well as for public facilities. Other reports are available that explore ways to deploy public funding to support grid and mini-grid electrification, as well as off-grid productive uses and public facilities.<sup>2</sup>

**The report explores how public funding mechanisms can be deployed—on the supply side, the demand side, or both—to provide energy access through OGS.** Funding mechanisms are defined as “supply-side” when funding goes to companies or investors to reduce the cost or risk of supplying products to end users. They may include, for example an upfront grant to test a new product or business model, or results-based financing to expand into a new area. Funding mechanisms are defined as “demand-side” when they are designed to make OGS more affordable for end users, for example by providing them with vouchers that they can use to purchase OGS solutions at a discount.

The report considers the circumstances in which each funding mechanism is likely to be appropriate, as well as the advantages, disadvantages, risks, and key design considerations for each approach. Based on extensive desk research and stakeholder consultation, the report shares the lessons that practitioners have learned from using each mechanism, and provides guidance on how to design and implement mechanisms effectively in the future. Table 1.1 lists and defines the funding mechanisms.

**TABLE 1.1: FUNDING MECHANISMS AND DEFINITIONS**

FUNDING MECHANISM	DEFINITION
<b>SUPPLY-SIDE MECHANISMS</b>	
Upfront Grants	Non-repayable funds transferred by the public sector or donor agencies to solar companies to help them develop new products, test new business models, or expand into new markets.
Results-Based Financing (RBF)	A form of public funding support where recipients (agents) receive funding from an issuing agency (principal), which can be a donor, government, or other institution, upon the achievement of a predefined set of results. Offers an incentive for companies to reach certain customer groups, number of sales, or other agreed milestones.
Tax Exemptions	A policy that involves removal of value-added tax (VAT) and/or import duty requirements for qualifying solar products or components. Intended to reduce inventory acquisition costs and increase the affordability of solar products.
Credit Lines	Set up to provide debt financing to OGS companies and/or end users directly through a development bank, or indirectly through financial intermediaries (for example, commercial banks, microfinance institutions, and independent fund managers). Provide external funding that can address liquidity issues in the local financing sector.
Risk Mitigation Instruments	Risk sharing between commercial lenders and one or more donors in the form of guarantees, insurance products, or grants. Can be mobilized to reduce the risk for commercial banks that are otherwise hesitant to engage in the sector.
<b>DEMAND-SIDE MECHANISMS</b>	
Demand-Side Subsidies	Funds provided either directly to end users or to companies to make OGS more affordable. Reduce the effective price paid by consumers, thereby increasing the affordability of products.
Public Procurement	A strategy whereby government agencies or donors purchase systems through an organized bid and distribute the systems to end users directly. Widely used by government to purchase institutional systems for clinics, schools, and other public buildings.

Section 1.1 explores the case for using public funding to achieve energy access through OGS, while Section 2 provides an overview of the sector’s financing needs. Section 3 outlines the steps that governments and development partners might consider when designing an OGS program, and Section 4 explores each funding mechanism in detail. Section 5 provides conclusions and recommendations.

## How Off-Grid Solar Can Help to Achieve Universal Energy Access

The off-grid solar (OGS) sector has grown tremendously over the past 10 years and now serves an estimated 420 million users. It has a positive social impact far beyond providing energy access. Solar lighting customers report savings compared to their previous spending on kerosene, battery-powered torches, or candles, while solar home systems (SHS) enable people to use a range of efficient appliances, including refrigerators and other domestic and productive appliances. OGS companies create skilled jobs in areas such as sales, distribution, and after-sales service, and the Global Off-Grid Lighting Association (GOGLA) estimates that 24 percent of OGS customers use it to support a business or income-generating activity. Households using OGS report improvements in education, health, safety, and well-being.<sup>3</sup>

Despite progress, the world remains off-track to achieve Sustainable Development Goal 7 (SDG 7): universal access to affordable, reliable, sustainable, and modern energy for all by 2030. Electricity access is improving in both Africa and Asia, but remote and rural areas are lagging and progressing more slowly.<sup>4</sup> With 789 million people lacking access today, on current trends as many as 674 million people could remain without access in 2030.<sup>5</sup>

OGS represents the fastest and most cost-effective way to reach a significant proportion of the population, particularly lower-income households and more remote communities. According to the International Energy Agency, off-grid and mini-grid solutions are the most cost-effective approach to delivering access to 70 percent of the rural population currently lacking access, and 25 percent of all new connections need to take the form of OGS.<sup>6</sup> Although OGS solutions provide a more basic electricity service than grid connection, this level of service can be more in line with consumer demand and ability to pay. For many low-income households, especially in rural areas, electricity is only needed for lighting, phone charging, and low-consumption appliances such as radios, fans, and televisions, all of which can be cost-effectively powered through OGS solutions.

**Governments are increasingly taking advantage of the off-grid opportunity.** As of 2017, 77 countries in regions with significant populations lacking access had adopted a defined role for OGS in their national electrification plans.<sup>7</sup> These “integrated” electrification plans are technology and delivery model agnostic. They determine the most appropriate technology and delivery model according to a range of factors, including size of community, population density, distance to national grid, terrain, affordability, demand, and level of economic activity. Countries such as Ethiopia, India, Kenya, Myanmar, Nepal, and Togo are developing and implementing electrification strategies that take advantage of all available technologies and leverage the private sector’s expertise to meet SDG 7.<sup>8</sup> In these plans, OGS is seen as both a pre-electrification solution, providing immediate tangible benefits to households and the economy until grid electrification can be extended, and a long-term solution for areas where grid service might never be economically viable.

**Development institutions are also increasing funding allocations to the OGS sector.** The World Bank Group is playing a leading role. It approved over \$800 million for OGS projects across 25 countries in 2018–19 alone, with around \$400 million approved in 2020 and 2021. Almost all this funding is provided in the form of loans to governments, with governments’ willingness to borrow funds to support the sector underlining their growing commitment to the role of OGS in achieving universal electricity access.<sup>9</sup>

## Public Funding for OGS Can Leverage Private-Sector Capacity and Co-Investment

**Private-sector innovation has been the driving force behind the growth of the OGS sector.** R&D in the private sector has led to costs falling dramatically over the past few decades and they are expected to continue to do so over the long term. Average prices fell by 3–10 percent for pico-solar products and around 5–15 percent for SHS between 2018 and 2020.<sup>10</sup> The private sector has also led efforts to build distribution and after-sales capability, since as far back as the 1980s in markets such as Bangladesh, India, Kenya, and Uganda.

**OGS companies are present—to some extent—in almost all countries that have significant populations lacking access. They have the capacity to support government efforts to achieve universal access.** Major markets in Asia include India and Bangladesh, while in sub-Saharan Africa, markets such as Kenya, Ethiopia, Uganda, and Nigeria are well-established. In recent years larger providers in East Africa have expanded into new markets, especially in West Africa, as established markets become more saturated.<sup>11</sup> In smaller and more nascent markets international companies are less likely to be present, but local companies are often active. By working with the private sector, governments can leverage companies' capability in areas such as sales, marketing, distribution, consumer financing, and after-sales service.

**By adopting a private-sector-led approach, governments can leverage private investment to help them achieve their access goals, and ensure they use scarce public funding as efficiently as possible.** As of the end of 2019, the OGS sector had attracted more than \$1.5 billion in investment, with investment of \$316 million in 2020 alone. Over half of this funding was provided in the form of repayable debt (\$205 million), and less than 10 percent was provided in the form of grants (\$29 million).<sup>12</sup> Clear government commitments to support the OGS sector, coupled with the provision of public funding to support sector growth, encourages companies to enter markets and enables governments to attract private investment in pursuit of their access goals.

**Working through the private sector creates sustainable markets, which deliver electricity services on an ongoing basis without a need for ongoing public funding.** Long-term sources of public funding, and delivery models such as public procurement, are needed to serve particularly remote or low-income households. But a high proportion of those lacking access today can be sustainably served by the private sector on a fully commercial basis, once companies are established in a market and have achieved a degree of scale. OGS companies selling quality products have a strong interest in building long-term relationships with customers, providing additional products and services to meet their evolving electrification needs over time.

**Public funding is needed to accelerate market development and incentivize the private sector to enter underserved geographical locations, to reach lower-income customer segments, or to provide a higher level of service to existing customers.** The ways in which public funding can be used to achieve these objectives, at scale and at speed, are explored in detail in Section 4.

## Public Funding for OGS Can Promote Quality Products and Help to Protect Consumers

**Non-quality-verified (non-QV) products, of variable quality, make up around 72 percent of the global OGS solar market.**<sup>13</sup> The World Bank Group has worked for over a decade to develop test methods and quality standards, building test lab capacity and providing technical assistance to governments in the development, adoption, and implementation of standards. In 2020 it set up VeraSol, a new quality assurance platform designed to meet the sector's evolving needs. VeraSol uses the quality standards for



pico-solar products and SHS kits up to 350 watts contained in International Electrotechnical Commission (IEC) Technical Standard 62257-9-8, the only internationally recognized standards for these products.<sup>14</sup>

**Governments can use OGS programs to promote quality in the market by providing funding and other forms of support to companies selling quality-verified (QV) products.** They can use project-level standards to promote QV products, or mandatory national standards that make it illegal for companies to import non-QV products. At the time of writing, nine countries had adopted national standards in line with IEC standards, covering the OGS sector. Four more countries and one regional body—the Economic Community of West African States (ECOWAS)—are also in the process of adoption. It is expected that the number of countries adopting standards will grow in the future.

**Rwanda has been particularly successful in using public funding to promote quality.** Over 95 percent of OGS products sold in Rwanda are from companies selling QV products. In 2016 the government introduced mandatory quality standards, ensuring that only QV products would benefit from public funding, and making it illegal to import non-QV products. Importer compliance with national standards has led to a market dominated by QV brands, including BBOXX, Greenlight Planet, NOTS, and Ignite Power.<sup>15</sup>

### The Pay-As-You-Go Opportunity

**While 80–85 percent of OGS sales consist of basic solar lights sold upfront for cash, an increasing proportion of sales consist of larger SHS sold on credit using pay-as-you-go (PAYG) technology and business models.**<sup>16</sup> PAYG is a metering technology that enables customers to pay for solar lights and SHS over time using mobile technology, rather than paying the entire cost upfront. Often PAYG systems come bundled with efficient appliances such as torches, radios, fans, televisions, and other domestic and productive appliances. Some companies are also starting to bundle digital and financial services with PAYG, selling customers additional products and services on credit and using OGS systems as collateral. PAYG allows non-traditional, low-income customers to gain access to credit and start building a credit history. This payment history can then be leveraged to gain access to financial services outside the energy space.

**PAYG is helping to overcome affordability barriers and enabling end users to access a higher level of electricity service than they would otherwise be able to afford.** PAYG has driven up the proportion of OGS customers benefiting from “Tier 1” electricity services according to the Multi-Tier Framework for Energy Access,<sup>17</sup> to just over 50 percent. Many governments use Tier 1 as a minimum threshold when setting energy access targets.

## 2: THE OFF-GRID SOLAR SECTOR AND ITS FUNDING NEEDS

The off-grid solar (OGS) supply chain consists of a mix of vertically integrated and more niche, specialized business models. Larger, vertically integrated companies engage in product design, manufacturing, software development, distribution, sales, consumer financing, and after-sales (see Figure 2.1). Smaller distributors tend to focus on distribution, sales, consumer financing, and after-sales.<sup>18</sup> Specialist service providers are emerging, particularly in the area of software but also in HR and logistics.<sup>19</sup> Partnerships between companies with distinct, complementary capabilities are helping to drive efficiency along the value chain. In recent years, some OGS companies have moved “beyond energy” to sell other kinds of durable or consumable products, or to offer financial services to their customers, leveraging data on credit-worthiness. Others are targeting unreliable grid customers with energy solutions that enhance the reliability or range of energy services available, such as battery backup installations or gas for cooking.

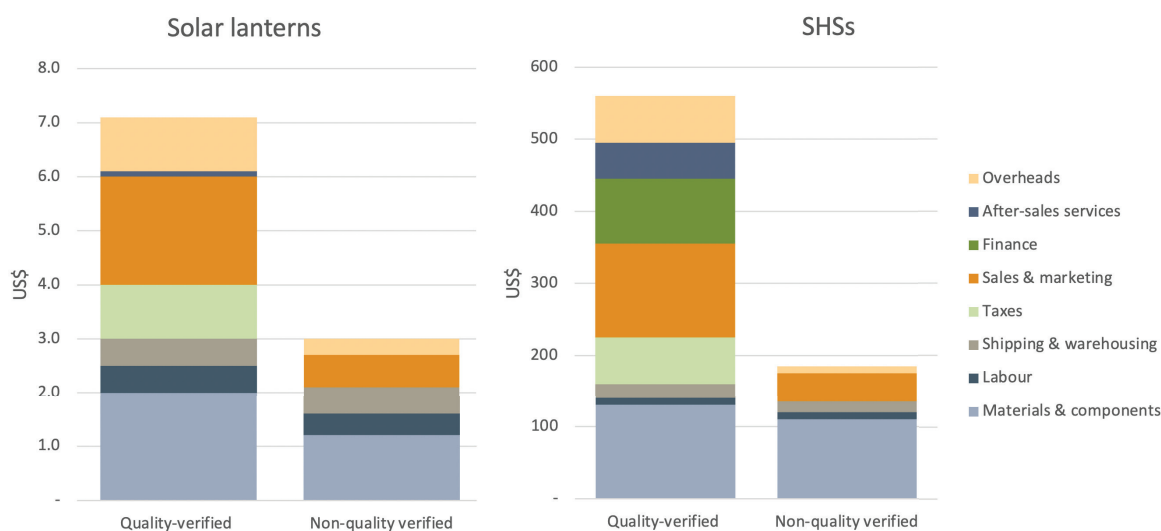
**FIGURE 2.1: THE OFF-GRID SOLAR SUPPLY CHAIN**



Source: Adapted from World Bank.

The cost drivers for OGS companies depend primarily on whether they are selling basic solar lights or larger SHS, whether they are selling quality-verified (QV) products, and whether they are importing them through formal or informal channels. A cost breakdown, based on research covering more than 20 OGS companies, found that OGS companies providing QV products incur higher costs upstream because of the cost of quality components (especially batteries), and downstream because they are much more likely to provide consumer financing and after-sales service. They are also more likely to import products through formal channels, and to pay import taxes when they do so. An estimate of the cost of providing QV and non-QV solar lanterns and SHS is outlined in Figure 2.2.<sup>20</sup>

**FIGURE 2.2: ESTIMATED RELATIVE COSTS OF QUALITY VERIFIED AND NON-QUALITY VERIFIED OFF-GRID SOLAR**



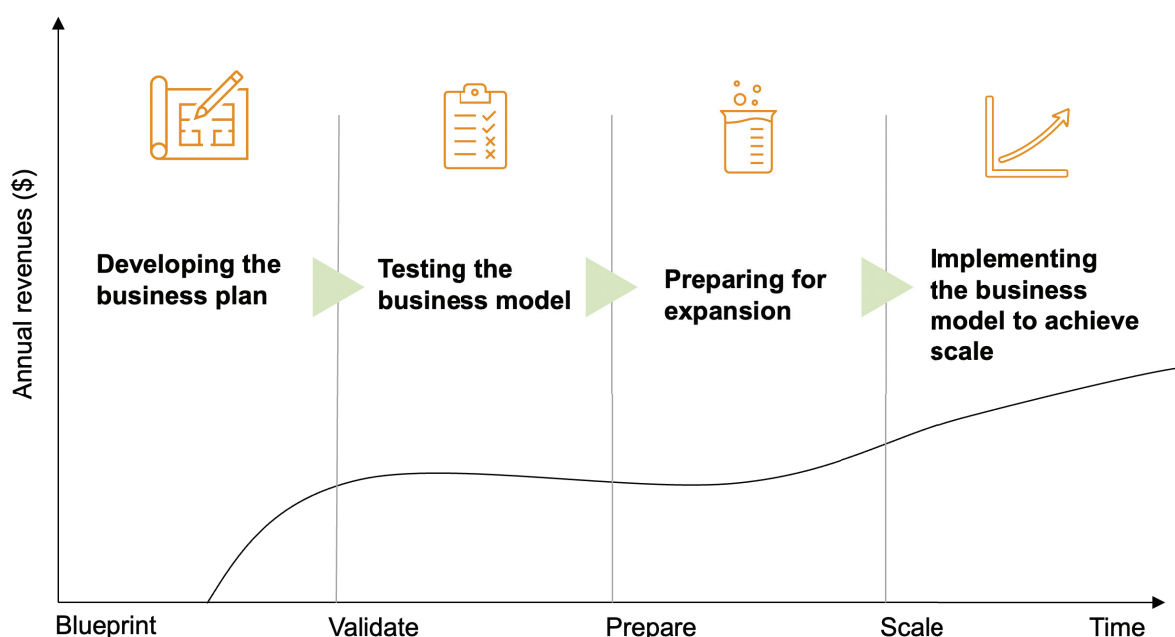
Source: Adapted from Pricing Quality: Cost Driver and Value Add in the Off-Grid Solar Sector, Hystra Strategy Consulting, 2019

**To reach universal energy access by 2030, the OGS sector needs to serve an estimated additional 228 million people with products that provide a Tier 1 level of service or higher. This will require an injection of \$6.6–11 billion in public and private financing.** Roughly \$4–5 billion in debt financing is needed, alongside \$300 million in grants, and up to \$3.4 billion in subsidies from governments and development partners to bridge the affordability gap.<sup>21</sup>

**Before considering how best to use public funding, policy makers need to understand the overall financing needs of OGS companies in their market, and the extent to which these are being met.** In this section, we share general insights on the financing needs, and likely current sources of financing, for cash sales and PAYG sales by OGS companies at different stages of development. It is important to note, however, that in-depth market assessments are needed to fully understand the private sector’s stage of growth and development, its financing needs, and current sources of financing.

**OGS companies go through several stages of growth and development before they achieve scale and profitability.** As shown in Figure 2.3 and Table 2.1, they need different volumes of financing at each stage, for different purposes. The type of financing, and most likely source of financing, also change as companies mature.<sup>22</sup>

**FIGURE 2.3: CAPITAL NEEDS DURING DIFFERENT GROWTH STAGES**



Source: Adapted from Accelerating Energy Access, the Role of Patient Capital, Acumen 2018.

**TABLE 2.1: TYPE OF FINANCING AND LIKELY SOURCES AT DIFFERENT GROWTH STAGES**

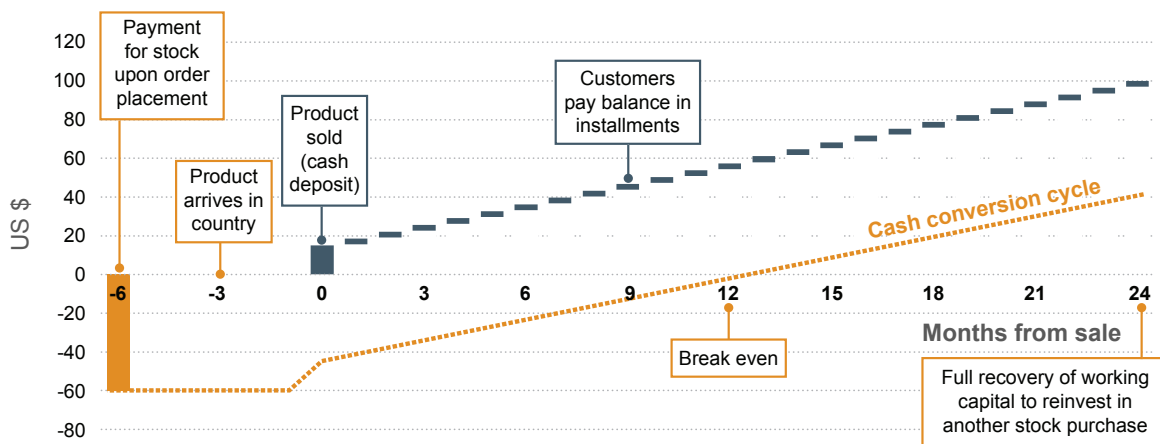
	<b>BLUEPRINT</b>	<b>VALIDATE</b>	<b>PREPARE</b>	<b>SCALE</b>
Financing Needs	\$10,000–1 million	\$250,000–5 million	\$1–10 million	\$10 million+
Purpose	Customer research, business plan development	Business plan testing and validation	Professionalize operations, build capacity, develop supply chain	Expand within existing markets, enter new markets, offer new products and services
Type of Financing Needed	Grants, founder's equity	Grants, early-stage equity, and debt	Equity and debt	Equity, debt, consumer receivables financing*
Likely Source of Financing	Friends and family, accelerators, foundations, crowdfunding platforms	Foundations, high-net-worth investors, early-stage impact investors, crowdfunding platforms	Foundations, high-net-worth investors, early-stage impact investors, specialized intermediary funds, crowdfunding platforms	Foundations, specialized intermediary funds, private and institutional investors, crowdfunding platforms, development finance institutions

\* Refers to off-balance sheet financing vehicles dedicated to acquiring PAYG SHS accounts receivables.

**Not all OGS companies pursue scale as a means of achieving profitability.** Research by the Global Distributors Collective found that some smaller companies, especially locally owned and led companies, pursue a different growth trajectory to the one illustrated above. These companies grow more slowly and steadily, and tend to have a narrower geographic focus. Deep local market knowledge, strong networks, and a lighter capital structure can give them an advantage when seeking to serve harder-to-reach customers. The financing needs of these companies are different—they typically rely less on external growth equity and more on working capital financing.<sup>23</sup>

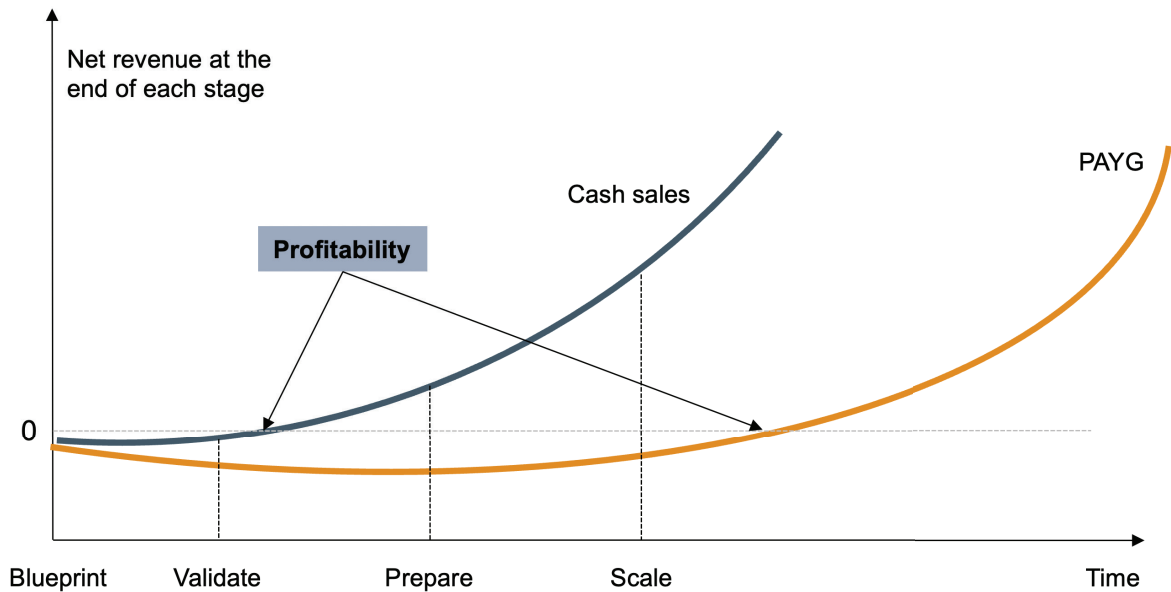
**All OGS companies have significant working capital needs, especially PAYG companies.** The working capital needs of PAYG companies are higher than those selling products for cash, and their cash conversion cycle is longer, because the products are higher value and customers pay over 12–36 months instead of upfront with cash. Figure 2.4 below gives a sense of how much funding OGS companies need to commit to place an order, and how long it takes them to recover funds from the end user before covering their costs and finally making a small profit. This has implications for the overall profitability of PAYG companies, which arrives at a much later stage of growth than for companies operating on cash sales, as illustrated in Figure 2.5:.

**FIGURE 2.4: INDICATIVE PAY-AS-YOU-GO CASH CONVERSION CYCLE**



Source: ECA.

**FIGURE 2.5: FUNDING REQUIREMENT BY BUSINESS CYCLE STAGE FOR CASH SALES AND PAY-AS-YOU-GO**



Source: Adapted from ESMAP, Funding the Sun: New Paradigms for Financing Off-Grid Solar Companies, 2020.

**OGS companies face a variety of challenges in raising capital to sustain operations and growth, particularly working capital finance.** Challenges include ticket sizes not corresponding to company needs, lack of acceptable collateral, high interest rates, and foreign exchange risks. Table 2.2 lists these challenges from both the OGS company's and the funder's perspectives.

**TABLE 2.2 OFF-GRID SOLAR COMPANY AND FUNDER PERSPECTIVES ON ACCESS TO FINANCE**

<b>OGS COMPANY PERSPECTIVE</b>	<b>FUNDER PERSPECTIVE</b>
Minimum investment amounts are too high	Transaction costs are too high on small investments
Collateral requirements are hard to meet	Loans too risky without collateral
Interest rates are too high	OGS industry is high risk, requiring a high return/interest rate
Application process and due diligence requirements are too complex and onerous	High-risk transaction requires extensive inquiry process and due diligence
Raising funds is especially challenging for small and local OGS companies	Small companies have limited track records
	Performance data are not always reliable and/or are hard to verify
	Small and local companies sometimes have poor governance/financial management
Foreign exchange risk	
Lack of market intelligence	

Source: Adapted from Last Mile Distribution: State of the Sector Report, Global Distributors

Collective (GDC) 2019.

**Public funding can help to address these challenges** by demonstrating government commitment to the sector and reducing the perceived risk of investing in a given country. Public funding mechanisms can also be specifically designed to provide debt, either directly or through partners such as local banks and specialized debt providers. They can de-risk specific transactions or reduce transaction costs for investors.

**Public funding schemes always need to be designed with consideration of the sector’s broader financing situation.** If public funding is provided to companies for a specific purpose, but their broader financing needs are not met, then their ability to deliver energy access at scale will be constrained. Section 3 outlines ways that public funding can be used to facilitate access to private investment.

# 3: PREPARING THE DESIGN OF A PUBLIC FUNDING PROGRAM

## Review How OGS Is Integrated into the National Electrification Plan

**If off-grid solar (OGS) is not yet integrated into a country's national electrification plan, consider using geospatial, least-cost electrification planning tools to model optimal electrification pathways.**

These powerful tools can be used rapidly and at low cost for that purpose. The resulting models offer a guiding framework for the role of grids, mini-grids, and OGS in achieving universal electricity access. Emerging open-source geospatial planning tools are now widely available, especially following the launch of the Global Electrification Platform (GEP) in November 2019. The World Bank and ESMAP (Energy Sector Management Assistance Program) have supported, or are in the process of supporting, geospatial least-cost electrification plans in 30 countries. Other development partners, such as GIZ and Power Africa, are also providing support.<sup>24</sup>

**If integrated electrification plans are already in place, check that they are up to date.** Older plans may be based on out-of-date assumptions on the cost and pace of grid extension or mini-grid deployment, the cost of solar home systems (SHS), or consumer demand and willingness to pay.

## Consider a Multi-Tier Framework Survey

**The Multi-Tier Framework (MTF) goes beyond a traditional binary measure of “connected or not connected” for electricity access, to measure energy access in terms of quantity, availability, quality, reliability, convenience, affordability, and safety.** MTF surveys collect a comprehensive set of data that can be analyzed to describe in detail the status of electricity access for households, businesses, and institutions. They explore the main reasons why households are not using electricity, or why their usage is limited, and recommend a set of measures to remove such constraints. MTF surveys allow for a nuanced tracking of Sustainable Development Goal 7 (SDG 7) targets, and help governments fine-tune their policies and approaches for reaching them. Governments and development partners are encouraged to review any available MTF survey data before designing public funding mechanisms for the OGS, and to consider undertaking an MTF survey if data are not available, or if they are out of date.

## Undertake an OGS Market Assessment

**A thorough understanding of the market's needs is the cornerstone of effectively selecting and designing a public funding mechanism.** A market assessment can provide a baseline against which progress can be measured, as well as a comprehensive in-depth analysis of market barriers, which can serve as a foundation for designing effective solutions. A market assessment should cover the following:



- **Demand.** If information on demand is not available from a recent MTF survey, a market assessment can also be used to explore these issues. Estimates of current expenditures on kerosene, candles, and battery charging for lighting can reveal consumers' willingness to pay for electrical services and analyze households' ability to pay for OGS systems. Surveys and focus group discussions can be used to get a sense of current levels of awareness and demand, as well as perceptions surrounding quality.
- **Supply.** Analysis of currently available products can provide a sense of the extent to which the current market consists of quality-verified (QV) or non-quality-verified (non-QV) products. Understanding the structure of OGS companies, value and supply chains, and markets can give a sense of the current size and structure of the market, and of its potential growth in the coming years. Consulting with a wide range of companies, from smaller distributors to large companies that may not yet be active in the market, can help identify unmet financing needs and capacity gaps. It enables governments to consider different ways of accelerating market growth, such as creating more OGS companies, accelerating the growth of existing companies, or encouraging international companies to enter a market.
- **Access to finance.** Consulting with companies can shed light on how they are currently financed, their financing needs, and any challenges they face in accessing finance. Consulting with domestic and international investors (including microfinance institutions, banks, and other equity and debt providers) is vital to understand their perceptions of the market and get a sense of what it would take to attract additional private investment into the market. Consulting with development partners, which may already be providing grants or results-based financing to the sector, is also important to understand how public funds are being deployed, what impact this is having, and what constraints remain.
- **Enabling environment.** Market assessments can provide understanding of the policy and regulatory environment in which companies are operating, including the status of any quality standards that apply to the sector, applicable taxes and tariffs, and other policies or regulations that might affect OGS companies' ability to operate, or to grow. If quality standards are not in place, lead agencies may use voluntary standards to promote quality through their projects, or support development of mandatory national standards. If quality standards are in place, support may still be needed to ensure meaningful implementation and compliance.<sup>25</sup>

**Stakeholder mapping and capacity assessment exercises can also be useful to understand the mandates, roles, and support needs of a range of stakeholders in the OGS sector.** Stakeholders include not only companies, aid agencies, and investors, but also government agencies that have a role to play in the promotion of quality, in oversight of importation and taxation policies, or in the implementation of other policies and regulations that affect the sector. Having a strong understanding of stakeholders' current plans and financial commitments can help to avoid duplication and ensure that any new initiative to support the OGS sector adds as much value as possible to what others are already doing.

### Consider the Role of the Lead Agency and Potential Implementing Partners

**In government-led OGS projects, a rural electrification agency (REA) or the ministry of energy is normally the lead agency responsible for project implementation.** Depending on the public funding mechanism being deployed, the lead agency might consider implementing through partners such as national development banks or an independent fund manager. Working with banks and fund managers enables governments to leverage the skills, experience, and capabilities of these institutions to achieve their goals. The choice of funding mechanism may necessitate a certain kind of partner; for example, some REAs would not be able to operate a credit line under their current mandate, but would be able to partner

with a financial institution to do so. Fiduciary risk management is a key consideration—regardless of the funding mechanism being deployed, lead agencies and implementing partners need strong fiduciary risk management systems and processes to guard against the risk of misappropriation of funds, favoritism, or use of position for personal gain.

**Lead agencies should consider working with partners if they lack capacity, or if partners are better-qualified to undertake certain activities than they are.** Lead agencies typically invite partners to carry out activities such as consumer awareness campaigns, development and implementation of quality standards, private-sector capacity building, fund management, and verification of results.

**It is important to have a good understanding of the strengths and weaknesses of potential partners before selecting and designing public funding mechanisms.** The capacity of potential implementing partners is an important consideration when determining which public funding mechanism to use, as well as how best to implement it. REAs and other government agencies might not have the capacity, or the legal authority, to deploy public funding in some ways, for example lending directly to OGS companies themselves. An international fund manager might have in-depth knowledge of the OGS sector as a whole, but might lack knowledge of a given national market, leading to excessive transaction costs on a small-scale project. In contrast, a domestic bank might know the country very well, but lack knowledge and experience of working in the OGS sector.

**Implementing partners should have, or be able to build, deep knowledge of the OGS sector and the country context, as well as capacity to implement the public funding mechanism(s) in question.**

They need to be adequately resourced, with suitably skilled and experienced personnel. They should have a strong mandate to implement their role in the project and should, over time, be able to build established relationships of trust with market actors.

### Consider Other Interventions that Might Be Needed

The principal considerations for selecting funding mechanisms are in Section 4. However, market assessments might reveal a need for further complementary activities, in areas such as:

- **Consumer awareness.** If levels of awareness of OGS are particularly low, or if perceptions of its quality are particularly poor, there may be value in working with a marketing agency or local government agencies to carry out consumer awareness campaigns. These campaigns can use a mix of in-person demonstrations and community meetings, alongside radio, television, and online marketing, to promote OGS and to help customers identify and obtain QV OGS products. They help to raise awareness of, build trust in, and create demand for OGS products.
- **Private-sector technical assistance.** Depending on the market's maturity, companies might require non-financial support in areas such as business strategy and investment readiness, in commercial areas such as customer segmentation and product–market fit, and operational areas such as procurement, marketing, distribution, consumer financing, and after-sales service. Private-sector capacity building can be particularly helpful for smaller companies, helping them to grow and to meet standards so that they can benefit from other forms of public funding.
- **Government technical assistance.** There may be a need for technical assistance for REAs if they are working with the private sector for the first time, or are learning to manage and disburse funding in new ways. Standards bureaus may need support to develop and implement quality standards, while customs and revenue authorities might need support to develop new taxation and importation processes.

- **Financial-sector technical assistance.** If one of the project's long-term objectives is to enable OGS companies and their customers to access finance from domestic financial institutions, technical assistance may be needed for microfinance institutions (MFIs) and/or domestic banks. This can help to build their capacity to accurately appraise the risks of investing in OGS companies, and to develop the systems and processes needed to, for example, accept a company's receivables as collateral.
- **Market intelligence studies.** Markets evolve quickly and it is important that companies, investors, and project implementers have access to up-to-date market research as well as insights into the latest trends. Regular market intelligence studies enable informed decision-making and help public funding mechanisms adapt to changing market conditions so that they stay efficient and effective over time.

The Regional Off-Grid Electricity Access Project (ROGEAP) in West Africa is a good example of a comprehensive project that seeks to address all major market barriers through a range of public funding mechanisms and complementary market-enabling interventions. It offers solar companies upfront grants, a credit line, and risk mitigation alongside technical assistance. It also supports a wide range of market-enabling activities such as market intelligence studies, consumer awareness campaigns, and development of quality standards (see Box 3.1).

### BOX 3.1:

#### **Regional Off-Grid Electricity Access Project: Offering Smaller OGS Companies Credit Lines with Various Complementary Instruments**

**Funding mechanisms:** Upfront grants, a credit line and risk mitigation, alongside technical assistance and a wide range of market enabling activities

Regional Off-Grid Electricity Access Project (ROGEAP) aims to increase access to sustainable electricity services in 15 ECOWAS member countries and four additional countries (namely Cameroon, Chad, Mauritania, and Central African Republic). It provides grants to smaller companies alongside a credit line managed by the West African Development Bank (BOAD), with risk mitigation that varies depending on the size and risk profile of the investee. Other complementary support includes:

- **Consumer awareness campaigns** to promote QV OGS solutions through marketing campaigns.
- **Private-sector technical assistance**, particularly for smaller companies.
- **Government technical assistance** around the adoption and implementation of a harmonized regional quality standard.
- **Market intelligence studies** to inform company, investor, and project-level decision-making.
- **Quality assurance (QA)** to help countries develop QA frameworks for OGS systems suitable for institutional applications, such as health clinics and schools.

Source: World Bank.

## 4: PUBLIC FUNDING MECHANISMS

This section outlines the key considerations when selecting funding mechanisms to support off-grid solar (OGS) and reflects on how the mechanisms can be used in combination, before exploring in depth the advantages, limitations, and design considerations for each mechanism.

Two main kinds of funding mechanisms are considered: **Supply-side mechanisms, which channel funding to companies or investors and are designed to reduce the cost and risk of supplying products to end users.** They focus on reducing upstream risks and costs for business, without affecting consumer price expectations. Supply-side mechanisms encourage companies to expand their operations. They reduce risks and costs for companies, which can indirectly help to lower prices for end users and reduce the affordability gap through economies of scale and increased competition among companies.

**Demand-side mechanisms, which are designed to make OGS more affordable for end users, with funding channeled either direct to end users or through companies.** They help to overcome affordability challenges, while still enabling companies to operate on a commercial basis.<sup>26</sup> Funds can be disbursed to end users in cash or in kind, for example through vouchers that provide a discount. Funds can also be disbursed to companies, which use the funds to offer lower prices, which are independently verified once sales have been achieved. Results-based financing (RBF) programs, although broadly categorized as supply-side mechanisms, can also act as demand-side mechanisms if they directly reduce end-user prices (see Section on “Demand-Side Subsidies”). This category also includes public procurement models that provide a cost-effective solution for the supply of affordable OGS products to end users in areas that cannot be served on a commercial basis because of limited ability to pay, prohibitively high cost or risk of distribution, or because the target population to be reached is too small or too dispersed.

### Selecting Funding Mechanisms

**Governments and development partners need to consider a range of factors when deciding which funding mechanisms to deploy.** Some of these relate to internal considerations, such as the objectives they are trying to achieve, the time available, and the implementing capacity of the lead agency as well as any potential partners. Program implementers must also consider the risks inherent in more complex program designs, such as the risk of delays in approval and disbursement, potential implementation capacity constraints, and the need to put in place more complex environmental and social safeguards. Other factors relate to external considerations, such as the current status of the market and the broader country context. Table 4.1 provides an overview of the circumstances in which each public funding mechanism is likely to be appropriate. In most cases, a mix of different mechanisms will be required to address barriers identified during the preparation phase. Mechanisms listed below can be highly complementary and reinforce one another.

**TABLE 4.1: SUITABILITY OF PUBLIC FUNDING MECHANISMS**

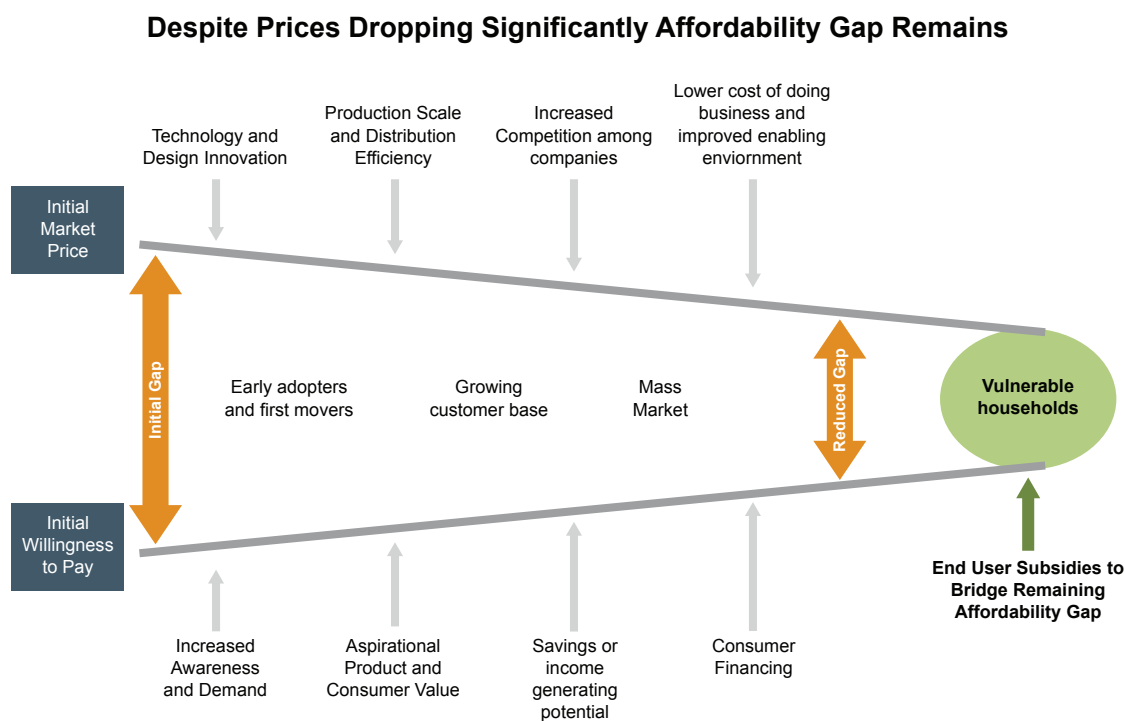
<b>PUBLIC FUNDING MECHANISM</b>	<b>WHEN IS IT SUITABLE TO USE IT?</b>
<b>SUPPLY-SIDE MECHANISMS</b>	
Upfront Grants	<ul style="list-style-type: none"> <li>• Nascent markets</li> <li>• Young and innovative companies</li> <li>• Companies lack track record to attract investment</li> <li>• There is a need to incentivize established companies to enter a new market</li> </ul>
Results-Based Financing (RBF)	<ul style="list-style-type: none"> <li>• High costs or risks are preventing companies from entering an underserved geographical area, but companies are already operating nearby</li> <li>• There is a need to rapidly scale up the number of people reached, or the geographical area served by existing OGS companies</li> </ul>
Tax exemptions	<ul style="list-style-type: none"> <li>• The OGS sector has political support and market growth is a government priority</li> <li>• Affordability is a major barrier to growth</li> <li>• There is a need to promote quality verified OGS</li> <li>• Revenue and customs authorities are willing and/or able to implement quality-linked tax exemptions</li> <li>• If introduced, tax exemptions can be relied upon to remain in place for a reasonable length of time</li> </ul>
Credit Lines	<ul style="list-style-type: none"> <li>• Companies require working capital and are close to being able to meet lender requirements</li> <li>• Domestic financial sector is close to having the willingness and capacity to lend to the OGS sector</li> <li>• Banks are reluctant to lend because of liquidity constraints</li> </ul>
Risk Mitigation Instruments	<ul style="list-style-type: none"> <li>• Companies require working capital and are close to being able to meet lender requirements</li> <li>• Domestic financial sector is close to having the willingness and capacity to lend to the OGS sector</li> <li>• Financial institutions have liquidity but are reluctant to lend because of perceived risk</li> <li>• Financial institutions lack experience of lending to the OGS sector</li> <li>• Financial institutions are unable to accept OGS assets, such as receivables, as collateral</li> <li>• Bank systems and processes or regulatory requirements disincentivize lending to OGS companies</li> </ul>
<b>DEMAND-SIDE MECHANISMS</b>	
Demand-Side Subsidy (DSS)	<ul style="list-style-type: none"> <li>• Households are unable to afford OGS products</li> <li>• Supply-side mechanisms to address affordability are either not feasible, or are already being implemented, but an affordability challenge remains</li> </ul>
Public Procurement	<ul style="list-style-type: none"> <li>• A market-based solution is not viable because target population is too poor, too remote, too few, or too dispersed</li> </ul>

Source: ECA.

**Program implementers must first decide on their objectives, before selecting a public funding mechanism.** When markets are nascent and companies are small, upfront grants and technical assistance are likely to be needed, to enable the sector to grow and begin attracting private investment. As markets mature, RBF is likely to become more appropriate to incentivize companies to enter underserved geographical areas. Credit lines and risk mitigation instruments may also be needed to ensure that companies have sufficient access to debt for working capital. Tax exemptions can help to address affordability and support growth at any stage of a market’s development.

**In most settings, supply-side mechanisms should be considered before demand-side mechanisms.** Supply-side mechanisms can bring down market prices by means of supporting technology and business model innovation, fostering competition, lowering costs, and improving the enabling environment. They can increase willingness to pay by increasing awareness and demand, making solar home systems (SHS) aspirational, and enabling customers to save money by avoiding inefficient fuels. They can also help to address affordability by enabling companies to offer consumer financing on a pay-as-you-go (PAYG) basis. Figure 4.1 shows how supply-side mechanisms can be used to bridge the gap between initial market prices and initial willingness to pay, minimizing the need for higher-cost demand-side subsidies to bridge the remaining affordability gap.<sup>27</sup> For example, EnDev—the strategic partnership of donors to support access to modern energy—introduced demand-side subsidies in Rwanda following years of supply-side support to the market. EnDev noted a severe decline in sales, after years of growth. It was at this point that they realized the addressable market had become saturated, and a demand-side subsidy instrument would be needed to reach those that still could not afford an OGS product (see Box 5.9).

**FIGURE 4.1: A SCENARIO IN WHICH BOTH SUPPLY- AND DEMAND-SIDE MECHANISMS PLAY A ROLE IN BRIDGING THE AFFORDABILITY GAP**



Source: ESMAP.

**In situations where supply-side mechanisms are feasible, they can reach more people, at lower cost, than demand-side mechanisms.** Since they are focused on accelerating organic market growth, they tend to attract a greater proportion of private co-investment. Some supply-side mechanisms, such as credit lines and risk mitigation instruments, are reimbursable and funding can be recycled to continue supporting the sector over time. In contrast, demand-side subsidies require continuous and sustained investment of public funding to cover their cost. In situations where affordability is a major constraint, supply- and demand-side mechanisms may both be needed, and it can make sense to implement them in parallel.

### Combining Funding Mechanisms

**A holistic approach that combines more than one public funding mechanism with other interventions is usually needed, to avoid bottlenecks.<sup>28</sup> Many government-led OGS projects have taken credit lines as their starting point, but this is not always an appropriate instrument.** One reason for the focus on credit lines has been that governments prefer to lend rather than make grants when using International Development Association (IDA) loan funding. They may also be reluctant to make grants to companies because of concerns about their trustworthiness and capacity to deliver. Typically, governments provide loans and risk mitigation instruments via an apex institution, such as a state-owned development bank, to domestic banks who are then expected to invest in OGS companies. But if the financial sector lacks the capacity or willingness to lend, or the OGS private sector is still nascent and a long way from being able to meet banks' lending requirements, failure to disburse credit lines can occur. OGS companies, especially larger ones, may also be able to access financing at more attractive rates or terms from international sources (see section on "Credit Lines").

**If the objective is to support nascent markets, or expand them into underserved areas, a combination of upfront grants and RBF can work well.** Upfront grants can help smaller companies develop to the point where they are able to access credit, while RBF can help companies expand. The approaches can be combined, with some funding disbursed upfront upon achievement of milestones linked to set-up costs, such as establishment of a physical presence in an underserved location, and some funding disbursed based on sales achieved. This approach is used in the Kenya Off-Grid Solar Project (KOSAP) (see Box 4.1).<sup>29</sup> RBF can also be "frontloaded" to shorten companies' working capital cycles, by making partial payments to companies upon verification that they have placed orders for stock, or once those orders have arrived in the country, in addition to payments made upon verification of sales achieved.

#### BOX 4.1:

### Kenya Off-Grid Solar Project: Combining Results-Based Financing and Working Capital to Address Upfront Capital Needs

**Funding Mechanisms:** RBF and credit lines, together with technical assistance and capacity building

Kenya Off-Grid Solar Project (KOSAP) was initiated by the government of Kenya to close the access gap by providing electricity services to remote, low-density, and traditionally underserved areas of the country. Two financing instruments were made available to eligible solar service providers (SSPs):

- **RBF** of \$12 million to compensate SHS operators for initial, ongoing incremental, and higher risks associated with an expansion of operations in the 14 KOSAP service territories.
- **A debt facility** of \$30 million to support costs associated with bringing hardware inventory into the market and medium-term consumer financing to enable households to pay off the systems over time. The debt is only available in Kenyan shillings.

Participating companies can claim up to 30 **percent** of RBF funds upfront upon contract signing. They must submit a workplan showing how these funds will be used and agree milestones to be met before funds are disbursed. They can claim a further 60 **percent** of their RBF upon verification of sales achieved. The remaining 10 **percent** is paid after one year, upon verification that solar systems are still operational, with warranties honored and after-sales service provided as needed.

Source: Interviews with World Bank staff.

**If companies lack access to working capital financing, credit lines and risk mitigation can also be considered.** Credit lines and risk mitigation instruments are appropriate if OGS companies are close to being able to meet lender requirements, and the financial sector has the capacity and will to lend with a reasonable degree of risk mitigation. The Regional Off-Grid Energy Access Project (ROGEAP) risk mitigation instrument covers up to 50 percent of the loan principal in case of default by mature companies, and up to 80 percent of the loan principal for early-stage companies, reflecting the higher challenges that the early-stage companies face in meeting lender requirements for collateral (see Box 3.1).<sup>30</sup>

**In settings where risks are already very high and affordability is low, and companies are unwilling to take on additional risk, the provision of supply-side and demand-side support in parallel can work well.** The Yemen Emergency Electricity Access project, for example, imported quality-verified (QV) solar systems and gave them to participating microfinance institutions (MFIs) to sell, before MFIs made a contribution to the landed cost of goods after sales had been achieved. Customers were able to access QV OGS at affordable prices, and MFIs were able to get to know rural customers and markets without having to commit their own financial resources upfront. Once companies had built capacity and experience, they become more willing and able to take risk and commit their own financial resources in future (see Box 4.2).



#### BOX 4.2:

### Yemen Emergency Electricity Access Project

**Funding Mechanisms:** Supply-side and demand-side support in parallel, in a humanitarian setting

Yemen Emergency Electricity Access Project (YEEAP) sought to improve access to electricity in rural and peri-urban areas through subsidized micro-credits for households to purchase SHS. However, MFIs were reluctant to commit their own funds, or take on significant risks by attempting to sell QV OGS in rural areas for the first time. The United Nations Office for Project Services (UNOPS), the implementing partner, provided MFIs with an **in-kind grant** to distribute SHS to eligible beneficiaries. UNOPS procured QV OGS products, imported them and gave them to participating MFIs in major cities. MFIs then sold them, before making a partial repayment to UNOPS towards the landed cost of goods.

Customers were able to access QV OGS at affordable prices and experience the benefits of QV products for the first time. MFIs did not have to commit their own working capital upfront and were able to participate in the project without taking significant risks. They were able to sell SHS at affordable prices, while covering their sales, distribution, and financing costs. They built their capacity and experience of selling QV OGS in rural areas and were able to learn about the customers and products, as well as the business model required.

Three years later, UNOPS introduced an RBF mechanism targeting the larger, less capital-constrained MFIs. Under this mechanism the MFIs procure and import QV SHS themselves and sell them, before receiving payment from UNOPS upon verification of sales. MFIs would not have been willing to bear the upfront costs and risks of procuring their own QV products if they had not previously had experience selling QV OGS in rural areas through the in-kind grant mechanism. In future, RBF amounts can be gradually reduced to facilitate a transition to a sustainable, commercial market.

Source: Interviews with World Bank staff.

**In situations where market-based solutions are not viable, a public procurement approach can be used.** This approach has been used extensively in Latin America, where the remaining populations lacking access were too small, and too dispersed, for a market-based solution.<sup>31</sup> It is commonly used in fragile, conflict-affected, and vulnerable (FCV) contexts, humanitarian settings, and disaster relief settings, where ability to pay is very low, distribution costs and risks are very high, or weak governance and institutional capacity means that alternative public funding mechanisms cannot be deployed without incurring unacceptable fiduciary risks. Public procurement is also widely used for the electrification of off-grid public institutions, such as clinics and schools.

## Upfront Grants

**Upfront grants are non-repayable funds transferred from government or donor agencies to solar companies, to help them develop new products, test new business models, or expand into new markets.** Typically, grants are disbursed in tranches upon completion or achievement of pre-agreed milestones or deliverables. In the OGS sector’s early years, upfront grants played a catalytic role in the emergence of a new generation of affordable, high-quality solar lanterns as well as new technologies and business models such as PAYG. Narrow objectives and criteria can help focus grant funding on addressing a specific objective, while more open-ended criteria can be used to source innovation and ideas from the private sector. Their key advantages and limitations are summarized in Table 4.2.

**TABLE 4.2: ADVANTAGES AND LIMITATIONS OF UPFRONT GRANTS**

### ADVANTAGES

- Can have a catalytic role in nascent markets, helping businesses develop a track record and become investment-ready, especially when combined with capacity-building support
- Can accelerate product or business model R&D
- Can incentivize companies to enter high-risk markets

### LIMITATIONS

- Inherently involves “picking winners,” which gives some companies an advantage over others
- Can be difficult to build inclusive portfolios that support both larger and smaller companies
- Risk of poor performance lies with grant maker
- Grants may not be large enough, or long enough, to enable companies to access private capital—more than one phase of grant support might be needed

**Upfront grants can play an important role in supporting the growth and development of smaller, earlier-stage or locally owned companies, especially in more nascent markets, enabling them to grow to a point where they can access private capital.** Early-stage solar companies operating in the OGS sector often have untested business models that they cannot validate and commercialize without grant funding. When markets are at an early stage of development and companies are too small to attract investment, upfront grants can play a vital role in helping companies conduct R&D, refine their product offering, hone their business model, build a robust supply chain, develop a track record, and become investment ready. When combined with technical assistance and capacity building, upfront grants can be particularly effective in helping companies to build their core team. Grant makers such as the AECF are seeking to support early-stage companies develop to the point where they can access equity or debt financing (see Box 4.3).<sup>32</sup>

**BOX 4.3:****AECF REACT Fund Targeted at Smaller Companies**

**Funding Mechanisms:** Upfront grants, interest-free loans, and technical assistance

The AECF provides grants, interest-free loans, and technical assistance to renewable energy companies. Its REACT SSA fund provides grants and interest-free loans worth between \$100,000 and \$1.5 million, coupled with intensive technical assistance, in early-stage markets such as Burkina Faso, Liberia, and Mali. Whereas previous funding windows targeted larger companies and had a higher minimum funding amount, REACT SSA specifically seeks to include smaller, earlier-stage companies. Transaction costs and risks are expected to be higher than in other windows, but smaller-scale financing is expected to lead to a larger number of locally owned companies getting to a point where they can access commercial finance.

Source: AECF website.

**Upfront grants can also be used by more established companies to accelerate product or business model R&D.** Public funding for product R&D is most needed for early-stage technologies, such as those used for productive uses of energy. Public funding for business model R&D can also play an important catalytic role. For example, Nova Lumos used a seed grant from the GSMA (the global mobile telecoms body) to partner with MTN Nigeria and develop an innovative prepaid electricity service using airtime credit. The project demonstrated that airtime was a viable payment mechanism for PAYG markets with limited mobile money penetration. It highlighted how partnerships with OGS companies could benefit telecoms companies by increasing average revenue per user (ARPU) and customer loyalty. The project enabled Lumos to access debt financing and to expand across the country.<sup>33</sup>

**Upfront grants can also be used to incentivize companies to enter high-risk markets.** For example, Bboxx used grant funding from the Shell Foundation, the UK Foreign, Commonwealth and Development Office, and the US Agency for International Development (USAID) to pilot its PAYG business model in the Democratic Republic of the Congo. The pilot delivered remarkable results, with ARPU being four times higher than the average OGS customer in East Africa. The company has since been able to access RBF and working capital from a government project support by the World Bank.<sup>34</sup>

**Upfront grants involve selecting a small number of companies and providing them with support, which gives them an advantage over others.** In the past they have tended to be awarded to larger, more established companies, giving them an additional advantage over smaller, earlier-stage companies that already have less access to equity and debt financing. Program implementers choose to partner with larger, more well-established firms because they are seen as less risky and more likely to achieve the

desired results. Working with larger firms can also reduce transaction costs, since portfolios consist of a small number of large grants rather than a larger volume of smaller grants.

**However, grant funding for smaller companies is particularly needed for the development of a vibrant, competitive, sustainable, and resilient OGS market.** As mentioned in Section 2, deep market knowledge, strong networks, and a lighter capital structure can give these companies an advantage when seeking to serve harder-to-reach customers. Many governments are increasingly keen for public funding to go to smaller, locally owned and led OGS companies. Donors such as USAID, multi-donor initiatives funds such as AECF, and World Bank-supported government projects such as ROGEAP in West Africa and KOSAP in Kenya, are all taking steps to ensure the participation of smaller OGS companies in their programs.<sup>35</sup>

**With upfront grants, the risk of poor performance lies with the grant makers.** As funds are committed and paid upfront, they are unrecoverable should the company fail to meet expectations. The larger the upfront payment the greater the risk of non-performance, although this can be partly mitigated by disbursement in tranches linked to milestones, or requirements for companies to provide match funds to show commitment. In some cases, funders may be happy to take all the risk, to encourage companies to focus more on experimentation and innovation.

**Grants need to be of sufficient size and duration to enable companies to access other forms of capital once they come to an end.** Follow-on funding could take the form of a second, larger, longer-term grant, or—in an ideal world—companies would be able to access equity and debt financing. Often, however, grants are too small, or too short, and companies find themselves again facing a cashflow challenge as grants come to an end. The scarcity of grant funds makes them highly competitive and highlights the need to secure alternative sources of financing over time to make a material and sustainable impact.

## Results-Based Financing

**Results-Based Financing (RBF) describes funding that is disbursed upon verification of achievement of a predefined result, such as the sale of an SHS.** It is based on the principles of conditionality, independence, and verification. The recipient is only paid on *condition* that the result is achieved. Recipients are *independent* and decide how best to achieve the results, and results are *verified* to ensure that they are achieved.<sup>36</sup>

**RBF approaches have been deployed in a wide range of countries to promote uptake of OGS products.** Their popularity among the donor community is linked to a desire to transfer risk away from the donor to the company and make development aid more effective, as well as to overcome the moral hazard that is often associated with upfront grant funding. EnDev has been the main proponent of RBF for energy access, deploying the approach through 17 projects across 14 countries around the world between 2012 and 2020. Subsidies are typically structured as a one-time payment upon sale, but in some cases a proportion of RBF is disbursed either earlier, upon procurement or importation, or later, upon delivery of satisfactory after-sales service.

**RBF can be used as a supply-side mechanism, a demand-side mechanism, or both.** Demand-side subsidies can be channeled through companies in the form of “pro-poor” RBF, enabling them to offer products at lower prices, while still adhering to the principles of conditionality, independence, and verification. The company may be able to choose how much to reduce prices, or a fixed price reduction may be specified as a condition for receipt of RBF, in which case prices are verified along with sales before funds are disbursed. Key advantages and limitations are summarized in Table 4.3.

**TABLE 4.3: ADVANTAGES AND LIMITATIONS OF RESULTS-BASED FINANCING**

<b>ADVANTAGES</b>	<ul style="list-style-type: none"><li>• Can be used to achieve a wide range of objectives, including incentivizing companies to enter a new area, or scale up quickly</li><li>• Can be used to address financial bottlenecks at different points along the value chain (e.g., providing funding to manufacturers, importers, or their retail partners) or the sales cycle (e.g., providing funding for procurement, importation sales, or after-sales service)</li><li>• Financial risk lies with the recipient company rather than funder</li><li>• Lower risk of misuse of funds compared to upfront grants</li><li>• Can help to foster competition, which can help to reduce prices</li></ul>
<b>LIMITATIONS</b>	<ul style="list-style-type: none"><li>• Not an appropriate mechanism for smaller, more basic solar lights sold for cash</li><li>• Need to be carefully designed if there is an objective to support smaller companies</li><li>• Determining the “right” amount of incentive can be challenging</li><li>• Tracking, verification, disbursement, and reporting can be challenging for both companies and funders</li><li>• RBF can have a limited impact if companies remain capital-constrained when the RBF program ends</li></ul>

**RBF can be a powerful, versatile tool in incentivizing companies to reach non-commercial markets.** Incentive levels can be linked to verified sales in a specific geographical location. By subsidizing sales made in the target area, RBF can convince companies to enter an area that they were previously reluctant to serve. In a market with high pico-PV penetration, RBF can be provided to Tier 1+ systems only, to incentivize people to move to higher tiers of electrification.

**RBF can also stimulate investment in specific technologies and accelerate OGS market growth by targeting specific consumer groups and companies, irrespective of their size and development stage.** RBF schemes can be used to incentivize upstream investment, catalyze wholesale markets, and support large-scale procurement. For example, the Global LEAP RBF facility adopted a holistic approach to scaling the early-stage market for the most energy-efficient appliances, which involved identifying and promoting leaders in early-stage product markets and bringing those products to market at scale by reducing financial risks related to appliance procurement. The program resulted in the procurement of over 265,000 high-quality off-grid televisions, fans, and refrigerators by 27 companies across the four target countries.<sup>37</sup>

**In an RBF approach, the risk of poor performance lies with the recipient and there is a lower risk of misuse of funds compared with upfront grants.** If results are not achieved, then funds are not disbursed. This helps to reduce risk for the funder. RBF mechanisms are linked to specific objectives and are contingent on the delivery of results that are independently verified. With robust verification systems and processes, implemented by independent verification agents, the risk of moral hazard or of misuse of funds is lower for RBF than for upfront grants.

**RBF can help to foster competition, which can lead to price reduction.** If multiple companies are provided with the same level of RBF support to enter an area, then competition helps to keep prices down.<sup>38</sup> RBF can also use auctions to maximize the efficient use of public funds. In this approach, companies bid

for the level of public funding they need to deliver a certain result, and funders select the most credible proposals offering value for money (see Box 4.4). This approach is only recommended where there are likely to be enough bidders, with enough knowledge of the market they are seeking to serve, to be able to submit credible proposals. If bidders are inexperienced, they may submit unrealistic proposals that they cannot deliver on, or there may not be enough competition between bidders to ensure efficient use of public funding, with a higher risk of collusion between applicants.

#### BOX 4.4:

### Beyond the Grid Fund for Africa RBF Reverse Auction

#### Funding Mechanism: Upfront Grants

Beyond the Grid Fund for Africa (BGFA) aims to bridge the gap between early-stage financing and concessional and/or commercial debt. To be eligible, firms must provide evidence of operating at certain scale. Energy service providers need to have a minimum of 200,000 connections to apply. To best match the grant amount with the amount needed to bridge the gap, BGFA funding is awarded to providers using a reverse auction. Providers bid for the lowest value of subsidy needed to scale up their operations. Other criteria are also used, such as overall best value for money, to select the winner of the bid.

BGFA is based on a pilot project in Zambia, where the same reverse auction approach was used. The project funded four firms with up to €10 million. The four firms provide a variety of energy services, including pay-to-own SHS, PAYG SHS, micro-grids, and bioenergy and solar cooking products. Together the four firms have leveraged \$41 million of co-funding, reaching close to one million beneficiaries.<sup>81</sup>

**RBF is not an appropriate mechanism for smaller, more basic solar lights sold for cash.** The cost of collecting customer contact details is prohibitive for companies focused on selling high volumes of low-cost, low-margin products. Basic solar lights play a vital role in seeding markets, establishing trust in solar, and creating demand for larger PAYG SHS. They are increasingly excluded from public funding mechanisms designed to support the sector, even though they are the only affordable option for a large proportion of people lacking access and constitute a major product category for leading OGS companies such as D.Light and Greenlight Planet, as well as many smaller distributors. If companies are selling a mix of basic solar lights for cash and larger SHS on PAYG, then this may not present an issue, since RBF can still be linked to the sale of larger systems and used to support the company's overall business plan. If companies are only selling basic solar lights, however, then alternative funding mechanisms, such as upfront grants or credit lines, could be considered. Funding and capacity-building support can also be used to help these companies explore the possibility of selling larger SHS on PAYG, alongside their existing operations selling basic solar lights upfront for cash.

**RBF needs to be designed carefully if there is an objective to include smaller, locally owned and led companies.** As with upfront grants, RBF is usually limited, with competition among companies for inclusion

in RBF schemes. This can lead to RBF portfolios consisting of a small number of large international companies, helping funders to minimize risk and transaction costs while benefiting from economies of scale. However, there may be good reasons for supporting less-efficient, smaller local companies as well to build a sustainable, resilient market for the long term. Funders can make their RBF portfolios more inclusive of smaller companies by allowing any company that meets eligibility requirements to participate, rather than competitively selecting firms. They can also make RBF more inclusive by establishing separate funding windows for smaller companies, with shorter application processes, eligibility requirements that are easier to meet, and provision of more extensive capacity building or technical assistance to recipients.

**Determining how to set the “right” amount of incentive can be challenging.** Funders have a range of options for designing the structure of an RBF mechanism, and a key decision they face concerns the value of the RBF incentives and how they are determined. If the subsidy proves inadequate to compensate companies for costs and risks, there will be insufficient company participation in the funding mechanism, whereas if it is too high, public funding is not used efficiently. Linking RBF payments to energy output (for example, watts peak [Wp]) is one option, while linking incentive levels to energy access tiers under the Multi-Tier Framework is another (although further differentiation is usually needed between systems providing lower or higher levels of service within the same tier).

In some cases, EnDev has used stakeholder consultation and market analysis to estimate the additional revenue that would be needed to incentivize a company to enter a targeted market. This approach requires monitoring uptake and adjusting incentives where necessary. They have also used market mechanisms such as auctions to set incentive levels. Both approaches are combined with technical criteria that align incentive levels with the level of service provided and/or the overall cost of the system sold.<sup>39</sup>

**Tracking, verification, disbursement, and reporting can be challenging for both companies and funders, especially at the outset of an RBF scheme.** Lead agencies need to initiate recruitment of fund managers or independent verification agents as quickly as possible to avoid disbursement delays, especially if the lead agency has a long or complex procurement process. Fund managers, independent verification agents, and companies all require the capacity to play their respective roles. Verification agents must complete verification in a timely manner, including resolving any issues they identify. Fund managers must disburse in a timely manner once results are verified, to ensure companies do not face cashflow challenges, and companies must ensure they have adequate systems and processes in place for the collection and management of customer data, as well as the timely submission of reports and RBF claims. They may also need to build capacity to meet requirements in other areas, such as ensuring their agents and retailers clearly communicate to customers about warranty availability, complaint hotlines, and responsible e-waste management. Funders should build flexibility into their program designs and be prepared to adapt if, for example, they are unable to recruit a suitably qualified verification agent, the verification system or process they originally envisioned is not running smoothly, or if companies lack capacity to provide adequate data and require further support.

**The impact of RBF can be limited if companies remain working capital constrained.** Participating companies need access to capital to meet their operating needs and to procure stock before they receive RBF payment. Several RBF programs have struggled because companies lacked access to working capital. In the Democratic Republic of the Congo, a World Bank-supported RBF scheme worked well for larger companies but proved less beneficial for smaller local companies that faced more significant working capital constraints. World Bank procurement regulations setting a maximum threshold for upfront disbursement at 10 percent prevented smaller local companies from being able to fully participate, since they lacked sufficient working capital to buy stock in the first place.

## Tax Exemptions

**Tax exemptions are an effective policy support tool that can lower the cost of OGS products for end users.**<sup>40</sup> Although not strictly a mechanism for the deployment of public funding, they are included here because governments forego revenue, which has a similar fiscal impact to the deployment of public funding. Exemptions send a powerful signal of government commitment to OGS market growth, which attracts companies and investors, increasing competition and ultimately benefiting consumers. Table 4.4 summarizes their key advantages and limitations.

**TABLE 4.4: ADVANTAGES AND LIMITATIONS OF TAX EXEMPTIONS**

<b>ADVANTAGES</b>	<ul style="list-style-type: none"><li>• Send a powerful signal that helps to attract companies and investors into a market</li><li>• Improve affordability and accelerate market growth, with low market distortion risk</li><li>• Can help QV products to compete on price with non-QV products</li></ul>
<b>LIMITATIONS</b>	<ul style="list-style-type: none"><li>• Quality-linked importation and taxation processes can be challenging to set up</li><li>• Can be politically contentious, with a risk of change at short notice</li><li>• Governments may be concerned about loss of government revenue</li></ul>

**Value-added tax (VAT) and import duty exemptions have been a major driver of market growth all over the world, bringing high impact at low cost.** Kenya, Tanzania, Uganda, and Rwanda have all used tax exemptions to drive growth; these four countries alone account for over 25 percent of the global OGS market share. Exemptions are also widely used in other African countries within the East African Community (EAC) and Economic Community of West African States (ECOWAS). They can be applied at a national or regional level. Countries can choose to introduce VAT exemptions, duty exemptions, or both. Sometimes exemptions are applied to all products imported under a given harmonized system code, whether QV or not, but usually exemptions are applied to a list of qualifying solar products or components that meet quality standards. In some cases, partial tax reductions are also used. Unlike other public funding mechanisms, tax exemptions are untargeted, with low risk of market distortion—they benefit all companies selling eligible products, and their customers, equally.

**Reducing VAT and import duty enables OGS companies to offer their products to end users at substantially lower prices, which helps to address affordability.**<sup>41</sup> Competition between OGS companies helps to ensure that savings made because of tax exemptions are passed on to end users. A Duke University study of sales data from 700,000 SHS in Kenya and Uganda found that a 20 percent import tariff on SHS reduced sales by 18 percent for basic systems and 32 percent for larger kits that include televisions.<sup>42</sup> A similar study in Kenya found that reducing prices of solar lamps from \$7 to \$4 increased household uptake from 37 percent to 69 percent.<sup>43</sup>



**Tax exemptions can help QV products to compete with non-QV products on price.** Non-QV products tend to be significantly cheaper than QV products, in part because they are more likely to be imported through informal channels without incurring tax. Governments can develop quality standards, then link tax rates to those standards. Governments can choose to adopt International Electrotechnical Commission (IEC) Technical Standard 62257-9-8, the only internationally recognized standards for these solar lights and home systems up to 350 Wp, or use it as a starting point for developing their own national standards.<sup>44</sup> Other IEC standards are available, covering components such as PV modules, batteries, and inverters for larger, component-based OGS systems.

**Tax exemptions are most efficient when procedures for qualification, importation, and verification are clear, transparent, and quick.** Slow or opaque verification procedures at import can be costly, putting a strain on company cashflows if products are held up at customs awaiting approval. Customs authorities, revenue authorities, and standards bureaus all have a role to play in establishment of “pre-verification of conformity” (PVoC) systems and processes, used for verifying whether products meet quality standards and are eligible for tax exemptions at import. Pre-shipment assessments are conducted by licensed agents to ensure product conformity before shipment. Once in place, a PVoC process can be used to prevent non-QV products from entering a market, or to apply different tax rates to QV products.<sup>45</sup>

**Quality-linked importation and taxation processes can be challenging to set up. Clear lines of communication with the private sector can help.** PVoC processes should be piloted before being rolled out at scale. Stakeholders with a role to play in implementing new systems and processes may require capacity building, with plans and budgets put in place to ensure meaningful implementation. Seeking feedback from the private sector on how new importation processes are functioning can be helpful, especially when they are first being set up. This can be done in consultation with the Global Off-Grid Lighting Association (GOGLA) and with national renewable energy associations, where they exist.<sup>46</sup>

**Tax exemptions can be politically contentious, with a risk of changes in tax rates being introduced at short notice, which causes significant disruption.** Tax exemptions should only be considered if there is strong political support for the OGS sector. Given the time it takes to set up a functioning, quality-linked tax exemption, lead agencies need to be confident that the tax exemption will remain in place for at least a few years. Companies need to be sure that tax rates will remain stable so that they can set their pricing strategy accordingly. If changes are made, companies need to be given sufficient advance notice so they can adjust their plans accordingly.

**The loss of government revenue is a concern for many governments, but research has shown that OGS tax exemptions lead to minimal foregone revenue and can have a net positive fiscal impact.** Studies in Kenya, Mozambique, and Liberia have all found that accelerated OGS market growth leads to additional revenues from income tax and business tax that exceed VAT and duty revenue losses.<sup>47, 48</sup> Governments and their development partners are encouraged to undertake research to better understand the revenues raised from the OGS sector and the potential fiscal impact of tax exemptions, as well as the potential impact of accelerated OGS market growth on kerosene subsidy expenditure, job creation, income tax, and business tax revenues.

## Credit Lines

**OGS companies need working capital to finance inventory and extend credit to customers, but commercial banks generally consider such loans too risky.** OGS companies need working capital loans in a suitable currency with reasonable interest rates, acceptable collateral requirements, and repayment over a long enough period. Lending from local financial institutions is, however, limited. Banks may lack liquidity

in some cases, and/or lack incentives to lend to OGS companies due to information gaps, industry immaturity, and perceived risk. Loans offered by commercial banks typically provide terms (pricing, tenor, and collateral requirements) that do not meet the needs of OGS companies.

**Financial intermediary models that channel credit through domestic banks, or specialized OGS debt funds, are filling the gap.** With credit lines, funding is provided to participating banks to solve liquidity issues. If this funding is provided at concessional rates, or accompanied by risk mitigation instruments such as guarantees, banks have a further incentive to lend to OGS companies. Technical assistance can also play an important role in helping financial institutions understand the sector, and to consider ways they might adapt their credit and risk management processes to be able to invest.

**Credit lines are typically structured with a publicly owned development bank that can borrow funds directly from the government, and then on-lend to participating financial institutions (PFIs) or to companies directly,** depending on whether a wholesale or retail lending approach is taken. PFIs can be commercial banks, but may also be other types of financial institution such as MFIs, savings and credit cooperative societies (SACCOs), cooperative banks, and credit unions, or specialized solar debt funds. PFIs on-lend to OGS companies at market or concessional rates.

Credit lines need to be flexible, innovative, and customized to country-specific requirements. For example, the Rwanda Renewable Energy Fund (REF) opened a fourth “window” for direct financing of OGS after there was insufficient uptake of credit made available through banks under window two. By operating multiple windows in parallel, the REF has built flexibility into its design, and is able to quickly respond if uptake is higher or lower under a particular window, without the need for a time-consuming restructure of the program (see Box 4.5).

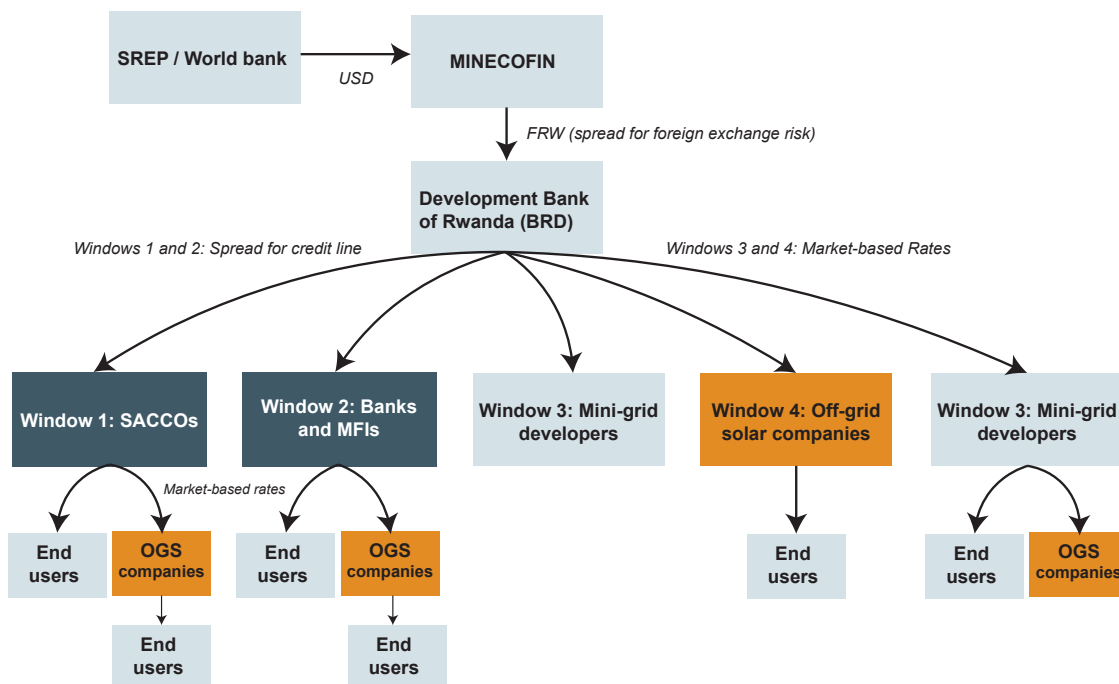
**BOX 4.5:**

## Rwanda Renewable Energy Fund Project: Operating Multiple Windows in Parallel

**Funding Mechanisms:** Credit lines, DSS, and RBF

The Renewable Energy Fund (REF) is a \$50 million fund managed by the Development Bank of Rwanda (BRD). The project started in 2017 and is due to run until 2023. It was set up to provide debt financing under four windows: (1) on-lending through SACCOs to households and micro-enterprises; (2) on-lending through commercial and microfinance banks to households and small and medium-sized enterprises; (3) direct lending to mini-grid developers; and (4) direct financing of locally registered OGS companies supporting Tier 1 and above solar systems.

The first three windows opened in 2018 and window 4 opened in early 2019. The uptake of the credit line through commercial banks has been very low. By contrast, the opening of window 4 in early 2019 triggered substantial interest from solar companies.



Source: World Bank REF project.

Credit lines have so far seen mixed results. Those funded by the Infrastructure Development Company Limited (IDCOL) SHS program in Bangladesh<sup>49</sup> and the Development Bank of Ethiopia (DBE) in Ethiopia (see Box 5.6), have been highly successful, having disbursed \$600 million and \$40 million of loans respectively. However, the drivers of success have been specific to the national context. In the case of IDCOL, favorable interest rate loans were passed from multilateral agencies such as the World Bank to the government, which on-lent to IDCOL, which on-lent in turn to MFIs. The MFIs, which were also provided with some upfront and results-based grants as well as technical assistance, were then able to lend to end users at rates that were less than previous expenditure on kerosene for lighting.<sup>50</sup> Many countries would not be able to replicate this model because the MFI sector is not as mature in their context. In the case of Ethiopia, national banks restrict access to hard currency and DBE's credit facility was attractive to OGS companies because it was able to provide access to US dollars for the purchase of stock (see Box 4.6). In most other countries, access to hard currency is available without the need for a dedicated facility to provide it.

#### BOX 4.6:

### The Development Bank of Ethiopia Credit Facility: Access to US Dollars for Off-Grid Solar Companies

**Funding Mechanisms:** Credit lines and collateral support

Access to foreign exchange is a major challenge in Ethiopia, making it difficult to import OGS products. To address this, the Government of Ethiopia and the World Bank set up a financing facility with \$20 million in 2013.<sup>82</sup> The facility is administered by Development Bank of Ethiopia (DBE) and provides private-sector companies with letters of credit to import QV solar products. Companies repay the debt in local currency. The reflow feeds into a local currency working capital window. MFIs can access this window to provide loans for OGS products at the household level.

By 2017, eight OGS companies and 11 MFIs had been approved for loans, resulting in the importing of over 850,000 QV solar lighting products during the first 18 months of operation. An additional \$20 million has since been added to the program, and a collateral support facility has been created to support smaller companies in meeting collateral requirements. At the time of writing, the number of participating companies had grown from eight to 30, the number of MFIs participating had grown from five to 14, and the number of products imported through the facility had risen from 10,000 to more than 72,000.

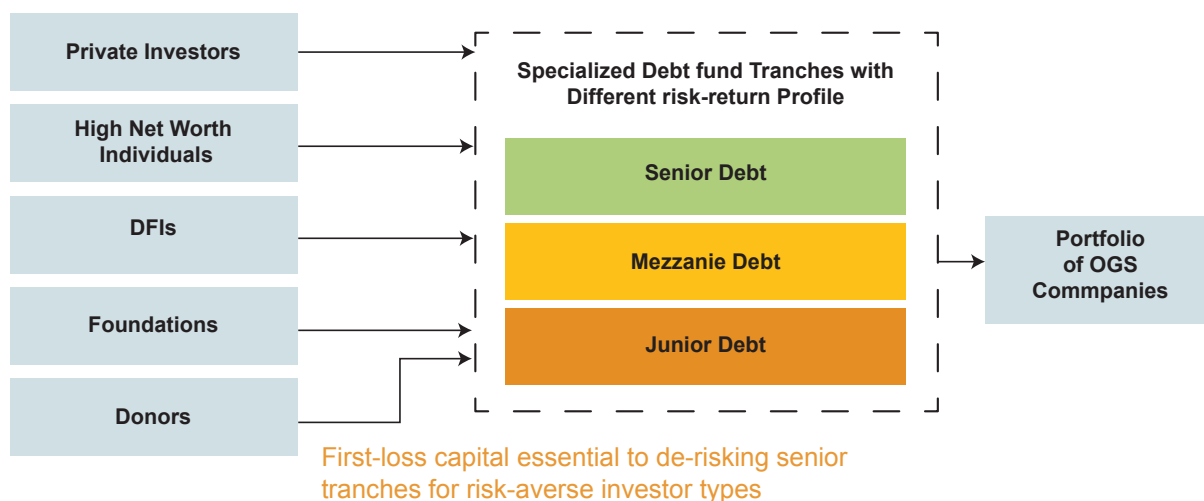
Source: World Bank.

**Other credit lines deployed by the World Bank have seen limited uptake from banks and OGS companies.** In Uganda, commercial banks have perceived small OGS companies as being too risky, even when offered significant loan guarantees by the Uganda Energy Credit Capitalization Company.<sup>51</sup> Larger OGS companies, on the other hand, have been able to access finance on better terms from international development finance institutions, specialized OGS debt funds, and crowdfunding platforms.

**Innovative design in credit lines is showing promising results.** Credit lines are starting to perform better and disburse more as they integrate lessons learned from previous credit lines and operate more flexibly and innovatively. REF in Rwanda uses multiple windows in parallel to maximize chances of uptake by the private sector. In Haiti, Bamboo Capital Partners works with Fonds de Développement Industriel to manage the Off Grid Electricity Fund on behalf of the government, bringing together in-depth knowledge of both the OGS sector and the Haitian market. The fund has a broad mandate to provide grant, equity, and debt to companies as needed.<sup>52</sup>

**In addition to credit lines, public funding can also support lending to OGS companies through specialized debt providers such as SunFunder, ResponsAbility, SIMA, and Oikocredit.** There are over 20 such funds in the OGS sector,<sup>53</sup> contributing 14 percent of all the commercial debt provided to the sector since 2012.<sup>54</sup> These facilities are structured as a tiered capital stack with different tranches that meet the risk tolerance and return expectations of different investor types. For example, with SunFunder’s Beyond the Grid fund, the addition of public funding was made possible by private investors and foundations taking more risk-tolerant positions, lower down the capital stack. Concessionary or risk-tolerant capital providers can be essential to de-risking senior tranches for more risk-averse investors. Grants or highly concessional loans can be used in junior positions as first-loss capital to deliver an overall risk profile attractive to more senior investors (Figure 4.2).

**FIGURE 4.2: ILLUSTRATIVE TIERED CAPITAL STRUCTURE OF A SPECIALIZED DEBT FUND**



Source: ECA.

Table 4.5 sets out the key advantages and limitations of using public funding to provide debt financing through credit lines or specialized debt providers.

**TABLE 4.5: ADVANTAGES AND LIMITATIONS OF CREDIT LINES**

**ADVANTAGES**

- Enable financial institutions to select companies to invest in using their normal commercial process. As lenders gain experience in the sector, risk perception and need for de-risking decrease.
- Play a critical role in providing OGS companies with working capital upfront, in either local or global reserve currency.
- Can be used to improve access to finance in either local or global reserve currency.

**LIMITATIONS**

- Can “crowd out” commercial investment if poorly designed.
- Even with credit and risk mitigation made available, banks may remain unwilling to lend, and companies may still not be able to meet requirements.
- Need to be carefully designed if intended to support smaller, local companies.
- Can take time to set up, and by the time facilities are in place, companies may be able to access cheaper capital elsewhere.
- Can be slow to adapt to rapidly changing market dynamics.

**Credit lines can move markets towards sustainable, commercial working capital financing.** They can provide liquidity in the banking sector, as well as mitigate risk when deployed together with guarantees, insurance, or grants. Involving commercial banks or other local financial institutions as PFIs allows them to get used to transactions and gain familiarity with the OGS sector. Credit lines enable banks to select companies to invest in using their normal commercial process. As lenders gain experience in the sector, risk perception and the need for de-risking decreases. Projects can help lenders to better understand the OGS market and get more comfortable committing their own funds to off-grid projects, especially when credit lines are combined with financial sector technical assistance or capacity building.

**Credit lines can play a critical role in providing OGS companies with working capital upfront, in either local or global reserve currency.** Most investments have to date been in US dollars, while OGS companies generate revenues in local currency. Long revenue cycles for PAYG sales expose companies to potential local currency depreciation as they convert local currency revenues to repay financing in US dollars over time. Credit lines can also provide access to US dollars where this is in short supply, such as in the case of DBE’s credit facility in Ethiopia.

**If poorly designed, these instruments can “crowd out” or delay commercial lending.** Credit lines can have a negative impact on the financial sector if they offer loans at substantially below market interest rates. This runs the risk of giving the banks selected to participate in the credit line scheme an unfair advantage over their peers, or of creating unrealistic borrower expectations. However, in most countries’ cases there is little if any existing commercial lending by domestic financial institutions, especially to

smaller, local OGS companies. Interest rates slightly below market might be justified if there are no other better ways to attract banks into the sector.

**When credit lines are operational, banks may still be reluctant to lend to OGS companies.** This may be because the sector is relatively immature and companies are a long way from meeting their requirements. It may also be because banks are unwilling to adjust their credit and risk management systems and processes to enable them to provide the kind of equipment financing which OGS companies need, for example, by accepting receivables as collateral. Their management teams may still lack experience in the OGS sector, robust data collection processes, and credit management systems; all of these result in increased credit risk. Some banks are of the opinion that credit lines targeted at the sector do not offer sufficient risk coverage.<sup>55</sup>

**If credit facilities target smaller, local companies, they need to be carefully designed to meet these companies' distinct needs.** High transaction costs for small ticket sizes and high perceived risk are major deterrents for banks to lend to smaller companies. Public funding can help address them by providing capacity building (both for OGS companies to help them grow, and for investors learning how to assess their bankability), financial incentives, and risk mitigation. Data generated by PAYG systems can be used to reduce due diligence efforts and transaction costs, which can help to make smaller ticket sizes viable.

The SIMA Angaza Distributor Finance Fund was created on this principle.<sup>56</sup> Data generated by Angaza's PAYG software, which is widely used by smaller companies, is leveraged to assess eligibility for funding, reduce the duration and complexity of due diligence, and monitor and report on loans. In recognition of the important role of smaller companies in driving future OGS market growth, donors are actively supporting a number of early-stage equity and debt providers that specialize in investing in smaller companies, such as Persistent Energy, SIMA, and VentureBuilder, as well as crowdfunding platforms that support them, such as Kiva and Charm Impact.<sup>57</sup>

**Implementing credit lines is a complex process that takes time to set up.** Securing agreements with governments and development banks, designing procedures, and ensuring all participating financial institutions comply with requirements is a slow process. Market conditions may have changed by the time the facility is operational. World Bank experience with credit lines shows that it can take years to progress from project approval to closure of the first transaction.<sup>58</sup> It is also not uncommon to have to revise facility designs after a few years of operation to make them better adapted to the context. For example, the credit lines under the REF project in Rwanda and the ERT III in Uganda had to be revised to facilitate direct lending to OGS companies, to increase uptake.

## Risk Mitigation Instruments

**Similar to credit lines, risk mitigation instruments help to move markets towards sustainable, commercial working capital financing.** They are recommended when risk perception is high, which may be because the level of risk is high—the market may be nascent, or the broader country context may pose political, macroeconomic, or security risks. Risk perception may also be high because there is a lack of market intelligence, or because financial institutions lack experience working with OGS companies.

**Risk mitigation instruments involve risk sharing, typically between commercial lenders and governments or development partners.** The commercial lender selects a suitable borrower, manages the loan, and still takes on some risk. Guarantees, insurance products, or grants are mobilized to reduce the lender's risk, enabling the transaction to go ahead. Table 4.6 outlines the main types of risk mitigation instrument, and their key features.

**TABLE 4.6: TYPES AND FEATURES OF RISK MITIGATION INSTRUMENTS**

TYPES	FEATURES
<b>GUARANTEE</b>	<ul style="list-style-type: none"> <li>• Covers identified contractual cash flows such as loan repayments or losses, in whole or in part.</li> <li>• First-loss guarantees take 100 percent of losses up to a certain pre-agreed maximum.</li> <li>• Pro-rata guarantees share losses between parties at an agreed ratio.</li> <li>• Claims can be initiated as soon as pre-agreed conditions are met and verified. Conditions might include non-payment of a loan instalment, or realization of a loss.</li> <li>• Provides cash relatively quickly, minimizing the risk of liquidity issues.</li> <li>• A fee is normally charged, reflecting the cost of capital needed to back the guarantee.</li> <li>• Financial institutions are normally the beneficiaries.</li> </ul>
<b>INSURANCE</b>	<ul style="list-style-type: none"> <li>• Can cover all risks or only certain types of risk (for example, natural, commercial, or political risk), as a whole or in part.</li> <li>• The nature of the risk event and the amount of the loss must be verified before a claim can be made.</li> <li>• More flexible than guarantees because it does not depend on a specific set of contractual cash flows.</li> <li>• Slow to pay out compared to guarantees, which can lead to liquidity issues.</li> <li>• A premium is charged, reflecting the cost of providing the insurance.</li> <li>• Solar companies or financial institutions could be beneficiaries.</li> </ul>
<b>GRANTS AND CONTINGENT GRANTS</b>	<ul style="list-style-type: none"> <li>• Contingent grants are a substitute for a guarantee, typically provided by donors that lack a guarantee instrument.</li> <li>• Risk cover can be similar to a guarantee and can offer “first-loss” or “pro-rata” cover.</li> <li>• A fee should still be charged to avoid crowding out private risk mitigation providers.</li> </ul>



Table 4.7 summarizes the key advantages and limitations of risk mitigation instruments.

#### TABLE 4.7: ADVANTAGES AND LIMITATIONS OF RISK MITIGATION INSTRUMENTS

<b>ADVANTAGES</b>	<ul style="list-style-type: none"><li>• Help to mitigate risk and encourage lending, with or without an accompanying credit line</li><li>• Help to move the market towards sustainable, commercial working capital financing</li><li>• Can reduce borrowing costs or collateral requirements for companies</li></ul>
<b>LIMITATIONS</b>	<ul style="list-style-type: none"><li>• Partial risk guarantees are sometimes deemed insufficient by participating commercial banks</li><li>• Risk of high transaction costs, administrative burden, and disbursement delays for participating financial institutions</li></ul>

**Risk mitigation instruments can be used alongside credit lines, or on their own to encourage lending if liquidity is not a constraint.** If financial institutions have sufficient liquidity, but credit risk perception is too high, risk mitigation instruments can be an option. They can leverage commercial lenders' own funds until lenders become more familiar with the OGS sector and risk perception decreases.

**The objective of risk mitigation instruments is to reduce the risk exposure of financial institutions when commercial lending is not viable, but not to eliminate the risk for them entirely.** Guarantees could in principle cover 100 percent of a cash flow, but should ideally cover only part of it, leaving commercial banks to bear part of the risk. Partial guarantees may be "first-loss" or "pro-rata". First-loss guarantees take 100 percent of losses up to a certain pre-agreed maximum, while pro-rata guarantees share losses between parties at an agreed ratio, helping to minimize moral hazard and ensure the financial institution will diligently undertake loan supervision and loan recovery work. It is also possible to combine first-loss and pro-rata and approaches. Box 4.7 provides examples of guarantees designed to mitigate the risk of providing credit facilities. This includes a first-loss partial risk guarantee under Ethiopia's ADELE project and a pro-rata guarantee in Rwanda's REF project.

## BOX 4.7:

### Application of Guarantees to Mitigate Risk of Credit Facilities

**Funding Mechanism:** Risk mitigation instruments (partial loan guarantees)

Ethiopia's ADELE project builds on the success of DBE's credit line presented in Box 5.6. In addition to windows providing foreign exchange for the import of off-grid systems, and local currency for working capital and consumer financing, a third window provides a risk-sharing mechanism. This consists of partial loan guarantees to reduce credit constraints driven by commercial banks' significant aversion to lending to OGS companies because of high perceived risk, their strong preference for traditional forms of collateral (primarily real estate), and the high coverage ratios normally used when making loans. The risk-sharing fund assumes a limited first-loss guarantee.

In Rwanda's REF project, presented in Box 5.5, the Swedish International Development Cooperation Agency (SIDA) provides a \$20 million guarantee to de-risk off-grid market lending, which is available to all REF financial intermediaries. The SIDA guarantee is 50 percent, although for female borrowers SIDA covers 70 percent of potential losses.

Sources: World Bank, SIDA

**Experience shows that, despite the availability of risk mitigation instruments, PFIs may find risk coverage is insufficient.** Guarantees are typically partial, only covering part of the loan repayments. Some credit lines, including partial risk guarantees, have had low uptake, with commercial banks indicating that there was not sufficient risk coverage.<sup>59</sup>

**Risk mitigation instruments run the risk of carrying high transaction costs and administrative burdens for participating financial institutions. PFIs also report delays processing claims and disbursing funds.** Wherever possible, project implementers should work to simplify the processes that financial institutions need to go through when applying for a guarantee, for insurance, or for a contingent grant. They should make sure that the terms of any contract signed are clear and well-understood by both parties. Contracts should clearly state how long it will take to process claims, perhaps with mechanisms in place to provide compensation to claimants if delays in claim processing incur financial costs.

### Demand-Side Subsidies

**Demand-Side Subsidies (DSS) are funds provided either to end users or to companies, with the objective of making OGS products more affordable.** The cost of OGS has declined by 5 to 15 percent in the last two years, and the emergence of PAYG has also helped to address affordability; however, limited ability to pay remains a major market barrier.<sup>60</sup>

**Governments and donor agencies have experimented with DSS to provide electricity access to more vulnerable populations.** Since 2017, four notable DSS pilots have been implemented:

- *Kenya Energy and Cash Plus Initiative*: The program, which was launched in 2018, heavily subsidized OGS products for 1,500 beneficiaries in the deprived counties of Kilifi and Garissa in Kenya. The program will be expanded to another 3,500 households in those counties.<sup>61</sup>
- *Rwanda Pro-Poor RBF*: Implemented in 2019, the program provides a subsidy amount to households depending on which category they are in, according to the government’s system of socio-economic categorization. The lowest-income class receives the highest subsidy.
- *Mozambique COVID-PAY*: In 2020, the COVID-PAY program was implemented to allow consumers who purchased an OGS product through PAYG to maintain access to energy throughout the COVID-19 crisis. DSS were made available through solar companies. To avoid a long-term lock-in effect, the roll-out of the subsidy was branded as a “special promotion”.
- *Togo CIZO Program*: In 2017, the government of Togo launched the CIZO Program, which aims to increase energy access in the country. One component of the program involves the provision of DSS to support households in the purchase OGS products.

**While preliminary results have been positive, it is not possible to draw definitive conclusions regarding the effectiveness of this public funding mechanism because of limited track record.** The few initiatives that have been implemented are mostly pilot programs and have been operational for less than three years. Pilots are unique to each country context and learnings would not always be relevant for other country contexts. Table 4.8 summarizes the key advantages and limitations of DSS.

**TABLE 4.8: ADVANTAGES AND LIMITATIONS OF DEMAND-SIDE SUBSIDIES**

**ADVANTAGES**

- If prices go down, demand and sales volumes increase significantly
- DSS can also help to reduce default rates on PAYG sales
- Support more vulnerable households to gain access to electricity

**LIMITATIONS**

- High market distortion risks, especially if implemented in parallel with supply-side mechanisms and attempts to build a commercial market in parallel, or in nearby locations
- Targeting, setting of appropriate subsidy amounts, verification, and exit strategy can all be challenging

**If prices come down, demand for OGS can increase dramatically.** A Kenyan study revealed that a reduction in the price of a pico-solar product from \$7 to \$4 increased uptake by 86 percent.<sup>62</sup> Evidence from the CIZO Program in Togo reveals that DSS drove up adoption by 125 percent in the first three months after launch and roll-out, and by 164 percent in the regions with the lowest electrification. These encouraging results should be treated with caution—with public funding being used to provide supply-side support, and other enabling activities taking place in parallel, it can be difficult to attribute changes in uptake to one specific intervention. In Togo, DSS are implemented alongside tax exemptions, consumer awareness campaigns, and a credit line (see Box 4.8).

#### BOX 4.8:

### Togo CIZO Program: Responsiveness of Demand to Price Reductions

**Funding mechanisms:** DSS, tax exemptions, consumer awareness campaigns, concessional financing

The CIZO Program is a government initiative to support unelectrified households to buy OGS products. The scheme offers every rural household a subsidy of around \$4 a month that can be used towards the purchase of OGS products from suppliers that participate in the program.

According to data provided by participating companies:

- The subsidy drove up adoption by **125 percent in the first three months** after launch and roll-out (and up to **164 percent** in the prefecture group with the lowest electrification); and
- The subsidy resulted in customers making **bigger, less frequent payments.**

*Source: Interviews with Bboxx.*

**DSS can also help to reduce default rates on PAYG products that have already been purchased.** In Rwanda, DSS led to a reduction in the dropout rate among subsidized end users by 70 percent compared to non-subsidized.<sup>63</sup> Again, these promising findings must be treated with caution—the reporting period only covers the first six months of repayment. A carefully designed DSS scheme, where subsidies are linked to monthly instalments, has the potential to reduce the risk of end users defaulting on their payments over the lifetime of their loan.

**DSS can create market distortions if not carefully designed, with strong consumer awareness campaigns to help manage customer expectations.** The risk of “leakage,” where a subsidized SHS ends up being used by an ineligible household or in an ineligible geographical location, is highest if DSS is being implemented at the same time as efforts to build a commercial market, or in a neighboring geographical area. DSS also runs the risk of negatively affecting consumer behavior. For example, a customer may choose not to buy an SHS at a normal commercial price if they think that, at some point in future, they will be available at subsidized prices. If price reductions are only temporary, customers may be reluctant to make purchases when systems return to normal commercial prices. Consumer awareness campaigns are needed to clearly communicate who is eligible for subsidy and who is not, what checks are in place to ensure subsidized SHS are only used by eligible households in eligible locations, and to manage expectations regarding SHS pricing in future. If the timeline for price reductions resulting from DSS schemes is not communicated properly, consumers will have the wrong perception regarding the actual price of these products. When subsidies are removed, consumers will be reluctant to buy the products at the full price.

**Effective targeting of DSS can be challenging.** DSS can be made available in restricted geographical areas, but it can still be challenging to obtain proof that a potential customer is resident in a given area, and to prevent them from claiming a subsidy more than once. DSS can also be made available only to

those on lower incomes, but most countries with large energy access deficits do not have effective systems for categorization of individual households by income level or other socio-economic indicators. Rwanda's Ubudehe system of socio-economic categorization has enabled the country to target DSS towards those with the lowest incomes. The categories divide citizens into four groups (Ubudehe 1-4, with Ubudehe 1 being the lowest), based on factors such as income, employment, profession, and land ownership, and are assigned by local government.<sup>64</sup> The eligibility tool developed by EnDev as part of the Rwanda Pro-Poor Program helped solar companies determine whether a household is eligible for subsidies and the amount of the financing support available (see Box 4.9).

#### BOX 4.9:

### Rwanda Pro-Poor Program Eligibility Tool

**Funding mechanisms:** DSS (following RBF to companies in the first iteration)

After years of successfully providing supply-side incentives through RBF, EnDev Rwanda launched the Pro-Poor RBF, aiming to address the widening affordability gap via DSS. The Rwanda Pro-Poor RBF is a program that provides DSS to low-income households for the purchase of OGS products. For every OGS product sold, participating companies receive a subsidy that varies according to the location and Ubudehe category of the household. A special tool was developed by EnDev to allow companies to assess the eligibility of households. The eligibility tool is linked to the Off-grid Monitoring Information System (OMIS). It allows companies to check whether a potential household is eligible for a subsidy and the maximum level of incentive, based on their national ID, location, and product price, and to report a sale once concluded to ensure that households only access the subsidy once. The eligibility tool can also be used by companies to see the remaining budget they have left for each Ubudehe category. The approach is now being scaled up by the Government of Rwanda with financing from the World Bank.

*Sources:* Endeavor 2020,<sup>83</sup> GIZ 2020.<sup>84</sup>

**DSS amounts must accurately reflect the difference between commercial prices and what consumers are able to pay, especially over time as conditions evolve.** If the subsidy is too high, public funding is used inefficiently, but if it is too low, then people on the lowest incomes are at risk of still being unable to afford SHS. Rwanda's pro-poor program was able to align subsidy amounts with Ubudehe categories, but it would not be feasible to replicate this approach in countries that lack socio-economic data and citizen categorization systems.

**Verification is particularly important when using a DSS approach, to ensure the same households do not benefit more than once.** In Togo, the post office maintains a national platform with information on the electrification status of each household, tracking their eligibility for subsidy and ensuring any subsidy claims are linked to actual solar installations (see Box 4.10).

**BOX 4.10:****Togo CIZO Program Verification**

**Funding Mechanisms:** DSS, tax exemptions, consumer awareness campaigns, concessional financing

The CIZO Program offers every rural household a subsidy of around \$4 per month that can be used towards the purchase of OGS products from suppliers that participate in the program. The national post office conducts eligibility checks and maintains a database of subsidized customers. Mobile network operators ensure all eligible customers are integrated into their database and send SMS to inform them about availability of the subsidy. When an eligible customer makes a payment to an OGS company, the mobile network operator automatically makes a subsidy payment from the government to the OGS company.

Source: Bboxx 2020<sup>85</sup>

**Phasing out DSS can be particularly challenging. In long-term programs, DSS can be phased out gradually. If DSS are made available only for a short period, they can be branded a promotion.** The Bangladesh IDCOL program was able to phase out DSS over a period of years by gradually scaling it back, as technology costs came down. As the market grew, competition could be relied upon to keep prices down, and participating MFIs benefited from economies of scale, which they passed on to the end user. The grant component declined from 18 percent in 2004 to 3–8 percent from 2007 onwards, as a proportion of SHS price. From 2012, a grant of \$9–13 per SHS was available only for systems smaller than 30 Wp, with no grant support for larger SHS.

**The Mozambique COVID-PLUS initiative, in contrast, implemented a short-term demand-side subsidy, and branded it as a promotion to minimize the risk of distorting consumer price expectations.** People were used to the fact that promotions last for a limited period, so there is no expectation from consumers that they will continue paying the subsidized price for an indefinite period (see Box 4.11).

**BOX 4.11:****Mozambique COVID-PLUS Demand-Side Subsidies Sustainability****Funding Mechanisms:** DSS through different promotions

The objective of COVID-PLUS, implemented by EnDev Mozambique, was to allow consumers who have already purchased an OGS product through PAYG to maintain access to energy throughout the COVID-19 crisis and ensure the financial sustainability of PAYG solar providers. To avoid negatively affecting consumer price expectations, they branded the support as a promotion. As a result, consumers did not have the expectation that the subsidized price would be available indefinitely. The subsidies were channeled through FASER, a fund that was already operating in Mozambique to provide support to businesses active in the OGS sector. The initiative offered up to €60 per customer towards the cost of their OGS products. Companies could design their own concept for the promotion provided that the entire value of the subsidy was passed on to the consumer (up to €60/customer).

Source: ESMAP 2021.<sup>86</sup>

**Public Procurement**

**Public procurement is a strategy whereby government agencies purchase systems through a tender, before providing distribution, installation, and maintenance services either directly or through contractors. It is used to reach poor, remote, and isolated communities in areas where market-based solutions have proven unviable.** In Latin America this has helped countries reach the last few percentages of their populations that still lacked access to electricity. Publicly supplied systems are often intended as a long-term alternative to grid connection and are larger in order to provide a higher level of service at Tier 2 or above. They are purchased with government funding and installed by utilities that have well-staffed off-grid electrification departments. In most cases, the systems are owned and maintained by the utility on behalf of the government, and they may be repossessed if a customer relocates.<sup>65</sup>

**Public procurement is also used in humanitarian or disaster relief settings where market-based solutions are not viable.** In these settings, large numbers of people can be reached quickly with standardized systems of different sizes. For example, after an earthquake in Haiti in 2010, the World Bank procured QV lanterns and distributed them for free. This helped to boost awareness of and demand for QV products, paving the way for more market-based efforts to promote QV OGS in the future. Key advantages and limitations of public procurement are summarized in Table 4.9.

**TABLE 4.9: ADVANTAGES AND LIMITATIONS OF PUBLIC PROCUREMENT**

<b>ADVANTAGES</b>	<ul style="list-style-type: none"><li>• Appropriate solution for poor, remote, or isolated communities, or for humanitarian settings where market-based solutions are not viable.</li><li>• Central government purchasing can reduce costs through bulk tendering of equipment.</li><li>• Can be used to reach large numbers of people relatively quickly.</li></ul>
<b>LIMITATIONS</b>	<ul style="list-style-type: none"><li>• Requires government agencies or their contractors to have, or be able to build, the capacity to provide distribution, installation, and maintenance services over the long term.</li><li>• Requires a long-term source of public financing to ensure energy services are sustained over time.</li><li>• Can be challenging to adapt to evolving needs and demands over time.</li><li>• High risk of misuse of funds and moral hazard if tenders are not designed carefully, with strict rules around bid evaluation, due diligence of applicants, and management of contracts over the course of implementation.</li><li>• Potential to disrupt and undermine any existing commercial market.</li></ul>

**Public procurement approaches are best used when market-based solutions are not viable. This may be because of affordability constraints, the high costs and risks of distribution, the small or dispersed nature of the population lacking access, or because of an emergency situation.**

Centralized, bulk procurement can help to reduce technology costs by unlocking economies of scale. However, for public procurement to succeed, a government agency or contractor must have sufficient incentive and capacity to provide distribution, installation, and maintenance services (including payment mechanisms) for the long term. In some countries such as Colombia and Mexico, the utility is responsible for the operation and maintenance of a small number of remote systems. In others, regional government authorities set up sales and service centers. This approach was used in a World Bank project in Mongolia in 2006, to supply 70,000 portable SHS to nomadic herders.<sup>66</sup> In Peru distribution concessions were granted to solar companies, providing them exclusive rights to supply electricity services through OGS systems (see Box 4.12). The additional subsidy provided to the companies through the national fund for rural electrification allowed companies to fully recover their operating expenses.



**BOX 4.12:****Off-Grid Solar Concessions for Rural Electrification in Peru****Funding Mechanism:** Public procurement

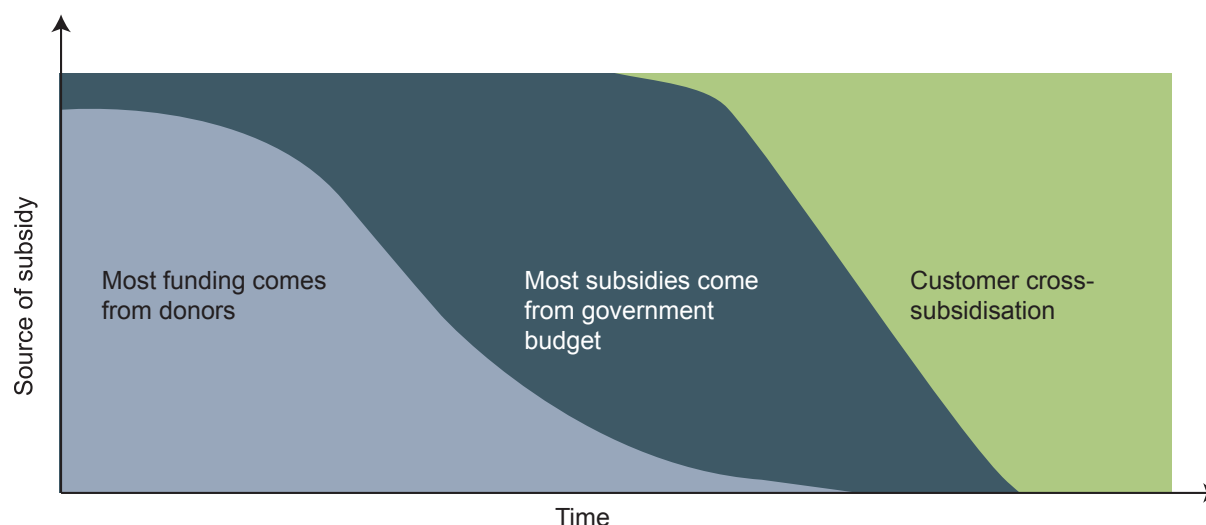
In 2012 the Government of Peru sought to electrify the last few communities in the country that lacked energy access, through Off-Grid Solar (OGS) concessions. The government granted the first concession to Acciona Foundation, targeting Cajamarca. Acciona Foundation supplied, installed, and maintained OGS systems using a fee-for-service model. Beneficiary communities were involved in the scheme through solar electrification committees set up to market the project, collect tariffs, and protect OGS systems from theft or vandalism. The tariff was set at an affordable rate, helping to cover part of the cost of the program. The rest of the cost is covered by a national fund, set up to facilitate cross-subsidies from higher-income customers in on-grid settings, to low-income customers in off-grid settings.

To date, the project has connected 3,900 homes and 12 schools within the concession area. The model has been very successful, with a customer default rate of under 2 percent. It has expanded to other areas of Peru, such as Lima, Loreto, and Ica. A similar approach is being taken in other Latin American countries where the context is similar, such as Bolivia, Panama, and Colombia.

Source: Universidad Politécnica de Madrid 2020<sup>87</sup>

**A long-term source of public financing must also be found to ensure that energy services delivered through publicly procured OGS systems can be maintained over the long term.** Peru's rural power utility<sup>67</sup> and Thailand's Provincial Electricity Authority<sup>68</sup> both deliver electricity services in remote rural areas using SHS and face a much higher cost of service compared to the main utility in the country. Cross-subsidy between higher-consuming customers in grid-connected settings and lower-consuming customers in off-grid settings is used to make electricity services affordable to SHS customers. This approach is feasible in countries where grid-connected customers can pay higher tariffs, and the number of people to be reached through publicly procured SHS is small compared to the overall population (see Figure 4.3). It is not feasible in countries where grid-connected tariffs are already high, such that any further increase would have a negative effect on consumption and overall utility tariff revenues, or the population to be reached through SHS is large.

**FIGURE 4.3: TRANSITION TO A SUSTAINABLE MARKET TO DELIVER ENERGY ACCESS THROUGH CROSS-SUBSIDY**



Source: Designing Sustainable Subsidies to Accelerate Universal Energy Access, Tearfund 2020.

**Public procurement approaches need careful consideration of how they will adapt to evolving need and demand over time.** For example, some customers may be willing to pay more for a larger or upgraded SHS, if one is available, or to obtain additional efficient appliances. They may also be interested in obtaining a larger OGS system for productive use, along with a refrigerator or solar water pump. With technology costs constantly falling, tenders need to be regularly repeated to take advantage of the latest QV products and appliances available in the market.

**Public procurement approaches are particularly vulnerable to misuse of funds and moral hazard.** Companies bidding for contracts may overstate their capabilities, or underprice their bids to win contracts, before failing to deliver. There is a risk of fraudulent or opaque relationships between agencies responsible for procurement and their suppliers, as well as a risk of political interference. Tender documents and processes must be carefully designed and managed to ensure impartiality and objective, transparent scoring of bids. Extensive due diligence is also required to confirm that firms have the capability and track record that they claim to have. Once projects have started, progress must be carefully monitored with results carefully verified. Public procurement approaches require a lead agency to have strong systems, processes, and capacity in a wide range of areas. The use of independent procurement or monitoring agents, such as UNOPS, can also help to minimize fiduciary risks for any grant-making mechanism, including public procurement, particularly in FCV settings.

**Targeting is essential to ensure that publicly procured SHS do not disrupt or undermine any pre-existing private markets.** For example, in Somali refugee camps, poor-quality solar lanterns were distributed for free by aid agencies. A study conducted in 2018 revealed that many of the systems failed and QV solar equipment traders complained that the project reduced consumer confidence in solar and flooded the market with free equipment, depressing prices for the quality equipment they were trying to sell.<sup>69</sup>

# 5: KEY CONSIDERATIONS AND CONCLUSIONS

There is no one-size-fits-all solution that meets the evolving needs of diverse off-grid energy markets at different stages of development. Public funding mechanisms should be selected and designed to take advantage of specific opportunities, or address specific barriers, in each country context. However, the following key considerations have been identified, which are relevant regardless of which combination of public funding mechanisms is deployed.

## Flexibility

**Off-grid solar (OGS) markets are complex, dynamic, and constantly evolving. Public funding mechanisms need to be flexible so that they can adapt to changes in the market, and rapidly apply lessons learned from implementation experience.** For example, when a public funding program is launched, implementers may discover that the funding on offer is insufficient to persuade enough companies to participate in the project, or that smaller, locally owned companies are excluded. Once enough companies have been recruited, and they are established in the target geographical area, it may be possible to scale back public funding support, to increase efficiency without putting results at risk. Over time, it may make sense to transition from one funding mechanism, or combination of funding mechanisms, to another as the needs of the sector change. External events, such as natural disasters or the COVID-19 pandemic, can cause shocks that public funders need to respond to, to protect gains achieved to date and company capacity to deliver results in the future. Close monitoring of developments in the market is essential, to identify emerging challenges and opportunities and respond in a timely fashion.

## Targeting

**OGS projects should be targeted to ensure public funding is used as efficiently as possible in pursuit of specific objectives.** The most common form of targeting is geographic, whereby funding is made available for companies to reach unelectrified households in an underserved area. In Rwanda demand-side subsidies for OGS are provided only to poorer households, leveraging the government's Ubudehe system of socio-economic categorization (see Box 5.9). In the Bangladesh IDCOL program, targeting of poorer households was achieved by focusing price reductions on smaller OGS systems, which were more likely to be purchased by poorer households.<sup>70</sup>

**Targeting can also help to achieve inclusivity and ensure that no one is left behind.** For example, the Yemen Emergency Electricity Access project, described in Box 5.2, was able to increase sales to female headed households from 5 percent to 21 percent by providing microfinance institutions (MFIs) with a small additional incentive for reaching them. MFIs recruited more women to help them reach female customers, with the proportion of female MFI staff increasing from 16 percent to 29 percent.<sup>71</sup>

**Digital platforms can help with the segmentation of end users according to location, income levels, and other metrics.** For example, Fraym's geospatial data and machine learning capability helps off-grid energy companies, governments, and development partners make strategic decisions by providing them with information on demographics, socioeconomics, and potential customers' ability to pay.<sup>72</sup>

### Proportionality

**The level of public funding should be aligned with the costs and risks that companies will face, to ensure sufficient company participation in a public funding scheme without compromising efficiency in the use of public funds.** If the level of funding is too low, companies will be unable to participate in a public funding scheme. If the level of support is too high, then public funding will be used inefficiently. In more mature markets, where companies are familiar with the cost and risks of serving a given area, auctions can be used whereby companies bid for the amount of public funding they need to deliver a certain volume of sales in each location. This approach has been successfully deployed by Beyond the Grid Fund for Africa in Zambia and elsewhere (see Box 5.4).<sup>73</sup> If markets are nascent, or companies are unfamiliar with the risks and costs of serving a given area, public funding amounts can initially be fixed and set by the funder, before being adjusted over time based on project experience.

### Efficient Fund Management using Digital Technology

**Delays in disbursement of public funding pose a major challenge for capital-constrained OGS companies, preventing them from growing and in some cases leading to disruptive stock shortages.** An SEforALL study found that delays in disbursements affect 52 percent of energy access projects in high-impact countries.<sup>74</sup> Companies consulted for this report stated that in some cases delays of up to two years had occurred between grants being awarded and funding being disbursed.

**Automation and digitalization of fund management systems and processes can enhance management information and transparency, while streamlining verification and disbursement, and reducing transaction costs and risks of delay.** Digital technologies can be used to collect consumer and company data, communicate with portfolio companies, track progress towards program objectives, verify sales, and disburse funding in a timely manner. For example, the Nigeria Electrification Project uses the Odyssey Platform to manage tenders, track implementation, verify results, and monitor performance.<sup>75</sup> REEEP (Renewable Energy and Energy Efficiency Partnership) has built Edison, a software platform which gives them full visibility of company performance and is also used for verification purposes.<sup>76</sup>

### Verification

**Verification of results is essential to managing fiduciary risks, and ensuring programs are achieving their objectives and that public funding is being used appropriately.** Sales can be verified via in-person visits, telephone calls, desk-based documentation checks, or through fund management software, which may or may not be linked to companies' own software platforms. Program implementers need to ensure verification is rigorous enough to effectively manage risk, without making it too burdensome for companies. Verification mechanisms also need to consider practical challenges that might be faced, for example it is not always possible to reach customers by telephone, especially a long time after an initial sale, and in-person visits may not be feasible if end users are spread across a large, remote area.

Verification is usually undertaken by a third party to ensure impartiality and transparency, and is accompanied by a complaints procedure or hotline that customers can use if they are dissatisfied with how companies have addressed a warranty claim or after-sales service issue.<sup>77</sup>

## Sustainability

**OGS projects need to consider carefully what will happen when they come to an end.** It may be possible to exit entirely, leaving behind a sustainable, commercially funded market that will continue to sell, maintain, and replace systems as needed. Or a second phase of support may be needed, perhaps using a different configuration of public funding mechanisms to pursue different objectives. Any reduction in public funding should take place gradually, in phases, accompanied by close monitoring of the impact of each reduction. Stakeholders, especially companies, should be given plenty of advance notice of changes so that they can plan accordingly.

**In non-commercial settings, long-term sources of public funding need to be found to ensure continued delivery of energy services through OGS.**<sup>78</sup> In South America, countries such as Peru and Bolivia use on-grid/off-grid cross-subsidies, whereby small increases in tariffs for high-consumption grid customers are used to cover the cost of providing and maintaining SHS for poor households living in the most remote areas (see Box 4.12).<sup>79</sup> Off-grid energy services can also be incorporated into existing social assistance mechanisms where they exist.<sup>80</sup>

## Conclusions

**The suitability of each public funding mechanism depends on the context.** Smart deployment of public funding can accelerate off-grid market growth while also ensuring no one is left behind. In most countries, supply-side mechanisms need to be deployed to help companies extend their reach first before demand-side subsidies are used to reach the poorest or most remote communities. However, in some contexts, for example fragile, conflict-affected, and vulnerable settings, a “demand-side subsidy in parallel” approach can make sense. Implementing a range of mechanisms across both the supply and demand side in parallel is also possible, although market distortion risks need to be carefully considered with mitigation strategies in place.

**While there is no such thing as a perfectly designed public funding mechanism, adhering to the above design principles will help to maximize the chances of success.** All public funding mechanisms should promote quality products and services, ensure support is targeted towards companies and end users that need it, and ensure that support is proportionate, considering the affordability or financing challenge the program seeks to address. Funding needs to be provided in an efficient and timely manner to the intended recipients, and results need to be verified to manage fiduciary risks and monitor progress. All funding schemes should be flexible and adaptable, with a phased approach that enables them to adapt to evolving market conditions and continue to deliver energy access via OGS efficiently and effectively over time.

## ENDNOTES

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# ANNEX 1: LIST OF PROJECTS EXPLORED

- Yemen Emergency Electricity Access Project
- GSMA Market Validation Grant
- Shell's upfront grant facility in DRC
- Shell Foundation grant to M-KOPA
- Africa Enterprise Challenge Fund (AECF) REACT Fund
- USAID Development Innovation Ventures Program
- USAID/Power Africa grant funding facility for refugee settlements
- EnDev RBF Malawi, Uganda, Kenya, Bangladesh, Rwanda, Tanzania, Madagascar, and Mozambique
- Beyond the Grid for Africa (BGFA)
- Beyond Grid Fund for Zambia (BGFZ)
- The Development Bank of Ethiopia's (DBE) Credit Facility
- Lighting in Ethiopia (ADELE) project
- Rwanda REF program
- Swedish International Development Cooperation Agency Sida guarantee
- Regional Off-Grid Electricity Access Project (ROGEAP)
- Togo CIZO Program
- Kenya Energy and Cash Plus Initiative
- Myanmar National Electrification Project and Department for Rural Development (DRD)
- Infrastructure Development Company Limited (IDCOL) product targeting in Bangladesh
- Rwanda EnDev Pro-Poor Program
- Mozambique COVID-PLUS DSS
- Dutch government's NpM Agriculture Program
- Tanzania Sustainable Solar Market Packages

- The Kenya Off-Grid Solar Access Project (KOSAP)
- CLASP RBF Facility
- Global LEAP Program
- Collaborative Labeling and Appliance Standards Program (CLASP)
- Tax exemptions in Kenya, Uganda, Mali, Mozambique, Uganda, and Zambia
- Climate Finance Facility (South Africa, Namibia, Lesotho, and Swaziland)
- Renewable Energy Performance Platform (REPP) in Africa
- Haiti Renewable Energy for All Project
- Uganda Structured Asset Financing Instrument (Sunfunder)
- Specialized OGS debt funds by responsAbility, SIMA, and Oikocredit
- ERT-III in Uganda
- FCDO's Access to Clean Energy (ACE) program
- USAID Development Credit Authority
- SIDA's Guarantee Facility

# ANNEX 2: STAKEHOLDERS CONSULTED

- Africe Clean Energy Technical Assistance Facility (ACE TAF)
- Bboxx Rwanda
- Bboxx Togo
- EnDev Mozambique
- EnDev Rwanda
- GreenMax
- GSMA
- IIED
- Kuungana-Advisory
- Lion's Head
- M-KOPA
- NEFCO
- Practical Action
- REEEP
- SIDA
- SNV
- Sunculture
- USAID Power Africa
- Vitalite

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