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EnDev DSS Performance Study

Uganda country report

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endev

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Abbreviations

ATP	Ability to Pay
DSRBF	Demand-Side Results-Based Financing
DSS	Demand-Side Subsidies
EASP	Electricity Access Scale-up Project
EnDev	Energising Development
EPCs	Electric Pressure Cookers
ESMAP	Energy Sector Management Assistance Program
FGDs	Focus Group Discussions
GDPR	General Data Protection Regulation
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GPS	Global Positioning System
HTC	Higher Tier Cookstoves
ICS	Improved Cookstoves
ID	Identification
IVAs	Independent Verification Agents
KPIs	Key Performance Indicators
LNOB	Leave No One Behind
LQ	Learning Question
NGO	Non-Governmental Organization
NIRA	National Identification Registration Authority
OGS	Off-Grid Solar
OPM	Office of the Prime Minister
PAYGo	Pay-As-You-Go financing
PSFU	Private Sector Foundation Uganda
QR	Quick Response
RBF	Results-Based Financing
RVO	Netherlands Enterprise Agency
SHS	Solar Home Systems
SMEs	Small and Medium-sized Enterprises
UECCC	Uganda Energy Credit Capitalisation Company
UGX	Uganda Shillings
UNBS	Uganda National Bureau of Standards
UNHCR	United Nations High Commissioner for Refugees
VSLA	Village Savings and Loan Association

1. Executive summary

Background

Uganda's energy access challenge has structurally shifted from expanding product availability to addressing affordability constraints. While overall national electricity access reached a landmark range of 60% - 65% of the population as of mid-2025, rural penetration remains stagnant at 36%.[1,2,3] Furthermore, over 85% of households and 95% in rural areas still rely on traditional biomass fuels.[4] Purely market-based approaches have proven insufficient to reach the most vulnerable, particularly the 1.9 million refugees hosted in rural settlements.[5]

In response, EnDev with funding from the Netherlands Ministry of Foreign Affairs launched a Demand-Side Subsidies (DSS) pilot to test whether targeted point-of-sale retail discounts could sustainably close this affordability gap for off-grid solar and clean cooking products.

Programme design

The DSS pilot was implemented through 20 private-sector companies under a Results-Based Financing (RBF) structure, with subsidies applied directly at the point of sale and reimbursed after verification. Key design features included:

Design	Key elements
Targeting	The pilot targeted refugees and host communities across hard-to-reach markets in Northern and Western Uganda, including Bidibidi, Rhino Camp, Imvepi, Kiryandongo, Lobule, Palabek, Palorinya, Kyaka II, Rwamwanja, and Adjumani refugee settlements and respective host districts, alongside broader rural energy-poor districts such as Amuru, Maracha, Omoro, Nwoya, Moyo, Zombo, Packwach, Nebbi and Kitgum.
Subsidy level	Point-of-sale discounts ranged from 52–68% for solar products and 42–67% for clean cooking technologies. Subsidies were applied uniformly across refugee and host populations to minimize social tension. Following implementation feedback, the absolute subsidy cap for Improved Cookstoves (ICS) products was increased from Ugandan shillings (UGX) 10,000 to UGX 20,000 alongside the introduction of a 60% relative price cap to better reflect last-mile delivery costs in refugee-hosting areas.
Delivery model	The pilot utilized the Private Sector Foundation Uganda (PSFU) as the Fund Manager to coordinate participating private-sector firms. Through this framework, subsidies were delivered via these private-sector partners, who sold products directly to households using agent-based and mobile delivery models
Financing	Solar products were primarily financed through Pay-As-You-Go (PAYGo) models, with repayment periods typically ranging from 3–12 months and relatively low upfront deposits.
Verification	To trigger reimbursement payments, the verification process was conducted through four key steps: data consistency checks, paper trail verification, phone verification, and field verification. Operational adjustments were introduced over time to reflect low-connectivity environments and fast-moving retail realities, particularly within the clean cooking segment.

[1] *Ministry of Energy and Mineral Development (MEMD), Energy Policy for Uganda, 2023, Link*

[2] *ERA deepens Public Engagement in the 2026 Electricity Tariff Review, Link*

[3] *Uganda National Bureau of Statistics (UBOS), Uganda National Household Survey 2019/2020, 2021, Link*

[4] *S4ALL, Taking the Pulse: Uganda Country Study, 2019, Link*

[5] *UNHCR Uganda Comprehensive Refugee Response Portal, Link*

Operational adaptation	The project timeline was extended to June 2026 to allow the programme to meet targets, consolidate operational lessons for larger government-led initiatives such as the Electricity Access Scale-up Project (EASP).

Objectives

This study evaluates how the DSS performed in practice in Uganda, focusing on:

- How effectively subsidies reached low-income households
- How programme design affected market functioning and sustainability

These questions align with EnDev's broader objective of improving the efficiency of public funding and minimizing market distortion in energy access programmes.

Methodology

The study combines quantitative and qualitative data to assess programme performance. Key inputs include:

- A household survey of 500 beneficiaries (250 solar, 250 ICS) across 6 priority localities, including Imvepi, Rhino Camp, Kiryandongo, Bidibidi, Palorinya, and Lobule
- Key informant interviews with participating companies, government stakeholders, and programme implementers
- Focus group discussions with beneficiary households, local leaders, and participating company sales agents
- Review of programme monitoring data, including sales, subsidy disbursement, and verification records

Survey data was collected by EnDev's pool of vetted enumerators through a mix of in-person (70%) and phone-based (30%) interviews using the Kobo tool.

Key findings

1. Solar and clean cooking technologies responded differently to uniform targeting structures

Balanced refugee-host targeting functioned relatively effectively within solar markets, with refugees accounting for 59% of sales. This suggests that once affordability barriers were reduced, latent demand existed across both demographic groups. In contrast, clean cooking uptake remained concentrated among host communities (66% of ICS units and 55% of HTC units), reflecting higher delivery costs, weaker product familiarity, and greater behavioural adoption barriers within refugee settlements.

Implication: Future targeting approaches may need to account for differences in market maturity and operational feasibility across technologies and geographies.

2. Subsidies significantly improved affordability but did not fully address income volatility

Point-of-sale discounts and PAYGo financing substantially reduced entry barriers for low-income households. Approximately 82% of beneficiaries considered products affordable following subsidy support, while PAYGo financing accounted for 76% of solar sales.

However, affordability gains remained constrained by irregular household incomes. Approximately 41% of PAYGo users reported missing at least one repayment, while nearly 90% of beneficiaries across technologies indicated they would still require subsidies for future purchases.

Implication: DSS can substantially expand access, but sustained affordability remains closely linked to broader household income vulnerability.

3. Delivery challenges reflected broader last-mile market constraints rather than programme design alone

Participating firms, particularly within the clean cooking sector, faced substantial operational pressures linked to transport costs, weak infrastructure, staffing limitations, verification requirements, and high cost-to-serve within refugee-hosting districts. Smaller firms were often less able to absorb reimbursement delays and operational shocks.

At the same time, awareness generation and programme legitimacy relied heavily on community-based communication systems involving company agents, local leaders, peer networks, and demonstrations.

Implication: Future DSS programmes may need to complement retail subsidies with broader market systems support, shared infrastructure, and stronger ecosystem coordination.

4. Verification systems created important trade-offs between accountability and operational efficiency

Verification systems functioned relatively effectively within the solar component due to stronger PAYGo and customer-management systems. However, documentation-heavy onboarding and offline verification processes created operational friction, particularly within lower-margin clean cooking markets operating in low-connectivity environments.

Verification delays also contributed to liquidity pressure for participating firms, particularly smaller companies with limited working-capital buffers.

Implication: Future programmes will likely need to balance accountability objectives with more proportionate and operationally realistic verification systems.

5. Clean cooking markets remained more vulnerable to distortion risks and subsidy dependence

The clean cooking sector demonstrated stronger interaction effects with overlapping humanitarian interventions and previous free product distributions, which shaped customer expectations around pricing and willingness-to-pay. While product appreciation and reported benefits were high, affordability constraints remained substantial. By contrast, solar markets appeared comparatively more commercially mature and less exposed to distortion risks due to stronger PAYGo ecosystems and existing consumer familiarity.

Implication: Clean cooking markets may require longer-term market-building support and more gradual transition pathways toward commercial sustainability.

Recommendations

1. Adopt more flexible targeting approaches that account for differences across technologies, geographies, and market maturity.
2. Strengthen upfront community engagement and ID-readiness to reduce onboarding friction during market activations.
3. Complement retail subsidies with shared delivery infrastructure and broader market systems support, including shared energy access hubs and logistics platforms.
4. Improve liquidity support and operational financing for smaller firms through stronger linkages to working-capital facilities and more adaptive reimbursement structures.
5. Design verification systems that are proportionate to transaction size, technology type, and operational realities in low-connectivity environments.
6. Support gradual market transition pathways through stronger coordination with humanitarian actors, phased subsidy reduction approaches, and continued ecosystem-building support.
7. Explore carbon finance aggregation and other results-based financing mechanisms to support longer-term affordability and market sustainability, particularly within clean cooking markets.

Conclusion

The Uganda DSS pilot demonstrated that Demand-Side subsidies can play an important role in accelerating access to off-grid energy technologies within displacement-affected and low-income rural settings. Across both solar solar and clean cooking technologies, the programme successfully reduced affordability barriers, stimulated uptake, and enabled households to experience substantial welfare benefits related to lighting, cooking efficiency, safety, productivity, and reduced reliance on traditional fuels.

At the same time, the pilot highlighted that Solar and clean cooking markets operate under significantly different commercial and operational realities. Solar delivery benefited from comparatively stronger PAYGo systems and more mature distribution ecosystems, while clean cooking technologies faced greater behavioural adoption barriers, higher delivery costs, and stronger dependence on community engagement and ecosystem support.
The findings also suggest that many implementation challenges, including verification bottlenecks, liquidity pressures, and high cost-to-serve, reflected structural constraints associated with operating in fragile rural and refugee-hosting environments rather than weaknesses in programme design alone.

Importantly, significant unmet demand for off-grid energy technologies remains across refugee-hosting settlements and underserved rural districts in Uganda. While shrinking aid budgets and evolving refugee dynamics are changing the landscape on the ground, deep affordability constraints dictate that future scale-up opportunities are likely to extend into additional refugee-hosting and impoverished communities where energy gaps remain substantial.

Overall, the Uganda DSS pilot provides important evidence that demand-side subsidies can support both energy access and market development objectives when designed with sufficient operational flexibility and realistic recognition of the complexities associated with last-mile delivery in displacement-affected settings.

2. Country context and relevance for DSS

Uganda has made steady progress in expanding access to modern energy over the past decade, supported by investments in both grid infrastructure and distributed energy solutions. However, access remains uneven, with rural electrification at 36% compared to over 70% in urban areas.[1] In addition, many connected households continue to experience low-tier access, with limited reliability and insufficient capacity to support productive uses.[2]

Off-grid solar has become a central component of Uganda's electrification pathway, particularly in rural areas where grid extension is not cost-effective. Supported by declining technology costs, PAYGo financing, and strong private sector participation, the sector has expanded rapidly and is expected to remain a key pillar of the least-cost electrification strategy. However, future growth will increasingly depend on reaching lower-income and more remote populations, where affordability constraints and delivery costs are higher.

The clean cooking sector faces a more pronounced challenge as access remains significant. Despite national ambitions to achieve universal access by 2030, current trends suggest that a significant share of households will continue to rely on biomass, particularly in rural and low-income segments. Persistent affordability constraints, combined with behavioural barriers and limited financing options, continue to slow the transition to modern cooking solutions.

[1] *Uganda National Bureau of Statistics (UBOS), Uganda National Household Survey 2019/2020, 2021, Link*
[2] *IEA, Uganda National Energy Transition Plan, 2023, Link*

These dynamics point to a structural shift in Uganda's energy access challenge, from expanding availability to addressing affordability and inclusion. While products are often physically present, low incomes and high last-mile distribution costs render them inaccessible to many without external support. This suggests that purely market-based models remain insufficient to reach the most vulnerable populations.

In response, a growing number of programmes in Uganda are incorporating demand-side elements to address affordability constraints. Electricity Access Scale-up Project (EASP), the Beyond the Grid Fund for Africa, and EnDev have addressed these constraints through a strategic mix of supply- and demand-side subsidies, including results-based grants and credit support to bridge the affordability gap. Together, these approaches reflect a broader shift toward models that aim to deepen market inclusion.

Demand-Side subsidies play an important role within this evolving landscape. By directly reducing the price paid by end users, DSS expands access for households that would otherwise be excluded. However, their impact remains highly design-dependent, as misaligned targeting or inadequate subsidy levels can create trade-offs between inclusion, efficiency, and long-term market sustainability. Through targeted interventions in Northern Uganda and parts of Western Uganda, the EnDev DSS programme provides a practical basis for understanding how such models perform in last-mile contexts and how design choices influence outcomes.

This report provides a detailed assessment of the DSS pilot performance in Uganda as part of the broader EnDev DSS performance study. It focuses on the operational realities of reaching marginalised populations and the market dynamics that shape programme outcomes, to inform the design and scale-up of future demand-side interventions in Uganda and comparable contexts.

3. Research objectives and methodology

3.1. Study objectives and learning focus

The analysis is structured around two core learning questions:

1. How can scarce public funding be used most efficiently to reach low-income and marginalised groups?
2. How can DSS be designed to minimise market and price distortion?

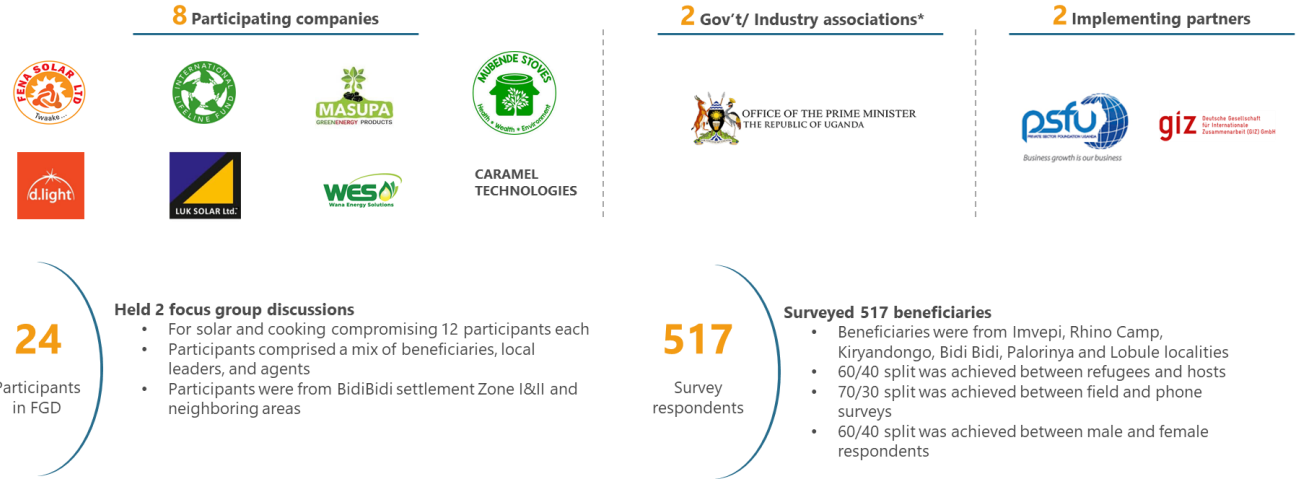
To address the learning questions, the study assessed how the Uganda pilot performed in reaching low-income and marginalised groups and how key design choices influenced programme outcomes.

3.2. Research methodology

This study used a mixed-methods evaluation matrix to align research questions with the World Bank End-User Subsidy Toolkit for Energy Access elements.[1] This ensured that data analysis focused precisely on how design choices influenced pilot performance and market interactions. The evaluation matrix was populated through the integration of **pilot data analysis, key informant interviews, focus group discussions, and field surveys.**

[1] *End-User Subsidy Toolkit for Energy Access, Link*

Figure 1: *Snapshot of stakeholder engagement*[1]



4. Pilot context and operational overview

The DSRBF pilot in Uganda builds on EnDev's prior work with blended RBFs in refugee-hosting districts. The programme is managed by EnDev, with PSFU serving as the fund manager and implementing partner. The project aims to improve the affordability of clean energy solutions for refugees, host communities and other rural poor households across Northern Uganda, and parts of Western Uganda. By providing targeted subsidies to private energy companies, the project triggers retail price reductions for off-grid solar and clean cooking products, ensuring the financial benefits directly reach the end-user. Operating in hard-to-reach, nascent markets required the pilot to strategically adapt its initial design during active implementation across the key design elements.

4.1. Targeting

Initial design

The demographic targeting used focused on refugees and hosting communities, aiming to maintain a 50/50 split for solar and lower-tier clean cooking technologies. The geographic locations included refugee settlements and the host districts of Bidibidi (Yumbe), Rhino Camp and Imvepi (Terego and Madi-Okollo), Kiryandongo (Kiryandongo), Lobule (Koboko), Palabek (Lamwo), Palorinya (Obongi), Kyaka II (Kyegegwa), Rwamwanja (Kamwenge), and settlements within Adjumani (Adjumani). Other rural, energy-poor districts of Amuru, Maracha, Nebbi, Nwoya, Moyo, Pakwach, Omoro, Kitgum, and Zombo were also targeted under the project.[2]

Implementation reality and drivers of change

To maximize impact and scale adoption of clean cooking technologies, the pilot was strategically extended in late 2025 to include the Kyaka II and Rwamwanja Refugee Settlements (and their host districts), alongside Omoro and Kitgum districts. This expansion allowed the project to leverage broader rural markets while maintaining its focus on vulnerable populations in Western and Northern Uganda.[3] Furthermore, while the 50% sales target for refugee households remained a core objective, the project applied sector-specific flexibility to account for varying market speeds. Solar providers consistently met the 50/50 ratio; application was relaxed for the clean cooking

[2] Discussions were held with the Settlement Commandant for Palorinya and the Deputy Head Regional Desk Officer, Arua, within the Office of the Prime Minister
[2] DSS Concept note Uganda 2025 Update
[3] PSFU Operations Manual

sector to accommodate slower adoption rates in remote areas without stalling project momentum. HTC, on the other hand, operated without a ratio requirement as a market-learning component.

Acknowledging the fast pace of product innovation, the design allowed companies to continuously update or register new products mid-scheme, provided their products are checked against quality standards. As part of the mid-2025 adjustments, the project removed the Kobo eligibility tool for clean cooking and permitted up to five sales per ID. However, to prevent duplication, verification remained at the end-user level to ensure each household benefited from only one subsidized stove.

4.2. Subsidy level

Initial design

The core methodology for establishing subsidy levels was anchored in calculating the affordability gap by comparing target beneficiaries' willingness and ability to pay against prevailing market prices. To prevent social tensions, the subsidy was kept uniform for both refugees and host communities, ranging from 42-67% for cooking technologies and 52-68% for solar technologies. The subsidy was delivered as maximum absolute incentive amounts that directly reduced the end-user's initial deposit and monthly instalments. The mechanism was structured to provide companies with a 30% upfront advance upon contract signing, with the remaining 70% disbursed only after successful sales verification to address private sector cash flow constraints.

Implementation reality and drivers of change

ICS companies expressed that initial pricing models did not account for the high costs of doing business in refugee markets, such as long supply distances and poor road infrastructure. Consequently, the project increased the absolute ICS subsidy cap from UGX 10,000 to UGX 20,000 and introduced a 60% relative price cap. This restructuring led to adjusted targets: ICS units were reduced to 100,004, while HTC targets increased to 10,453 units (including Modern ICS, EPCs, and ethanol stoves), and solar lanterns with charging capabilities increased to 1,737 units.[1]

4.3. Delivery

Initial design through implementation

The pilot channeled retail discounts through a cohort of 20 contracted companies (12 ICS; 8 OGS). The pilot utilized a predefined lot-size system to manage delivery capacities and contract targets, requiring companies to apply for predefined delivery capacities, with options ranging from 1,000 to 5,000 units for solar home systems, 5,000 to 20,000 units for ICS, and 1,000 to 500 units for HTC, proportionate with their proven distribution networks.[2] To participate, companies underwent physical due diligence to ensure their portfolios met the quality standards, specifically VeraSol for Tier 1 OGS products (lanterns and solar) and UNBS for clean cooking technologies. The eligible range spans biomass-based ICS (Tiers 1-3) to HTC (Tier 4), including ethanol stoves and EPCs for electrified areas.

4.4. Verification

Initial design

[1] *Revised write-up - for Budget Amendments and Subsidy Restructure*
[2] *PSFU Operations Manual*

Before forwarding claims to EnDev to initiate verification with IVA, PSFU conducted initial data consistency and completeness checks across: (i) completeness, verifying claims meet minimum thresholds and following up on missing records; (ii) consistency, cross-referencing sales against the Kobo Eligibility Tool and confirming discounts were passed to customers; and (iii) double claiming, using Kobo data to identify duplicates across companies and recognising only the first recorded sale. A clean dataset is then shared with EnDev to initiate verification. The IVA then conducts paper-trail checks, phone interviews, and field visits; however, this structure underwent significant operational revisions to accommodate real-world market constraints.

Implementation reality and drivers of change

For lower-tier ICS distributors, the pilot waived both the paper-trail requirement and the real-time Kobo eligibility check to accommodate rapid, low-margin market sales, relying instead on phone verification. Conversely, higher-tier (modern) ICS sales still required Kobo tools, and the IVA maintained standard paper-trail checks. While a 10% tolerance value for unreachable customers was initially proposed in the manual, it overlooked risks like customer denials, faulty systems, and incorrect products. Instead, a second-level phone verification layer was established where all denial cases and 50% of unreached customers were forwarded to the field for further investigation, expanding the original field sample.

The final workflow enforces performance thresholds for payments where at least 50% of customers must be successfully reached during phone verification; failing this, the claim is rejected unless alternative verification methods can prove customer eligibility and product functionality. Furthermore, if the overall eligibility score falls below 50%, the entire claim set is rejected and returned to the company via PSFU for an internal integrity check before it can be resubmitted.

4.5. Exit strategy

Initial design

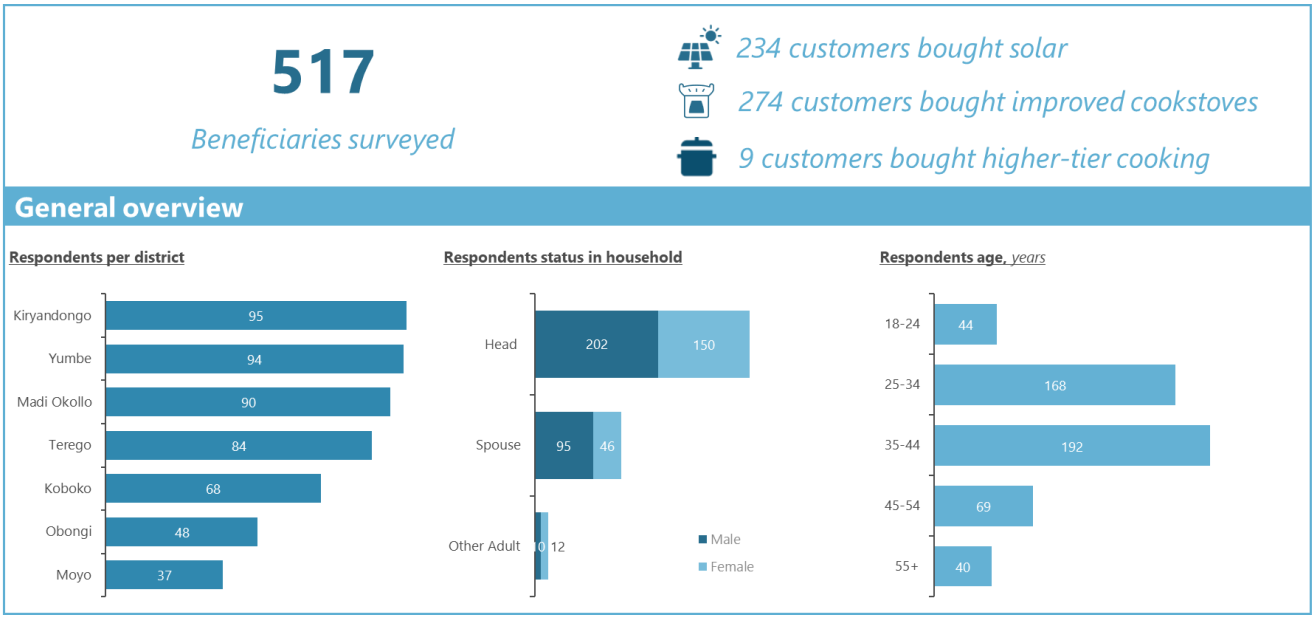
The project's primary objective is to scale up the pilot's successful elements into a larger, government-led fund supported by the World Bank's EASP. To facilitate this, the project coordinates closely with the UECCC on market awareness and design harmonization. Should a formal scale-up not materialize, the project was structured to execute a smooth phase-out by carefully managing consumer communication, specifically branding the incentive as a limited-time discount and seamlessly handing over established tools to local partners for continued use.

Implementation reality and drivers of change

While the project was originally planned to close by Q3 2025, the timeline was extended to June 2026 to achieve sales targets and consolidate operational lessons. This extension provides the necessary window to finalize performance data and integrate key findings into larger government-led initiatives, such as the EASP.

5. Findings

***Figure 1**: Snapshot of household and respondent profile*



5.1. Targeting effectiveness and efficiency

Results: ID requirements enhanced targeting precision but limited participation among households lacking physical documentation at the point of sale

Solar home systems

Programme sales data suggests strong alignment between solar targeting and underlying demand dynamics. Verified sales data show that solar uptake was led by refugee households, who accounted for approximately 59% of all solar units sold (around 72% when measured against host communities alone, excluding poor communities), compared with 23% for host communities and 17% for poor communities, indicating that once affordability barriers were reduced through subsidies and PAYGo financing, demand existed across both demographic groups. The targeting framework also appears to have been operationally clear to most end users. Approximately 73% of beneficiaries reported being informed why they qualified for the subsidy, with explanations primarily linked to refugee or host status and geographic eligibility criteria. In addition, 69% of solar beneficiaries perceived the subsidy as reaching households most in need.

While formal identification mechanisms supported accountability objectives, companies and programme implementers noted that they occasionally introduced operational friction within the pilot's mobile delivery model. Although most beneficiaries possessed the required documentation, including National IDs, Refugee IDs, or Attestation cards, many were reluctant to carry original documents to temporary market activation points due to the risk and cost associated with replacement. In remote areas with limited photocopying infrastructure, this occasionally resulted in missed transactions during short sales windows.

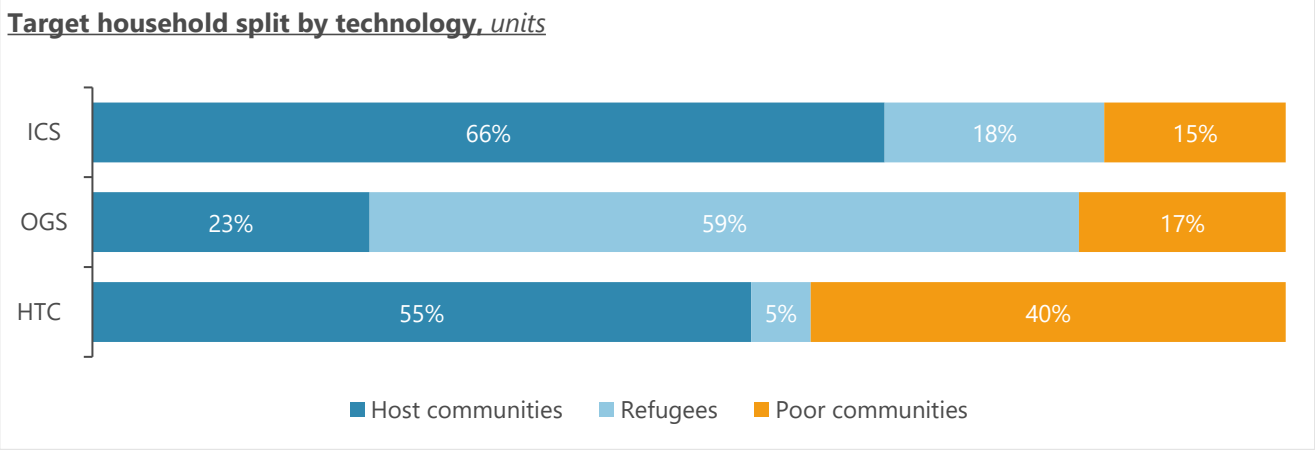
Overall, findings suggest that demographic targeting functioned relatively effectively within the solar component, particularly where strong latent demand and comparatively mature distribution systems already existed. However, accountability requirements continued to introduce trade-offs between programme control and transactional efficiency in last-mile settings.

Clean cooking

The clean cooking component experienced substantially different targeting outcomes relative to solar. Host communities accounted for approximately 66% of ICS sales and 55% of HTC sales (around 78% and 92% respectively when measured against refugee uptake alone), suggesting that uptake remained more concentrated outside refugee populations despite the programme's targeting objectives. Participating companies and programme stakeholders observed that demographic quotas interacted differently with underlying demand and operational realities across technologies. While the 50/50 ratio remained an important accountability mechanism within the broader LNOB framework, ICS companies reported greater difficulty achieving balanced uptake within refugee settlements.

Several factors appear to have contributed to this outcome, including lower refugee purchasing power, weaker familiarity with improved cooking technologies, and higher operational delivery costs for participating firms. Unlike solar, where affordability appeared to be the primary barrier, clean cooking uptake remained influenced by a broader set of logistical and economic factors, even with a distribution-cost subsidy. Notably, the HTC component operated without quotas as a market-learning exercise, allowing the programme to assess adoption dynamics for higher-tier cooking technologies in these contexts.
Taken together, these findings suggest that blanket demographic quotas may not fully reflect the differing market conditions across technologies and geographies, particularly for clean cooking solutions operating in displacement settings.

Figure 2: *Target populations split across technologies*[1]



5.2. Subsidy level determination and impact

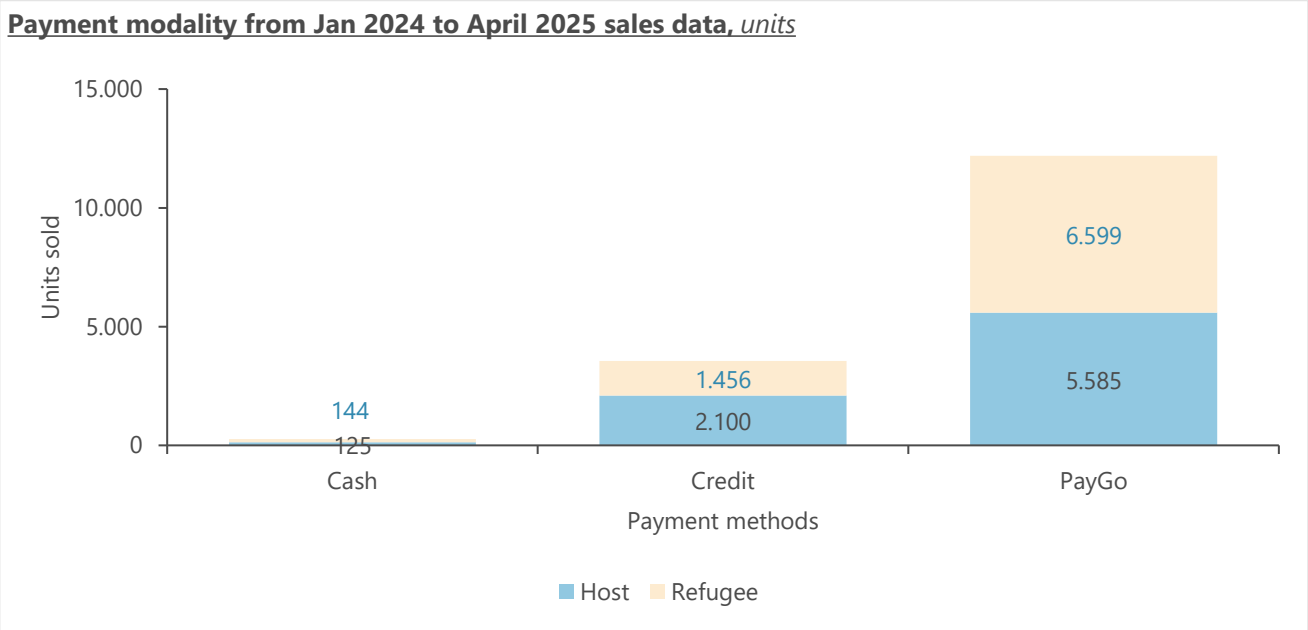
Results: Subsidies bridged the affordability gap for the majority, but remained shallow to serve those below DSS' lowest affordability threshold

Solar home systems

Subsidies substantially improved affordability for solar customers. Household survey findings indicate that 82% of beneficiaries considered the discounted product affordable, while programme sales data show that PAYGo financing accounted for 76% of solar sales. By reducing upfront deposits to approximately UGX 5,000–10,000 and allowing repayment periods of 3–12 months, the DSS significantly lowered initial entry barriers for low-income households.

[1] *ODM Cooking and Solar Data as of May 2026*

Figure 3: *Modes of payment for solar technologies from January 2025 to April 2025*[1]



Participating companies adopted a range of adaptive credit-risk management approaches suited to refugee and rural contexts, including VSLA-backed approvals, agent-led vetting, and digital credit scoring. These mechanisms enabled companies to expand financing access while managing repayment risks in highly volatile income environments.

Despite these gains, sustained affordability remained sensitive to household income instability. Household survey data showed that 41% of PAYGo beneficiaries (19 of 46 respondents) had missed at least one repayment. Refugee households were disproportionately represented among respondents reporting missed payments, often linking repayment challenges to temporary liquidity gaps and disruptions in humanitarian cash assistance or ration cycles. FGDs reinforced these findings, with participants describing irregular incomes and seasonal shocks as ongoing constraints to repayment consistency.

The pilot also revealed early signs of demand progression among a smaller segment of solar users. Approximately 7% of surveyed respondents expressed interest in higher-capacity systems capable of powering additional lighting points, televisions, or refrigerators. However, these aspirations remained closely tied to continued financial support, with 93% of solar buyers indicating they would still require subsidies to purchase future energy products.

Overall, the findings suggest that DSS and PAYGo financing significantly improved initial affordability and expanded solar access among low-income households. However, repayment sustainability remained exposed to broader economic vulnerability in displacement settings.

Clean cooking

The clean cooking component demonstrated that retail subsidies improved access but did not fully address the structural affordability and cost-to-serve challenges associated with remote refugee-hosting areas. While household survey findings showed strong appreciation for the technologies and high levels of reported daily usage, KIIs with companies highlighted that initial subsidy structures underestimated the operational costs associated with transport, staffing, warehousing, and servicing in hard-to-reach settlements.

In response to field consultations and company feedback, the programme increased the absolute ICS subsidy cap from UGX 10,000 to UGX 20,000 and introduced a 60% relative price cap. These adjustments were intended to better reflect the realities of operating in last-mile refugee and rural markets, where companies faced higher delivery costs and thinner margins. Despite these revisions, operational pressures remained significant, particularly for smaller firms with weaker infrastructure and limited working capital. Compared to solar distributors, ICS companies generally appeared less able to absorb logistical shocks and scale efficiently within remote areas.

At the household level, clean cooking beneficiaries reported substantial functional benefits. Survey findings showed that reduced cooking time accounted for 30% of reported benefits, reduced fuel costs for 27%, and improved health or safety outcomes for 16%. Approximately half of clean cooking households also reported transitioning away from firewood, charcoal, or traditional three-stone fires following adoption.

Figure 4: *Product benefits across clean cooking customers*



However, affordability constraints remained significant despite high product appreciation. Household survey findings showed that approximately 88% of clean cooking beneficiaries would still require subsidies to purchase future energy products. FGDs further suggested that for vulnerable groups, including recently arrived refugees and highly cash-constrained households, remaining out-of-pocket costs continued to compete with immediate household survival priorities.

Overall, the findings suggest that while DSS substantially improved access to clean cooking products, affordability and cost-to-serve constraints remained more structurally significant than within the solar component, limiting the extent to which retail discounts alone could drive sustained commercial uptake.

5.3. Delivery and communication effectiveness

Results: Effective awareness and data integrity, but operational barriers hindered growth for clean coking companies and smaller solar companies

Solar home systems

The solar component benefited from comparatively mature delivery systems and stronger operational capacity among participating firms. Participating solar companies generally demonstrated more established agent networks, stronger PAYGo systems, and greater familiarity operating in rural and refugee-hosting districts. Compared to the clean cooking sector, larger solar firms also appeared better positioned to absorb operational shocks linked to logistics, verification delays, and customer financing. However, as the project neared closure, unit allocations from struggling solar companies were reassigned to higher-performing partners.

The DSS model stimulated demand for solar products while leveraging existing commercial delivery structures. However, smaller providers in particular experienced working capital pressure during delayed

reimbursement cycles, which occasionally constrained restocking and expansion into more remote locations. Community-based communication channels played an important role in awareness generation and product uptake. Survey findings showed that 74% of solar beneficiaries were aware of the product and subsidy before purchase. Company agents accounted for the largest share of product awareness at 45%, followed by friends or relatives, community meetings, local leaders, and awareness campaigns. The findings suggest that awareness generation operated through a mix of business marketing and local community networks. Company agents played a central role in driving both product awareness and programme participation, while community networks helped reinforce programme visibility and legitimacy within target communities.

Figure 4: *Solar awareness and product discovery*



Agents also played a critical procedural role in explaining programme rules and eligibility requirements. Survey data showed that company agents accounted for 56% of programme-rule explanations, followed by local leaders and awareness campaigns. At the same time, local leaders appeared particularly effective at reinforcing understanding of programme eligibility. Approximately 90% of households briefed by a local leader recalled why they qualified for the subsidy (n=45), compared to 86% through awareness campaigns (n=31) and 81% through company agents (n=159). These findings suggest that while company agents were the backbone of programme delivery and customer engagement, community leaders provided an important secondary layer of trust and reinforcement around programme legitimacy and targeting rules.

Figure 5: *Communication and messaging on program rules and payments for solar*



The project's communication strategy also appears to have effectively conveyed the temporary nature of the subsidy. Approximately 75% of beneficiaries reported being informed that the discount was temporary, with relatively consistent comprehension between refugees (74%) and host communities (76%). A modest difference emerged across technologies, with cookstove beneficiaries (79%) slightly more likely than solar beneficiaries (71%) to recall temporary pricing messages.

Overall, the findings suggest that the solar component benefited from stronger delivery ecosystems, more established agent infrastructure, and relatively effective communication systems that supported both programme uptake and customer understanding.

Clean cooking

The clean cooking component stimulated demand but introduced greater operational pressure on participating firms. Companies reported that high delivery costs within remote and refugee-hosting areas

significantly reduced margins, particularly for smaller firms with less developed distribution infrastructure and weaker logistical capacity.

Although the logistical subsidy was later increased to correct an initial underestimation of distribution costs, participating companies continued to struggle with transport limitations, staffing gaps, and heavy servicing requirements. Compared to the solar sector, several clean cooking firms appeared less equipped to absorb operational shocks or scale efficiently within fragile rural environments. The findings also suggest that clean cooking delivery relied more heavily on behavioural engagement and community-based awareness structures. Similar to solar, survey data showed high pre-purchase awareness levels, with beneficiaries primarily learning about products and subsidies through company agents.

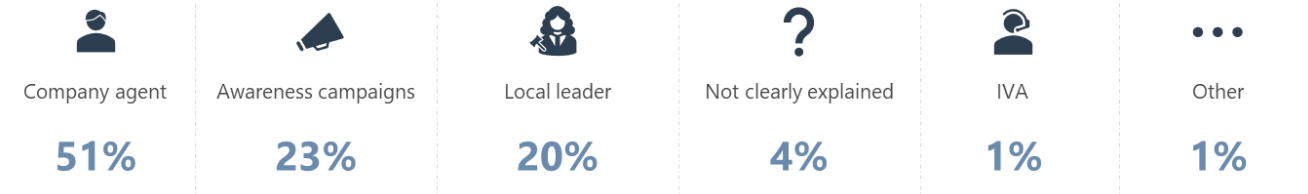
However, survey data suggest that awareness drives played an especially important role in the clean cooking segment because of the greater behavioural change associated with cooking technologies. Beneficiaries often relied on demonstrations, peer experiences, and local endorsement to build familiarity and confidence around new cooking products.

Figure 4: *Clean cooking awareness and product discovery*



As with solar, company agents played the leading role in programme communication and eligibility explanation, while awareness campaigns and local leaders reinforced understanding within communities. This layered communication ecosystem appears to have supported programme visibility and reduced confusion around targeting rules and subsidy eligibility.

Figure 5: *Communication and messaging on program rules and payments*



Overall, the findings suggest that while the DSS successfully stimulated awareness and demand for clean cooking technologies, delivery systems remained operationally more complex and resource-intensive than for solar products. The clean cooking component relied more heavily on community engagement, behavioural reinforcement, and adaptive operational support to sustain uptake in remote and displacement-affected settings.

5.4. Subsidy valuation and behavioural impacts

Results: Discounts delivered clear functional benefits with minimal social friction between refugee and host communities

Solar home systems

The solar component generated substantial functional and behavioural benefits at the household level. Survey respondents consistently reported improvements in lighting quality, phone charging access, household safety, and productivity following product adoption. Approximately 54% of reported benefits related to improved lighting and power access, while 62% of solar households reported transitioning away from torches, kerosene, or candles.

FGDs further highlighted broader social and behavioural impacts associated with solar adoption. Beneficiaries frequently linked improved lighting to longer productive hours, enhanced study conditions for children, greater nighttime visibility, and improved convenience within the household. Several respondents also described increased flexibility in household routines due to reduced dependence on fuel-based lighting sources.

Figure 6: *Product benefits across solar customers*

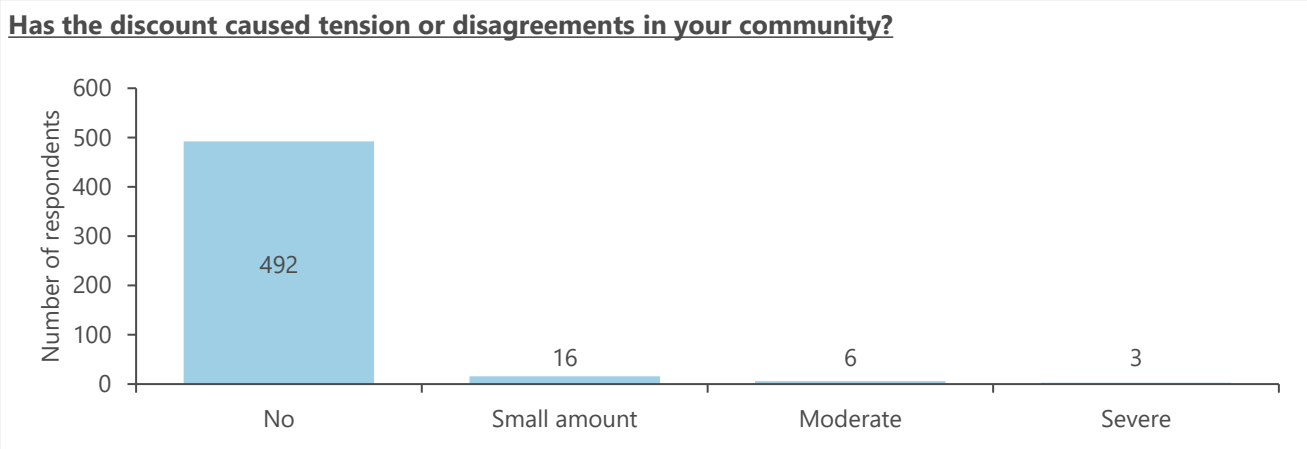


The findings suggest that the DSS reduced the upfront affordability barrier sufficiently to enable households to experience the practical benefits of higher-tier energy access. Product appreciation was consistently high across both refugee and host communities, with many beneficiaries indicating that solar products had become integrated into daily household activities shortly after acquisition.

At the same time, affordability constraints remained significant despite strong perceived value. Approximately 93% of users indicated they would still require subsidies to purchase future energy products, suggesting that willingness-to-use did not necessarily translate into full commercial affordability. This was particularly evident among refugee households, where income volatility and dependence on humanitarian support continued to constrain purchasing power.

The programme's uniform pricing structure also appears to have contributed positively to social cohesion between refugee and host communities. Approximately 95% of respondents reported no tension related to subsidy allocation or pricing differences. Most observed friction instead related to operational bottlenecks around verification processes and identification requirements rather than perceptions of unequal treatment.

Figure 7: *Social dynamics and subsidy-related tensions*



Overall, the findings suggest that solar subsidies generated strong immediate welfare and behavioural benefits while supporting progression away from lower-tier lighting sources. However, sustained demand for future energy purchases remained closely tied to continued affordability support.

Clean cooking

The clean cooking component also generated substantial household-level benefits, particularly related to cooking efficiency, household comfort, and reduced dependence on traditional biomass fuels. Survey findings showed that reduced cooking time accounted for 30% of reported benefits, reduced fuel expenditure for 27%, and improved health or safety outcomes for 16%.

Figure 8: *Product benefits across clean cooking customers*



FGDs further highlighted several behavioural and social impacts associated with clean cooking adoption. Beneficiaries reported reduced smoke exposure, lower physical burden associated with firewood collection, improved portability, and greater convenience during meal preparation. Women in particular described reduced time spent gathering fuel and improved comfort while cooking indoors. Approximately half of clean cooking households reported moving away from traditional firewood and three-stone open fires, while others upgraded from inefficient traditional charcoal stoves, to high-efficiency stoves.. Survey findings also indicated that many households experienced multiple simultaneous benefits, with approximately half of respondents reporting at least three positive changes associated with the technology**.**

At the same time, the findings suggest that behavioural adoption for clean cooking remained more complex than for solar. Unlike solar products, where value was often immediately visible through lighting and phone charging access, clean cooking adoption appeared more dependent on sustained behavioural reinforcement, familiarity with product use, and household cooking preferences.

While appreciation for clean cooking technologies was very high, willingness and ability to purchase products at full commercial prices remained limited. Approximately 88% of ICS beneficiaries indicated they

would still require subsidies for future purchases, suggesting that affordability constraints remained substantial despite strong user satisfaction and positive product experiences. Similar to solar, the programme's uniform pricing strategy appears to have minimized friction between refugee and host populations.

Overall, the findings suggest that DSS support enabled households to experience substantial welfare and behavioural benefits associated with cleaner cooking technologies. However, sustained commercial uptake remained constrained by affordability limitations, behavioural complexity, and continued dependence on subsidy support in displacement-affected settings.

5.5. Verification

Results: High data integrity and control, but operational bottlenecks and disbursement delays created a liquidity gap for smaller participating companies

Solar home systems

The solar verification system functioned comparatively more efficiently than the clean cooking component, reflected in lower rejection rates of approximately 8%. Existing PAYGo infrastructure, stronger digital systems, and more established customer management processes appear to have provided solar companies with a stronger operational foundation for complying with RBF verification requirements.

The Kobo tool's offline capability enabled programme implementation in low-connectivity environments but limited real-time validation checks, increasing the likelihood of clerical errors, duplicate entries, and incomplete customer records. As a result, verification quality depended heavily on agent performance at the point of sale. Companies and programme teams noted that data integrity was largely determined by the consistency and accuracy of field-level data capture during customer onboarding.

Although programme documentation targeted a 30-day reimbursement cycle, participating companies reported that disbursement timelines frequently exceeded this target due to batch processing delays, data inconsistencies, and verification bottlenecks. Smaller solar providers in particular experienced liquidity pressures linked to delayed reimbursements, which constrained restocking cycles and slowed operational expansion into more remote locations. Several stakeholders also noted that verification requirements occasionally conflicted with the realities of fast-moving field sales operations. Temporary market activations, long travel distances, weak connectivity, and customer reluctance to carry original identification documents all increased the operational burden associated with compliance.

Despite these constraints, the solar component generally adapted more effectively to the verification framework than the clean cooking segment. Participating solar firms appeared better equipped to manage digital onboarding, customer tracking, and document verification processes due to stronger operational systems and greater prior experience with PAYGo-enabled customer management.

Overall, the findings suggest that verification systems were broadly functional within the solar component but still introduced important trade-offs between accountability, operational efficiency, and company liquidity.

Clean cooking

The clean cooking component experienced substantially greater verification challenges, with rejection rates reaching approximately 15%, nearly double the rate observed within the solar portfolio. Several programme adaptations were introduced in response to these operational constraints. To better align verification processes with the realities of low-margin clean cooking retail, the project relaxed certain requirements for ICS distributors, including removing real-time Kobo eligibility checks and relying more heavily on phone verification mechanisms. These adjustments reflected the faster-moving nature of clean cooking transactions and lower levels of digital readiness among both agents and customers.

Despite these changes, companies and implementers continued to report significant operational bottlenecks related to incomplete records, inconsistent data capture, device sharing, and lower digital familiarity among sales agents and beneficiaries. High customer mobility within refugee settlements further complicated post-sale verification efforts, particularly where follow-up calls or physical validation were required.

Verification challenges were also amplified by broader operational constraints within remote refugee-hosting districts. Stakeholders noted that weak connectivity, difficult terrain, and limited transport infrastructure slowed field verification activities and increased the time required for IVA teams to complete validation processes.

The findings further suggest that smaller clean cooking firms faced greater difficulty adapting to verification requirements due to weaker operational systems, more limited staffing capacity, and thinner liquidity buffers. Compared to solar, some clean cooking providers appeared less equipped to absorb reimbursement delays or dedicate personnel to compliance management.

At the same time, programme stakeholders emphasized that many of the observed challenges reflected the inherent complexity of operating in fragile and displacement-affected settings rather than weaknesses in programme design alone. Several adaptations introduced during implementation, including simplified verification processes and revised subsidy structures, helped reduce some of the operational burden on participating firms.

Overall, the findings suggest that verification systems designed around more mature solar delivery models required additional adaptation for lower-margin clean cooking markets operating in fragile rural contexts. While verification remained essential for accountability and subsidy integrity, the operational burden associated with compliance introduced significant efficiency and liquidity trade-offs for participating firms.

5.6. Market distortion assessment



Results: Rapid adoption confirms strong demand, signaling that long-term access depends on transitioning pilot support into larger national frameworks

Solar home systems

The solar market appeared comparatively less exposed to distortion risks than the clean cooking sector, reflecting stronger underlying commercial demand, more established distribution ecosystems, and greater familiarity with PAYGo-enabled business models.

Baseline DSS findings indicated that some households had previously received solar lanterns through humanitarian or NGO-supported programmes. However, participating companies consistently reported that

solar purchases under the DSS were still largely driven by consumer demand rather than purely aid-based acquisition. The widespread use of PAYGo financing further reinforced a commercial relationship between companies and customers, even where subsidies reduced upfront costs.

Survey findings suggest that beneficiaries generally perceived the subsidy as fair and appropriately targeted. Approximately 70% of respondents reported that the subsidy reached households most in need, along with 81% reporting that DSS products were generally cheaper compared to similar products, suggesting that while willingness-to-use and perceived product value were high, full commercial affordability remained constrained for many low-income households.

Participating companies did not report major evidence of market displacement or reduced willingness-to-pay associated with the programme. However, several stakeholders noted that the temporary nature of the subsidy needed to be communicated clearly to avoid creating long-term expectations around permanently discounted pricing.

Overall, the findings suggest that DSS can stimulate solar uptake without fundamentally displacing commercial market behaviour where consumer demand, PAYGo systems, and distribution networks are already relatively established. However, the continued dependence on subsidies for future purchases also suggests that affordability gaps remain significant within refugee-hosting and low-income rural contexts**.**

Clean cooking

The clean cooking component demonstrated stronger interaction effects with overlapping humanitarian interventions and greater exposure to potential market distortion risks. Baseline studies indicated that NGO distributions accounted for a substantial share of prior cookstove ownership, with approximately 67% of cookstove acquisitions linked to free or highly subsidised distributions.

Participating companies reported that these overlapping interventions shaped consumer expectations around pricing and increased sensitivity to upfront product costs, particularly within refugee settlements where purchasing power remained extremely constrained. Several stakeholders noted that prior experiences with free distributions sometimes reduced households' willingness to pay commercially viable prices for similar products.

The findings also suggest that clean cooking markets in displacement settings remain structurally more dependent on ecosystem coordination and complementary support mechanisms than the solar sector. Compared to solar products, clean cooking technologies faced weaker existing market penetration, greater behavioural adoption barriers, and higher logistical costs associated with delivery and servicing. Several stakeholders further noted that abrupt withdrawal of subsidies or poorly coordinated humanitarian distributions could risk undermining emerging commercial market activity, particularly for smaller firms operating with limited liquidity and narrow margins.

Overall, the findings suggest that while DSS successfully expanded access to clean cooking technologies and generated strong beneficiary satisfaction, the sector remained more vulnerable to distortion risks and continued subsidy dependence than solar markets. Long-term sustainability will likely depend on how future programmes balance affordability objectives with realistic pathways toward gradual market development and commercial viability.

6. Recommendations

The Uganda DSS pilot demonstrated that Demand-Side subsidies can significantly expand access to off-grid energy technologies in displacement-affected settings. At the same time, the findings highlighted important trade-offs between inclusion, affordability, operational feasibility, accountability, and long-term market sustainability. The recommendations below focus on practical implementation options that future programmes could consider when refining DSS approaches in Uganda and similar refugee-hosting contexts.

1. Adopt more flexible targeting approaches across technologies and geographies

The findings suggest that solar and clean cooking technologies responded differently to uniform refugee-host targeting structures. While balanced targeting functioned relatively effectively within solar markets, clean cooking technologies faced greater difficulty achieving similar uptake due to higher delivery costs, weaker product familiarity, and lower purchasing power among refugee households.

Future programmes could therefore consider more flexible targeting structures that account for differences across technologies, geographies, and market maturity. This may include maintaining overall refugee inclusion objectives at programme level while allowing greater flexibility within specific technologies or districts. Such approaches may improve operational realism and reduce pressure on firms operating in high-cost delivery environments. However, they may also require stronger monitoring systems to ensure vulnerable populations remain adequately served.

Future programmes may also consider limited additional incentives for firms serving particularly vulnerable population groups, including PWDs, elderly-headed households, or child-headed households. While these approaches may improve inclusion outcomes, they would also reduce the total number of households that can be reached within fixed programme budgets.

2. Strengthen upfront community engagement and ID-readiness

The pilot demonstrated that operational bottlenecks were frequently caused by limited ID-readiness during temporary market activations. Many beneficiaries understood programme rules only after arriving at sales points, contributing to delays and incomplete transactions.

Future programmes could therefore front-load communication around eligibility requirements before field activations occur. Community leaders, refugee welfare structures, radio campaigns, SMS outreach, and community meetings could help ensure that beneficiaries understand documentation requirements prior to interacting with sales agents.

This approach may improve onboarding efficiency and reduce failed transactions, particularly within fast-moving clean cooking campaigns and remote solar market activations. However, it may also require greater upfront investment in non-sales community engagement and coordination activities.

3. Complement demand side subsidies with shared delivery infrastructure and market systems support

The findings suggest that many operational challenges stemmed not only from household affordability constraints but also from weak last-mile delivery infrastructure within refugee-hosting districts. Smaller firms in particular struggled to absorb the high costs associated with transport, warehousing, servicing, customer onboarding, and verification.

Future programmes could therefore complement retail subsidies with more market systems-oriented approaches that strengthen shared delivery infrastructure. One potential option could involve establishing shared energy access hubs within or near refugee-hosting areas, where OPM or local authorities support land access, development partners co-finance enabling infrastructure, and private-sector firms contribute operational investment and commercial activity.

Such hubs could support product demonstrations, after-sales servicing, agent training, warehousing, spare-parts access, and shared logistics coordination across multiple firms. Existing infrastructure, including NGO innovation centres, and energy kiosks established through prior EnDev programmes, may also provide opportunities to reduce duplication and lower cost-to-serve.

These approaches may be particularly relevant for clean cooking markets and smaller local firms that face higher operational barriers in remote settlements. However, they may also require stronger coordination structures, shared governance arrangements, and longer implementation timelines.

4. Improve liquidity support and operational financing for smaller firms

The pilot highlighted that reimbursement delays and high working-capital requirements created significant pressure for smaller participating companies, particularly those operating in remote refugee-hosting districts.

Future programmes could therefore facilitate stronger linkages between participating firms and dedicated SME liquidity or working-capital facilities. Existing and emerging financing ecosystems, including the UECCC working capital facility and the Humenergi financing facility expected from 2026, may help firms manage restocking cycles, bridge reimbursement delays, and expand operations without facing severe liquidity constraints between field sales and subsidy reimbursement.

Future programmes could also explore more competitive approaches to subsidy allocation in hard-to-reach areas. Mechanisms such as reverse auctions or minimum-subsidy tenders, similar to approaches used under BGFA, may help reveal actual delivery costs while reducing risks of over-subsidization.

These approaches may improve supply-side efficiency and support participation by smaller firms. However, they may also increase programme management complexity and favour firms with stronger proposal-development and compliance capacity.

5. Design verification systems that are proportionate to operational realities

The findings suggest that documentation-heavy onboarding and transaction-level verification introduced significant operational friction, particularly within lower-margin clean cooking markets operating in low-connectivity environments.

Future programmes may therefore benefit from accountability systems that are more proportionate to transaction size, technology type, and delivery conditions. Practical options could include offline-compatible onboarding systems, staged verification approaches, simplified compliance requirements for lower-value products, rolling reimbursements, or greater use of post-sale audits and sampling approaches rather than universal transaction-level verification.

The findings further suggest that programmes should prioritize practical low-connectivity verification tools before pursuing more advanced digital ID systems that may not yet be operationally feasible in remote implementation environments.

These approaches may reduce onboarding friction and improve delivery efficiency, particularly for clean cooking firms and smaller market entrants. However, they may also introduce trade-offs around audit precision and require stronger monitoring systems to manage risks around duplicate registrations or inclusion errors.

6. Support gradual market transition and stronger coordination with humanitarian actors

The findings suggest that affordability constraints remain significant across both solar and clean cooking markets, particularly for refugees and highly vulnerable households. At the same time, overlapping humanitarian distributions, particularly within clean cooking markets, continue to shape customer expectations around pricing and willingness-to-pay.

Future programmes may therefore need to view subsidies not as short-term stand-alone interventions, but as part of a longer transition pathway toward commercially sustainable delivery systems. This may include phased subsidy reduction approaches, longer market activation timelines, stronger coordination between humanitarian actors and private-sector firms, and complementary investments in demonstrations, behavioural engagement, and local delivery ecosystems.

These approaches may be particularly important within clean cooking markets, where abrupt withdrawal of subsidies or repeated free distributions risk undermining emerging commercial activity. However, they may also require longer-term donor commitment and more complex coordination structures across stakeholders.

7. Explore carbon finance and results-based aggregation mechanisms to support long-term sustainability

The findings suggest that long-term affordability challenges are likely to persist beyond the duration of donor-funded DSS programmes, particularly within clean cooking markets where willingness-to-pay remains constrained despite high product appreciation.

Future programmes could therefore explore whether carbon finance aggregation platforms or bundled results-based financing mechanisms could help support longer-term market transition pathways. Under such approaches, programme implementers or aggregators could pool emissions reductions across multiple firms and technologies to generate additional revenue streams that help offset customer subsidies, delivery costs, or after-sales support.

These mechanisms may be particularly relevant for clean cooking technologies, where carbon revenues are already more established and where additional financing could help sustain affordability support beyond direct donor subsidies. Over time, similar aggregation models may also emerge within solar and productive-use markets as monitoring systems and carbon methodologies evolve.

7. Conclusion

The Uganda DSS pilot demonstrated that demand-side subsidies can play an important role in accelerating access to off-grid energy technologies within displacement-affected and low-income rural settings. Across both solar and clean cooking technologies, the programme successfully reduced affordability barriers, stimulated uptake, and enabled households to experience substantial welfare benefits related to lighting, cooking efficiency, safety, productivity, and reduced reliance on traditional fuels. The findings further suggest that DSS approaches can support inclusion objectives within refugee-hosting contexts while also strengthening broader market visibility and consumer familiarity for off-grid energy technologies.

At the same time, the pilot highlighted that solar and clean cooking markets operate under significantly different commercial and operational realities. Solar delivery benefited from comparatively stronger PAYGo systems, more mature distribution ecosystems, and clearer consumer familiarity, while clean cooking technologies faced greater behavioural adoption barriers, higher delivery costs, and stronger dependence on community engagement and ecosystem support. The findings therefore suggest that future DSS programmes may benefit from more differentiated and operationally flexible approaches across technologies, geographies, and market conditions.

The pilot also demonstrated that many of the implementation challenges observed, including verification bottlenecks, liquidity pressures, and high cost-to-serve, reflected structural constraints associated with operating in fragile rural and refugee-hosting environments rather than weaknesses in programme design. Future programmes will therefore likely need to balance accountability objectives with realistic delivery conditions, while increasingly complementing demand-side subsidies with broader market systems support, shared infrastructure, financing linkages, and stronger coordination across humanitarian and private-sector actors.

Importantly, the findings suggest that significant unmet demand for off-grid energy technologies remains across refugee-hosting settlements and low-income rural districts in Uganda. Given the continued presence of humanitarian interventions, evolving refugee settlement dynamics, and persistent affordability constraints, future scale-up opportunities are likely to extend beyond the pilot geographies into additional refugee-hosting communities and other underserved and impoverished districts where energy access gaps remain substantial.

Overall, the Uganda DSS pilot provides important evidence that demand-side subsidies can support both energy access and market development objectives when designed with sufficient operational flexibility and realistic recognition of the complexities associated with last-mile delivery in displacement-affected settings.