SUSTAINABLE ENERGY FOR ALL

Global Energy Alliance for People and Planet

Foreign, Commonwealth & Development Office

EXECUTIVE SUMMARY

Powering Social Infrastructure in Sierra Leone:

Market Assessment and Roadmap for Health Facilities

Acknowledgements

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Objectives, Scope and Approach

Rationale

- Data on powering social infrastructure (healthcare facilities and schools) is sparse, outdated, and/or stored in multiple locations.
- There is limited coordination between energy and health and education sector actors (e.g., choice of locations for interventions, maintenance of installed infrastructure, appliances and investments in social infrastructure).
- There is a need to understand the investment need to bridge the energy access gap in schools.
- There is a lot of duplication happening across multiple interventions (e.g., needs assessment tools, system design, research on medical appliances, testing sustainable delivery models).

Market Assessment & Roadmap Objectives

01 Provide the government and its development partners with market intelligence and the evidence base for advancing electrification of healthcare facilities and schools in Sierra Leone

02 Provide the strategic information and implementation guide needed by the government and their partners to increase investment on powering social infrastructure and efforts on their sustainability.

03 Provide practical recommendations targeted at the government and its development partners in terms of the planning and coordination of electrification efforts for schools and healthcare facilities in Sierra Leone.

02 | Market Assessment

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Access to electricity could transform challenges into opportunities for improved healthcare service delivery

Access to improved healthcare services could lead to improved health outcomes

Unreliable energy access leads to poor healthcare services and outcomes

- 74% of population do not have access to electricity
- Only 38% of PHUs have access to electricity, with 6-10 hours average power supply from any combination of sources
- Healthcare facilities lack electronic health, logistics and financial information systems
- Health sector fragmentation continues to impede healthcare service delivery
- Improvements in health outcomes is constrained by geographical barriers, high out-of-pocket expenditures, shortage of skilled medical staff, and poor service quality
- Maternal mortality 1,120/100,000 live births;
- Infant mortality 80/1,000 live births rank: 185/193;
- Life expectancy: 54.2 years (average global: 72.7 years)

Demand challenges

- The electrification gap is still very large. Although access to electricity is improving, the rate of electrification is still slow as the demand for electricity continues to grow rapidly.
- Lack of access to financing mechanisms for providers and end users
- Inadequate access to electricity for social/public services such as healthcare facilities

Healthcare financing and donor funding

- GoSL is strengthening public–private partnerships for healthcare services delivery in Sierra Leone
- GoSL has shown strong leadership, determination and political will to increase healthcare spending to 15% of the national budget
- GoSL has plans to track donor resources through a regularly updated national health database system.

Key Policy Actions

GoSL remains committed to:

- Improved governance at all levels and ensuring rural electrification is done through engagement and involvement of key stakeholders, including the private sector.
- Improved policy and regulatory environment – e.g., GoSL unbundled the power sector in 2015 and created new state utilities.
- Exploring the potential of renewable energy sources, especially solar and hydro-power and increase investment
- Sustaining the implementation of the FHCI that was launched in 2010.
- Strengthening the Health Management and Information System through the digitalization of healthcare systems and processes.
- Strengthening the capacity of medical regulatory bodies through the review of a legal and policy regulatory framework in line with regional and international benchmarks.

Improved energy access will lead to improved quality of healthcare services and better health outcomes

- GoSL plans to increase installed electricity capacity from 160 MW (in 2022) to 850 MW by 2030 and restore electricity in all district headquarters and cities.
- GoSL plans to increase renewable energy contribution to 80% by 2030 from 31% in 2022.
- These electrification plans could help transform the health sector from an under-resourced, ill-equipped, and inadequate delivery system into a well resourced and functioning national health-care delivery system that is affordable for everyone and accessible to all.

Source: MoE. Energy transformation. Sector goals and Development partner alignment. June 2022

Inter-sectoral coordination on powering social infrastructure

- There is currently no formal inter-ministerial coordination platform that focuses on electrification of social infrastructure such as healthcare facilities and schools. Therefore, coordination between MoHS and MoE or MBSSE and MoE is ad-hoc and driven by emerging needs. Also, there is currently no mechanism for coordination between ministries and stakeholders specifically on powering healthcare or schools.
- However, several coordination mechanisms exist to facilitate discussions on intervention among key players in the sectors. For instance, the Health Sector Coordinating Committee (HSSC) is the highest coordinating body for the MoHS and its development partners. Similarly, the Health Development Partners (HDP) forum and Health NGOs forum both meet monthly. Both are occasionally attended by government stakeholders in order to brief the partners on various activities and issues.
- MoHS is currently examining the issue: senior advisers to the Ministers are currently working through the office of the Deputy Minister to coordinate all interventions related to health facility electrification, with proposed plans to establish a maintenance unit within MoHS that will be responsible for O&M of installed solar PV systems at healthcare facilities countrywide. It is expected that this unit will coordinate with officials at MoE. No such plans are currently envisaged for MBSSE in the education sector.
- Informal discussions are currently ongoing for a multistakeholder platform on powering social infrastructure (incl. civil society, donors, private sector and government stakeholders). Virtual and in-person meetings have been held to discuss key issues related to powering social infrastructure in Sierra Leone, such as the sustainability of solar PV technology after installations and the related O&M issues.

Healthcare electrification status: general overview and analysis

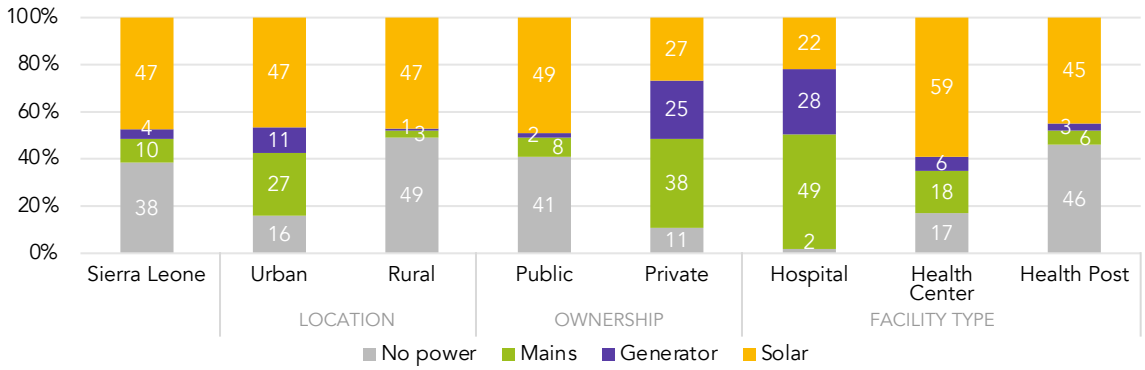
1 Access to power is improving

Over the years, several nationwide surveys have estimated the electrification rate of health facilities. These include:

2012 SARA survey:	2017 SARA survey:	2018 SDI survey:
15% access rate	**23% access rate**	**62% access rate**

While progress has been made, this needs to be qualified by power availability (e.g., many pico-solar and SHS type solutions) and reliability (frequent power outages and sub-optimal performance of installed solar systems are common; some facilities have electricity but for a single room only or type of loas e.g., lights).

Sources of electricity by facility type



Source: 2018 SDI (https://microdata.worldbank.org/index.php/catalog/4038/download/50704

2 Power availability varies significantly between districts

- Energy access rates for healthcare facilities vary greatly across districts, getting progressively lower with the level of healthcare from tertiary and secondary care (hospitals/clinics) to various levels of primary healthcare facilities (PHUs).
- In general, healthcare facilities in Western Urban and Western Rural – where the capital Freetown is located – have higher access rates (95.4% and 89.9%, respectively) compared to Kenema (26.9%), Kailahun (46.0%), Kono (38.7%) or Koinadugu (41.6%).

Percentage access to electricity for health facilities by district

Bo	Bombali	Bonthe	Kailahun	Kambia	Kenema	Koinadugu
79	57	81	46	58	27	42

Kono	Moyamba	Port Loko	Pujehun	Tonkolili	Western Rural	Western Urban
39	52	71	85	64	90	95

3 Electrification data on quality shows large gaps in reliability as well as availability

- There are varying levels of electricity access at healthcare facilities with respect to the quality and duration of electricity available. Many secondary and tertiary healthcare facilities (hospitals/clinics) are connected to the national grid, but they suffer from frequent power outages. These facilities still require backup power sources like gensets and/or stand-alone PV solar systems.
- A small number of facilities at all levels of healthcare facilities have solar PV systems with 24/7 access to electricity. However, for most facilities at the primary healthcare (PHU) level, installations were typically very small systems designed to power a refrigerator and/or providing lighting for only a few health services, usually the maternity room/wing of the facility.
- In many locations and at all levels of healthcare, the stand-alone solar PV systems operate sub-optimally, with many systems providing electricity for less than 12hrs.

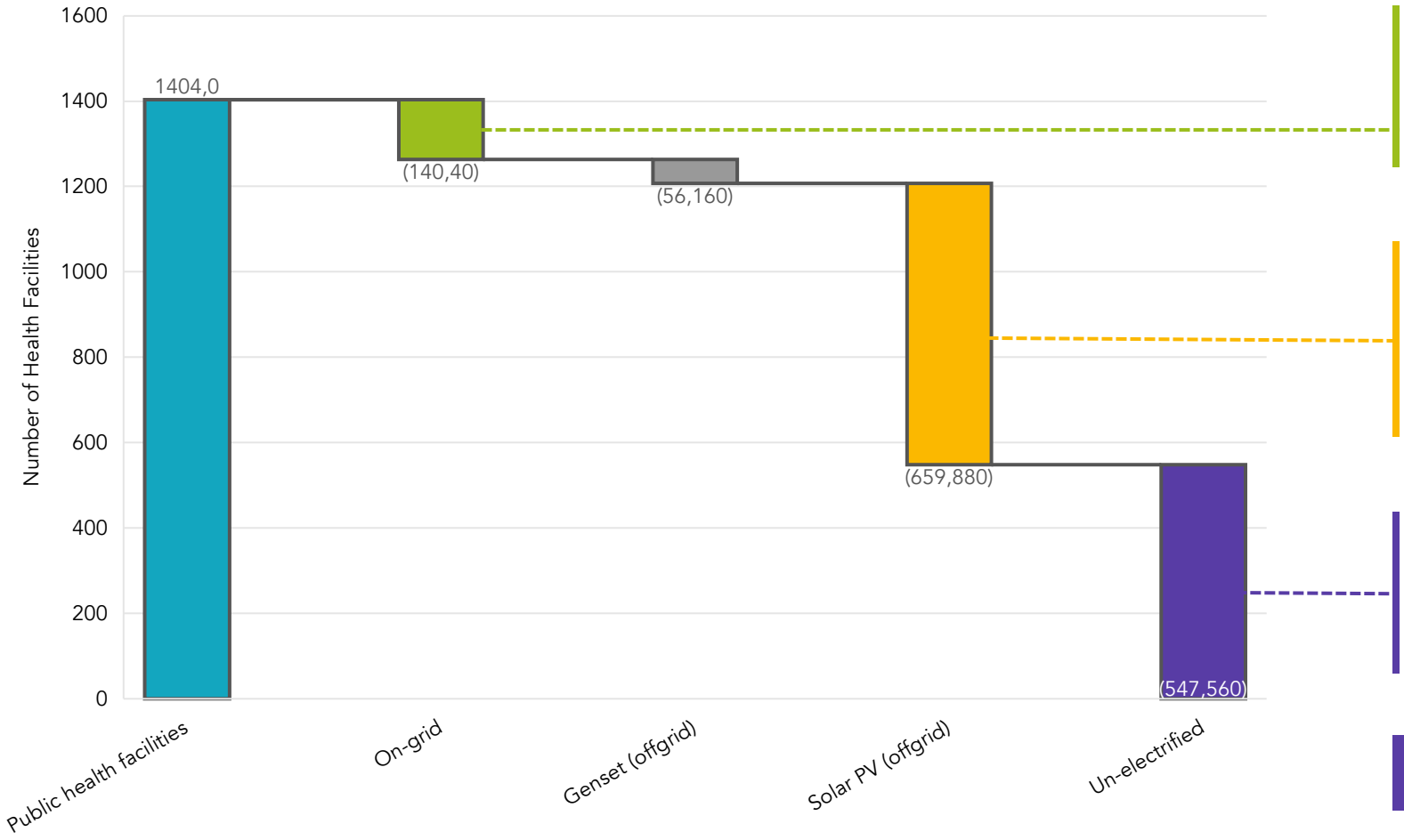
4 Electricity access rates drops significantly for remote and lower-tiered PHUs

- Access rates drop significantly with remoteness from a large town/city with grid connection. The majority of the approximately 80% PHUs without access to the national grid are lower tiered healthcare facilities located further away from large towns/cities that are connected to the national grid.

5 Low-tiered PHUs lack long-term O&M

- A noticeable key challenge of PV stand-alone systems at many lower-tiered healthcare facilities is the lack of long-term operation and maintenance regimes or sustainability plans; this leads to declining performance of the equipment, e.g., faulty wirings, dysfunctional batteries, and broken light bulbs.

Sizing the access gap - market opportunity for solar PV systems



Solar PV back-up systems can be provided to address frequent outages and quality of access for healthcare facilities **connected to the national grid.**

→ **25% of on-grid and all genset-powered PHUs require solar PV back-up = 91 PHUs**

+

Primary health facilities with solar PV solutions tend to be **under-electrified**, as they mostly only have power for a specific health service (e.g., maternity ward or vaccine refrigerator) and/or lighting.

→ **75% of PV-powered PHUs need additional power = 495 PHUs**

+

Most of the PHUs **without access** to a reliable power source are lower-tiered healthcare facilities in last-mile communities.

→ **All un-electrified PHUs require additional power = 548 PHUs**

Total market opportunity: 1,134 PHUs

Recommended solar PV system sizes for health facilities

		CURRENT LOAD	IDEAL LOAD	CapEx*	OpEx**
1.5 kWp	3 kWh	MCHP		$ 18,200	$ 320 / year $1,120 at year 10
3 kWp	6 kWh	CHP	MCHP	$ 24,700	$ 330 / year $2,240 at year 10
6 kWp	12 kWh	CHC	CHP	$ 39,300	$ 370 / year $4,320 at year 10
12 kWp	24 kWh		CHC	$ 67,200	$ 440 / year $8,640 at year 10

**CapEx costs include: design, PV system components, balance of systems, internal rewiring, energy efficiency improvements, civil works, and transportation*

***OpEx costs include: component maintenance, basic preventative maintenance; battery replacement is not included*

Average CapEx: $ 8.2 / Wp

Financing need to electrify all PHUs

1,134 (88%) PHUs
in need of a reliable energy solution

567 MCHPs
requiring av. 3 kWp

340 CHPs
requiring av. 6 kWp

227 CHCs
requiring av. 12 kWp

$14m in CapEx
$4m in OpEx

$16.7m in CapEx
$3.3m in OpEx

$22m in CapEx
$3.4m in OpEx

- *OpEx costs include regular O&M for 15 years + battery replacement after 10 years*
- *A 50-30-20 split is used for MCHPs, CHPs, and CHCs that require an energy solution*

Total CapEx required: $53m

Total OpEx required: $11m

Installed Capacity to be added: $6.4 MWp

Three delivery models emerged as relevant for HFE in Sierra Leone

Delivery model	Description	Biggest drawbacks
Traditional equipment ownership model	Describes a model where a donor agency either directly provides grant funding and commissions an NGO or private sector actor, or grants a public agency funding to commission an NGO or private sector actor to design, purchase and install solar PV systems at a public institution e.g. health facility. The asset is typically owned by the public institution or agency. This has been the predominant model for most HFE interventions implemented in Sierra Leone.	Limited opportunities for long-term sustainability.
Service-based model	Describes a model where a public agency selects a service provider (private sector or NGO) to provide electricity services (design, procure, install, operate and maintain solar PV systems) to public institutions e.g. health facility, typically over a 10- to 15-year period. The service provider raises investment capital (debt or equity) from investors and may also get subsidies and guarantees from donors. The service provider ensures that service levels are met for the contract period. The government pays the provider on a regular basis, as it would with other utilities directly or through a financial institution once a 3rd party verifies that the services have been rendered accordingly.	Difficult to set up a long-term service-based model between public sector actors and service providers. Several critical risks need to be addressed to ensure that willingness and ability to pay is appropriately addressed.
Hybrid model	This combines elements of the traditional equipment ownership model and the service-based model, where it is not fully commercially market driven and yet not fully dependent on donor funding and public agency ownership and management. Given compliance management and procurement management capacity challenges in most settings, it however proposes a Program Management Unit (PMU) or Compliance Management Entity (or similar) through which service contracts and repayments for energy services are managed with the private sector ESCO. The role of donors in this model could be to provide grant funds in the form of (partial) subsidies for e.g. aggregated procurement of energy efficiency upgrades or supply side subsidies to cover portions of system CAPEX. The private sector ESCO raises additional concessional funding through impact investors, DFIs, corporates or philanthropies, but with an assumed lower risk profile given partial subsidies/grants.	Not enough incentive currently exists to make health facilities entry points/anchors for community electrification. Consistency of contributions from public agency is required for sustainability and building confidence of private sector ESCOs and investors

Traditional equipment ownership approach – model

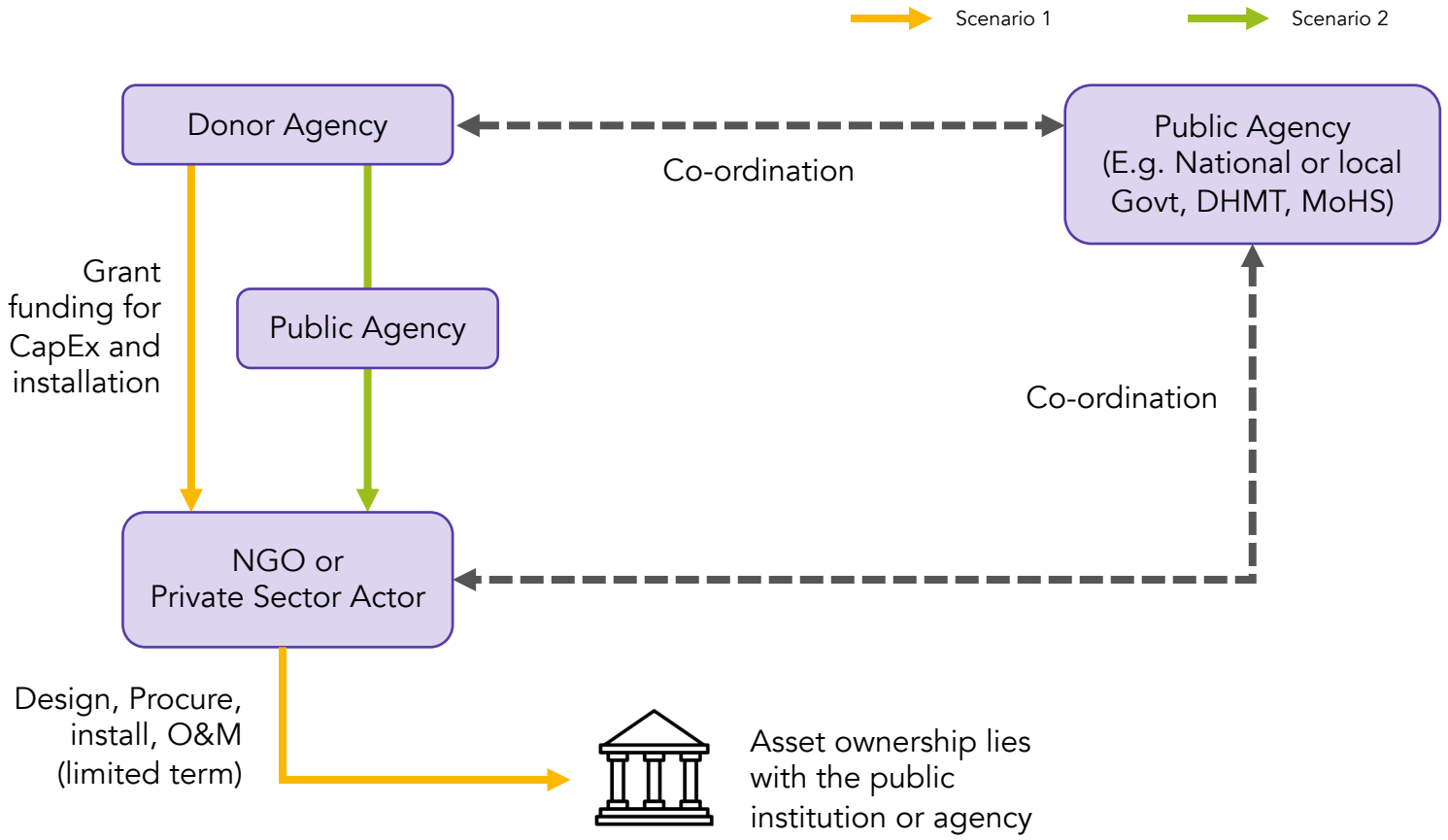
Scenario 1

A donor(s) directly provides grant funding and commissions an NGO or Private sector developer to design, purchase and install RE systems at a health facility.

Scenario 2

A donor(s) provides grant funding directly to an implementing public agency who commissions an NGO or Private sector developer to design, procure and install RE systems to a health facility.

In both instances, a public agency plays a co-ordination role, and the asset is owned by the public institution or agency



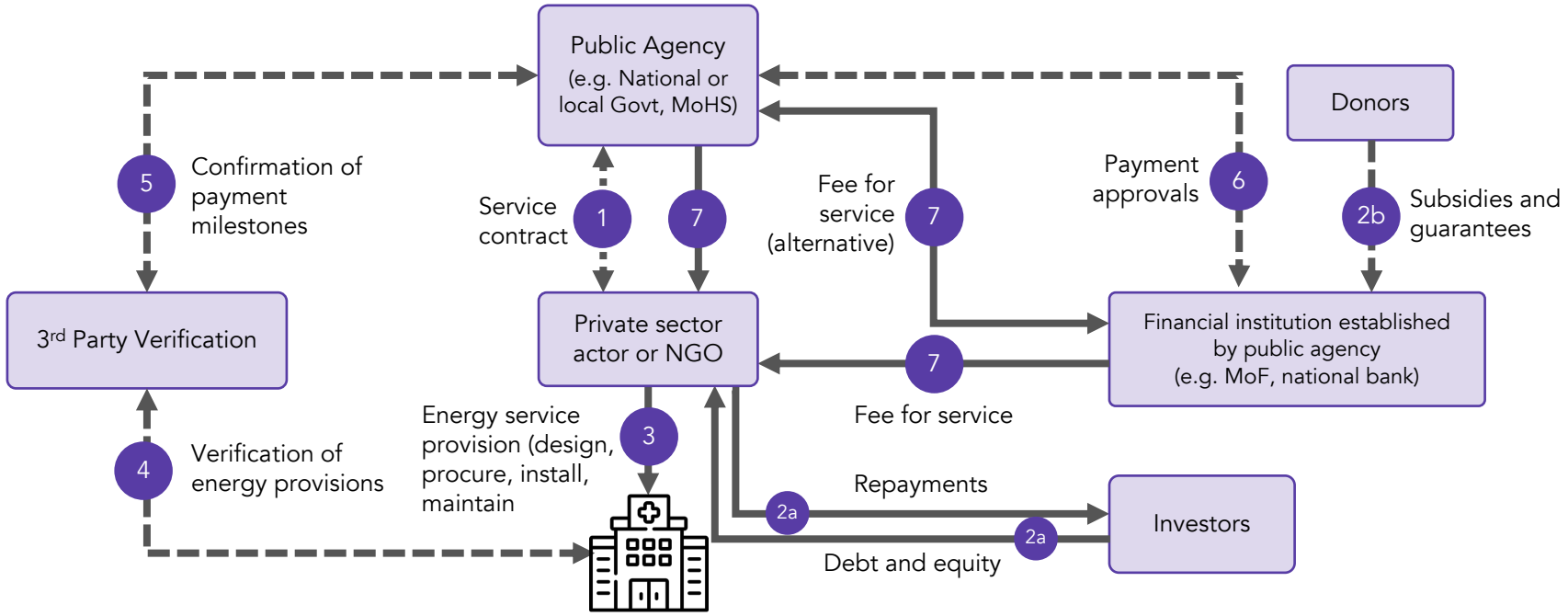
Note: illustration from SEforALL, WB, ESMAP (2021) 'From Procurement to Performance'.

Service-based approach – model

01 A service contract is signed between the service provider and the public agency

2a The service provider raises capital from investors; direct grants to the investors (for e.g., RBF) are not included in this figure

2b Subsidies and guarantees are deployed; these are in addition to existing funds and finance going to public spending (e.g., health, education, etc.). Alternatively, the health facility pays for energy services provided



03 An energy solution is deployed, and the health facility starts using power as a service

04 A third party verifies that energy is being provided and consumed, including through remote monitoring technologies

05 The third-party verifier sends confirmation that payment milestones have been met to the public agency

06 The public agency sends payment approval to the financial institution

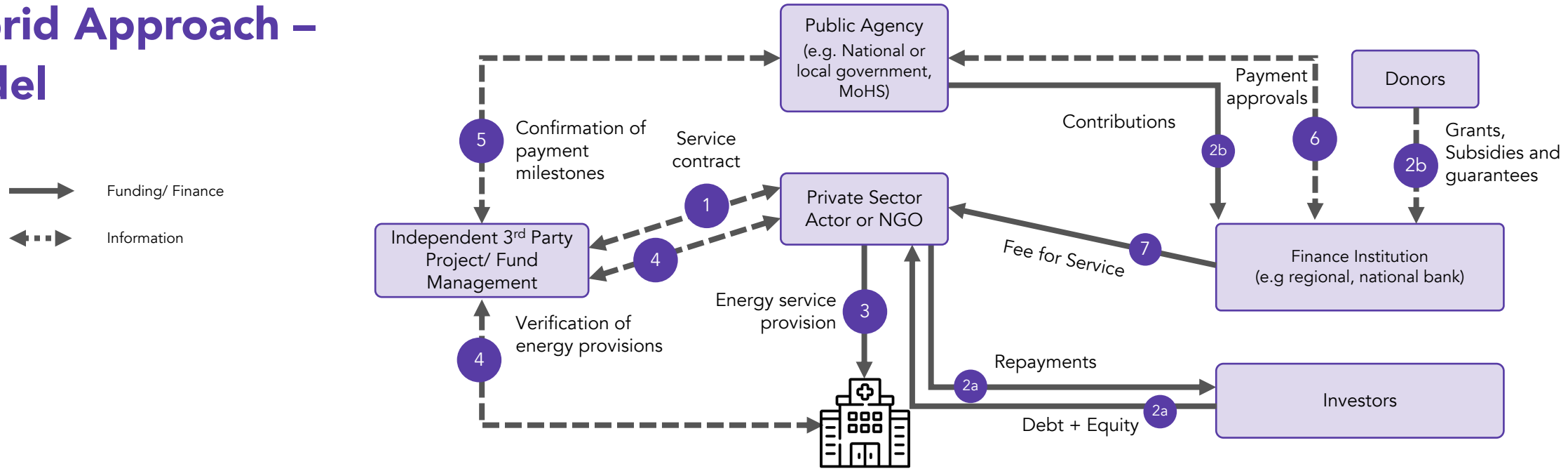
07 The financial institution (e.g., fund manager) issues payment in accordance with the contract and the service delivered

7 alt The financial institution releases funds, which the public agency uses to pay the service provider. Note: these funds can be provided up front.

→ Funding/ Finance

◄- - -► Information

Hybrid Approach – model



01 A service contract is signed between the service provider and the public agency e.g. MoHS SLA Unit, PPP Unit

2a The service provider raises capital from investors; direct grants to the investors (for e.g., RBF) are not included in this figure

2b Public health and education electrification specific subsidies, guarantees and contributions from donors and government

03 An energy solution is deployed, and the health facility starts using power as a service

04 A third party manages the project contract, verifies that energy is being provided and consumed, including through remote monitoring technologies

05 The third-party verifier sends confirmation that payment milestones have been met to the public agency and financial institution

06 The public agency sends payment approval to the financial institution

07 The financial institution issues payment in accordance with the contract and the service delivered

03 | Roadmap: Powering Healthcare Facilities

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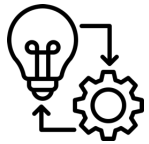

Proposed next steps for phased implementation

Phase 1: Structuring and feasibility (2023 - 2024)

- Engagements initiated between GoSL, IPs and other stakeholders to plan framework for coordination and support for projects on powering social infrastructure (PSI), including the establishment of a dedicated Project Management Unit (PMU) for PSI.
- Commit and provide funds to: i) establish PMU; ii) undertake energy-health ecosystem mapping and energy audits/assessment.
- Establish a fully staffed and equipped PMU that takes the lead on the comprehensive energy-health ecosystem mapping, energy audits/assessments of healthcare facilities countrywide.
- Commit and provide resources for technical assistance and programmatic support to MoHS & MoE for developing proof-of-concept for healthcare electrification.
- Development of central and dynamic database with real time application at MoHS commences.
- PMU commences and begin to provide technical assistance, leads healthcare electrification plans and engage all stakeholders, including GoSL, IPs, private sector, etc.

Phase 2: Development and demonstration (2024 – 2026)

- Implement pilots on healthcare electrification with different financing, ownership and operating models/practices; gather and analyze lessons learnt.
- PMU use initial MEL outputs to refine investment and aggregation of health facility electrification plans, as well as MEL plans.
- Launch large-scale health facility electrification programme and engage donors, GoSL, IPs and the private sector (EPCs) to activate health facility electrification programme.
- Funding and financing mechanisms are secured and electrification (design, procurement and installation) of an initial 300 PHUs commences in partnership with relevant parties (GoSL, donors, private sector and IPs and impact investors.
- MEL performance management framework developed and activated on ownership and operation and maintenance regimes .

Phase 3: Scale up (2026 – 2029)

- Refine and elaborate on implementation plans and delivery models on financing and ownership models from Phase 2.
- Scale-up and complete electrification of additional 834 PHUs, including a complete and functional MEL framework on O&M.
- Data on O&M/MEL framework feeding directly into central and dynamic database in real time for impact evaluation.

01	**Data and digitalization**	Invest in data collection, management, and analysis
02	**Funding and financing mix**	Unlock appropriate financing and risk mitigation vehicles
03	**Technology, standards and energy efficiency**	Adopt minimum technical quality standards and invest in energy efficient appliances
04	**Sustainability and delivery approach**	Analyze different delivery models and preconditions for sustainability
05	**Coordination and information exchange**	Strengthen coordination between health and energy stakeholders, through linkages with existing national energy and health sector strategies

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About SEforALL

Sustainable Energy for All (SEforALL) is an international organization that works in partnership with the United Nations and leaders in government, the private sector, financial institutions, civil society and philanthropies to drive faster action towards the achievement of Sustainable Development Goal 7 (SDG7) – access to affordable, reliable, sustainable and modern energy for all by 2030 – in line with the Paris Agreement on climate.

We work to ensure a clean energy transition that leaves no one behind and brings new opportunities for everyone to fulfil their potential.

Contact us to learn more

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