Busara Groundwork

LITERATURE REVIEW

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Powering primary healthcare: Financing models and enabling conditions for energy access in Kenya

LITERATURE REVIEW

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Abbreviations and acronyms

PPHF	Private Primary Healthcare Facilities
EaaS	Energy as a Service
LFI(s)	Local Financial Institution(s)
DFI(s)	Development Financial Institution(s)
PPP(s)	Public-Private Partnership(s)
RBF	Results-Based Financing
IPP(s)	Independent Power Producers(s)
CDM	Clean Development Mechanism
CAPEX	Capital Expenditure
O&M	Operations & Management
PAYGO	Pay As You Go
OBA	Output Based Aid

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Executive summary

Reliable electricity is essential for quality healthcare, yet many private primary healthcare facilities (PPHFs) in sub-Saharan Africa, especially in rural areas, remain underpowered. In Kenya, 26% of health facilities have no access to electricity, and only 15% of grid-connected facilities receive an uninterrupted, stable supply. This severely affects and impairs the emergency care, essential services, and cold chain services that these facilities provide.

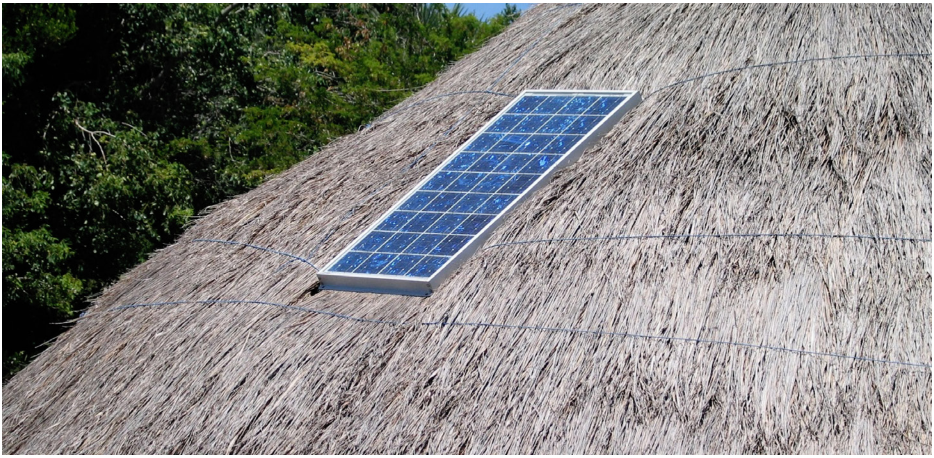
This report synthesizes lessons from Kenya and comparable contexts on how to finance and deliver clean, reliable electricity for primary healthcare facilities, particularly those that are privately operated and underserved by electric grids. It examines the roles and constraints of Energy-as-a-Service (EaaS) providers, local financial institutions (LFIs), and donor financial institutions including financial donors, guarantors, funders, and government actors in enabling this transition.

Blended finance models are proving to be a viable pathway to scale electricity access in health facilities. Successful approaches have combined grants, concessional loans, and results-based financing (RBF) to reduce the risk and thereby attract private investment. Operational innovations—lease-to-own systems, local energy management teams, and digital performance monitoring—further support the electrification of health facilities in a sustainable and accountable manner. Donor-backed mechanisms like output-based aid and first-loss guarantees are also known to play a critical role in financing electrification where revenues are limited or uncertain.

However, significant barriers remain: high upfront capital costs, short funding cycles, limited LFI engagement, and financing models misaligned with the realities of small health facilities. Moreover, many PHCs lack the credit history, autonomy, or technical capacity to engage with the available products, and access electricity.

Unlocking scale will require a more targeted approach—specific financial products for different stakeholders, deeper LFI involvement supported by de-risking instruments, and stronger alignment between health, energy, and climate policy. With the right structures in place, decentralized renewables offer a high-impact opportunity to strengthen healthcare systems, improve resilience, and advance equitable energy access across Kenya and the region.

Introduction



Background and objectives

Reliable electricity access is a critical essential for the delivery of healthcare services. Despite this many private primary healthcare facilities (PPHFs) across sub-Saharan Africa remain, either unelectrified or reliant on inconsistent sources such as diesel generators. In response, Energy-as-a-Service (EaaS) models such as pay-as-you-go (PAYGO) and build-operate-transfer (BOT) are emerging as promising solutions, particularly for off-grid and underserved areas. However, their uptake and scalability are constrained by limited access to appropriate financial products, particularly from local financial institutions (LFIs).

This literature review was undertaken to explore the enabling factors and constraints affecting financing for healthcare electrification through distributed renewable energy solutions. The review aims to surface lessons and models from past and ongoing initiatives that can inform how to 1.) facilitate access to local finance for both EaaS providers and PPHFs 2.) understand which financial product structures have succeeded or failed in relevant contexts, and 3.) clarify the evolving role and requirements of LFIs and impact-focused investors in de-risking and scaling these solutions. The findings are intended to support the design of financeable and scalable renewable energy access interventions that ensure the continuous and unobstructed delivery of essential health services.

Scope of the literature review

This report focuses on literature related to financing mechanisms and landscapes for healthcare facility electrification in low and middle-income countries, with particular emphasis on East Africa and comparable contexts. It includes peer-reviewed studies, donor and development financial institute (DFI) reports, and grey literature documenting experiences with blended finance, public-private partnerships (PPP), results-based financing (RBF), and EaaS delivery models. The scope is guided by four research areas:

1. The willingness and capacity of EaaS providers to utilize LFI financial products.
2. The willingness and ability of PPHFs to access the financial products.
3. LFI requirements to develop and offer the aforementioned financial products.
4. The expectations of investors and development funders to de-risk and co-finance these financial structures.

Although the review centers on healthcare, relevant insights from energy access efforts in adjacent sectors, such as education and humanitarian infrastructure, are also considered, particularly where financing and delivery models are transferable.

Methodology and sources

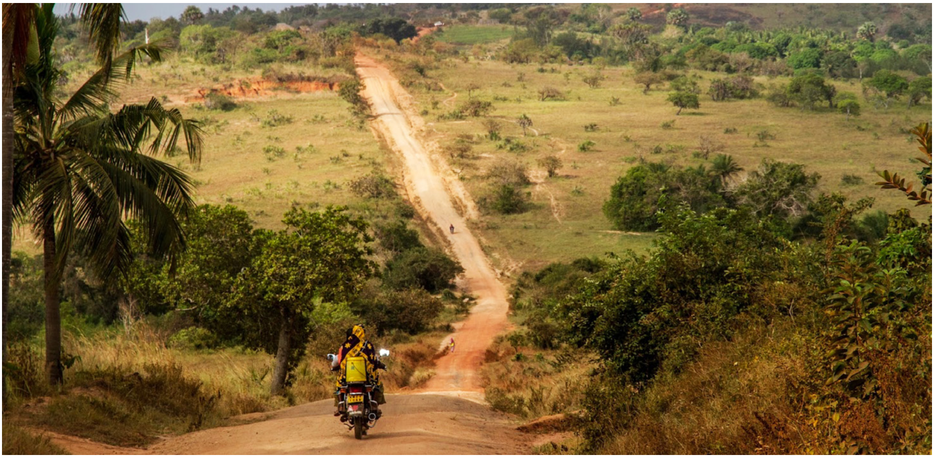
The literature review was conducted manually, and in a structured manner. Sources were identified and reviewed based on their relevance to the research questions, with a focus on empirical evidence, case studies or ongoing pilots, and the documented outcomes of past financing efforts. The key terms that guided the search strategy included combinations such as "Energy-as-a-Service", "healthcare facilities," "healthcare electrification financing," "results-based financing and electrification," and "donor funding for off-grid electrification in Africa."

Foundational documents included capital landscape assessments by Sustainable Energy for All (SEforALL), financing strategy papers from SouthSouthNorth, results-based financing assessments from World Bank, and grey literature published by Norwegian Refugee Council(NRC), German Corporation for International Cooperation (GIZ), and other development actors.

Each selected source was reviewed for insights into financial structures, credit terms, de-risking mechanisms, and institutional engagement. Other relevant data was also manually extracted and synthesized into a thematic matrix to support comparative analysis across geographies and funding models. Themes captured included 1.) context, 2.) stakeholders involved, 3.) financing mechanisms, enablers/barriers, and 4.) outcomes.

Artificial intelligence tools were used solely to support the synthesis and drafting of narrative sections based on notes from manually reviewed sources. All content reflects human-led analysis and sourcing. AI-generated text was reviewed and edited for accuracy, clarity, and fidelity to the original source material.

Landscape



Kenya: Electricity coverage and distribution

Kenya's power generation is plentiful and largely renewable, it has made significant progress in expanding electricity access over the past decade, with national electrification rising from 19.2% in 2010 to 76.5% in 2021 (World Bank, 2022). However, these gains are not evenly distributed.[1] As of 2021, 26% of Kenya's medical facilities remained unelectrified (meaning they lack any access to electricity at all, whether from the grid or other sources like generators or solar power), and of those connected to the grid, only 15% received uninterrupted power.

1 County-level data from the Kenya Health Facility Census (MoH, Sept 2023) reveals stark disparities in electricity access across public health facilities. While counties like Mombasa, Nairobi, and Kirinyaga report near-universal electrification, others such as Mandera (48.6%), Wajir (54.2%), and West Pokot (66.9%) show significant energy access gaps. The data includes all electricity sources (grid, solar, or generator) and illustrates the inequity in infrastructure that disproportionately affects remote and underserved areas.

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Specific Energy Gaps in Percentages in Kenya

Figures represent the percentage of public health facilities with any form of electricity access across counties in Kenya.

County	Facilities	Electrified	Without Power	Without Power
Baringo	253	81.0%	19.0%	
Bomet	173	91.3%	8.7%	
Bungoma	294	89.1%	10.9%	
Busia	174	91.4%	8.6%	
Elgeyo Marakwet	140	91.4%	8.6%	
Embu	130	91.5%	8.5%	
Garissa	186	61.8%	38.2%	Low access
Homa Bay	229	86.9%	13.1%	
Isiolo	55	83.6%	16.4%	
Kajiado	204	79.9%	20.1%	
Kakamega	395	89.1%	10.9%	
Kericho	204	91.2%	8.8%	
Kiambu	505	89.5%	10.5%	
Kilifi	264	73.1%	26.9%	
Kirinyaga	179	96.1%	3.9%	High access
Kisii	305	92.5%	7.5%	
Kisumu	234	93.6%	6.4%	
Kitui	353	70.3%	29.7%	
Kwale	193	72.5%	27.5%	
Laikipia	127	83.5%	16.5%	
Lamu	47	72.3%	27.7%	
Machakos	325	90.8%	9.2%	
Makueni	328	79.3%	20.7%	68 off-grid facilities
Mandera	177	48.6%	51.4%	Lowest access
Marsabit	131	64.1%	35.9%	
Meru	460	91.3%	8.7%	
Migori	259	87.3%	12.7%	
Mombasa	89	100.0%	0.0%	Full access
Murang'a	301	92.4%	7.6%	
Nairobi	351	99.1%	0.9%	
Nakuru	371	98.5%	1.5%	High access
Nandi	224	90.2%	9.8%	
Narok	219	73.5%	26.5%	
Nyamira	184	91.8%	8.2%	
Nyandarua	196	95.4%	4.6%	
Nyeri	251	93.2%	6.8%	
Samburu	94	62.8%	37.2%	
Siaya	214	91.6%	8.4%	
Taita Taveta	132	78.0%	22.0%	
Tana River	123	61.8%	38.2%	
Tharaka-Nithi	183	90.2%	9.8%	
Trans Nzoia	184	91.8%	8.2%	
Turkana	304	75.7%	24.3%	294 facilities to be solarised
Uasin Gishu	172	91.9%	8.1%	
Vihiga	190	94.7%	5.3%	
Wajir	225	54.2%	45.8%	Very low access
West Pokot	163	66.9%	33.1%	

All county-level electrification data is sourced from Annex P4, Kenya Health Facility Census 2023 (MoH, Sept 2023).*

Important Notes:
Covers public health facilities only
Percentages reflect availability of any electricity source (grid, solar, generator)
Highest access: Mombasa (100%), Nakuru (98.5%), Kirinyaga (96.1%)
Lowest access: Mandera (48.6%), Wajir (54.2%), West Pokot (66.9%)

*as of June 2025, no newer versions are available.

This mirrors the broader reality of sub-Saharan Africa, where over 70% of the global population that is without electricity resides. Here 15% of all medical facilities still lack any power connection and 45% of health facilities have only partial or inconsistent access (Ireri et al., 2023, WHO, 2023).

In 2021, 88% of the power that was generated came from clean sources: geothermal (41%), hydropower (30%), wind (16%), and solar PV (1%) (Apergi et al., 2024). Despite its surplus in generation capacity, systemic barriers related to transmission and distribution infrastructure, affordability, and last-mile delivery create a gap between supply and demand.

Decentralized renewables, are small-scale renewable energy generation systems that are located near points of consumption. They are featured in solar home and business systems, standalone PV units, and mini-grid setups, often in rural areas that lack access to the national grid. These renewables can be installed quickly and scaled in remote regions, offering power access in areas where extending the national grid is impractical or economically unfeasible. During grid outages, they maintain continuity of services critical for rural healthcare, schools, and small businesses. They make up a small share of the total capacity but are growing rapidly. From 2011 to 2018, Kenya saw significant growth in solar lights and systems (that are also decentralized renewables), from 0.408 MW to 24.523 MW, making it the second-highest in Africa after Tanzania (Apergi et al., 2024).

Independent power producers (IPPs) now contribute to around a third (33.6%) of the effective generation capacity, which is the actual available electricity generation capability that contributes reliably to the grid after factoring in maintenance, downtime, and seasonal variations. This is conducted mainly through thermal and geothermal projects, although there remains a lack of transparency in how public and private generation projects are allocated (Apergi et al., 2024).

Energy access in healthcare facilities and infrastructure gaps

Access to reliable electricity remains a major barrier to healthcare delivery in Kenya, particularly in rural areas where the majority (73%) of the population resides. Despite this concentration of people, rural business electrification rates range from just 5% to 22%, highlighting the broader access challenge even beyond the health sector (Imasiku & Saunyama, 2025).

A study of 695 health centers in Kenya found that 181 of them had no electricity, 104 had electricity but was unreliable, and only 173 (25%) had a steady, uninterrupted power supply. (Imasiku & Saunyama, 2025). Without consistent and reliable electricity, healthcare centers struggle to operate essential equipment, maintain cold chains for vaccines, and deliver safe services after dark, making electrification a critical enabler of health system performance. The scale of the problem is significant, and estimates that electrifying Kenya's healthcare facilities alone would require $235 million ($133 million for private facilities and $102 million for public) (Ireri et al., 2023).

Despite Kenya's substantial progress, raising national electricity access to approximately 75% by 2018 (World Bank, 2018), major gaps remain, especially in rural areas where healthcare delivery depends on reliable power. The Kenya National Electrification Strategy (KNES) which also launched in 2018, aimed to achieve universal access by 2022 but was grounded in a five-year investment plan (2017–2022) that targeted 5.65 million new household connections, which was insufficient given a rural population of 39.2 million (Imasiku & Saunyama, 2025). A follow-on investment plan from 2023 to 2027 allocated only USD 292.2 million for an additional 767,510 connections, bringing the projected total to 6.42 million connections. Even with these efforts, approximately 69.6% of rural households are expected to remain unconnected[2] (Imasiku & Saunyama, 2025).

2 This figure excludes the 14% existing electrification in rural areas

These gaps have direct implications on healthcare delivery, as under-electrified regions are often the same areas where health infrastructure is weakest. Limited grid expansion, outdated distribution systems, and financing constraints continue to hinder reliable power provision to health facilities, making it difficult to scale energy-dependent services and equipment in high-need locations.

Policy review

Existing policy alignment or gaps across health, energy, and finance

Kenya currently has a strong set of policies that support the use of blended finance to expand energy access. The National Energy Policy (2025-2034) and the Kenya National Electrification Strategy (KNES, 2018) lay out a clear roadmap toward universal electricity access, with targeted efforts to reach underserved public services like healthcare through off-grid systems and PPPs. By 2022, the KNES helped raise national electrification levels to 75%, with a significant share of connections in remote counties enabled by solar mini-grids and standalone systems (World Bank, 2023). However, despite this progress, electrification of public health facilities remains inconsistent, especially in areas with weak infrastructure or limited fiscal capacity.

Climate-related frameworks like the Climate Finance Policy and the Climate Change Act (2016) further enable the financing flows for these initiatives. These policies guide how the country mobilizes and manages climate finance from public and private sources, including instruments such as RBF and co-financing arrangements (GOK, 2016). Between 2016 and 2022, Kenya mobilized more than $2 billion in climate finance, primarily from international partners such as the Green Climate Fund, World Bank, and other bilateral donors. While most of these investments have focused on energy access and climate resilience, the health sector remains an under-tapped channel for applying such funds.

National commitments and frameworks

Kenya has made several national-level commitments that support blended finance for off-grid energy access. The KNES emphasizes universal electrification through off-grid systems, a priority for rural healthcare. The Energy Act of 2019 further promotes private sector participation by formally licensing non-state actors in the generation and distribution of electricity, supporting off-grid and mini-grid systems. It also introduces third-party access provisions and competitive procurement frameworks. These changes lower the barriers of entry for private EaaS providers and create the regulatory certainty necessary for investment in decentralized healthcare electrification projects (Republic of Kenya, 2019).

Kenya's climate finance frameworks, including the Climate Change Act (2016) and the Climate Finance Policy, have mobilized over $2 billion in international funding, though few initiatives have directly targeted health facility electrification. The Carbon Market Regulations (2022) and CDM Guidelines have created a regulatory infrastructure for monetizing emissions reductions, laying the groundwork for integrating carbon finance into energy-health projects.

Regulatory frameworks such as the Energy Market Regulations (2024) and Open Grid Codes support these financing strategies by enabling independent power producers to participate in energy delivery. This is particularly important for remote facilities where grid extension is not feasible. Institutions like Kenya Bureau of Standards (KEBS) further reinforce system credibility by establishing and enforcing quality standards for energy infrastructure, including systems used in public buildings like clinics and hospitals. For example, KEBS ensures that solar products, such as panels and batteries, meet the approved safety and performance standards before they can be sold or used in Kenya. Through its Standardization Mark (SM) program, KEBS checks that energy products are reliable and safe for use, especially in public institutions. This protects consumers and guarantees that systems installed in places like rural clinics are durable and effective (KEBS, 2022).

Kenya's flagship blended finance program, the Kenya Off-Grid Solar Access Project (KOSAP), illustrates how technical assistance, concessional capital, and RBF can be used to attract private sector participation in off-grid energy (Ministry of Energy, 2024). KOSAP channels concessional loans through local financial institutions to lower the cost of capital, offers technical assistance to support providers in meeting regulatory and performance standards, and uses results-based financing to disburse subsidies once verified outputs, such as energy connections, are achieved. By the end of 2022, KOSAP had deployed over 380 solar systems to public institutions, including dispensaries and health centers, and delivered clean energy access to more than 400,000 households across 14 underserved counties. The program's ability to crowd in private actors through output-based subsidies makes it a strong candidate for health facility electrification scale-up.

Kenya's evolving carbon finance architecture, from CDM to new voluntary mechanisms, also introduces additional revenue streams for healthcare-linked electrification projects, which can help close financing gaps and improve financial viability. However, there remain gaps in clarity regarding licensing requirements, procurement timelines, and tariff approvals, which may delay or disincentivize private participation in service delivery models like EaaS.

Sub-national frameworks

At the sub-national level, County Climate Change Funds (CCCFs) provide a strong model for delivering results-based funding locally. These funds reward counties for meeting planning, budgeting, and accountability benchmarks, creating incentives for transparent climate spending.

As of 2023, 14 counties had functional CCCFs, with some, like Isiolo and Wajir, allocating part of their funds to solar-powered water systems that serve both communities and public institutions (Agade & Halakhe, 2019).

Between 2017 and 2020, five counties—Makueni, Kitui, Isiolo, Wajir, and Garissa—financed around 94 climate resilience projects through CCCFs with a total investment of approximately KES 267 million (USD 2.5 million). Makeuni County alone invested over KES 843 million (USD 8.2 million) in climate-related projects between FY 2017/18 and 2019/20.

Importantly, this success offers a replicable foundation for integrating healthcare electrification at the county level, particularly when paired with support from a development partner.

Opportunities and challenges

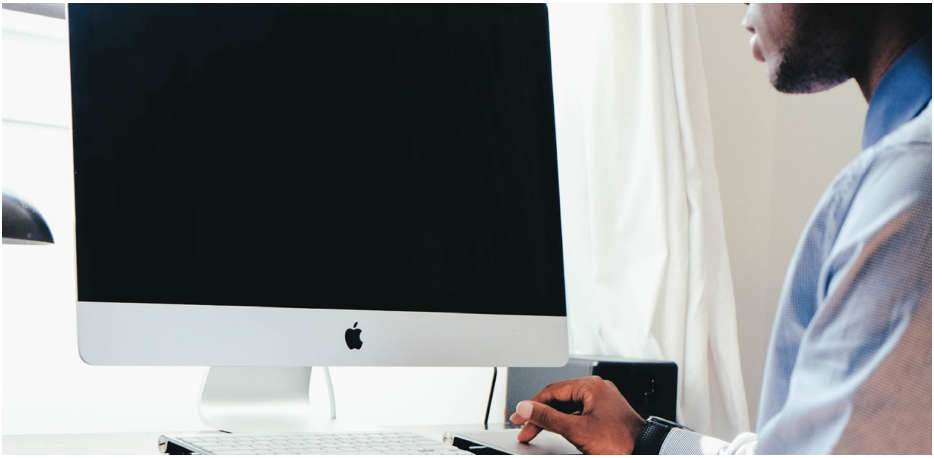
Kenya's policy environment is well-positioned to continue and expand its support in blended finance, but gaps in coordination and implementation continue to hinder the electrification of healthcare facilities. One of the core issues is the lack of alignment across the energy, health, and climate sectors. Although policies like the National Energy Policy and the Climate Finance Policy highlight broad goals, they often fail to explicitly include the health sector, which weakens cross-sectoral planning and funding flows.

Challenges also often arise during implementation, particularly in the licensing and procurement processes. For example, stakeholders involved in KOSAP noted delays in obtaining mini-grid licenses from the Energy and Petroleum Regulatory Authority (EPRA), sometimes exceeding six months, which discourage small-scale private operators from entering the space (Africa Minigrid Developers Association, 2021). Similarly, procurement challenges have arisen in the public sector, where county health departments have faced slow procurement cycles when trying to engage with private solar providers, due to rigid approval systems and limited pre-qualified vendor lists. Additionally, a lack of clarity around tariffs for off-grid services hinders operations for EaaS providers, who rely on predictable revenue flows to maintain operations.

At a national level, practical challenges temper the promise of additional funds from sources such as CCCFs. While a few counties such as Isiolo and Wajir, have demonstrated how CCCFs can be used for solar-powered infrastructure, most counties lack the technical capacity, planning systems, or interdepartmental coordination to deploy these funds effectively for healthcare-linked energy needs. Despite enabling frameworks, health-sector projects rarely access carbon credits due to the high technical requirements for monitoring and reporting. The absence of tailored guidance or support for health-related energy projects in this area means a potentially valuable revenue stream remains largely untapped.

Despite these challenges, there are real opportunities to strengthen Kenya's blended finance landscape. The success of KOSAP shows that output-based incentives and concessional loans can be scaled to include health facilities, especially if tailored technical assistance is provided. CCCFs can evolve to explicitly incorporate healthcare electrification in their performance frameworks, particularly through revised county planning templates. Kenya could also adapt its carbon market systems to lower the barriers to entry for health-linked projects, such as simplified monitoring requirements. Finally, formal collaboration between the Ministry of Health and energy and climate authorities could go a long way in ensuring that healthcare electrification becomes a policy and investment priority under future blended finance models.

Key stakeholders



Energy-as-a-Service (EaaS) providers

EaaS providers are emerging as critical actors in the healthcare electrification ecosystem, particularly where grid extension is unviable. These providers deploy distributed renewable energy systems (typically solar PV with battery storage) under service-based business models in which end users pay for energy usage or performance rather than owning the infrastructure outright. EaaS providers strive to secure stable revenue streams via predictable payments, which often requires aggregation of demand across multiple facilities or partnerships with ministries and NGOs to lower transaction costs and ensure payment reliability.

EaaS providers currently operate or engage with a variety of PPHF delivery models, each suited to different health facility types, financing environments, and contractual arrangements. The Design-Build-Operate-Transfer (BOT) model leverages PPPs in order for private entities to build out projects and then transfer them to public entities. Widely used in public facilities, BOT models avoid the need for de-risking during installation but suffer from weak sustainability if operations and maintenance (O&M) budgets are not institutionalized (SEforALL, 2023). Pay-as-you-go (PAYGO) systems are more common among smaller health facilities, offering gradual ownership of the system through small, regular payments. However, they require effective payment collection mechanisms and credit assessment (Ferrall et al., 2021). A growing number of hybrid models, supported by donors, combine aspects of lease-to-own and third-party subsidization to reduce upfront costs and allow governments to gradually assume ownership (SEforALL, 2023).

These delivery models perform best where strong billing systems, professional management, and supportive regulation are in place. Cost-reflective tariffs, prepayment meters, and access to concessional finance help improve financing attractiveness of both grid and off-grid solutions (World Bank, 2015). Still, providers face persistent challenges: fragmented procurement, unreliable facility budgets, and limited familiarity among local financial institutions (LFIs) with EaaS models. Developers often struggle to recover costs in contexts marked by low facility revenues, short donor funding cycles, and uncertain government payment flows.

EaaS providers are well-positioned to benefit from Results-Based Financing (RBF) and carbon credits resulting from Clean Development Mechanism (CDM) models. Their ability to monitor service delivery, energy uptime, and other related outcomes, such as emissions reductions or improved health services, makes them strong candidates for performance-linked incentives. RBF structures can directly reward providers for verified service delivery, while carbon credits offer a potential, though underused, income stream, limited by verification complexity and market volatility.

To scale effectively, EaaS providers need improved access to working capital, standardized contracting tools, and technical assistance, particularly in monitoring and verification (Thorne & Gerhard, 2021, SEforALL, 2023).

Capacity to deploy at scale is closely tied to visibility of aggregated demand across health systems or geographies. With the right support, EaaS providers can move beyond one-off installations to anchor long-term, service-based models for resilient, decentralized energy in the public sector.

Healthcare facilities and operators

Healthcare facilities are critical to the electrification ecosystem, and are the end users in results-based and performance-linked financing structures. Their primary interest lies in securing reliable and uninterrupted electricity to support essential medical services such as vaccine refrigeration, lighting for night-time procedures, diagnostics, and the use of life-saving equipment. Stable power access also reduces dependency on costly and unreliable diesel generators and allows for more predictable energy budgeting (Ireri et al., 2023; Ani, 2024).

Facilities vary widely in scale and energy demand, with important implications for electrification models. Small rural clinics, or health posts, typically consume just around 5 kWh/day and rely on solar kits for lighting, refrigeration, and basic device charging. These sites generate a limited revenue, are often unelectrified, and rarely serve as viable anchor loads for mini-grids. District health centers, commonly located in peri-urban areas, require around 20 kWh/day to support emergency services and diagnostic equipment. While they offer higher revenue potential, they are often located in grid expansion zones that are under regulatory barriers—land access and proximity to existing infrastructure—which further complicate the investment. Larger urban hospitals demand over 100 kWh/day, with systems typically combining grid power, diesel generators, and solar mini-grids. These sites are the easiest to electrify from a technical perspective, but their uptake is often hindered by high upfront capital requirements and skepticism about solar reliability, particularly during peak usage (SEforALL, 2023).

Despite their critical role, healthcare facilities, especially in low-resource settings, face structural and financial barriers to adopting and sustaining clean energy systems. Many operate with minimal energy budgets and lack the autonomy or operational capacity to enter into long-term Energy-as-a-Service (EaaS) contracts or explore alternative financing. Procurement is often fragmented across facility networks, and the technical capacity to maintain or monitor systems is limited (SEforALL, 2023).

To better engage with financing mechanisms, facilities require stronger budgeting systems, access to standardized contracting tools, and basic energy literacy. Data infrastructure that links energy inputs to service outcomes is particularly important for RBH. Metrics such as energy uptime, cold chain functionality, and service delivery improvements can be tied to disbursements or used as baselines for carbon credit issuance (NRC, 2022; World Bank, 2015). Studies such as the SEforALL Capital Landscape and Ethiopia's Off-Grid Strategy emphasize that healthcare facilities should be treated as active service clients, capable of participating in and benefiting from modern financing models, not passive recipients of infrastructure.

Local financial institutions (LFIs)

Local financial institutions (LFIs) are a critical, yet underutilized, stakeholder in scaling electrification for healthcare delivery. Their participation is essential for expanding access to credit and enabling Energy-as-a-Service (EaaS) providers and healthcare facilities to move beyond donor dependency. LFIs are motivated by opportunities to diversify their lending portfolios as a de-risking mechanism and strengthen their regulatory standing through partnerships with donors and DFIs. When supported by guarantees or concessional credit lines, LFIs can provide essential working capital and project finance to developers and facility operators (Thorne & Gerhard, 2021; SEforALL, 2023).

LFIs often perceive health-related energy projects, particularly in rural or low-income contexts, as high-risk and commercially unattractive. Key barriers towards investment include the facilities' irregular cash flows, limited or non-existent credit histories among borrowers, lack of collateral, and both parties' unfamiliarity with energy access business models such as mini-grids and service-based contracts (NRC, 2022; SEforALL, 2023). Compounding these risks, most energy-health investments involve relatively small ticket sizes and high transaction costs, which further discourage engagement.

Regulatory uncertainty also plays a role. Shifting tariffs, donor-dependent budgets, and limited national guidance on energy-health integration make it difficult for LFIs to confidently underwrite or price risk. These challenges are furthered by the absence of standardized due diligence tools and weak visibility into repayment performance from early pilots or demonstration projects (NRC, 2022). Although LFIs are not typically direct recipients of Results-Based Financing (RBF) or Clean Development Mechanism (CDM) funds, they can serve as critical financing partners. For example, LFIs could pre-finance contracts for EaaS providers with the expectation of reimbursement upon the achievement of verified performance indicators. In such cases, RBF schemes that offer first-loss tranches, credit enhancement tools, or other strong de-risking mechanisms could be particularly useful in unlocking LFI capital (Thorne & Gerhard, 2021; NRC, 2022).

To enable more active engagement, LFIs require targeted technical assistance in energy-health lending, standardized tools to assess risk, and capacity-building around blended finance structures. Integration into national electrification strategies and access to pooled risk-sharing facilities would further increase their willingness to lend.

Donors and government actors

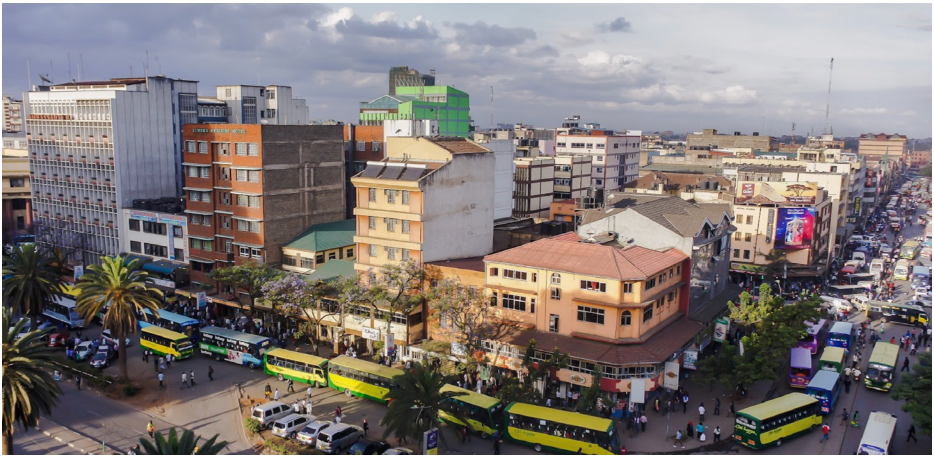
Donors are foundational actors and potential enablers in the healthcare facility electrification landscape. Their engagement is often motivated by overlapping mandates to accelerate universal health coverage, expand energy access, and catalyze private sector investment in underserved regions. Beyond grant-making, donors play a pivotal role in piloting innovative financing structures, such as Results-Based Financing (RBF), Energy-as-a-Service (EaaS) models, and public-private partnerships, and demonstrating pathways to scalability for eventual government adoption or replication. They ensure that rural or low-income healthcare facilities are not excluded from national electrification (SEforALL, 2023; Thorne & Gerhard, 2021).

However, the impact of donor capital is often constrained by several factors. Many donor programs operate on short-term cycles (typically two to three years) which misalign with the multi-decade lifespan of energy infrastructure. The majority of funding still goes toward capital expenditures (CAPEX), with limited attention to long-term operations and maintenance (O&M), service continuity, or sustainability planning. Additionally, a fragmented donor ecosystem can result in overlapping pilots, inconsistent standards, and competition among partners for the same implementation bandwidth, potentially creating inefficiencies and unnecessarily long runways for effective action (NRC, 2022).

Donors are well positioned to lead the design and deployment of performance-based instruments. In RBF schemes, they may fund disbursements linked to measurable outputs, support aggregators and intermediaries who manage fund distribution and performance tracking across regions, and provide de-risking mechanisms such as first loss capital or FOREX hedging to LFIs. While their role in embedding climate co-benefits through CDM or voluntary carbon markets has been limited to date, some programs have begun exploring these opportunities to further enhance project bankability (World Bank, 2015).

To maximize impact, donors must continue investing in ecosystem enablers such as demand aggregation, digital monitoring infrastructure, and technical assistance for both service providers, LFIs, and government partners. Longer-term funding frameworks aligned with infrastructure lifecycles, better coordination across funders, and stronger integration with national energy and health systems will be essential. As primary architects of blended finance structures and RBF mechanisms, donors can help shape a more coherent and durable investment environment for healthcare electrification.

Financial structures for electrification



Types of financial products

Electrifying healthcare facilities—particularly in remote or underserved areas—requires financial products that can address high upfront costs, long payback periods, and investment risks. A variety of financing mechanisms have emerged to meet these needs. Grants and donor capital provide catalytic funding, often covering capital expenditures or early-stage project development. Concessional loans and guarantees offer below-market terms or partial risk protection to crowd in private capital. Pay-As-You-Go (PAYGO) and microfinance models enable end-users to access energy services through small, recurring payments rather than large upfront investments. Finally, Results-Based Financing (RBF) links the disbursement of funds to the achievement of pre-defined outcomes, helping align incentives for performance and accountability. Each of these instruments plays a distinct role in scaling clean energy solutions for the health sector and is explored in more detail below.

Grants and donor capital

Grants remain the dominant form of financing for healthcare facility electrification (HFE) in sub-Saharan Africa, with approximately 95% of capital deployed in seven focus countries provided through donor-funded capital expenditure (CAPEX) grants (SEforALL, 2023). These grants have played a critical role in de-risking early-stage projects, supporting technical assistance, feasibility studies, and pilot deployments, especially in fragile or underserved markets (Thorne & Gerhard, 2021). However, their reliance on short-term humanitarian or donor funding cycles makes them unsustainable for long-term operations and maintenance needs (NRC, 2022).

Donor capital has also been used to structure blended finance vehicles, catalyzing private sector participation through risk-sharing mechanisms like guarantees, first-loss capital, and technical assistance funds. For example, pilot initiatives by the Health Finance Coalition combined grant capital with private investment both at the enterprise level (supporting PPHF providers directly) and at the fund level through pooled structures (Health Finance Coalition, 2021). While these models did not directly finance energy systems, they reinforced the critical enabling role of electricity in delivering services, particularly for cold chains, lighting, and diagnostic equipment. Despite their potential, these efforts remain limited in scale and have yet to be widely replicated or mainstreamed in national energy-health strategies.

Grants have also underpinned off-grid electrification in displacement and humanitarian settings, but the lack of alignment between short-term budget cycles and the multi-year nature of energy infrastructure projects continues to undermine sustainability (NRC, 2022). As such, stakeholders increasingly emphasize the need to transition from grant-dependent approaches toward blended financing structures that leverage concessional capital and performance-based incentives to unlock more durable investment. Nonetheless, where grant funding is structured to mitigate early-stage risks and bundled with technical and operational support, it remains a powerful tool for mobilizing capital into healthcare electrification.

Concessional loans and guarantees

Concessional loans are a key financial tool for reducing the cost of capital in healthcare electrification projects, especially when used alongside commercial financing in blended structures. By offering below-market interest rates, extended runways, or subordinate repayment terms, these loans help make projects more bankable and attractive to private investors. They are often integrated into capital stack designs for BOT or Design-Build-Own-Operate-Transfer (DBOT) models, where a mix of concessional finance from DFIs and private equity is used to fund infrastructure development (SEforALL, 2023). These blended structures lower the required return thresholds and can enable participation from senior secured lenders who might otherwise find the projects too risky.

Recent analyses of health facility electrification investments have emphasized the value of concessional loans not only for project developers but also through specialized vehicles such as working capital facilities and debt finance for original equipment manufacturers. These instruments help address liquidity constraints and scale energy service delivery in perceivably risky or resource-constrained contexts (SEforALL, 2023). Although no major limitations were noted in terms of concessional loan performance, access remains an implied constraint, particularly in low-capacity or vulnerable contexts where borrowing restrictions or institutional requirements can limit uptake. Nonetheless, concessional finance remains a critical lever for unlocking commercial capital and structuring long-term, sustainable energy investments in the health sector.

Pay-As-You-Go (PAYGO) and microfinance models

PAYGO models have become a dominant financing mechanism used by Energy-as-a-Service (EaaS) providers, especially in off-grid contexts. These systems allow end-users, typically households or small facilities, to make small, incremental payments for energy services, often bundled with solar home systems. Rather than requiring large upfront capital, PAYGO functions like a microloan, enabling affordability through daily or weekly payments (Ferrall et al., 2021). Creditworthiness is generally assessed through behavioral proxies such as mobile phone usage or payment patterns, and no formal credit history is required. While this increases accessibility, it also introduces risks: repayment terms are often opaque, and users can lose access to electricity if payments lapse.

Many PAYGO initiatives operate within public–private partnerships or hybrid institutional arrangements, including concession agreements or models that separate distribution, generation, and transmission. These structures offer flexibility in navigating regulatory environments and can combine the efficiencies of private delivery with public oversight. However, this model faces growing constraints. Market saturation, high system costs, and regulatory complexity have slowed growth, particularly in mini-grid deployments. High-profile failures, such as the bankruptcy of Mobisol, underscore the challenges in sustaining PAYGO at scale (Farquhar & Rai, 2021). De-risking mechanisms remain essential to reduce capital costs and attract investment. Despite these challenges, PAYGO remains a critical option for extending access, particularly in underserved settings where traditional finance mechanisms are not viable.

Results-based financing (RBF)

Results-based financing (RBF) is increasingly recognized as a catalytic mechanism for advancing healthcare facility electrification, particularly in fragile or low-revenue environments where traditional repayment models may be unfeasible. By linking disbursements to the achievement of specific, verifiable results, such as the number of energy connections completed or sustained operational uptime, RBF ensures that public and donor funding is only released upon delivery. This output-oriented approach has the advantage of aligning incentives across funders, implementers, and service providers, while also mitigating investment risks by shifting the focus from inputs to outcomes (Thorne & Gerhard, 2021).

One commonly used form of RBF is Output-Based Aid (OBA), which pays implementers upon the delivery of measurable outputs, such as new energy connections to underserved facilities. In humanitarian and displacement settings, these mechanisms have played a role in addressing affordability barriers, improving access, and building confidence among service providers and funders (NRC, 2022). While RBF mechanisms are not yet widely deployed for health facility electrification, there is growing evidence of their relevance. For instance, projects that have embedded RBF into their financial architecture often experience improved service quality and greater alignment between capital flow and developmental outcomes.

Carbon finance shares several features with RBF, as it involves performance-linked payments made upon the verified reduction of emissions. Though it is not structured as an RBF mechanism, carbon finance contributes a supplementary revenue stream that can enhance project viability when integrated into blended finance structures. However, its current application remains limited due to market volatility, complex monitoring & reporting procedures, and uncertain pricing (Thorne & Gerhard, 2021; World Bank, 2015).

The successful deployment of RBF mechanisms depends on several enabling factors. These include a shared commitment among stakeholders to deliver impact, the technical and operational capacity of recipients to implement and manage energy systems, and funders' ability to offer predictable and flexible financial support. Access to upfront capital remains essential, as payments are typically made only after results are achieved; bridging this gap often requires equity or concessional finance. RBF models are most effective when results are clearly measurable (e.g., number of verified units distributed, delivery of health benefits attributable to electrification) and when there is predictability in both the outcomes and associated costs (World Bank, 2015).

For community-level energy systems, enablers include the presence of a consistent base load demand, affordable and reliable energy sources (such as solar, possibly in hybrid configurations), and functional billing and collection mechanisms. These are often supported by tools like PAYGO meters. Business acumen among implementing agencies, cost-reflective tariffs, smart subsidies, and regulatory frameworks that streamline licensing and grid access also support RBF effectiveness. Equally important is the availability of financing for scale, including concessional lending to complement RBF structures.

Despite the relatively limited application of RBF to healthcare electrification thus far, its capacity to incentivize delivery, attract private sector participation, and reinforce complementary tools like carbon finance underscores its potential as a cornerstone of future blended finance strategies.

Other financial mechanisms

Beyond core financing products, several additional instruments and support structures play a critical role in enabling electrification investments. Local currency credit lines reduce foreign exchange risk and enable domestic lenders to participate in mini-grid financing, a key requirement for LFI engagement (Thorne & Gerhard, 2021). Minimum subsidy tenders offer a transparent, competitive method for allocating capital support to private developers, ensuring cost efficiency in mini-grid procurement. In parallel, technical assistance (TA) is frequently cited as a foundational input for success, supporting project preparation, capacity-building, and pre-investment structuring to improve bankability and scale.

Finally, while equity financing is less frequently applied in health facility electrification projects, it is noted as a complementary instrument for mobilizing private investment, especially when used alongside concessional finance and de-risking tools to build robust blended structures (NRC, 2022). Together, these mechanisms and support structures help address systemic barriers to scaling distributed renewable energy in the healthcare sector.

Financial Product Alignment Per Stakeholder

Stakeholder	Best-Suited Instruments
Donors	Grants, RBF subsidies, first-loss guarantees
LFIs	Concessional loans, credit lines, guarantees
EaaS Providers	RBF, working capital, PAYGO bundles
Health Facilities	Lease-to-own, PAYGO, microfinance

Credit terms and risk sharing

Credit terms play a critical role in determining the bankability and scalability of healthcare electrification projects, particularly in remote or high-risk settings. In blended finance structures, concessional capital is often used to offer affordable, long-tenure loans through institutions such as DFIs. While specific repayment schedules are not always detailed, effective designs emphasize payment flexibility during construction and commissioning, as well as risk-mitigated lending backed by donor facilities (Thorne & Gerhard, 2021; SEforALL, 2023).

Credit terms, when combined with risk-sharing tools mentioned in detail below, not only lower the cost of capital but also provide the financial flexibility and assurance needed to engage the private sector in energy access projects. Especially those targeting under-resourced healthcare systems. Ensuring that these terms are well structured and aligned with project lifecycles is essential to improving uptake and long-term sustainability.

De-risking mechanisms

De-risking mechanisms are essential to attracting private sector participation in health facility electrification projects, particularly given the long payback periods, low perceived profitability, and operational uncertainties associated with many public-sector energy users. According to the Health Facility Electrification Capital Landscape report, the most preferred de-risking instruments (ranked by stakeholders) are guarantees (to limit developer exposure), performance-linked grants, and concessional debt (SEforALL, 2023). These tools help mitigate different types of risk, from credit and foreign exchange volatility to uncertain energy demand and insufficient O&M budgets.

For de-risking to be effective, certain preconditions must be addressed. On the public side, there must be clear mechanisms to fund ongoing O&M, particularly when BOT or EaaS models are used. Without these, even well-funded capital investments may become unsustainable over time. On the private side, demand aggregation is critical to reduce transaction costs and shorten sales cycles, particularly when developers must negotiate with numerous small facilities or counties individually (SEforALL, 2023).

The following subsections explore key de-risking tools, including first-loss capital, guarantees, forex hedging instruments, technical assistance, and portfolio-based bundling.

First-loss capital

First-loss capital is a foundational de-risking tool used to absorb initial losses in blended finance structures, thereby improving the risk-return profile for senior investors and unlocking private capital. This mechanism works by establishing a cash reserve or concessional tranche that takes the first financial hit in case of project underperformance or borrower default, effectively shielding LFIs and commercial lenders from downside risk (Thorne & Gerhard, 2021; FaithInvest, 2023; Mission Investors Exchange, 2013). In fragile or low-income contexts, first-loss capital can play a pivotal role in attracting investors who would otherwise avoid such markets.

While widely recommended, the use of first-loss capital in healthcare electrification settings remains largely conceptual, with limited documented success in the available literature. For example, a review of blended finance solutions in humanitarian and displacement settings noted the tool's theoretical potential but found no case studies demonstrating effectiveness in practice, particularly for energy access projects serving social infrastructure such as health facilities (NRC, 2022). Despite this, first-loss capital continues to be viewed as a promising mechanism, especially when combined with guarantees, technical assistance, and other de-risking layers to build investor confidence.

Guarantees

Guarantees are a widely used de-risking instrument that help mitigate a range of risks, including credit risk, political or regulatory uncertainty, and grid encroachment, thereby enabling commercial capital to more easily flow into historically risky markets. In the context of healthcare facility electrification, guarantees can offer partial risk coverage for developers, particularly when they take on debt to finance infrastructure. For example, if a health facility fails to meet payment obligations, a guarantee can absorb part of the loss, reducing the financial exposure of the developer and making lenders more willing to underwrite such projects (SEforALL, 2023).

While guarantees require strong institutional backing, often from multilateral donors or DFIs, they are considered one of the most preferred and effective de-risking mechanisms, especially when layered with concessional finance or first-loss capital to further protect investors and developers from downside risk (SEforALL, 2023; NRC, 2022; Thorne & Gerhard, 2021).

Forex hedging

Foreign exchange (FOREX) risk is a significant barrier to scaling healthcare facility electrification in sub-Saharan Africa, where many clean energy investments rely on foreign-denominated capital but generate revenues in local currency. In such contexts, currency depreciation or volatility can erode returns and expose developers and lenders to substantial financial loss. Forex risk hedging tools are therefore essential to stabilize funding streams, protect project cash flows, and ensure financial predictability over multi-year contract periods (Thorne & Gerhard, 2021).

These tools can take various forms, including currency swaps, forward contracts, and guarantee-backed hedging instruments provided by multilateral agencies. When deployed effectively, forex hedging can help unlock access to international capital and reduce the need for prohibitively high interest rates that might otherwise be required to offset currency risk. However, access to affordable hedging instruments remains limited in many African markets, and their successful use often depends on the availability of local currency credit lines, supportive regulation, and technical assistance to structure appropriate risk-sharing arrangements.

Technical assistance

Technical Assistance (TA) is a critical de-risking mechanism that supports early-stage project development, strengthens local capacity, and enhances the overall bankability of healthcare electrification initiatives. Often funded by donors, TA can take the form of feasibility studies, legal and regulatory support, financial modeling, or training for implementers and local institutions. These interventions help ensure that energy projects are well-designed, context-appropriate, and aligned with funder requirements, thereby reducing the likelihood of delays, cost overruns, or technical failure (NRC, 2022).

Donor-funded TA also plays a key role in subsidizing unviable rural sites that may not attract commercial interest due to high costs and low revenue potential. By covering pre-investment costs or providing targeted support to local governments and developers, TA helps attract private capital to underserved areas that would otherwise be excluded from energy infrastructure investment (Thorne & Gerhard, 2021). When bundled with financial instruments such as grants, concessional loans, or guarantees, technical assistance serves as a foundational layer of support that can significantly enhance project outcomes and long-term sustainability.

Portfolio-based bundling

Portfolio-based project bundling is an emerging strategy for reducing transaction costs and improving the financial viability of small-scale electrification projects, such as those targeting individual healthcare facilities. Instead of approaching projects on a one-off basis, bundling aggregates multiple facilities, sites, or geographies into a single investment portfolio, enabling economies of scale in procurement, financing, and monitoring. This structure can make otherwise unviable rural projects more attractive to investors by spreading risk, creating more predictable cash flows, and lowering the cost per connection through shared operational and financing structures (Thorne & Gerhard, 2021).

In contexts where demand fragmentation and lengthy sales cycles are barriers to private sector participation, bundling offers a practical solution, particularly when combined with other de-risking instruments such as guarantees, concessional loans, and technical assistance. While not yet widely implemented in the healthcare electrification space, portfolio-based approaches hold strong potential for replication and scale when supported by clear governance structures and performance-linked financing.

Enabling factors and barriers

Enablers of success

A combination of policy alignment, financing innovation, and local engagement is driving progress in healthcare electrification. Together, these enablers highlight a viable path to resilient and sustainable energy for healthcare delivery.

Policy and regulatory alignment

A strong policy and regulatory environment lays the groundwork for scaling energy access in healthcare. Kenya, for example, has implemented feed-in tariffs, open access grid codes, and tax incentives that improve the commercial viability of renewable energy projects (Ikwuoma et al., 2024). Additionally, ministries of health and energy in several countries have aligned around electrification as a national development priority, enabling coordination across sectors and reducing regulatory uncertainty for private actors.

Government participation as an energy payer or operator also serves as an enabler. In some models, ministries commit to covering power costs for public facilities, creating payment certainty for developers while allowing healthcare operators to focus on service delivery (Olatomiwa et al., 2022). For rural facilities with limited ability to pay, leasing models subsidized by the government have been used to limit upfront costs.

Policy alignment also enhances the case for clean energy through clear economic and environmental justification. For instance, a recent study in Nigeria found that a solar PV-powered system had a total net present cost of €21,478 compared to €85,528 for a diesel alternative, strengthening the argument for solar transition in budget-constrained public sectors (Ani, 2024).

Awareness campaigns and community engagement have further proven essential for long-term sustainability. Engaging local communities not only builds trust but reduces system vandalism or theft, while training local technical personnel supports long-term maintenance (Olatomiwa et al., 2022).

Public-private partnerships

PPP models are central to scaling healthcare electrification. These models often pair smart grants with market-based remuneration structures, allowing both public and private actors to share risk and returns. In Nigeria, PPPs under the Nigeria Electrification Project (NEP) have accelerated rural deployment by blending donor and private capital through performance-based agreements (SEforALL, 2023).

Cross-sector collaboration between health and energy ministries has also played an important role, particularly during the health facility mapping and needs assessment phase (Paim et al., 2022). However, despite these advances, private sector participation remains limited. Barriers include poor profitability of healthcare facilities, revenue uncertainty, and high operational costs, especially when a single healthcare facility serves as the only off-taker (SEforALL, 2023).

Local ownership and capacity building

Investments in local capacity, operations, and ownership structures are crucial enablers of sustainability. For example, some projects created Energy Management Teams composed of trained health workers, who manage energy systems internally, enhancing accountability and reducing reliance on external technicians (Ani, 2024). Local manufacturing and sourcing of components, like Nigeria's NASENI, also reduce downtime and boost local supply chains.

University teaching hospitals and other anchor institutions have been identified as valuable partners in local electrification schemes. These actors benefit indirectly from a healthier population and can play a role in risk-sharing for operational costs through reserve funds (SEforALL, 2023).

Other enablers include broadening the consumer mix to include productive use clients or SMEs, strengthening business cases for energy service providers, and integrating local NGOs to support implementation and trust-building (NRC, 2022).

Effective monitoring and evaluation

Effective monitoring and evaluation (M&E) frameworks are essential for tracking performance, identifying issues, and building the case for scale. M&E tools can monitor system uptime, energy use, and link performance to healthcare outcomes like immunization capacity or night-time procedures (Ani, 2024). This proves especially valuable for RBF and OBA models.

Digital monitoring using smart meters and control devices enables remote troubleshooting and supports maintenance, while also generating credible performance data for funders and regulators (Olatomiwa et al., 2022). These innovations are particularly valuable in remote locations where onsite support is limited.

Other enablers

Declining costs in solar PV and battery storage have made off-grid systems significantly more viable. PAYGO systems, despite recent market slowdowns, helped pave the way for distributed models that lower upfront costs (Olatomiwa et al., 2022).

Financial innovations like minimum subsidy tenders, RBF mechanisms, and local currency credit lines offer developers predictability and improved economics. Long-term Power Purchase Agreements (PPAs), especially when structured as part of project finance, provide bankability by locking in revenues over 10–25 years (Baucia, 2018).

Common barriers

High upfront capital costs

The high capital expenditure (CAPEX) required for renewable energy systems, particularly solar PV and battery storage, continues to be one of the most cited barriers to electrifying healthcare facilities in sub-Saharan Africa. Even where long-term savings are expected, the initial investment remains prohibitive. For example, the total initial cost of a solar PV system for a health facility in Karshi, Nigeria was €19,379, a figure that severely limits replicability in the absence of grants or blended finance mechanisms to share risk (Ani, 2024).

Component costs such as batteries, which can require replacement every 3–5 years, further inflate the total lifecycle cost of solar systems. By contrast, cheaper but less sustainable alternatives like diesel generators remain attractive due to lower upfront costs, despite higher long-term expenses and environmental drawbacks (Olatomiwa et al., 2022). In many rural areas, energy costs can be up to 8–10 times higher than in urban regions, exacerbating affordability constraints (Ferrall et al., 2021).

Beyond system costs, infrastructure-related expenses, such as grid extension at $10,000/km plus material costs, also deter electrification of remote health facilities (Baucia, 2018). In areas with low population density and uncertain demand, these costs are rarely justifiable to private investors or public budgets (Thorne & Gerhard, 2021).

Fragmented governance and limited coordination

Weak institutional coordination, overlapping responsibilities, and inconsistent policy implementation are major roadblocks to scaling healthcare electrification. Kenya's 2018 five-year electrification plan, for example, made good strides but ultimately failed to meet its rural connectivity targets, as stated at the beginning of this report (Imasiku & Saunyama, 2025).

In many countries, energy access efforts skew toward urban and economically stronger regions, leaving rural health facilities underserved. In Tanzania, only 2% of energy access funding between 2009–2017 was allocated to off-grid solutions, despite being the least-cost option for nearly 90% of the rural population (Ferrall et al., 2021).

Institutional and administrative challenges, such as unclear mandates, limited staff capacity, and opaque permitting, further slow project delivery (Ikwuoma et al., 2024). Inadequate demand data and fragmented donor coordination often result in underperforming or misaligned projects (NRC, 2022).

Limited LFI engagement

Despite the critical role of local financial institutions (LFIs) in scaling decentralized energy, their participation in healthcare electrification remains minimal. LFIs often perceive renewable energy investments, especially in rural or humanitarian settings, as too risky due to limited repayment capacity, unclear revenue flows, and unfamiliar business models (SEforALL, 2023).

Local governments also lack adequate budgetary allocations to co-finance infrastructure or cover recurring operational expenses such as diesel fuel (Ani, 2024). In Nigeria, access to affordable credit remains constrained by high interest rates and limited public incentives, limiting the capacity of health systems to take on energy upgrades (Ikwuoma et al., 2024).

Short-term funding cycles

Sustainable electrification requires long-term planning and ongoing operations and maintenance (O&M) support, which is often incompatible with the short-term nature of most donor or humanitarian funding. Inflexible financing windows, typically one to three years, fail to align with the needs of infrastructure projects that require sustained investment over decades (NRC, 2022).

Routine maintenance budgets are either insufficient or entirely lacking, threatening the long-term functionality of installed systems (SEforALL, 2023; Olatomiwa et al., 2022).

Market uncertainty and investor risk perceptions

Healthcare facility electrification is often seen as a high-risk, low-return investment. In many cases, project feasibility is tied to continued donor support, which is inherently uncertain and difficult to scale (Ani, 2024). Private investors are hesitant to enter a market dominated by grant funding, especially when public facilities are underfunded and revenue models are unclear (Health Finance Coalition, 2021).

The lack of de-risking instruments, such as guarantees or results-based financing, further limits investor confidence (SEforALL, 2023). Many energy service providers face high transaction costs and uncertain returns when working with small, fragmented healthcare providers that may not be investment-ready (Ferrall et al., 2021).

Lessons learned from case studies

The most effective healthcare electrification efforts combine sound financial models with operational innovations that enhance sustainability. Successful projects often deploy blended finance approaches; including grants, concessional debt, and results-based financing, to de-risk private capital and improve project bankability. These financial structures are strengthened by on-the-ground innovations such as lease-to-own models, embedded monitoring systems, and the formation of local energy management teams. When paired with supportive policies and technical assistance, these strategies reduce upfront cost barriers, improve system reliability, and enable broader replication. Together, they demonstrate a growing convergence between finance and delivery, highlighting pathways for scaling electrification in healthcare settings across sub-Saharan Africa.

Successful models

Multiple financial structures have emerged to support healthcare facility electrification across sub-Saharan Africa, each offering different pathways to overcome the high capital costs and operational sustainability challenges of clean energy deployment. A common thread among successful models is the integration of grant funding to de-risk early-stage investment, often blended with private capital to enable scalability.

Lease-to-Own solar model
Top care nursing home, Kenya

During a nationwide blackout in Kenya, Top Care Nursing Home remained fully operational thanks to its on-site solar PV and battery system. The facility used an innovative lease-to-own model, where the healthcare provider made a 10% down payment and gradually repaid the remainder over 5–7 years through energy bills. This model has proven effective for financing installations without requiring large upfront investments from facilities (World Resources Institute, 2023).

Grant-based electrification with local capacity building
Karshi PHC, Nigeria

The proposed solar electrification of Karshi Primary Healthcare Centre in Abuja provides a clear example of a grant-based financing model designed to replace unreliable and costly diesel generators. The project prioritizes full donor or institutional funding and includes provisions for local equipment manufacturing (NASENI) and staff training via an energy management team to enhance sustainability. Although not yet implemented, HOMER[3] modeling suggests the PV system's net present cost (€21,478) is significantly lower than the diesel alternative (€85,528), strengthening the economic rationale (Ani, 2024).

3 HOMER (Hybrid Optimization of Multiple Electric Renewables) is an optimisation tool developed by the National Renewable Energy Laboratory (NREL) for modelling mini grids

Ethiopia's off-grid funding strategy
Multilayered financing

Ethiopia's strategy includes RBF, minimum subsidy tenders, concessional loans, and local currency financing, designed to attract private developers while keeping tariffs affordable. The approach includes donor-backed guarantees, first-loss capital, and policy alignment to reduce investor risk. Though not yet fully scaled, this layered financing structure is cited as a model for replication in other low-access markets (SouthSouthNorth, 2021).

Hybrid capital stack
Mini-grid, Nigeria

In Mokoloki, a planned solar-diesel hybrid mini-grid demonstrated the financial feasibility of renewable-heavy systems when paired with upfront grants. The model uses grant capital (e.g., via the Interconnected Mini-grid Acceleration Scheme) to lower upfront costs and achieve commercial viability under a regulated tariff regime. Sensitivity analysis showed that timing of grant disbursement critically affects project viability, with early-stage support significantly improving net present value (NPV) and internal rate of return (IRR) (Osele et al., 2024).

Double-blended finance model
Uganda

The Health Finance Coalition tested a "double blended finance" model in Uganda, combining grant capital and private investment at both the project and investment levels. Though not directly tied to energy systems, the model successfully catalyzed investment in PPHF service delivery, offering a framework applicable to electrification initiatives. The design used donor capital as a de-risking mechanism, enabling private investment in high-impact service delivery through PHC facilities (Health Finance Coalition, 2021).

Replicable practices and innovations

A number of replicable innovations emerge across health facility electrification efforts in sub-Saharan Africa, such as flexible financing models, systems linking energy access with health outcomes, and blended finance approaches that combine donor and private capital. Initiatives highlight the importance of local ownership, training, and the use of locally manufactured components to improve system sustainability. These practices offer scalable blueprints for advancing resilient, cost-effective energy solutions in the healthcare sector.

Local ownership and monitoring
Karshi PHC, Nigeria

The Karshi project emphasizes creating a trained Energy Management Team from among existing health workers, embedding capacity within the facility to manage and maintain the solar system. It also proposes a dedicated M&E framework to track energy use, system performance, and its correlation with healthcare outcomes, reinforcing accountability and building evidence for scale (Ani, 2024).

Targeting and demand mapping
Makueni County, Kenya

In Makueni, WRI and Strathmore University used geospatial data and health system mapping to prioritize electrification of facilities like Makueni County Referral Hospital. This approach identified high-need locations and guided solar investment decisions, leading to savings of 7 million KSH/year and energy resilience covering 30–33% of facility demand (Ireri et al., 2024, Ireri et al., 2024).

Concession-based and hybrid public-Private partnerships
Tanzania

In Tanzania, the delivery of solar home systems has predominantly occurred through public-private partnerships, which represent 75% of all identified delivery models. These mixed approaches, involving both public and private actors, have been instrumental in expanding off-grid energy access. However, challenges remain, including limited institutional support and the need for greater inclusion of local companies in donor frameworks (Ferrall et al., 2021).

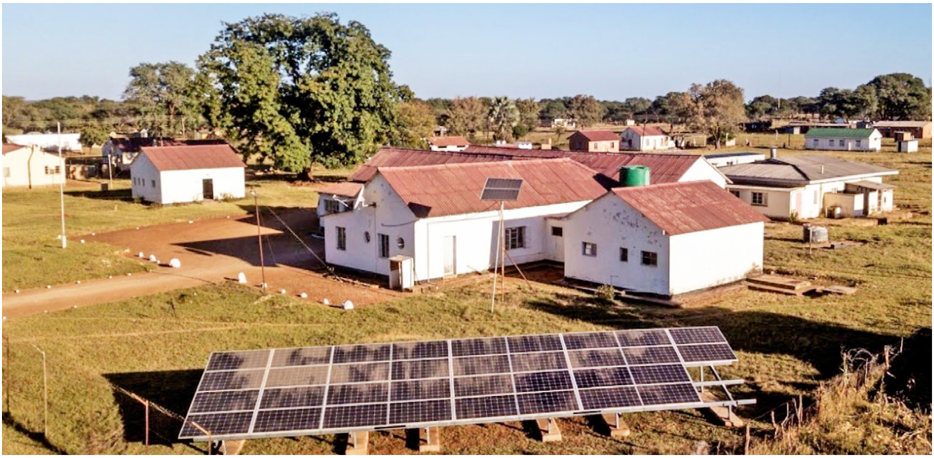
Dual revenue anchoring
Nigeria

In several Nigerian models, PPHFs are co-located with productive users (e.g., teaching hospitals or local businesses) to anchor revenue streams. This helps distribute operational costs and increases system sustainability, particularly where PPHF revenue alone is insufficient. Risk allocation frameworks suggest combining public subsidies with donor support and partial user fees to balance financial viability and equity (Paim et al., 2022).

Integrated energy planning with health prioritization
Kenya & Nigeria

Geospatial and health system data were used in Makueni County, Kenya, to guide solar investment at facilities like the Makueni County Referral Hospital, resulting in significant annual savings and improved energy resilience (Ireri et al., 2024). Similar planning tools, such as HOMER modeling, have been applied in Nigeria to assess the feasibility and cost-effectiveness of hybrid mini-grids in healthcare settings (Osele et al., 2024). Together, these examples highlight the value of integrated energy-health planning for optimizing investment decisions.

Conclusion



Key takeaways

Reliable energy access is foundational to delivering essential health services, supporting everything from vaccine refrigeration to emergency care. Yet in many parts of Kenya, electrification remains limited or unreliable, undermining both health outcomes and system resilience.

Scalable solutions exist but require more than hardware or upfront capital. Financing models like EaaS, RBF, and blended capital structures have demonstrated promise in improving affordability, sustainability, and performance. However, their success depends on stronger institutional support, demand aggregation, and alignment with facility needs.

Strengthening coordination between the health, energy, and finance sectors is essential to align planning, funding, and implementation. LFIs must be more deeply engaged through technical assistance, risk-sharing instruments, and visibility into aggregated demand. Financing models should also be matched to the diverse needs and capacities of healthcare facilities, ranging from low-revenue rural clinics to urban hospitals with higher ability to pay and sustain services.

Enabling the shift

To move from fragmented projects to scalable energy-health solutions, stakeholders must embed monitoring and evaluation, ensure policy alignment, and commit to long-term operational funding. Healthcare facilities should be treated as active clients in service delivery, capable of participating in performance-linked financing and energy management, not simply as recipients of infrastructure. With the right ecosystem in place, electrification can become a cornerstone of both resilient healthcare and inclusive energy access.

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Busara Groundwork
LITERATURE REVIEW

About Busara

Busara is a research and advisory organization, working with researchers and organizations to advance and apply behavioral science in pursuit of poverty alleviation. Busara pursues a future where global human development activities respond to people's lived experience; value knowledge generated in the context it is applied; and promote culturally appropriate and inclusive practices. To accomplish this, we practice and promote behavioral science in ways that center and value the perspectives of respondents; expand the practice of research where it is applied; and build networks, processes, and tools that increase the competence of practitioners and researchers.

About Busara Groundwork

Busara Groundwork lays the groundwork for future research and program design. As think pieces, they examine the current state of knowledge and what is needed to advance it, frame important issues with a behavioral perspective, or put forward background information on a specific context.

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