OCTOBER 2023

Health Facility Electrification Capital Landscape

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In analysing the need for a financial de-risking mechanism in HFE, we took a systematic approach to assessing demand, current supply and capital provided to HFE

Demand for energy

How can we stratify demand in target countries, and understand ability and willingness to pay for electrification?

Supply of energy

What financial barriers are constraining developers and what financial de-risking mechanisms have been used to attempt to overcome them?

Financing for suppliers

Who is providing capital to developers active in HFE, what kind of capital is being provided, and how could more be catalysed?

Taken together, this provides a view of:

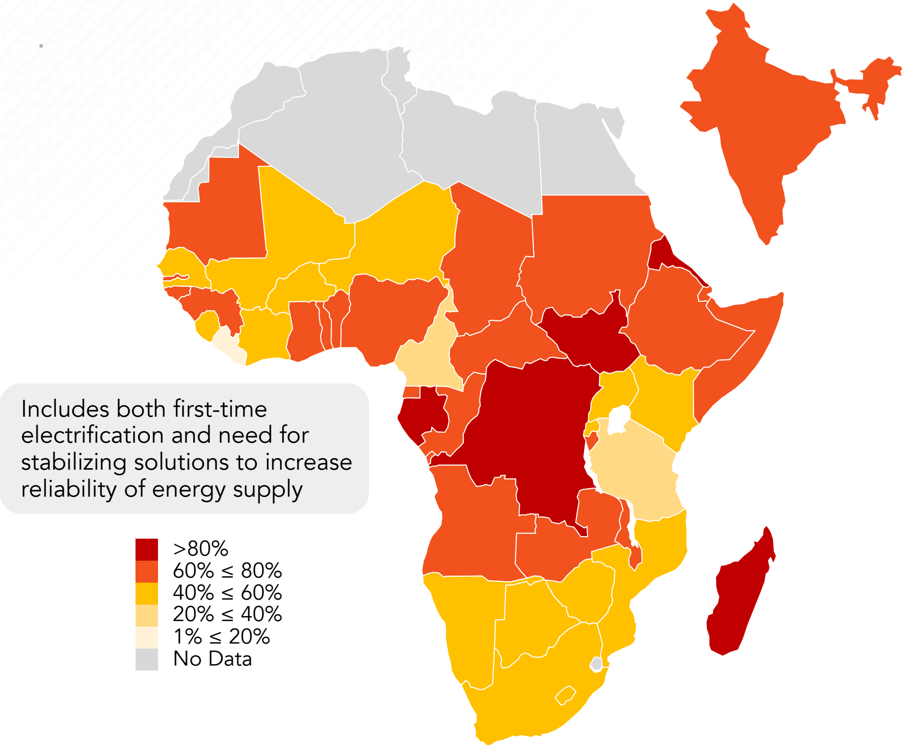
Demand for electrification, and who the ultimate payors are or could be for the energy generated

Who does or potentially could supply this energy, and what financial de-risking tools they need to unlock more activity

Who does or could provide the capital to do so, and where gaps exist relative to what the supply side have asked for

Across sub-Saharan Africa and India need for HFE is significant – without intervention, facilities will not be able to deliver quality healthcare to best-practice standards

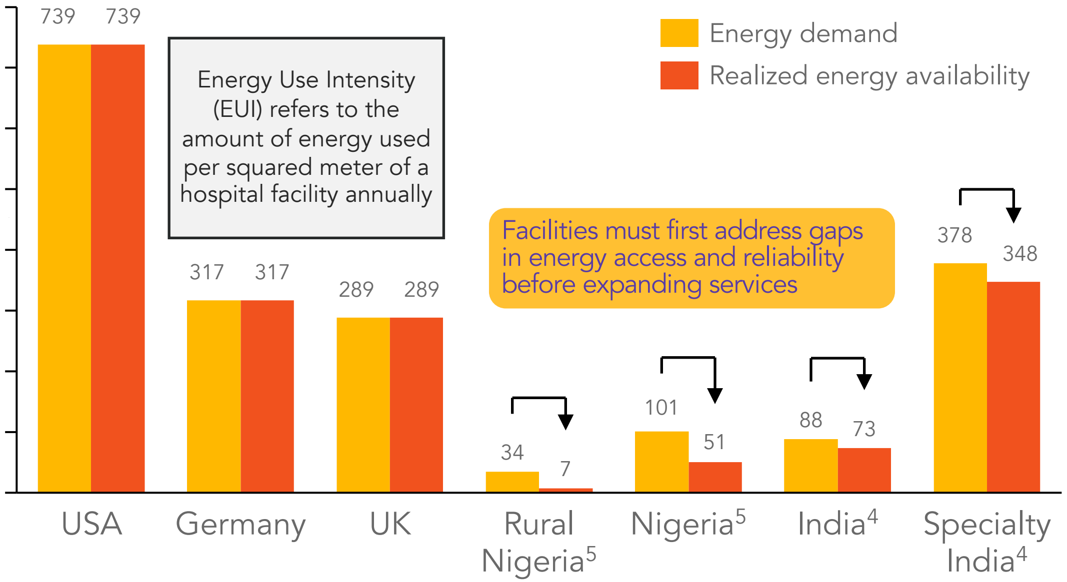
Percentage of healthcare facilities requiring energy interventions[1]



Health facility energy deficits mean…

70%	50%	25-50%
of medical equipment fails[6]	of vaccine supplies are lost[6]	additional travel time to energy-functional facility[7,8]

Hospital facility energy use intensity (EUI) (kWh/m²)[1]



(1) Energizing Health: Accelerating Electricity Access in Healthcare Facilities, WHO, 2023; (2) Monitoring Electricity Reliability at Kenyan Healthcare Facilities, PEDL, Aug 2022; (3) Powering Social Infrastructure in Sierra Leone, SEforALL, 2023; (4) Caring for the Energy Health of Healthcare Facilities, Berkeley National Laboratory, 2016; (5) Energy Performance of Hospital Buildings in Nigeria, University of Nigeria, 2013; (6) Energy Access Outlook: From Poverty to Prosperity, IEA, 2017; (7) People across Africa have to travel far to get to a hospital, The Conversation, 2018; (8) Achieving universal electrification of rural healthcare facilities in sub-Saharan Africa with decentralized renewable energy technologies, Joule, 2021

To better understand electrification demand, we stratified health facilities into three categories, with increasing energy requirements at each level

	Tier 1	Tier 2	Tier 3
HF type	Health post; Primary health clinic	District health centre	Hospital
Setting	Rural or remote areas	Peri-urban areas	Urban areas
Typical services	Basic sub-acute care, antenatal/postnatal care, low-risk pregnancy delivery	Basic emergency services, and local referral services, including some labs	Emergency, and outpatient care in specialties, inpatient care, and labs
Energy demand	~5 kWh/day	~20 kWh/day	~100 kWh/day
Electricity supply tech	Solar kits, or small solar standalone system	Medium-to-large solar standalone system, mini-grid, hybrid system[1]	Large solar mini grid, central grid, fuel generator, hybrid systems
Electricity usage examples	General lighting, small refrigerator, device charging	Procedure lighting, oxygen concentrator, ultrasound, heart rate monitors	Diagnostics machines, operating theatre equipment, monitoring equipment
Typical revenue per month[2]	\$100 – \$200	\$1,500 – \$5,000	\$10,000 – \$15,000

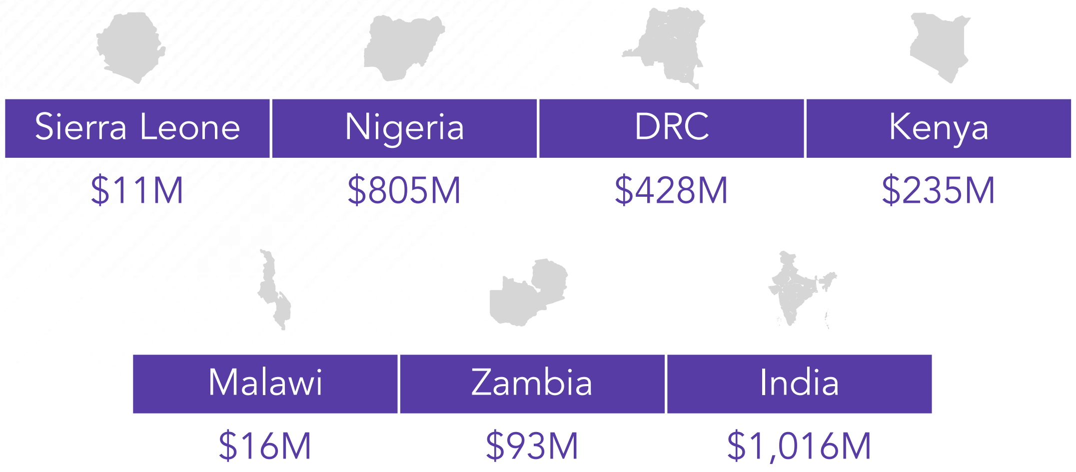
Unique challenges exist at each level

- **Tier 1** - More likely to be **un-electrified and difficult to service** due to distance from cities; have lower healthcare service capacity and serve the poorest patients
- **Tier 2** - Tend to be easier to service, but **fall within grid expansion zones,** which **complicates investment**; higher-value services tend to increase ability to pay
- **Tier 3** - Often the **easiest to electrify,** however the scale of installations required can drive high upfront costs which facility managers see as a barrier

(1) Typically, a combination of solar panels and a battery storage system (2) Estimates based on figures from Nigeria and Kenya. Will vary widely based on country, and private vs public sector HF

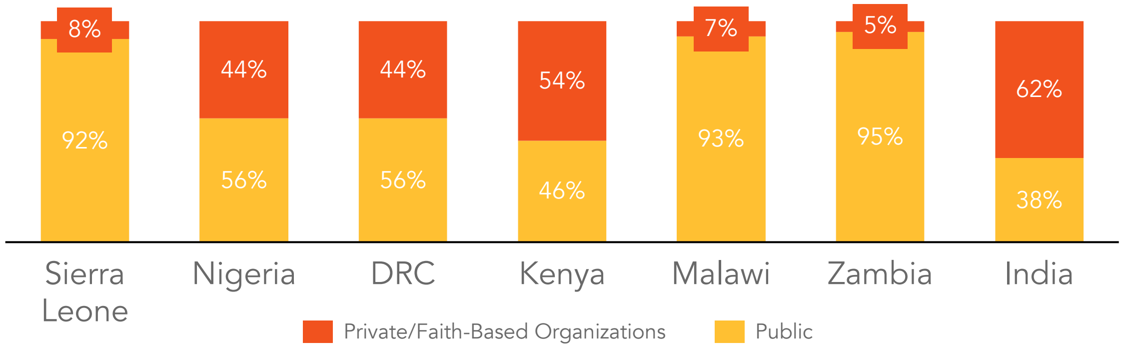
Across markets examined, there is an investment need of ~$2.6B, with $1.4B for public facilities and $1.2B for private facilities – India and Nigeria make up ~70% of total need

Estimated HFE investment deficit (US$)



Segmenting investment need across public and private facilities lets us better understand who the ultimate payor for new installed capacity would be, informing bankability and approaches to de-risking

Percentage of HFs in private and public sector operation



Breaking down total HFE investment need across public versus private facilities supports effective intervention planning

	SL	NG	DRC	KE	MW	ZA	IND
Total	**$11M**	**$805M**	**$428M**	**$235M**	**$16M**	**$93M**	**$1B**
Public	$10M	$600M	$240M	$102M	$12M	$75M	$386M
Private	$1M	$205M	$188M	$133M	$4M	$18M	$630M

NB: All assumptions around the number of facilities and breakdown by tier are explicated in the main report text

Markets we assessed need ~$1.4B in public facility investment, but unreliable government payors and inconsistent delivery of quality O&M pose challenges

Estimated public HFE investment deficit in priority markets (US$)

Tiers 1& 2: $1B

Tier 3: $410M

For public facilities, government's ability to pay either for the upfront investment costs, or ongoing O&M, is constrained by a number of factors:

General under-investment in healthcare

- Low levels of government spending limits health coverage
- High out-of-pocket spend from budget constrained consumers
- Government is still a major provider of healthcare services despite lack of spending, especially to the poorest and more vulnerable

Tighter government budgets which limit infrastructure spend

- Macro-economic constraints are squeezing government budgets
- Growth is slowing, public debt-to-GDP is increasing as is the cost of that borrowing
- This limits government's ability to invest in long-term infrastructure plans, including HFE

Reliance on project-based funding for healthcare

- Considerable reliance on donor funding in health expenditure
- This creates a short term-focus on asset purchase vs. service delivery
- Donor funding is typically geared toward system installation and not towards operation, maintenance and sustainability of projects

This **limits the private sector's ability to invest in HFE**, especially in models that require longer term contractual arrangements with government as an ultimate payor

To address private facility demand, ~$1.2B is needed in markets we assessed – despite higher ability to reliably pay for power, these facilities also encounter barriers

Estimated private HFE investment deficit in priority markets (US$)

Tiers 1& 2	$874M
Tier 3	$305M

Privately-run facilities do not have to wait on slow and fickle government sponsorship, but they too struggle to present bankable power projects:

Unprofitable business models cannot cover fixed costs

- High operational costs cause constraints on ability to pay
- Caused by high fixed costs and significant variability in income
- While gross margins can be high, overheads drive unprofitability
- Adding fixed costs to electrification makes this worse

Inability to pay for upfront capex costs

- Demand for solutions that require no upfront costs (energy as a service, or lease-to-own models)
- Thin margins still leave risks of non-payment which ultimately still sits with the developers

Capacity constraints limit the demand for energy

- Smaller facilities, particularly in more remote areas, do not demand enough energy to justify stand-alone systems.
- Better suited to be an off-taker in a community level installation

Developers across our markets have been active in HFE, and most projects are delivered 'turnkey'-ready – but funded with capex grants from donors

Developers active in HFE

- Sierra Leone
- Nigeria
- DRC
- Kenya
- Malawi
- Zambia
- India

HFE delivery models in-market or being trialed

1 Design, Build, Operate, Transfer (BOT)	Most donor-funded installations are still done through a design, build, operate and transfer model, where the government is the eventual owner. No de-risking is necessary, but the model is unsustainable without ongoing O&M budget and execution.
2 Pico-PV System Pay-Go	Some companies utilize a SHS PAYGO model, where smaller HFs eventually own the systems outright.
3 Energy as a Service (EaaS)	Some developers have operated an EaaS model with private hospitals in particular – relying on guarantees to secure commercial lending for their project finance debt. This could work for public facilities as well if government is the ultimate off-taker.
4 Hybrid model	Through some donor programs, developers are introducing hybrid models – whereby the government will eventually own the system through a lease-back model, or where separate donor supported funds are paying for the energy services once verified as delivered.

Most **developers noted that a majority of their projects are BOT,** where the limiting factor is government's ability to maintain the systems once transferred

Developers face challenges serving different facility types, as stability of payments and frequency of system maintenance can both vary heavily

Developers noted idiosyncratic challenges when servicing HF tiers…

Tier 1

- **Most installations came through donor capex** or community electrification
- Small facility **stand-alone installations suited for SHS**
- Most are not **large enough** to be a mini-grid anchor load

Tier 2

- **Limitations** on the system size due to **land availability** and, **regulations** about proximity to the grid
- **Tend to be public,** as they are referral facilities[1]

Tier 3

- **Easiest clients to service given their ability to pay**
- Grid-connected but rely on diesel for back-up generation
- Management **unconvinced of savings** and reliability over diesel
- **Limited ability to meet upfront capex costs** – and require systems large enough to meet peak energy need or with significant storage capacity

…and any financing approach must consider off-take certainty and O&M

Developers have available financing

- Developers maintain strong relationships with commercial lenders
- **For bankable projects, they have capital available to be deployed**

Investment is dependent on ability to pay

- **Lack of certainty around government payment and poor profitability in private facilities**
- Lenders and guarantors cannot **underwrite projects due to uncertain revenues**

O&M costs need to be considered in both public and private

- For public and private sector, the costs of those O&M contracts must be considered
- **It is not efficient to have only the HF as the off-taker**, versus embedded in community electrification to share costs

(1) Anchor load defined as the main productive use customer of a mini-grid that takes up a consistent and significant portion of demand to justify the installed size of the mini-grid capacity; (2) Referral facilities are larger health facilities that have more sophisticated diagnostic and clinical infrastructure, better able to deal with more complex and acute patient needs

Baseline project viability should be established before preferred de-risking mechanisms can be used to crowd in additional capital

There are foundational elements that must be considered before financial de-risking…

Government as an off-taker needs to be solved first

- For government as payor **mechanisms needed to pay for on-going O&M if the BOT model is preference**
- To move to an EaaS model, mechanisms needed for **greater certainty on off-take**

Demand aggregation is key for both public and private sectors

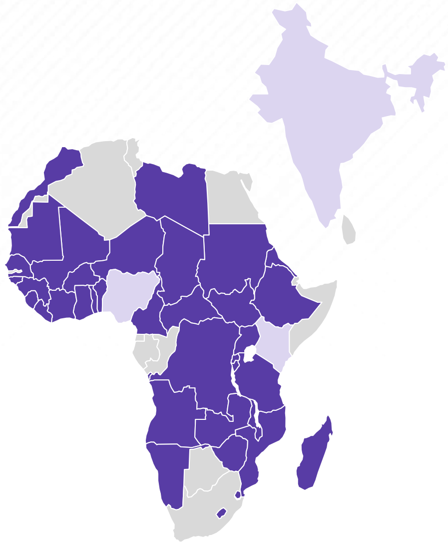
- For private sector, support for demand aggregation would benefit developers **reducing the sales cycle for them with private facility management**
- Demand aggregation should also link to wider electrification efforts to share **the fixed costs of O&M and ultimately drive down the costs of HFE** – for either public or private sector facilities

…but once these are addressed, developers expressed a preference for the following de-risking instruments (in rank order):

	Risks being mitigated	Benefits
1 Guarantees	Limits developers' exposure in the event of non-payment by their off-take counterpart, should they be using debt financing for the project.	• Mitigates the risk that the developer cannot repay loans should the customer default • Enables them to ensure solvency should projects not perform
2 Performance-linked grants	Mitigates the risk that the payor cannot cover the full cost of energy produced in a service model where the client is paying a tariff.	• Gives developers increased certainty on capex payback should they deliver services • Keeps the project performance in their locus of control • Can be sun-setting, reducing over time as investment is recouped
3 Concessional debt	Reduces the overall costs of the project, therefore reducing the time for the project to breakeven. And can be subordinated in the capital structure to transfer risk to parties best able to bear it.	• Allows developers to reduce the pay-back period of the project • Does still leave them exposed in the case that their counterpart defaults on payment

The vast majority of capital provided to HFE has been in grants, with some small de-risked DFI investments testing new models

Activity across Africa & India



Grants only
Grants & other financing

	Grants	Debt	Guarantees
Average investment size: >$10M		There is a significant gap in the capital market for project finance debt and guarantees	
Average investment size: <$10M+			Debt currently being provided through blended mechanisms is one off

Grants in kind

Most HFE capital is donor grants channelled through broader electrification programs

At-risk capital has been provided by DFIs who themselves were de-risked

Major guarantors are absent

NB - List is non-exhaustive and to be updated through additional market research

Source: CrossBoundary Analysis

While most donor funding has been capex grants, new approaches are being tested which could unlock commercial capital investing in distributed energy

~$175M-250M invested in HFE by donors in seven analyzed countries – 95% of which is capex grants

Only 7 identified HFE projects include results based financing or blended finance

Vast majority of private finance is channelled through developer relationships, and not HFE specific

- Rural Energy Program – Uganda
- World Bank ROGEAP pilot – Nigeria
- UNDP Performance PPA – Zambia and Malawi

There are several donors that are testing new models – some of which involve innovative financing structures to enable government to be a more stable off-take, enabling other investors to enter the market

All HFE specific investments have been undertaken by DFIs, with some form of concessional capital used to de-risk the investment. Most investors are not willing to enter the market given the constraints – even impact focused investors.

There are commercial investors that could be drawn into the market, many of which have blended capital structures themselves which can enable them to take on more risk – but projects still need to be made bankable

There remains a significant investment gap of at least $2.35B in the countries analyzed – and conservatively extrapolating globally we estimate a gap of at least $3.6B

$2.6B
Estimated investment need for HFE across countries analyzed

~$175-250M
Estimated investment in HFE across countries analyzed

Based on the demand and investment estimates **across countries of analysis, we estimate a funding gap of at least $2.35B**. This is a conservative estimate.

$4.9B
World Bank and WHO estimates of investment need for HFE globally

~$1.25B[1]
Conservative estimate of HFE investments globally based on countries analyzed

By conservatively taking **5x the amount of funding estimated in the countries of analysis** for this study, there would still be a funding gap of at least **$3.6B globally for HFE.**

1 – This represents a conservative estimate and is not based on collection of data for all countries globally. As the countries of interest for this report constitute six of the top ten most active countries for donor programs in HFE, a conservative multiple of 5 or greater could be applied to the estimated funding in the target countries to approximate a global investment total.

There are several potential de-risking mechanisms that, if implemented, could catalyse the deployment of at-risk capital into HFE

Potential mechanism	Target of intervention	Most relevant for
Donor-supported liquidity pool for energy services	Provides certainty to developers that there is sufficient funding available to pay for contractual obligations by the government.	Public sector facility investments
Sovereign credit guarantees for project debt finance	Should the government default on their obligations, allows the developer to be at least partially covered for any debt obligations taken on for project financing.	Public sector facility investments
Guarantees to developers for debt project finance	Should the health facility default on their obligations, allows the developer to be at least partially covered for any debt obligations taken on for project financing.	Private sector facility investments
Concessional loans to developers for debt project finance	Encouraging senior secured lenders to enter into projects by taking a subordinate position or providing below-market rate debt to developers.	Private sector facility investments
OEM concessional working capital facility for developers targeting HFE	Reduction of upfront costs to the developer, allowing them to unlock more working capital and reach a larger scale more quickly. As they are paying for most of the system close to the time of installation (and therefore payment from customers), it reduces their working capital burden. This can also eliminate or reduce any upfront costs of system installation for the customers.	Private sector facility investments
Support to identify private facilities and explain benefits of a solar energy installation	Developers noted that the costliest part of the transaction was identifying the potential partners and explaining the benefits of the solar installation to them. Having programs in place to reduce the sales time would enable developers to spend more time actually installing solutions.	Private sector facility investments
Time-bound subsidy to incentivize action	Related to the issues above, developers noted that time-bound grants (where subsidy was only on offer within a given fiscal year for example) helped in the sales process as it focused facility management and gave them a deadline to focus the decision making around the installation of a solar system. Could also be relevant for public facilities.	Public and Private sector facility investments
Decentralised Renewable Energy Certificates (D-RECs) for HFE investments	D-RECs are electronic records that verify the source of electricity used, allowing electricity buyers to make reliable claims about this energy. These certificates can be purchased by corporates that are seeking to offset their global emissions. The purchase of these certificates then creates revenues that flow back to the project developer.	Public and Private sector facility investments

Large commitments have been made by some of the most active donors to electrify >98K facilities[1], offering potential areas for partnership

	THE WORLD BANK	USAID / POWER AFRICA	UNDP	Gavi / unicef / World Health Organization	IKEA Foundation
Commitments	• DARES[2] program to electrify 100K schools and health facilities by 2026 • ESMAP to allocate $10M to include health facility electrification in existing World Bank programs	• Health Electrification and Telecommunications Alliance (HETA) initiative to electrify 10K health facilities by 2030	• Piloting a PPA/service based model to electrify health facilities across Africa • Piloting an Islamic finance compliant endowment structure in Cameroon, Mauritania, and Senegal to finance HFE	• Piloting a model that can be scaled to electrify 10K facilities per year leveraging the CCEOP[3] platform. The pilot will electrify 2.6K facilities	• Provide energy to 25k health facilities across 12 states by 2026
Partners	IFC, MIGA (Multilateral Investment Guarantee Agency, World Bank Group)	Abt, bechtel.org, RESOLVE, orange	IsDB البنك الإسلامي للتنمية Islamic Development Bank	Bill & Melinda Gates foundation, PATH, Clinton Health Access Initiative	SELCO Foundation

Collectively **these programs are seeking to electrify 98K facilities across the target markets**. They may present an opportunity for partnership should they support and seed new models for investment into HFE.

1. Assumes 50% of World Bank commitment covers health facilities 2.Distributed Access through Renewable Energy Scale-up Platform 3. Cold Chain Equipment Optimization Platform

Sources: Powering Healthcare Intervention Database, SEforALL, 2022; CrossBoundary Analysis; https://www.worldbank.org/en/events/2022/11/15/partnerships-to-scale-up-energy-access

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CrossBoundary and KOIS were engaged to map the capital landscape for health facility electrification (HFE) and design financial interventions to de-risk HFE investment

CROSSBOUNDARY ADVISORY

KOIS CARING FINANCE

Task A	Task B
Study the market for health facility electrification in select geographies and provide qualitative and quantitative analyses of investment risks to be mitigated	Investigate and design suitable financial interventions for de-risking investments in HFE, with the goal of enabling increased public-private partnerships and catalysing the deployment of at-risk capital

Given the breadth of the challenge represented by HFE, the CrossBoundary-KOIS Consortium agreed with the Funders and Partners that the focus of Task A should be a capital map targeting Sierra Leone, Nigeria, DRC, Kenya, Malawi, Zambia, and India. These countries were chosen due to their heterogeneity in size, level of economic development, and HFE need.

We utilized desk-based research and stakeholder interviews to develop qualitative and quantitative analyses of investment risks to be mitigated in HFE

Literature review

We built on relevant work from leading institutions and programs including:

- World Health Organization
- FCDO Africa Clean Energy
- USAID Power Africa
- World Bank
- SEforAll
- IEA
- IRENA
- PEDL
- IMF

Stakeholder interviews

We interviewed various types of stakeholders to gain a holistic view of on-the-ground challenges:

A. **Developers:** PowerGen, Havenhill, Blue Camel Energy, SAO Energy, Okra, Nuru, Equatorial Power, Arc Energy, Orb Energy, PeriUrja

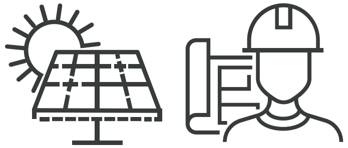
B. **Investors:** Sunfunder, Acumen, MIGA, CrossBoundary Energy Access, SAO Capital

C. **Donor Capital Providers:** UNDP, USAID Power Africa, World Bank ESMAP, FCDO ACE TAF, SELCO Foundation, GEAPP, CHAI

In analysing the need for a de-risking mechanism in HFE, our systematic approach first assesses the demand for and current supply of off-grid solar electrification

Demand for energy

Key question	Section in analysis to follow
What is the electrification gap in the healthcare space?	HF energy access
How do we stratify need by HF types?	Investment need
How does this differ across public and private HFs?	Public vs. Private need
Who pays for electricity at different types of facilities, what is their ability to pay, and what does that information tell us about how to supply them?	Ability to pay



Supply of energy

Key question	Section in analysis to follow
What developers have been active in this space, and with what types of HF?	Active developers
How are they currently servicing HFs?	Models
What risks are keeping them from expanding their HF electrification work?	Supply constraints
What financial de-risking options could unlock more supply?	De-risking approaches

With this view of the market, we then overlayed what capital is being deployed, in what form, and by whom in order to identify gaps for de-risking mechanisms to address

Financing for suppliers

Key question	Section in analysis to follow
What has been the main source of funding for HFE and what gaps exist?	Capital flows
Among donor funding, how has this capital been deployed and by whom?	Donor capital
Among private capital, what form has this taken?	Private capital
	Capital map
What potential financial instruments/mechanisms could be employed to close these gaps?	Potential instruments

Taken altogether, this provides a view of:

- Demand for electrification, and who the ultimate payors are or could be for the energy consumed
- Who does or potentially could supply this energy, and what de-risking tools they need to take on more projects
- Who does or could finance suppliers, and where financing gaps exist that inhibit suppliers

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We disaggregated demand for electrification to best understand what models could work for different facility types and payors

Demand for energy

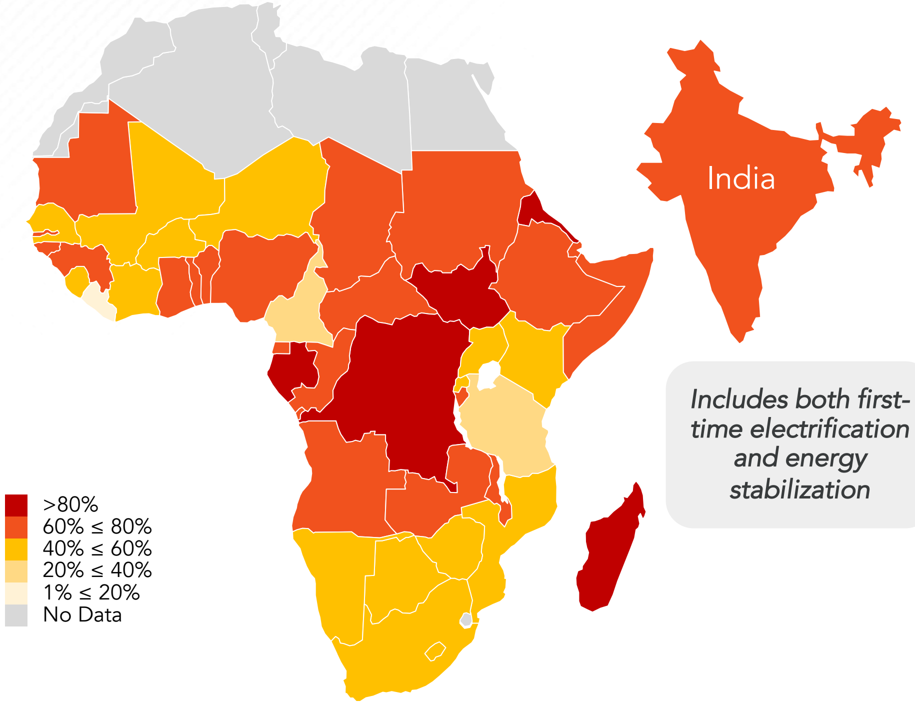
Key question	Section in analysis to follow
What is the electrification gap in the healthcare space?	Capital map
How do we stratify need by HF types?	Donor capital
How does this differ across public and private HFs?	Private capital
Who pays for electricity at different types of facilities, what is their ability to pay, and what does that information tell us about how to supply them?	Potential instruments

Key takeaways

- Demand for electrification is **greatest in Nigeria** (in Africa) **and India** (overall), but all priority markets exhibit the highest demand at the primary HF level
- Public facilities constitute ~55% of expected investment need, making them an integral part of the HFE effort
- **Most governments** in the priority markets have **increasingly challenged fiscal environments**; even prior to this constrained position they depended on donor funding for a significant proportion of overall health budgets
- Few HFs can pay for their own electricity, making the **government a necessary payor** – but one that is often very unreliable
- Across both public and private HFs, there **is limited ability to pay** for any upfront capex costs for electrification (either for Pico-PV Systems or BOT installations), making payments only per use of electricity most appropriate
- Primary HFs are commonly **not large enough to act as an anchor load** in and of themselves, as most do not have the equipment or technology required to generate sufficient demand
- Taken together, the greatest need is in public HFs, but from an investment perspective the **most bankable opportunities are with larger private facilities**

Across sub-Saharan Africa and India there is significant need for HFE, and the priority countries for this analysis broadly represent different types of access gaps

Percentage of healthcare facilities requiring energy interventions[1]



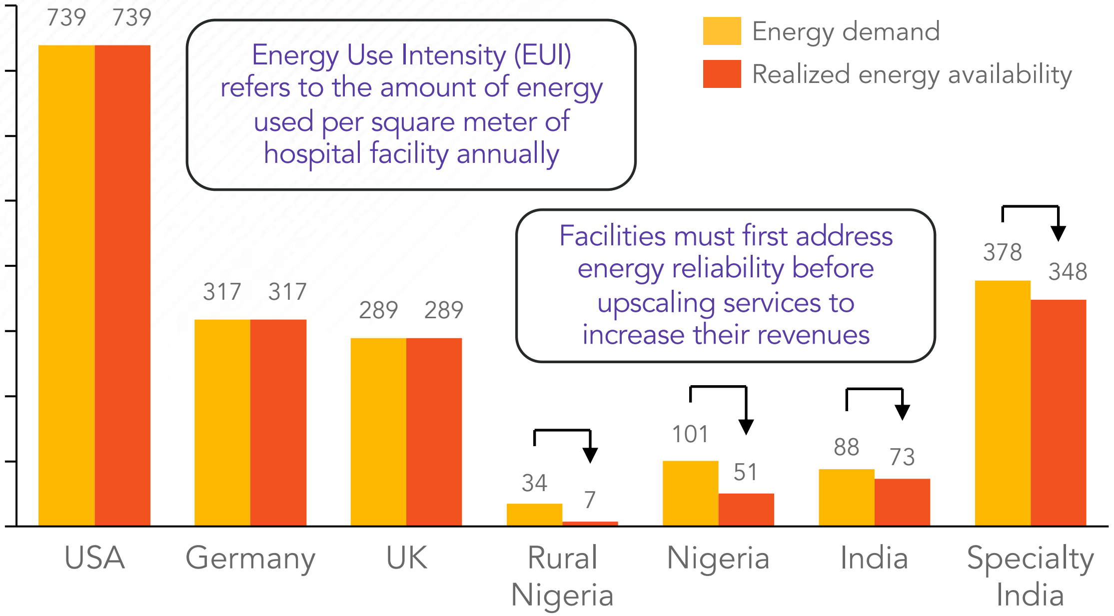
Includes both first-time electrification and energy stabilization

Country	HFs requiring electrification[6]	HFs requiring primary electrification	HFs requiring stabilizing electrification
Sierra Leone	41%	400	125
Nigeria	68%	27,340	6,360
DRC	84%	9,840	2,500
Kenya	42%	1,250	3,120
Malawi	77%	680	330
Zambia	77%	970	445
India	71%	21,380	118,140

(1) Energizing health: accelerating electricity access in healthcare facilities, WHO, 2023; (2) Monitoring Electricity Reliability at Kenyan Healthcare Facilities, PEDL, Aug 2022; (3) Powering Social Infrastructure in Sierra Leone, SEforALL, 2021; (4) Caring for the Energy Health of Healthcare Facilities, Berkeley National Laboratory, 2016; (5) Energy Performance of Hospital Buildings in Nigeria, University of Nigeria, 2013; (6) HFs requiring primary electrification' and 'HFs requiring stabilizing electrification' in table are separate but related CB calculations whereas 'HFs requiring electrification' is more directly from the WHO report

Healthcare facilities with unreliable or no power are less able to provide consistent, modern, quality care, affecting patients' wellbeing and facilities' financial health

Hospital facility energy use intensity (EUI) (kWh / m² / year)[1]



Energy poverty for health facilities means…

70% of medical equipment fails[3]

50% of vaccine supplies are lost[3]

25-50% extra travel time to powered facilities[4,5]

Key takeaways

- Energy Use Intensity for hospitals in Low-Middle Income Countries (LMICs) is **significantly lower** compared to higher income counterparts
- **Hospitals are less equipped** with energy-consuming technology, and **thus unable to provide global-standard care**
- While annual HF energy use is already low, intermittent energy loss means **LMIC HFs are unable to provide consistent services or sustain equipment**
- **Vital services** such as blood storage, vaccine / drug storage, surgery, water purification, lighting and thermal comfort **require reliable energy supply**
- In addition to service discontinuity, medical **equipment can be damaged** by sudden outages or surges
- As such, there is often **low HF utilization, reduced productivity** and an **inability to generate more revenue; as a result, ability to pay remains low**

(1) Caring for the Energy Health of Healthcare Facilities, Berkeley National Laboratory, 2016; (2) Energy Performance of Hospital Buildings in Nigeria, University of Nigeria, 2013; (3) Energy Access Outlook: From Poverty to Prosperity, IEA, 2017 (4) People across Africa have to travel far to get to a hospital, The Conversation, 2018; (5) Achieving universal electrification of rural healthcare facilities in sub-Saharan Africa with decentralized renewable energy technologies, Joule, 2021

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Energy demand	~5 kWh/day	~20 kWh/day	~100 kWh/day
Electricity supply tech	Solar kits, or small solar standalone system	Medium-to-large solar standalone system, mini-grid, hybrid system[1]	Large solar mini grid, central grid, fuel generator, hybrid systems
Electricity usage examples	General lighting, small refrigerator, device charging	Procedure lighting, oxygen concentrator, ultrasound, heart rate monitors	Diagnostics machines, operating theatre equipment, monitoring equipment
Typical revenue per month[2]	$100 – $200	$1,500 – $5,000	$10,000 – $15,000

Unique challenges exist at each level

- Tier 1 - more likely to be **un-electrified, and difficult to service** due to distance from cities; have lower healthcare service capacity and service the poorest patients
- Tier 2 - tend to be **easier to service, but fall into grid expansion plans** which complicates investment; higher-value services tend to increase ability to pay
- Tier 3 - often the **easiest to electrify**, however the scale of installations required can drive upfront costs which management do not want to bear

(1) Typically, a combination of solar panels and a battery storage system (2) Estimates based on figures from Nigeria and Kenya. Will vary widely based on country, and private vs public sector HF

Tier 1 facilities are most likely to be completely unelectrified, with the greatest need for first-time electrification of these facilities being in Nigeria and India

Estimated demand for first-time electrification (# of facilities)

HF type	Tier 1	Tier 2[1]	Tier 3
Sierra Leone	375	25	1
Nigeria	25,440	1,695	205
DRC	8,925	595	325
Kenya	1,075	70	105
Malawi	85	415	5
Zambia	960	975	75
India	20,040	1,335	0

Potential interventions

- **Tier 1 facilities have the greatest need for full electrification;** due to relative size, these are best serviced by either community wide electrification via mini-grids or Pico-PV systems
- Tier 2 facilities tend to be peri-urban and urban, and may be best served by stand-alone systems (or mini-grid solutions where feasible); **higher revenues and more stable returns** facilitate the viability of such solutions
- While Tier 3 facilities may have some access to the central grid, a significant **lack of reliable energy** may warrant stand-alone PV systems

(1) Simplifying assumption that there are approximately 15 health posts to each district HF equivalent in most countries

Source: WHO: Energizing Health: Accelerating Electricity Access in Healthcare Facilities

Many health facilities across target countries have access to electricity in some form but suffer from intermittency, requiring additional energy stability solutions

Estimated demand for energy stability (# of facilities)

HF type	Tier 1	Tier 2[1]	Tier 3
Sierra Leone	100	10	20
Nigeria	5,565	370	425
DRC	2,240	150	110
Kenya	2,300	155	665
Malawi	40	180	10
Zambia	250	255	50
India	110,755	7,385	0

Potential interventions

- Energy stability solutions for Tier 1 could be a simple **Pico-PV system or small inverter**; PHCs may also benefit from solar equipment such as solar refrigerators or portable solar kits (e.g., Koolboks and We Care Solar); stand-alone mini-grid systems pose financial difficulty for facilities of this size
- Tier 2 and Tier 3 facilities benefit most from **stand-alone PV with battery capacity**
- Tier 3 facilities have been known to be **hesitant to adapt** these systems, though rising diesel costs and education are bringing about perception shifts

(1) Simplifying assumption that there are approximately 15 health posts to each district health facility equivalent in most countries

Source: WHO: Energizing Health: Accelerating Electricity Access in Healthcare Facilities

We calculated deficits in HFE investment using direct data and proxies, leveraging secondary research to determine inputs

Number of health facilities

Tier 1 + Tier 2 + Tier 3

X

Health facility energy deficit

Energy access + Energy stability

X

New generation capacity to address deficit

Capacity (kW) to meet peak demand X Capex cost per kW of installed capacity

=

Capex investment to meet HFE demand

- The number of HFs in each country was identified and assigned to HF tiers
- Facilities were also grouped by public and private segments for sub analysis

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- Energy Access denotes facilities that will require full electrification
- Energy Stability refers to facilities that require some additional capacity to bridge the energy deficit, whether as additional capacity or back-up
- (NB for this, we assume ALL energy stability deficit will be bridged by Solar PV, though in reality generators plays a significant role)
- Figure is conservative, as it does not include facilities that are under-electrified / require additional investment to provide full suite of services.

- A peak demand (kWp) calculation was used to assess the capacity of solar needed to address the energy deficit
- A simplified capex cost per kW of installed capacity was then applied to ascertain the capex investment need
- Capex cost per kW was assumed to be the same for both energy solution types

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A comprehensive list of input assumptions is available in the quantitative model accompanying this report

Distinguishing between privately-operated facilities and public ones provides useful insights around how to increase electrification financing

While the need for investment in HFE is broadly clear, differences in facilities' business models and appropriate financing solutions provide for significant complexity

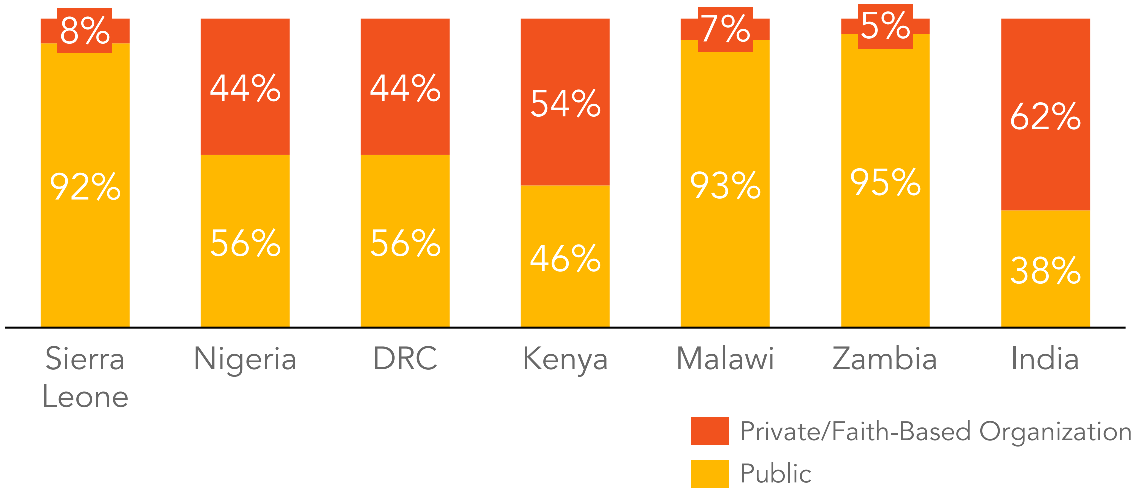
Publicly-owned facilities get their operating budgets from national or sub-national governments, exposing those facilities' staff and stakeholders to bureaucratic inertia – replicable solutions to this challenge will be very powerful in unlocking HFE investment

Capital required for HFE deficit (US$)

Sierra Leone	Nigeria	DRC	Kenya
$11M	$805M	$428M	$235M

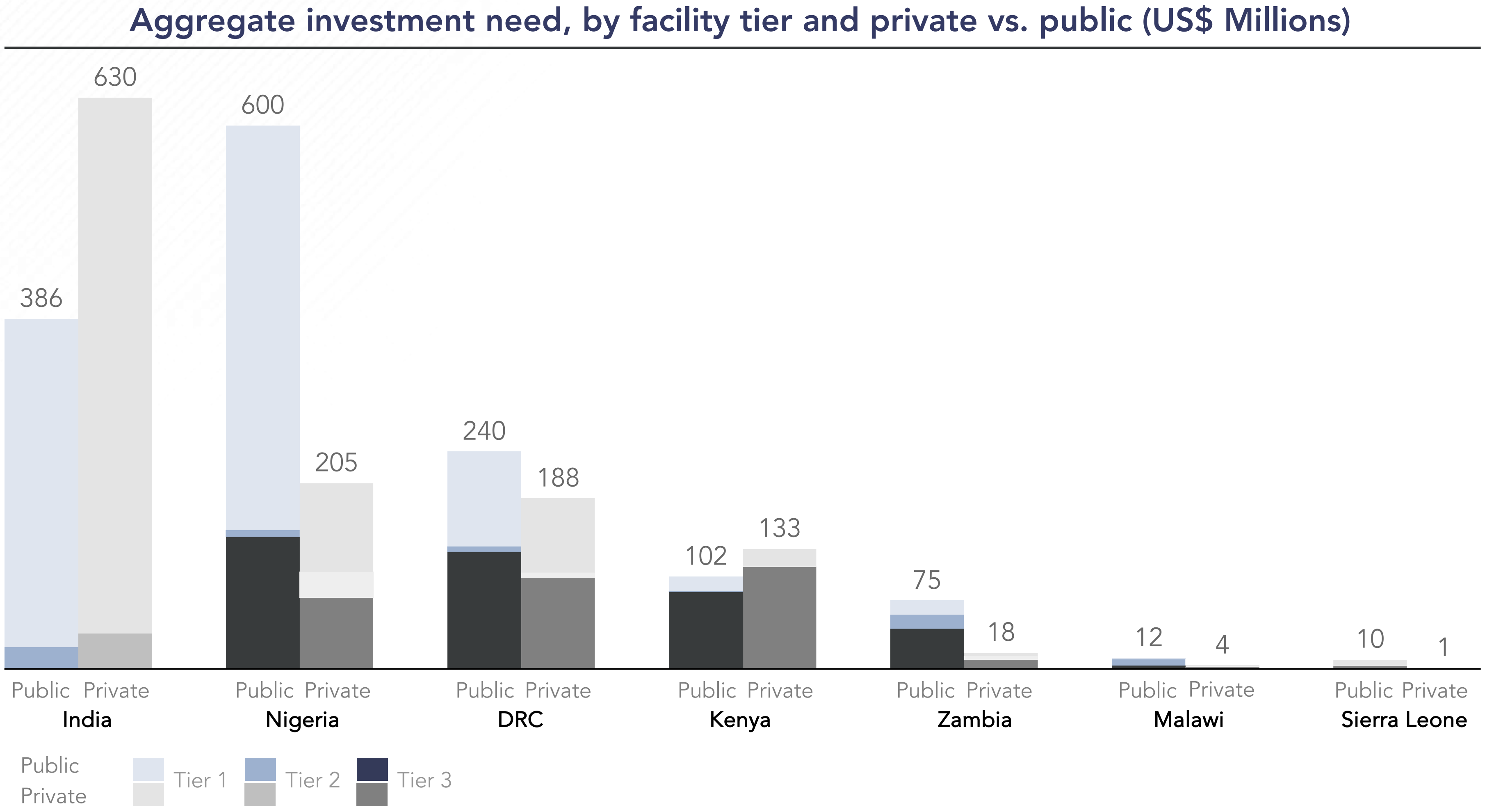
Malawi	Zambia	India
$16M	$93M	$1016M

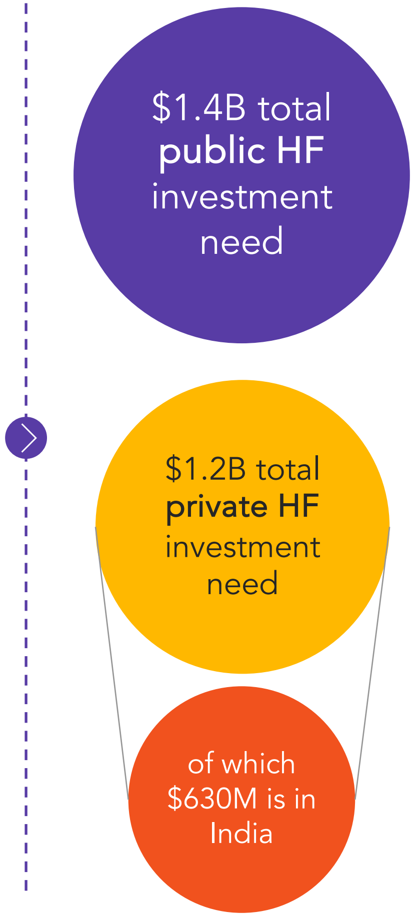
Percentage of HFs in private and public sector operation



Though we can estimate the amount of capital required to address HFE deficiencies, the reality of solving this problem sustainably is much more complicated than merely providing the capital

The need for electrification is greatest among public sector facilities; India accounts for over 50% of the private demand for selected geographies





Investment needed is considerable, but it's critical to understand who the ultimate purchaser of energy would be, public or private sector, to understand bankability

Aggregate investment need, by private vs. public

	SL	NG	DRC	KE	MW	ZA	IND
Total	**$11M**	**$805M**	**$428M**	**$235M**	**$16M**	**$93M**	**$1B**
Public	$10M	$600M	$240M	$102M	$12M	$75M	$386M
Private	$1M	$205M	$188M	$133M	$4M	$18M	$630M

> "Power cuts are repeated. We hope that the implementation of this system will be able to meet this challenge related to electrification which is one of the major problems of this clinic.
>
> *Clinic manager, charity funded HFE Pilot*

Key takeaways

- The access gap makes clear that there is a significant demand for electrification solutions, but to understand the bankability of HFE projects **we must consider both ability and willingness to pay**
- When considering **private sector facilities**, they have in many cases a **higher ability to pay due to their collection of fees** for services at market rates, and generally have a high willingness to pay so long as they can see cost savings and limited upfront capex
- **Public sector** has a generally **constrained ability to pay** due to limited revenue and increasingly strained fiscal positions, but can also have a **limited willingness to pay given competing demands on limited health budgets**
- These considerations ultimately drive the underlying bankability of investments in HFE, and drive the constraints in supply to these two customer groups

Budgeting for energy & fuel varies widely across geographies

Approach to budgeting electricity & fuel

	Approach to budgeting electricity & fuel
Nigeria	Varies by state; many PHCs purchase fuel & electricity through the Basic Healthcare Provision Fund (BHCPF). Secondary/tertiary facilities fund fuel and electricity through MOH stipend.
DRC	Electricity bills covered by central government for payment. (Currently in arrears up to ~$100M) Fuel funded out of a mix of user fees, partners, and provincial government.
Kenya	Facilities directly budget for fuel and electricity; in practice many are without water/electricity for months due to lack of funds.
Malawi	Budgeted by the District Health Management Teams, who handle budgets rather than PHCs and district hospitals.
India	Electricity & fuel to be budgeted and paid at the health facility level; in practice, many health centers do not have a bank account, so it occurs at the district level

Key Takeaways

- Budgeting and payment for electricity and fuel may occur at **facility level, district level, state level or federal level** depending on national policies;
- Payment consistency throughout the year may vary depending on competing budget priorities, user fees generated, and other factors, **resulting in an unpredictable payment profile** that challenges bankability.

(1) Collected from interviews

Markets we assessed need ~$1.4B in public facility investment, but unreliable government payors and inconsistent delivery of quality O&M pose challenges

Estimated public HFE investment deficit in priority markets (US$)

Tier	Deficit
Tier 1& 2	$1B
Tier 3	$410M

For public facilities, government's ability to pay either for the upfront investment costs, or ongoing O&M, is constrained by a number of factors:

General under-investment in healthcare

- Low levels of government spending limits health coverage
- High out-of-pocket spend from budget constrained consumers
- Government is still a major provider of healthcare services despite lack of spending, especially to the poorest and more vulnerable

Tighter government budgets limit infrastructure spend

- Macro-economic constraints are squeezing government budgets
- Growth is slowing, public debt-to-GDP is increasing as is the cost of that borrowing
- This limits government's ability to invest in long-term infrastructure plans, including HFE

Reliance on project-based funding for healthcare

- Considerable reliance on donor funding in health expenditure
- This creates a short term-focus on asset purchase vs. service delivery
- Donor funding is typically geared toward system installation and not towards operation, maintenance and sustainability of projects

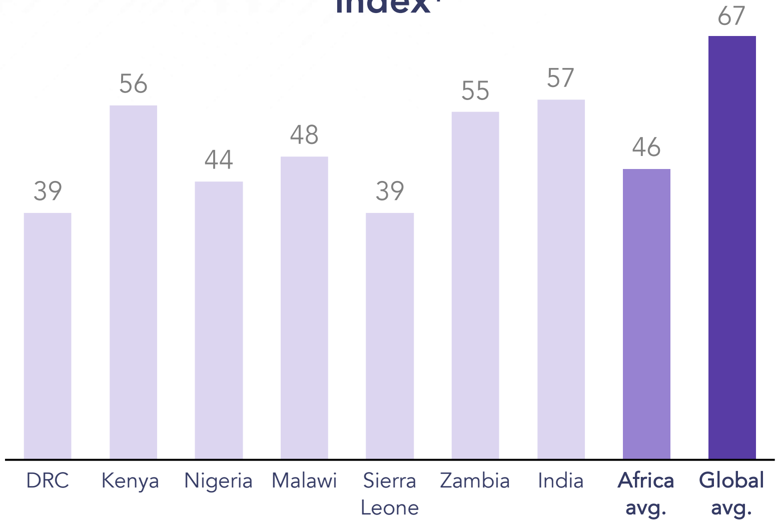
This limits the private sector's ability to invest in HFE, especially in models that require longer term contractual arrangements with government as an ultimate payor

Across Africa and India, governments' inability or failure to fund healthcare systems leads to high out-of-pocket spend from low-income consumers

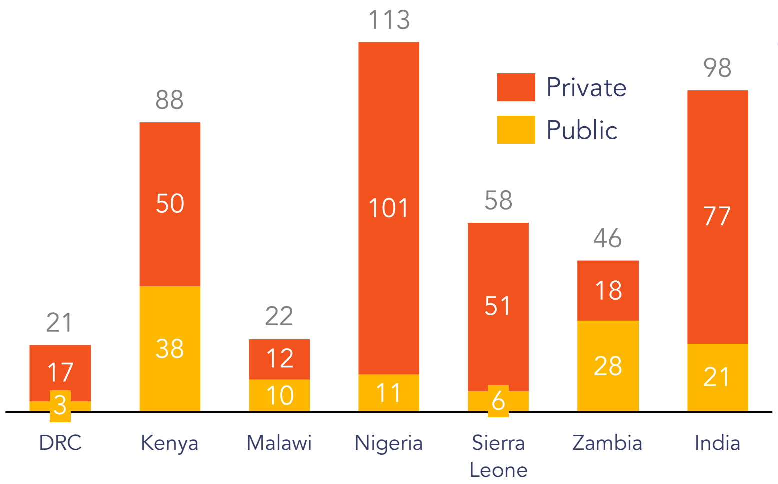
Africa's universal healthcare metrics are the lowest in the world due to constrained government spending. Though India scores higher, it remains far below the global average.

This out-of-pocket spend[2] pushes the 66% of Africans already living in poverty further into crisis. Similar trends exist in India, with 30% of the population experiencing impoverishing health spend.[4]

Universal healthcare service coverage index[1]



Domestic private and domestic public spend on healthcare (US$ per capita)



Key takeaways

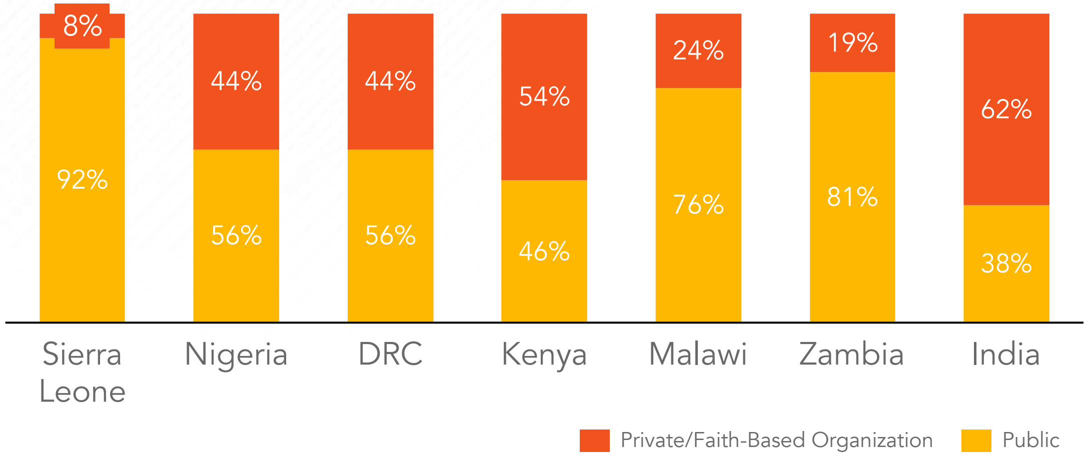
- Limited government intervention **creates the need for private sector to step in** – but this also **creates fragility for consumers** who have limited ability to pay overall for healthcare.
- The limited ability for patients to pay in turn **limits the private HFs ability to pay for energy** and other services.
- Additionally, this creates a situation wherein those government health systems **lack the consistent funding needed to invest in electrification.**
- Those most **marginalized** in society **are typically served by the public sector,** making electrification of these facilities even more critical

(1) UHC index is measured on a scale of 1-100 based on the average coverage of essential health services the level of financial protection provided by the coverage and the range of health services according to need; (2) Private health expenditure includes direct household (out-of-pocket) spending, private insurance, charitable donations, and direct service payments by private corporations; (3) Direct out of pocket payments for healthcare which drive people below a poverty threshold of $1.90/day

Source: Tracking Universal Health Coverage, WHO, 2021

Despite limited spending, government is still a major provider of healthcare services in these markets and is therefore the ultimate payer to facilities' power suppliers

Percentage of HFs in private and public sector operation



Facilities serving more remote areas also tend to be public facilities. Many Tier 2 facilities (which tend to be peri-urban) receive acute care referrals from these smaller, more remote facilities.

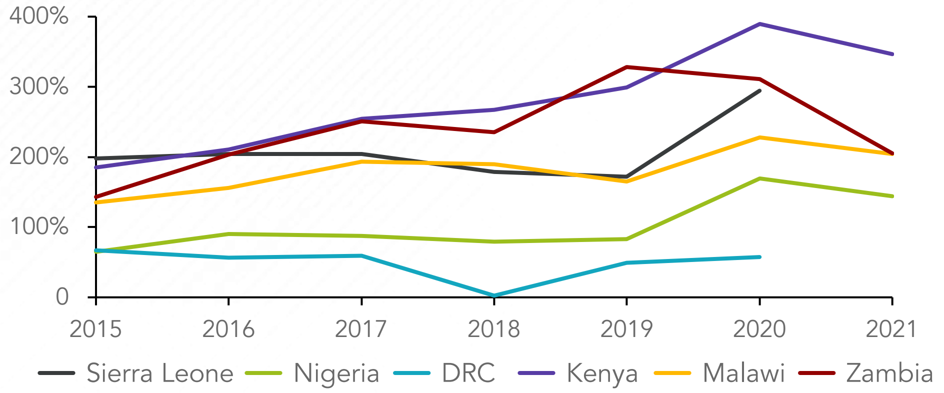
Key takeaways

- In most countries, **government is either a major purchaser or represents the most accessible care option** that the most marginalized patients will turn to, especially in remote areas.
- HFE faces a significant challenge as **energy providers often need to be linked to government procurement and payment.**
- **Electricity bills for public institutions are usually included in district or facility budget lines.** Diesel for backup generators is often budgeted differently, and frequently runs into funding shortfalls.
- While public facilities may charge fees for services, **energy service contracting is not always devolved to clinic management,** particularly for longer-term power purchase agreements.
- In most countries the **private sector plays a key role** in care provision; given their ability to collect revenue from patients at point of care they are **more likely to be able to pay for energy services.**

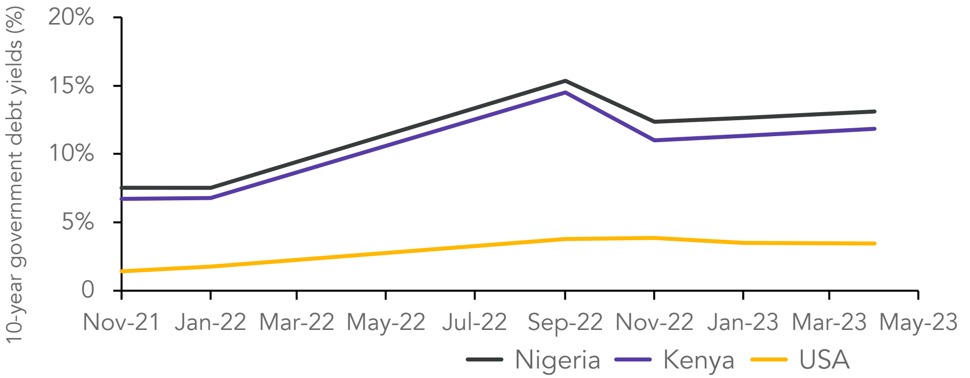
Source: WHO; PEPFAR Operational Plans; USAID SHOPS Plus

Many African governments are highly fiscally constrained, and more hard currency or local currency sovereign debt to fund healthcare expansion is unlikely

Fiscal positions in Africa are increasingly strained…



…and costs of borrowing are set to continue to rise



- Growth in **2023 is expected to slow down sharply to 3.6%** as a worldwide slowdown, tighter global financial conditions, and a dramatic pickup in global inflation drastically affecting the region
- Lower growth rates have put pressure on government budgets, which has caused them to have to go to debt markets for financing. **Africa's public debt ratio is now at 56% of GDP – at levels not seen since the early 2000's.** Since the pandemic, the debt increase has been driven by widening fiscal deficits because of overlapping crises, slower growth, and exchange rate depreciations.
- The combination of lower growth, larger borrowing, and US monetary tightening has also put **upward pressure on the cost of financing for these countries** (as evidenced in the yield graph).

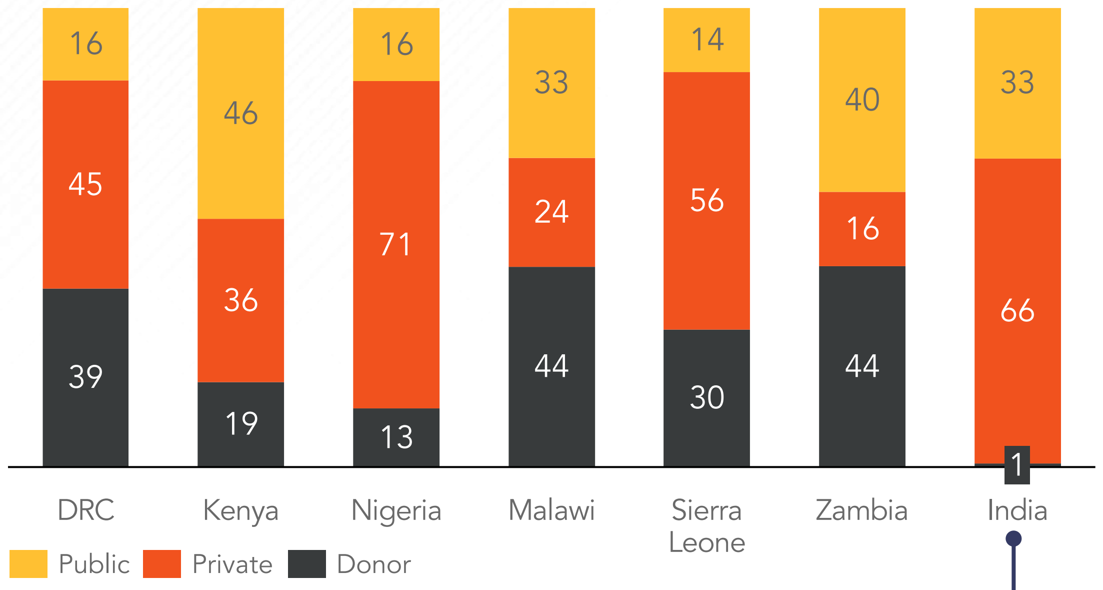
Implications for HFE financing

- Taken together, this means that **governments are increasingly constrained in their ability to pay for government services which has a significant impact on the healthcare sector as it is very exposed to government spending across the value chain, which limits the exposure to government payors that investors are willing to underwrite**
- The increasingly constrained foreign exchange position of many governments means they have limited foreign currency to pay for imported hardware, which constrains HFE efforts
- Even before the impacts of this fiscal pressure were onset, it was not unheard of for **African governments to have extremely lengthy accounts payable cycles** (in some cases >270 days) – increasing fiscal pressure will elongate these payment cycles, placing a greater burden on firms exposed to government

Sources: IMF; AfDB; World Bank; Cbonds

Current government budget constraints aside, there has always been a reliance on donors' grants to fund HFE capex – once in place though, systems are often neglected

Health expenditure sources (% of total expenditure)[1]



NB: Dark blue represents the minimum donor outlay as some capital is channeled through public spend

Low donor activity due to middle income status[1], lack of trust in public health system and size and complexity of market

Potential interventions

- **Donor expenditure** on health is significant, ranging **upward of 50%** in markets such as Malawi and Zambia. This makes donors considerable stakeholders in HF electrification
- **Donor funding** is principally used for **non-recurrent spend** and deployed within the year of allocation which is reflected in their concentration in capex grant deployment. This causes donor funding to be constrained to goods, as opposed to O&M, **limiting the models of funding** applicable when donor funding is involved
- In HFE this results in **donor funding being focused on energy system installation and not towards operation and maintenance** for long term sustainability. As significant stakeholders in HFE this impact is far reaching.

Source: World Bank

(1) The graph shows the breakdown of total spending on healthcare, based on donor contributions, government allocation, and private spend. **Public expenditure on health** consists of government budget allocation, external borrowing and **donor grants channeled through the government.** This means the full extent of donor contributions are not captured in the graph, as donor spend is embedded within public spend

National health insurance schemes have the potential to ease government budgets through pooled risk-sharing, but they remain nascent, and implementation is slow

Broad based insurance coverage can radically change healthcare markets by widening the base of customers, making businesses more profitable through economies of scale

Despite the significant push to improve public health insurance options, uptake has been limited to major markets in East and West Africa.

Roll-outs remain slow and do not effectively offer the full benefit of risk pooling to increase access.

For suppliers to HFs it is common to have working capital delays due to the long reimbursement cycles that facilities have with insurance programs

While these programs hold promise in creating risk pools that will more effectively share costs, they are currently not robust enough to offset the need for major government interventions

Case Study: NHIF Kenya

- With private health insurance there is low penetration beyond corporate clients, so low retail penetration – **the gap between willingness and ability to pay persists, especially in the informal economy**
- In Kenya, the National Health Insurance Fund (NHIF) is the government's response – a risk sharing mechanism that comes from garnered wages on most salaried employees
- While promising, this still doesn't cover all treatment. **New regulations mean that all private benefits must be exhausted before the use of NHIF, making private insurance provision increasingly uneconomic**
- Reimbursement times from NHIF can be extremely long, causing working capital delays for suppliers of any services to HFs, including energy providers

To address private facility demand, ~$1.2B is needed in markets we assessed – despite higher ability to reliably pay for power, these facilities also encounter barriers

Estimated private HFE investment deficit in priority markets (US$)

Tier 1& 2

$874M

Tier 3

$305M

Privately-run facilities do not have to wait on slow and fickle government sponsorship, but they too struggle to present bankable power projects:

Unprofitable business models cannot cover fixed costs

- High operational costs cause constraints on ability to pay
- Caused by high fixed costs and significant variability in income
- While gross margins can be high, overheads drive unprofitability
- Adding fixed costs to electrification makes this worse

Inability to pay for upfront capex costs

- Demand for solutions that require no upfront costs (energy as a service, or lease-to-own models)
- Thin margins still leave risks of non-payment which ultimately still sits with the developers

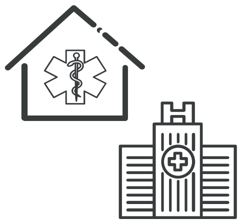
Capacity constraints limit the demand for energy

- Smaller facilities, particularly in more remote areas, do not demand enough energy to justify stand-alone systems.
- Better suited to be an off-taker in a community level installation

The combination of high fixed costs and significant variations in revenues and gross margins causes facilities to experience frequent budget shortfalls

Most smaller HF operators have healthy gross margins (on services, medications, diagnostics) but **often run loss-making operations due to an inability to cover fixed costs like rent, wages, and energy.** High fragmentation reduces capacity utilizations and keeps these HFs from scaling.

> "We see a lot of clinics where owners are dipping into savings month on month, and then only scraping by in a few months of breakeven or slight profit.
>
> *Co-Founder, Health Clinic Network in East Africa*



Larger facilities usually have higher capacity utilization, **but cost pressures arise from higher staff wages to retain qualified workers, higher consumables costs, and higher specialized infrastructure costs.** Despite, steadier revenue, operating margins are still constrained, limiting their ability to invest in additional capex.

Implications for HFE financing and risk mitigation

- For both large and small facilities, thin (or negative) operating margins leave little to no room for investment in capex related to electrification. For the most part these **smaller private clinics are not profitable.**
- HF operators at both the small and large end of the spectrum are therefore **unable to make long-term planning decisions** related to these types of investments, and would rather have the flexibility to control the cost of energy generation as needed (e.g. reducing diesel costs)
- For both small-scale and large-scale facilities, there is demand for solutions that require **no upfront costs** (energy as a service, or lease-to-own models)
- However, the thin margins still leave **risks of non-payment** which ultimately still sits with the developers or providers of energy solutions
- Both of these problems can be addressed with various **de-risking mechanisms**

Source: Interviews with clinic operators and developers

Both public and privately-run Tier 1 facilities are often underequipped and understaffed, leading to low productivity, poor profitability and an inability to attract capital

Developers noted that **smaller facilities alone often lack the base load to justify a small stand-alone solution.**

In some cases, small facilities can receive a free quota of energy in exchange for space for PV array. Effectively, they are cross-subsidized by other mini-grid customers

Many of these facilities require low levels of energy (>15 kWh), as they lack medical equipment. This is due to both a lack of electricity, and a lack of equipment financing options for facilities (either public or private).

Currently, **many of these clinics must refer patients to larger facilities for relatively routine diagnostics,** like ultrasounds or simple blood tests. **This limits their ability to serve clients,** resulting in lost revenue.

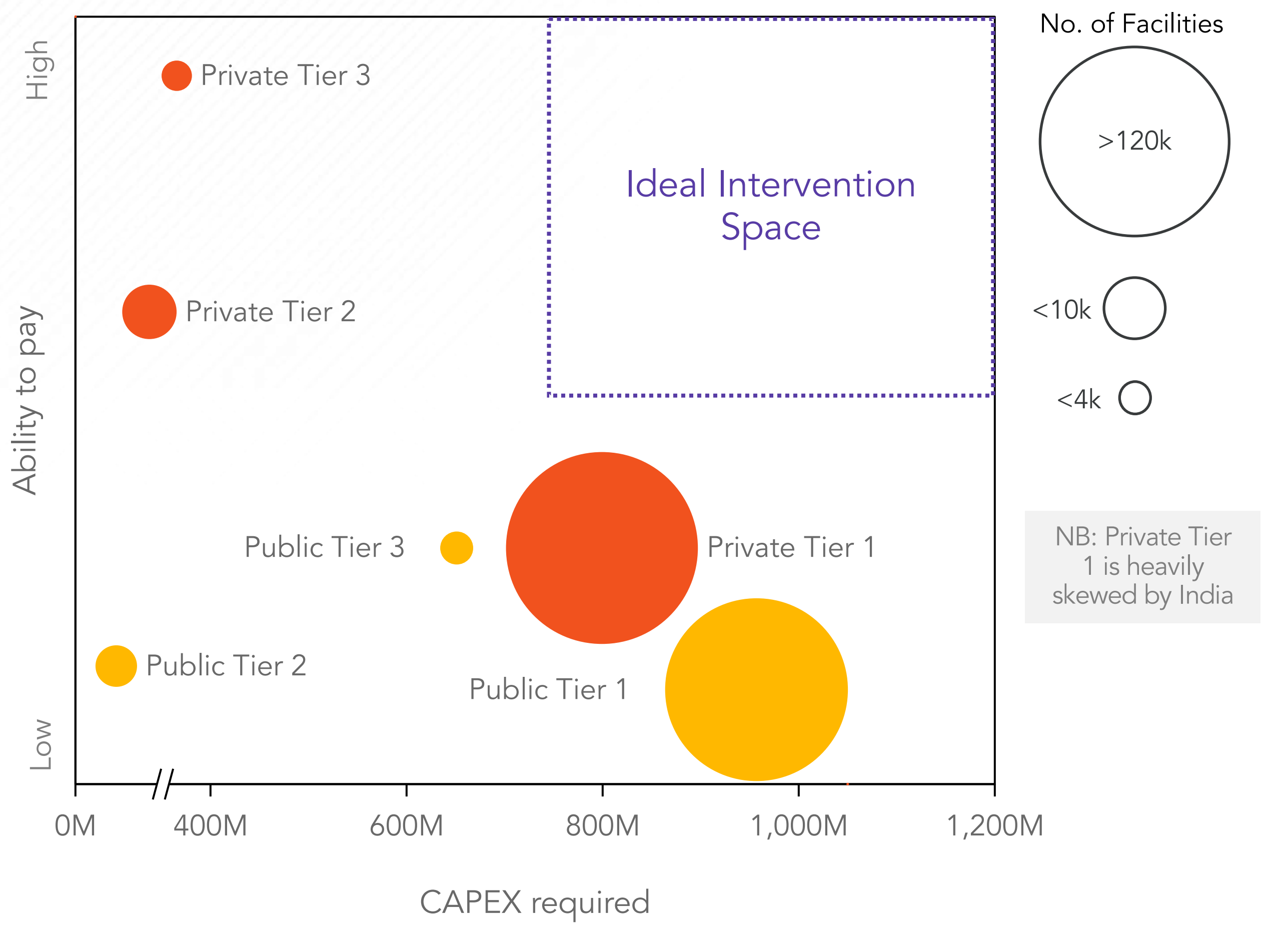
Implications for HFE financing and risk mitigation

- Smaller facilities, particularly in more remote areas, are comparable to their average clients for small community level systems. Most developers do not consider these to be apt **anchor loads.**
- For mini-grid developers , electrifying these facilities is **a consequence of electrifying the community,** not specifically to target HFE
- To increase productivity, these facilities **require asset financing** options to purchase point of care devices (e.g., ultrasounds) to reduce referrals. These assets can also generate greater revenue
- These facilities could also be effectively electrified by small solar systems, but these systems may need to be combined with asset financing (as they are in consumer plays) to get the most productive use out of the HF

Case Study: Mirova | Sunfunder

Mirova Sunfunder is currently exploring a financing facility that would include asset financing to HFs to increase their energy demand, therefore making them a better candidate for larger electrification solutions and decreasing payment defaults

Taken together, private health facilities could be an attractive target for investment de-risking, but the most impactful solution would be for public facilities



Key takeaways

- Ideal investment opportunities would be in top right quadrant: significant investment need and high ability to pay
- However, lack of opportunities here shifts **ideal focus to private facilities** as they have the ability to pay for electrification, and demand is sizeable
- **Public facilities have a larger demand relative to private sector, both within tiers and overall,** but their low ability to pay makes them less attractive investment opportunities, that would require a **complex financing facility,** that is able to mitigate the risk of government non-payment
- De-risking mechanisms could be put in place for private Tier 3 facilities (those with the highest ability to pay) but many of these interventions will be focused on stabilisation of energy or reduction of costs rather, which may be less attractive to donor funders looking to maximize impact

Source: CrossBoundary analysis

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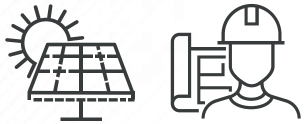
On the supply side, we focused on identifying models that developers have used to electrify health facilities and the de-risking mechanism needed to scale their activity



Supply of energy

Key question	Section in analysis to follow
What developers have been active in this space, and with what HF?	Active Developers
How are they currently servicing HFs?	Models
What risks are keeping them from increasing HF electrification work?	Supply Constraints
What financial de-risking options could unlock more supply?	De-risking Approaches

Key takeaways

- Because of the challenges of government as an off-taker, there are only a **select number of developers and OEMs that have engaged with HFE** in priority markets to date
- Much of this has been channelled through donor programs, where **developers had the systems paid for through capex grants**
- Where developers have tested other models, it is largely through other donor programs like Power Africa's HETA program, and the Shell Foundation HFE Pilots
- Much like other investments in distributed energy, macroeconomic risks, currency challenges, and underutilization are risks that developers face in HFE, but **by far the greatest challenge they identified was government as a purchaser of the energy**
- Developers access project financing from commercial investors for bankable projects, but noted that they **have utilized guarantees, tariff subsidies/performance based grants, and concessional debt capital** in their HFE projects to reduce risk where possible
- Regardless of the off-taker, **developers noted that some mix of the three instruments above are required** for them to scale their activities in the HFE space

There are several developers identified in each priority market that have been active in HFE – mostly funded through donor programs

Sierra Leone	Nigeria	DRC	Kenya	Malawi	Zambia	India
Sunlight	Havenhill Synergy Limited	nuru	AptechAfrica	ARC	Power Roll	SELCO
Winch Energy	Creeds Energy	Equatorial Power	W. Giertsen	zuwa	engie	orb energy
PowerGen	engie		PowerGen	DIFFER Community Power	Switch ACDC	Fourth Partner Energy
Power Leone	arnergy		ofgem	MEGA	SM	Oriano
We Care Solar	Blue Camel Energy		KEMSI Engineering		Muhanya Solar Limited	Minda
azimut360	Auxano Solar		Illumina		Vitalite	
Easy Solar	SAO Energy		DIFFER Community Power			
	EMONE Energy Solutions					
	AYO Tropical Technology Ltd.					

Across developers interviewed, the **vast majority of their HFE work was paid for by donor programs which funded capex investments through grants.**

To be sure, some larger developers have had success installing energy solutions that have been entirely financed and paid for by private clients, typically larger private hospitals.

Source: Interviews with developers and investors; CrossBoundary Analysis

The systems installed by developers can range from Pico-PV Systems[1] to larger Stand-Alone PV Systems, and can be owned by the HF, the developer, or some combination

System	Typical cost	Sales model	Ownership models
Pico-PV System  Pico-PV system in Malawi	A typical Pico-PV system in SSA will cost between \$500-\$1000. Pico-PV installed costs are \$3-5 per watt.	Systems are sold through developers directly to the end consumer. The consumer typically makes a small down-payment for the system and then pays off the system through the on-going fixed-fee charged for electricity in a pay-as-you-go model	Lease-to-own models are growing in adoption for Pico-PV systems. Ultimately the system is owned by the consumer once they have paid off the cost of the system through their tariff payments.
Stand-Alone PV Systems  Mini-grid in Nigeria	Off-grid Capex for Stand-Alone PV Systems is ~\$3000 per kilowatt. Installed capacity of these systems typically ranges from <1kW for a small grid to 40kW+ for a large system.	Developers design and build the system bespoke to meet clients' energy needs.	The system can be either transferred to the client upfront, transferred over time through a lease-back model, or retained by the developer in an energy-as-a-service (EaaS) model.

(1) Pico-PV systems are micro-power plants with integrated energy storage that provide electricity to individual buildings or households. Pico-PV systems typically provide DC power that can be used without any problems for lamps and mobile phone charging. They can also provide AC power for larger appliances, but this requires a converter

Source: UNDP; IRENA Image credits: KOIS; CrossBoundary

Developers face several financial and operational challenges when implementing projects, all of which are relevant to HFE projects

Non-Exhaustive

	Challenge	Impact	Description
Financial	Bankability		Although mini-grids closely mirror utility infrastructure, the fragmented nature of mini-grid users makes Power Purchase Agreements (PPA), typical in power projects, difficult to achieve.
	Affordability		Customers for mini-grids in rural communities are often the most vulnerable to economic shocks and have inconsistent streams of income resulting in low-willingness/ability to pay. This leads to underutilization.
	FX & Unstable Macroeconomics		Developers receive payment in local currency which is subject to fluctuation. Meanwhile, investors withhold hard currency financing to reduce exposure to unstable economies which can limit sector growth.
	Expensive Local Currency Debt		There is a high cost of local currency debt due to high perceived risk; commercial banks are not incentivized to lend to the sector without de-risking instruments.
Operational	Tariffs		Mini-grid developers struggle to agree on a viable tariff with communities or suffer underutilization resulting in reduced profitability and project viability overall.
	Approval Timelines		In some geographies, approval timelines for registration/permits can be lengthy, often slowing down mini-grid development.
	Poor Anchor Load Candidate		Rural HFs have low energy needs relative to minimum viability for mini-grid supply, and low or no ability to pay. As such, these HFs alone are not sufficient anchors for off-grid intervention (via mini-grid).
	Grid Encroachment		As the main grid expands, it threatens the viability of mini-grid installments by undercutting tariff prices and energy demand. Without suitable agreements, developers/investors become averse to installment to avoid stranded assets

When specifically assessing HFE projects, different types of healthcare facilities present different challenges for developers and their financing partners

Tier 1

- Developers noted **most Tier 1 HFS installations came through direct donor funded programs for HFE**, or through wider community electrification
- **Most facilities were best supplied by Pico-PV systems**, due to insufficient energy demand
- **Due to their small size and lack of energy demand, Tier 1 facilities are not sufficient anchor loads**[1], and so were simply a part of wider community electrification efforts

> The facilities we electrify in these more remote areas are **not big enough to be an anchor load**[2]. For many, they are **lacking the equipment and tools to first be most productive for patients**, and second to be an anchor consumer for larger systems.
>
> Nigerian Developer Interview

Tier 2

- Tier 2 installations tended to be in peri-urban areas, and had **limitations on the system size that could be installed due to land availability and, in some cases regulations about proximity to the grid**
- This limits the ability to offer connections to the surrounding community, as **often the systems do not have excess capacity**
- These **HFs tend to be public,** as they are referral facilities[2], dealing with cases that cannot be treated at smaller facilities

> These facilities tend to be in peri-urban/urban areas which **restricts the land availability** for the systems. They are also more likely to **be public facilities as they are referral centres from PHC** (both public and private).
>
> Nigerian Developer Interview

Tier 3

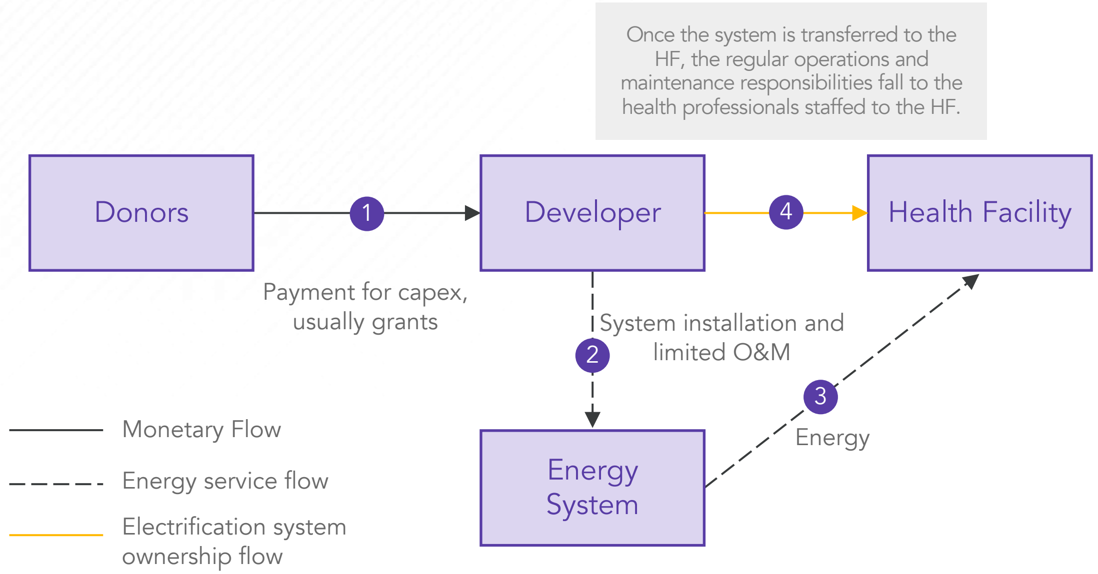
- Developers noted that hospitals (especially private) were in many ways **the easiest clients to service given their ability to pay**
- For the most part, these facilities are grid connected but rely on diesel for back-up generation.
- Developers noted it can be challenging to convince management that solar installations will be cheaper and more reliable over time than diesel
- **These facilities also have limited ability to front upfront capex costs**

> We have installed systems with large hospitals, both public and private. In either case, **they are cautious about signing long term PPAs**, but also want to limit their upfront capex investments. It can be a process to build trust.
>
> East African Developer Interview

(1) Anchor load defined as the main productive use customer of a mini-grid that takes up a consistent and significant portion of demand to justify the installed size of the mini-grid capacity; (2) Referral facilities are larger health facilities that have more sophisticated diagnostic and clinical infrastructure, better able to deal with more complex and acute patient needs.

Under most donor programs, developers operate under Build, Operate, Transfer (BOT) contracts – this limits the long-term viability of systems and scale of interventions

Typical Build, Operate, Transfer (BOT) structure



Donors can channel funding through the government ministry, but typically these interventions are done directly with developers with acknowledgement/partnership with the Ministry of Health

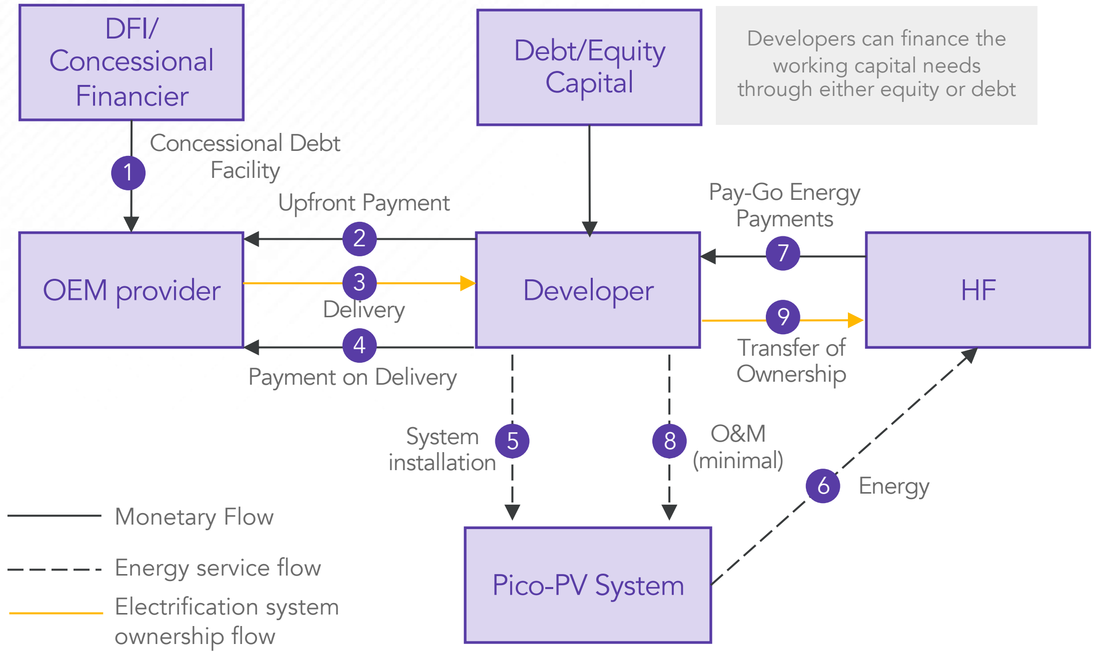
Lessons learned for HFE investment

- There is a broad acknowledgement among developers that a BOT model is not sustainable, as the assets are transferred to public facilities that do not have the technical know-how, nor the budget to maintain the system
- Donors are willing and able to pay for capex, and limited opex (usually a year) and then the system is meant to be transferred to the HF
- This structure is preferred by donors because it allows for expenditure in the current budget year, but fundamentally fails in terms of sustainability as maintenance is left to healthcare workers versus energy professionals
- The capex grants solve for one problem (inability to finance the system) but fail to solve for the longer-term problem which is the ability for public facilities to pay for the on-going maintenance costs
- While many facilities are paying for diesel, something as simple as the way appropriations are made at the government health budget level can mean that government institutions can only pay for diesel – not energy related services more broadly defined. This can mean that even if facilities wanted to buy other energy solutions, regulations are limiting their ability to do so

Source: CrossBoundary Analysis

When installing Pico-PV systems, developers have benefitted from non-HFE related concessional working capital facilities from OEMs to reduce upfront costs

Pico-systems working capital structure



For small private clinics that generate sufficient revenue these small Pico-PV system solutions can be appropriate electrification solutions, and you could also bundle asset financing into the offering to increase energy usage by the clinics.

Lessons learned for HFE investment

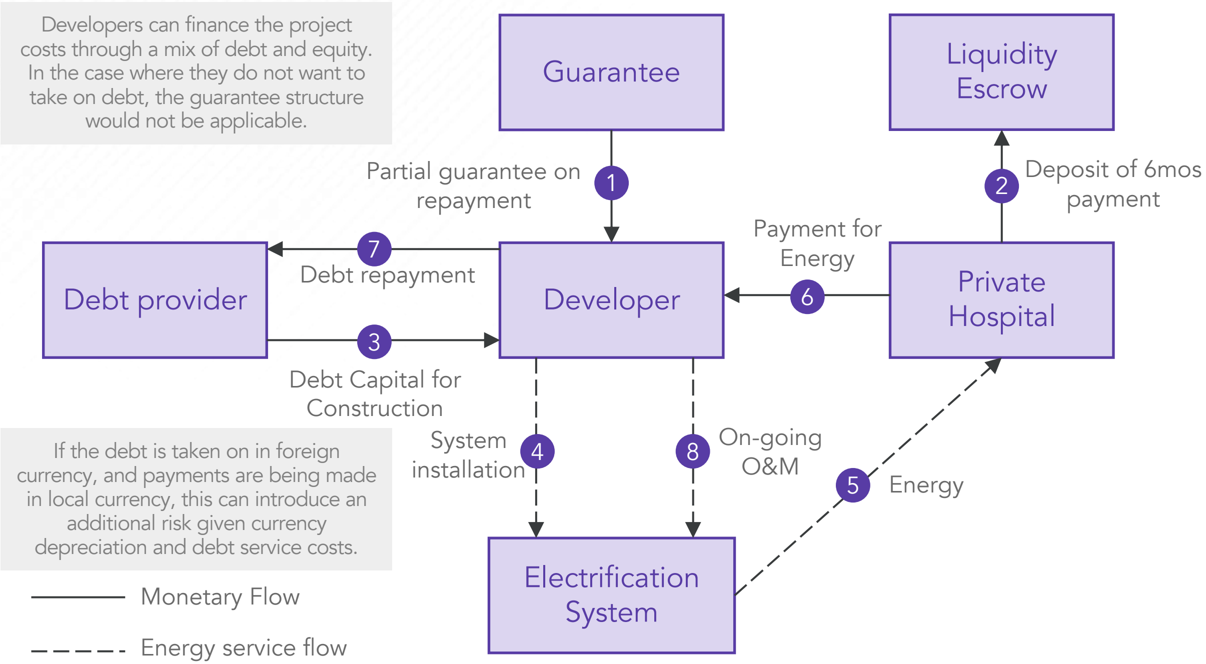
- As noted in the demand section, when electrifying Tier One HFs, many will only require a Pico-PV systems for their electrification needs
- As many of these facilities generate some amount of revenue through out-of-pocket payments in addition to any energy budget they have from government appropriations, they can in many cases afford to use Pay-As-You-Go systems[1]
- One OEM noted that some developers who have installed systems across communities have benefitted from the concessional working capital facility provided by the OEM through DFI partnerships
- This allows the developer to pay a smaller upfront payment for the system(30%), and then pay the remainder when installed(70%) – inverting the typical arrangement where they would invoice developers 90% upfront, and then 10% on delivery
- By reducing upfront costs to the developer, this allows them to unlock more working capital and reach a larger scale more quickly. As they are paying for most of the system close to the time of installation (and therefore payment from customers), it reduces their working capital burden.
- To be sure, this is not a HF specific working capital program, but something that has had wider impacts

(1) With Pay-As-You-Go Systems an energy service provider rents or sells solar PV systems in exchange for regular payments through mobile payment systems. In cases of non-payment, the service provider can remotely disconnect the service. The customer can be transferred the asset over time as they pay down the system cost through regular energy payments

Source: CrossBoundary Analysis

When engaging with hospitals, particularly private hospitals, developers have used IPP[1] models and leveraged both guarantees and liquidity escrows to de-risk projects

Typical IPP structure with de-risking mechanisms



A major advantage of the IPP model is that the HF does not have to take ownership of the system unless they would like to. In that case it can be structured as a lease-back model, but they may introduce upfront costs to the HF.

Lessons learned for HFE investment

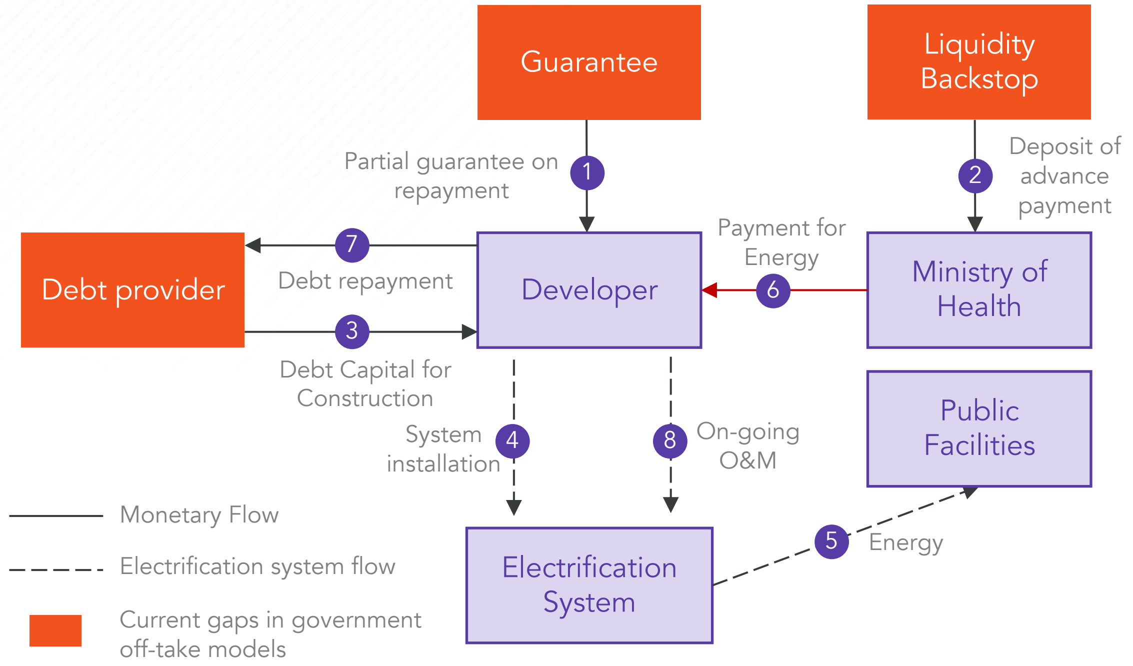
- Several developers noted successful IPP implementation with private (and some public) hospitals
- The main selling feature for the hospitals was showing immediate costs savings on energy relative to the cost of their diesel back-up and grid connection energy mix, and the fact that they did not have to own/operate/maintain the system themselves
- Developers noted strong relationships with commercial lenders for these projects, but that they do typically utilize two de-risking mechanisms – liquidity escrows and guarantees
- The liquidity escrow is typically 6 months worth of payments that is held in escrow that the developer can draw down in the case of default on the part of the hospital
- The guarantee is provided to them on the construction debt they take out with their commercial lenders
- The combination of these two mechanisms gives them the comfort that they will be able to 1) recover the capex investment from the system, and 2) repay their obligations to the lender
- This model hinges on the hospitals willingness to enter a long term PPA (purchasing energy in pre-agreed amounts) , as well as their ability to provide the upfront liquidity for the escrow – both of which can be very challenging

(1) Independent Power Producer

Source: CrossBoundary Analysis

While a shift to energy-as-a-service (EaaS) models is needed for public sector HFE, government non-payment exposure limits de-risking availability and investment activity

Government EaaS structure would require elements currently not available



Lessons learned for HFE scale-up

- While the EaaS model could in theory be scaled to include public facilities, it's scale up is limited by several factors
- In EaaS models an energy service company provides energy service for a fixed fee per kWh. Payment can also have different KPIs than would normally be included in IPPs, such as percentage of up-time
- First and foremost, most governments are unable to effectively budget and pay for energy services on a long-term basis, making entering into long term Power Purchasing Agreements an issue from the onset
- Even in a situation where a developer is willing to take on that risk, should the government default, there are backstop systems in place to replicate the benefits of the liquidity account utilized in the private sector example
- Because of the combination of the first two factors, guarantors are not willing to step in and act as a back-stop to the developer when seeking debt financing
- Without the guarantee, debt providers are not willing to underwrite what is effectively sovereign credit risk that is channeled through the Ministry of Health or the facility itself
- This makes the model unfeasible in the current environment as there is no capital available for investment, and few if any developers willing to take the risk of not at minimum recouping their capex investment

Source: CrossBoundary Analysis

Crowding private sector investment into HFE is not constrained by capital, but rather by the current paradigm dominated by BOT models versus EaaS models

Status Quo is Sub-Optimal

There is a recognition among donors and developers that the current BOT model does not work. **HFs or Ministries of Health are not best placed to own and operate energy systems. Regardless of the ability to pay for the system, BOT is a sub-optimal solution.** There is therefore a need to move to the energy as a service model where government (or private clinics) are paying a tariff (as they would with a utility) rather than owning the system. **This puts the financing risk onto developers but introduces contractual risk over the course of the power purchase agreement with either government or private sector purchasers.**

Developers Have Available Financing

Developers maintain strong relationships with commercial lenders and have sufficient capital to cover the equity costs for the projects they intend to develop that include HFs. In the course of our interviews no developer mentioned capital as their constraint in HFE – particularly with large private HF projects. **For bankable projects, they have capital available to be deployed.**

Investors Cannot Underwrite Off-take

The main obstacle to their activity in HFE is the lack of certainty around government payment and the thin margins in private facilities. An inability to be certain about payment limits developers' unwillingness to invest in the capex costs for systems. It also limits lenders' ability to underwrite the project due to uncertain revenues and keeps guarantors from stepping into the market due to high probability of default.

Developers are willing to go beyond the BOT model, taking on the risk of non-performance, but **procurement systems that are not set up for long-term contracts drive them to the current model**. Moving to EaaS provision in the private sector is also predicated on enabling scale to reduce costs for servicing those clients by developers. Scaled public procurement can enable this by increasing the total addressable market across the sector.

> "We have commercial lenders that are willing and able to finance our projects. **The issue isn't the availability of the financing, its in getting our lenders comfortable with uncertain government revenue.**
>
> *Nigerian Developer Interview*

> "EIB as an example is keen on providing concessional debt. **The reality is the risk is not in the financing.** There is no private sector appetite in HFE because of the off-take risk.
>
> *Developer active in East Africa Interview*

> "Even with these small systems, **they are effectively being subsidised by the community that it is being installed in.** Public facilities just can't afford the power.
>
> *Nigerian Developer Interview*

Source: CrossBoundary Analysis

A shift away from the BOT model to an EaaS model when interacting with public facilities / government will require long-term agreements, donor support, and capital

Donor and Government Preferences Shape the Market

From our conversations with developers, donor stakeholders, and investors, **the current BOT model based on donor capex is not a sustainable solution.** From interviews, we gathered that one of the biggest **challenges in shifting away from this model is donors are much more comfortable purchasing power systems than they are paying for long-term services.** Given donors play a significant role in health systems financing, both through their own stand-alone programs and also through funding channeled through government, **it is as much a shift from within donors as within partner governments that is required.**

Investment is predicated on ability to pay

As shown on the EaaS diagram slide, in order to move to a service-based model there should be a replication of the types of de-risking mechanisms that are put in place at the project level (or in other energy systems like the Southern Africa Power Pool). **Without backstops like liquidity pools and guarantees on sovereign default, the private sector developers will not be willing to step into the market.**

There will be no one sized solution

To be sure, **these solutions will be very dependent on the country of interest,** but across the interviews with developers operating in the priority markets the overarching concern was government repayment risk – which given the current fiscal situation of most developing **country governments will require donors to consider longer-term service-based solutions.**

> "Through a number of donor programs, we have been contracted to simply be an EPC. **We build the system and at most we provide O&M for a year and then we have to walk away.** It's sad because **we know the system can't be maintained,** but we can afford to service it any longer either.
>
> *Nigerian Developer Interview*

> "**In three successive programs we have been asked by the government to electrify the same list of HFs.** We build the systems, transfer them to the government, and they aren't maintained. Doctors shouldn't be expected to maintain energy systems.
>
> *Donor Interview*

> "ESCO models, Lease-to-Own, they can all work. **But someone needs to be in the middle taking the government risk off the table.** Right now, it's all capex and opex grants, and we end up turning over the assets and know they won't be utilized
>
> *Developer active in East Africa Interview*

Source: CrossBoundary Analysis

O&M costs must also be considered, especially when assessing the feasibility of electrifying stand-alone clinics in remote areas versus as part of a wider electrification effort

The O&M cost of standalone electrification for health clinics is prohibitive…

- The economics of getting O&M teams out to site for remote rural groups of customers is challenging. This cuts across both public and private facilities
- The costs for getting O&M teams out to site for a single remote rural customer (e.g. a stand-alone HF) can fundamentally challenge the economics of that system

Example of O&M Challenge for stand alone solutions

- In a stylized example from East Africa, mobilization costs for an O&M team to go out to a rural energy system installation are typically US$1,000 – this is inclusive of transportation, fuel, per diems, salaries, etc.
- Therefore, even if something as simple as a $1 fuse blows, it costs 1,000x to fix it by sending a technical team

…but can be dramatically reduced by electrifying health clinics as part of a wider electrification effort in rural areas

- If those systems were being serviced by a community level mini-grid (should this be the least cost solution), the costs of this O&M drop considerably
- Now if a $1 fuse blows, it's not necessary to spend $1,000 sending a technician out. A local onsite agent from the mini-grid operator can carry out simple repairs
- For O&M servicing that requires a trained technician, the fixed costs of regular O&M visits can be shared across 100+ customers, versus being borne by just one customer


Engineering teams in Zambia and Nigeria

Critically, this is an issue for both public and private facilities in these remote areas. In this way, aggregation of demand is a critical intervention to ensure that the economics of electrifying the HFs are sustainable in the long term.

Source: CrossBoundary Analysis
Photo credit - CrossBoundary

Once the off-take has been solved for, to mitigate financial risks developers stated a preference for guarantees, but a menu of de-risking tools is required to scale-up engagement in HFE

Setting issues of off-take aside, developers have used a suite of de-risking tools to engage in HFE (as shown in examples previously). Developers expressed the rank order preference for:

	Risks being mitigated	Benefits
1 **Guarantees**	Guarantees enable developers to limit their exposure in the event of non-payment by their off-take counterpart, should they be using debt financing for the project.	Guarantees mitigate the risk that the developer cannot repay loans should the customer default. This enables them to ensure solvency should projects not perform.
2 **Performance-linked grants**	Performance-linked grants mitigate the risk that the payor cannot cover the full cost of energy produced in a service model where the client is paying a tariff.	The grants gives developers increased certainty on capex payback should they deliver services, and keeps the project performance in their locus of control. These subsidies can be sun-setting, reducing over time as the initial investment is recouped.
3 **Concessional Debt**	Reduces the overall costs of the project, therefore reducing the time for the project to breakeven. And can be subordinated in the capital structure to transfer risk to parties best able to bear it.	Concessional debt for projects simply allows them to reduce the pay-back period of the project. It does however still leave them exposed in the case that their counterpart defaults on payment and leaves project success out of their locus of control.

These de-risking mechanisms allow developers to either: **limit default risk, increase certainty on breakeven, or reduce the time to breakeven**

While there is a preference for guarantees, it is not a panacea. **For many projects there will be a need for all three mechanisms.**

This simply constitutes the beginning of **a menu of options** that could be used to de-risk projects once the revenue model is clear.

> "We have used all three of these tools in projects. It's not a one size fits all solution, and sometimes we need all three to make a project work.
>
> *Nigerian Developer Interview*

Source: CrossBoundary Analysis

Table of Contents

With an understanding of the financial de-risking instruments developers need in HFE, we can now turn to understanding where gaps in the capital market are relative to that demand

Financing for suppliers

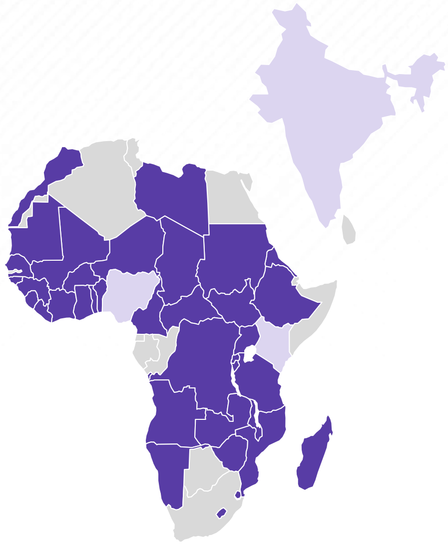
Key question	Section in analysis to follow
What has been the main source of funding for HFE and what gaps exist?	Capital map
Among donor funding, how has this capital been deployed and by whom?	Donor capital
Among private capital, what form has this taken?	Private capital
What potential financial instruments/mechanisms could be employed to close these gaps?	Potential instruments

Key takeaways

- The main form of capital being provided to HFE has been donor funding, which has mostly taken the form of capex grants
- There has only seemingly been a recent shift even among donors in the HFE space to move beyond a Build, Operate, Transfer model to begin exploring results-based financing mechanisms that are linked to service provision
- What little capital has been provided outside of donor/philanthropic capital been through DFI investments, which have also been de-risked through concessional capital/grants provided by their government shareholders
- Given the nascency of the space from a private capital perspective there are certainly opportunities to have de-risking mechanisms step into the market, but such mechanisms will likely need to focus on even the most risk tolerant, impact focused private investors
- To be sure, there are mechanisms that investors and stakeholder have begun to ideate on and develop but many of these options are still in early stages of development – but there are other like mechanisms targeting general electrification that could be augmented for HFE

The vast majority of capital provided to HFE has been in grants, with some small de-risked DFI investments testing new models

Activity across Africa & India



Grants only
Grants & other financing

	Grants	Debt	Guarantees
Average investment size: >$10M	Power Africa, GIZ, World Bank Group, Gavi, The Global Fund, UNDP, USAID, Swiss Agency for Development and Cooperation, German Cooperation, UKaid, World Health Organization, European Union	There is a significant gap in the capital market for project finance debt and guarantees	
Average investment size: <$10M	SELCO Foundation, Shell Foundation, KFW, Global Energy Alliance for People and Planet, USTDA, Unicef, Norad, Probitas, Village Health Works, Children's Investment Fund Foundation, OVO Foundation, eau vive, United Nations Foundation, World Vision, RESOLVE, IRENA, Agència Catalana de Cooperació al Desenvolupament, Catalyst; Grants in kind: We Care Solar, Orange, Little Sun	FMO Entrepreneurial Development Bank, NDF Nordic Development Fund, NCF, Swedfund, Norfund, EDFI ElectriFI	Debt currently being provided through blended mechanisms is one off

Grants in kind

Most HFE capital is donor grants channelled through broader electrification programs

At-risk capital has been provided by DFIs who themselves were de-risked

Major guarantors are absent

NB - List is non-exhaustive and to be updated through additional market research

Source: CrossBoundary Analysis

Donor grant activity is the dominant form of capital being directed specifically at HFE, as commercial and blended finance solutions remain nascent

To map capital flows to HFE, we leveraged databases from SEforALL, DFI project databases, and conversations with developers and investors

We expect there will be financiers that are providing capital to developers which may not be readily apparent, so we have included a wider off-grid capital map of potential investors as well that could be included in a de-risking mechanism

Of the projects, programs, and investments mapped:

- ~$175M-$250M invested in HFE by donors in the seven analyzed countries – 95% of which is capex grant focused
- Only 7 identified HFE projects include results based financing or blended finance
- Vast majority of private finance is channelled through developer relationships, and not specifically targeted at HFE

Source: Powering Healthcare Intervention Database, 2022, SEforALL; CrossBoundary Analysis

Across all priority markets there exists a significant gap between the identified investment need and the capital that has be allocated to HFE – most of which is capex grants

	Sierra Leone	Nigeria	DRC	Kenya	Malawi	Zambia	India
Identified investment need	$11M	$805M	$428M	$235M	$16M	$93M	$1,0160M
Approx. donor funding deployed[1]	$5M	$83M	$13M	$10M	$14M	$1M	$52M
Funding gap	**$6M**	**$721M**	**$415M**	**$225M**	**$2.6M**	**$92M**	**$964M**
Funding gap relative to health budget	1.7%	4.9%	21.1%	5.2%	0.4%	9.1%	1.2%

In Sierra Leone and Zambia, the funding gap of HFE relative to the health budget allocated to non-recurring spending exceeds 200%, in Kenya it exceeds 100%, highlighting the limited available funds for HFE.

(1) This includes all identified donor projects where funding for standalone HFE alone was disclosed (i.e., not part of larger programs where HFE was a smaller component), and approximations based on all identified donor projects where HFE was one component, and direct HFE funding was not disclosed. This number is derived from allocating an estimated percentage of funding allocated to HFE in broad electrification/health programs where HFE was an identified component. Estimates for each country can be found in the country profiles

Source: CrossBoundary Analysis

There remains a significant investment gap of at least $2.35B in the countries analyzed – and conservatively extrapolating globally we estimate a gap of at least $3.6B

$2.6B
Estimated investment need for HFE across countries analyzed

~$175-250M
Estimated investment in HFE across countries analyzed

$4.9B
World Bank and WHO estimates of investment need for HFE globally

~$1.25B[1]
Conservative estimate of HFE investments globally based on countries analyzed

Based on the demand and investment estimates **across countries of analysis, we estimate a funding gap of at least $2.35B.** This is a conservative estimate.

By conservatively taking **5x the amount of funding estimated in the countries of analysis** for this study, there would still be a funding gap of at least **$3.6B globally for HFE.**

1 – This represents a conservative estimate and is not based on collection of data for all countries globally. As the countries of interest for this report constitute six of the top ten most active countries for donor programs in HFE, a conservative multiple of 5 or greater could be applied to the estimated funding in the target countries to approximate a global investment total.

Donor funding is concentrated in capex grants in particular for Tier 1 facilities, with most of this funding being channelled to government health facilities

Grants for capex

Activity
- 95% of projects had a focus on providing capex – both in terms of provision and installation of renewable energy equipment
- In some instances, capex funding is provided directly by developers, through provision and installation of their solar solutions

Example
- USAID Power Africa Off-grid Project has dedicated capex grants for HF electrification
- Schneider Electric provided containerized microgrids to primary health centres across Kaduna State in Nigeria

MOST DONOR ACTIVITY

Grants for opex

Activity
- Only ~5% of projects in Africa included dedicated opex financing
- Capital is either provided to engage external companies to complete O&M, or for in-house capacity building and training for O&M

Example
- RESOLVE partnered with Orange for O&M support for HealthGrid Sierra Leone
- UNDPs Solar4Health offers O&M training and capacity building

Results-based financing

Activity
- Only 4 donors have used RBF to facilitate HFE investment
- In all instances, the RBF was provided to developers for delivery of services

Example
- ENDEV implements RBF across portfolio
- GIZ's GBE program

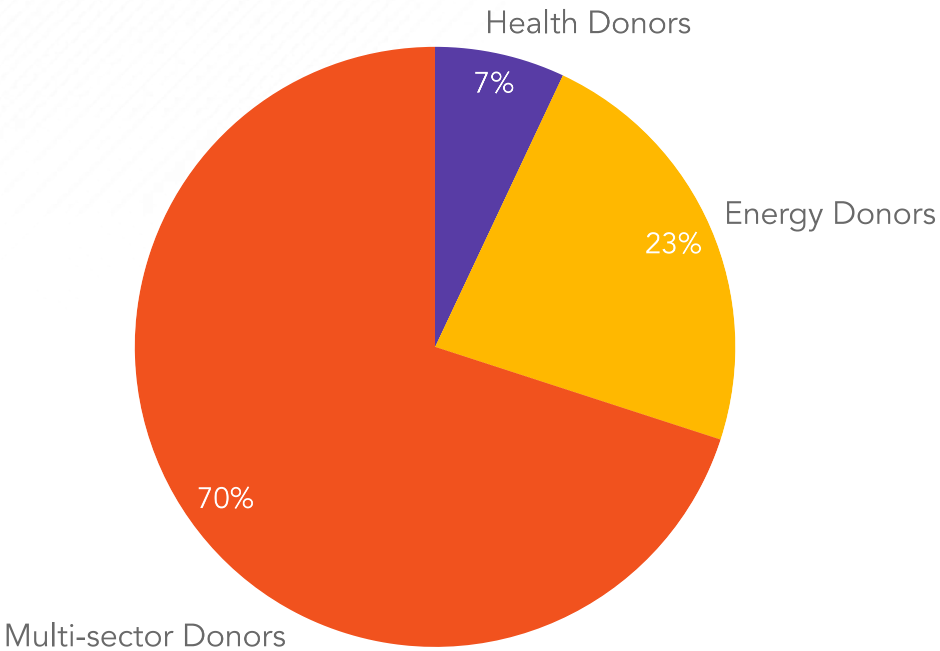
Key takeaways

- Outside capex grants, there is limited donor activity in opex financing, RBF and blended finance, with most of this nascent activity in Nigeria, Kenya, and India
- Stakeholders noted the challenge of donors focusing on installation of systems versus consistent and sustained delivery of energy
- This is likely a consequence of some donor success metrics which focus on shorter term outputs versus longer term outcomes, which drives intervention decision making

Source: Powering Healthcare Intervention Database, 2022, SEforALL; CrossBoundary Analysis

Most investment into HFE is funded through multi-sector donors, with only The Global Fund and GAVI as active health sector donors identified in the target markets

Funding for HFE by donor type, %[1]



Key takeaways

- **Most donors** investing in health facility electrification **are multi-sector players**, such as the World Bank, UNDP and FCDO
- **Energy donors almost make up ¼ activity directed towards health facility electrification** in the target markets. The most active energy donor was Power Africa
- Health donors are relatively inactive in the health facility electrification space, making up less than 10% of the identified programming
- **The only active health sector focused donors** in the target markets for health facility electrification are **Gavi and the Global Fund**

1. Split based on activity as funding allocation was not always disclosed

Source: Powering Healthcare Intervention Database, SEforALL, 2022; CrossBoundary Analysis

Most active donor programs have been focused on capex grants for HFE, but are now seeking to move into more sustainable electrification efforts

Which donors are most active in HFE?

Donors (by level of activity): The World Bank; USAID (From the American People); Green Climate Fund; UKaid (from the British people); giz; IKEA Foundation; Gavi, unicef[4]

Largest established programs: Power Africa; The World Bank Country programs; UNDP Solar for Health; endev

Where are donors most active?

Most active countries, by number of HFE projects: Nigeria, Uganda, Kenya, India, Malawi, Sierra Leone, Zambia, Ghana, Ethiopia, Mozambique, Liberia | DRC

DRC falls far outside top 10 most active markets with only 3 projects

What new models are being tested?

World Bank ROGEAP[1] pilot

Pilot program in Nigeria & Niger to electrify 40 HFs and schools. Currently collaborating with MIGA to create a sub-national de-risking mechanism for payment from government, and developing a line of credit for energy companies servicing public institutions including HFs

DIFFER – Differ Community Power[2]

Piloting a lease-to-own delivery model with complete "plug and play" power kits to power small systems. DCP handles full value chain from developing, building, owning, operating, maintaining with payments on a pre-agreed installment plan.

UNDP Performance PPA – ZM/MW[3]

'Performance based PPA' model in which the PPA is subsidized through donors and co-financed by the government. The model includes a backstop trust fund in case government does not pay, providing reliable off-take for the private sector and encouraging their participation

(1) Regional Off-grid Electrification Project; (2) https://www.seforall.org/system/files/2021-12/ Procurement-to-Performance-SEforALL.pdf (3) Other target markets include Namibia, Zambia and Liberia (4) Gavi/UNICEF focused on medical cold chain to date but approach is evolving

(2) Source: CrossBoundary Analysis

Across priority markets, the World Bank is the largest funder, with FCDO being most active in terms of number of projects at 15

	THE WORLD BANK	USAID / POWER AFRICA	Foreign, Commonwealth & Development Office	UNDP	giz	IKEA Foundation
Number of projects	4	8	15	2	2	1
Known Funding	UD	$7M	$43M	UD	UD	$52M
Estimated Funding	$61M	UD	$6M	UD	UD	UD
Total Funding	$61M	$7M	$49M	UD	UD	$52M
High-level profile	• Largest funder in priority markets • Active in Nigeria, Kenya, DRC & Sierra Leone • Largest program is Nigeria Electrification Program	• Active in Nigeria, Malawi and Zambia • Also launched the Health Electrification and Telecommunications Alliance with the aim of electrifying 10,000 health facilities	• Most active donor by number of programs • Active in Nigeria, Malawi and Sierra Leone • Largest program is Solar Nigeria Program	• Testing new models in Malawi and Zambia around PPAs for health facilities • Solar 4 Health program active in Malawi and Zambia	• Green People's Energy initiative active in Zambia	• Significant funder in India • Partnering with Ikea Foundation to electrify 25K public health facilities across India

Source: Powering Healthcare Intervention Database, SEforALL, 2022; CrossBoundary Analysis

The limited repayable capital invested in HFE has been deployed by DFIs, and investments have been provided through concessional capital windows

DFI investment into HFE has been small, one-off investments, that are de-risked through donor activity

Investor	Recipient	Size and instrument	Description
FMO Entrepreneurial Development Bank; Ministry of Foreign Affairs of the Netherlands; Access to Energy Fund	d.light	$100K loan	The aim of the project was to electrify 300 off-grid private clinics across rural Kenya. The investment was made available through FMO's Access to Energy Fund, which is a concessional window capitalized by the Dutch Ministry of Foreign Affairs.
Norfund; Norwegian Ministry of Foreign Affairs; Frontier Facility	arnergy	$2M loan	Norfund provided debt capital to Arnergy through their Frontier Facility, which is a concessional window capitalized by the Norwegian Ministry of Foreign Affairs. While not solely directed at HFE, Arnergy does have a focus on HF electrification.
NDF Nordic Development Fund; NCF Nordic Climate Facility Initiative by NDF	DIFFER	$700K repayable grant	The project was meant to develop an innovative and sustainable financing vehicle that enables impact investors and debt providers to finance solar electrification of health clinics in Kenya. Nordic Development Fund provided a grant through the Nordic Climate Facility to Differ to test the investment structure.

Source: CrossBoundary Analysis

Commercial off-grid investors could be brought into HFE through their relationships with developers should solutions be built to de-risk investment

Active investors in off-grid solar

List is non-exhaustive and to be updated through additional market research

Source: CrossBoundary Analysis

As noted in the supply section, developers interviewed maintain relationships with commercial investors which will not be focused on their individual and on-off work in HFE

These financiers will need to understand how projects are being de-risked in order for them to step into the market – either through guarantees, subsidies, or other approaches

To be sure, there is capital available should the challenges addressed in the previous sections be addressed and mitigated

There are blended finance vehicles in market that have a focus on distributed energy – but for them to invest they need the solutions to make projects bankable

Concessional capital has a role to play in investing in distributed energy in priority markets, but projects must be bankable

- Concessional capital has a key role to play in bridging the funding gap in decentralized energy (and HFE more specifically)
- Blending concessional and commercial capital can drive down the ultimate costs of installing energy systems that will meet the needs of consumers in remote areas, making the cost of energy more affordable and attainable for these customers.
- This can come in the form of investments into developers themselves, or through project financing to scale portfolios of projects.
- **There are several vehicles in market that are addressing this problem, but none have been actively engaged in HFE** – getting them involved in the HFE space requires bankable projects which remain challenging for the reasons outlined in the last section
- **These funds typically target an IRR of 6 -10% on a project basis**
- To be sure, projects may benefit from additional de-risking mechanisms, but there are capital providers that have a blended finance structure active in the market that would be ready and able to jump in should that challenge be overcome in HFE

Examples include:

mirova | SUNFUNDER

Sunfunder manages three blended finance vehicles focused on investing in solar companies working in Africa. These include the Solar Energy Transformation (SET) Fund, the Kenya Off-Grid Solar Access Project (KOSAP) debt fund, and the Beyond The Grid Solar (BTG) Fund.

CROSSBOUNDARY ENERGY ACCESS

CrossBoundary Energy Access (CBEA) is Africa's first project finance platform for mini-grids. CBEA finances and owns solar mini-grids for electrification across the continent, utilizing blended finance structures. CBEA has raised capital from ARCH, Bank of America, and Microsoft Climate Innovation Fund.

REPP managed by camco clean energy

The Renewable Energy Performance Platform (REPP) invests in small-scale distributed renewable energy across Africa. REPP had contracted 38 projects spanning 16 countries across Africa and has employed a number of different technologies in those installations. REPP has been capitalized with funding from FCDO and EIB.

Source: CrossBoundary Analysis

Large commitments have been made by some of the most active donors to electrify >98K facilities[1], offering potential areas for partnership

	The World Bank	USAID / Power Africa	UNDP	Gavi / unicef / World Health Organization	IKEA Foundation
Commitments	• DARES[2] program to electrify 100K schools and health facilities by 2026 • ESMAP to allocate $10M to include health facility electrification in existing World Bank programs	• Health Electrification and Telecommunications Alliance (HETA) initiative to electrify 10K health facilities by 2030	• Piloting a PPA/service based model to electrify health facilities across Africa • Piloting an Islamic finance compliant endowment structure in Cameroon, Mauritania, and Senegal to finance HFE	• Piloting a model that can be scaled to electrify 10K facilities per year leveraging the CCEOP[3] platform. The pilot will electrify 2.6K facilities	• Provide energy to 25k health facilities across 12 states by 2026
Partners	IFC; MIGA Multilateral Investment Guarantee Agency, World Bank Group	Abt; bechtel.org; RESOLVE; orange	IsDB البنك الإسلامي للتنمية Islamic Development Bank	Bill & Melinda Gates foundation; PATH; Clinton Health Access Initiative	SELCO Foundation

Collectively **these programs are seeking to electrify 98K facilities across the target markets**. They may present an opportunity for partnership should they support and seed new models for investment into HFE.

1. Assumes 50% of World Bank commitment covers health facilities 2.Distributed Access through Renewable Energy Scale-up Platform 3. Cold Chain Equipment Optimization Platform

Sources: Powering Healthcare Intervention Database, SEforALL, 2022; CrossBoundary Analysis; https://www.worldbank.org/en/events/2022/11/15/partnerships-to-scale-up-energy-access

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When considering investments in an EaaS model, various de-risking instruments could potentially be utilized depending on the type of ultimate payor

Risk	Potential mechanism	Target of intervention	Type of commitment	Enabling conditions required	Potential challenges	Potential partners
Sovereign Credit Risk	Donor-supported liquidity pool for energy services	Provides certainty to developers that there is sufficient funding available to pay for contractual obligations by the government	Disbursed commitment	• Donor willingness to place funds in a vehicle for services over a longer timescale • Mechanism for enforceability, and government buy in that creates • Multilateral involvement	• Gov't ability to pay into the structure • Moral hazard of them not paying and or gov't default	Bill & Melinda Gates foundation; World Bank Group
	Sovereign credit guarantees for project debt finance	Should the government default on their obligations, allows the developer to be at least partially covered for any debt obligations taken on for project financing	Contingent commitment	• Backstops to government ability to pay • Monitoring tools for clear adjudication of performance against contractual obligations	• Gov't willingness to pay • Donor support given need for backstop	MIGA
Private Credit Risk	Guarantees to developers for debt project finance	Should the HF default on their obligations, allows the developer to be at least partially covered for any debt obligations taken on for project financing	Contingent commitment	• Commercial lenders willing to lend to projects • Guarantors willing to take on the credit risk of private HFs	• Ability to aggregate enough projects to reduce origination/transaction costs	GuarantCo Guarantees For Development; InfraCredit
	Concessional loans to developers for debt project finance	Encouraging senior secured lenders to enter into projects by taking a subordinate position, or providing below-market rate debt to developers	Disbursed commitment	• Commercial lenders willing to take senior secured • Availability of risk tolerant capital	• Ability to aggregate enough projects to reduce origination/transaction costs	Shell Foundation; The Rockefeller Foundation

Assumption made that obligations are in local currency, and that any foreign currency expenses are hedged

Source: CrossBoundary Analysis

For investments targeting facilities best served by Pico-PV systems, financing could be provided by OEMs to developers – ultimately reducing working capital costs

Risk	Potential mechanism	Target of intervention	Type of commitment	Enabling conditions required	Potential challenges	Potential partners
Liquidity Risks	OEM Concessional working capital facility for developers targeting HFE	Reduction of upfront costs to the developer, allowing them to unlock more working capital and reach a larger scale more quickly. As they are paying for most of the system close to the time of installation (and therefore payment from customers), it reduces their working capital burden. This can also eliminate or reduce any upfront costs of system installation for the customers.	Disbursed commitment	• Developers willing to target PHCs given their limited ability to pay • Ability to integrate PHC targeting into broader community electrification efforts by developers	• Ability to pay for assets by the PHC • Public sector entity involvement in repayment	d.light OKRA

It is important to note that the ultimate ownership of the system then sits with the end customer in these models, and therefore requires a differentiated view of financing

Source: CrossBoundary Analysis

For private facilities that do have an ability to pay, demand aggregation and time-bound incentives can be powerful tools to encourage uptake

Risk	Potential mechanism	Target of intervention	Type of commitment	Enabling conditions required	Potential challenges	Potential partners
Lack of Demand	Support to identify private facilities and explain benefits of a solar energy installation	Developers noted that one of the largest transaction costs was identifying the potential facility partners and explaining the benefits of the solar installation to them. Having programs in place to reduce the sales time would enable developers to spend more time actually installing solutions.	Disbursed commitment	• Developers willing to target private facilities given their at times limited ability to pay	• Ability to pay for assets by the private facility being targeted	Global Energy Alliance for People and Planet
	Time-bound subsidy to incentivize action	Related to the issues above, developers noted that time-bound grants (where subsidy was only on offer within a given fiscal year for example) helped in the sales process as it focused facility management and gave them a deadline to focus the decision making around the installation of a solar system. This can be connection subsidies or tariff subsidies.	Disbursed commitment	• Willingness of donors to pay for targeted subsidies to private facilities	• Willingness for the facility management to enter either long term PPAs, or to purchase systems	

Source: CrossBoundary Analysis

Distributed renewable energy certificates (D-RECS) could also be used to reduce the costs borne by end customers – however this has yet to be tested in HFE

D-REC INITIATIVE

Decentralised Renewable Energy Certificates (D-RECs) are electronic records that verify the source of electricity used, allowing electricity buyers to make reliable claims about this energy.

These certificates can be purchased by corporates that are seeking to offset their global emissions. The purchase revenues then flow back to the project developer.

Electricity is generated and distributed to off-takers

Data about the electricity generation is then transmitted to the D-REC platform and once verified and validated a D-REC is created

The D-RECS can be purchased by corporations, and the revenue from the sales flows back to the project developer

This additional source of revenue can improve the overall rate of return of the project

While an interesting and promising intervention to increase revenues, and could be targeted for developer's HFE efforts, this remains untested

Source: CrossBoundary Analysis

De-risking mechanisms will need to be tailored to the risks associated with the end customer, and/or the project structure – there is no one sized solution (1 of 3)

Examples	Potential mechanism	Risks mitigated	Description	Potential partners
$20M need for public facilities in Malawi	Donor-supported liquidity pool for energy services	Default by government for services rendered under a tariff-based contract	UNDP is exploring the use of an endowment structure that could be be utilized for the purpose of providing funding to energy as a service companies, which will further meet the energy needs of health care facilities in peri-urban and rural areas. Once the endowment is established by the recipient government, it can channel its resource to fulfil its obligations towards the energy service providers. The shift towards this delivery model will give HFs access to energy, without having to incur upfront investments and have a reliable long-term source of funding, as the income generation time frame from the fixed assets of the endowment will match the time frame of the energy companies.	UNDP
$100M need for private Tier 2/3 facilities in Nigeria	Guarantees to developers for debt project finance	Limits exposure in the event of non-payment by their off-take counterpart	Given the significant need among private hospitals in Nigeria, and the availability of commercial bank financing, an off-balance sheet vehicle could be capitalized for a specialized guarantor link InfraCredit. From this vehicle they could then write guarantees for developers looking to undertake energy as a service contracts with private hospitals. The level of capitalization for the vehicle will depend on the estimated probability of default for hospitals and the number of loans that would be expected to be undertaken. This could also be achieved by a counter guarantee provided by a DFI/Government guarantor like DFC or SIDA.	InfraCredit Securing Infrastructure Finance

Source: CrossBoundary Analysis

De-risking mechanisms will need to be tailored to the risks associated with the end customer and the project structure – there is no standard solution (2 of 3)

Examples	Potential mechanism	Risks mitigated	Description	Potential partners
$630M need for private facilities in India	Demand aggregation, bank guarantees, and potentially concessional debt	Limits exposure in the event of non-payment by their off-take counterpart, and reduced costs	The Global Energy Alliance for People and Planet (GEAPP) is in the initial phases of deploying a program that would support developers across several target states in India. They are first supporting demand aggregation – identifying potential target facilities in the private sector (mostly hospitals) and educating the management on the benefits of solar installations. Once management is committed, they will be linked to developers. They are then looking to partner with financial institutions for the financing of the projects and will provide guarantees to approved project portfolios. As needed, they will also layer in concessional debt to either developers or the health facilities where needed to bridge financing gaps.	Global Energy Alliance for People and Planet
$240M need for public facilities in DRC	Performance-based connection subsidies for metro-grids in DRC, combined with government payment backstop	De-risks projects due to reduced capex investment, and mitigates government default risk for services rendered under a tariff-based contract	GEAPP has already partnered with the Government of DRC and other donors to unlock a planned $1B worth of investment to support the metro-grid sector in DRC. Given the focus on dense urban areas where metro-grids are being installed, there could be an opportunity to build on the work that the government is doing to tender metro-grids and offer additional connection subsidies for health facilities connected to these systems. This would eliminate or significantly reduce the additional up-front cost of those connections to developers incentivizing them to add these customers. The additional de-risking mechanism that would be needed however would still be a backstop to government facility off-take. This could be done in partnership with GEAPP, the World Bank, and others as well.	Global Energy Alliance for People and Planet; THE WORLD BANK

Source: CrossBoundary Analysis

De-risking mechanisms will need to be tailored to the risks associated with the end customer and the project structure – there is no standard solution (3 of 3)

Examples	Potential mechanism	Risks mitigated	Description	Potential partners
$18M need for private Tier 1 facilities in Kenya	Concessional working capital facility for Pico-PV OEMs targeting HFE	Reduced upfront costs to the developer, reducing working capital burden	EDFI's ElectriFi Initiative provides concessional working capital loan facilities to Pico-PV OEMs that they can make available to developers should developers meet certain impact criteria in terms of marginalized populations. A similar structure could be provided to OEMs that are supporting developers that have HFE as some element of their projects in off-grid communities in India.	EDFI ElectriFI

Source: CrossBoundary Analysis

In Task B, KOIS will develop a menu of options for potential de-risking mechanisms from this initial long-list of opportunities

KOIS
CARING FINANCE

Task B

Investigate and design suitable financial interventions for de-risking investments in HFE, with the goal of enabling increased public-private partnerships and catalysing the deployment of at-risk capital

The de-risking options identified in Task A constitute a starting point from which KOIS will further refine and identify potential interventions to catalyze the deployment of at-risk capital into HFE

Donor-supported liquidity pool for energy services	Sovereign credit guarantees for project debt finance	Guarantees to developers for debt project finance	Concessional loans to developers for debt project finance
Time-bound subsidy to incentivize action	OEM concessional working capital facility for developers targeting HFE	Support to identify private facilities and explain benefits of a solar energy installation	D-RECS for HFE

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Country overview | Sierra Leone

Sierra Leone overview

Total population:	8.4M
Rural population:	57%
Health facilities:	1,404
Electrified facilities:	62%
On-grid cost/kWh:	US$0.109

Government and donor HFE Programs

Amount	10 donor programs, 5 identified government programs
Largest	Insufficient disclosed funding to determine
Smallest	Insufficient disclosed funding to determine
Programming Gaps	Government as the only provider of healthcare impedes private sector participation given govt inability to pay

Sector planning

National Renewable Energy Action Plan
Aims to increase renewable energy share in the energy mix, through renewable off-grid solutions for rural areas, grid-connected renewable energy projects, and the development of a supportive policy and regulatory framework.

National Energy Policy
Promotes sustainable development of the energy sector, with goals such as increasing access to affordable and renewable energy services. It also focuses on regulatory frameworks, capacity building, and energy data management.

Energy Act 2011
Regulates the generation, transmission, distribution, and supply of electricity.

Regulatory environment

- Electricity Act (2011) regulates the generation, transmission, distribution, and supply of electricity. It was established to manage the country's electricity generation and transmission infrastructure. As well as the licensing of electricity suppliers, the establishment of electricity tariffs, and the protection of the rights of consumers. Additionally, the Act promotes the use of renewable energy sources and encourages private sector investment in the electricity sector.

Government fiscal position

- External debt: US$1.4B
- Budget deficit: -11%
- Current BoP: -US$276M
- External debt (% exports): 294%

480	GDP per capita, US$
43	YoY inflation, %
3.7	Unemployment, %

Key players and ongoing programs

Sierra Leone Energy Access Project

USAID FROM THE AMERICAN PEOPLE

Foreign, Commonwealth & Development Office

UNOPS

Incentive schemes

TAX

Tariff subsidy

Tax incentives

- Renewable energy project auctions to encourage investment and activity into the renewable energy sector

Source: Sierra Leone Ministry of Health, World Bank, Economist Intelligence, International Monetary Fund, Statista, SEforALL

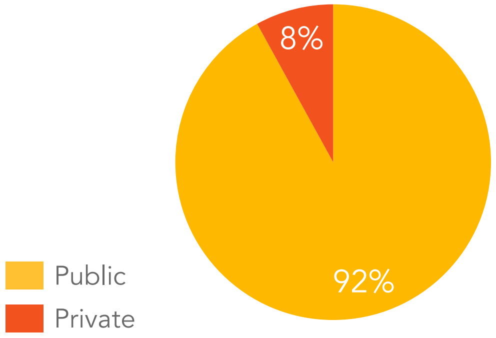
Overall capex requirement of $11M; majority comes from Public facilities which make up the bulk of all HFs in Sierra Leone, greatest HFE demand in Tier 1 public facilities

Electrification need, in # of facilities & capex (US$'000)

	Tier 1		Tier 2		Tier 3	
	New	Stability	New	Stability	New	Stability
# of facilities requiring electrification	375	100	25	10	1	20
	475		45		21	
	541					
	Public	Private	Public	Private	Public	Private
Capex need (US$ '000)	$6,350	$550	$420	$40	$3,350	$2,90
	$6,900		$460		$3,640	
	$11,000					

Electrification need is heavily concentrated in Tier 1 public facilities, which have the lowest ability to pay for electrification

Split of public and private facilities

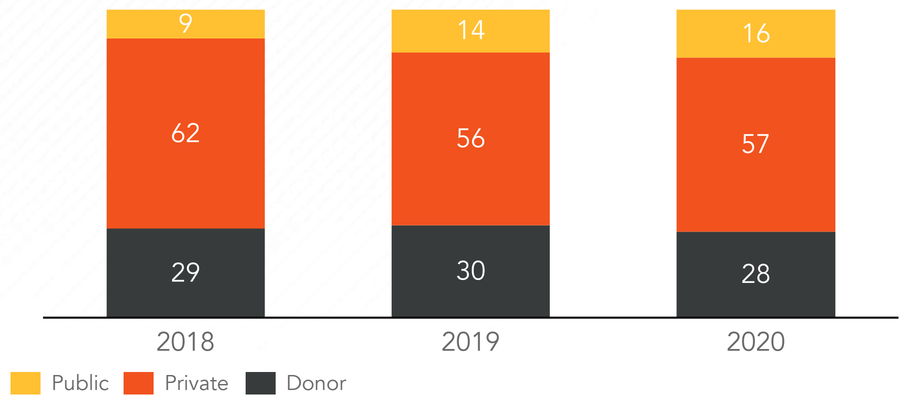


There is a high reliance on public facilities, with only 112 total private facilities in the whole of Sierra Leone. Government remains unreliable as an off-taker, and donor funding makes up most of the health spending in the country.

Source: Powering Social Infrastructure in Sierra Leone, SEforALL; CrossBoundary Analysis

Public sector expenditure in Sierra Leone is exceedingly low, with donors and private spend making up the vast preponderance of spend – donors play a key role

Health expenditure distribution, %[1]



In 2017/2018, household out pocket expenditure in user fees contributed 56% of total health expenditure, one of the highest in Africa

Private spend is largest contributor to health expenditure. At 16% domestic general government spend for HC, Sierra Leone has one of the lowest public spends in Africa

Health budget allocation of total national budget (excluding grants & transfers) reached 11% in 2020, closing in on 15%[2] showing the push towards increasing public health spend

Health budgeting process

National Budget

- MoHS[3] prepares a detailed budget proposal, which is reviewed and adjusted by MoFED[4]
- Upon completion, the MoHS[3] received a budget allocation
- Budget is then divided into sub-sectors (e.g., primary health care, mental health care etc.)

District Budget

- National budget is dispersed by districts, with allocations decided based on population size and health need
- District councils must align their spend with national health guidelines and goals
- Some budget allocation is tied up in programs, meaning district councils have no say in allocation

Supplies

- In addition to district budgets, a portion of the national health budget is specifically allocated towards procuring essential medical supplies and equipment
- There is central procurement and the MoHS[3] distributes this across facilities based on need

Ministry of Energy is responsible for making electrification decisions, as part of electrification efforts for the country. MoHS[3] plays a role in advocating on behalf of health facilities and making sure they have adequate infrastructure

(1) Latest available year where public spend includes government budget allocated funds and donor funds channelled through government; (2) African Union Abuja Declaration threshold; (3) Ministry of Health and Sanitation; (4) Ministry of Finance and Economic Development

Source: World Bank, Sierra Leone Global Climate Scope, BloombergNEF, 2023; Government of Sierra Leone

Sierra Leone's sector planning is focused on increasing energy access through renewables

The priority electrification targets in Sierra Leone are centered on increasing energy access through renewable sources

1

2025

Universal energy access

Achieve universal access to electricity throughout Sierra Leone

2

2030

80% renewables

Reach 80% renewable energy sources in energy mix

3

2030

850MW installed capacity

Reach 850MW of installed capacity by 2030, up from 160MW in 2022

Policy and regulatory interventions to meet targets

Electricity Act (2011)
Regulates the generation, transmission, distribution, and supply of electricity. It was established to manage the country's electricity generation and transmission infrastructure. As well as the licensing of electricity suppliers, the establishment of electricity tariffs, and the protection of the rights of consumers. Additionally, the Act promotes the use of renewable energy sources and encourages private sector investment in the electricity sector

National Energy Policy
Provides a framework for the sustainable development of the energy sector, with the objectives of increasing access to modern and affordable energy services, promoting renewable energy, improving energy efficiency, enhancing energy security, and promoting private sector investment. It also set the groundwork for improvement in the institutional and regulatory framework for the energy sector, increasing capacity building, and improving energy data management.

National Renewable Energy Action Plan
Focuses on increasing renewable energy share in the energy mix, through off-grid renewable energy solutions for rural areas, grid-connected renewable energy projects and the development of a supportive policy and regulatory framework

Source: World Bank; Powering Social Infrastructure in Sierra Leone, SEforALL; Government of Sierra Leone; Sector Scan, The Energy Sector in Sierra Leone, SNV

Although Sierra Leone has supply incentives in place for renewable energy, these support packages are less comprehensive than in other priority markets

Tariff subsidies

Fixed price that utility companies must pay to renewable energy producers for each unit of electricity they generate and supply to the national grid. This fixed price is usually set higher than the cost of conventional electricity, thereby incentivizing the development of renewable energy projects.

Tax incentives

Import duty exemption for solar and other renewable energy related products, for both persons and institutions importing these. After introduction of this policy, the number of households with access to solar energy increased from 0.8% in 2015 to 6.6% in 2018.

Renewable energy auction

Competitive bidding process in which developers submit bids to sell a specified amount of renewable energy at a specified price. It is used to drive down the cost of renewable energy and to encourage the development of new renewable energy projects.

Active developers

- Sunlight – Power is Knowledge
- Winch Energy
- PowerGen
- We Care Solar
- Power Leone
- azimut360
- Easy Solar

Source: Government of Sierra Leone; ACE-TAF; Sierra Leone Global Climate Scope, BloombergNEF; International Energy Agency

Sierra Leone's HFE is currently dominated by donor BOT and SHS models, with no private sector de-risking programs being designed or tested

HFE Models in market or development

Established	1	Design, Build, Operate, Transfer	Most donor funded installations are still done through a design, build, operate and transfer model, where the government is the eventual owner. No de-risking is necessary, but the model is unsustainable without on-going O&M considerations.
Established	2	SHS Pay-Go	Easy Solar and We Care Solar have contributed to HFE programs through the provision of SHS using a pay-as-you-go scheme

Sierra Leone has a small health electrification market, where BOT and SHS are the prevailing models. There are currently no de-risking tools being designed for this market specifically given the dependence on programmatic donor funding.

> "We set up a project to provide 6kW of free energy to health centres in rural areas. But even with this, the energy is being misused for personal use, causing health centres to go over the 6kW limit, which they are not able to pay for. This highlights the issues of working with government facilities.
>
> *Private Power Company operating across Africa*

> "There is very little private health or public government health infrastructure spending in SL. All the work is done via NGOs. The challenge in HFE is there are differing goals/targets between the Ministry of Health and Ministry of Energy, and in the larger energy sector programs health electrification is only ever likely to be a very small part. So, then the Ministry of Health gets different funding, and the work is either duplicated or not effectively integrated.
>
> *Former Program Manager, International Health NGO*

Source: Interviews with developers and investors

Given the health financing make-up in Sierra Leone, donors play a critical role and have focused efforts on capex grant activity – only two programs have funding for O&M[1]

Implementor / Investee	Capital provider	HF Tier	Financing type	Financing purpose
Resolve	Orange SL, USAID, GAVI, World Vision	1	Grant	Capex & opex
Crown Agents	FCDO	1	Grant	Capex
GAVI, Orange Sierra Leone	Power Africa	1	Grant	Capex
World Bank / Government of Sierra Leone	World Bank	1	Grant	Capex
UNOPS	FCDO	1 & 2	Grant	Capex
UNICEF	UNICEF	1	Grant	Market Assessment
We Care Solar	UD	1	Grant-in-kind	Capex
Azimut 360	UD	UD[2]	Grant	Capex
ENDEV	ENDEV	UD[2]	Grant	Capex
SEforALL	GEAPP, FCDO	UD[2]	Grant	Capex

RESOLVE partnered with Orange SL to provide the O&M as a 'grant-in-kind', to ensure sustainability of power systems

Part of US$44M Sierra Leone Energy Access Project. Which included he installation of solar power at 54 community health centres across 12 districts of Sierra Leone. Part of the program objectives were to encourage private sector investment in rural energy generation.

(1) Non-exhaustive – based on interviews and desk-based research; (2) Undisclosed

Source: Powering Healthcare Intervention Database, SEforALL, 2022; CrossBoundary Analysis

Estimated funding for HFE in Sierra Leone was $5M, with the largest contributors being World Bank and FCDO/UNOPS projects – leaving a $6M estimated funding gap

	Funding Amount	Number of Projects	Description
Known investment[1] into HFE in Sierra Leone	$0	0	
Estimated investment[2] into HFE in Sierra Leone	$5M	2	• Only 2 broad energy electrification projects from which HFE investment was estimated - **UNOPS Access to Energy Sierra Leone project, funded by FCDO and World Bank Enhancing Sierra Leone Energy Access**
Projects with **undisclosed funding**	N/A	8	
Total	$5M	10	
Estimated Funding Gap	$6M		

(1) Based on all identified donor projects where funding for HFE alone was disclosed (i.e., not part of larger programs where HFE was a smaller component); (2) Based on all identified donor projects where HFE was one component, and direct HFE funding was not disclosed. This number is derived from allocating an estimated percentage of funding allocated to HFE in broad electrification/health programs where HFE was an identified component.

Source: CrossBoundary Analysis

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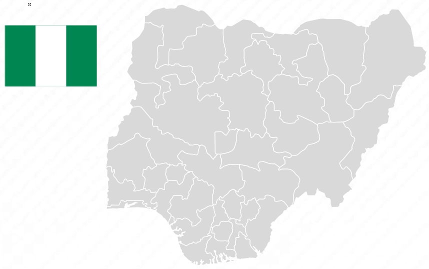
Country overview | Nigeria

Nigeria overview



Total population:	213M
Rural population:	47%
Health facilities:	40,821
Electrified facilities:	~60%
On-grid cost/kWh:	US$0.139

Donor and government HFE programs

Amount	15 donor programs, 8 identified government programs
Largest	NEP[1]: US$550M, World Bank and African Development Bank
Smallest	USADF[2]-All On Challenge: ~US$4M; DSOLs:~US$4M
Programming Gaps	Little focus on healthcare electrification specifically, as most programs focus on electrification generally

Government fiscal position

- External debt: US$76B
- Budget deficit: 4.78%
- Current BoP: -US$1.85B
- PV external debt (% exports): 144%

2,066 GDP per capita, US$

22 YoY inflation, %

38 Unemployment, %

Sector planning

National Strategic Health Development Plan (2018 – 2022)

Approved in 2016 and documents FGN's[3] implementation framework and measures for driving rural electrification across the country using both on and off-grid energy solutions

'1 PHC per Ward' Revitalization Plan

NPHCDA[4] has outlined a plan to revitalize 10,000 PHCs. So far, ~3,500 PHCs have been renovated with ~6,500 more planned for the next 3 – 5 years.

USAID Call to Action

USAID (PA-NPSP[5], IHP) call-to-action plans to electrify 700 PHCs by the end of 2023

Key players and ongoing programs

Nigeria Electrification Project (NEP)

Renewable Energy Fund

Demand Aggregation for Renewable Energy (DART)

Regulatory environment

- **Rural Electrification Strategy & Implementation Plan (RESIP):** FMOP plan to provide implementation framework and drive on- and off-grid rural electrification
- **Mini-grid Regulations:** NERC[6] regulations to accelerate mini-grid growth by minimizing major risks and facilitating private sector participation
- **Energy Transition Plan (ETP):** FGN's[1] Strategy to achieve net-zero emissions by 2060
- **National Renewable Energy and Energy Efficiency Policy:** Blueprint for harnessing renewable resources to drive sustainable development

Incentive schemes

Grant / Grant Subsidies

Demand Aggregation

Results-Based Subsidies

- **Rural Electrification programme:** Subsidies for businesses providing off-grid renewable energy and solar home systems

(1) Nigeria Electrification Program; (2) US Africa Development Foundation; (3) Federal Government of Nigeria; (4) National Primary Healthcare Development Agency; (5) Power Africa Nigeria Power Sector Program; (6)Nigeria Electricity Regulation Commission

Source: Nigeria Ministry of Health; World Bank; International Monetary Fund; Powering Healthcare Nigera, SEforALL

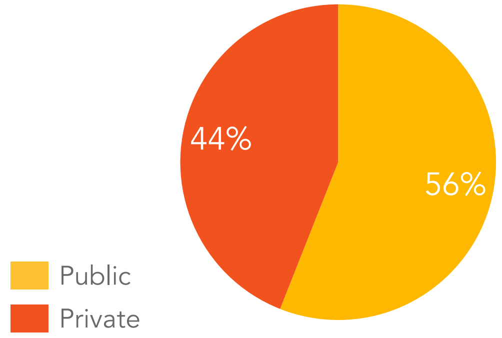
The overall capex investment need in Nigeria is ~$805M, with demand being greatest in Tier 1 public facilities, however there is significant need in private facilities

Electrification need, in # of facilities & capex (US$ '000)

	Tier 1		Tier 2		Tier 3	
	New	Stability	New	Stability	New	Stability
# of facilities requiring electrification	25,440	5,565	1,695	370	205	425
	31,005		2,065		630	
	33,700					
	Public	Private	Public	Private	Public	Private
Capex need in US$ '000	$446,330	$97,980	$7,620	$28,670	$145,620	$78,410
	$544,310		$36,290		$224,030	
	$804,630					

Tier 3 facilities account for ~40% of the capex need despite making up only 3% of all healthcare facilities and predominantly requiring stability interventions. Nigeria's Tier 1 and Tier 3 is only ~20% and 35% private respectively resulting in the reduced capex contribution overall (Tier 1 is high volume; Tier 3 is high capex).

Split of public and private facilities

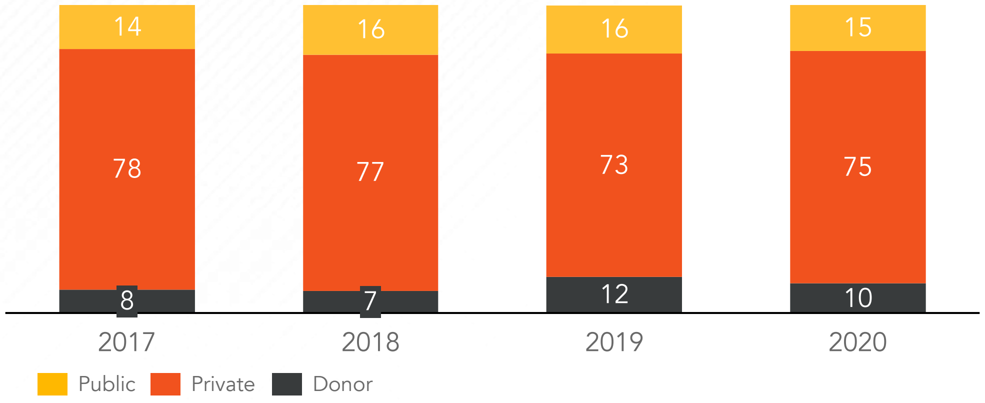


Unlike other geographies, Nigeria's secondary facilities are ~80% private. These peri-urban and urban facilities may represent an opportunity to explore alternative electrification models as there is an implied ability to pay, while there is a prevailing unmet need for electrification and the stability to support higher powered equipment energy demand.

Source: Powering Healthcare Nigera, SEforALL; CrossBoundary Analysis

Private sector expenditure dominates Nigeria's healthcare sector, and there is a significant mismatch between public health budgeting and expenditure

Health expenditure distribution, %[1]



In Nigeria, there is severe underfunding for the public health budget; on average, only ~35% of the gov. allocated amount is actually disbursed

Due to a lack of government funding, out-of-pocket spend is most common which is burdensome for households and increases catastrophic healthcare expenditure

Health budgeting process

National Budget

- The federal government provides funding that is disbursed through funds e.g., Basic Healthcare provision fund, to the National Primary Healthcare Development Agency, and National Health Insurance Scheme
- This funding is provided directly at the facility level

County Budget

- The state budget is channelled through the State MoH[2]; states are responsible for secondary care
- A separate pool of capital is allocated to the State Ministry of Local Government Affairs which is used for PHC development and salaries

Budget Expenditure

- In the past ~10 years, ~70% of the health sector budget has gone towards salaries and office running costs, with the remaining ~20% for capex expenditure (inc. equipment and constructions)
- Limited funding disbursement vs. allocation has restricted HFE efforts

Public facilities face slow disbursement and restricted funding at the federal, state, and local level. While PHCs are meant to be the first-port-of-call for patients, they are financially neglected compared to secondary and tertiary facilities.

Electrification decisions are made by the FMoP[3] and implemented by Rural Electrification Agency (REA). Potential key partnerships include the NPHCDA[4], FMoH[5] and Health Strategy and Delivery Foundation

(1) Latest available year where public spend includes government budget allocated funds and donor funds channelled through government, (2) State Ministry of Health; (3) Federal Ministry of Power; (4) Nigeria Primary Health Care Development Agency; (5) Federal Ministry of Health

Source: World Bank; Government of Nigeria

Nigeria's sector planning focuses on reducing fuel dependence while improving access to modern, standardized quality care through HFE

The relevant priority electrification targets in Nigeria focus on revamping health infrastructure and reducing fuel dependence

1. ~2026 — **PHC renovation**
   The renovation of 10,000 PHCs in Nigeria to include HFE or to prepare these facilities for HFE

2. 2060 — **Fuel transition**
   For economic and climate reasons, Nigeria is looking to increase energy access and replace generators through renewables

3. 2030 — **Clean HFE**
   The sustainable and clean electrification of health facilities across Nigeria to improve access to quality health

Policy and regulatory interventions to meet targets

National Strategic Health Development Plan II 2018 – 2022
Of the many strategic objectives, the plan seeks to improve availability and functionality of health infrastructure required to optimize service delivery at all levels including sustainable health facility electrification

NERC Mini-Grid Guidelines 2016
Mini-grid guidelines outlining key regulations and processes for developers and operators of mini-grids in order to increase transparency and ease private participation in expanding energy access across Nigeria

Petrol Subsidy Removal (year/occurrence TBD)
At present, the generator is solar energy's biggest competitor. While the removal of petrol subsidies has broader sovereign financial implications, it will undoubtedly dissuade heavily subsidized generator use in favor of cheaper, cleaner renewable energy solutions.

Energy related policy/plan | Health related policy/plan

Source: World Bank; International Energy Agency; USAID; Energy Transition Office; Rural Energy Agency Nigeria

There are a number of key financial incentives for renewable energy in Nigeria, which has increased developer participation and investment in the sector in recent years

Tariff subsidies

Guaranteed price for electricity generated from renewable sources, providing investors with a level of guaranteed revenue. Typically, developers/operators agree to pass this discount on to end-consumers.

Demand aggregation

This may include import duty and VAT exemptions for renewable energy products. There are also organizations that provide bulk purchasing of standardized equipment to benefit smaller companies that cannot themselves benefit from economies of scale or warehousing. This drives down the cost of developing mini-grids and increases competition in supply.

Results Based Subsidies

Developers and vendors are provided increasing amounts of grants/grants-in-kind based on key outlined metrics. This has allowed new innovative indigenous entrants into the space reaching more underserved communities. It has also help to crowd in additional capital.

InfraCredit Climate Finance Blending Facility

InfraCredit's (and FCDO's) CFBF offers credit enhancement to increase the accessibility of funding for mini-grid projects. Under Solar Power Naija (SPN), InfraCredit provides credit guarantees through its AAA rating. Domestic institutional investors can directly invest in a 7-year fixed rate local currency project – the first of its kind for solar mini-grids in Nigeria.

Active developers in HFE

- Havenhill Synergy Limited
- Engie
- Creeds Energy
- Arnergy
- Blue Camel Energy
- Auxano Solar
- SAO Energy
- Okra
- Emone Energy Solutions
- Ayo Tropical Technology Ltd.

Source: Powering Healthcare Nigeria, SEforALL; USAID Power Africa; CrossBoundary Analysis

Identified developers have found ways to successfully work with both private and public health facilities across all tiers – but government is still a constraint

HFE models in market or under development[1]

Established	1 Design, Build, Operate, Transfer	Most donor-funded installations are still done through a design, build, operate and transfer model, where the government is the eventual owner. No de-risking is necessary, but the model is unsustainable without on-going O&M considerations.
Established	2 SHS Pay-Go	SAO Energy is partnering with Okra to deploy mesh-grids to rural communities which will have health facilities as either paying customers or offer them energy free of charge depending on the size of the community installation.
Established	3 EaaS	Some developers have operated an EaaS model with private hospitals in particular – relying on guarantees to secure commercial lending for their project finance debt.
Design/pilot phase	3 Hybrid model	The World Bank Regional Off-Grid Electricity Access Project is including a pilot program in Nigeria & Niger to electrify health facilities and schools. They are currently collaborating with MIGA to create a sub-national de-risking mechanism for payment from government and developing a line of credit for energy companies servicing public institutions including health facilities.

There is a significant private sector need in Nigeria; there is still a lot of demand aggregation needed among smaller private facilities, and convincing of larger facilities of the benefits of solar energy . Public facilities – the bulk of PHCs – remain the largest gap, suffering from inability to pay

"Government has been supportive of our efforts, but they have constrained budgets. They understand the importance and support however they can, but they cant pay for energy. For the smaller public clinics, they are charging fees for service, so many of them do have some ability to pay. These are quite small systems, usually just 1-1.5 kWh installations.

Nigerian Developer

"We have found it much easier to get lenders involved with larger hospitals, given their confidence in their ability to pay. With those entities we are more likely able to get a guarantee, or escrow set up to mitigate the payment risk (or both). Some hospitals want to own the system through a lease-to-own model which we can certainly do.

Nigerian Developer

"We've generally been good with sourcing funding and getting payments back. One segment we struggle with in Nigeria […] is public rural PHCs. Since these are owned by the government it's a challenge to get them to commit to paying for the power because of government bureaucracy and budget.

Private Power Company Operating Across Africa

(1) Non-exhaustive

Source: Interviews with developers and investors; CrossBoundary Analysis

Donor activity is concentrated in capex grants for developers, with some nascent blended finance activity although with little direct focus on HFE[1]

Implementer/investee	Capital provider	Tier	Financing type	Financing purpose
Crown Agents		1	Grant	Capex
EM-ONE	FCDO, European Union	1	Grant	Capex
World Bank / Government of Nigeria	World Bank	1	Grant	Capex
Adam Smith International	FCDO	1 & 2	Grant	Capex
WindGen Power	Shell Foundation, FCDO	2	Grant	Capex
Green Village Electricity	Schneider Electric	1	Grant-in-kind	Capex
Havenhill Synergy	Shell Foundation, FCDO	1	Guarantee facility	Capex
EM-ONE	USTDA	1	Grant	Feasibility Study
SEforALL	Power Africa	1, 2 & 3	Grant	Feasibility Study
Havenhill Synergy	Power Africa	UD[2]	Grant	Capex
AECOM	European Union	UD[2]	Grant	Capex

Part of US$765 Nigeria Electrification Program

(1) Non-exhaustive – based on interviews and desk-based research; (2) Undisclosed

Source: Powering Healthcare Intervention Database, SEforALL, 2022; CrossBoundary Analysis

Donor activity is concentrated in capex grants for developers, with some nascent blended finance activity although with little direct focus on HFE[1]

Implementer/investee	Capital provider	Tier	Financing type	Financing purpose
Just Stand Out	UD	UD[2]	UD	UD[2]
REA Nigeria	FCDO	UD[2]	Grant	Facility Mapping
Okra Solar	SAO Group, World Bank, AfDB	1	Blended Finance	Capex
Arnergy	Norfund, EDFI, All On	UD[2]	Blended Finance	UD[2]

All capital providers are collaborating to create a Special Purpose Vehicle to raise $6M for the scale-out of Okra mesh-grids, which will have some knock-on effects for HFE

Small part of Arnergy's business focuses on HFE. Investment is not specifically geared towards this but rather for general business operations.

Grant | Other financing methods

(1) Non-exhaustive – based on interviews and desk-based research; (2) Undisclosed

Source: Powering Healthcare Intervention Database, SEforALL, 2022; CrossBoundary Analysis

Known funding is driven by Power Africa and FCDO funded projects, with the World Bank being another key investor in HFE – leaving a $732M estimated funding gap

	Funding Amount	Number of Projects	Description
Known investment[1] into HFE in Nigeria	$41M	2	• Only 2 projects in Nigeria disclosed their funding amount for HFE - Power Africa Off Grid Project and FCDO project
Estimated investment[2] into HFE in Nigeria	$42M	2	• Only 2 broad energy electrification projects from which HFE investment was estimated • World Bank Nigeria Electrification project, and FCDO Kaduna State Electrification Project
Projects with **undisclosed funding**	N/A	11	
Total	$83M	15	
Estimated Funding Gap	$721M		

(1) Based on all identified donor projects where funding for HFE alone was disclosed (i.e., not part of larger programs where HFE was a smaller component); (2) Based on all identified donor projects where HFE was one component, and direct HFE funding was not disclosed. This number is derived from allocating an estimated percentage of funding allocated to HFE in broad electrification/health programs where HFE was an identified component

Source: CrossBoundary Analysis

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Country overview | DRC

DRC overview

Total population:	96M
Rural population:	54%
Health facilities:	14.746
Electrified facilities:	33%
On-grid cost/kWh:	US$0.084

Donor and government HFE programs

Amount	3 donor programs, 1 identified government program
Largest	KIN Elenda Program, US$250M, World Bank Funded
Smallest	Insufficient disclosed funding to determine
Programming Gaps	Lack of both general and health electrification initiatives

Government fiscal position

- External debt: US$10B
- Budget deficit: 2.7%
- Current BoP: -US$588M
- External debt (% exports): 34%

577	GDP per capita, US$
18	YoY inflation, %
5.4	Unemployment, %

Sector planning

National Health Development Plan

National Health Development Plan (2019-2022)
Plan for the creation and delivery of a primary health care services package that emphasizes improvements in reproductive, maternal, neonatal, child and adolescent health and nutrition (RMNCAH-N) using innovative financing mechanisms, including strategic purchasing, direct-facility financing, and single-contract pooled funding

Key players and ongoing programs

anser

IFC

Kin Elenda – Kinshasa Multisector Development and Urban Resilience Project

Regulatory environment

- **Energy Sector Act (2014)** governs the energy sector, through effective liberalization, promotion and development of energy access in urban, peri-urban and rural areas, providing reliable, sustainable energy coverage of all needs and creating an institutional framework and ensuring fair competition and establishing laws on production, transportation, distribution, importation, exportation and commercialization of electricity

Incentive schemes

TAX

Tax incentives

- **Rural Electrification Fund:** funds renewable energy and solar home systems for decentralized energy generation

Source: DRC Ministry of Health; World Bank; Improving Health System Efficiency DRC; WHO; DRC, International Energy Agency

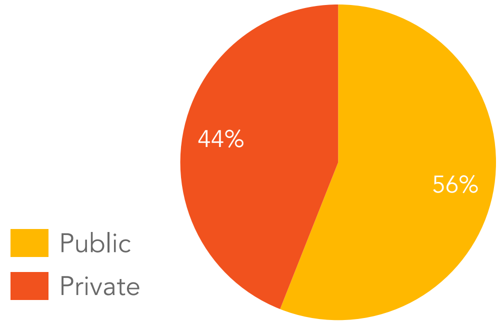
The overall capex investment need in DRC is ~$428M, with estimated demand being greatest in Tier 3 public facilities, closely followed by Tier 1

Electrification need, in # of facilities & capex (US$ '000s)

	Tier 1		Tier 2		Tier 3	
	New	Stability	New	Stability	New	Stability
# of facilities requiring electrification	8,925	2,240	595	150	325	110
	11,165		745		425	
	12,335					
	Public	Private	Public	Private	Public	Private
Capex need (in US$ '000)	$104,210	$81,880	$6,950	$5,460	$128,590	$101,030
	$186,090		$12,410		$229,620	
	$428,110					

Despite Tier 1 requiring low amounts of electricity, the capex need is almost similar to Tier 3, due to the high amount of facilities requiring electrification, especially new connections

Split of public and private facilities

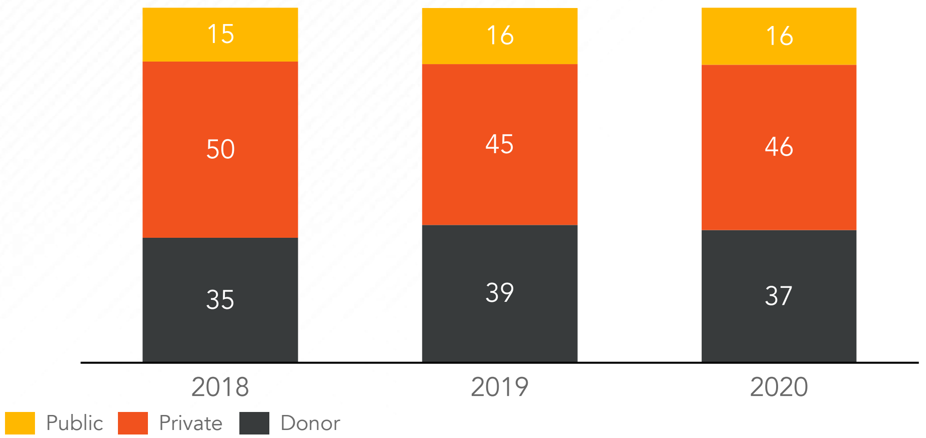


Low government spend on health created an informal taxation system of private sector facilities (e.g., sale of permits, fines, local taxes), which motivated health authorities to multiply for profit private facilities to increase finance flows used for administrative purposes. Moreover, low government spend creates a demand for well functioning and well funded facilities, both driving towards a relatively high amount of private facilities in DRC. However, electrification remains an issue in both public and private facilities.

Source: World Bank; Improving Health System Efficiency DRC

Low government budget allocation, combined with reverse financial flows, leaves little room for facilities to make investments into electrification

Health expenditure distribution, %[1]



In 2018, only 40% of DRC's health budget was spent, and most provinces only spent 20% of their budgeted resources

High fragmentation in donor interventions leads to waste, duplication and ineffectiveness throughout DRCs health system and health programs

Low government allocation to health and push for private facilities by officials contributes to high private health spend

Health budgeting process

Central Budget	Province Budget	District Budget
• GoDRC[2] allocates the health budget to the MoH[3] based on its budgetary priorities • National budget is allocated to national level expenditures, such as health policy and planning and disease control	• MoH[3] allocates part of the national budget to the district level • Provincial budget is used for technical and logistic support, and managing operations of health facilities that operate at the provincial level	• Provincial budget is partially allocated to districts within their jurisdiction, which manages a network of health centres and a district hospital • Budget is used for wages, medical supplies and infrastructure at the district level

Low government spend on health has caused reverse financial flows, with district health facilities collecting user fees, which are then channelled to district offices and from there to the provincial and national level. Informal taxation (e.g., sale of permits, fines, local taxes) of private facilities has also become common practice, to assure financial survival of health institutions and individuals operating in the health administrative space.

(1) Latest available year where public spend includes government budget allocated funds and donor funds channelled through government; (2) Government of DRC; (3) Ministry of Health

Source: World Bank; DRC, Global Financing Facility; Improving Health System Efficiency DRC

Sector planning is limited in DRC, with only one identified energy sector act and health action plan, both not specifically focused on HFE

Priority electrification targets in DRC are centered on increasing access and reducing GHG emissions

1. **2025 – Connect 15m people to energy**
   Provide an additional 15M people with reliable access to energy in rural and peri-urban areas

2. **2030 – 17% GHG reduction**
   Reduce GHG emissions by 17% compared to the business-as-usual scenario, equivalent to slightly more than a 70 Mt CO2 reduction

3. **2040 – 100 metro grids**
   Increase electrification through 100 new renewable energy metro-grids

Policy and regulatory interventions to meet targets

National Health Development Plan (2019-2022)
Plan for the creation and delivery of a primary health care services package that emphasizes improvements in reproductive, maternal, neonatal, child and adolescent health and nutrition (RMNCAH-N) using innovative financing mechanisms, including strategic purchasing, direct-facility financing, and single-contract pooled funding.

Energy Sector Act (2014)
Act that governs the energy sector, through effective liberalization, promotion and development of energy access in urban, peri-urban and rural areas, providing reliable, sustainable energy coverage of all needs and creating an institutional framework and ensuring fair competition and establishing laws on production, transportation, distribution, importation, exportation and commercialization of electricity.

Energy related policy/plan | Health related policy/plan

Source: World Bank; DRC, International Energy Agency; DRC Factsheet, USAID Power Africa; DRC National Agency for Electrification and Energy Services

Limited supply incentives in DRC are a directional indication that the energy market is still very fragmented and less centrally regulated vis-à-vis other priority markets

TAX

Tax incentives

All economic activities related to the production, import and export of electrical energy are exempt from customs tax and, in certain cases, valued-added tax (VAT) for four years from the first day of importation. This applies to all energy sources. However, the VAT exemption is not transparent and is not continuously applied.

National Electrification Fund

The national electrification fund is a financial mechanism that funds private operators, small businesses, NGOs, rural cooperatives that are involved in decentralised systems using renewable energies.

Active developers in HFE

nuru
congo connecté

Equatorial Power

Source: DRC, International Energy Agency; Government of DRC; DRC National Agency for Electrification and Energy Services

Based on interviews, there are developers that are actively interesting in participating in HFE, but they are constrained by government ability to pay first and foremost

HFE models in market or under development[1]

Established	1	Design, Build, Operate, Transfer	Most donor-funded installations are still done through a design, build, operate and transfer model, where the government is the eventual owner. No de-risking is necessary, but the model is unsustainable without on-going O&M considerations.
Established	2	PPA with guarantee	Nuru deploys a PPA model in which capex is either funded through a subsidy. Client pre-pays for energy using a smart meter and when selling to government, payment is guaranteed by donors

Donor BOT and a PPA model are present in DRC. There are currently no additional HFE specific models being designed beyond the Shell Foundation pilot.

> "There is a large appetite for electrification in DRC, but it is a very nascent market, lacking activity and government participation, making it very tricky to invest in.
>
> *Developer active in East Africa*

> "Conceptually, everyone would like us to work with the government, but commercially they are a difficult client. Because of this, the best case scenario for us when working with the government is to receive a subsidy to fund the capex of the connection, and have a 3-year payment guarantee provided by MIGA on government payments or a donor backstop equivalent.
>
> *Congolese Developer*

(1) Non-exhaustive

Source: Interviews with developers and investors; CrossBoundary Analysis

Nascency of the market results in limited donor activity in DRC, with only 3 projects identified, of which 1 focuses specifically on HFE[1]

Implementer / Investee	Capital provider	HF Tier	Financing type	Financing purpose
World Bank	World Bank	1	Grant	Capex
IFC	Global Infrastructure Facility, Green Climate Fund, Rockefeller Foundation, SRMI, Government of Italy, Government of Canada	1	Grant	Capex
Nuru S.A.R.L.	Shell Foundation, FCDO	1	Performance based grant	Capex

World Bank: Part of US$250m Kin Elenda project

IFC: Falls under the World Bank's Scaling Mini-Grid program, which helps emerging countries establish public-private partnership mini-grids to bring low-cost renewable energy to consumers, funding is expected to reach $400m from private investors

(1) Non-exhaustive – based on interviews and desk-based research

Source: Powering Healthcare Intervention Database, SEforALL, 2022; CrossBoundary Analysis

Funding identified in DRC was estimated based on the World Bank's Kin Elenda Project, with no known funding amount - leaving a $415M estimated funding gap

	Funding Amount	Number of Projects	Description
Known investment[1] into HFE in DRC	$0	0	
Estimated investment[2] into HFE in DRC	$12M	1	• Only 1 broad energy electrification project to estimate HFE from - World Bank Kin Elenda project
Projects with **undisclosed funding**	N/A	2	
Total	**$12M**	3	
Estimated Funding Gap	**$415M**		

(1) Based on all identified donor projects where funding for HFE alone was disclosed (i.e., not part of larger programs where HFE was a smaller component); (2) Based on all identified donor projects where HFE was one component, and direct HFE funding was not disclosed. This number is derived from allocating an estimated percentage of funding allocated to HFE in broad electrification/health programs where HFE was an identified component

Source: CrossBoundary Analysis

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Country overview | Kenya

Kenya overview

Total population:	53M
Rural population:	72%
Health facilities:	14,323
Electrified facilities:	56%
On-grid cost/kWh:	US$0.13

Donor and government HFE programs

Amount	13 donor programs, 5 identified government programs
Largest	KOSAP Program, US$150M, World Bank Funded
Smallest	US$100K, FMO funded
Programming Gaps	Little focus on electrifying health centres specifically, rather a focus on household electrification

Government fiscal position

- External debt: US$35B
- Budget deficit: 7.3%
- Current BoP: -US$5.7B
- External debt (% exports): 346%

2,082	GDP per capita, US$
9.2	YoY inflation, %
5.7	Unemployment, %

Sector planning

Kenya Vision 2030
Long-term development blueprint, with energy focus including infrastructure improvement, increasing energy access, improving access to healthcare and promoting renewable energy and the expansion of the grid

Rural Electrification Strategic Plan 2018 – 2023
Policy framework aimed at expanding access to electricity in rural areas by establishing renewable energy mini grids in off-grid areas and implementing stand-alone systems for institutions in rural areas

National Renewable Energy Action Plan
Policy framework focused on increasing renewable energy in Kenya's energy mix, through promoting investment, off-grid solutions in rural areas, and implementing regulatory and institutional reforms to support the development of the sector

Health Sector Strategic Plan
Aims to improve physical assets, including addressing infrastructure challenges, such as HFE

Key players and ongoing programs

Kenya Off-grid Solar Access Project

REREC
State corporation responsible for promoting & facilitating rural electrification

Kenya Power
National electric utility company

KENYA VISION 2030

Regulatory environment

- **Energy act:** Legal framework for promotion of renewable energy & energy efficiency, encourages private sector participation in energy sector, which has promoted renewable energy by creating regulatory bodies and increased private sector participation (through power purchase agreements, licencing and incentives) improving rural electrification rates
- Establishment of regulatory body known as the Energy and Petroleum Regulatory Authority (EPRA)

Incentive schemes

Tariff subsidy

TA

Tax incentives

Loan guarantees

- Rural Electrification programme: subsidies for businesses providing off-grid renewable energy and solar home systems

Source: Kenya Ministry of Health, World Bank, Economist Intelligence, International Monetary Fund, Statista

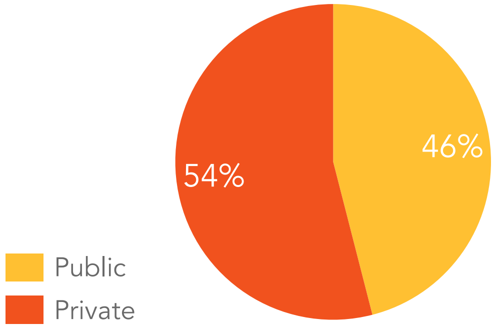
The overall investment need in Kenya is ~$235M, with demand being greatest in Tier 3 private facilities, creating an opportunity for a commercial intervention

Electrification need, in # of facilities & capex (US$ '000s)

	Tier 1		Tier 2		Tier 3	
	New	**Stability**	**New**	**Stability**	**New**	**Stability**
# of facilities requiring electrification	1,075	2,300	70	155	105	665
	3,375		225		770	
	4,370					
	Public	**Private**	**Public**	**Private**	**Public**	**Private**
Capex need (in US$ '000)	$15,920	$18,690	$1,130	$1,180	$84,970	$112,640
	$34,610		$2,300		$197,610	
	$234,530					

Although Tier 3 accounts for only ~16% of facilities in Kenya, it has the largest capex need, especially in terms of back-up systems. This shows that many smaller Tier 1 and 2 facilities are likely not using enough energy to be anchor loads, posing problems for sustainable investment.

Split of public and private facilities

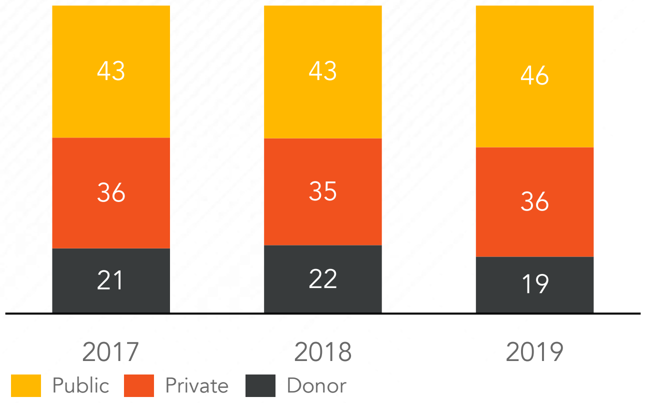


Kenya has slightly more private facilities than public at a national level. Within the tiers, the amount of private facilities is highest at Tier 3, at 57%, and lowest at Tier 2, at 51%. Although private facilities generally have a better ability to pay, facilities in Tier 1 and 2 are likely to struggle to afford electrification due to low revenue, and Tier 3 facilities' demand is lower, as back up generations make up two-thirds of capex need

Source: World Bank, Kenya Ministry of Health

Low budget allocation, combined with HF revenues/distributions being controlled at a national level, leaves little room for facilities to make investment decisions

Health expenditure distribution, %[1]



Between 2001-2016 donor spend, both direct spend and spend channelled through GoK, was at least 50% greater than GoK spend

In 2017, 4 donors made up ~90% of donor health spend

At ~9% of total national budget, GoK allocation to health remains well below 15%[2]

Hospital and health center revenue sources, %

	County A	County B	County C	County D	County E
Hospital revenue sources					
User fee collection	78%	-	3%	33%	60%
NHIF payments	22%	100%	4%	67%	40%
County financial grants	-	-	7%	-	-
County health care scheme reimbursement	-	-	86%	-	-
Health center revenue sources					
User fee collection	15%	-	-	-	-
User fee reimbursement	-	-	-	-	-
NHIF payments	11%	-	-	68%	-
County financial grants	-	4%	28%	-	-
Donor supported O&M	27%	35%	72%	32%	100%
Financial donor support	47%	61%	-	-	-

Hospitals' main income is through NHIF reimbursements, at an average of 47%

Health centres received average of 53% of revenue from donor funded O&M

Health budgeting process

National Budget

- GoK[4] allocates national health budget to MoH[4] and distributes donor funds to health projects
- National budget is used for health policies, health sector regulation, provision of guidance, capacity building for county governments and funding of national schemes e.g., NHIF

County Budget

- MoH[5] allocates county budget from national budget
- Used for primary health services, referral health services, provision of medical supplies and equipment, construction and renovations, work force development, disease prevention and control, research and data collection

HF Revenues

- 2012 PFM[6] act requires public health facilities to remit all revenues collected to the Consolidated Fund, which is then used to finance public expenditure in the country
- Exceptions can be made for HF to use their revenues for capital improvements

Due to the PMF act, HFs have limited autonomy to fund capital improvements, including electrification. This means that for public facilities, agreements must be made at a county level for off-take, even in situations where individual facilities generate sufficient revenue to fund their electrification individually.

Electrification decisions are made by the MoE, specifically and REREC makes rural electrification decisions specifically. Lack of coordination between MoH and MoE causes inefficiencies and delays in electrifying health facilities.

(1) Latest available year where public spend includes government budget allocated funds and donor funds channelled through government (2) African Union Abuja Declaration target; (3) O&M includes facility maintenance & refurbishment, support staff allowances, communications, utilities, non-drug supplies, fuel and community-based activities; (4) Government of Kenya; (5) Ministry of Health; (6) Public Finance Management

Sector planning is geared towards Vision 2030, with the aim to improve its installed capacity, make use of 100% renewable energy and obtain universal energy access

Priority electrification targets in Kenya are centered on access and renewable energy

1 — 2022 — Energy access

Achieve universal energy access for all households and businesses by 2022, at acceptable quality of service levels[1]

2 — 2030 — 100% renewables

Derive 100% of energy resources from renewable sources by 2030, focusing on geothermal and solar power in particular

3 — 2030 — 5000 MW installed capacity

Reach 5,000 MW of installed capacity by 2030, to better serve the increasing energy demand

Policy and regulatory interventions to meet targets

Health Sector Strategic Plan (2018-2023)
Sets the objectives for the health system to 2023, which guides budget expenditure. Aims to improve physical assets, including addressing infrastructure challenges, such as the availability of electricity in HFs.

Energy Act (No. 1, 2019)
Act that consolidates all laws relating to energy, thus providing the regulation of the generation, transmission, distribution, and sale of energy, as well as the licensing of energy projects and the establishment of energy regulatory bodies.

National Renewable Energy Action Plan (2013 – 2030)
Policy framework focused on increasing renewable energy in Kenya's energy mix, through promoting investment in renewable energy, promoting off-grid solutions in rural areas, and implementing regulatory and institutional reforms to support the development of the sector.

Rural Electrification Strategic Plan (2018 – 2023)
Policy framework aimed at expanding access to electricity in rural areas of the country and increasing capacity, in part through establishing renewable energy mini grids in off-grid areas and implementing stand alone systems for institutions in rural areas.

Energy related policy/plan | Health related policy/plan

(1) Energy access was 75% in 2018, there have been no further updates on achieving this target

Source: World Bank; DEVEX; Kenya is rolling out its national electricity program in half the time it took America, QZ; Kenya, International Energy Agency

There are a number of key financial incentives for renewable energy in Kenya, which has increased investment in the sector in recent years

Tariff subsidy	Guaranteed price for electricity generated from renewable sources, providing investors with a level of guaranteed revenue. Feed-in-tariffs apply to grid-connected plants and are valid for a 20-year period from the beginning of the Power Purchase Agreement.
Tax incentives	Import duty and VAT exemptions for renewable energy products (discontinued 2018 and reinstated in 2021 due to significant slowdown of renewable energy adoption).
Loan guarantees	KOSAP[1] provides loan guarantees to financial institutions that provide financing to off-grid solar companies, in order to reduce the risk associated with lending to these companies and encourage increased investment in the sector
REREC – Rural Electrification & Renewable Energy Corporation **Rural Electrification Program**	The REREC program provides subsidies to businesses that install solar home systems and mini-grids in rural areas, with the aim of increasing access to electricity in areas that are not connected to the national grid by making it more affordable

Active developers in HFE

AptechAfrica
ofgem
W. GIERTSEN
PowerGen
ILLUMINA – The Power of the Sun
KEMSI Engineering
DIFFER Community Power

(1) World Bank funded Kenya Off-grid Solar Access Project
Source: Government of Kenya; Kenya, International Energy Agency; Kenya Global Climate Scope, BloombergNEF

Based on interviews, we identified limited de-risking tools applied in Kenya for HFE, but developers and investors are designing new models to take to market

HFE models in market or under development[1]

Established	1	Design, Build, Operate, Transfer	Most donor-funded installations are still done through a design, build, operate and transfer model, where the government is the eventual owner. No de-risking is necessary, but the model is unsustainable without on-going O&M considerations.
Established	2	SHS Pay-Go	Nordic Development Fund invested in the pilot of a PAYGO model, which includes a financing vehicle ensuring investors and lenders recoup their investment & interest, through a pre-agreed instalment plan for health facilities.
Design/pilot phase	3	Hybrid model	Sunfunder is designing an 'AssetCo' guarantee model, where a separate legal entity acquires concessional equity and debt for financing and ownership of all equipment (assets)

The main challenge in electrifying health facilities is government inability to pay, and lack of demand aggregation in the private sector. This is causing developers to design innovative de-risking models, though none have been operationalized as of yet.

> "As debt providers, we are most likely to shy away from government linked investments. Even when they have the ability to pay, the willingness is not always there. So we tend to focus on private facilities that really need electrification, using concessional finance and grants.
>
> Off-Grid Investor

> "A lot of the clinics we see in peri-urban areas have very low energy demand. They deal with intermittency, but they use mostly rechargeable devices, so so-long as the intermittency isn't debilitating, they can manage patients and make referrals for more acute cases where energy demand for interventions is higher.
>
> Co-Founder, Health Clinic Network in East Africa

> "The largest challenges we have faced with electrifying health facilities at scale is that government owns a significant number of facilities that need electrifying, and it is challenging to get them to commit to paying for the power. Secondly, most of these health facilities lack equipment, and thus are not an anchor load in and of themselves, making it difficult to serve their demand.
>
> Private Power Company Operating Across Africa

(1) Non-exhaustive

Source: Interviews with developers and investors; CrossBoundary Analysis

Most donor activity is concentrated in capex grants, but there is nascent activity in blended finance solutions with participation from DFIs[1]

Implementer / Investee	Capital provider	HF Tier	Financing type	Financing purpose
Energy4Impact	Ovo Foundation	1	Grant	Capex
Little Sun Foundation	UD	1	Grant	Capex
Moving energy initiative, Kube Energy, Crown Agents	FCDO	1	Grant	Capex
Res4Africa Foundation	Electricians without borders	1	Grant	Capex
We Care Solar	UD	1	Grant	Capex
World Bank / Government of Kenya	World Bank	1	Grant	Capacity building & Capex
WRI	DFID	1	Grant	Capex
WHO	Solar Electric Light Fund	1	Grant-in-kind	Capex
ENDEV	SNV, GIZ	UD[2]	Grant	Capex
Differ AS	Nordic Climate Facility	1	Blended Finance	Capex & Opex
D.Light	Swedfund	1	Blended Finance	Capex
D.light	FMO	1	Blended Finance	Capex

Grant | Blended finance

Capex provided through provision of solar system, NGO is funded by various donors

Part of US$150m KOSAP project

PAYGO targeting private clinics, pre-agreed payment instalments have been put in place to de-risk investors & debt providers to finance solar electrification of health clinics

Blended Finance solution, through FMO's publicly funded AEF fund

(1) Non-exhaustive – based on interviews and desk-based research; (2) Undisclosed

Source: Powering Healthcare Intervention Database, SEforALL, 2022; CrossBoundary Analysis

Most funding identified in Kenya was estimated based on the World Bank's KOSAP project – leaving a $225M estimated funding gap

	Funding Amount	Number of Projects	Description
Known investment[1] into HFE in Kenya	$2.1M	1	• Only 1 project in Kenya disclosed its funding amount for HFE - OVO Foundation investment in Project Jua, implemented by Energy 4 Impact
Estimated investment[2] into HFE in Kenya	$7.5M	2	• Only 1 broad energy electrification project to estimate HFE from - World Bank KOSAP project
Projects with **undisclosed funding**	N/A	10	
Total	**$9.6M**	13	
Estimated Funding Gap	**$225M**		

(1) Based on all identified donor projects where funding for HFE alone was disclosed (i.e., not part of larger programs where HFE was a smaller component); (2) Based on all identified donor projects where HFE was one component, and direct HFE funding was not disclosed. This number is derived from allocating an estimated percentage of funding allocated to HFE in broad electrification/health programs where HFE was an identified component

Source: CrossBoundary Analysis

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Country overview | Malawi

Malawi overview

Total population:	19.9M
Rural population:	82%
Health facilities:	1,331
Electrified facilities:	48%
On-grid cost/kWh:	US$0.064

Donor and government HFE programs

Amount	9 donor programs, 2 identified government programs
Largest[1]	US$7.5M, FCDO/USAID funded
Smallest	US$233K, Power Africa funded
Programming Gaps	Country's main healthcare strategy, Health Sector Strategic Plan III does not place a strong emphasis on HFE

Government fiscal position

- External debt: US$3.2B
- Budget deficit: 8.7%
- Current BoP: -US$1.5B
- External debt (% exports): 156%

635	GDP per capita, US$
8.6	YoY inflation, %
5.6	Unemployment, %

Sector planning

National Energy Policy 2020
Establishes a framework for affordable, reliable, and efficient energy access. It led to the creation of energy regulator and serves as guiding policy for energy sector developments.

Renewable Energy Strategy
Goal of achieving universal access to renewable electricity and a sustainable bioenergy.

Health Sector Strategic Plan
Integrates health care delivery, creates a One Plan, One Budget, and One Report system, establishes a sector-wide performance management system and increases domestic revenue for health.

Key players and ongoing programs

egenco – Parastatal with primary purpose to generate electric power

POWER AFRICA – A U.S. GOVERNMENT-LED PARTNERSHIP

MERA

ESCOM – National electric utility company responsible for distribution

Regulatory environment

- Malawi Energy Regulatory Authority (MERA): MERA is a statutory corporation created under the Energy Regulation Act, 2004. Its mandate is to regulate all energy industry activities, including licensing, tariff approval, compliance monitoring, and standards development.
- Malawi's power sector is guided by the updated 2018 National Energy Policy and the 2016 Electricity (Amendment) Act. These aim to improve the regulatory framework's transparency, predictability, and generate investor confidence, supported by the Renewable Energy Strategy.

Incentive schemes

Tariff subsidy

Tax incentives

- Malawi Rural Electrification Programme (MAREP): Includes the development of micro, mini and small hydropower stations
- IPP Framework: commitment from government and stakeholders to establish a robust and transparent process for attracting investment in the power sector

Source: Malawi Ministry of Health; World Bank; Malawi Integrated Energy Plan, SEforALL, 2022; International Monetary Fund

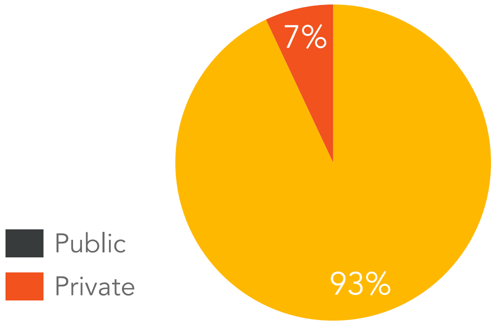
The overall capex investment need in Malawi is ~$16M, with estimated demand being greatest in Tier 2 public facilities

Electrification need, in # of facilities & capex (US$ '000s)

	Tier 1		Tier 2		Tier 3	
	New	**Stability**	**New**	**Stability**	**New**	**Stability**
# of facilities requiring electrification	85	40	415	180	5	10
	125		595		15	
	735					
	Public	**Private**	**Public**	**Private**	**Public**	**Private**
Capex need (in US$ '000)	$940	$830	$7,380	$1,100	$3,600	$2,400
	$1,770		$8,480		$6,000	
	$16,260					

Due to high number of facilities, public Tier 2 accounts for almost half of the total capex need in Malawi. Within this Tier, ~70% of facilities require either new connections.

Split of public and private facilities

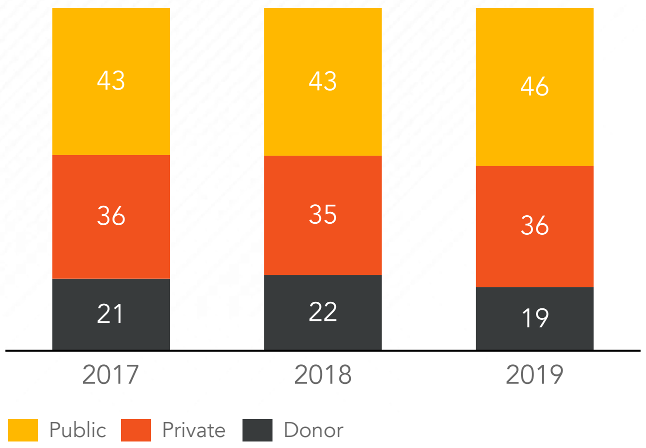


More than 80% of Malawi's population is rural, causing majority of health facilities to fall in Tier 1, which are most often publicly owned as they are the least commercially viable. Moreover, the government places a heavy emphasis on primary health care, which is similarly mainly offered through public facilities. This drives a high number of public health facilities, meaning government is the off taker in more than 75% of health facilities.

Source: World Bank; Malawi Ministry of Health

Almost 80% of all health expenditures go towards recurring cost, leaving little possibility for investments into HFE

Health expenditure distribution, %[1]



Donors contributed an average of 75% to the health sector between 2018 and 2019

~74% of donor funding was off-budget in 2017/18, contributing to fragmentation in planning and financial management

Households spend on health increased by 35% between 2014/15 and 2017/18

Key figures in Malawi's public health spend

- ~20% of MoH budget is used for operations of 5 central public hospitals
- 55% of the health budget is channelled through MoH
- 43% of the health budget is channelled through council/district level expenditures, of which the majority is used for personal emoluments
- 78% of all health expenditures are used for recurrent costs

Health budgeting process

National Budget

- MoH[2] prepares a budget based on the HSSP[3], which is reviewed and allocated by MoFEPD[4]
- National Budget is used for national level spend, such as procurement of equipment and financing referral hospitals

District Budget

- MoH[2] allocates district budget from national budget
- District managed by DHMT[5] that dispersed funds based on District Implementation Plan
- Funds are used for district activities, such as financing district hospitals and health facilities

Electrification decisions are made through coordination of the MoE[6], MoH[3], ESCOM[7] and district level health offices

(1) Latest available year where public spend includes government budget allocated funds and donor funds channelled through government; (2) Ministry of Health (3) Health Sector Strategic Plan; (4) Ministry of Finance, Economic Planning and Development; (5) District Health Management Team; (6) Ministry of Energy; (7) Electricity Supply Coordination of Malawi

Source: Malawi Health Budget Brief, UNICEF, 2022; World Bank; Health Financing at the District Level in Malawi, Health Policy and Planning Journal, 2017

Electrification targets in Malawi are guided by the National Energy Policy, aiming to create universal access to affordable, reliable and sustainable energy

Priority electrification targets in Malawi are guided by the National Energy Policy of 2020

1
2030
Universal energy access
Achieve universal energy access for all Malawi

2
2030
35% renewables
Derive 35% of electricity generation from renewable sources by 2030

3
2030
1631 MW installed capacity
Reach 1,631 MW of installed capacity by 2030, to better serve the increasing energy demand

Policy and regulatory interventions to meet targets

Health Sector Strategic Plan (HSSP) III (2023-2030)
Builds on the previous HSSP I & II, with the aim to integrate health care delivery, create a One Plan, One Budget, and One Report system, establish a sector-wide performance management system and increase domestic revenue for health.

National Energy Policy (2020)
Policy to increase access to affordable, reliable, sustainable, efficient and modern energy for every person in Malawi, through diversifying energy sources, developing an efficient energy sector, modernizing sustainable energy services, increasing access to clean, affordable and sustainable energy.

Renewable Energy Strategy
Strategy with the goal of achieving universal access to renewable electricity and a sustainable bioenergy sector, through investing in grid-scale renewables, clean energy mini-grids, off-grid solar and bioenergy.

Energy related policy/plan | Health related policy/plan

Source: Malawi Global Climate Scope, BloombergNEF; Government of Malawi; Malawi Energy Sector, JICA

There are a number of key financial incentives for renewable energy in Malawi, but investment remains low due to poor implementation of the incentive programs

Tariff subsidy

A feed-in tariff scheme has been in place since 2012 and is based on capacity or a combination of capacity and energy charges. Energy producers are paid for the net amount of energy sent out.

TAX

Tax incentives

Many products related to solar generation and energy efficiency measures have zero value added tax as well as the removal of import tariffs for all renewables equipment.

Access to Clean and Renewable Energy (ACRE)

The ACRE Project seeks to enhance the government's efforts to improve access to modern and clean energy services. It will offer cost-effective and sustainable renewable energy solutions, along with financial and regulatory incentives, to tackle energy access issues. The project will prioritize poor and vulnerable individuals, commercial establishments, entrepreneurs, and social sectors.

Active developers in HFE

- MEGA – Mulanje Electricity Generation Agency
- ARC
- DIFFER Community Power
- zuwa – The Solar Champions

Source: Government of Malawi; Malawi Global Climate Scope, BloombergNEF; Malawi, International Energy Agency

Malawi's HFE is currently dominated by the donor BOT model, with one de-risking mechanism being designed for PPAs

HFE Models in market or development[1]

Established	1 Design, Build, Operate, Transfer	Most donor funded installations are still done through a design, build, operate and transfer model, where the government is the eventual owner. No de-risking is necessary, but the model is unsustainable without on-going O&M considerations.
Design/pilot phase	2 De-risked PPA	UNDP is designing a program to partially subsidize PPAs using donor and government financing, to provide a more stable off-taker to the private sector. Still searching on ways to implement a 3rd party to guarantee residual government risk

Malawi has a small health electrification market, where DBOT is the main method. The UNDP is currently designing a de-risking tool for government payments in PPAs, which will be applied in Malawi (among 5 other countries)

> "Health facilities are just one part of wider community electrification. Many of the facilities are very basic and don't have a lot of equipment that requires a high energy demand.
>
> Developer Active In Malawi

(1) Non-exhaustive

Source: Interviews with developers and investors; CrossBoundary Analysis

Given the health financing make-up in Malawi, donors play a critical role and have focused efforts on capex grant activity – only one program has funding for O&M[1]

Lead implementing agency	Capital provider	HF Tier	Financing type	Financing purpose
GAVI	GAVI	1	Grant	Capex
IPCS	Power Africa Off-grid Project	1	Grant	Capex
UNDP S4H	Global Fund, Innovation Norway, UNDP	1	Grant	Capex
UNICEF	UNICEF	1	Grant	Capex
UNICEF	UNICEF, Differ Community Power	1	Grant	Capex
Zuwa Energy	Power Africa Off-grid Project	1	Grant	Capex
Community Energy Malawi, United Purpose	Government of Scotland	1	Grant	Capex
Malawi Ministry of Health	FCDO, USAID	1	Grant	Capex
Little Sun Foundation	UD[2]	1	Grant	Capex
Differ Community Power	GIZ	1	Grant	Capex & opex

All but 1 donor projects in Malawi take shape as capex grants, concentrated in HF Tier 1

Projects includes financing for O&M at 8 health facilities, duration not specified

(1) Non-exhaustive – based on interviews and desk-based research

Source: Powering Healthcare Intervention Database, SEforALL, 2022; CrossBoundary Analysis

Power Africa, FCDO, UNICEF are all active in Malawi – leaving a $2.6M estimated funding gap

	Funding Amount	Number of Projects	Description
Known investment[1] into HFE in Malawi	$11M	4	• 4 projects in Malawi disclosed their funding amount for HFE - 2 Power Africa Off-grid Projects, one FCDO & USAID co-funded project, and one Government of Scotland funded project
Estimated investment[2] into HFE in Malawi	$3.3M	1	• Only 1 broad energy electrification project to estimate HFE from - UNICEF's Sustainable Energy Malawi Project
Projects with **undisclosed funding**	N/A	5	
Total	**$14.3M**	9	
Estimated Funding Gap	**$2.6M**		

(1) Based on all identified donor projects where funding for HFE alone was disclosed (i.e., not part of larger programs where HFE was a smaller component); (2) Based on all identified donor projects where HFE was one component, and direct HFE funding was not disclosed. This number is derived from allocating an estimated percentage of funding allocated to HFE in broad electrification/health programs where HFE was an identified component

Source: CrossBoundary Analysis

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Country overview | Zambia

Kenya overview

Total population:	19M
Rural population:	55%
Health facilities:	2,928
Electrified facilities:	47%
On-grid cost/kWh:	US$0.045

Donor and government HFE programs

Amount	7 donor programs, 4 identified government programs
Largest	US$700K, UNDP Bank Funded
Smallest	US$200K, Power Africa funded
Programming Gaps	Based on known funding, limited amount of capital flowing into health electrification

Government fiscal position

- External debt: US$15B
- Budget deficit: 9.8%
- Current BoP: -US$1.2B
- External debt (% exports): 100%

1137 GDP per capita, US$

10.2 YoY inflation, %

13 Unemployment, %

Sector planning

Zambia Vision 2030
Long term plan aims at attaining middle-income nation status by 2030 by creating an enabling environment for sustainable socio-economic development

National Renewable Energy Strategy Action Plan
Policy framework focused on increasing renewable energy, by creating favourable conditions for investment, developing innovative financing, encouraging integrated productive use of renewable energy, capacity building and research and development

Rural Electrification Act
Act that promotes and enhances rural electrification through continuing the existence of the REA and REF, constituting the Board of the Authority

Rural Health Facility Electrification Act
Act to aid in electrifying health facilities through solar power, focusing on data, O&M, capacity building and technical assistance and funding

Key players and ongoing programs

REA ZAMBIA — UNDP

Regulatory environment

- **Energy act:** Act that governs the energy sector, through a framework for energy planning and policy, establishment of the ERB1, outlining licensing requirements and procedures, promoting development and utilization of renewable energy, establishing of energy efficiency standards, providing consumer protection and outlining environmental considerations and standards, among others)
- **Electricity act:** regulates the generation, transmission, distribution and supply of electricity

Incentive schemes

Tariff subsidy — TAX Tax incentives — Loan guarantees

- **Rural Electrification fund:** dedicated fund for supporting rural electrification
- **REA capital provision:** up to 100% capital provision for projects supporting rural electrification

Source: Zambia Ministry of Health; World Bank; Rural Electrification Agency Zambia

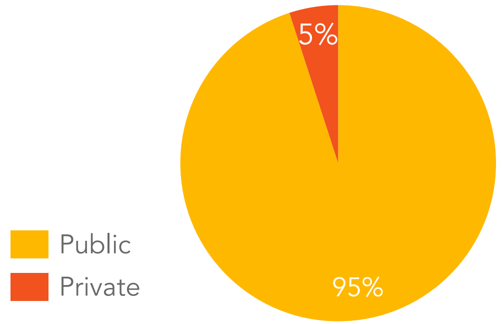
The overall capex investment need in Zambia is ~$93M, with the majority of demand being driven by Tier 3 public sector

Electrification need, in # of facilities & capex (US$ '000s)

	Tier 1		Tier 2		Tier 3	
	New	Stability	New	Stability	New	Stability
# of facilities requiring electrification	960	250	975	255	75	50
	1,210		1,230		125	
	2,585					
	Public	Private	Public	Private	Public	Private
Capex need (in US$ '000)	$15,430	$3,620	$15,680	$3,680	$44,250	$10,380
	$19,050		$19,360		$54,630	
	$93,030					

The largest investment need is in Tier 3 public facilities. This is partially due to the large public ownership of health facilities at all levels, and the relatively high amount of Tier 3 facilities requiring either new (60%) or stability (40%) connections.

Split of public and private facilities

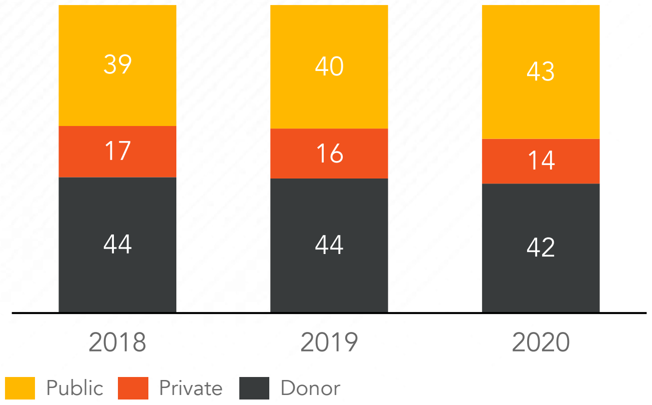


Zambia's health sector is dominated by public ownership of health facilities. As most demand is concentrated in Tier 3, this provides opportunities for intervention. However, the high number of public facilities creates issues of both willingness and ability to pay.

Source: World Bank; Zambia Ministry of Health; CrossBoundary Analysis

Government contribution to health is steadily increasing, however allocation to infrastructure projects is decreasing meaning less funds available for HFE

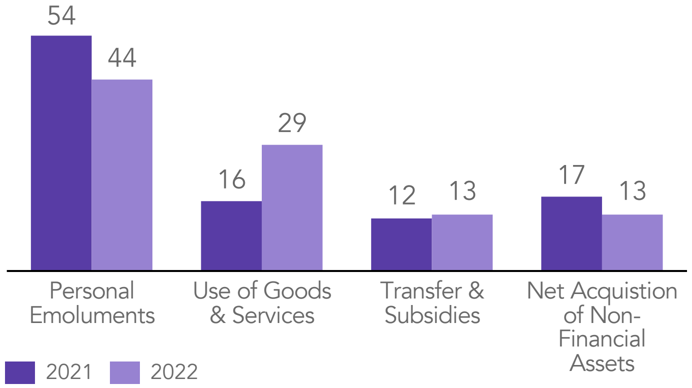
Health expenditure distribution, %[1]



On-budget financing[2] largely comes from domestic resources, accounting for 85% of the MoH's[4] budget.

2023 gov budget has a 25% increase in health budget allocation

Composition of health budget by economic classification, %



Although decreasing, personal emoluments make up almost 50% of government spend on health

Decreasing allocation to infrastructure projects mean an even smaller budget allocated to HFE

Health budgeting process

National Budget

- GoZ[3] allocates national health budget to MoH[3] which allocates to programs, initiatives and institutions, policy creation, investment management and drug procurement (e.g., MoH[3] headquarters and national hospitals),
- Part of the budget is distributed to provincial and district health offices

Provincial Budget

- Provincial budget is used for management and delivery of healthcare services at regional level
- Budget is used for supervision and technical support, human resource management and funding of provincial hospitals
- Health centres receive budget for operations that they may allocate as needed

District Budget

- District budget is used for management and delivery of healthcare services at the local level
- Budget is used for non-wage recurrent expenditures, supervision and technical support to health centres and posts
- Posts receive budget that they may allocate as needed

Electrification decisions for health facilities are made by the Rural Electrification Agency.

(1) Latest available year where public spend includes government budget allocated funds and donor funds channelled through government; (2) Financing channelled through Government's Health Budget (3) Government of Zambia; (4) Ministry of Health

Source: Zambia Health Budget Brief, UNICEF, 2022; World Bank; Zambia Health Sector Public Expenditure Review, World Bank

Sector planning is mainly geared towards Vision 2030, in which Zambia aims to obtain universal energy access, and have 30% renewable energy in its energy mix

Priority electrification targets in Zambia are centered on access and renewable energy

1 — 2030 — Energy access

Achieve universal access to affordable, reliable and modern energy services

2 — 2030 — 30% renewables

Derive 30% of energy needs from renewable energy, excluding large hydro

Policy and regulatory interventions to meet targets

Energy Regulation Act (2019)
Act that governs the energy sector, through a framework for energy planning and policy, establishment of the ERB[1], outlining licensing requirements and procedures, promoting development and utilization of renewable energy, establishing of energy efficiency standards, providing consumer protection and outlining environmental considerations and standards, among others.

National Renewable Energy Strategy & Action Plan (2022)
Policy framework focused on increasing renewable energy, by creating favorable conditions for investment, developing innovative financing, encouraging integrated productive use of renewable energy, capacity building and research and development.

Rural Electrification Act (2023)
Act that promotes and enhances rural electrification through continuing the existence of the REA and REF, constituting the Board of the Authority.

Electrification of Health Facilities Action Plan (2022)
Plan to aid in electrifying health facilities through solar power, focusing on data, O&M, capacity building and technical assistance and funding.

Energy related policy/plan | Health related policy/plan

(1) Energy Regulation Board, the regulatory authority of energy sector

Source: Zambia Institute for Policy Analysis and Research, UN Zambia; Zambia, International Energy Agency; Government of Zambia; World Bank; National Assembly of Zambia; Zambia Rural Electrification Agency; Zambia Global Climate Scope, BloombergNEF

There are a number of key financial incentives for renewable energy in Zambia, encouraging investment into renewables

Tariff subsidy

Guaranteed premium price for electricity generated from renewable sources, providing investors with a level of guaranteed revenue.

Tax incentives

Customs duty exemptions for most renewable energy project components as well as a 0% tax rate on dividends and profits for the first five years of the project lifetime for PV and small-hydro plants. VAT exemptions for +US$500K investments in renewable energy.

Loan guarantees

Loan guarantees are offered to ZESCO[1] from the government for development of its energy projects – not available for privately owned companies.

Rural Electrification Fund & REA

Fund is drawn form a 3% levy on every unit of electricity consumed across all customer categories and used for the development of rural electrification projects to include grid extension and construction of electricity generation facilities. Additionally, REA also offers capital support up to 100% for mini-hydro power projects or mini-grid power projects to promote community access to electricity.

Active developers in HFE

- Power Roll
- Engie
- Switch ACDC
- SM
- Muhanya Solar Limited
- Vitalite

(1) Zambian state-owned power company, producing 80% of energy consumed

Source: Government of Zambia; Zambia Global Climate Scope, BloombergNEF; International Institute for Sustainable Development ; Zambia FiT, African Energy;

Based on interviews, we identified no currently applied de-risking tools in Zambia for HFE, but UNDP is designing a new pilot to be tested in Zambia and Malawi

HFE models in market or under development[1]

Established	1 Design, Build, Operate, Transfer	Most donor-funded installations are still done through a design, build, operate and transfer model, where the government is the eventual owner. No de-risking is necessary, but the model is unsustainable without on-going O&M considerations.
Design/pilot phase	2 De-risked PPA	UNDP is designing a program to partially subsidize PPAs using donor and government financing, to provide a more stable off-taker to the private sector. Still searching on ways to implement a 3rd party to guarantee residual government risk

Zambia has a small health electrification market, where DBOT is the main method. The UNDP is currently designing a de-risking tool for government payments in PPAs, which will be applied in Zambia (among 5 other countries)

> "We need to work closely with donors to get to the last mile customers because the cost is just too high to service these communities. When it comes to health facility electrification, our biggest wins were coordination between the Ministry of Health and the Ministry of Energy – ensuring the energy ministry plans for grid extension and mini-grids matched the needs from the health ministry.
>
> Former Energy Program Chief of Party

(1) Non-exhaustive

Source: Interviews with developers and investors; CrossBoundary Analysis

Most donor activity in Zambia has been capex grants, with one project aimed at facility mapping and ministerial coordination

Implementer / Investee	Capital provider	HF Tier	Financing type	Financing purpose
ENGIE Power Corner	Engie	1	Grant	Capex
GAVI	GAVI	1	Grant	Capex
Muhanya Solar	Power Africa Off-Grid Project	1	Grant	Capex
UNDP S4H	NOREPS, Global Fund	1	Grant	Capex
UNDP	UNDP	1	Grant	Capex
ACE-TAF	FCDO	1	Grant	Facility mapping
Prospero	FCDO	UD[2]	Grant	Capex

Apart from two projects aimed at facility mapping and market assessment, all current donor activity in Zambia is in capex grants

(1) Non-exhaustive – based on interviews and desk-based research; (2) Undisclosed

Source: Powering Healthcare Intervention Database, SEforALL, 2022; CrossBoundary Analysis

Only $1M in known funding has been dispersed in Zambia, through two projects funded by UNDP and Power Africa – leaving a $92M estimated funding gap

	Funding Amount	Number of Projects	Description
Known investment[1] into HFE in Zambia	$1M	2	• Only 2 projects in Zambia disclosed funding amounts for HFE - Power Africa Off-grid Project and UNDP project
Estimated investment[2] into HFE in Zambia	$0	0	
Projects with **undisclosed funding**	N/A	5	
Total	$1M	7	
Estimated Funding Gap	$92M		

(1) Based on all identified donor projects where funding for HFE alone was disclosed (i.e., not part of larger programs where HFE was a smaller component); (2) Based on all identified donor projects where HFE was one component, and direct HFE funding was not disclosed. This number is derived from allocating an estimated percentage of funding allocated to HFE in broad electrification/health programs where HFE was an identified component

Source: CrossBoundary Analysis

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Country overview | India

India overview

Total population:	1.4B
Rural population:	65%
Health facilities:	43,486
Electrified facilities:	89%
On-grid cost/kWh:	US$0.105

Donor and government HFE programs

Amount	7 donor programs, identified government programs
Largest	US$52M, SELCO Foundation and Ikea Foundation Funded
Smallest	Insufficient disclosed funding to determine
Programming Gaps	Large programs still have a focus on capex grants

Government fiscal position

- External debt: US$631B
- Budget deficit: 6.4%
- Current BoP: -US$533B
- External debt (% exports): 28%

2257 GDP per capita, US$

4.7 YoY inflation, %

5.9 Unemployment, %

Sector planning

National Solar Mission
Aimed at promoting development and deployment of solar energy in India, by achieving 450GW solar capacity by 2030, through incentives such as feed-in-tariffs, subsidies and generation-based incentives

Deen Dayal Upadhyaya Gram Jyoti Yojana
Policy framework aimed at strengthening rural electricity distribution infrastructure

National Health Mission
Focuses on strengthening healthcare infrastructure, including in rural areas, by providing financial support to states for improving healthcare facilities, which may include electrification projects

Key players and ongoing programs

Global Energy Alliance for People and Planet

SELCO Foundation

IKEA Foundation

Regulatory environment

- **Electricity act:** promotes competition, transparency, and efficiency in the power sector. Includes provisions for distribution of electricity, encouraging private sector participation, and the establishment of regulatory commissions at the central and state levels

Incentive schemes

Tariff subsidy

Loan guarantees

- **Generation based incentives and accelerated depreciation** to provide steady income and reduced taxation

Source: World Bank; UNICEF; Government of India; GEAPP; Selco foundation

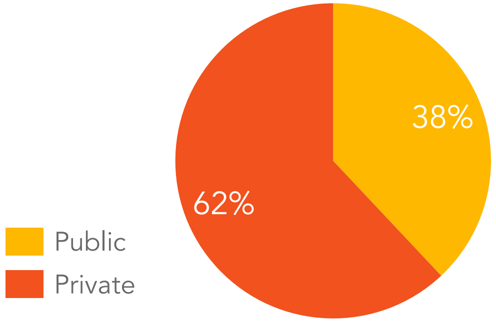
The overall capex investment need in India exceeds $1B, with stability connections in the private sector driving this demand at predominantly the Tier 1 level

Electrification need, in # of facilities & capex (US$ '000s)

	Tier 1		Tier 2		Tier 3	
	New	Stability	New	Stability	New	Stability
# of facilities requiring electrification	20,040	110,755	1,335	7,385	0	0
	130,795		8,720		0	
	139,515					
	Public	Private	Public	Private	Public	Private
Capex need (in US$ '000)	$362,070	$590,740	$24,140	$39,380	$0	$0
	$952,810		$63,520		$0	
	$1,016,330					

Electrification need in Tier 3 is not for primary or stabilization – investment here is needed to reduce energy costs through. The largest electrification requirement is in Tier 1, reaching almost US$1B. With majority of this driven through stability requirements as India aims to improve its power infrastructure, but lags behind on distribution.

Split of public and private facilities

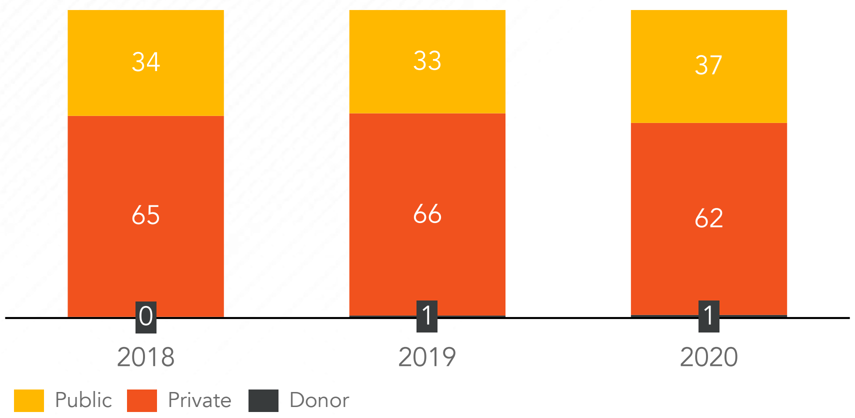


India's large share of private health facilities is driven by lack of trust in public health facilities, as they often lack adequate infrastructure and therefore. Despite private healthcare costing four times more (on average) than public healthcare, 72% of rural population and 79% of urban population would not trust a public healthcare facility, causing, 70% of Indians to choose private healthcare services when spending out of pocket.

Source: World Bank; India Ministry of Health; S&P Global; Private Healthcare in India, Institut Montaigne, 2022

Little donor activity in India, with most health expenditure driven by the private sector, creating more opportunities for HFE investments

Health expenditure distribution, %[1]



India has a low direct donor contribution to health spend, as it is recognised as a middle income country and because of the complexity and size of the country which discourages donors to channel funds through government. Donor led programs are more present in India

As majority of the population prefers private healthcare, this is the largest contributing factor to health expenditure. India's public contribution to health expenditure lies slightly above the region average (~2%). But remains inadequate, as direct government expenditure on health is less than 1% of GDP.

Health budgeting process

Central Budget	State Budget	District Budget
• GoI[2] allocates a health budget, based on national priorities, development goals, and the recommendations of the MoHFW[3] • The health budget is distributed to different departments and programs under the ministry	• GoI[2] allocates state level budgets for health • State governments are in charge of the allocation of this budget based on state priorities and goals	• State health budget is also partially distributed to district and local levels • District health administrations receive funds for implementing healthcare programs, managing healthcare facilities, and addressing local health needs

Due to the size of the country and the federal state, India's health budget is predominantly manged at a state level, with the MoHFW[3] in charge of formulating and implementing policies and programs, disease control and health infrastructure development[4]

Electrification decisions are made by the MoE[4], but in collaboration with the MoHFW[3]. One of the responsibilities of the MoHFW[3] is to formulate and implement policies, including those relating to energy and infrastructure. The ministries collaborate with state electricity boards to achieve electrification targets.

(1) Latest available year where public spend includes government budget allocated funds and donor funds channelled through government; (2) Government of India; (3) Ministry of Health and Family Welfare; (4) Ministry of Energy

Source: World Bank; Government of India; International Healthcare System Profile India, Commonwealth Fund, 2020

India has relatively high electrification rates, leading most of its goals to be geared towards increasing the share of renewable energy in its energy mix

Priority electrification targets in India are centered on access and green energy

1 — 2030
Energy access
Achieve universal energy access, which is mainly dependent on scaling up distribution

2 — 2030
50% renewables
Derive 50% of electricity requirements from renewable sources

3 — 2030
500 GW fossil-fuel free capacity
Reach 500 GW of fossil fuel free energy capacity, to aid in achieving net zero by 2070

Policy and regulatory interventions to meet targets

National Health Mission
Focuses on strengthening healthcare infrastructure, including in rural areas, by providing financial support to states for improving healthcare facilities, which may include electrification projects.

Electricity Act (2003)
Act aimed at promoting competition, transparency, and efficiency in the power sector. Including provisions for distribution of electricity, encouraging private sector participation, and the establishment of regulatory commissions at the central and state levels.

National Solar Mission
Aimed at promoting development and deployment of solar energy in India, by achieving 450GW solar capacity by 2030. The mission includes several incentives and support mechanisms such as feed-in-tariffs, subsidies and generation-based incentives.

Deen Dayal Upadhyaya Gram Jyoti Yojana
Aimed at strengthening rural electricity distribution infrastructure, through feeder separation, system strengthening, metering and providing last mile connectivity. Though not specifically aimed at health centers they may be included.

Energy related policy/plan | Health related policy/plan

Source: Policy Roadmap to Realizing India's Green Energy Potential, EY, 2022; Mapping India's Energy Policy, IISD, 2022;

There are a number of key financial incentives for renewable energy in India, which have encouraged investment in the sector in recent years

Tariff subsidy

Guaranteed price for electricity generated from solar, wind, biomass, and small hydropower. The tariffs are determined by the respective state electricity regulatory commissions and are based on factors such as the type of technology, project size, and location

Loan guarantees

Indian Renewable Energy Development Agency (IREDA) Limited's Credit Guarantee Scheme (CGS). IREDA provides guarantees to commercial banks and financial institutions for loans extended to renewable energy projects

Generation based incentives[1] & accelerated depreciation

Generation based incentives that offer additional payment of Rs.0.50 per unit of electricity fed into the grid by solar or wind generation. This scheme is in parallel with accelerated depreciation on the capital cost of renewable energy assets. The higher depreciation rates reduce taxable profits, providing a tax benefit and improving the financial attractiveness of renewable energy projects

Active developers in HFE

- Fourth Partner Energy
- SELCO
- orb energy
- Oriano – Your Solar Partner
- MLINDA – Produce well · Consume wisely

(1) Generation Based Incentive

Source: Government of India: India, International Energy Agency; Roadmap to India’s 2030 Decarbonization Target, Energy Transitions Commission, 2022

We identified limited de-risking tools applied in India for HFE, but developers and investors have been targeting captive solar for larger facilities to reduce energy cost

HFE models in market or under development[1]

Phase	Model	Description
Established	1 Design, Build, Operate, Transfer	SELCO Foundation is working to electrify health facilities across India with a BOT model, where they will transfer assets to the government once installed, with the plan for the government to shift to covering O&M in the long-term.
Established	3 DBOT + Service Contracts	Many developers operate under this model when installing captive systems for larger health facilities. Many large facilities in India prefer to own the system. While this model can work, it requires facilities to have capital available for capex (which many do) but also involves significant sales lead times.
Design/pilot phase	3 DBOT + Service Contracts	GEAPP is in the early stages of piloting a program that will aggregate demand among private facilities, provide guarantees to banks providing financing to facilities, and then potentially offer concessional lending to further reduce the costs of the systems.

> "Government in India is interested in owning the solar systems, we therefore focus on creating a complementary system with the government, so that we can design, build, operate and then transfer both the equipment and the management of the system to the government.
>
> Indian NGO

> "We mainly work with the private sector seeking alternative energy sources, as they are first far larger than the public sector, and within the public sector the government is focused on owning the system, which SELCO is working on. We are testing models to support the roll out in the private sector through demand aggregation, guarantees through banks, and potentially concessional lending.
>
> Development Alliance

(1) Non-exhaustive

Source: Interviews with developers and investors; CrossBoundary Analysis

All identified donor activity across India was in capex grants, with the government playing a crucial role as capital provider in larger programs alongside donor partners

Implementer / Investee	Capital provider	HF Tier	Financing type	Financing purpose
Mlinda	Mlinda	1	Grant	Capex
SELCO Foundation	SELCO Foundation	1	Grant	Capex
UNDP	UNDP, GEF, GoI	1	Grant	Capex
UNICEF	UNICEF, KfW, GoI	1	Grant	Capex
Power for All	CEED	UD[2]	Grant	Capex
GHE	UD[2]	UD[2]	Grant	Capex

SELCO Foundation program has a target of US$110m to electrify 25k health facilities across India, so far they have electrified 2k

Government is very involved, even with donor led programs

(1) Non-exhaustive – based on interviews and desk-based research; (2) Undisclosed

Source: Powering Healthcare Intervention Database, SEforALL, 2022; CrossBoundary Analysis

Known funding for HFE in India was $52M, driven by SELCO Foundation's program to electrify 25k health facilities – leaving a $948M estimated funding gap

	Funding Amount	Number of Projects	Description
Known investment[1] into HFE in India	$52M	2	• Only 1 project in India disclosed its funding amount for HFE - SELCO foundation and Ikea Foundation investment, of which $52M has been raised, but the goal until 2026 is $110M
Estimated investment[2] into HFE in India	$0	0	
Projects with **undisclosed funding**	N/A	5	
Total	$52M	7	
Estimated Funding Gap	$948M		

(1) Based on all identified donor projects where funding for HFE alone was disclosed (i.e., not part of larger programs where HFE was a smaller component); (2) Based on all identified donor projects where HFE was one component, and direct HFE funding was not disclosed. This number is derived from allocating an estimated percentage of funding allocated to HFE in broad electrification/health programs where HFE was an identified component

Source: CrossBoundary Analysis

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From an overall access perspective, smaller facilities require the most intervention – particularly in Nigeria and India

Estimated capex investment needed, in US$ '000

HF type	Tier 1		Tier 2[1]		Tier 3		Health System Total
	New connections	Stabilizing systems	New connections	Stabilizing systems	New connections	Stabilizing systems	
Tier Total	$1,089	$656,530	$96,780	$46,040	$464,540	$250,990	$2,603,880
Sierra Leone	$6,390	$520	$430	$30	$640	$3,000	$11,000
Nigeria	$519,560	$34,100	$34,640	$2,270	$138,630	$85,400	$814,600
DRC	$173,050	$13,040	$11,540	$870	$208,530	$21,090	$428,110
Kenya	$21,070	$13,540	$1,400	$900	$67,510	$130,100	$234,530
Malawi	$1,570	$200	$7,510	$980	$3,810	$2,190	$16,260
Zambia	$17,650	$1,390	$17,950	$1,410	$45,420	$9,210	$93,030
India	$358,490	$594,320	$23,900	$39,620	$0	$0	$1,016,330

(1) Simplifying assumption that there are approximately 15 health posts to each district health facility equivalent in most countries

Source: WHO: Energizing Health: Accelerating Electricity Access in Healthcare Facilities

The need for electrification is greatest among public sector facilities, and within the private demand more than half is in India

Estimated capex investment needed, in US$ '000

	Tier 1		Tier 2[1]		Tier 3		Health System Total
	Public	**Private**	**Public**	**Private**	**Public**	**Private**	**Total**
Tier Total	$951,250	$794,290	$63,320	$79,510	$410,380	305,150	$2,603,900
% of total	37%	31%	2%	3%	16%	12%	100%
Sierra Leone	$6,350	$550	$420	$40	$3,350	$290	$11,000
Nigeria	$454,000	$99,660	$7,750	$29,160	$145,620	$78,410	$814,600
DRC	$104,210	$81,880	$6,950	$5,460	$128,590	$101,030	$428,110
Kenya	$15,920	$18,690	$1,130	$1,180	$84,970	$112,640	$234,530
Malawi	$940	$830	$7,380	$1,100	$3,600	$2,400	$16,260
Zambia	$15,430	$3,620	$15,680	$3,680	$44,250	$10,380	$93,030
India	$362,070	$590,740	$24,140	$39,380	$0	$0	$1,016,330

$1.4B total public facility investment need

$1.2B total private facility investment need

$630M of which is in India

(1) Simplifying assumption that there are approximately 15 health posts to each district health facility equivalent in most countries

Source: WHO: Energizing Health: Accelerating Electricity Access in Healthcare Facilities