Transforming Energy Access

Shell Foundation

March 2024

Landscape Analysis & Market Sizing Report

Results Based Financing for Productive Use Appliances to Promote Gender Outcomes

CrossBoundary Advisory

ODYSSEY

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CrossBoundary was engaged by Odyssey Energy Solutions, Shell Foundation, and FCDO to support a gender-based outcome financing program

This Landscape and Market Sizing report is part of the first phase to assess the various appliances with the greatest impact on women and the market size for RBF programming for gender-based outcomes in energy access. The learnings from this report will inform the RBF design (second phase) in early 2024.

Landscape & Market Sizing Report

This report will aim to capture the following:

- Impact of energy access on women
- Identification of appliances with the greatest impact on women
- Learnings from previous RBF programs
- Market size for clean gender-based outcome financing in the sector

RBF Design

CrossBoundary will design a gender outcome-focused RBF program for the most impactful appliances as identified in the landscape analysis.

The design phase will implement learnings from previous RBF programs and stakeholder feedback

Learnings Report

The final learnings report will primarily seek to address three questions:

- How do you effectively measure gender outcomes from the productive use of energy?
- How do you design effective RBF programs to incentivize gender outcomes?
- What are the practical learnings from running a pilot of an outcomes-based financing program?

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We utilized desk-based research and stakeholder interviews to develop the landscape analysis and market sizing report

Literature Review

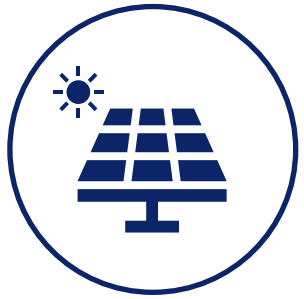
We built on relevant work from leading institutions and programs, including but not limited to:

- Sustainable Energy for All (SE4All)
- World Bank
- CLASP
- 60 decibels
- The Rockefeller Foundation
- Global Clean Cooking Alliance
- Energizing Development (EnDev)
- Global Off-grid Lighting Association (GOGLA)
- Bill and Melinda Gates Foundation

Capital Providers

9 investors & ecosystem players interviewed to understand the perspective of capital suppliers

Nithio
mirova Investing in sustainability
SUSTAINABLE ENERGY FOR ALL
ACUMEN
BIX CAPITAL
Global Energy Alliance for People and Planet GEAPP
THE WORLD BANK
CrossBoundary Group
OSPREY FOUNDATION



DRE Businesses

8 DRE Businesses interviewed to learn from their on-the-ground experiences

Bidhaa Sasa
altech
Bboxx
SOSAI
KOOLBOKS LIFE IS KOOL
burn manufacturing
AGSOL
SUNKEN LIMITED

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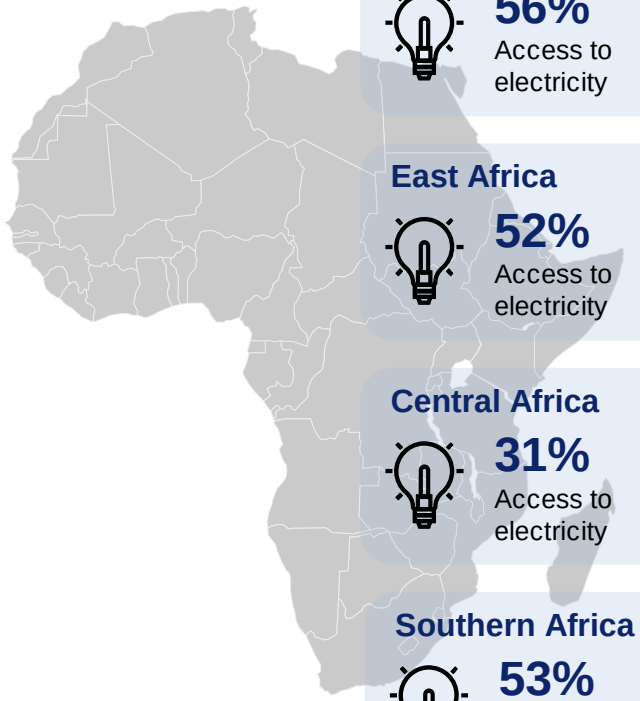
Productive Use of Energy & Gender

As access to energy continues to improve in SSA, it is important to focus on economic development of people at the last mile through energy consumption

During 2011-21, access to electricity has increased by 15% and access to clean cooking by 6% in Sub-Saharan Africa (SSA)



West Africa

56% Access to electricity

14% Access to clean fuels and technology for cooking

East Africa

52% Access to electricity

14% Access to clean fuels and technology for cooking

Central Africa

31% Access to electricity

10% Access to clean fuels and technology for cooking

Southern Africa

53% Access to electricity

39% Access to clean fuels and technology for cooking

Increased energy consumption can be a powerful tool to boost the incomes of people in SSA

- Based on research funded by the Rockefeller Foundation, there is evidence that inadequate consumption of electricity in an economy is a constrain on job creation, economic growth, and poverty alleviation
- As access to energy continues to improve across the continent, it is important to ensure that people also increase their demand for power as income and energy consumption have a strong positive correlation over time and across geographies
- According to Africa-EU Energy Partnership, the Productive Use of Energy (PUE) could be defined as “agriculture, commercial and industrial activities, powered by renewable energy sources, which generate income”. PUE focuses on consuming electricity for purposes that ultimately improve livelihoods and has become increasingly important to impact-focused stakeholders
- In SSA in particular, where 63% of the population is rural and depends on agriculture, PUE presents a strong opportunity for people to improve their livelihoods by using energy to improve productivity, reduce drudgery, and ultimately increase income

Source: World Bank, The Rockefeller Foundation, IEED, Deutche Bank, Africa-EU Energy Partnership
Note: Sub-Saharan Africa excludes high-income countries.

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PUE is especially relevant to women as their economic development has lagged behind that of men in Sub-Saharan Africa, where there is a gender pay gap of 30%

Women in SSA face significant gender gaps in access to economic opportunities while also having significantly less free time

	Time Spent on Unpaid Care Work[1]	Time spent on Paid Work[1]	Share Engaged in Informal Employment[2]	Ownership of Small and Medium-Scale Enterprises (SMEs)[3]	Sole Ownership of Land[4]	Own Bank Account[5]
	**249** Minutes per day	**184** Minutes per day	**94%**	**~40%**	**13%**	**37%**
	**87** Minutes per day	**275** Minutes per day	**89%**	**~60%**	**36%**	**48%**

Gender gaps are exacerbated when looking at rural women in particular. Based on the UN's Millenium Development Goals, rural women suffer disproportionately from poverty. They also face higher levels of discrimination, violence, and insecurity when compared to rural men or urban men and women.

Source: 1 - ILO, 2 – IMF, 3 - Harvard University, 4 - World Bank, 5 – IMF, UN, UN Women Africa
Note: UN Women (2016) finds that the gender wage gap in sub-Saharan Africa is 28 percent for the informal sector, far higher than the 6 percent gap for the formal sector

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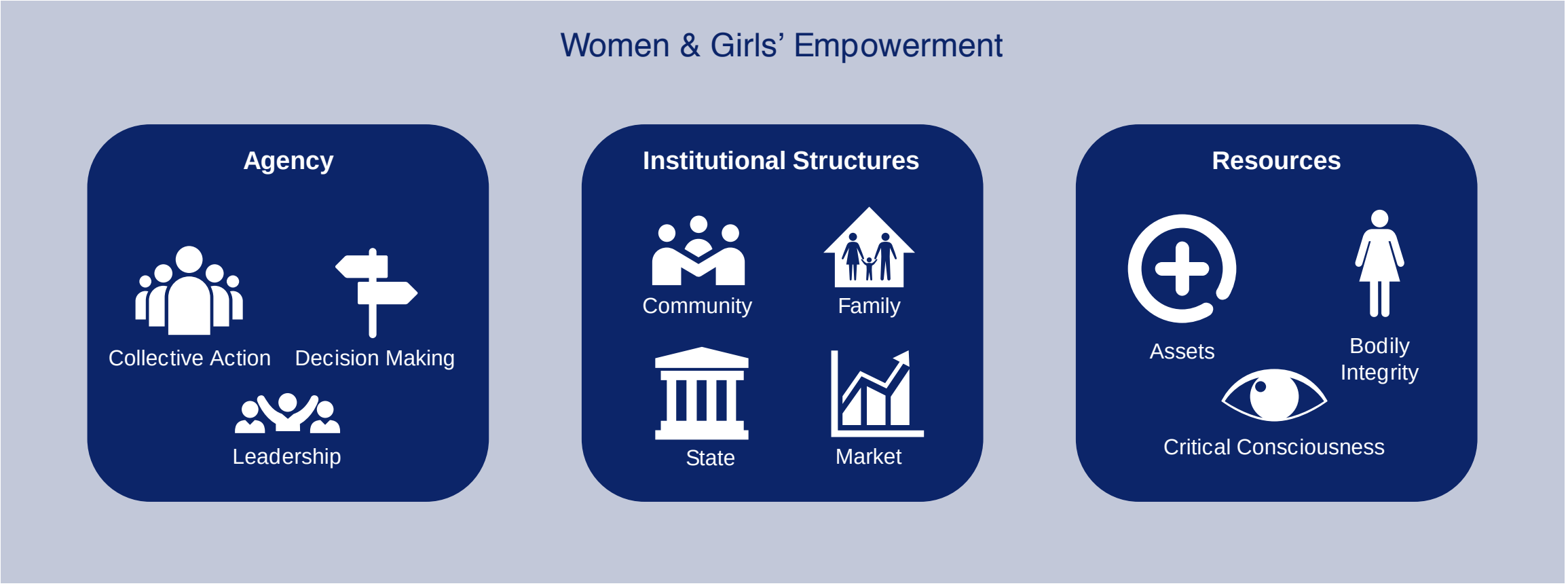
Gates' Conceptual Model of Women and Girls' Empowerment provides a strong framework to understand the elements to track while measuring gender outcomes

The Gates Foundation's Equality toolbox provides a holistic methodology to measure women's empowerment, which includes the consideration of agency, institutional structures, and resources



Source: Gates' Gender Equality Toolbox

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In this context, we believe ‘Resources’ is the most critical element for capital providers to target given its close linkage with economic development

Women and Girls’ Empowerment

Agency

- Agency is the capacity of women to “take purposeful action and pursue goals, free from the threat of violence or retribution”
- Agency is a highly complex element of empowerment, especially for capital providers, as the positive gender outcomes desired by them may not necessarily align with women’s wishes
- It can also be challenging to attribute decisions to Agency with certainty, as it is difficult to gauge the difference between women’s independent choices and those made with external pressures

Institutional Structures

- Institutional Structures are “the social arrangements, including both formal and informal rules and practices, that shape and influence women and girls’ ability to express agency and assert control over resources”
- Institutional structures are shaped by relations, norms, and laws & policy that are ultimately out of the control of individual stakeholders
- While capital providers may be able to affect institutional structures through where they allocate their capital, objectively quantifying gender impact from this change is extremely challenging

Resources

- Resources are “sources of power that women and girls have, own, or use individually or collectively in exercising agency”. Key Resources include bodily integrity (health and safety & security), critical consciousness, and assets (financial and productive assets, knowledge and skills, time, and social capital)
- **‘Resources’ is the most tangible and measurable aspect of empowerment, and the only element that directly affect women’s livelihoods, hence we recommend that capital providers focus on ‘Resources’ when selecting outcomes to measure improvements in livelihood**

Source: Gates’ Gender Equality Toolbox

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Within ‘Resource’, Financial & Productive Assets and Time are the most relevant outcomes to target given the direct and measurable impact on income

		Resources (as an element of women’s empowerment)						
		Bodily Integrity		Critical Consciousness	Assets			
		Health	Safety & Security		Time	Knowledge and Skills	Social Capital	Financial & Productive Assets
Impact on Livelihood		*Health is often a core focus for capital providers as health is not only important in itself, but also affects a woman’s ability to earn an income*	*A sense of safety enables women to live more freely and can even give women the confidence to pursue livelihood opportunities*	*Critical consciousness can help women recognize inequalities and push their pursuit of improving their livelihoods*	*Women often lack control of their own time, and often spend significant time on household chores and other drudgery which limits their earning potential*	*Increasing knowledge and skill levels is critical for women to exercise agency, and often has a high correlation with increased economic growth*	*Social capital allows women to access both tangible and intangible support that can build confidence to pursue livelihood opportunities*	*Improving access to financial and productive assets is the most direct way to improve women’s livelihoods*
Willingness to pay for Outcome*	*Capital Providers*	High	Low	NA	High	High	NA	High
	Beneficiaries	Low	Medium	NA	Medium	Low	NA	High
Measur-ability		Measurable medium term & difficult to isolate driver	Intangible	Intangible	Can be measured easily	Intangible	Intangible	Can be measured easily

Based on impact, value to stakeholders, and measurability, we select **Financial & Productive Assets (i.e., Productivity and Income – either saved or generated) and Time** as the outcomes we recommend to focus on in order to improve livelihoods. We consider **Health** as a supplementary lens as it greatly affects a women’s ability to earn, is valued by capital providers, and is measurable (though it is complex to do so)

Source: Gates’ Gender Equality Toolbox
Note: *Based on Interviews

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Impact of PUE Appliances on Gender Outcomes

To understand the gender impact of PUE, we shortlisted certain appliances based on their ability to directly increase income or save time for the end-user

Common off-grid appliances	Appliance Type	Is the appliance commonly used to increase income / savings?	Does the appliance save / extend available time?
Solar Water Pump	Agricultural Value Chain	✓	✓
Cold Storage / Cold Chain Technology	Agricultural Value Chain	✓	✓
Ag-processing	Agricultural Value Chain	✓	✓
Mobile Charging Banks	Electronics	✗	✗
Radios	Electronics	✗	✗
Computer	Electronics	✗	✗
Televisions	Electronics	✗	✗
LED Lighting	Other	✗	✓
Fans	Other	✗	✗
Clean Cookstove	Other	✓	✓
Hair Clippers	SME-related	✓	✓
Hand Power Tools	SME-related	✓	✓
Sewing Machine	SME-related	✓	✓

Shortlisted Appliances

- Solar Water Pumps
- Cold Storage
- Ag-Processing
- Clean Cooking
- Hair Clippers
- Hand Power Tools
- Sewing Machines

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We then selected four appliances to conduct a deeper analysis of based on their relevance for and impact on women in Sub-Saharan African

Shortlisted Appliance	Does the appliance have an outsized impact on women in SSA?
Solar Water Pump	✓
Cold Storage / Cold Chain Technology	✓
Ag-processing	✓
Clean Cookstove	✓
Hair Clippers	✗
Hand Power Tools	✗
Sewing Machine	✗

According to UN Women, Agriculture is the most important source of work, employing nearly 60% of the women in Sub-Saharan Africa. Women do the bulk of the work to produce, process and market food.

Across developing countries, the role of cooking and serving food falls primarily on women.

Based on surveys conducted by CLASP, Hair Clippers and Hand Power tool have a low development impact potential on women. Though sewing machines tend to be associated largely with women, anecdotal evidence suggests that both men and women are employed as tailors throughout Africa's informal markets

Top four productive use appliances that have an outsized impact on women

1. **Clean Cookstove** — Improved Cookstoves (Tier 2-5)
2. **Ag-Processing** — Ag-processing machines such as milling machines, grinders, hullers
3. **Cold Storage** — Cold storage, cold chain technologies, freezer units
4. **Solar Water Pump** — Solar or electric water pumps powered by renewable energy

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Source: UN Women, WIPO, CLASP

1 Clean cooking solutions can have a significant impact on time savings for women in SSA, with additional impact on health and financial savings

	Clean Cookstoves	Description	Current Situation	Improvement from PUE	Result
Time		• The burden of collecting firewood in an unpaid chore that mainly falls upon women and girls • Switching to Tier 2-3 cookstoves allows women to reduce the frequency of fuel collection due to increased stove efficiency, and a switch to Tier 4-5 cookstoves allows women to move away from firewood collection altogether	• Women in SSA spend an average of 2.1 hours a day collecting firewood[1] • Women in biomass dependent communities SSA spend up to 4 hours a day cooking[2]	Evidence from Nigeria suggests that switching to improved cook stoves (ICS) saved 0.75 hours a day in fuel collection and 1.44 hours a day on cooking[3]	Women could earn an additional **US$480 per annum** if they use time saved from ICS usage to do waged work*
Income		Through the use of clean cooking solutions, women are able to reduce their expenditure on fuel	In SSA, it is estimated that the expenditure on charcoal for cooking is approximately US$30 per month[4]	ICS reduce fuel needs by 20-70%[5]	Women could save up to an additional **US$252 per annum** by moving to clean cookstoves
Health		• Fuel collection was viewed as women's least-liked and most high-risk activity due to the risk of accidents associated with it • According to the WHO, there is substantial evidence that household air pollution (HAP) caused by solid fuels can increase health risks, especially for women (who usually have greater exposure to this pollution) as well as children in the household. It is globally linked to around 2.5 million premature deaths a year[6]. HAP is the greatest health risk for women and girls in sub-Saharan Africa • A study suggests that replacing traditional biomass-burning stoves across SSA could save more than 463,000 lives and US$66B[7] in health costs annually			

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Source: 1- MECS, 2- Clean Cooking Alliance, 3- Onyenke et al., 4- Envirofit, 5- IEA 6- IEA, 7- Duke Global Health Institute; M. Njenga et al. IISTE, Uchenna, Berkeley Air Monitoring Group , Impact Principles
*Note: We use the same assumptions used by Njenga in 2021: Wage workers earn US$0.6 per hour of wage work

Case Study: Bidhaa Sasa

Women prioritize earning an income and saving time, instead of health

Bidhaa Sasa supplies life-improving products to last-mile customers in East Africa. They aim to employ a women-to-women distribution model to increase the adoption of clean cooking appliances by low-income women.

- Bidhaa Sasa estimates that **30-40% of the customers surveyed use improved cookstoves (ICS) for income-generating activities** such as selling cooked food or renting out their products to their neighbours
- Bidhaa Sasa **does not use Health as a marketing message for ICS**: It is difficult for customers to gauge the effect of clean cooking appliances on health, unless the woman is already suffering from respiratory ailments. Moreover, women have a low willingness to pay for appliances that may improve health outcomes, and are more willing to acquire a product that will ultimately saves them time, money, or provides convenience

Source: Bidhaa Sasa Interview

2 Women supply major labor input to the ag sector in SSA and hence access to ag-processing appliances can be a catalytic tool in improving productivity

	Ag-Processing	Description	Current Situation	Improvement from PUE	Result
Time		Women are primarily responsible for the post-harvest processing of agricultural produce	Assuming a female population of SSA as 607M, women spend, on average, almost 66 hours of unpaid time each year on milling[1]	It takes 30 minutes to grind a kilogram of flour by hand, while a machine could do the same work in a minute – reducing time spent by almost 97%[2]	Women can earn at least an additional **US$38 per annum** if they use time saved on milling to do waged work*
Income		In Africa, women are usually the ones responsible for household food processing. Rural women micro-entrepreneurs can look to set up ag-processing businesses for an additional source of income	*Considerable income from ag-processing is only accrued to the owners of the appliance which is currently primarily men*	Considering a base tariff ($0.60 per kW), a flour milling microenterprise can early a daily gross profit of US$5.57[3]	Women can earn an additional **US$2,033 per annum** by setting up their own off-grid mills
Health		• There is anecdotal evidence that the use of solar mills may provide health benefits such as reduced diesel contamination of cereal			

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Source: 1 - CLASP, 2- MIT, 3- A2EI, AgSol, CLASP, IFC, IMF, Lelea et al.,
*Note: We use the same assumptions used by Njenga in 2021: Wage workers earn US$0.6 per hour of wage work

Case Study: AgSol

Ag-processing companies are working to make their offerings more gender-inclusive

AgSol has developed efficient solar milling machines, aiming to help small businesses in Africa. AgSol has focused on increasing the number of women mill owners through the following approach:

- **Products designed to be gender-inclusive:** AgSol has designed its mill with female operators in mind, ensuring its features are lightweight and easy to use. The operations & maintenance of the mill are made less physically demanding and hence encourage equal participation of both men and women
- **Pay-as-you-earn model:** In SSA, only 37% of women have bank accounts, compared to 48% of men. Women in Africa often do not have the assets or collateral required to access credit. To improve uptake from women, AgSol implements a pay-as-you-earn model which has a small monthly fixed fee as well as a variable payment each month linked to income generated from mill usage, with a cap of 30% of gross income

Source: IMF, AgSol

3 Access to cold storage increases shelf life of food, improves food security, and provides much greater income opportunities for small holder farmer women

	Cold Storage	Description	Current Situation	Improvement from PUE	Result
Time		Off-grid cold storage can reduce the time spent by women on trips to the market, cooking, and harvesting by preserving food for a longer time	Women have to spend additional time a day cooking, harvesting, and purchasing food due to its perishable nature	Access to cold storage has been shown to save 2 hours every week from less frequent trips to the market[1]	Women can earn at least an additional **US$62 per annum** if they use time saved from cold storage to do waged work*
Income		• Based on estimates from the Food and Agriculture Organization, food losses in SSA total US$4B annually, largely due to the lack of cold chain storage • Access to cold storage helps microentrepreneurs keep their produce fresh for longer. This can enable them to increase sales volumes by reducing losses (through exports and the domestic market) and receive higher and more stable prices for their produce	A study from Nigeria suggests that the gross revenue per week of market agents selling produce was US$365[2]	Cold storage users increase their gross revenues by 70%[2]	Women can earn an additional **US$598 per annum** by accessing cold storage solutions
Health		• Over 91 million people in Africa fall ill from food-borne diseases. Cold storage can help keep food fresh and free of contaminants for longer and hence decrease the negative consequences of food-borne diseases			

Source: 1- ENERGIA, 2- Takeshima et al., FAO, UN, Bisholo et al., CNN, ESI Africa
*Note: We use the same assumptions used by Njenga in 2021: Wage workers earn US$0.6 per hour of wage work

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Case Study: Koolboks

Cold storage helps women increase their income and reduce expenses

Approximately 40% of food in Nigeria is lost, in part due to the lack of cold storage. Moreover, 40% of the population lacks access to electricity. Solar powered cold storage solutions, such as Koolboks', makes cold storage units to address this problem. These cold storage appliances are especially useful in increasing the incomes of sellers of agricultural produce:

- **Fair prices for produce:** As cold storage preserves freshness, women no longer need to sell produce on the same day. Women would often have to reduce prices significantly at the end of the day but are now able to charge fair prices for longer
- **Less food waste:** Less food goes to waste as it is preserved better due to cold storage, allowing women to increase their earning potential
- **Reduction in fuel expenses:** As the appliance is not dependent on electricity from the grid, which is often unreliable, or from diesel generator sets, which are extremely expensive to run, women are able to save on fuel expenses

Source: ILO, ESI Africa, Koolboks

4 Water collection for farming can have a considerable impact on both time savings and on income through an improvement in farm yield

	Water Pumps	Description	Current Situation	Improvement from PUE	Result
Time		62% of Sub-Saharan African women are involved with farming, and access to water is often a challenge in the region, therefore affecting their ability to do both subsistence and income-generating agricultural work	According to estimates from CLASP, on average women spend 7 hours a week collecting water for irrigation purposes[1] Irrigation is usually done by collecting water in buckets / watering cans from boreholes	Time spent on water collection reduces significantly with access to solar water pumps. We assume no time is spent on collecting water after a water pump is purchased	Women can earn at least an additional **US$218 per annum** if they use time saved from water pumping to do waged work*
Income		• There is evidence that solar water pumps increase agricultural productivity and reduce seasonality, ultimately leading to increased incomes • However, it is worth noting that the income benefit does not necessarily accrue to women as they represent a small proportion of landholders in SSA	The average smallholder farm size in Kenya is estimated to be 0.47 hectare, which has an average yield of US$888 per hectare[2]	Solar water pumps have the potential to increase yields by up to three-fold[1]	Women can earn an additional **US$835 per annum** when solar water pumps are used
Health		• Irrigation and water collection is a highly strenuous activity. Based on research from 60 dB, a majority of farmers use buckets / watering cans for irrigation. There is evidence that irrigated agriculture in warm climates may intensify lethal heat stress due to heat and humidity exposure • Solar water pumps can also be used to pump water for drinking and for washing, increasing the hygiene/sanitation levels of those who own a pump			

Source: 1 - CLASP, 2- FAO, 3- Efficiency for Access, WIPO, Lorenzo Rosa, AfDB
*Note: We use the following assumptions used by Njenga in 2021: Wage workers earn US$0.6 per hour of wage work

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Case Study: Sunken Limited

Solar water pumps are being used by women for more than just farming

Sunken Limited supplies solar water pumps to small-holder farmers in East Africa. From a study conducted by CLASP, it was found that **22% of solar water pump customers use pumps for uses other than irrigation or Farming**. Some women use the water for domestic consumption, for both drinking and washing.

One of Sunken's customers from Nairobi acquired a water pump to improve the productivity of her laundry business. Nairobi is challenged by irregular access to water and the pump allows her to store water in a tank and be operational for more days/hours relative to her competitors.

The use of the pump has saved her significant money as she no longer has to pay for water trucks during power outages. Moreover, she has become the laundry business of choice as she is able to serve customers even during water outages.

Source: : CLASP, Sunken Limited, Interview with Sunken's Customer, World Economic Forum (Image)

All four of the selected appliances have a transformational impact on gender outcomes, albeit in different ways

Appliance	% of female users	Indicative appliance price[1]	Economic value of time saved	Financial impact
Clean cooking	85%[1]	~US$65	US$480	US$252
Ag processing	44%[2]	~US$1,350	US$38	US$2,033[4]
Cold storage	45%[3]	~US$790	US$62	US$598
Solar Water Pump	27%[3]	~US$760	US$218	US$835

Clean cooking and **solar water pumps** have the largest impact on time savings for women

Access to / ownership of **cold storage,** and **ag-processing** for micro-entrepreneurship have a large impact on a woman's income. Solar water pumps also have a considerable impact on income; however, it is worth noting that female ownership of these appliances is low

Source: 1- Interviews with PUE businesses; 2- *Proxy from 60 dB case study on a milling company; 3- 60 dB; 4 – note that this is for appliance owners only*
Note: The gender impact of an appliance will vary by context. For example, in a region with a higher-than-average proportion of female ag workers, solar water pumps, and ag-processing machines may be more impactful. % of female users is indicative *as these are the proportion of female respondents to surveys conducted by 60 dB. It is possible that more male respondents were interviewed and/or asset ownership and usage were not clearly defined.*

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3

Learnings from Previous RBF Programs

The primary benefits of an RBF can be realized through its outcome-first structure, accountability and flexibility, allowing beneficiaries to drive their desired outcomes

By linking the instrument to outcomes, results-based financing (RBF) is an innovative financing tool that allows for the alignment of gender outcome targets with priorities / incentives of stakeholders, and offers a means of tracking investments and progress

Current issues
In SSA, the livelihoods of women in SSA are sub-par to men

Theory of change
Energy usage can have a disproportionate impact on women's livelihoods through (i) a reduction in time spent & (ii) an increase in income

Target outcome
Increase in energy consumption by women through usage of PUE appliances to improve livelihoods

Barriers to uptake PUE appliances

Affordability	▪ Biggest barriers to uptake ▪ Limited access to finance ▪ A low ability and/or willingness to pay, particularly in rural SSA as women have low income for which they have control
Accessibility	▪ Women in rural areas face mobility challenges in terms of travel to distances
Decision making	▪ Women have limited say in terms of purchasing decisions for household spending which are typically at the discretion of the man in a household who is the income earner
Knowledge	▪ Low level of education limits women's understanding of benefits of PUE appliances

RBF rationale

- ✓ **Drive outcomes through aligned incentives across stakeholders**
- ✓ **Verified results**
- ✓ **Provide flexibility to maximize results**
- ✓ **Accountability for beneficiaries**

Enabling environment to ensure success of RBF program

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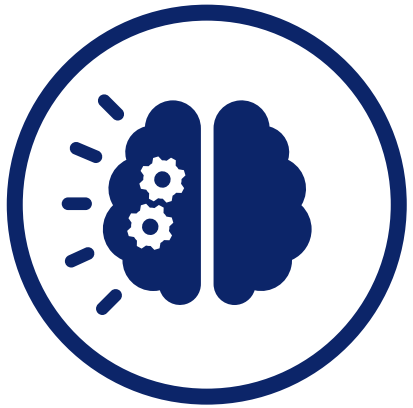
We analyzed learnings from previous RBF programs that can be adopted, improved, and incorporated in the design of a gender outcome focused, productive use RBF

In this section, we aim to build upon the knowledge and lessons learned from previous RBF programs[1], including best practices, gaps and challenges identified, solutions to address those hurdles as well as relevant recommendations noted for future RBF initiatives to date. These learnings are categorized into three key stages of the RBF process.



I. Planning

Incorporates key considerations that need to be analyzed, considered, and planned among relevant stakeholders prior to deep diving into the RBF design

II. Design

Incorporates aspects that should be considered as part of the RBF design, including elements that would help achieve better implementation

III. Implementation, monitoring, and verification

Incorporates takeaways and challenges faced during the pilot and/or actual implementation of previous programs, including data collection, monitoring of results, and verification

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Note:1. Refer to Annexure III for a full list of the RBF literature review.

To achieve desired objectives of the RBF, it is crucial to understand targeted stakeholders, informed by market insights of the service delivery value chain

	Lessons learned and key takeaways
Market maturity impact on the scope of the RBF support	▪ Given that **appliances appropriate for each target country/community are context-specific**, the RBF and **accompanying interventions need to be tailored to each market** such that **the enabling environment within those to help drive the success** of the program. ▪ For example, in the nascent/less mature[1] markets, there might be the need for technical assistance that can raise consumer awareness, create market linkages, or establish/work with existing financing facilities to provide pre-financing to companies that are eligible and enrolling in the RBF program. ▪ Such TA may differ in relatively (more) mature markets given the greater availability of existing stakeholders for potential partnerships as well as sources of financing (i.e., upfront working capital facilities) which allow the RBF beneficiaries to be able to use the RBF funding to pay off their working capital loans more productively.
Prioritization of beneficiaries	▪ By nature of being results-based, RBF programs provide incentives (or at least a part of) upon a result being demonstrated. This means that (a) the **RBF beneficiaries have to be able to finance the purchase of inventory until the sale of the asset**[2] and (b) do so by incurring a portion of the total cost themselves since RBF programs typically do not finance the full amount of asset. ▪ These **two requirements are therefore more conducive for mature companies to achieve**, whereas earlier stage companies might struggle to play their part in making the RBF program successful as they may face cash flow issues required for inventory financing. ▪ Therefore, tailored incentives and intervention of the RBF program is required if participation from smaller/less mature companies is desired, as they have lower institutional and financial capacity to address requirements of the RBF. This could included technical assistance, higher % incentives, ensuring that qualification thresholds are not too high ▪ While the benefit of including the less mature cohorts is that it helps develop the ecosystem of the sector in the long-term, this could require more resources and a smaller scale of impact per dollar provided by the donor in the short term ▪ Additionally, the RBF programs should build on the existing structure of the market **and not actively encourage companies to make significant pivots to the company strategy or the underlying business model**, especially when these are outside of the current plans, as that has a likelihood of not achieving long-term sustainability

> *Have noticed that men are not really willing to listen to conversations on getting clean cookstoves, so they need to focus on community sensitization and engagement for clean cooking solutions.*
>
> *Investor Interview*

> *KPIs of RBFs are often not aligned with DRE companies' strategic objectives. E.g., an RBF's target requires a certain number of customers reached in new regions while regional expansion was not in the growth plan of the participating DRE company*
>
> *DRE Company Interview*

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Note: 1. The mature market in this context is defined as markets with access to inventory financing, a robust business model, and established relationships with other actors in the supply chain that can help make their products or services available to consumers. 2. This may vary depending on how an RBF is structured. Nevertheless, most previous/existing RBFs have a payment trigger upon sale of a product.

Any complementary measures required through partnerships will be crucial to identify to increase the efficacy of RBF as it does not work on a standalone basis

	Lessons learned and key takeaways
Partnerships & stakeholder management	RBF co-funders/donors ▪ **Sourcing and mobilizing appropriate outcome payers for innovative transactions for a gender RBF can take time** to align framework, incentives and for stakeholders, negotiation on terms and conditions, thus requiring appropriate resource allocation (in terms of time, cost, staffing, and division on roles and responsibilities). [1] ▪ **Engaging with funders/donors early**, for the scale-up phase of the RBF program, as they typically have long-term programs and may take several years to add a new program to their budget, particularly for larger institutions. Additionally, the **RBF developers should assess and understand the requirements and key questions that need to be answered** for their participation. Such understanding can then be incorporated into the program pilot phase to appropriately address them. ▪ **Focusing on flexible funders/donors who are open to innovation** is crucial in structuring RBF, particularly for an innovative structure with outcome buyers rewarding the targeted gender outcomes given that there very limited precedent RBF programs. Non-RBF funders ▪ Under RBF programs, **other sources of financing are crucial to the participating companies** given that RBF typically covers a portion of the asset value[2]. If the eligible RBF beneficiaries (i.e., DRE businesses) cannot raise the remaining financing, such RBF program may be rendered less effective and have a slower deployment rate, and thereby becoming less likely to achieve its intended impact objectives. ▪ To encourage faster deployment of the RBF facilities, the program should engage relevant funders/financing partners or communities (including village banking, (women) co-ops, etc.) in parallel such that they can readily engage with the eligible companies once they are onboarded to the program.[3] Other partnerships ▪ Beyond the consumer financing and non-RBF funding sources among community-bases structure/organizations in SSA, the program may also consider a broader engagement – where relevant – with other existing initiatives/programs as well as community-based organizations specific to each target market to collaborate on needed education and awareness-raising where appropriate.

> *Women cooperatives can play a role in enhancing women's participation and access to credit*
>
> *Investor Interview*

> *One of the key challenges of implementing RBF is not having access to working capital / bridge financing for companies to get to the tipping point of growth*
>
> *Investor Interview*

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Note: 1. IFC Clean Impact Bond (2023). 2. Or the inventory cost required depending on the RBF structure and incentive. 3. These financing partners will be complementary in all scenarios even in the case of a milestone-based incentive structure (whereby the RBF program pays a certain % upfront) discussed more under the design phase on page 32-33.

Case Study: Access to Water in Kenya

Successful identification of a capacity gap led to RBF effectiveness

Description

In Kenya, the World Bank launched an RBF pilot scheme, using an output-based aid (OBA) subsidy to expand water coverage given only half of the population had access to water in 2007.

Water services providers' (WSPs) pre-financing capacity for required investments before RBF payments are made was identified as crucial for the RBF's effectiveness.

Complementary measures

Given suppliers' **limited access to finance, technical assistance and other support was provided** as follows:

(i) At the initial stage – toolkits to strengthen financial management, project modeling, and business plan writing;

(ii) At the scale-up phase – a credit guarantee structure was introduced, combined with the OBA subsidy

Outcome

WSPs were able to contribute 20% of the total project cost upfront and borrowed 80% from a 5-year loan from a domestic bank. Upon achievement of OBA agreed targets, WB also provided OBA to WSPs to buy down 40% of the debt, achieving the program's overall targets.

Source: World Bank (2018) and Advani (2016).

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Clear and simple objectives with cost-effective and measurable KPIs are top priorities when designing RBF, yet with a focus on learnings for the pilot phase

	Lessons learned and key takeaways
Objective and design focus	▪ **Objectives should be clear, kept simple, and focus** on addressing **a specific barrier** – such as affordability, quality improvement, or accessibility – with simple targets that are easy to measure and track ▪ Clearly **define the target population** and their **selection criteria at the outset**, then **agree on common KPIs** with partners for achievement measurement. For example, discuss characteristics – such as living standards measure, income level, fuel use, ownership of assets, or others – that would be most suitable to match the low-income that will be targeted. ▪ The RBF **indicators must also be cost-effective, scalable, replicable, robust, and operationally feasible.** In some instances, to the extent applicable, the indicators should also ideally be compatible with third-party standards and carbon methodologies that address gender co-benefits (such as Gold Standards). ▪ The design should **focus on outcomes while noting that there are a range of technologies for each appliance** that work in very different ways for different types of fuels and approaches ▪ For a pilot phase of the gender PUE RBF, the **emphasis** should be **on learnings and with a diversification lens** across various maturity stages of markets and companies with the goal post of achieving impact outcomes upon scale up
RBF structuring and optimization	▪ **Balancing the needs of the funders and beneficiaries** – From the funders' perspectives, it makes sense to provide incentives upon outcomes being achieved and verified. However, to ensure the success of the program, adjustments to such incentive payments should be considered on a case-by-case basis as follows: ▪ **Considering RBF structures with a milestone / upfront funding** (particularly for certain RBF instruments whereby DRE companies are the incentivized parties) by paying x% of RBF upfront such as at the time they acquire the appliance and y% when sales is verified, or other milestones as agreed upon with the companies. These would allow the RBF beneficiaries to manage their cash flows better and not be constrained by upfront financing required for working capital. This mechanism invites more companies at varying degrees of maturity to participate and access RBF funding as well as help accelerate the program rollout at a faster rate compared to the status quo of paying RBF incentives 100% upon results verification, which may adversely delay the outcome that RBF is set out to achieve. Absence of such upfront payment, the RBF cohort would then be skewed towards mature companies as the smaller/less mature ones are less incentivized to participate due to the cash flow consideration discussed above. In our view, this mechanism is reasonable given that the capacity to take risks fall within the hands and interest of the RBF program funders. ▪ **Varying RBF incentives to companies** (under the same program) **at different stages of growth** and development **based on the categories of beneficiaries and organizational capacity**. For example, larger/ more mature companies receive less amount of incentive than less mature ones upon achieving a certain growth milestone. This allows smaller companies to be eligible to participate in the RBF given they have less access to capital and the ability to reach milestones.

> *Objective of RBF should be clear to the recipient.*
>
> *Investor Interview*

> *Amongst others, we track SDG 13 (CO2) and SDG 5 (Gender), which is not monetizable yet but are certifiable (but this puts extra demand on the investee companies), W+ Standard from WOCAN measures time saved…*
>
> *Investor Interview*

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Embedding tailored technical assistance and milestone payment mechanism to stress test key design hypothesis

	Lessons learned and key takeaways
RBF structuring and optimization (Cont'd)	▪ **Incorporating technical assistance (TA)** – Based on the conclusion from the planning process regarding the type and stage of the market and company that the RBF program aims to focus on, in some instances it might be necessary to incorporate technical assistance to get the desired engagement from the relevant stakeholders to get buy-in and achieve the RBF objectives. In the program design phase, these specific TAs are decided upon, which may include but are not limited to the following: ▪ **Awareness raising**: (a) of end-users on PUE appliances; (b) of broad stakeholders regarding the RBF structure and incentives disbursement itself; as well as (c) of the RBF project developers and implementers (DRE companies) on data awareness and data fluency to help them understand the significance of record keeping and how to use relevant technologies ▪ **Market development support**: supporting DRE companies on market linkages and introductions through separate funding, leveraging partners' network, or on gender-specific marketing ▪ **Operational and/or financial support**: Such as product improvement design support, financial management, financing facility ▪ **Monitoring and evaluation**: training to RBF stakeholders on the data required for RBF, or advising the field survey for ex-ante estimation of the gender co-benefits performed by a third party ▪ **Other capacity building of local institutions**: working with local communities, village banks, co-ops
Metrics and gender considerations	▪ From interviews, the key gender metrics tracked by investors and DREs have been mostly based on (1) number of connections with female owners and (2) percentage of female employees, given that most RBFs implemented in the past have largely focused on outputs (than outcomes). Furthermore, the fact that of assessing gender equality relevant to PUE appliances have been difficult and any translation from any observed gender benefits into a quantitative gender impact has been nascent if not non-existent[1] ▪ However, it is clear from our study that number of appliances sold does not directly equate to impact (for women in particular) and **increasingly the focus needs to be on usage of appliance**. ▪ With technology increasingly being incorporated into appliances themselves given the often PAYGO nature of devices, coupled with the rise of carbon finance requiring further data tracking from the appliances such as energy usage, time spent, and other relevant metrics, this is providing access to better data and insights into gender outcomes, beyond sale. ▪ To date, there has been limited RBF programs and study which measure gender outcomes. Two of which that are available consider the concept of: ▪ *Quality Time* – which considers the number of minutes per day that a woman spends on income generation, the production of goods that otherwise would be bought, education, rest, and/or leisure[2] ▪ *Time-use agency* – which hinges upon the concept that of having agency over the allocation of available discretionary time to achieve one's goals may provide a better representation to empowerment than simply time savings.

> *For future RBF, it would be good to add inventory financing, a certain amount of payment upfront (maybe based on receivables) could also work*
>
> *DRE Company Interview*

> *For metrics, we track (i) carbon, (ii) access – reliability, etc., (iii) jobs, and (iv) Finance mobilized / leveraged*
>
> *Most of the metrics we collect are disaggregated by gender, but they currently do not have specific indicators (like women's health or drudgery) to look at for gender impact.*
>
> *Investor Interview*

Source: 1. World Bank (2023). 2. IFC Clean Impact Bond (2023).

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Understanding how the target results can be measured is crucial to the RBF program's effectiveness and disbursement

Case Study: Ningbo Municipal Solid Waste

Unidentified factors affecting measurable results and outcome payment

Description

The World Bank's RBF scheme aimed at tackling issues of the increasing amount of municipal solid waste in Ningbao, China by providing **incentive payment** to the local government (NRC)[1] **based on the quality and quantity of recycling achieved.**

Outcome

The program resulted in limited effectiveness and sustainability whereby NRC did not receive any anticipated disbursement due to **timing difficulties in measuring the recycled waste** that they **achieved**.

Challenges

The factor causing the challenge was the fact that (a) any **recyclables separated by households may not make it to the final collection point** as (b) **private waste recyclers would take those recyclables** delivered to nationhood collection points for resale before NRC results would be measured and verified.

Source: World Bank (2015, 2018)

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Smooth implementation requires close coordination, continuous communication, and an adaptive management approach to respond to dynamic needs

	Lessons learned and key takeaways
Program management	▪ **Prioritizing advocacy, networking, and communication about the RBF program that is being launched**. It is essential that the program works with its partners, network organization, and relevant media platforms to broadcast to the public and communicate about the program to generate demand for the program as well as raise awareness among the stakeholders. This includes, but is not limited to, working with governmental bodies/ associations / community groups as well as with DRE companies to increase understanding of the RBF structure, incentives and requirements (e.g., on data collection). ▪ **Ensuring efficient, close coordination, adaptive management, and continuous communication** among teams/stakeholders involved – including funder(s), implementers, DRE companies, and third-party evaluation agents – is essential for smooth implementation ▪ Ensuring clarity in outcome targeted, level of funding, and the implementation timeline. For example, during the pilot phase, the focus may emphasize more on learning and ensuring success for the scale up phase as opposed to achieving impact outcomes.

Data collection & verification	▪ Data tracking of results and verification have challenges yet are critical and demanded by capital providers to ensure that RBF outcomes are appropriately disbursed. This results in
	  ▪ Disbursement delay to DRE companies. Companies have reported that the time taken for payment of a claim can be anywhere from 30 days to a year, if not longer in some cases
	  ▪ Problems for companies involved in the RBF programs, as they are forced to use their own capital to finance part of the implementation. Smaller ones are most vulnerable to cash flow shortages
	  ▪ Costly and slow verification process (e.g., via phone or on-site survey) and not 100% accurate as it (a) is mostly collected through sampling; and (b) depends on end-user feedback, which is often subjective, as well as issues around data privacy concerns of end users;
	  ▪ Confusion to the end customers upon being independently verified by the implementors;
	  ▪ Strain on companies' and implementors' time and resources
	  ▪ Payment process needs to be more transparent and the speed to deployment is important, especially for small companies

> *Regarding implementation, we have our own data analytics, which is our selling point, and having a template approach that plugs into company data directly is helpful*
>
> *Investor Interview*

> *Lack of trust when it comes to verification. Everything is, digitized so they should do an audit on our side (the DRE company) rather than the end client. Customers feel awkward not to mention having done that without our permission before reaching out"*
>
> *DRE Company Interview*

Source: 1. Clean Cooking RBFs – Key Design Principles

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Particularly in addressing key challenges in the monitoring and verification that are key pain points by stakeholders

	Lessons learned and key takeaways

Data collection & verification (Cont'd)	▪ Factors that may cause **difficulty in verification** are as follows:
	  ▪ **Different technologies** even for the same appliance such as clean cooking;
	  ▪ **Certain business models** – for example, companies with a business-to-business-to-consumer model (B2B2C) because that it is harder to get contact details of end users that are needed for audits. For technology-agnostic RBF funds, streamlining the verification of different technologies across an appliance would be a challenge
	▪ Time-use data for cookstove users can be expensive and difficult to collect and often unavailable for several low-income countries. To date, most project developers reference qualitative impacts that clean cooking has on time savings for women as a positive side effect and do not usually attempt to quantify these impacts. However with increasing interest in monetizing carbon credits the data collection process is seeing improvements
	▪ To prioritize usage, adoption of an Internet of Things (IoT) devices – such as smart / remote monitoring devices – would be required. However, this would limit the eligible appliances that an RBF program can target.
	▪ Additionally, the cost-benefit between the added expenses and complexity of installing such IoT devices compared to the value of the data collected must be considered as this may not be operationally viable across all RBF programs.

> *IoT could help with monitoring but not for everything. For example, one program required proof of training for the appliances (which is not needed for fridges). Thus, requirements should be tailored to the intervention*
>
> *DRE Company Interview*

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Technology can serve as solutions to address challenges in monitoring and verification, though a balance between benefits and costs will be required

Value adds of technology to address data collection and verification fatigue and challenges

Planning → Design → Program management and operation → Data collection and verification

Potential application of technology solutions across the RBF workstreams:

Program management:

- Leveraging a centralized project / CRM software or platform to automate RBF procurement documents for future cross-reference with eligible companies and centralized data collection. *[The viability of this project management software – particularly for the pilot phase is to be discussed further with Odyssey].*

Monitoring and verification:

- Streamlining the monitoring and reporting of quality standards or progress made by RBF recipients through remote monitoring and control;
- Tracking which RBF recipients are ready for verification; and
- Shortening the verification process and disbursement timeline – through solutions to assist in baselining and standardization of metrics linked to finance, fostering transparency and insights to investors, and visibility of claims across relevant parties

Limitation of technology as solutions

Digitizing the verification process through embedded IoT solutions / IoT-enabled usage sensors have challenges:

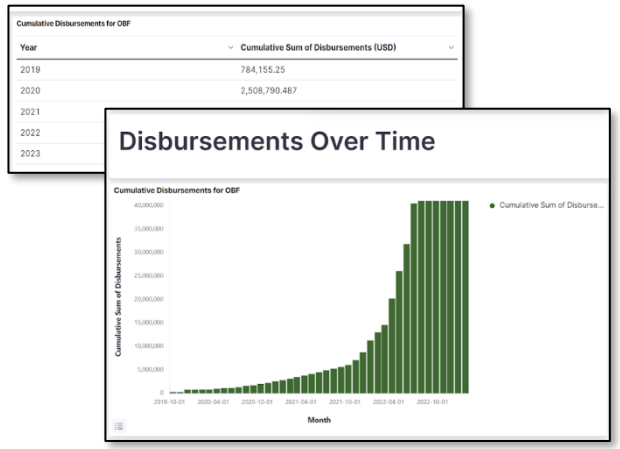
Costs and expenses
relating to additional hardware to be installed with appliances

Servicing & maintenance
Ongoing resources are required for maintaining the database and system

Consumer financing requirement
Adoption of technology particularly if borne through increased selling price may exacerbate the need for consumer finance of end users

Sample use cases

PMIS[1] dashboard for the Utkrisht Impact Bond



Odyssey's sample dashboard for a CRM system, displaying RBF increased disbursement over time[2]

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Note: 1. Denotes Project Management Information System. 2. Odyssey's case study on RBF at scale – remote verification

Case study: Project Management Information System in India

Leveraging technology in data collection, monitoring, and evaluation

Background:

To improve maternal and newborn health care in the private sector in Rajasthan, India, the Utkrisht Development Impact Bond was designed to **incentivize health outcomes** whereby the outcome funders only pay when results are achieved.[3]

Use of technology:

- The RBF implementing manager developed and managed a **Project Management Information System (PMIS) for monitoring the progress** of healthcare facilities and **making decisions about** which facilities were ready for **verification**
- The service providers (SPs) who work with the facilities assessed quality standards, collected data, and entered it into the PMIS
- A summary of **relevant metrics** containing information about each facility's progress, **from baseline assessment, KPIs, through to verification readiness**, is provided in the dashboard; an important tool to help the service provider determine and prioritize which facilities to conduct verification

Challenges and solutions:

- **Lack of data awareness and data fluency** among (a) SP field staff and (b) facility staff
  a) This was overcome by educating the service provider's staff on how to use the system and its importance. Any parallel systems of SPs were also handled by hiring data leads to avoid duplicating efforts
  b) TA was provided in each facility to increase awareness of the importance of data and regular record-keeping keeping. Training was also provided
- **Lack of a PMIS single point of contact for each service provider.** This was addressed by hiring a data lead at each SP, thereby streamlining communications across teams and leading to increased data-analysis capabilities for each provider

Source: The Utkrisht Impact Bond (2022)

Leveraging the lessons learned from previous RBF programs, there are five key tenets identified as key considerations for the design and pilot phases

Effective RBF program requires context-specific interventions tailored to specific target markets and countries

RBF objectives should be clear, simple, and focus on addressing a specific barrier
Objectives of a pilot should prioritize learnings with the goal to ultimately maximize the impact and scale in the full program rollout

RBF indicators must be measurable, cost-effective, and driven by outcomes as opposed to outputs
That is the focus should be on energy usage and not number of appliances sold to drive the desired impact

Balancing the needs of investors and RBF beneficiaries: Considering a milestone / upfront payment structure or gradient level of incentives across different beneficiary groups (mature vs less mature)

Technology can be a solution to address key RBF challenges in monitoring and verification. However, cost-benefit analysis should be considered for each pilot vs scale up phases

Note: 1. Most gender-disaggregated data is tracked across clean cooking and lighting but less with high-cost appliances

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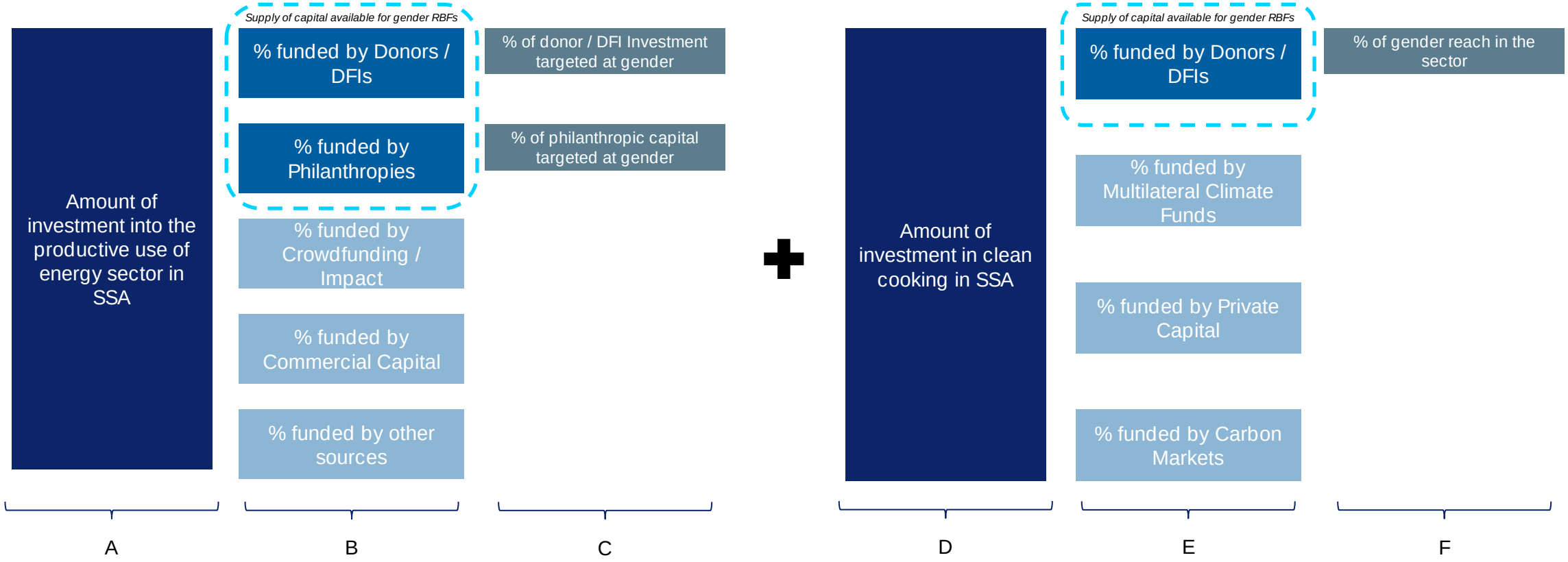
4

Market Sizing for Capital Available for Gender RBFs for PUE

To calculate the supply of capital available for RBFs at the nexus of PUE and Gender, we add the total allocation of relevant capital providers to gender investments

Though clean cooking is a productive use of energy, data on the two are often separated since clean cooking also includes Tier 2 / 3 stoves that still make use of biomass but in a more efficient manner



Supply of capital available at the nexus of PUE & Gender = $\sum_{i=1}^{n} A\ (B_i \times C_i) + D\ (E_i \times F_i)$

n = number of capital sources that provide funding for RBF programs

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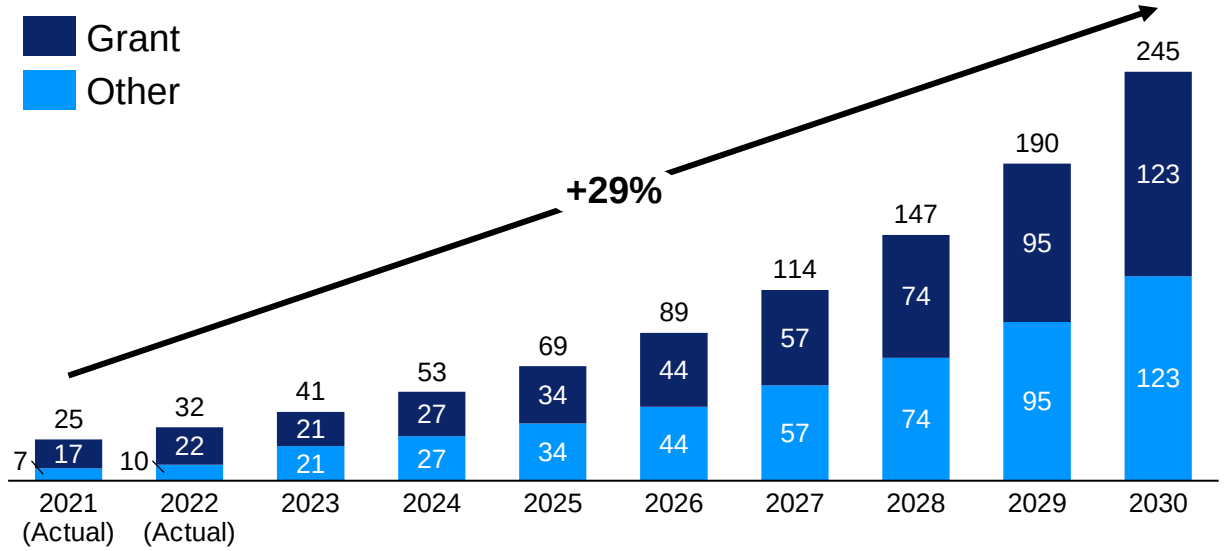
Investment into PUE is expected to grow significantly as access to energy improves in SSA

Growing focus on PUE: The Productive Use of Energy (PUE) Appliance market is becoming an increasingly important segment in the off-grid solar. Investment reached US$32M in 2022, a 29% increase from the year before. In 2021, approximately 70% of the capital that went towards PUE was in the form of grants.

- There is very limited publicly available data on the investment into the productive use of energy
- GOGLA's database, though global has significantly greater coverage of Sub-Saharan Africa

- For simplicity, we assume that all tracked PUE investments from GOGLA were made in SSA
- We make an optimistic assumption that PUE investments will continue to grow at a rate of 29%, as stakeholders are increasingly looking at PUE to improve livelihoods and the utilization of off-grid systems to meet decarbonization targets
- We assume for the forecast period that grants, on average, will comprise 50% of the capital supply for the sector given the impact of PUE on livelihoods. We believe that grants would likely be concentrated in the nearer term as there is a growing focus on catalysing this market.

Expected investment into the PUE sector in SSA US$M)



Based on these assumptions, we estimate that US$41M was invested into PUE in Sub-Saharan Africa in 2023 and that investment will grow to **US$245M by 2030**

Source: GOGLA, GOGLA

Note: PUE is defined as "agricultural, commercial and industrial activities involving electricity services as a direct input to the production of goods or provision of services". This analysis excludes e-mobility.

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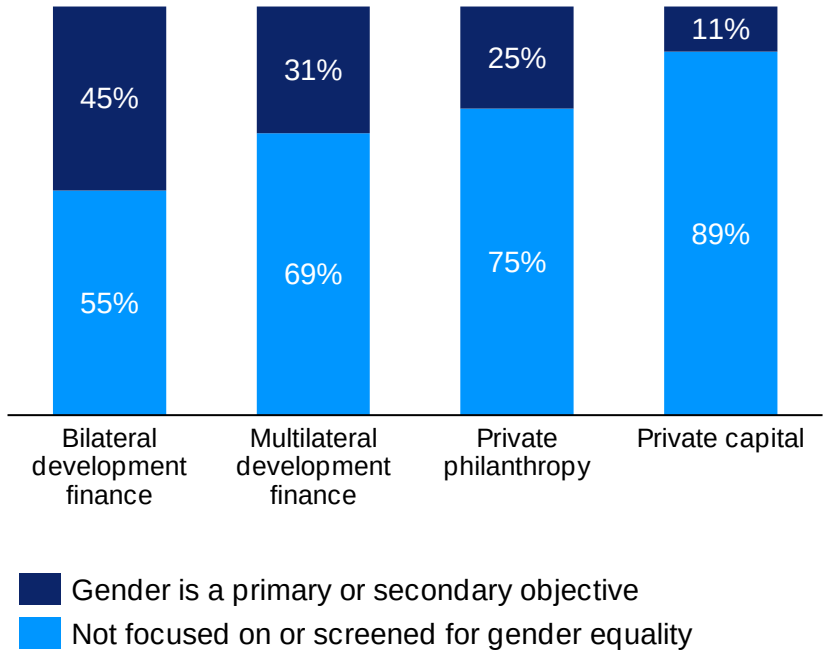
We use historic data around gender commitments of capital providers to estimate the proportion of their capital that is focused on gender (1/2)

Proportion of gender focused capital from various sources (2018-2019)



Based on OECD data from 2018-2019, we see the following allocations for gender as a principal objective or as a significant secondary objective. This allocation is not specific to the energy sector:

- **45% of bilateral development finance** Official Development Assistance (ODA)
- **25% of private philanthropy** flows
- **11% of private capital mobilised** by public development finance

- We exclude Other Official Flows (OOFs) from development finance sources as they are focused on non-developmental activities such as export credit, direct investment, financing of international organizations
- We assume that bilateral development finance can be used as a proxy for DFI / donor capital. Historically, bilateral organizations have been more active in RBF programs than multilateral organizations (see Annexure for Capital Map)
- As we do not have data on whether grants for PUE are from philanthropies or donors, we utilize data from the off-grid solar sector as a whole (detailed in later slides). We consider the weighted average of gender-focused capital from these two capital sources which is calculated to be **38%**

Source: OECD

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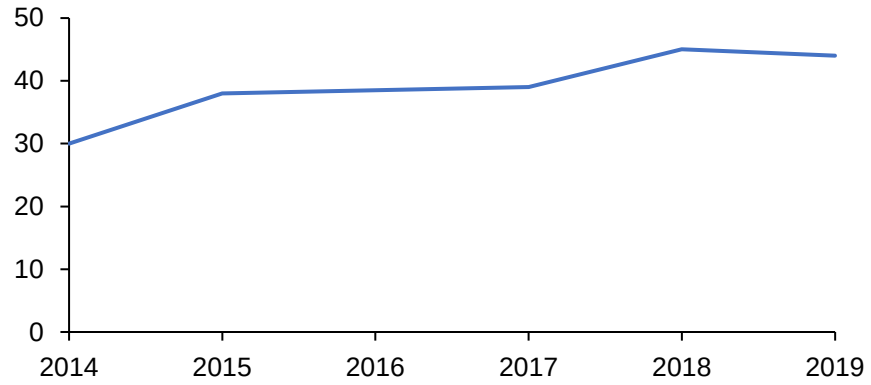
We use historic data around gender commitments of capital providers to estimate the proportion of their capital that is focused on gender (2/2)

ODA commitments focused on gender from bilateral development financiers



Historical gender-focused ODA commitments of bilateral DFIs have increased at a CAGR of 8% between 2014 and 2019

As capital providers increasingly focus on gender lens investments, we make a conservative assumption that all capital sources' gender investments will continue to grow at the rate of 8% over the forecast period

We estimate that $US41M was invested into into the productive use of energy sector in Sub-Saharan Africa in 2023

~50% was funded by donors / DFIs / philanthropies

~38% of which was focused on gender

Growing at a rate of 8% over the forecast period

We estimate that the potential capital supply for gender RBFs in the off-grid solar sector is **US$8M as of 2023** and can grow to **US$50M by 2030**

Source: OECD

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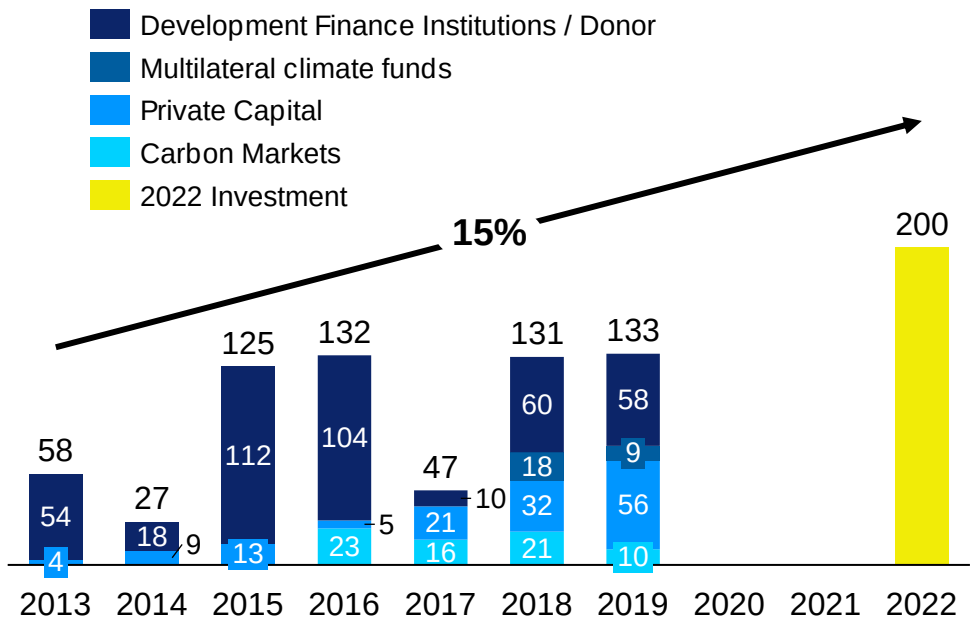
Tracked investment into the clean cooking sector amounted to US$200M in 2020

Clean cooking investments have been relatively stagnant between 2013 and 2019

Commitment to clean cooking (in US$M)



*Complete list of HICs is available in the annex

This dataset, except for data from 2022, is based on SE4All's tracked investments in the clean cooking space in select High Impact Countries (HICs)*. Data from 2022 is from the Clean Cooking Alliance.

- Based on SE4All's data on the geographic split of clean cooking investments in 2018 and 2019 in HICs, we can conclude that 60% of the committed capital goes to HICs in Sub-Saharan Africa, while the remaining 40% flows into HICs in Asia (calculations are available in the Annexure). We will assume this geographic split between Africa and Asia remains constant as we estimate the market size for clean cooking in Sub-Saharan Africa from 2022 onwards
- We will assume that only Development Finance Institution / Donor would be available for gender outcomes
- DFI / donor capital dominated the capital stack between 2013 to 2016. We consider the most recent data available from 2018-2019, and assume that the proportion of DFI / donor capital in the capital stack 2022 onwards is similar to that of 2018 to 2019 – 44.6%.
- As investment in clean cooking is critically below levels for universal clean cooking access, we assume that investment will continue to grow *at least* at the current rate of 15% CAGR

Source: SE4All, Clean Cooking Alliance

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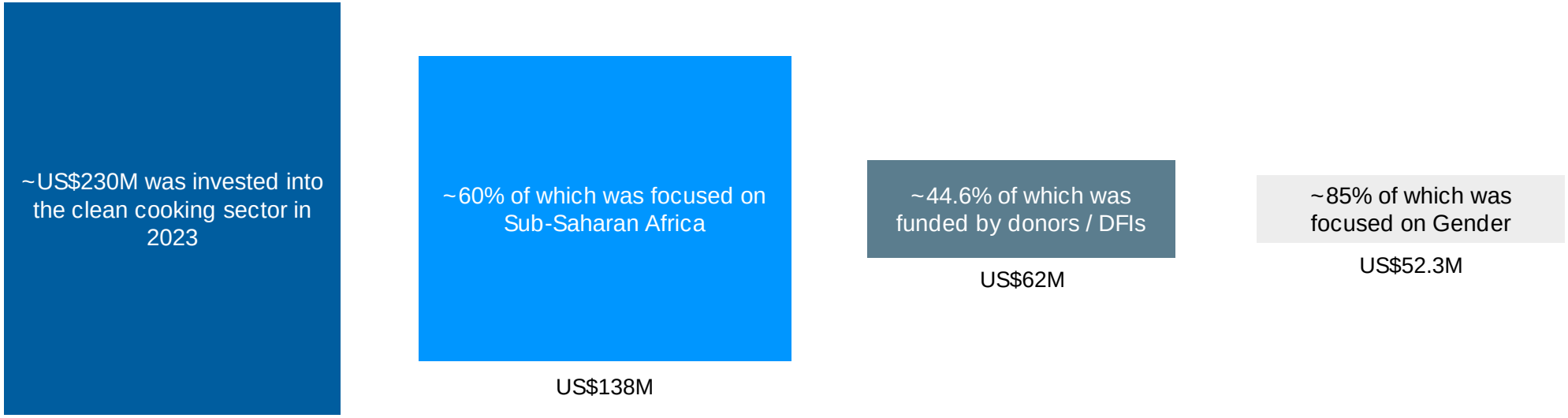
We estimate the amount of capital supply for gender RBFs in clean cooking in SSA in 2023 based on historic geographic flows and sources

Due to prevalent gender roles in the global south, cooking is largely a woman's responsibility, and hence, clean cooking projects are inextricably linked with gender outcomes. For a conservative estimate, we assume on average that 80-90% of the capital is gender-focused since this is the proportion of female customers based on DRE Business interviews. Based on these assumptions, the amount of capital available for gender outcomes in clean cooking as of 2023 has been estimated below:



We estimate that the market size of capital that could potentially be available for RBF programs at the nexus of clean cooking and gender is at least **US$52M as of 2023** and will reach **US$139M by 2030**

Source:

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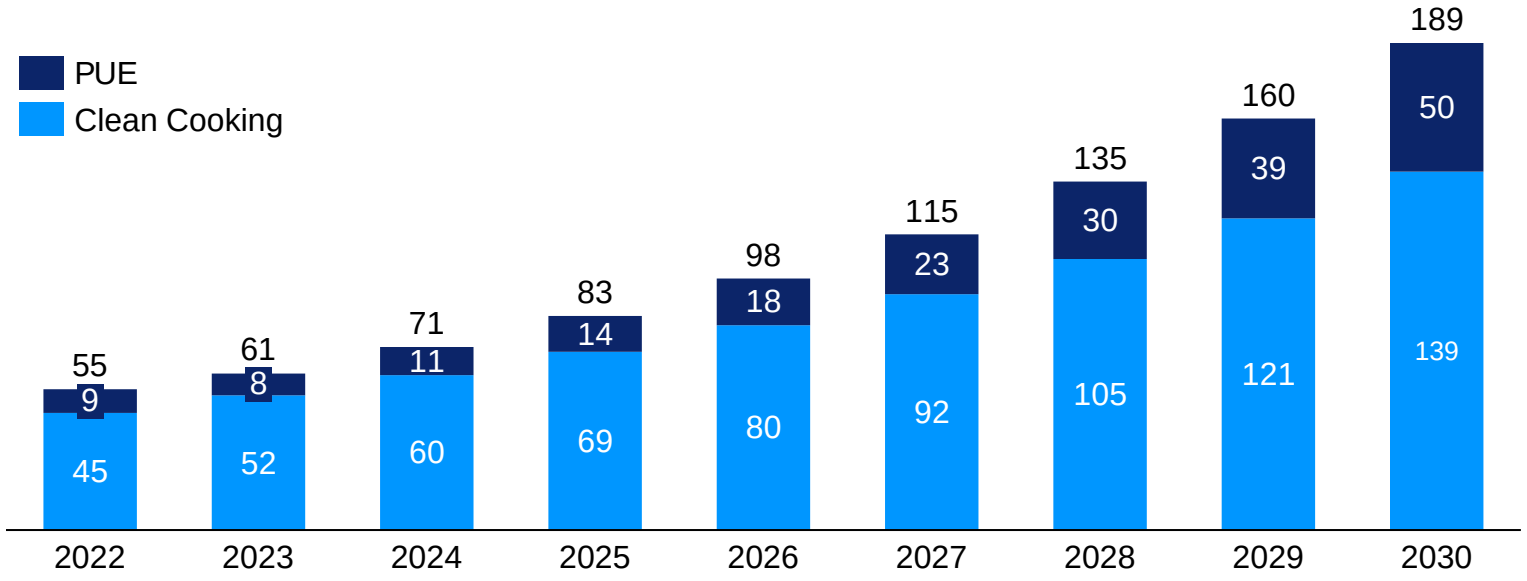
We estimate that the market size for potential capital available for gender and PUE RBFs in SSA can reach US$189M by 2030

Market size of capital for RBFs at the nexus of Gender and PUE (in US$M)



We estimate that the supply of capital potentially available for gender outcomes from the productive use of energy (including clean cooking) is between **US$61M as of 2023** and will grow to **US$189M by 2030**.

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US$189M of RBF capital could result in almost US$3B of economic value for over 11M women in Sub-Saharan Africa by 2030

Appliance	Avg. RBF size as a % of appliance cost [1] (A)	Indicative Price[1] (B)	% of PUE Market Opportunity[2] (C)	Total Capital Available for Appliance (D = C*$189M)	Women Supported (E = D / A*B)	Economic Impact from Appliance[4] (F)	Total Economic Impact (G = E*F)
Clean cooking	20%	~US$65	74%	US$139.9M	10,758,462	US$252	US$2.7B
Ag processing	20%	~US$1,350	4%	US$7.6M	28,000	US$2,033	US$56.9M
Cold storage	20%	~US$790	7%	US$13.2M	83,734	US$598	US$50.1M
Solar Water Pump	20%	~US$760	15%	US$28.4M	186,513	US$835	US$155.7M

11.1M
Women impacted

US$2.97B
Economic value created

Source: 1 – Based on interviews; 2 – Clean cooking % from analysis on page 45, other appliances estimated based on funding requirement from PREO. 'Other Appliances' in PREO are assumed to be ag-processing. Please note that estimates from PREO have been extrapolated so as to include only the three PUE appliances in the table; 3 – Based on analysis in previous section; 4 – Analysis in previous sections

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We may also consider the off-grid market as a whole rather than only investments into PUE as the segment is nascent and traditional off-grid solar companies are increasingly looking to support the sale of PUE appliances

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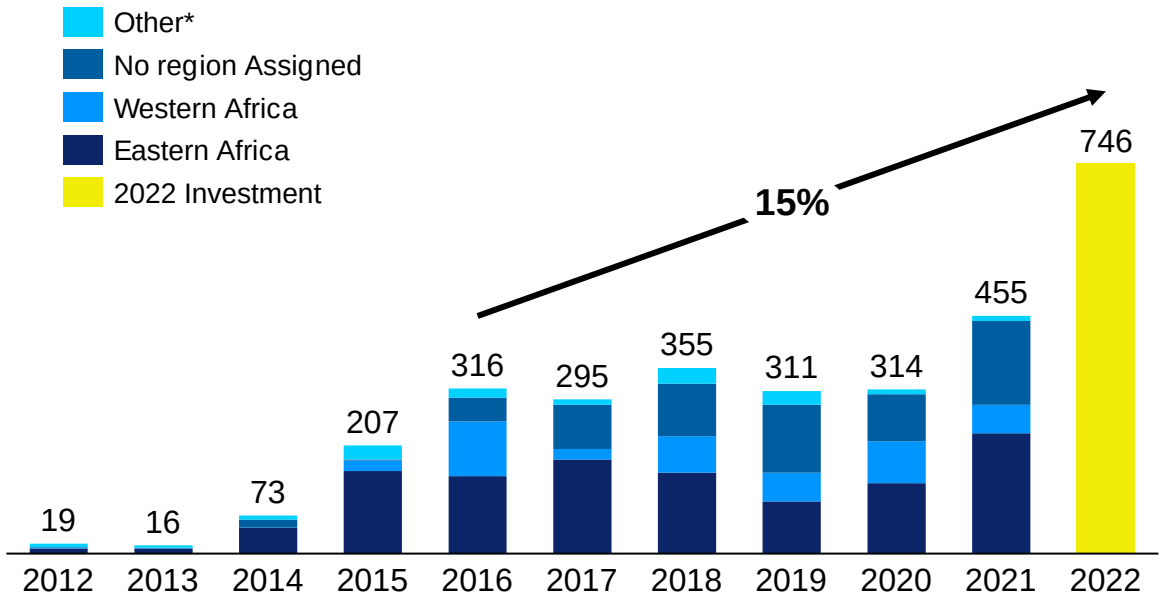
Tracked investment into the off-grid solar sector for energy access amounted to US$746M in 2022

Investment into the off-grid solar sector (in US$M)



*Other includes Southern Asia, Northern Africa, Southern Africa, Middle Africa, and Southeast Asia.
Note: The geographical split of investments in this graph is illustrative; data on the geographic split of 2022 investments is currently not accessible

- Off-grid solar includes both solar energy kits and off-grid solar appliances. The off-grid sector is the segment of energy access that directly impacts access to energy for consumers / individuals
- This data set is based on GOGLA's investment database and although it is global, it has greater coverage of Sub-Saharan Africa. GOGLA's database excludes deals that are not earmarked for energy access
- Based on data from GOGLA, the CAGR of investments into the off-grid sector between 2012 and 2022 is 44%. Investments in 2022 were especially high, with a growth of almost 64% from the previous year

To assume a CAGR for the forecast period, we look at the sector's growth since 2016, when the off-grid sector began to see significant activity, and hence consider a CAGR of 15%

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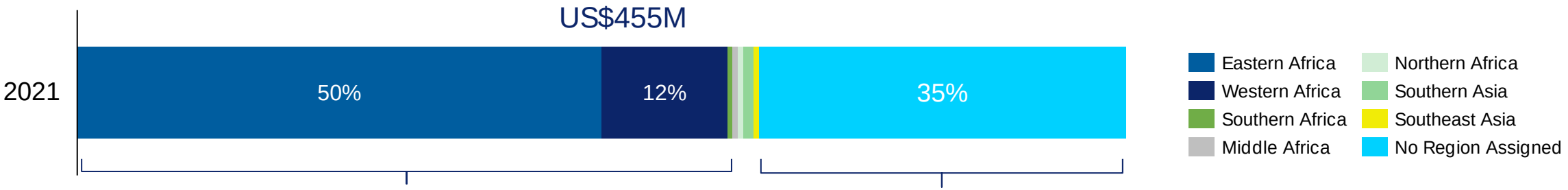
Source: Off-Grid Solar Market Trends Report 2022: State of the Sector, GOGLA, GOGLA

We estimate that the amount of capital invested in the off-grid solar sector in Sub-Saharan Africa today, by assuming similar geographic flows to 2021



A majority of off-grid investment has gone to Eastern and Western Africa

As investments into other regions of SSA are negligible, we will take a simplified and conservative approach and only consider investment into these two regions for the forecast period

- 35% of investments in the off-grid sector cover multiple regions and hence do not have an assigned region in this dataset
- According to estimates from Wood Mackenzie, 79% of off-grid energy access investment between 2010 and 2018 went into Sub-Saharan Africa

We will assume that this proportion for investments, without a specific assigned region, remains constant throughout the forecast period

Based on these assumptions, we estimate that US$769M was invested into the off-grid sector in Sub-Saharan Africa in 2023

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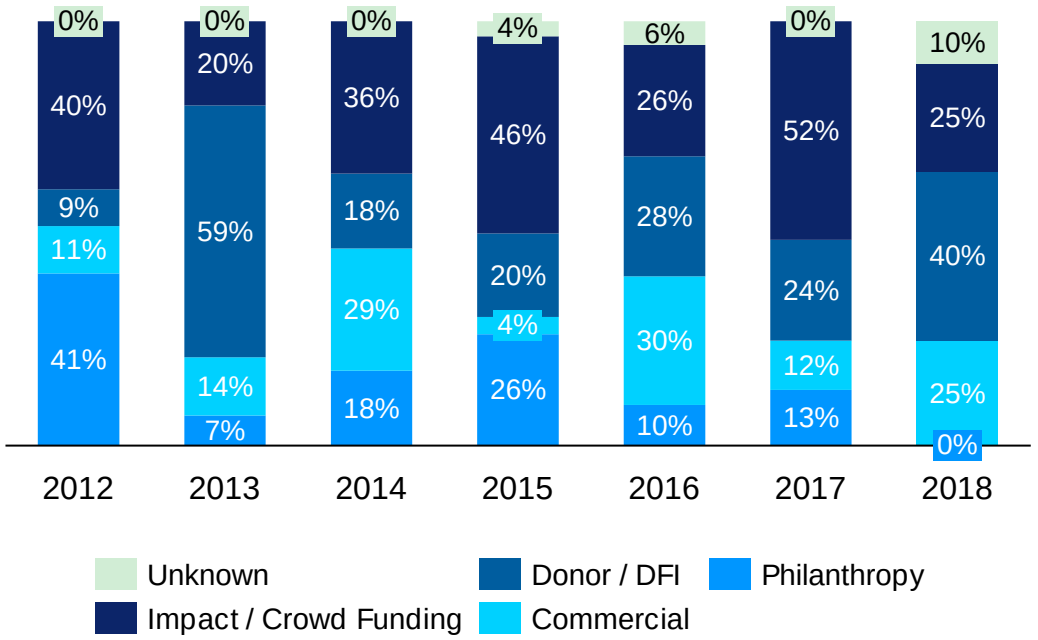
Source: Off-Grid Solar Market Trends Report 2022: State of the Sector, Wood Mackenzie

We estimate the quantum of finance that could be aimed at RBF programs based on past data points and the impact appetite of capital providers

Sources of capital into the off-grid solar sector



Over the years, contributions from the various sources of capital have fluctuated significantly

Organization Type	Average %
Impact / Crowd Funding	34.6%
Donor / DFI	27.9%
Commercial	17.6%
Philanthropy	16.1%
Unknown	2.7%

- We use an average of data from 2012 to 2018 to estimate sources of capital for off-grid solar for the forecast period. Due to the significant fluctuations in contributions from various sources, for simplicity, we consider the average contribution by capital source to remain steady
- We assume that donor / DFI capital, and philanthropic capital would be available as capital supply sources for RBFs in the off-grid sector

Source: Investing in the off-grid solar sector: What you need to know

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From historical gender commitment data, we estimate that the capital that could be available for gender RBFs in the off-grid sector in 2030 is US$505M

We estimate that US$769M was invested into the off-grid sector for energy access in Sub-Saharan Africa in 2023

~27.9% was funded by donors / DFIs

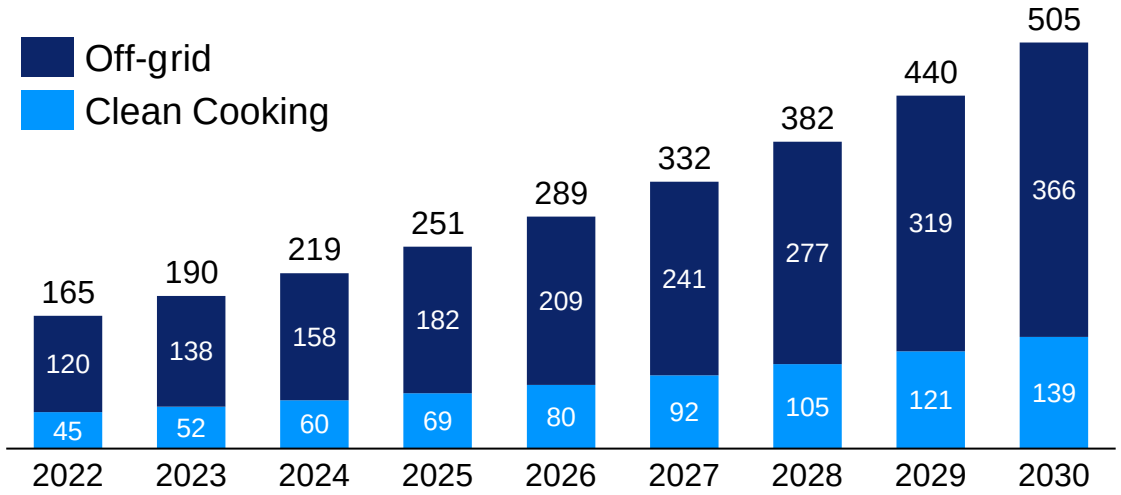
~16.1% was funded by philanthropies

~45% of which was focused on gender

Growing at a rate of 8% over the forecast period

~25% of which was focused on gender

Market size of capital for RBFs at the nexus of Gender and off-grid solar (in US$M)



We estimate that the capital supply for gender focused-RBFs in the off-grid solar sector (including clean cooking) is **US$190M as of 2023** and will grow to **US$505M by 2030**

Source: OECD

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If US$505M of RBFs at the nexus of gender and off-grid solar can be mobilized towards gender outcome focused PUE, ~US$8B of economic value can be created for nearly 30M women by 2030

Appliance	Avg. RBF size as a % of appliance cost [1] (A)	Indicative Price[1] (B)	% of PUE Market Opportunity[2] (C)	Total Capital Available if scaled up to off-grid levels in 2030 (D = C * $505M)	Economic Impact from Appliance[4] (E)	Women Supported (F = D / A*B)	Total Economic Impact (G = E*F)
Clean cooking	20%	~US$65	74%	US$373.7M	US$252	28,746,154	US$7.2B
Ag processing	20%	~US$1,350	4%	US$20.2M	US$2,033	74,815	US$152M
Cold storage	20%	~US$790	7%	US$35.4M	US$598	223,734	US$133.8M
Solar Water Pump	20%	~US$760	15%	US$75.8M	US$835	498,355	US$416.1M

29.5M
Women impacted

US$7.95B
Economic value created

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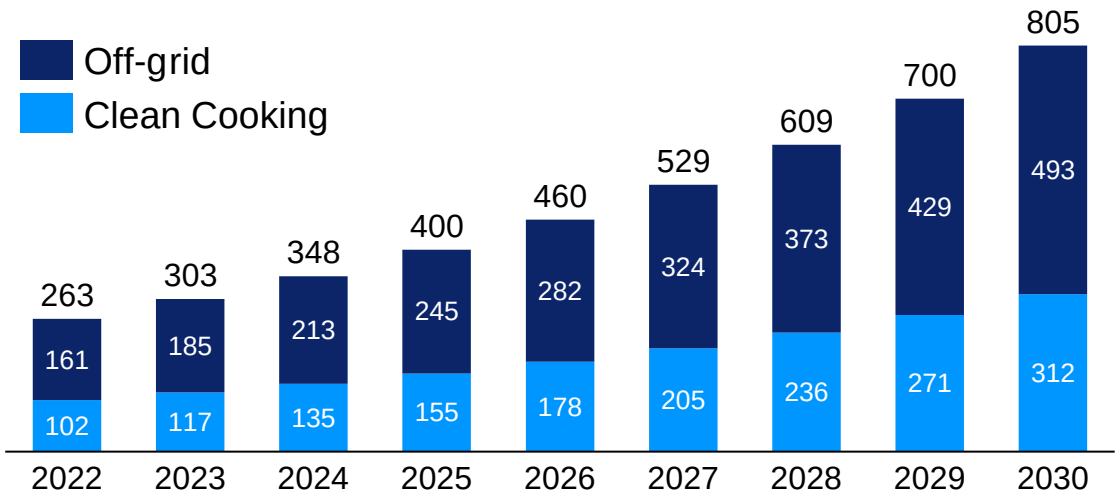
Source: 1 – Based on interviews; 2 – Clean cooking % from analysis on page 45, other appliances estimated based on funding requirement from PREO. 'Other Appliances' in PREO are assumed to be ag-processing. Please note that estimates from PREO have been extrapolated so as to include only the three PUE appliances in the table; 3 – Based on analysis in previous section; 4 – Analysis in previous sections

Using the assumptions in previous sections, we can also estimate the quantum of total capital available for the sector as a whole

We use data from SSA investments in off-grid and clean cooking from our calculations and assume that the supply of capital from each source for off-grid solar and clean cooking remains the same

	Organization Type	Average commitment	Assumed Gender Focused Capital*
Off-grid	Impact / Crowd Funding	34.6%	11%
	Donor / DFI	27.9%	45%
	Commercial	17.6%	11%
	Philanthropy	16.1%	25%
	Unknown	2.7%	0%
Clean Cooking	Donor / DFI	45%	85%
	Private Capital	33%	85%
	Multilateral Climate Funds	10%	85%
	Carbon Markets	12%	85%

Market size of capital for the nexus of Gender and off-grid solar (in US$M)



Approximately **US$805M will be available in 2030** from various sources of capital for investments at the nexus of off-grid solar and gender

Source: OECD

Note: *For off-grid, this is based on OECD Data. We also assume that gender-focused investments for off-grid grow at a rate of 8% every year.

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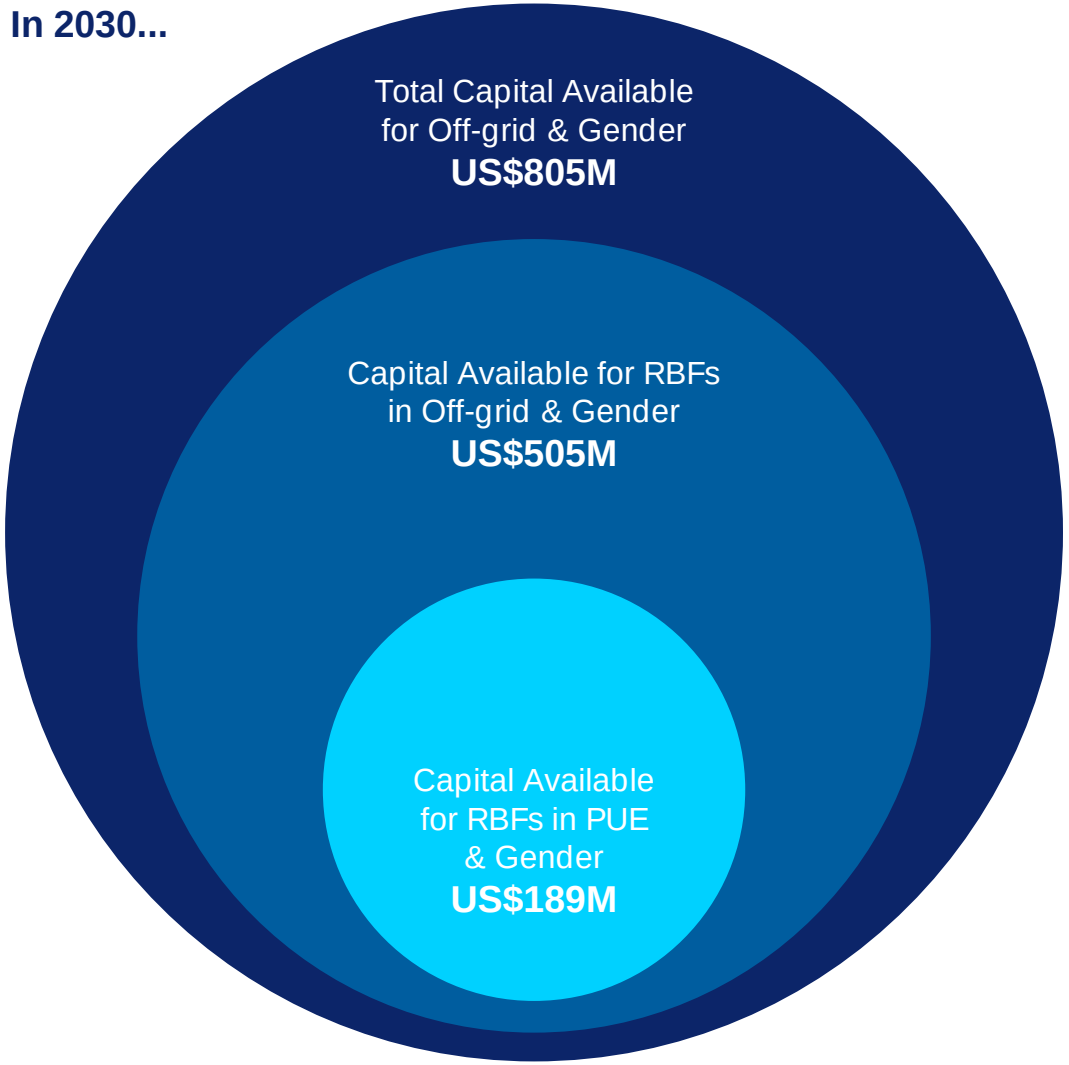
RBFs focused on gender outcomes can be catalytic tools to unlock capital for the improvement of livelihoods of women through PUE

There is a clear interest in the nexus of energy access and gender: All the energy access investors we engaged with see immense value in having a gender focus given the disproportionate benefit energy access can have on women

Most investors are currently focused on output: The focus of investors in the energy access space who are trying to integrate gender is mostly on outputs (for example, the number of women hired or the number of appliances sold to women) as they are easy to track and measure, rather than outcomes (for example, usage of the appliance by women for the maximum benefit or number of training given to women to increase their participation in leadership / technical roles) which can qualify the depth of impact

RBFs can be an important tool for gender impact for capital providers looking to integrate gender into energy access investments: We are still in the early days of gender lens investing. Though there is an increasing number of energy access investors who are interested in producing positive gender outcomes, they are unclear on how to integrate a gender lens in a meaningful way. Outcome-focused RBFs can be a useful tool to approach gender impact

In 2030...



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5

Annexure

Annexure I: Clean Cooking Tier System

	Stove Technology & Fuel	Efficiency	Ventilation	Time	Cost	Impact
Tier 0 – 1 No Access	Open fire, three-stone stove or traditional stove with traditional solid fuel (e.g., firewood, charcoal, dung, agricultural residue)	<20%	Poor	More than 7 hours per week for fuel acquisition and preparation	Stove: US$0-5 Fuel per month: US$0-30 Fuel is often collected for free or purchased in the local market	Significant negative health, climate, and gender impact
Tier 2 -3 Improved	Improved cookstove (e.g., rocket stove, natural draft gasifier with traditional solid fuel, pellets / briquettes, or kerosene)	20-40%	Improved	Less than 7 hours per week	Stove: US$10-30 Fuel per month: US$0-18 Fuel switching is not required. Households save fuel expense or time required for collection due to efficiency improvement	Good climate and gender equality improvement due to reduced fuel usage. Limited health improvement as indoor air can remain polluted
Tier 4 – 5 Modern	Modern cooking appliances with clean cooking fuel (e.g., biogas, LPG, ethanol, electricity, and natural gas or forced air gasifier with pellets)	>40%	Good	Less than 1.5 hours per week	Stove: US$40-100 Fuel per month: US$10-30	Negative health, climate, and gender impact are significantly mitigated

Source: Energypedia

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Annexure II: Glossary

- **Off-grid solar:** Off-grid solar products include both solar energy kits and off-grid solar appliances. The off-grid sector is the segment of energy access that directly engages with consumers / individuals

- **Solar energy kits (SEKs):** These include solar lanterns, multi-light kits and solar home systems (SHS)

- **Off-grid solar appliances:** These include solar-powered appliances and include both household/small business appliances (such as fans, televisions, radios) and productive use of energy (PUE) appliances. PUE appliances are appliances that leverage solar energy to enable improved or new income generating activities, often in agriculture. These products include solar water pumps, refrigerators/cold rooms or agro-processing

- **SE4All's High Impact Countries:**
  - Africa: DRC, Ethiopia, Ghana, Kenya, Madagascar, Mozambique, Niger, Nigeria, Uganda, Tanzania
  - Asia: Bangladesh, India, Indonesia, Vietnam, China, Myanmar, Pakistan, Afghanistan

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Source: Off-Grid Solar Market Trends Report 2022: State of the Sector

Annexure III: List of RBF literature reviewed

#	Literature Name
1	Lighting Africa - Case Study: Kenya'S Solar Lighting Entrepreneurs
2	Endev'S Rbf Facility For Mini-Grids: Experience From Kenya And Rwanda
3	Kosap Clean Cooking Solutions Challenge RBF Facility
4	Accelerating Uptake Of Pico PV Systems And High Tier Cookstoves In Kenya Through Results-Based Financing
5	Energy Access Policies Peru
6	A-Guide-For-Effective-Results-Based-Financing-Strategies
7	Africa Mini-Grid Developers Association (AMDA) Smart Rbf Policy Recommendation
8	Productive Use Of Energy: Moving To Scalable Business Cases
9	Market-Focused Gender Strategy
10	Results-Based Financing (RBF) For Modern Energy Cooking Solutions: An Effective Driver For Innovation And Scale?
11	Time Savings From Improved Cookstoves (ICS)
12	The Utkrisht Impact Bond | Final Report
13	Results-Based Financing For Municipal Solid Waste
14	Clean Cooking RBFs Key Design Principles
15	Clean Impact Bond: Mobilizing Finance For Clean Cooking
16	Biogas Project In Nepal Pilot Project For W+ Standard - Women'S Time Savings From Biogas In Nepal
17	Building Evidence To Unlock Impact Finance - A Field Assessment Of Clean Cooking Co-Benefits For Climate, Health, And Gender

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Annexure IV: Capital map for DRE / Clean cooking RBFs

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Annexure V: Market Sizing Approach – Calculations

Sources of capital into the off-grid solar sector (%)	2012	2013	2014	2015	2016	2017	2018	Average (%)
Unknown	0.0	0.0	0.0	3.5	5.5	0.0	10.0	2.7
Impact / Crowd Funding	39.0	19.5	35.5	46.0	26.0	51.0	25.0	34.6
Donor / DFI	8.5	58.5	17.5	19.5	28.0	23.5	39.5	27.9
Commercial	11.0	13.5	28.5	4.0	30.0	11.5	24.5	17.6
Philanthropy	40.0	7.0	17.5	26.0	9.5	13.0	0.0	16.1

Sources of capital into the clean cooking sector	2018 (US$M)	2019 (US$M)	Total across 2018-2019 (US$M)	% of total investment
DFI	60	58	118	45%
Private Capital	32	56	88	33%
MCF	18	9	27	10%
Carbon	21	10	31	12%

Clean Cooking Investment by Country	2018 (US$M)	2019 (US$M)	Total across 2018-2019 (US$M)
Kenya	36.3	62.2	98.5
Bangladesh	61.9	20	81.9
Uganda	7.2	12.9	20.1
India	6.8	9.3	16.1
Ethiopia	0.9	7.2	8.1
Tanzania	3.1	7	10.1
Ghana	6.8	6.6	13.4
Nigeria	0.7	3.6	4.3
Indonesia	0.6	1.2	1.8
Vietnam	0.5	1	1.5
Mozambique	1	0.9	1.9
China	1.4	0.8	2.2
Madagascar	2.6	0.6	3.2
Myanmar	0.6	0.3	0.9
Pakistan	0.1		0.1
DRC			0
Niger			0
Afghanishtan	0.1		0.1
Total	**130.6**	**133.6**	**264.2**
Africa	**58.6**	**101**	**159.6 (60%)**
Asia	**72**	**32.6**	**104.6 (40%)**

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Annexure VI: Market Sizing Approach – Calculations

	Organization Type	Average %	Assumed Gender Focused Capital*		2022	2023	2024	2025	2026	2027	2028	2029	2030
			Off-grid gender investments grow at 8% annually	**Off-grid Investment in SSA ($M)**	**669**	**769**	**884**	**1,017**	**1,170**	**1,345**	**1,547**	**1,779**	**2,046**
			85% of which is gender focused	**Clean Cooking Investment in SSA ($M)**	**120**	**138**	**159**	**183**	**210**	**241**	**278**	**319**	**367**
Off-Grid	Impact / Crowd Funding	34.60%	11%		27	32	36	42	48	55	64	73	84
	Donor / DFI	27.90%	45%		91	104	120	138	159	182	210	241	277
	Commercial	17.60%	11%		14	16	18	21	24	28	32	37	43
	Philanthropy	16.10%	25%		29	33	38	44	51	58	67	77	89
	Unknown	2.70%	0%		-	-	-	-	-	-	-	-	-
	Total Capital for Gender				**161**	**185**	**213**	**245**	**282**	**324**	**373**	**429**	**493**
Clean Cooking	Donor / DFI	45%	85%		46	53	61	70	80	92	106	122	140
	Private Capital	33%	85%		34	39	45	51	59	68	78	90	103
	Multilateral Climate Funds	10%	85%		10	12	13	16	18	21	24	27	31
	Carbon Markets	12%	85%		12	14	16	19	21	25	28	33	37
	Total Capital for Gender				**102**	**117**	**135**	**155**	**178**	**205**	**236**	**271**	**312**

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