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EnDev DSS Performance Study

Liberia country report

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Netherlands Enterprise Agency

endev

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Abbreviations

ATP	Ability to Pay
BRAC	Bangladesh Rural Advancement Committee (Fund Manager, Liberia)
DSS	Demand-side subsidies
EnDev	Energising Development
ESMAP	Energy Sector Management Assistance Program
FGDs	Focus Group Discussions
FM	Fund Manager
GDPR	General Data Protection Regulation
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
IS	Indirect Subsidy (supply-side)
IVA	Independent Verification Agent
KIIs	Key Informant Interviews
KPI	Key Performance Indicator
LESSAP	Liberia Electricity Sector Strengthening and Access Project
LNOB	Leave No One Behind
LQ	Learning Question
MPI	Multidimensional Poverty Index
MSME	Micro, Small and Medium Enterprises
NES	National Electrification Strategy
OGS	Off-Grid Solar
OPHI	Oxford Poverty & Human Development Initiative
PAYGo	Pay-As-You-Go financing
PUE	Productive Use of Energy
RBF	Results-Based Financing
RREA	Rural and Renewable Energy Agency (Liberia)
RVO	Netherlands Enterprise Agency
SHS	Solar Home System
SSS	Supply-Side Subsidy
USD	United States Dollars
WB	World Bank

1. Executive summary

Background

Liberia is one of the least-electrified countries in the world. National electricity access stands at approximately 27.5%, with rural access below 5%, and more than half of the population of 5.2 million lives below the national poverty line. Off-grid solar is the central pathway to closing this access gap, and the Government of Liberia targets the deployment of over 250,000 off-grid solar products by 2030 under the National Electrification Strategy. However, the off-grid market remained nascent at the time of pilot launch: only six to eight companies operated in the household solar home system (SHS) segment, and the two most established players had exited the segment entirely, leaving the market to small, often newly established local firms. Affordability constraints, weak last-mile infrastructure, and limited working capital further restrict the ability of purely market-based approaches to reach marginalised groups and people living in poverty.

In response, EnDev, managed jointly by GIZ and RVO, partnered with the Rural and Renewable Energy Agency (RREA) and BRAC Liberia (acting as Fund Manager) to launch a Demand-Side Subsidy (DSS) pilot in December 2023. The pilot operates as the demand-side component of a joint Results-Based Financing (RBF) mechanism with the World Bank-funded LESSAP I programme, where RREA implements parallel supply-side incentives. The DSS reduces the retail price of Tier 1 SHS products (≤20W) at the point of sale, with a beneficiary contribution preserved to maintain ownership and after-sales service incentives.

Program design

Design element	Key elements
Targeting	The main pilot used geographic targeting based on the OPHI Multidimensional Poverty Index**,** with off-grid status and existing market presence applied as separate county-selection filters. It initially covered Gbarpolu and Grand Cape Mount, before expanding to additional counties including Bomi, Nimba, Rivercess, Sinoe, Grand Kru, River Gee, and Bong. A separate sub-pilot tested socio-economic targeting for vulnerable women through a partner-validated voucher distribution.
Subsidy level	The main pilot started with a 20% subsidy capped at USD 40. Following low uptake and affordability evidence, the subsidy increased to 40% capped at USD 80. The sub-pilot tested an 80% subsidy capped at USD 160 for more vulnerable women.
Eligible products	The DSS was limited to Verasol-certified Tier 1 SHS products up to 20W, using product size as a self-selection mechanism for basic energy access.
Delivery model	Subsidies were delivered through participating private companies, with BRAC Liberia managing DSS fund disbursement and providing business development support. Companies relied heavily on local agents for outreach, sales, and payment collection.
Financing	Products were mainly sold through PAYGo models, although repayment collection often remained cash-based due to weak mobile money and network coverage in rural areas.
Verification	Sales were checked through a Kobo-based eligibility tool, BRAC completeness reviews, and IVA verification. The phone-to-field verification ratio was adjusted from 50:50 to 80:20 to reduce cost while maintaining accountability.

Operational adaptation	A 30% downpayment mechanism was introduced to help companies address inventory and working-capital constraints, after early implementation showed that lack of stock was a major barrier to sales.

Objectives

This performance study evaluates the operational realities and market dynamics of the Liberia DSS pilot to inform the design and scale-up of future national interventions, particularly under LESSAP II. The two analytical objectives are:

- LQ1, how can scarce public funding be deployed most efficiently to reach marginalised groups and people living in poverty?
- LQ2, how can DSS be designed to minimise market and price distortion?

Methodology

The assessment uses a mixed-methods evaluation matrix aligned with the ESMAP End-User Subsidy Toolkit and the OECD DAC criteria. Triangulation draws on the full pilot dataset of 12,161 verified beneficiary entries from 14 contracted companies across nine counties (sales period: January 2024 to October 2025); a household survey of 240 beneficiaries stratified between Grand Cape Mount (49%) and Nimba (51%); key informant interviews with EnDev, RREA, BRAC, the IVA, and 11 participating companies; and review of pilot operational documentation. The household sample includes 215 main-pilot respondents and 25 sub-pilot respondents (all in Nimba) to enable direct comparison of the two targeting modalities. All data was collected digitally in compliance with GDPR data minimization principles.

Key findings

1. Geographic targeting enabled rapid rollout but had limited precision

County-level targeting was appropriate in Liberia's low-data environment, where no national social registry or household-level poverty database was available. It allowed the programme to prioritise poorer and underserved areas using the best available evidence. However, energy poverty is widespread across Liberia. This meant geographic targeting worked more as a practical allocation mechanism than as a precise poverty-targeting tool. Within eligible counties, sales concentrated in more accessible areas, while poorer and more remote counties recorded lower uptake.

Implication: Future targeting should retain geographic filters but add more granular household or community-level validation where exclusion risks are highest.

2. The 40% subsidy improved affordability but did not fully reach the poorest households

The initial 20% subsidy was too low to generate strong uptake. The increase to 40%, capped at USD 80, helped accelerate sales and made SHS products more affordable for low-income households. However, the subsidy did not fully close the affordability gap for the poorest segment. Some households continued to struggle with upfront payments, irregular income, and PAYGo repayment schedules. The sub-pilot showed that deeper subsidies can reach more vulnerable groups when paired with tighter targeting controls.

Implication: Future programmes should consider tiered subsidy levels, with deeper support reserved for clearly identified vulnerable groups.

3. Delivery constraints were driven more by supply-side limitations than weak demand

Early implementation showed that demand stimulation alone was not enough. The first six months recorded very low sales largely because companies lacked in-country stock, inventory finance, and last-mile distribution capacity. The introduction of a 30% downpayment mechanism helped companies secure stock and accelerate sales. Business development support also helped strengthen company systems, but liquidity and logistics remained major constraints.

Implication: In Liberia's nascent market, DSS should be paired with supply-side support, working-capital instruments, and realistic assumptions about company absorption capacity.

4. PAYGo reduced entry barriers but created repayment and collection challenges

PAYGo helped households spread payments over time and made subsidised products more accessible. However, weak mobile money coverage and poor network connectivity meant that many repayments were collected physically by local agents.

This increased operational costs and created risks linked to delayed collections, agent fraud, payment disputes, and mismatches between household income cycles and repayment schedules.

Implication: Future programmes can build repayment flexibility into product and contract terms, for example by approving longer or seasonally aligned PAYGo schedules. They can also fund stronger cash-collection safeguards as a programme component, rather than leaving these for individual companies to absorb.

5. Verification improved over time but required adaptation to rural realities

Because phone reachability was low in many rural areas, field verification was the channel that reliably reached customers, and the programme relied on it at the outset. After early field results showed low risk, the ratio was shifted from 50:50 to 80:20 phone-to-field to reduce cost while retaining a field-based check. Two early classification issues required correction: accessory malfunctions misread as core system failures, and accelerated PAYGo repayments (variable-income customers, such as miners, paying off their systems early) misread as ineligible cash sales. Both were resolved through protocol clarification, and no sale or claim was ever rejected solely on phone-reachability grounds.

Implication: Verification systems should be risk-based, proportionate, and adapted to low-connectivity environments from the outset.

6. Distortion risks were localised and behavioural rather than driven by systematic leakage

The pilot did not show systematic evidence of product leakage. However, price anchoring and perceived unfairness emerged as important risks. Some customers came to view subsidised prices as the normal market price. Price differences across companies, counties, and time periods also created complaints, especially among early buyers and non-eligible communities.

Implication: Communication should be treated as a market protection tool, not only as an awareness activity.

Recommendations

1. Adopt a hybrid targeting model that combines geographic targeting with household-level validation.
2. Introduce tiered subsidy levels, with deeper support reserved for clearly identified vulnerable groups.
3. Pair DSS with working-capital support, inventory finance, and business development assistance for local companies.
4. Adapt PAYGo repayment models to rural income cycles and strengthen safeguards for cash collection.
5. Maintain risk-based verification, while front-loading IVA training and product-specific guidance.
6. Strengthen communication on subsidy eligibility, duration, and pricing to reduce price anchoring and perceived unfairness.
7. Design subsidy exit around market readiness rather than fixed timelines

Conclusion

The Liberia DSS pilot shows that demand-side subsidies can unlock access in a highly nascent off-grid solar market. The subsidy reduced affordability barriers, stimulated demand, and helped local companies expand into underserved counties.

However, the pilot also shows that DSS alone cannot overcome Liberia's structural energy access constraints. Geographic targeting enabled speed but not full precision. The 40% subsidy improved uptake but did not fully reach the poorest households. PAYGo expanded affordability but remained constrained by rural income volatility and cash-based collection risks.

The strongest lesson is that DSS in Liberia should be treated as a market-shaping instrument, not simply a retail discount. Any future scale-up, such as anticipated under LESSAP II, or similar programmes, should combine targeted subsidies, supply-side support, working-capital solutions, adapted verification, and stronger communication to reach poorer and more remote households without weakening the fragile commercial foundations of Liberia's off-grid solar market.

2. Country context and relevance for DSS

Liberia has made limited progress in expanding modern energy access, and structural constraints continue to shape both grid expansion and off-grid market development. National electricity access stands at approximately 27.5%, with rural access below 5% compared to roughly 20% in urban areas.[1, 2, 3] More than half of Liberia's 5.2 million inhabitants live below the national poverty line, with poverty concentrated in rural counties where infrastructure deficits and limited livelihood opportunities reinforce one another. Inadequate access to healthcare, education, and basic utilities remains a defining challenge, and Liberia's national poverty distribution intersects with its energy access deficit in ways that create distinct DSS design requirements: the population the programme aims to reach is not a defined sub-group within an otherwise functioning market, but the majority of rural households across nine of fifteen counties.

Access to modern energy services is highly unequal, with rural and remote populations facing significant structural barriers. Weak transport infrastructure, limited-service coverage, and high last-mile distribution costs combine with low and irregular household incomes to lock large segments of the population out of the energy market. Even where solutions are technically available, affordability constraints prevent purchase, particularly among marginalised groups and people living in poverty**.**

Off-grid solar represents a central component of Liberia's electrification strategy, particularly given the high cost of grid extension. The Government of Liberia targeted the deployment of over 250,000 off-grid solar products by 2030.[4] . However, the sector remained highly nascent at the time of the pilot. Only 6 to 8 companies operated in the household SHS market, each selling fewer than 1,000 units per year. The two most established players, LIB Solar and Easy Solar, had exited the household SHS segment entirely by the time the programme launched, leaving the market to entirely local, small, and often newly established companies. Six of the 14 companies ultimately contracted under the programme were new to last-mile SHS distribution, having previously focused on commercial battery and power solutions. This level of company nascency had direct implications for programme design, requiring lower eligibility thresholds for contracting and significant business development support throughout implementation.

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[1] *World Bank, Access to electricity (% of population) – Liberia, 2024, Link*

[2] *World Bank, Population, total – Liberia, 2024, Link*

[3] *World Bank, Liberia Poverty and Equity Brief, 2024, Link*

[4] *RREA, Rural Energy Strategy and Master Plan for Liberia until 2030, 2016, Link*

Market development is further constrained by affordability challenges. A large share of households cannot afford even entry-level solar products without financial support, particularly in rural and low-income segments. These constraints are compounded by high distribution costs and liquidity limitations among companies, which restrict their ability to expand into underserved areas. These dynamics point to a structural challenge in Liberia's energy access pathway. While off-grid solutions are technically viable, a significant share of the population remains excluded due to affordability constraints and weak market infrastructure. As a result, purely market-based approaches are insufficient to reach the poorest and most remote households.

This is particularly evident in Liberia's rural counties, where multidimensional poverty levels are highest and where access to both infrastructure and financing mechanisms remains limited. Geographic disparities in poverty levels also highlight limitations in broad targeting approaches, as significant variation exists within counties. In response, EnDev Liberia has adopted a hybrid approach combining demand-side subsidies with the Government's supply-side intervention. As a result, the joint Results-Based Financing (RBF) programme implemented jointly with the Rural and Renewable Energy Agency (RREA) under the World Bank funded LESSAP-programme integrates supply-side subsidies to incentivize market expansion, alongside demand-side subsidies to address affordability barriers.

Demand-side subsidies play a critical role within this framework. By directly reducing the price paid by end users, they enable access for households that would otherwise be excluded from the market. Evidence from implementation shows that uptake is highly sensitive to subsidy levels, with initial low subsidy levels resulting in limited demand and subsequent adjustments required to improve accessibility. Prior RBF experience in Liberia was limited to:

- The African Enterprise Challenge Fund (AECF)'s Renewable Energy and Adaptation to Climate Technologies (REACT) Program, a milestone-based RBF focused on company infrastructure (employees hired, agents trained, shops opened) with limited sales components.[1]
- The Beyond the Grid Fund for Africa (BGFA) program, managed by Nefco, with support from Sida, Denmark, Power Africa, and KfW[2], a supply-side subsidy program involving only international or internationally owned companies - fully local firms were not included.

The EnDev programme represents the first large-scale application of demand-side subsidies in Liberia's off-grid sector. Through iterative adjustments to targeting, subsidy levels, delivery mechanisms, and verification processes, the programme provides a practical basis for understanding how DSS models perform in nascent markets and low-capacity environments.

EnDev partners with RREA and BRAC Liberia to address these constraints through a joint Results-Based Financing approach. Under the LESSAP I programme, the World Bank funds RREA-managed supply-side incentives (Indirect Subsidies, IS) for products up to 350W, while EnDev funds demand-side subsidies for Tier 1 SHS products up to 20W, with BRAC Liberia acting as Fund Manager.[3] The two components share infrastructure (eligibility verification, IVAs, claim processing) but maintain distinct funding flows. This hybrid architecture is designed to address both supply-side market development and demand-side affordability simultaneously.

This report provides a detailed assessment of the DSS pilot performance in Liberia as part of the broader

[1] *AECF, Renewable Energy and Adaptation to Climate Technologies (REACT) Sub-Saharan Africa Programme, Link*

[2] *Nefco, Beyond the Grid Fund for Africa, Link*

[3] *World Bank, Liberia Electricity Sector Strengthening and Access Project (LESSAP) – Implementation Status & Results Report, 2025, Link*

EnDev DSS performance study. It focuses on operational realities, market constraints, and design trade-offs that shape programme outcomes, with the aim of informing future design and scale-up of demand-side interventions in Liberia 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 marginalized groups?
2. How can DSS be designed to minimize market and price distortion?

To address the learning questions, the study assessed how the Liberia pilot performed in reaching low-income and marginalized 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 ESMAP Subsidy Toolkit elements. 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.**

Figure 1: Snapshot of stakeholder engagement



4. Pilot context and operational overview

The DSS pilot in Liberia was implemented by EnDev Liberia in coordination with RREA and delivered through BRAC Liberia as Fund Manager. The pilot bridges the end-user affordability gap for off-grid solar products among marginalised groups and people living in poverty not reached by commercial markets. By providing targeted subsidies to private energy companies, the project reduces retail prices at the point of sale while preserving a beneficiary contribution to maintain ownership incentives.

The Government of Liberia, through RREA, has made off-grid electrification a national priority, targeting 250,000 SHS deployments by 2030 under the Renewable Energy Strategy and Master Plan.
EnDev and RREA implement the joint RBF mechanism under LESSAP I, with EnDev contributing EUR 1.88 million to the DSS component and RREA allocating USD 1.55 million to the parallel supply-side component. Operating in a nascent off-grid market with weak data infrastructure required iterative design adaptation across all five ESMAP Toolkit elements; this section presents both the initial design choices and the implementation realities that drove revisions, framing each as a deliberate trade-off rather than a deviation from plan.

4.1. Targeting

Initial design

The pilot used a geographic targeting approach grounded in the Oxford Poverty & Human Development Initiative (OPHI) Multidimensional Poverty Index (MPI)[1]. In the absence of a social registry or granular household-level data, geographic targeting represented the best trade-off given budget, time, and implementation constraints. The programme was initially launched in December 2023 in Gbarpolu and Grand Cape Mount Counties, the two highest-MPI counties with active off-grid market presence. All residents of selected counties were eligible to purchase one subsidised product, subject to point-of-sale eligibility verification through a Kobo-based tool. Eligibility required first-time access to the technology, valid ID, and a working phone number.[2]

Implementation reality and drivers of change

Two iterative expansions reshaped the initial targeting approach. The household income survey conducted in June 2024 showed that subsidy levels were not enough to meet target households' actual ability to pay; the primary response was to raise the subsidy from 20% to 40% (capped at USD 80). In parallel, and effective by November 2024, the programme expanded to five additional counties, Bomi, Nimba, Sinoe, Rivercess, and Grand Kru, with River Gee added in early 2025 and Bong added in September 2025. These dates refer to the first recorded sales in each county; the underlying eligibility decisions were taken earlier, with the five-county expansion confirmed by November 2024 and sales in the most remote counties following as companies established stock and reach.[3] The MPI-based selection logic was retained but augmented with regional clustering to reduce price arbitrage between neighbouring counties and to align with existing market flows. Nimba was added as a strategic exception. While not the highest-ranked county on the MPI, it offered larger population density and existing market, making it a useful test case for relative scalability.

A sub-pilot was also implemented to specifically target vulnerable women with lower ability to pay. It tested a more granular, demographic targeting approach to reach socio-economically vulnerable women in Bong and Nimba Counties. Partnerships were established with United Women for Sustainable Development and BRAC's Ultra Poor Group. A dedicated household survey conducted in October 2025 informed an 80 % subsidy level with a USD 160 cap. A closed-loop voucher system with anti-counterfeiting features ensured subsidies reached only the identified group.

4.2. Subsidy level

Initial design

[1] *OPHI / UNDP HDRO, Multidimensional Poverty Index – Liberia Country Briefing, 2023, Link*

[2] *Liberia Operations Manual.*

[3] *DSS Concept note Liberia 2025 Update.*

The subsidy design reflected three deliberate choices, each managing a distinct trade-off. First, product eligibility was limited to Tier 1 SHS up to 20W, aligning the programme with households lacking any functioning energy access and using product scope as a secondary self-selection filter, trading market reach against precision of targeting. Second, the subsidy was structured as a percentage of product price with an absolute cap, avoiding over-subsidisation of higher-priced products under an uncapped relative subsidy. Third, a beneficiary contribution was preserved to sustain ownership and after-sales service incentives, trading immediate inclusion against long-term market viability. The initial level of 20% (capped at USD 40) was derived from a World Bank affordability analysis using 5% of household expenditure as the energy affordability threshold, set deliberately below the calculated affordability gap to limit market distortion risk in a context of no granular household-level data.

Implementation reality and drivers of change

The program started with an initial subsidy level deliberately set to limit risk of spillover and market distortion given the lack of granular household-level data for a more precise targeting. However, sales remained very low in the first six months (under 500 units), prompting a dedicated affordability survey in June 2024. Based on this survey, the subsidy was increased in late 2024 to 40% (capped at USD 80), with the explicit acknowledgement that this would still not reach the poorest households. The voucher-based sub-pilot subsequently tested an 80% subsidy (capped at USD 160) for women identified by partner organisations as ultra-poor, using the closed-loop voucher system to contain distortion risk arising from such a deep subsidy.

4.3. Delivery

Initial design

The delivery model operated through a joint RBF mechanism, with private sector companies distributing subsidised SHS products and receiving payments upon verification of eligible sales**.** BRAC Liberia managed fund disbursement and provided business development support to companies covering sales capacity building, internal financial tracking systems, customer management, and credit risk practices. This support was particularly relevant for the six companies new to last-mile SHS distribution. In several cases, companies used their DSS contract as collateral to secure low-interest commercial bank loans, providing additional working capital beyond the downpayment mechanism. EnDev Liberia also conducted joint community engagement and awareness events with companies in DSS counties to support outreach and customer sensitisation.

Implementation reality and drivers of change

To address severe liquidity and inventory constraints, a downpayment mechanism was introduced, providing up to 30 % of contracted subsidy amounts upfront. The programme was launched in December 2023 and recorded near-zero sales for the first six months due to an absence of in-country stock. Once the downpayment mechanism was introduced the business development support function helped companies place a single consolidated order and split the resulting bulk shipment between them, which broke the in-country stock bottleneck. The downpayment was repaid via deductions on subsequent verified claims, functioning as a progressive credit mechanism.

In total, 14 companies were contracted, 6 of which were new to last-mile SHS distribution. Local agents were critical for both customer outreach and cash collection, particularly in areas without mobile money coverage. Cash-based operations increased fraud and inefficiency risks, as agents were required to physically transport collected payments to urban centres, sometimes holding funds for several days before deposit. In many

communities, agents could only visit every 7 to 14 days due to distance and poor roads, creating a timing mismatch between household cash availability and collection schedules.

The sub-pilot operated under a distinct delivery model. EnDev Liberia coordinated directly with the partner cooperatives to organise community gatherings where members were introduced to the programme. Companies attended these events to present their products and conduct sales on the spot. Voucher distribution was conducted back-to-back with company sales, so that women who expressed interest received their voucher and completed their purchase in the same interaction. Vouchers included the beneficiary's name, ID number, and a unique serial number, which were cross-checked by the fund manager at the claims stage. Given the absence of mobile network coverage in sub-pilot areas, full field verification was used for sub-pilot claims.).

4.4. Verification

Initial design

Verification was conducted by an Independent Verification Agent (IVA) contracted by EnDev, covering both the DSS scope (products up to 20W) and the IS scope (products up to 350W). The original protocol set a 50:50 phone-to-field verification ratio, with sales captured at point of sale through a Kobo eligibility tool that fed centrally into the claim processing workflow. BRAC Liberia conducted initial completeness and consistency checks before forwarding claims to the IVA.

Implementation reality and drivers of change

The initial 50:50 split was adjusted to 80:20 phone-to-field, with extended field verification triggered where companies fell below a 75% phone reachability threshold. This adjustment reflected a deliberate trade-off between verification cost and verification precision. In a context where field verification cost approximately three times that of phone verification, the 80:20 ratio was the lowest-cost configuration that retained acceptable confidence in verified sales. Field verification was geographically clustered from the outset, materially reducing administrative cost. However, mobile network issues in some localities impacted the filed verification, as in some instances if was difficult for the IVA to reach households despite multiple attempts and the use of local relays to reach some households over phone.

Two early-stage classification issues required mid-pilot correction. First, technical-failure misclassification with product malfunction (including to accessories such as radios and flashlights) initially treated as a core SHS technical failure causing claim pendency. Second, accelerated repayment misclassification with customers with variable incomes (notably gold miners) who paid off their systems early were initially flagged as ineligible cash sales rather than legitimate accelerated PAYGo repayments. Both issues were resolved through clarification of IVA criteria once flagged, leading to neither individual sales nor entire claims ever being rejected solely on phone reachability grounds.

4.5. Exit strategy

Initial design

The pilot was designed as a learning-oriented intervention to inform the scale-up of DSS within Liberia's national energy access strategy. EnDev Liberia, RREA, and the World Bank aligned the pilot with LESSAP from the outset, with the explicit objective of generating evidence to inform LESSAP II design and government adoption.

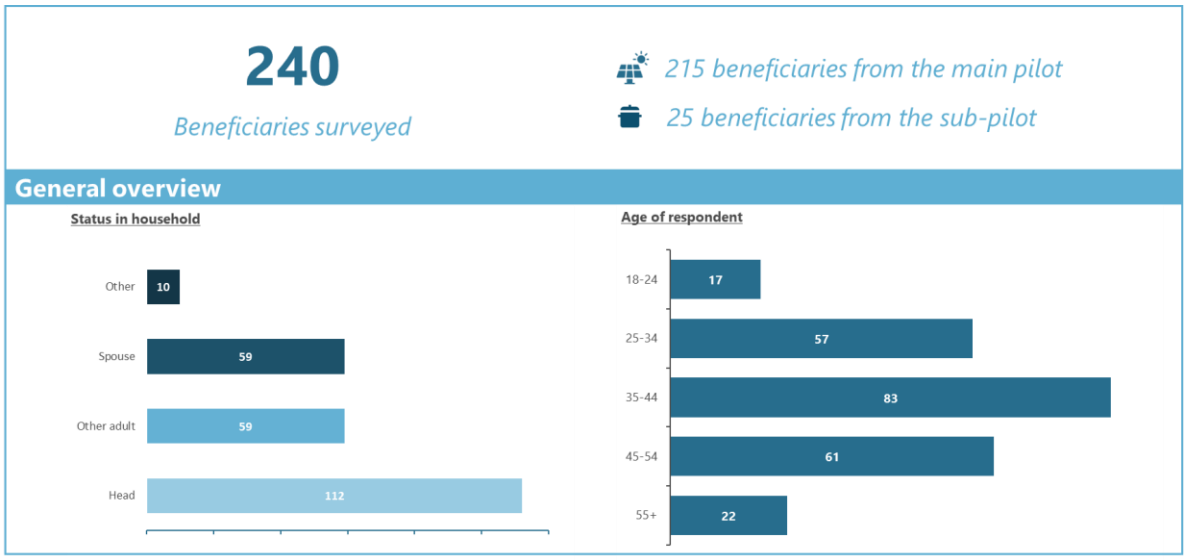
Implementation reality and drivers of change

There is now confirmation that LESSAP I will continue with a DSS for Tier 1 household systems, reflecting the

evidence that without demand-side price reduction, products in this range remain unaffordable for the target population. Under LESSAP II, discussions are ongoing regarding DSS for Tier 2 and productive use of energy products. The modality of scale-up, whether DSS is maintained as distinct mechanism or combined with supply-side subsidies, remains under discussion. The scalability of the approach and its funding efficiency at nationwide scale will be important considerations in these discussions.

5. Findings

Figure 1: Snapshot of household and respondent profile



5.1. Targeting effectiveness and efficiency

Results: Geographic targeting using the OPHI Multidimensional Poverty Index (MPI) enabled rapid rollout in the absence of a social registry, but limited targeting precision in a country where energy poverty is widespread.

In the absence of household-level poverty data, geographic targeting through the MPI provided a practical and operationally feasible way to direct subsidies toward poorer regions. County-level targeting was appropriate for the Liberia pilot given the absence of a national social registry, limited household-level poverty data, budget constraints, and uneven company capacity to serve all counties. The approach allowed the programme to prioritise poorer and underserved areas using the best available evidence. The limitation was not poor programme design, but the nature of geographic targeting in a context where energy poverty is widespread. Poor and energy-poor households exist across all 15 counties, including in non-DSS counties where companies reported similar affordability constraints when attempting to sell at market prices. As a result, geographic targeting worked well as a practical way to allocate limited subsidy resources, but could not precisely identify all households facing affordability barriers. This is important for future scale-up, as LESSAP II will need to preserve the simplicity of geographic targeting while adding more granular validation mechanisms where exclusion risks are highest.

Within targeted counties, sales concentrated in more commercially accessible markets, highlighting that geographic targeting alone does not ensure equitable reach when delivery depends on private-sector economics. Three counties, Nimba, Gbarpolu, and Grand Cape Mount, accounted for about 75% of verified sales

between January 2024 and October 2025. Conversely, four of the most remote and structurally poor counties, River Cess, River Gee, Sinoe, and Grand Kru, collectively accounted for around 11% of sales despite being eligible under the programme. This does not indicate weak demand in poorer or more remote counties. Companies attributed lower uptake in these areas to practical delivery barriers, including long distances, poor road access, sparse settlements, weak mobile network coverage, higher transport costs, and lower agent productivity. Nimba's higher sales reflect its larger population, more active market, better accessibility, and slightly stronger income base linked to agriculture and mining. The key lesson is that even when geographic targeting is appropriate, commercial delivery models will naturally concentrate in easier-to-serve markets unless programme design deliberately compensates companies for serving higher-cost areas.

Eligibility requirements helped strengthen accountability and reduce duplicate claims, but documentation and connectivity requirements excluded some of the households the programme was designed to reach. Local agents improved targeting by using community trust, local knowledge, and direct engagement with households in remote areas. However, point-of-sale eligibility requirements created practical barriers for some eligible households. The requirement for a valid ID excluded people without formal documentation, while the requirement for a working phone number posed a barrier for households in villages with weak or no mobile network coverage. In areas where network coverage was available, some companies addressed this constraint by bringing SIM cards to the field and helping prospective customers register phone numbers during sales visits. This workaround helped reduce exclusion, but also confirmed that the phone requirement was a real access barrier. The pilot evidence supports retaining core eligibility controls, as they helped reduce fraud and duplicate claims, but future programmes should plan for these exclusion points upfront, particularly for undocumented households, households without phones, and communities with poor network coverage.

Figure 2: Beneficiary awareness and product discovery

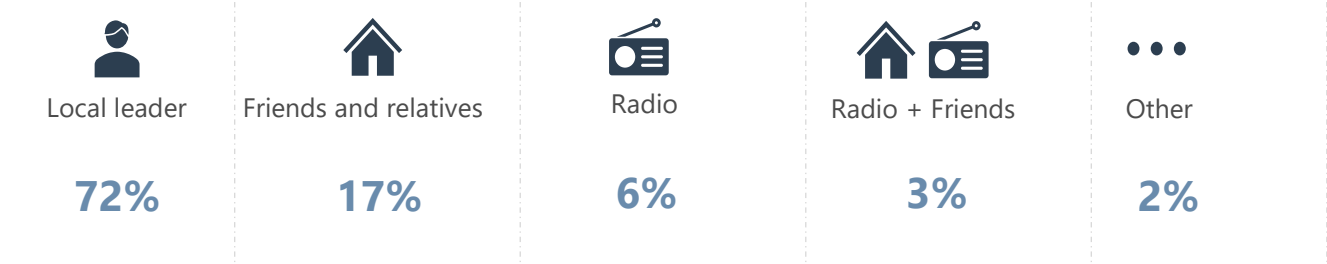
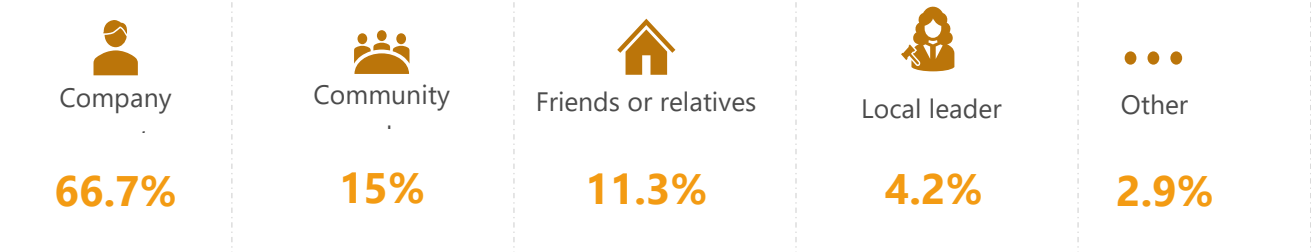


Figure 3: Communication and messaging on program rules and payments



Sub-pilot targeting

The Nimba voucher sub-pilot demonstrated that more targeted, partnership-based approaches can reach vulnerable groups more precisely than broad geographic targeting, though with higher operational complexity. The sub-pilot differed from the main pilot in three important ways. First, it used partner-organisation rosters from United Women for Sustainable Development and BRAC's Ultra Poor Group, which already held granular information on vulnerable women and marginalised households. Second, it used a closed-loop voucher system with beneficiary names, ID numbers, and unique serial numbers, reducing the risk that the subsidy would be transferred or misused. Third, it delivered the subsidy through organised community gatherings where

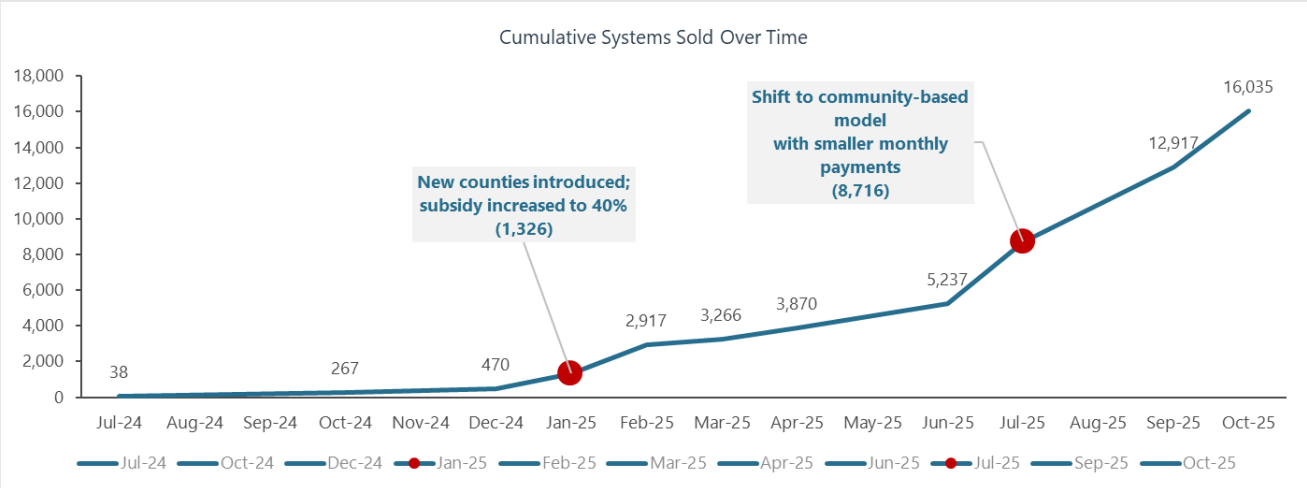
partners, companies, and beneficiaries were present at the same time, making eligibility, communication, and purchase processes easier to manage. This enabled the sub-pilot to reach approximately 3,800 women, including female heads of household, persons with disabilities, and socio-economically isolated groups. The model achieved greater targeting precision because of the existing institutional infrastructure of BRAC and UWSD, not because vouchers are automatically superior. Its main limitation is scalability: replicating this approach across all target counties would require trusted partners with reliable beneficiary data, strong coordination capacity, and additional administrative resources.

5.2. Subsidy level determination and impact

Results: The subsidy significantly improved affordability and stimulated uptake, but balancing inclusion, repayment sustainability, and long-term market viability remained a core programme tension.

The increase in the subsidy from 20% to 40% materially improved uptake, confirming that affordability was one of the primary constraints limiting access to solar products in the targeted counties. The transition from a 20% to a 40% subsidy led to a sharp increase in sales. The subsidy increase was a significant driver of this growth, alongside the expansion into additional counties and the introduction of upfront payments that helped companies secure stock. However, the 40% subsidy did not fully close the affordability gap for all target households. Survey results show that about 39% of credit buyers reported missing at least one monthly payment, while 86% indicated they would need a subsidy to purchase their next energy product. Focus group discussions in Bopolu confirmed that poorer households could not have afforded the product at the point of sale without the subsidy. This is distinct from, and reinforced by, the separate survey finding that 86% of beneficiaries said they would need a subsidy to purchase their next energy product. This indicates that the subsidy made products more accessible for many low-income households, but some lower-income groups still struggled even when PAYGo financing was available.

Figure 4: Cumulative number of units sold (Jul 2024-Oct 2025)

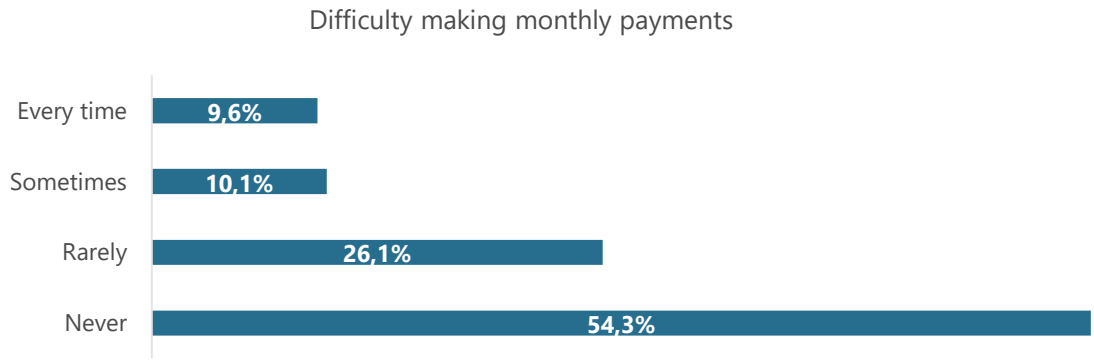


Source: EnDev Liberia

The near-universal use of PAYGo financing demonstrates that spreading payments over time was essential to making solar products accessible for target households. Across the full sales period, 97.6% of verified sales were made on credit, showing that PAYGo was a core affordability mechanism in the Liberia pilot. Over time,

some companies shifted from the standard 12-month repayment cycle to a 24-month cycle, reducing monthly instalments to about USD 4–5 to better match household cash flow. This eased the monthly payment burden for customers, but also extended the time companies needed to recover cash from sales. Repayment performance varied significantly across companies: BB Tech reported defaults of 10–15%, Lib Sunshine 20–25%, Eco Energy approximately 33%, while LEN 2 initially faced default rates of around 40%, which were later reduced through stronger agent follow-up and improved customer education. These differences suggest that repayment outcomes were shaped by both household income volatility and company-level factors, including collection systems, agent supervision, customer education, and portfolio management practices.

Figure 5: Frequency of difficulty making monthly payments among credit buyers



Sub-pilot Subsidy level

The Nimba sub-pilot suggests that deeper subsidies may be more viable when paired with tighter targeting and more controlled delivery mechanisms. The 80% subsidy, capped at USD 160, was calibrated through a dedicated affordability survey conducted in October 2025 and matched to the income profile of ultra-poor women identified by partner organisations. This differed from the main pilot because the target group was narrower, the beneficiary list was pre-validated through trusted partners, and the subsidy was delivered through a closed-loop voucher system. All surveyed sub-pilot beneficiaries reported the product as affordable, and none reported missing a payment. This suggests that the sub-pilot worked not only because the subsidy was deeper, but because the higher subsidy level was matched with more precise targeting, stronger partner-led validation, and a delivery model that reduced leakage and repayment risk.

5.3. Delivery and communication effectiveness

Results: Strong community-based delivery and agent outreach drove uptake, but operational and communication gaps created challenges around liquidity, customer understanding, and long-term market expectations.

Higher uptake increased operational and liquidity pressure on participating companies, especially newer last-mile distributors. The DSS model successfully stimulated demand once the subsidy level increased to 40% and companies were able to access stock. However, this placed pressure on companies' working capital, particularly for the six firms that were new to last-mile SHS distribution. Longer PAYGo tenures extended the time companies needed to recover cash from sales, while cash-based repayment systems increased operational burden. Survey data showed that 70.7% of interviewed credit buyers paid agents in cash, compared to only 14.4%

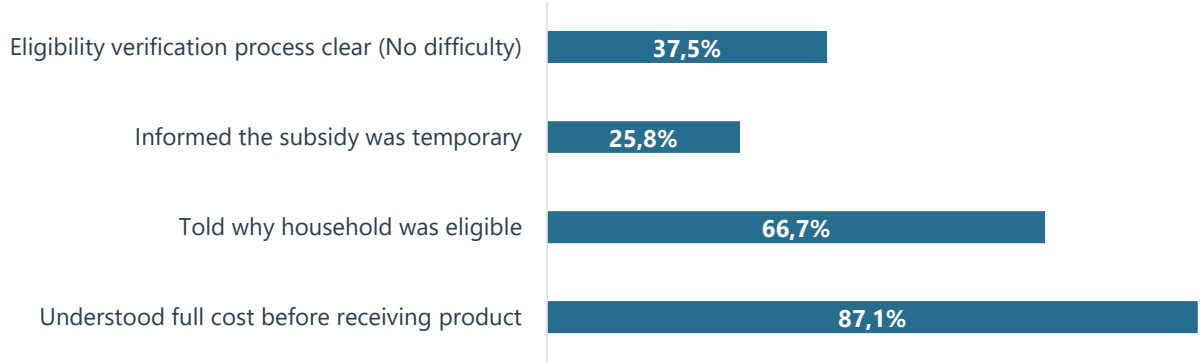
using mobile money; the remaining ~14.9% used other arrangements, mainly paying at a company office or a mix of methods. This required agents to physically collect and transport funds to companies in urban centres, sometimes holding cash for several days before deposit. In response, some companies introduced paper-based payment registries co-signed by agents and household heads to improve repayment traceability.

Inventory constraints and reimbursement delays limited how quickly companies could respond to increased demand. During the first six months of implementation, verified sales remained low partly because several companies had no inventory available in-country. Once demand increased, companies still faced liquidity constraints because PAYGo sales delayed cash recovery and verification challenges slowed reimbursement. To mitigate these pressures, BRAC introduced a 30% downpayment mechanism, facilitated consolidated bulk imports through business development support, and several companies leveraged their DSS contracts as collateral to secure low-interest commercial bank loans. These adjustments helped companies respond to demand but also showed that DSS delivery in Liberia required more than a price reduction. It required active support to inventory financing, working capital, and reimbursement processes.

High-touch community outreach drove awareness and sales, but communication on programme rules and subsidy duration remained inconsistent. Target beneficiary awareness was built primarily through direct engagement, including town halls, community events, and company agent outreach. Surveyed households reported that 66.7% first learned about the product through agents, 15% through community members, and 11% through friends or relatives. This confirms that company agents and community networks were central to demand generation. However, only 25.8% of surveyed beneficiaries reported being informed that the subsidy was temporary. This communication gap contributed to price anchoring, as some customers began to view subsidised prices as the normal market price. It also created confusion in non-DSS counties, where customers saw the same or similar products being sold at different prices.

Customer satisfaction and social cohesion were strong, but understanding of warranties, repayment obligations, and after-sales rights remained uneven. While 87.1% of surveyed beneficiaries reported understanding the full product cost before purchase, 7.1% reported partial understanding and 5.8% reported no understanding. The areas of weaker understanding related mainly to warranty terms, repayment terms, and eligibility criteria. At the same time, social cohesion concerns remained limited: 95.4% of beneficiaries reported no community complaints related to the subsidy, and 95.4% reported no requests to lend, share, or resell their product. This suggests that communication was effective enough to support uptake and limit major community tension, but not consistent enough to ensure that all customers fully understood their rights and obligations. Future programmes should strengthen sales scripts, customer receipts, warranty explanations, and agent incentives so that sales performance does not come at the expense of customer understanding.

Figure 6: Communication and messaging on programme rules and payments



Sub-pilot delivery

Partner-led delivery in the Nimba sub-pilot reduced communication gaps and repayment risk among highly vulnerable beneficiaries. EnDev Liberia coordinated directly with partner cooperatives to organise community gatherings where companies presented their products and completed sales on the spot. This meant that targeting, awareness raising, voucher distribution, and purchase happened in the same setting. The partner organisations helped explain the programme rules, confirm beneficiary eligibility, and clarify that the deeper subsidy was a one-off, partner-mediated benefit. This reduced the risk of confusion around eligibility and subsidy duration. The model also reduced repayment risk: among surveyed sub-pilot beneficiaries, none reported missing a payment. The key lesson is that partner-led delivery can work well for highly vulnerable groups when trusted organisations already have beneficiary data, community relationships, and the capacity to coordinate sales events. Its limitation is that it requires stronger institutional coordination than the standard agent-led commercial model.

5.4. Subsidy valuation and behavioural impacts

Results: Subsidies unlocked demand and delivered strong household benefits, but beneficiaries remain highly price sensitive and future programmes will need to manage expectations around subsidised pricing.

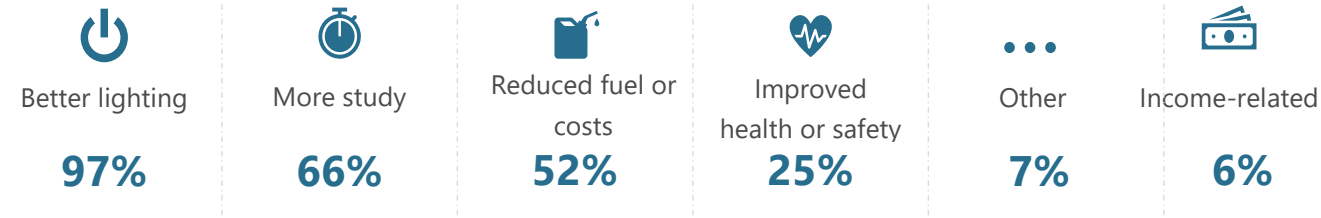
Subsidised pricing increased uptake but also shaped what customers now expect to pay for solar products. Companies reported that customers in subsidised areas increasingly treat subsidised prices as the normal reference price. Survey results show that 82.9% of beneficiaries perceived the subsidised product as cheaper than comparable alternatives, while 11.6% perceived it as similar in price or more expensive. In addition, 85.8% of surveyed households reported that they would need a subsidy to purchase their next energy product. This shows that the subsidy successfully unlocked demand, but also that households remain highly price sensitive. Future programmes will therefore need to communicate clearly that subsidy levels are time-bound and programme-specific, otherwise customers may delay purchases or reject commercial prices once the subsidy ends.

Although households valued solar products and were willing to repay over time, income volatility remained a major constraint to consistent repayment. Rural households strongly preferred solar products over fuel lanterns, but many had limited savings buffers and irregular incomes. When households faced competing expenses, such as medical fees, school costs, agricultural costs, or other shocks, solar repayments were sometimes delayed. The 39% missed-payment rate among credit buyers reflects this financial vulnerability, but it should not be interpreted only as unwillingness or inability to pay. Repayment was also affected by collection timing, agent follow-up, cash-based payment systems, and limited real-time balance tracking in areas with poor mobile connectivity. Future programmes can pair affordable pricing with repayment flexibility built into approved product and contract terms, for example by sanctioning longer or seasonally aligned PAYGo schedules that match rural income cycles. This is a design lever the programme itself controls, rather than a mismatch left for companies to absorb.

Energy access delivered consistent functional benefits to beneficiary households. Surveyed households reported strong usage and satisfaction: 92.5% used the product every time (the survey's highest-frequency response option, indicating regular, near-daily use), 100% described it as useful or very useful, 93.3% said they would recommend the product to others, and 84.2% said they would purchase another product from the same company. Beneficiaries cited clear benefits, including better lighting or power (96.7%), more study time for children (65.8%), reduced fuel or energy costs (52.5%), and improved health or safety (25.4%). Product performance was also strong: 99.2% still owned the product at the time of the survey, and 95.0% of those

reported that it was fully working. Income-related benefits were reported by 5.8%, which is expected given that Tier 1 systems are designed mainly for first-time household access rather than productive use. Among the 11.7% who would not buy another product or would consider alternatives, cost was the main barrier, cited by 43%.

Figure 7: Product benefits across surveyed beneficiaries



Sub-pilot Subsidy valuation and behavioural impacts

The sub-pilot showed that deeper subsidies can reduce affordability pressure when they are clearly framed as a targeted, one-off benefit. Behavioural patterns in the sub-pilot differed from the main pilot. The closed-loop voucher system and partner-led delivery made it clearer that the 80% subsidy was targeted to a specific group of vulnerable women and delivered through a specific programme channel. This helped reduce confusion around why beneficiaries received a deeper subsidy and made the temporary nature of the support easier to communicate. The sub-pilot therefore suggests that deeper subsidies can be used with lower behavioural risk when they are paired with precise targeting, trusted partners, and clear communication.

5.5. Verification

Results: Verification systems maintained strong control and low rejection rates, while evolving over time to better reflect operational realities in low-connectivity environments.

The verification system largely worked, but required practical adjustment to balance cost, speed, and rigour in low-connectivity areas. The initial 50:50 phone-to-field verification split was adjusted to 80:20 because field verification cost roughly three times more than phone verification. Field verification was also geographically clustered to reduce travel costs. Where companies failed to meet the 75% phone reachability threshold, additional field verification was used to compensate, ensuring that sales were not rejected solely because customers could not be reached by phone. This adjustment helped reduce verification costs while maintaining sufficient control over claims. The decline in rejection rates over the course of the programme, reaching 1.7% toward the end, with most companies reporting rates between 2% and 5%, suggests that the adapted verification model was broadly effective in Liberia's low-connectivity context.

Early verification challenges were driven mainly by unclear product definitions and repayment classifications, not by evidence of fraud or misuse. Two practical issues required clarification during implementation. First, some accessory problems, such as faults with radios or flashlights, were initially treated as technical failures of the solar home system, which delayed claim approval. BRAC and the IVA later clarified that core SHS technical failures should relate to the panel, battery, and bulbs, not optional accessories. Second, some customers with variable incomes, including mining households, repaid their systems earlier than expected and were initially classified as ineligible cash sales. The verification criteria were later clarified to recognise these cases as legitimate accelerated PAYGo repayments. These examples show that clearer technical guidance and repayment classification rules before launch could have reduced early confusion and avoided delays in claim processing.

Data quality depended as much on agent capacity and supervision as on the Kobo system itself. LEN 2's initial batch of 134 rejections, the largest rejection cluster in the pilot, was mainly caused by missing Kobo data after field agents failed to submit forms. The issue was not the digital tool alone, but how consistently agents used it in the field. LEN 2 addressed the problem through stronger management oversight, more field supervision, and additional agent training. Once these measures were introduced, data quality improved and claim processing became smoother. EnDev Liberia provided extensive, repeated hands-on training for companies and their agents, including in-field training over multiple rounds. The constraint was the uneven, piecemeal absorption of new digital tools and processes rather than an absence of training. This shows that future DSS programmes should treat agent training and supervision as part of the verification system, not as a separate company-level issue.

Sub-pilot verification

Verification in the Nimba sub-pilot was simpler because eligibility had already been checked through partner organisations and voucher controls. The partner organisations had already identified eligible beneficiaries before the sales events, and the voucher itself included beneficiary details and a unique serial number. This reduced ambiguity at the point of sale and made it easier for the Fund Manager to cross-check claims. The sub-pilot also used a more controlled delivery setting, with partners, companies, and beneficiaries present during community gatherings. This made the sales process easier to verify than standard commercial-channel sales. Because network coverage was limited in the sub-pilot areas, verification relied on full field verification rather than phone verification. The lesson is that verification becomes easier when targeting, delivery, and claim documentation are linked from the start.

5.6. Market distortion assessment

Results: The DSS accelerated rural market creation and expanded distribution, with limited evidence of leakage or resale, but subsidised prices began to shape customer expectations and created localised fairness concerns.

The pilot expanded rural SHS distribution with limited evidence of leakage or resale, but subsidised prices began to shape customer expectations. Survey evidence suggests that product leakage and resale were limited. Only 4.6% of surveyed beneficiaries reported having been asked to lend, share, or resell their product. The point-of-sale eligibility checks, including first-time-use requirements and local identification, helped limit misuse of the subsidy. At the same time, companies reported that customers in subsidised counties increasingly viewed subsidised prices as the normal price for SHS products. Some companies also reported that customers in non-DSS areas questioned why similar products were sold at higher commercial prices. This suggests that the main distortion risk was not large-scale leakage, but the effect of subsidised pricing on customer expectations and future willingness to pay.

Differences between subsidised and non-subsidised counties created some localized tensions, although these remained relatively limited overall. Because eligibility varied by county, neighbouring communities sometimes faced different prices for similar products. Companies such as Lib Sunshine and MaiFrance reported that some customers perceived this as unfair when they learned that subsidised products were available in nearby counties. Survey complaint detail suggests, however, that the more common trigger was price differences customers could observe close to home. These included comparisons between earlier (pre-subsidy) and later (subsidised) buyers within the same community, not only cross-county boundaries. The regional clustering

approach used in county selection helped reduce these boundary effects by grouping neighbouring counties where possible, but it could not eliminate them entirely. Survey results suggest that these tensions were present but not widespread: 7.9% of surveyed beneficiaries reported hearing subsidy-related complaints, while 92.1% reported hearing no complaints from others. Future programmes should therefore communicate eligibility rules more clearly and explain why some counties or groups receive support while others do not.

The pilot also highlighted an important strategic question for scale-up: how to balance first-time energy access with support for higher-capacity productive use systems. RREA raised concerns that limiting subsidies to basic lighting products could constrain productive energy use and reduce beneficiaries' ability to generate income. The pilot evidence suggests that Tier 1 systems remain important for reaching the poorest households because they provide affordable first-time access. However, productive use systems involve higher upfront costs, stronger repayment requirements, and different business-case assumptions. They are therefore likely to require a separate financing approach rather than being treated as a substitute for Tier 1 access subsidies. The evidence supports keeping Tier 1 household access and productive use financing as complementary but distinct instruments.

Sub-pilot market distortion

The Nimba sub-pilot suggests that deeper subsidies can be delivered with limited distortion risk when paired with tightly controlled targeting and voucher-based delivery mechanisms. Anti-counterfeiting features prevented voucher resale, and the partner-mediated identification ensured the benefit was institutionally anchored. The result was a deeper subsidy delivered without measurable distortion within the sub-pilot footprint. The trade-off space is that the depth of subsidy that can be safely deployed is endogenous to the targeting and verification architecture, not a fixed parameter: closed-loop, demographic targeting can sustain subsidy depths that geographic targeting through commercial channels cannot.

6. Recommendations

6.1. Targeting

Maintain geographic targeting as the foundation of the programme, while introducing complementary community-based validation mechanisms to improve inclusion of underserved and hard-to-reach households.

MPI-based geographic targeting should remain the foundation under LESSAP II or other programmes. It was practical in the absence of a national social registry and helped the programme direct subsidy resources toward poorer and underserved counties. The pilot evidence shows that geographic targeting worked reasonably well as a way to prioritise limited public funding, but it could not capture all vulnerable households because energy poverty is widespread across Liberia.

Future programmes should therefore keep the simplicity of county-level targeting while adding a light community validation layer in areas where exclusion risk is highest. This should focus on households that may be missed by standard eligibility processes, particularly those without formal ID, those without reliable phone access, and those living in remote settlements where companies have weaker reach. Local leaders, community-based organisations, women's groups, and trusted local agents can help validate eligibility and identify households that may not appear in formal systems.

Over time, Liberia should build toward stronger household-level targeting infrastructure. A national social registry or comparable vulnerability database would allow future DSS programmes to apply more precise

targeting and differentiated subsidy levels. However, this should be treated as a medium-term objective, not a precondition for LESSAP II. In the near term, the most practical path is to combine geographic targeting with targeted community validation. This is not a turnkey nationwide substitute for the sub-pilot's approach. The sub-pilot worked because trusted partners (UWSD and BRAC's Ultra Poor Group) already held a pre-validated roster. No comparable nationwide lists of vulnerable households, such as people with disabilities, food-assistance recipients, or female-headed households, currently exist or were available, and asking village leaders to compile such lists risks capture and favouritism. Community validation should therefore be applied selectively in the highest-exclusion areas, with explicit safeguards and dedicated staff time, as a resource-intensive interim measure pending a household-level registry.

6.2. Subsidy level

Calibrate subsidy levels based on observed household affordability and introduce targeted higher-support mechanisms for the most vulnerable groups through tightly controlled delivery channels.

Subsidy levels should be based on observed household ability to pay, not fixed assumptions. Future programmes should conduct affordability and willingness-to-pay assessments before setting subsidy levels and include a structured review point during implementation. The Liberia pilot shows why this matters: the initial 20% subsidy was not enough to unlock uptake, while the increase to 40% significantly improved sales.

The standard subsidy should continue to support broad access to Tier 1 SHS products, but deeper support should be reserved for the most vulnerable groups. The Nimba sub-pilot provides a useful model. The 80% subsidy worked because it was targeted through trusted partner organisations, calibrated through a dedicated affordability survey, and delivered through a closed-loop voucher system. This reduced the risk of leakage and made it clear that the higher subsidy was meant for a specific vulnerable group.

Future programmes should therefore pair deeper subsidies with tighter targeting and stronger delivery controls. A higher subsidy delivered broadly through standard commercial channels would increase the risk of price anchoring and perceived unfairness. A higher subsidy delivered through partner-validated beneficiary lists, controlled vouchers, or similar mechanisms is more likely to reach the poorest households without undermining the wider market.

Subsidy adjustments should also be clearly communicated. Customers and companies should understand why subsidy levels exist, who they are intended for, and whether they may change over time. This will help reduce confusion, manage expectations, and limit the perception that subsidised prices are the permanent market price.

6.3. Delivery

Strengthen last-mile delivery and repayment systems by aligning collections with household cash-flow patterns, expanding trusted local payment mechanisms, and improving liquidity support for participating companies.

The programme can require and fund repayment flexibility as a condition of participation. Because many households have irregular income linked to farming, mining, petty trade, or seasonal activities, LESSAP II can approve longer or seasonally aligned PAYGo schedules in company contracts so that collection timing matches when customers are likely to have cash. Where mobile money coverage exists, the programme can incentivise its use to reduce cash-handling risks. Where it does not, it can finance trusted community-based collection channels (cooperatives or savings groups) and set minimum cash-handling safeguards, such as co-signed registries and deposit timelines, verified through the IVA.

The programme can standardise what must be disclosed at the point of sale, including full product cost, subsidy amount, repayment obligations, warranty conditions, after-sales rights, and the temporary nature of the subsidy. It can do this by making standard sales scripts, customer receipts, and payment reminders contractual deliverables, and by funding the central design of these materials rather than leaving each company to develop its own. Results-based payments can also condition part of the company's incentive on the quality of customer onboarding, not only the number of sales completed.

Working-capital support should be built into future DSS design from the start as a designed feature the programme funds and underwrites, not an improvised fix. The Liberia pilot showed that increased demand can quickly strain company liquidity, especially when companies are new to last-mile distribution and sell mainly through PAYGo. The 30% downpayment mechanism, consolidated bulk imports, and use of DSS contracts to secure bank loans helped companies respond to demand. LESSAP II should formalise this type of support, formalising the downpayment mechanism, facilitating consolidated imports, and guaranteeing the use of DSS contracts as loan collateral, so that companies can maintain stock, manage repayment delays, and expand into harder-to-serve areas.

Digital payments should remain a long-term objective, but they should not be treated as the only solution. In Liberia's current context, a phased approach is more realistic: strengthen cash collection controls and community-based repayment channels now, while expanding digital payment options where infrastructure allows.

6.4. Verification

Retain the hybrid phone-to-field verification approach while strengthening upfront IVA training, product classification guidance, and digital data management systems.

Phone verification is cost-effective where connectivity exists but is structurally unreliable in rural Liberia. The 80:20 phone-to-field ratio, combined with extended field verification where phone reachability thresholds are not met, proved effective and should be retained in future programmes. Field verification was already geographically clustered throughout the pilot, and this practice should be retained. IVAs require systematic training on SHS core components, accessory definitions, and acceptable repayment patterns, including accelerated payoff scenarios common among variable-income workers, before programme launch, to avoid the classification errors that required mid-course correction in the pilot. The IVA Terms of Reference should specify the technical knowledge prerequisites explicitly, and pre-launch training should be a contractual deliverable rather than a recommendation. As digital infrastructure improves, the long-term direction is to invest in real-time digital verification platforms that capture sales data centrally and enable automated cross-checking; this is a multi-year investment that LESSAP II should initiate, not a short-term fix.

The front-loading IVA capacity-building raises set-up cost and lengthens programme inception, but materially reduces mid-pilot rejection rates, claim disputes, and the working-capital strain placed on participating companies. The pilot evidence shows that mid-pilot IVA recalibration is possible but costly in disrupted disbursements; investing pre-launch is the more efficient path. Real-time digital verification platforms, while a desirable long-term direction, depend on connectivity that does not yet exist across all DSS counties; a phased investment strategy is required.

6.5. Policy

Design future DSS programmes with clear transition pathways from the outset, while separating first-time energy access objectives from productive use financing and addressing the structural constraints that limit long-term market sustainability.

Future DSS programmes should include transition planning from the outset. The Liberia pilot shows that subsidies can quickly shape customer price expectations. If customers come to see the subsidised price as the normal market price, companies may struggle to sell products commercially after the subsidy ends. Programme communication should therefore explain clearly that subsidies are time-bound, targeted, and linked to specific public-access objectives. LESSAP II should also manage post-subsidy expectations with companies. Participating firms need clarity on how long subsidy support will last, which products will remain eligible, and what changes are expected over time. This will help companies plan inventory, repayment terms, customer communication, and future product offerings more effectively.

Tier 1 household access and productive use financing should remain complementary but separate instruments. Tier 1 SHS products are important for first-time access among low-income households because they are relatively affordable and meet basic lighting and charging needs. Productive use systems have higher upfront costs, more complex repayment profiles, and stronger links to income generation. They are likely to require different financing tools, such as credit guarantees, working-capital support, asset finance, or targeted productive-use subsidies. Combining both objectives into one subsidy instrument would risk weakening the focus on the poorest households while also under-serving productive users.

The collaboration between EnDev, RREA, BRAC, and the World Bank provides a useful foundation for this next phase. LESSAP II should build on this coordination model while making transition planning, customer communication, company liquidity, and differentiated financing explicit parts of programme design.

7. Conclusion

The Liberia pilot confirms that demand-side subsidies are a critical instrument to unlock access to modern energy in low-income and underserved contexts, and equally that their effectiveness depends on the design trade-offs through which they are operationalised. The pilot sales dataset demonstrates that demand is highly responsive to price reductions and that subsidies, when combined with PAYGo models, can expand access beyond early adopters. At the same time, the pilot highlights that while access can be accelerated, inclusion remains incomplete. The poorest households remain unable to participate without deeper subsidy and specific targeting mechanisms, like the sub-pilot demonstrated.

The findings demonstrate that the central design choices in DSS programmes are trade-offs, not optimisations. Geographic targeting traded precision for speed; the 40% subsidy traded distortion risk for depth; the 80:20 verification ratio traded rigour for cost. None of these trade-offs has a unique correct resolution; each requires explicit choice given the structural conditions of the operating environment. The pilot evidence is most useful not as a verdict on whether DSS works, but as a map of the design space within which LESSAP II will need to choose.

The pilot highlights that demand-side subsidies cannot be treated as standalone price interventions. Their effectiveness depends on how well they are integrated within the broader market system. Misalignment between targeting, subsidy calibration, delivery mechanisms, and verification processes led to unintended consequences, including localised social tensions that, as in the findings, remained limited and localised rather than systemic.

There was little evidence of large-scale leakage or resale. The more material behavioural risk was price anchoring, with customers coming to treat the subsidised price as the normal price, alongside slow repayment. Behavioural responses, particularly price anchoring and the difficulty of sustaining repayment discipline in cash-constrained households, further highlight the importance of aligning subsidy design with real household financial dynamics. The sub-pilot's voucher-based model demonstrated that more targeted approaches could reach groups excluded from the main pilot, but at higher operational cost and with specific institutional preconditions that do not yet exist at national scale. The inclusion-versus-cost trade-off identified in the sub-pilot is therefore not a flaw in the design but a feature of the structural environment: deeper inclusion requires institutional infrastructure that Liberia must build, not assume.

Looking ahead, scaling the model will require a shift from a pilot-driven approach focused on distribution to a more integrated system design. This includes adopting more granular targeting, calibrating subsidy levels to differentiated affordability profiles, strengthening delivery adapted to last-mile constraints, and improving verification to balance cost and accuracy. The evidence base supports maintaining DSS for Tier 1 household systems under LESSAP I and into LESSAP II as the primary access entry point for the lowest-income households, while parallel productive-use financing addresses the higher-tier market objectives. Complementary investments in rural connectivity, digital payment infrastructure, social registry development, and access to working capital for companies will be essential prerequisites for achieving sustainable scale. The collaboration architecture between EnDev, RREA, BRAC, and the World Bank that has functioned effectively through this pilot provides a working template for the inter-institutional coordination that scale-up will require.

Demand-side subsidies remain a powerful tool to advance inclusive energy access in Liberia. But achieving durable impact will depend on embedding them within adaptive, coordinated, and market-aligned frameworks that address the structural realities of the context ,and on framing the target population consistently as marginalised groups and people living in poverty, whose access to modern energy is a public-policy objective, not a commercial outcome.