



Global Energy Alliance
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Foreign, Commonwealth
& Development Office

Powering Social Infrastructure in Sierra Leone:

Market Assessment and
Roadmap for Schools



Acknowledgements

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Acronyms

Term	Definition		
ADRA	Adventist Development and Relief Census	ESCO	Energy Services Company
ASC	Annual School Census	ESMAP	Energy Sector Assistance Management Program
BMZ	German Federal Ministry for Economic Cooperation and Development	EU	European Union
CapEx	Capital expenditures	FCDO	Foreign and Commonwealth Development Office
CLSG	Côte d'Ivoire, Liberia, Sierra Leone and Guinea electricity networks interconnection	FQSE	Free Quality School Education (FQSE) Programme
COOPI	Cooperazione Internazionale	GDP	Gross Domestic Product
CUAMM	Doctors with Africa	GFF	Global Financing Facility
DFR	Directorate of Financial Resources	GOAL	International humanitarian response NGO working in Sierra Leone
DPs	Development Partners	GoSL	Government of Sierra Leone
DSTI	Directorate of Science, Technology and Innovation	ICT	Information and Communications Technology (or Technologies)
EERP	Economic Rehabilitation and Recovery Program	IDA	International Development Association (The World Bank)
EFO/ENFO	Energy For Opportunity	IDCOL	Infrastructure Development Company Limited
ENDEV	Energizing Development	IPs	International Partners
EPA_SL	Environmental Protection Agency - Sierra Leone	IsDB	Islamic Development Bank
EPCs	Engineering, Procurement, and Construction (EPC) solar company	JICA	Japan International Cooperation Agency
EPG	Education Partnerships Group	JSI	Global public health consulting organization
		MBSSE	Ministry of Basic & Senior Secondary Education

MDAs	Ministries, Departments, and Agencies	TTA	Trama TecnoAmbiental
MEL	Monitoring Evaluation and Learning	UNFPA	United Nations Population Fund
MICS	Multiple Indicator Cluster Survey	UNICEF	United Nations Children's Fund
MoE	Ministry of Energy	UNOPS	United Nations Office for Project Services
MoHS	Ministry of Health and Sanitation	USAID	United States Agency for International Development
NGOs	Non-governmental Organizations	WAO	West Africa Off-grid
O&M	Operation and Maintenance	WASSCE	West African Senior School Certificate Examination
ODA	Official Development Assistance	WHH	Welthungerhilfe
OpEx	Operating expenses	WHO	World Health Organization
PPP	Public Private Partnership		
PPP	Purchasing Power Parity		
PSI	Powering Social Infrastructure		
REASL	Renewable Energy Association of Sierra Leone		
REDISSE	Regional Disease Surveillance Systems Enhancement		
RREP	Rural Renewable Energy Project		
SDG7	Sustainable Development Goal 7		
SEforALL	Sustainable Energy for ALL		
SEND	A non-governmental organisation working in Sierra Leone		
TENN	The Energy Nexus Network		

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01

Introduction



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Objectives, Scope and Approach

The Powering Social Infrastructure Market Assessment & Roadmap for Sierra Leone was developed by Sustainable Energy for All (SEforALL), with support from the Foreign, Commonwealth & Development Office (FCDO) and the Global Energy Alliance for People and Planet (GEAPP)

Rationale

- Data on powering social infrastructure (healthcare facilities and schools) is sparse, outdated, and 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).

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 governments and their partners to increase investment on powering social infrastructure and efforts on the 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.



Methodology

Data was collected through various qualitative and quantitative methods including:

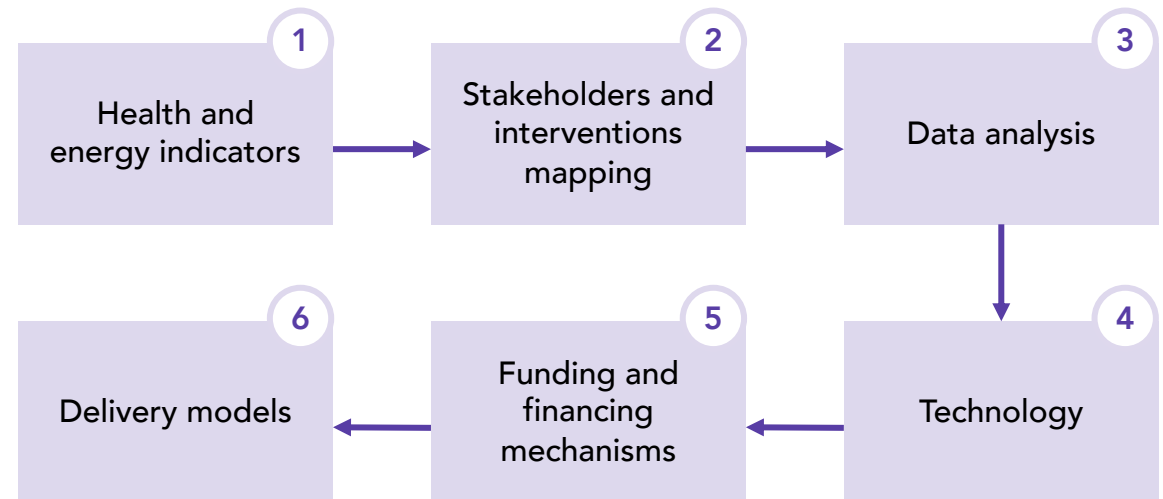
- Document review and realist synthesis;
- Stakeholder mapping;
- Semi-structured interviews;
- Energy needs assessment at 7 hospitals, 10 primary health facilities, and 10 secondary schools;
- Design and costing of standardized, customized and modular PV solar technology based on energy needs
- Co-creation, validation and dissemination.

The Market Assessment and Roadmap was developed in close collaboration with key stakeholders in the energy, health and education sectors, including the Ministry of Energy (MoE), Ministry of Health and Sanitation (MoHS) and the Ministry of Basic and Secondary School Education (MBSSE) and several other key stakeholders representing international development partners, NGOs and the private sector in Sierra Leone.

Approach

The Market Assessment and Roadmap consists of several components, including mapping of stakeholder and interventions, data analysis, technology assessment, funding and financing mechanisms, delivery models and roadmap for powering healthcare facilities (PHUs) and schools in Sierra Leone. The Market Assessment and Roadmap for Schools is presented in the following chapters, whereas the Market Assessment and Roadmap for Health Facilities can be accessed [here](#).

Market assessment and roadmap



02

Market Assessment



CHAPTER 1

Energy Access Challenges in Schools



26%

Population with access to electricity

Rural: 5%
Urban: 55%



36%

Share of school age children out of Senior Secondary School

Junior Secondary: 19%
Primary: 18%



~34%

Fraction of schools in difficult terrain

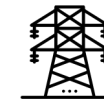
– cannot be accessed easily by road



45%-86%

of schools without access to electricity

Senior Secondary: 45%
Junior Secondary: 64%
Primary: 86%



90%

Fraction of primary schools that are not connected to the national grid



22%

Completion rate (secondary school)

Junior secondary: 44%
Primary: 64%

Education Policy Context

Landmark policies and plans

Historic Context and Perspectives

1964 Education Act; first White Paper on Educational Policy (1970); New Education Policy (1995) provided a framework for the new 6-3-3-4 education system; Introduction of 6-3-3-4 was influenced by several Acts in 2001 that culminated in the 2004 Education Act.

National Education Policy (2010)

The National Education Policy (2010) seeks to provide a sound basis for directing the implementation of the 6–3–4–4 national system of education. It is predicated on other legislative and policy documents, including Government White Paper on Education (2010); Local Government Act (2004’; Education Sector Plan (2007-2015); National Policy for Technical and Vocational Education and Training (2010); National Policy for Teacher Training and Development (2010).

National Policy on Radical Inclusion (NPRI, 2021)

The National Policy on Radical Inclusion in schools seeks to ensure that schools throughout Sierra Leone are accessible to, and inclusive of, all children – especially those that are typically marginalized or excluded.

Landmark programmes and interventions

- In August 2018, GoSL launched a phased Free Quality School Education (FQSE) initiative that provides free admission and tuition to all children in government-approved schools. FQSE ensures that all core costs for formal and non-formal school education are covered by the Government and requires parents/guardians to take responsibility for ancillary costs according to the ability to pay.
- The Ministry of Basic and Secondary School Education (MBSSE) and the Directorate of Science, Technology and Innovation (DSTI) are working in close collaboration to ensure schools and learners are equipped with connectivity and devices to support digital learning.
- In May 2019, the MBSSE commissioned Education Partnerships Group (EPG) to conduct a systems-level analysis of education service delivery, with an emphasis on identifying the disconnects between policy design and implementation. The findings and recommendations from the systems-mapping study informed several critical new initiatives within the MBSSE to strengthen policy and build effective delivery capacity.

Education facilities categorization and operating structure

Class/ Grade	N1	N2	N3	P1	P2	P3	P4	P5	P6	JSS1	JSS2	JSS3	SSS1	SSS2	SSS3	
Education Level	Pre-School			Primary Education						Junior Secondary Education			Senior Secondary Education			Tertiary Education
Theoretical Entry Age	3		5	6					11	12		14	15		17	18
Duration	3 Years			6 Years						3 Years			3 Years			4 Years
	Basic education															

The Education System in Sierra Leone is divided into five levels:

Three years of pre-primary school

Six years of primary education

Three years of junior secondary education

Three years of either senior secondary education or technical vocational education

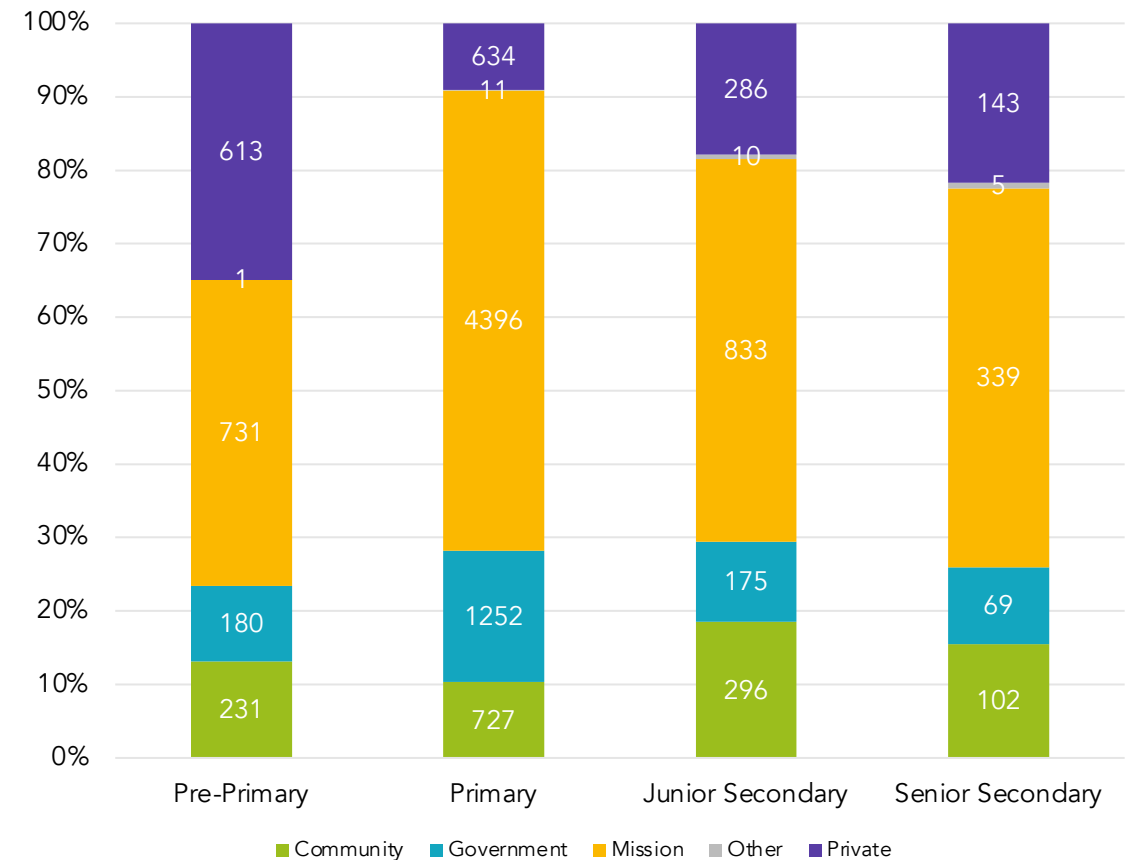
Four years of university education or other tertiary education

- Out of 11,034 schools counted by the Sierra Leone School Census of 2020, 15.9% are Pre-primary Schools, 63.6% are Primary Schools, 14.5% are Junior Secondary Schools (JSS), and 6% are Senior Secondary Schools (SSS).
- The greatest concentration of Junior and Senior Secondary Schools is in Western Area Urban and Western Area Rural Districts.

Management of school facilities

- Most schools are owned by religious missions (6,299) which accounted for 57.1%.
- Schools owned by government or privately owned accounted for approximately 15.2% (1,676) each.
- About 12.3% of the schools (1,356) are owned by the community and other agencies accounted for 0.2% (27).
- Ownership of school facilities is important even when they are government approved and received subventions from the government for staff salaries and other operational costs.
- School infrastructure and maintenance costs are usually managed by the owners of the facility, and this has a major role to play in accessing and paying for school infrastructure and services like electricity.

Share of school by ownership per type of school



Source: The Annual School Census (ASC), 2020

Countrywide accessibility to schools

- The majority of schools (66%) can be accessed easily by road, with cars, bicycles, motorcycles and by foot
- Approximately, 1/3 of schools cannot be accessed easily by road; 96% of which are in rough terrains while the rest are located on islands or in riverine areas that are only accessible by boat.
- The level of accessibility of schools by road affects delivery of education infrastructure and services like electricity.

School Level	Easily accessible	Island	Not accessible by road	Rough terrains
Pre-Primary	1,486	6	6	258
Primary	4,021	72	37	2,890
Junior Secondary	1,238	10	3	349
Senior Secondary	562	4	4	88
Total	7,307	92	50	3,585

Source: The Annual School Census (ASC), 2020



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



Access to improved education infrastructure and services will lead to improved outcomes on education

Unreliable energy access leads to poor education services and outcomes

- 74% of population do not have access to electricity
- ~45% of senior secondary schools have no access to electricity
- Absence of electronic/digital learning gadgets and systems to facilitate e-learning
- 36% of school age children who should be senior secondary school are out of school.
- Inadequate funding and financing of education institutions and delivery systems
- Operational and infrastructural challenges continue to impede service delivery of educational institutions countrywide
- Completion rates remain very low throughout the country; 22% for senior secondary school; 44%; junior secondary school and 64% for primary school.

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

Education financing and donor funding

- GoSL is strengthening partnerships with Ips to increase funding for improved education service delivery and outcomes
- GoSL has shown strong leadership, determination and political will to increase spending on education
- GoSL is tracking donor commitments and channeling resources to schools in need of sustained attention to achieve quality education outcomes.

Key Policy Actions

GoSL remains committed to:

- Improving governance at all levels and ensuring rural electrification is done through engagement and involvement of key stakeholders, including the private sector.
- Improving policy and regulatory environment – e.g., Government unbundled the power sector in 2015 and created new state utilities.
- Continuing to explore renewable energy sources, especially solar and hydro-power and increase investment for off-grid locations.

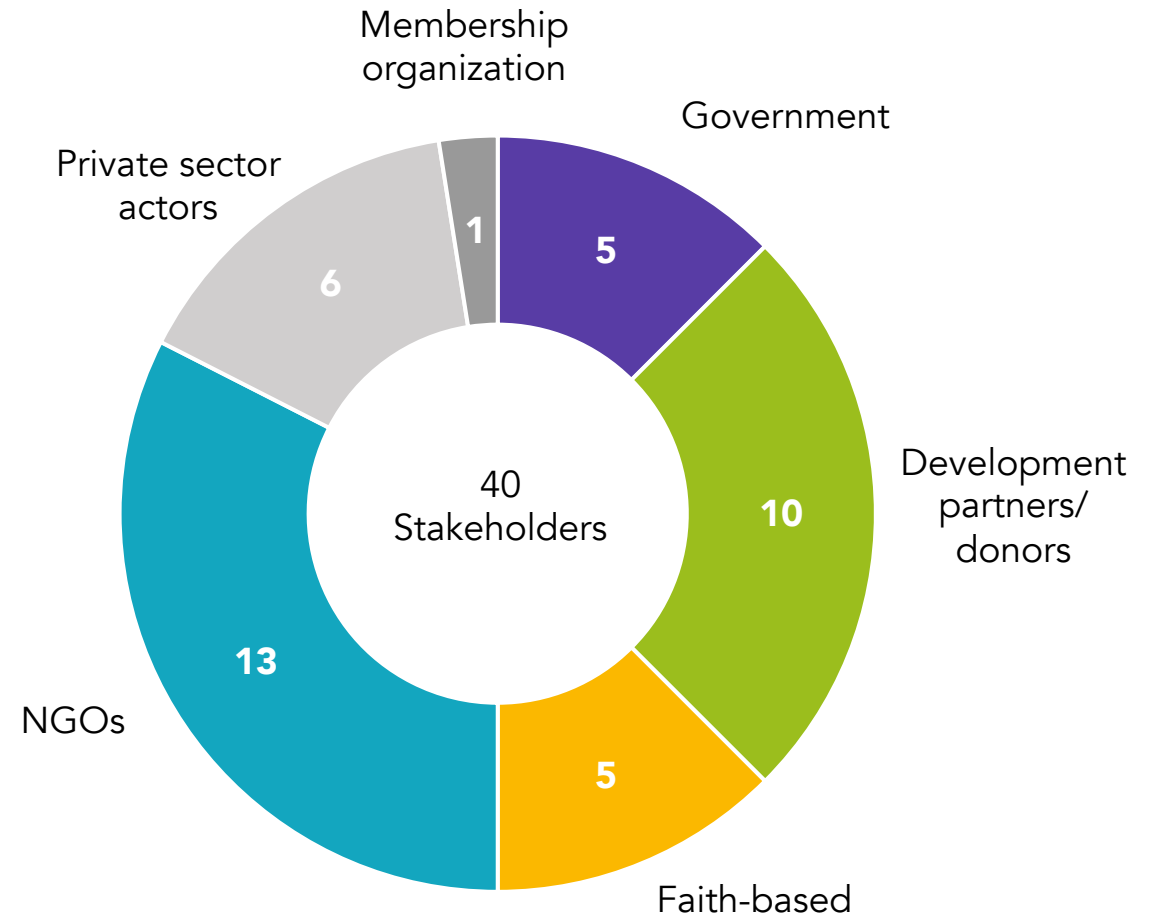
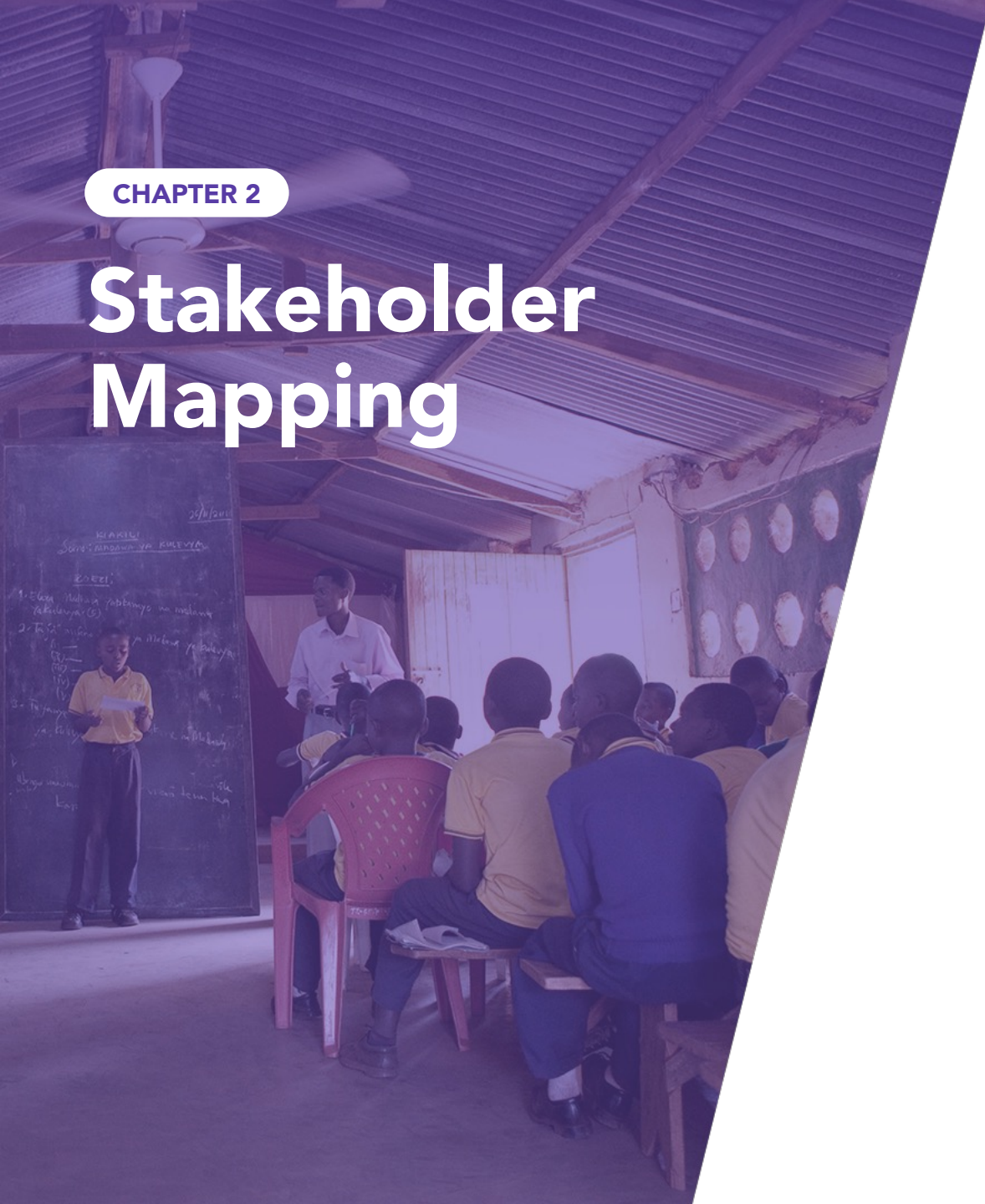
- Implementing the FQSE initiative on providing free tuition to all children in government-approved schools.
- Strengthening digital learning systems to ensure schools and learners are equipped with connectivity and the learning devices they need.
- Maintain the share of education budget to the total national budget at 15-20%, which is the largest national share per sector compared to other development sectors.

Improved energy access will lead to improved quality of education services and better 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 – at least twenty villages and eight towns in each district connected to the national grid or off-grid standalone schemes.
- Together with increased budgetary spending on education, these electrification plans could help transform the education sector from an under-resourced, ill-equipped, underperforming delivery system into a well resourced and functioning education system that is accessible for all school going children throughout the country.

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

Stakeholder Mapping



Stakeholder consultations

Over 40 public and private sector stakeholders were consulted and interviewed as part of the development of the Market Assessment & Roadmap.



Ministry of Energy (MoE)
 Ministry of Health & Sanitation (MoHS)
 Ministry of Basic & Senior Secondary Education (MBSSE)



Key Interventions Mapping - Powering Social Infrastructure

Intervention	Brief description	Status	Funder	Implementing organization & others	Stakeholder categories
<u>HealthGrid Sierra Leone (HealthGrid)</u>	<ul style="list-style-type: none"> PV electricity generation equipment for 31 remote, off-grid, healthcare facilities; Installing internet connections and WASH systems 	Planned	USAID	RESOLVE/Health-grid (lead); Orange-SL, World Vision, GAVI	Donor/State/NGO/Private
Enhancing the Impact of Rural Renewable Energy in Sierra Leone	<ul style="list-style-type: none"> 300 kWp of generation capacity in 6 rural communities under Bo district . Fully funded. 	Ongoing. The sites will be up and running by June 2023	Government of Japan (GoJ)	UNOPS (on behalf of MoE) Winch Energy is the operator	Donor/State/Private
UNICEF Renewable Energy (Solar) Market Assessment	<ul style="list-style-type: none"> Energy needs assessment covering all 16 District; 30 healthcare facilities and 30 schools 	Ongoing	UNICEF	UNICEF (lead)	Not applicable
Electrification through Mini-grids and Standalone Systems	<ul style="list-style-type: none"> Approx. 1.4 MW of generation capacity in 10 communities (Moyamba generation capacity + distribution and generation capacity in 9 other communities) 700 standalone systems for 500 schools and 200 CHCs. 	Ongoing. All the sites to be completed by December 2023	The World Bank	UNOPS (on behalf of MoE)	Donor/State/Private
SEforALL Powering Social Infrastructure “Market Assessment and Roadmap”	<ul style="list-style-type: none"> Energy needs assessment/audits of 7 hospitals, 10 peripheral healthcare facilities and 10 secondary schools, with technical design (standardized/customized) options; Evaluation of existing funding and financing models for powering healthcare and schools Roadmap and support on technical deep dives for GoSL, IPs and other stakeholders on powering healthcare and schools in Sierra Leone. 	Ongoing	FCDO, GEAPP	SEforALL (lead) in partnership with GoSL - , MoHS, MoE, MBSSE	Donor/State/NGO
Pilot Projects – Building Resilient Energy Ecosystems Around Decentralized Renewable Energy	<ul style="list-style-type: none"> Providing DRE solutions to power and light up healthcare facilities in rural Sierra Leone Small solar PV stand-alone solutions for lighting and powering small equipment 	Ongoing	Village Empowerment Inc	Global SDG7 Hubs (lead) and TENN	Donor/State/NGO/Private

Key Interventions Mapping - Powering Social Infrastructure

Intervention	Brief description	Status	Funder	Implementing organization & others	Stakeholder categories
<u>Enhancing Sierra Leone Energy Access Project (ID: P171059)</u>	<ul style="list-style-type: none"> Three components - grid extension (CLSG), mini-grids and stand-alone solar systems Targeting 700 health facilities and schools in total 	Ongoing	IDA; GFF	UNOPS (lead) on behalf of World Bank & MoE)	Donor/State/Private
<u>Rural Renewable Electrification Project (RREP)</u>	<ul style="list-style-type: none"> 5MW of renewable energy to 94 communities WP1/1+: 16-36 kWp solar PV generation systems (50 sites). Supported fully through grant financing. WP2: 44 larger solar PV generation systems (36 - 300 kWp). Co-financed distribution grids and indoor connections are grant supported. Generation assets are financed by the private operators (PowerGen, Power Leone, and Winch Energy). 	<p>WP1/1+: Completed</p> <p>WP2: 26 sites completed and operational. The remaining sites to come online by December 2022</p>	FCDO	UNOPS (lead) on behalf of MoE); UNOPS handed over all 94 sites to operators, i.e., PowerGen, Power Leone, Winch Energy, under a PPP contract	Donor/State/Private
WASH and electrification support for healthcare facilities in rural Sierra Leone	<ul style="list-style-type: none"> Stand-alone solar PV systems (510 Wp) and submersible pumps in (1600 Wp) in 177 health centers Stand-alone solar PV systems (2500 Wp) in 10 health centers 	Completed	Advancing Partners and Communities	JSI, GOAL, BMZ, WHH, SEND, ENFO IMC Solar, ADRA, Save the Children, ACF	Donor/State/NGO
<u>Promoting Renewable Energy Services for Social Development in Sierra Leone (PRESSD-SL)</u>	<ul style="list-style-type: none"> Electrification of public infrastructure; existing and sufficient awareness and capacity on renewable energy Installed solar home systems in 25 health centers and 12 schools 	Completed	Funded by European Union;	COOPI, Deutsche Welthungerhilfe, Oxfam Ibis, EFO	Donor/State
<u>Child Health and Mortality Prevention Surveillance (CHAMPS)</u>	<ul style="list-style-type: none"> Tracking the causes of under-five mortality and stillbirths through epidemiologic surveillance in Bombali District, Energy needs assessment at 23 healthcare facilities 	Completed	-	Crown Agents (lead), Emory Uni; MoHS	Donor/State/NGO

Key Interventions Mapping - Powering Social Infrastructure

Intervention	Brief description	Status	Funder	Implementing organization & others	Stakeholder categories
Support for Expanded Programme on Immunization, Sierra Leone	<ul style="list-style-type: none"> 1373 solar powered fridges (370 Wp) in health centers Solar fridges (300 Wp) in 6 health centers in Kono District 	Completed (2015)	USAID; ENDEV	MoHS (EPI), UNICEF (lead)	Donor/State/NGO
Strengthening Primary and Community Health Services in Sierra Leone	<ul style="list-style-type: none"> Revitalization of 305 health facilities to provide various levels of support: Improved water and sanitation; Installed solar power systems for lighting; Provided basic medical equipment; 	Completed	USAID	Advancing Partners & Communities (lead); (MoHS)	Donor/State
Rural Energy Activating Livelihoods	<ul style="list-style-type: none"> Installed SHS (10-20 Wp) in 36 schools Installing stand alone solar systems in 16 health centers, 14 schools 	Completed (2015)	EU, Playhouse Foundation	Environmental Foundation for Africa (lead)	Donor/state
<u>Partners in Health (PIH) – Sierra Leone</u>	<ul style="list-style-type: none"> Provided 24-hour electricity and running water Maintains a steady flow of vital medical supplies and medications 	Completed	-	Partners in Health (lead); MoHS	Donor/State/NGO
Project Bo	<ul style="list-style-type: none"> Providing a stable power supply to treat vulnerable babies at the Bo Government Hospital, Sierra Leone Supplies 24-hour electricity to the neonatal unit 	Completed	Rahul Boyle Foundation/ Liebreich Foundation	We Care Solar (lead); Energy for Opportunity	Donor/State/NGO
We Care Solar - Solar Suitcase project	<ul style="list-style-type: none"> UNFPA Country Office support to GoSL Installed solar PV suitcases in 516 maternal health clinics in 13 districts in Sierra Leone 	Completed (2016-2021)	UNFPA, Friends of PCMH	We Care Solar (lead), UNFPA, MoHS, MRC, CUAMM	Donor/State/NGO
<u>Barefoot Women Solar Engineers - solarizing healthcare in rural areas</u>	<ul style="list-style-type: none"> Installation of SHS/solar fridge in 2 staff quarters, 4 schools, 4 training centers, and 19 Peripheral Healthcare Unites (CHCs, MCHPs, CHPs) in Western Rural District. GOSL invested ~ \$820,000 in Barefoot women project. 	Completed	GoSL; Tools To Work; PUM; EnDev	Barefoot Women Solar Engineers; MoHS	Donor/State/NGO

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.

Stakeholders and intervention mapping: findings and recommendations

Situation

- The mapping exercise shows that in the last 8 years since the Ebola outbreak in West Africa, the largest single intervention targeted the electrification of approximately 100 CHCs.
- A similar model is being pursued for an additional 60 mini-grids that will provide power to primary healthcare facilities and other social infrastructure, including schools.
- Most of the other mapped interventions are small-scale stand-alone solar PV interventions installed by a range of stakeholder and spread all over the country, although the distribution of interventions is uneven. All 16 districts in Sierra Leone have benefited from several different projects.
- Most of the mapped interventions have been completed. There are currently 5 ongoing interventions with two planned interventions that will support the electrification of social infrastructure.
- Electrification interventions are still heavily donor dependent with most of the interventions funded and implemented by development partners
- Several needs assessments and mapping exercises have taken place, ranging from district surveys to nation-wide studies, including GIS-based assessments.

Findings and gaps

Public sector

- The public sector has a long-standing involvement in powering social infrastructure, in particular for healthcare, following the Ebola outbreak of 2014-2015. GoSL supports and facilitates interventions countrywide.
- MoHS is examining plans to establish a maintenance unit within the Ministry 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.

Private sector

- Private sector involvement remains minimal and primarily limited to procurement and installation of power solutions. There is growing interest and involvement from private sector actors to play a more expanded role, covering longer-term O&M (as is already the case for mini-grid operations).

Coordination

- There has been limited dialogue and alignment between energy and health/education sectors in the planning and coordination of health/education sector electrification interventions. However, there are structures in place with MoHS and MBSSE to facilitate dialogue and coordination at the policy and programme levels.
- As interest in this topic is growing, a working group on powering social infrastructure is gradually developing. SEforALL is working with sector actors to establish a working group that meets regularly to discuss and coordinate activities.

Findings and Gaps

Selection criteria

- There are no established criteria for site selections with respect to interventions on powering healthcare and schools. Decision are taken based on key stakeholder interests, donor priorities, and advice from the Ministries.
- Increasingly, digital and GIS-based analysis is being used to locate and collate information from high-need areas, e.g., by overlaying location of facilities with night-light satellite data and distance from the grid.

Data

- Lack of multi-sectoral data visibility, sharing and evidence-based planning for powering social infrastructure

Delivery and scope

- Most of the interventions have been directed primarily towards healthcare facilities in (off-grid) rural areas; only a handful of interventions have included schools.
- There is no clear technology preference or minimum standard: power solutions deployed to date range from pico-solar solutions to mini-grids that are anchored at healthcare facilities.
- The majority of the projects have followed a traditional donor-led EPC model, which has resulted in long-term sustainability challenges in particular on O&M.

Recommendations

- Development of a policy and partnership framework to clarify national priorities and national strategies on energy, health, and education.
- Increased cross-sector coordination, leveraging the emerging working group on powering social infrastructure; this could result in better evidence-based implementation, resource utilization, funding/financing flows and alignment towards achieving national targets and SDGs 3, 5, 7 and 13.
- Increased participation from public sector stakeholders (both centralized and decentralized) in intersectoral dialogue to foster accelerated progress towards the electrification of all social infrastructure



Data Insights



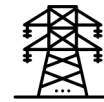
11,304

Total number of schools in Sierra Leone (ASC, 2020)



1,676 (~15%)

Total number of schools owned by government



1,845 (~16%)

Schools connected to the national grid



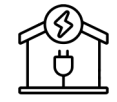
0-8%

Electricity access rates for schools in off-grid districts



8,865 (~96.5%)

Off-grid schools that are not using solar power



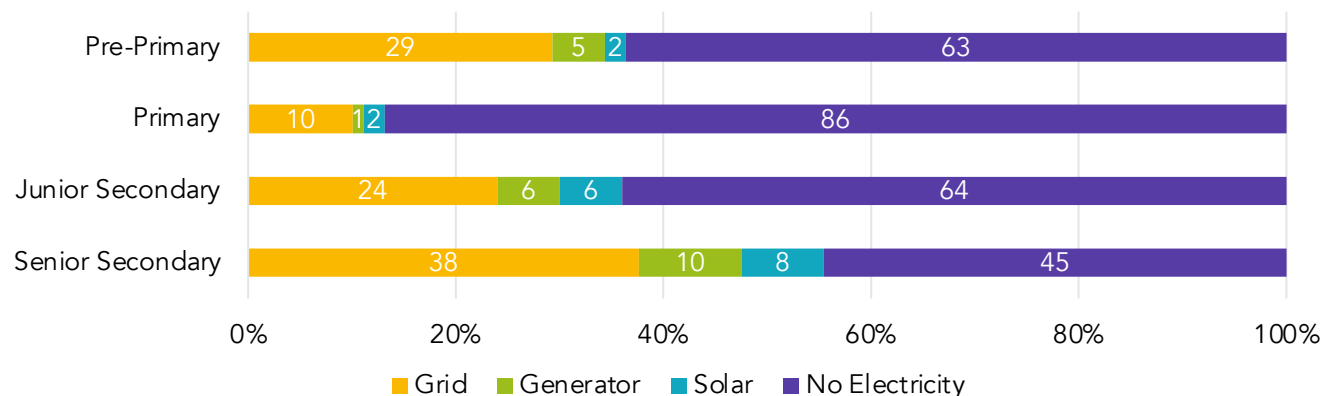
~56%

Electricity access for senior secondary schools (national)

School electrification status: general overview and analysis

1 Access to power is still very low

- The Annual School Census (ASC) captures data on school infrastructure including electricity access. Access rates at all school levels combined have remained very low (22.5%) compared to 2019 (22.0%): Out of a total of 11,034 schools, only 1,845 schools are connected to the national grid.
- 63% of pre-primary schools, 86% of primary schools, 64% of junior secondary schools and 45% of senior secondary schools have no electricity (ASC, 2020).
- Access rates in 2019/2020 remained static for all school levels compared to the 2018/2019 census, i.e., 63%, 87%, 65%, 45% for pre-primary, primary, junior secondary and senior secondary, respectively.



Source: The Annual School Census (ASC), 2020; rounded figures

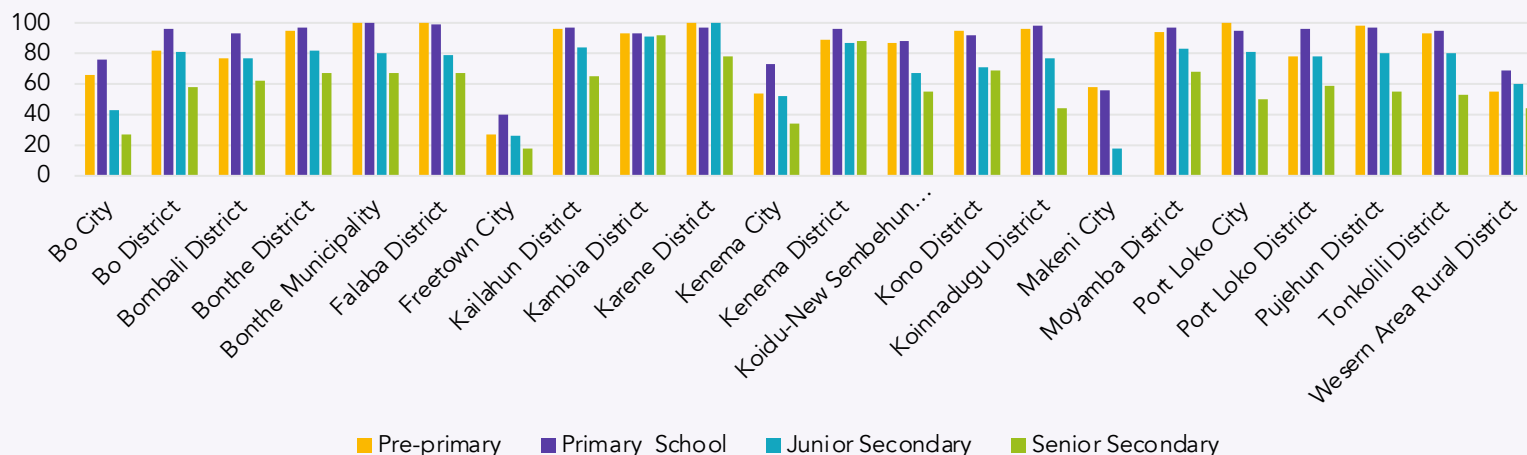
2 Access rates are significantly low for primary schools

- More than half (7,020) of the schools in Sierra Leone (63.6%) are primary schools, which is also the school level with the lowest electricity access rate on average. Pre-primary schools account for 15.9% (1,756), while junior secondary schools and senior secondary schools account for 14.5% (1600) and 6.0% (658), respectively. Senior secondary schools have the highest access rates, with 56% (368) of schools at this level having some access to electricity.
- The main source of electricity is connectivity to the national grid. Only a few schools (1-10%) have gensets or solar PV power solutions (2-8% primarily from stand-alone systems or connection to a mini-grid).

3 Access rates for schools vary significantly among districts and between urban and rural settings

- Access rates are generally higher for schools located in urban settings. These are typically city municipalities/district headquarter towns connected to the national grid (e.g., Bo, Kenema, Makeni and Western Urban/Rural where the capital Freetown is located).
- Access rates drop significantly with remoteness from a large town/city connected to the national grid. Electricity access is very low for schools located in rural settings - reflecting the generally low electricity access rate for rural areas.
- Some progress has been made to improve access for schools in rural areas with solar PV solutions. Nevertheless, very few schools have larger-scale solar stand-alone systems or mini-grid connections.
- With the rollout and scaling of mini-grids and stand-alone solar systems in off-grid communities, it is expected that electricity access will gradually improve.

Education facilities (%) without access to power



4 Electrification data for schools is binary with gaps in reliability

- Available data on school electrification status is binary, with very little information on duration or quality of access. Some schools in urban settings are connected to the national grid, but they suffer from frequent power outages and require backup solutions.
- A noticeable key challenge of solar PV systems is the lack of long-term operation and maintenance regimes or sustainability plans, leading to declining performance of the equipment, e.g., faulty wirings, dysfunctional batteries, or broken light bulbs.

Source: The Annual School Census (ASC), 2020

Centralized Dataset on School Infrastructure and Performance



Data sources

Since 2018, GoSL started collecting data on schools to improve planning and monitoring performance and outcomes through the Annual School Census (ASC).



Scope

The ASC collects, compiles, analyzes and disseminates education data related to schools, infrastructure, management and learning outcomes.



Datasets

The ASC provides data on schools throughout the country. It included information on public, private, faith-based and community run schools.



Facility management

Management of school is provided based on ownership and whether a school is approved by GoSL or not



School types

Schools are classified according to the level of education provided and this is consistent with the school classification system in Sierra Leone.



Electrification status

Electrification status is binary (yes/no) and aggregated. There is no accessible data on individual schools. Hours of electricity supply is not provided, and energy loads are not considered.

Electrification Status Analysis: SEforALL, 2022 (10 facilities)

Overview

Region: national coverage, not nationally representative

Sample size: 10 secondary schools

Size categorization of schools in the survey:

- 3 big/large sized schools (more than 860 pupils)
- 4 medium sized schools (between 400 and 860 pupils)
- 3 small sized schools (less than 400 pupils), one of which was a boarding school

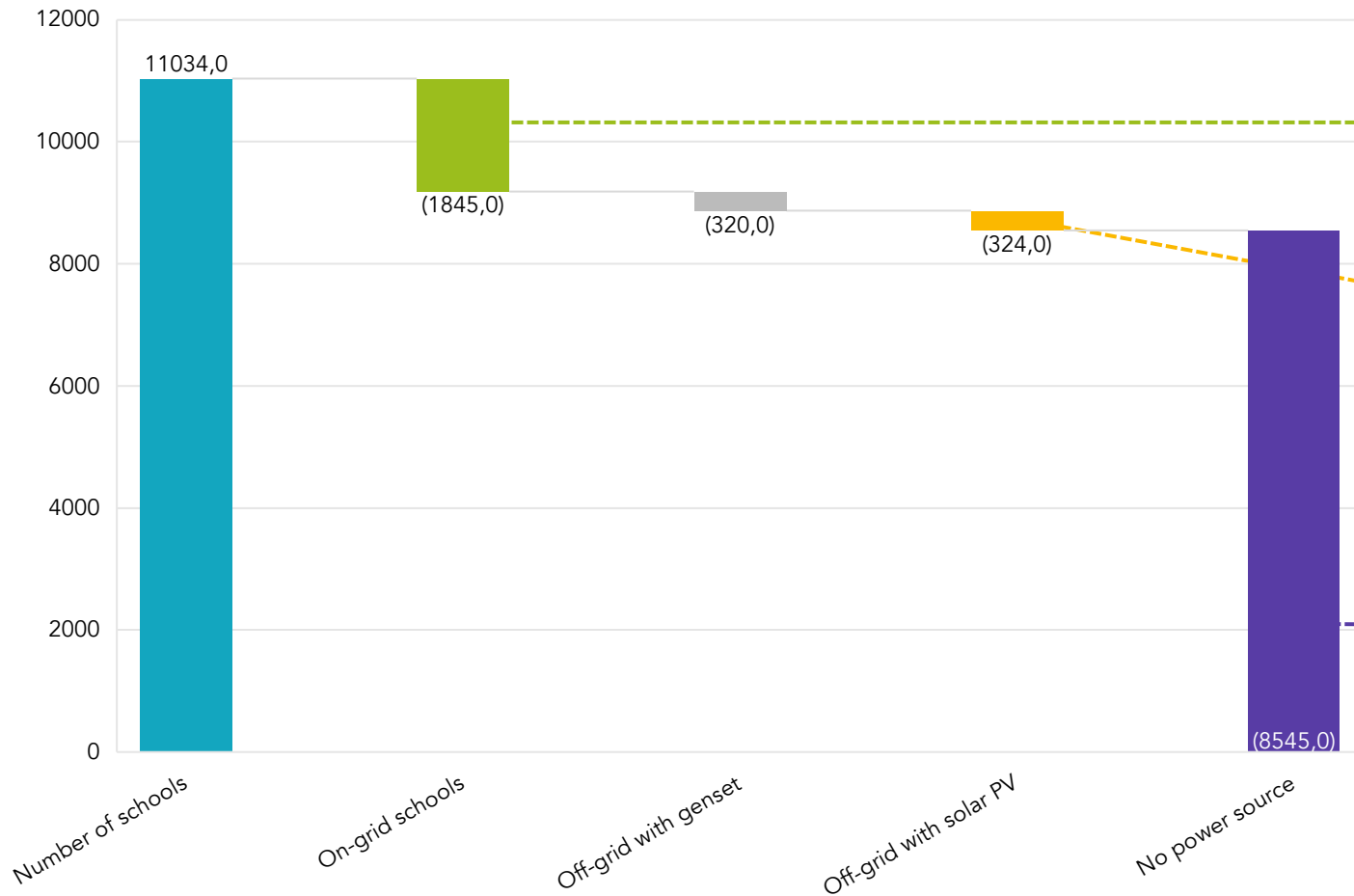
Findings and analysis

- The schools were selected from different districts, with different power and water supplies, ownership, internet connection, accessibility and shift status
- 8 out of 10 schools visited had no electricity; information on grid reliability was not reported in the national database, which was developed from the Annual School Census of 2020.
- The 2 schools with access to electricity had generators. Only one of those has internet connectivity.

Size of School	District	Electricity	Water Source	Internet	Owner	Accessibility
Big	Kenema	No Electricity	Borehole	No	Community	Easily accessible
Big	Bonthe	Generator	Piped	No	Mission/religious group	Easily accessible
Big	Bo	No Electricity	Borehole	No	Mission/religious group	Easily accessible
Medium	Western Area Rural	No Electricity	Well	No	Community	Easily accessible
Medium	Bombali	No Electricity	No Water	No	Mission/religious group	Easily accessible
Medium	Tonkolili	No Electricity	Piped	No	Community	Easily accessible
Medium	Kambia	No Electricity	Well	No	Government	Easily accessible
Small	Moyamba	Generator	Borehole	Yes	Private	Rough terrains
Small	Kono	No Electricity	No Water	No	Community	Easily accessible
Small-Boarding	Port Loko	No Electricity	Well	No	Mission/religious group	Easily accessible

Sizing the access gap - market opportunity for solar PV systems

School electrification (all levels): sizing the gap



Solar PV back-up systems can be provided to address frequent outages and quality of access for schools **connected to the national grid**.
 → **25% of on-grid schools and all schools powered by a genset require a robust power solution = 781 schools**

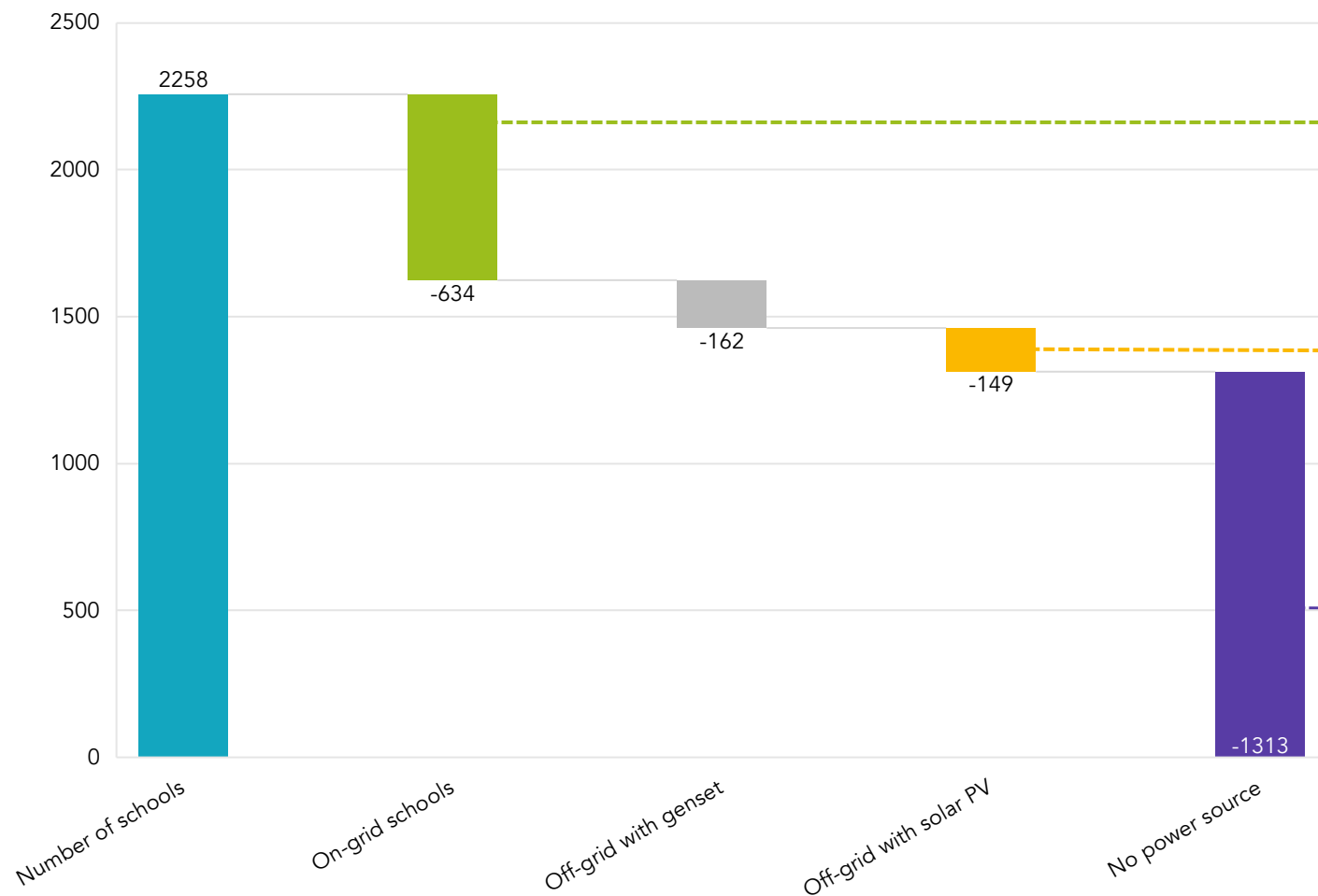
Schools with stand-alone solar PV solutions tend to be **under-electrified**, as they mostly only have power for lighting some rooms and/or powering small equipment.
 → **Est. 75% of schools with solar PV still require a robust power solution = 243 schools**

Most of the schools **without access** to any source of electricity supply are in communities, typically small towns and villages in off-grid districts located further away from large towns/cities.
 → **All schools in this category require a robust power solution = 8,545 schools**

**Total market opportunity:
9,596 schools**

Sizing the access gap - market opportunity for solar PV systems

Secondary school electrification: sizing the gap



For **on-grid** schools solar PV systems can be provided as back-up systems to address frequent outages and quality of access.
 → **25% of on-grid schools and all genset-powered schools = 320 secondary schools**

+

The fraction of secondary schools with stand-alone solar PV solutions tend to be **under-electrified**, as they mostly only have power for lighting some rooms and/or powering small equipment.
 → **75% of solar powered schools require a robust solution = 112 secondary schools**

+

The schools **without access** to any source of electricity supply are mostly in communities (small towns and villages) in off-grid districts.
 → **All unpowered schools require a robust solution = 1,313 secondary schools**

**Total market opportunity:
1,745 secondary schools**

Sizing the access gap - GIS tools provide an opportunity

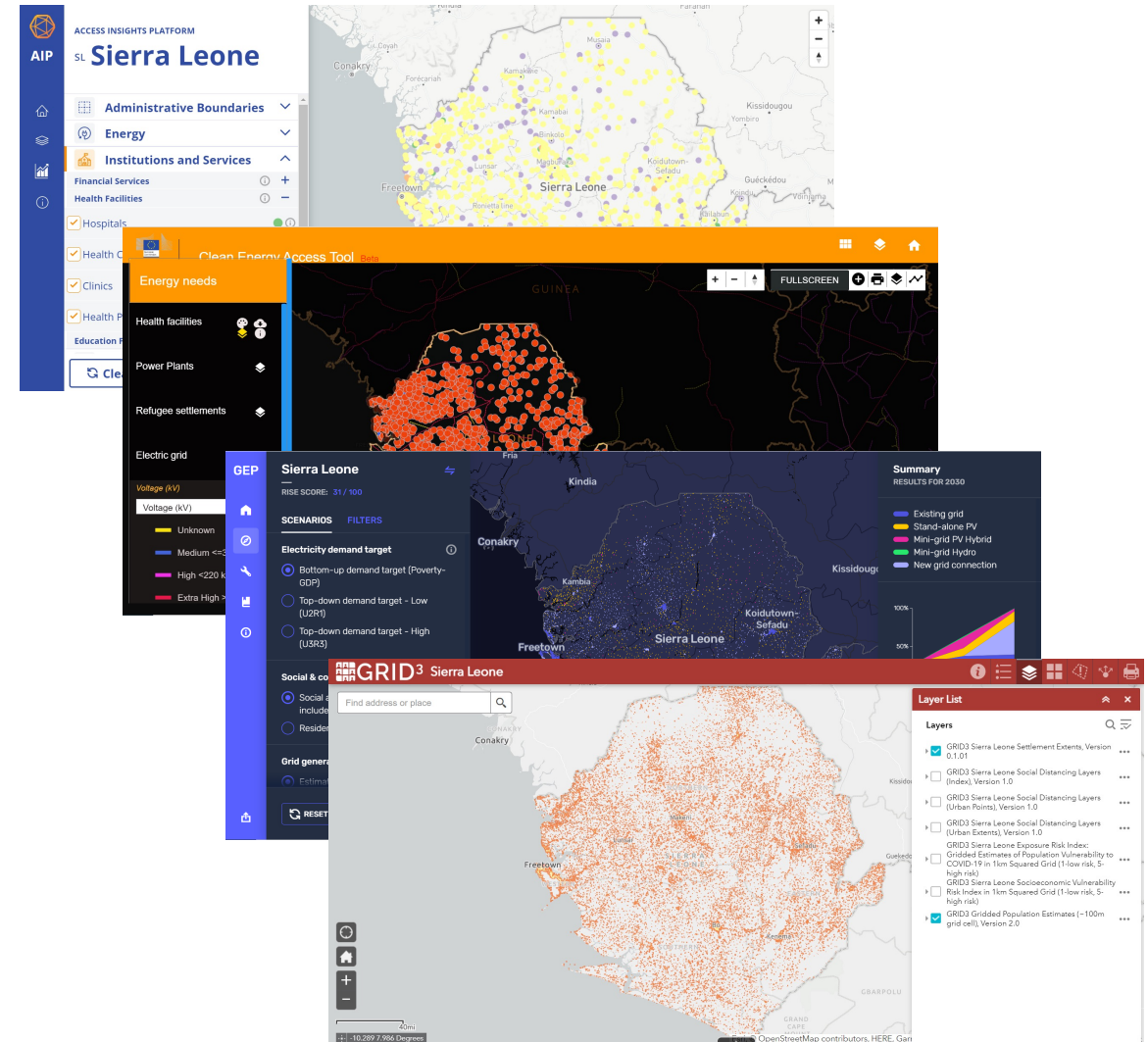
Increasingly, GIS tools are applied for data-driven analysis of energy access potential as well as for project opportunities. This is also the case for mapping out social infrastructure and identifying high-need areas.

Advantages

- Low-cost opportunity to identify potential sites that are far from the existing grid and are not showing any signs of electrification (e.g., through night-light satellite data).
- Potential to add in other socio-economic factors, such as geographic distances for specific communities to social infrastructure or ability to pay at the household level.

Limitations

- The analysis is only as good as the data that underpins it. Where data is outdated or incomplete (e.g., grid only partially mapped, or mini-grids not mapped), this may result in incorrect labelling of sites as being on-grid or off-grid.
- In most cases, the analysis can provide 'an order of magnitude' and identify a group of priority sites. The tools do not take away the need for (at least partial) site-level validation, in particular where there are known data gaps.



Data insights: findings and recommendations

Situation

- Data on electricity access for schools is available through the Annual School Census (ASC) although the ASC data is limited to binary indicators (grid/off-grid) and there is no data on quality of access (e.g., reliability or back-up solutions).
- The Annual School Census (ASC) which is managed by the Ministry of Basic & Secondary School Education (MBSSE) is the most comprehensive data outlook on school electrification.
- ASC collects, compiles, analyzes and disseminates data related to schools, their infrastructure (including electrification), management and learning outcomes.
- The conduct of the ASC went digital since 2018 being part of the digitization drive of education activities at MBSSE to transform the education system for record and document management in schools.
- School level data and statistics are collected and made available digitally on a near real-time basis for cleaning and analyses. It is possible with adequate resources to have a near real-time digital database hosted by the Ministry in a structured format for all schools at district and national level.

Findings

Size

- The Ministry of Basic & Secondary School Education (MBSSE) estimates a total 11,034 schools (ASC, 2020 report for 2019/2020 academic year). This includes all levels (pre-primary, primary, junior secondary and senior secondary) owned and operated by government, mission, local council communities and the private sector.
- More than half of the schools (7,020) in Sierra Leone (63.6%) are primary schools. This is followed by 1,756 pre-primary schools (15.9%), 1,600 junior secondary schools (14.5%) and 658 senior secondary schools (6.0%)

Electricity access

- Nationally, 63% of pre-primary schools, 86% of primary schools, 64% of junior secondary schools and 45% of senior secondary schools have no access to electricity.
- For the schools that do have access to electricity, a higher percentage of them have the national grid as the main source of electricity compared to those with genset or solar (stand-alone and mini-grid). This shows a still very low level of penetration of solar PV solutions in education facilities.
- Schools in rural locations have very poor access to electricity compared to schools in urban settings (i.e., cities and large towns such as Bo, Freetown, Kenema and Makeni). Access rates range vary widely between rural and more urban districts, ranging between 0% and 82% access for junior secondary schools, and 8% to 100% for senior secondary schools.
- For the schools with data on electricity access, the quality and duration of electricity access is unknown. Data granularity on electrification status could provide deeper and meaningful insights into the magnitude of the electricity access challenge for schools.

Data gaps

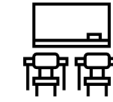
- Access to data on school electrification is possible only through the annual ASC publications since 2018.
- ASC includes data on access for all school levels but aggregated by administrative divisions. In addition, it is challenging to find data before 2018 to extrapolate trends or measure progress.
- The available data is aggregated at the district level. Data for specific schools is only accessible upon request. There is currently no open-source platform where such data can be located.
- Data on electrification status collated and analyzed through ASC is binary (yes/no) and based on source of electricity (grid, genset, solar). There is limited data granularity in terms of:
 - Electrification need, status, quality and hours (duration) of electricity supply
 - Monthly/annual budget and spend on electricity

Recommendations

- Improving data collection, recording and hosting methodologies will support the understanding trends and developments for schools in various locations in the country.
- While it is important to know whether a certain school is connected to a source of electricity or not, it is also important to capture the quality and duration of access. The development and adoption of a consistent energy needs assessment methodology will lead to more consistent data that allows for clear comparison among districts, as well as better integration in a national dataset on energy access for health facilities.
- It will be helpful to build on the existing digital approach to establish a central dynamic and standardized dataset that captures various attributes of data content and quality gaps including electrification status, O&M regime and intervention heat map.
- Technical assistance and programmatic support are required to bridge data and capacity gaps and update critical baseline inputs.
- The Directorate for Planning and Policy in the Ministry is well positioned to continue to co-lead the coordination of the ASC and planning to expand the aspects on energy assessment/audits under school infrastructure, with support from development partners and donors. In addition, the Directorate could integrate ASC findings on electricity access through an intersectoral working group with the MoE and other energy sector stakeholders.

CHAPTER 4

Technology



1.5 to 6 kWp

Est. PV power solution required to power secondary schools

1.5 to 3 kWp

Est. PV power solution required to power additional education services



~ \$8.6 / Wp

CapEx cost to deploy power solutions to schools including retrofit (rewiring and energy efficiency improvements)

Types of solar PV solutions deployed to date

- Standalone solar PV systems range widely in size and design specifications, from solar PV rechargeable pico-solar lanterns (50-200 Wp) to smaller stand-alone solar PV (500 Wp to 3 kWp)
- In addition, larger stand-alone solar PV solutions (16-36 kWp), and medium-sized and large-sized solar PV community-wide mini-grids have also been used in some communities to provide electricity for schools.
- The RREP which was led by UNOPS installed a total of 5MW for 94 communities across Sierra Leone. Some schools in these communities have benefitted from the project.
- Small solar PV stand-alone solutions are used primarily for lighting and powering small/basic equipment.
- For some schools, stand-alone solar PV systems have been used to power submersible pumps to provide drinking water.



Energy needs in secondary schools

Energy needs recommendations are based on energy audit survey data, interviews, and observations during site visits (TTA, 2022).

Energy needs are calculated along three scenarios of schools and three 'additional services':

- Schools: small, medium and large single-shift with no computer lab, boarding students, or WASSCE testing
- 'Additional services' are computer labs, WASSCE centers, and dormitories (for boarding schools)

School size categories

School Size Category	# Pupils / School
Large	>860
Medium	400 < # pupils < 860
Small	< 400

Quarters

Equipment	Dorms
Number of quarters	2
Light - Interior	4
Radio	2
TV small	0
Phone Charger	2
Fan	2
Refrigerator	2

School basic needs

	Small	Medium	Large	Computer Lab	Dormitory (100 stud.)	WASSCE
Classrooms	11	22	33	1	0	0
Other rooms	8	16	24	0	10	2
Water pump	1	1	1	0	1	0.5
UV water purifier	1	1	1	0	1	1
Light - interior	30	60	90	6	60	40
Light - exterior	4	6	8	0	6	0
Fan	10	20	30	3	20	10
Phone charger	8	16	24	0	50	6
Radio	0	1	1	0	0	0
Refrigerator	0	1	2	0	0	1
AC Unit	0	0	0	0	0	0
Printer	1	2	2	0	0	2
Desktop computer	1	1	2	30	0	2
Laptop	0	0	0	0	0	0
TV small	0	1	1	0	0	0

Energy needs in secondary schools

	kWh/day (single shift)	kWh/day (double shift)
Small School	6.5	10.4
Medium School	11.6	18.6
Large School	16.9	27.0
Computer Lab	11.6	18.5
Dormitory	10.5	-
WASSCE Center	6.5	-

Additional assumptions:

- *Computer lab is based on 30 computers run for 4 hours per day.*
- *Staff quarters are assumed to consume 1 kWh per day.*



Recommended solar PV system sizes for secondary schools



Solar PV array	Storage	Ideal school (size, # shifts)	Additional services	CapEx*	OpEx*
1.5 kWp	3 kWh	Small, single	WASSCE center	\$ 18,500	\$ 320 / year \$ 1,120 at year 10
3 kWp	6 kWh	Medium, single Small, double	Computer lab; dormitory for 100 students	\$ 25,000	\$ 330 / year \$ 2,240 at year 10
4.5 kWp	9 kWh	Large, single Medium, double		\$ 32,400	\$ 350 / year \$ 3,440 at year 10
6 kWp	12 kWh	Large, double		\$ 39,700	\$ 380 / year \$ 4,560 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 assumed at year 10

Average CapEx: \$ 8.6 / Wp

Additional Technology Considerations – social infrastructure

Infrastructure

- **Rewiring:** the majority of secondary schools require rewiring as electric wiring is either (i) not present, (ii) damaged, (iii) or inadequate.
- **Civil works:** In most sites, a separate 'powerhouse' or room needs to be constructed. Most facilities do not have sufficient space to safely house a power bank and other electrical equipment (e.g., inverter, switchboard).
- **Safety:** for ground-mounted PV arrays, fencing is recommended. For roof-mounted PV arrays, external security lights are recommended.

Equipment

- All audited sites were **under-equipped** compared to a list of required and recommended appliances.
- The **opportunity for energy efficiency** exists primarily in the future supply of electricity-dependent ICT equipment and basic appliances for secondary schools

Environmental Standards

- Waste from solar PV products contains toxic materials, such as heavy metals and polychlorinated biphenyls which are harmful to the environment and human health if improperly managed.
- There are currently no stringent regulations for the safe transport, disposal, and handling of e-waste.
- The lack of appropriate collection and recycling infrastructure presents additional challenges.

Technology: findings and recommendation

Situation

- Installed solar PV solutions at schools is growing slowly although the potential especially for off-grid communities remains very high.
- Solar PV systems installed so far vary greatly, both in size and design specifications. For example, it is now increasing common to find school children using rechargeable solar pico-lanterns and pico solar PV systems.
- In some schools, small and large solar home systems have been installed while others have been connected to community-wide mini-grids, which also vary depending on the other electrification needs they were designed to cater for.
- Some of the standalone systems installed are non-functional and in need of repairs but often there are no O&M procedures put in place.
- There are no national guidelines or standards to guide or manage solar PV products and there are no established facilities for recycling and no attempt to manage the e-waste.

Findings

- The energy access gap at schools throughout the country presents a huge market opportunity for investment in solar PV systems, especially for off-grid communities.
- This market opportunity is likely to grow even further as GoSL expands its FOSE programmes further in rural areas.
- There is no manufacturing base for solar PV products in Sierra Leone. A wide range of solar PV products and accessories are imported into the country.
- Sierra Leone is yet to develop the necessary policies, guideline/standards and management strategies to reduce the adverse health and environmental effects of e-waste.
- Informal handlers try to exploit the economic value contained in e-products (e.g., copper and lead) with rudimentary recycling processes and little regard to health and environmental safety.

Recommendations

- It is important to trained dedicated person(s) in the community to monitor and record the performance of installed systems. This person(s) should be provided with contact points of trained technicians who can undertake regular maintenance checks and repairs that may be required.
- Training is required for local technicians to understand the products that are being imported – installations, maintenance and repairs, performance monitoring and e-waste handling and disposal
- Minimum technical standards and/or minimum quality standards can be developed for the importation and handling solar PV systems.

Funding and Financing



3% – 5%

GoSL budgetary allocations to the education sector as a percentage to the GDP



15% – 20%

Share of education budget to the total national budget in recent years (<10years)



19% & 25%

GoSL spending directed to junior and senior secondary education, respectively



Le. 684,046 (million)

Average GoSL education expenditure (2015-2019)



Le. 1491.19 (billion)

Average Total Education Development Budget (2015-2019)



60% - 75%

Spending by Development Partners towards Total Education Development Budget

Sources of Funding for Education

The education development budget (as opposed to the recurrent budget) is largely funded by donors

The Dakar declaration commits governments to allocate 20% of their national budget to education (or 4% to 6% of its GDP to education).

In 2015, the GoSL achieved its commitments by allocating 20% of its budget to the Education sector, which is the largest received compared to any other sector. However, the budgetary allocation to the education sector decreased in 2016 and 2017 to 15% in each year.

An estimated 48-50% of GoSL spending was allocated to primary education. Junior secondary School and Senior secondary education levels received 19% and 25%, respectively, of GoSL total national allocation to education. GoSL budgetary allocations in terms of government expenditure on education as a percentage to the GDP has fluctuated over the years between 3-5%.

Actual spending on education always fall short of planned/ projected spending. For example, spending for Education Sector Plan for 2014-2016 fell short of planned spending by Le 1.12 trillion (US\$ 189.44 million), contrary to estimated spending of Le 2.5 trillion (USD 571 million).

Households contribute significant amount of their income to the education sector in the form of tuition fees and accompanying costs. 50% of the spending to primary education comes from households. The contribution from households to education (primarily through tuition) increases to 60% for secondary education.

The education development budget (as opposed to the recurrent budget) is largely funded by donors. However, the actual disbursement to the education sector is most times half of what was allocated. For example, in 2015, out of Le 907.9 billion (\$ 200.9 million) allocated to the education sector, only Le 426.6 billion (\$ 94.2 million) was disbursed and spent. This means that more than half of the activities for that year was not implemented.

Public funding cash flow for financing Basic Education

- The total education allocation comprises allocations from the central government and local councils. It includes recurrent and development expenditure, as well as wages and salaries.
- The GoSL provides largescale support including provision of teaching and learning materials, and financing (fee subsidies) to schools at all levels listed as approved 'government' and 'government-assisted'.
- However, GoSL resources are not always adequate to cover all the expenses and needs of beneficiary schools and unapproved schools are not included. The share of education budget as a fraction to the total national budget has fluctuated between 15-20% in the last 10 years .
- The major part of government resources for education goes to primary education which includes pre-primary education. An estimated 48-50% of GoSL spending was allocated to primary education for the period 2013-2017. A share for resources for education also go to secondary education, tertiary education, technical, vocational and non-formal education. Junior secondary School and Senior secondary education levels received 19% and 25%, respectively of GoSL total national allocation to education in the period 2013-2017.
- Other category of allocation of expenditure is administration and support services, which includes the office of the permanent secretary, planning and development services, physical and health education, the inspectorate Division, Non-Formal Education, and Tertiary Education Commission.

Sources: Financing Education: An Overview of Education in Sierra Leone <https://www.sciencepublishinggroup.com/journal/paperinfo?journalid=196&doi=10.11648/j.edu.20190805.15> Financing Education in Sierra Leone through Domestic Taxation; <https://campaignforeducation.org/images/downloads/f1/436/updated-efa-report.pdf>

Education and Other Social Sectors Compared, 2015–2019 (Le in Million)

Ministry	2015	2016	2017	2018	2019	Total	Average	Percent of Total
Education Sci & Technology	597,305	691,894	789,934	668,105	668,105	3,420,231	684,046	43.47
Health & Sanitation	223,717	325,031	230,231	230,231	394,400	1,413,430	282,686	17.97
Labour, Employment & Social Security	6,404	7,306	6,880	6,880	7,754	36,568	7,332	0.47
Social Welfare, Gender & Children's Affairs	12,148	12,792	15,977	15,977	37,971	91,699	18,340	1.17
Sports	5,999	11,901	16,765	16,765	28,410	70,900	14,180	0.90
Technical & Higher Education					260,015	260,015	260,015	3.30
Tourism & Cultural Affairs	5,485	9,348	4,364	4,364	2,961	26,822	5,364	0.34
Works, Housing & Infrastructure	412,273	739,695	517,111	517,111	307,408	2,491,221	498,424	31.68
Youth Affairs	6,009	15,427	11,333	11,333	16,959	55,596	11,119	0.71
Total	1,269,340	1,813,394	1,468,163	1,592,594	1,723,984	7,867,474	1,575,495	100

- Relative to other social sectors, the education sector receives the highest level of funding from total GoSL spending;
- Although GoSL resources are not always adequate to cover all the expenses and needs of beneficiary schools, education expenditure ranked first among the top five spending entities, ahead of health, labour and social welfare

Source: Sierra Leone Public Expenditure Review. Improving Quality of Public Expenditure in Health; <https://documents1.worldbank.org/curated/en/329991623665655127/pdf/Sierra-Leone-Public-Expenditure-Review-2021-Improving-Quality-of-Public-Expenditure-in-Health.pdf>

Total Education Development Budget – Donor funding compared to GoSL spending

- Like the health sector, donor spending complements GoSL efforts in the delivery of programmes for the education sector and donor spending is largely off-budget in the form of commitments and disbursements through technical assistance and the implementation of programmes/projects.
- The education development budget (as opposed to the recurrent budget) is largely funded by donors. Donor spending constitutes a significant proportion of the development budget, with several Development Partners (DPs) implementing various projects and programmes at the national, district and community school levels.
- External sources of funding include loans, grants, and in-kind contributions from multilateral organizations, bilateral agencies, international NGOs, International religious institutions, and individuals. Funding is channeled mostly through the government, although some of it is received directly by educational institutions and individuals (scholarships, projects).

Year	2013	2014	2015	2016	2017
Total Development Budget (in billion Leones)	1205.64	1592.15	1667.06	1518.03	1473.08
Development Partners spending (in billion Leones)	818.00 (67.8%)	1056.10 (66.3%)	1237.06 (74.2%)	904.62 (59.6%)	904.02 (61.4%)
Domestic (GoSL) spending (in billion Leones)	387.64 (4.1%)	536.05 (7.4%)	430.00 (5.3%)	613.41 (8.1%)	569.07 (5.5%)

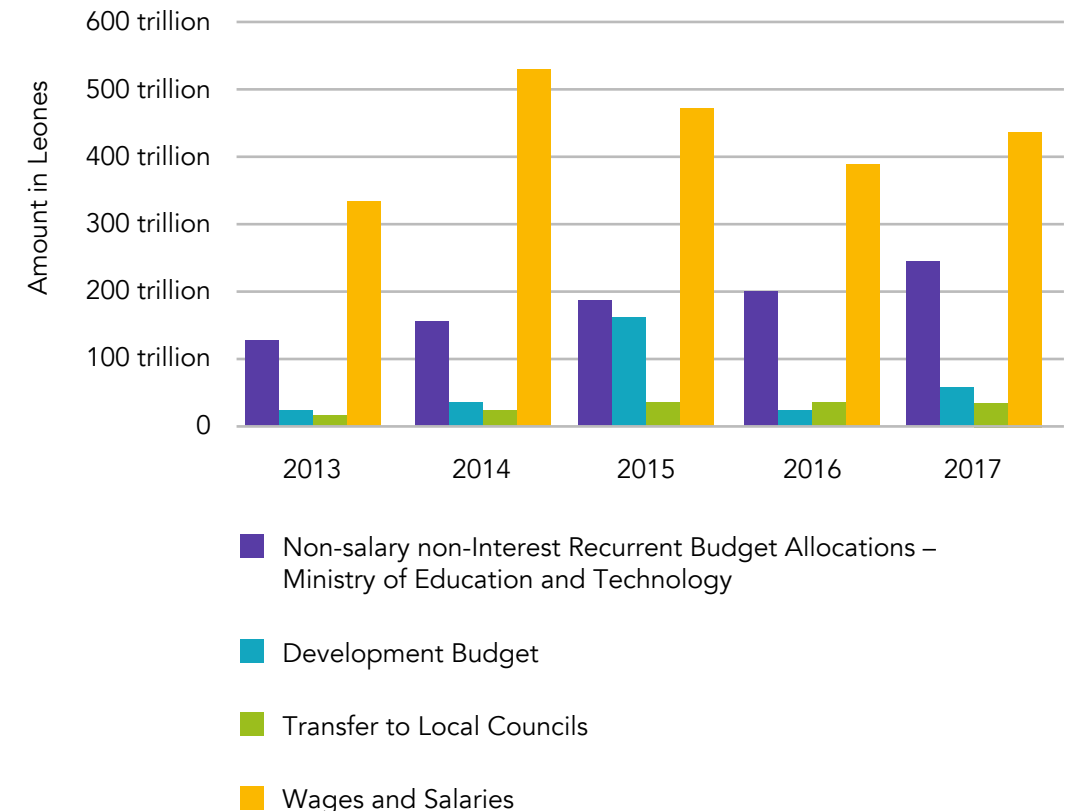
- The World Bank (through IDA), the African Development Fund, and European Union are by far the largest multilateral funding sources for education in Sierra Leone, and the largest bilateral donors remain the United Kingdom (through general budget support) and Germany.

Sources: Financing Education in Sierra Leone through Domestic Taxation; <https://campaignforeducation.org/images/downloads/f1/436/updated-efa-report.pdf>; Financing Education: An Overview of Education in Sierra Leone; <file:///C:/Users/yillia/Downloads/10.11648.i.edu.20190805.15.pdf>

Trends in Annual Education Expenditure

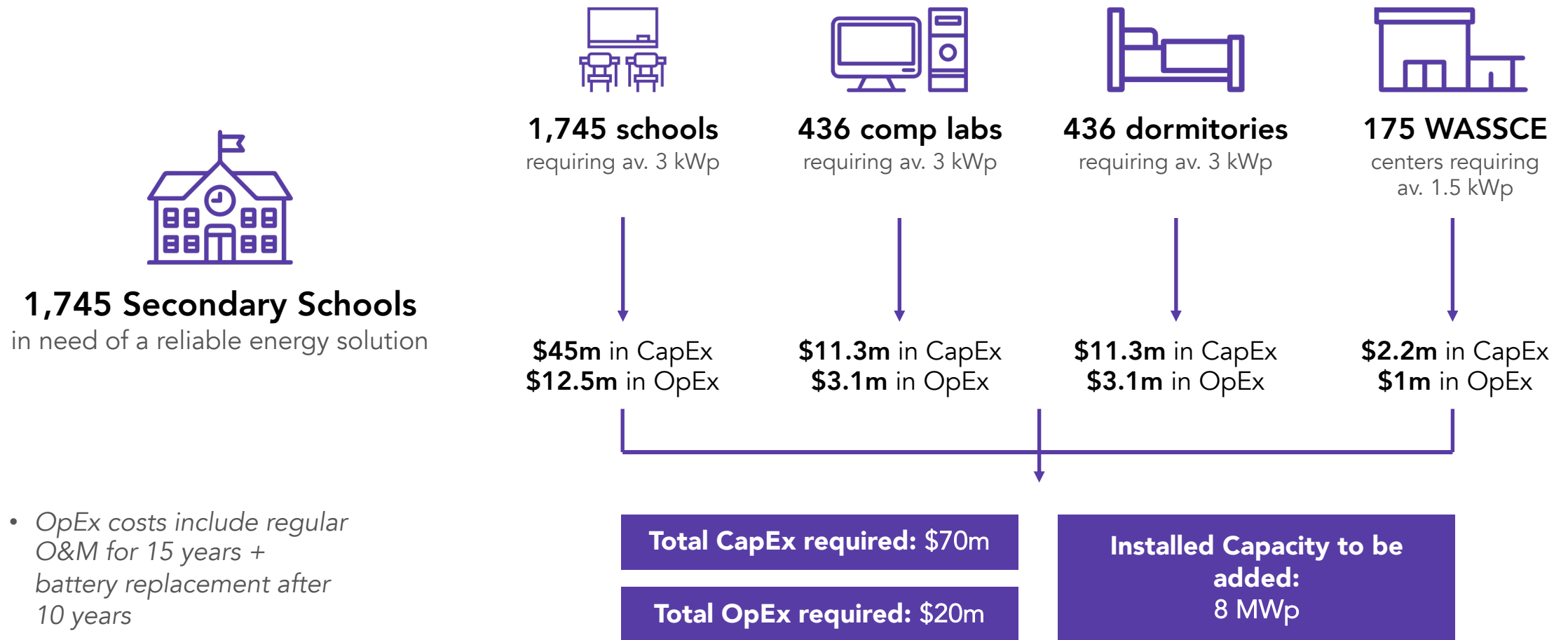
- For the period 2013-2017, GoSL expenditure directed to education for non-salary non-interest recurrent allocations grew steadily.
- Wages and salaries fluctuated in the same period, being highest in 2014 at > 500 trillion Leones compared to 2013 with spending slightly over 300 trillion Leones.
- GoSL contribution to the development budget also fluctuated, being highest in 2015
- This spending volatility and unpredictability in the education sector weakens informed decision-making and undermines systematic planning and performance.

Composition and trends in budgetary allocation (2013-2017)



Sources: Financing Education in Sierra Leone through Domestic Taxation; <https://campaignforeducation.org/images/downloads/f1/436/updated-efa-report.pdf>; Financing Education: An Overview of Education in Sierra Leone; <file:///C:/Users/yillia/Downloads/10.11648.j.edu.20190805.15.pdf>

Financing Need to Electrify all Secondary Schools



Funding and Financing: findings and recommendation

Situation

- Most schools are either owned by GoSL or they are “approved” by government and therefore qualify for and receive GoSL funding support.
- GoSL expenditure on education as a percentage of GDP is approximately 3-5% and the share of GoSL of education budget to the total national budget in recent years (<10 years) is 15-20%. This is significant because relative to other social sectors, the education sector receives the highest level of funding from total GoSL spending.
- However, GoSL funding is not always adequate to cover all the expenses and needs of beneficiary schools, including investing and maintaining critical infrastructure like access to electricity supply.
- Donor spending complements GoSL efforts in the delivery of programmes for the education sector, with Development Partners spending accounting for 60-75% of the total education development budget.
- However, the unpredictable nature of donor spending undermines systematic planning and sustainability.
- Funding from development partners is channeled mostly through the government, largely off-budget in the form of commitments and disbursements through technical assistance and the implementation of programmes/projects. Some funds from development partners go directly to educational institutions and individuals (scholarships, projects).

Findings

- The FQSE initiative of GoSL provides school enrolment at zero cost to parents and learners from pre-primary through senior secondary because of tuition subsidies.
- With FQSE, GoSL provides largescale support including provision of teaching and learning materials, and financing (fee subsidies) to schools at all levels listed as approved ‘government’ and ‘government-assisted’
- Actual spending on education always fall short of planned/projected spending. For example, spending for Education Sector Plan for 2014-2016 fell short of planned spending by Le 1.12 trillion (US\$ 189.44 million), contrary to estimated spending of Le 2.5 trillion (USD 571 million).
- Nevertheless, GoSL has in some years achieved its commitments to education spending by allocating up to 20% of its budget to the Education sector although the budgetary allocation to the education fluctuates between years.
- The major part of government resources for education goes to primary education which includes pre-primary education. An estimated 48-50% of GoSL spending was allocated to primary education for the period 2013-2017. Junior secondary School and Senior secondary education levels received 19% and 25%, respectively.
- Low capital expenditure has led to inadequate availability of health infrastructure, which has a serious impact on the effectiveness of service delivery and obviously poor education outcomes.

Gaps and Opportunities

- An estimated 1,745 (77.2%) secondary schools need a reliable energy solution to ensure that GoSL can strengthen digital learning systems for example and ensure all schools and learners are equipped with connectivity and devices.
- Electrifying all 1,745 secondary schools provides an investment opportunity of \$45 million in CapEx and \$12.5 million in OpEx over a period of 10 years. Adding computer labs, dormitories for some boarding schools and equipping WASSCE centers creates additional opportunities for electrification.
- Plans for the electrification of school facilities cannot solely depend on anticipated government funding given that the GoSL share of funding for the total education budget is less than 40%.
- International development partners could step up funding specifically for electrification of schools given that donor expenditures constitute a significant proportion of the total education development budget.
- Innovative financing grants such as performance-based financing have recorded some success in the school system in Sierra Leone. PBF grants for school maintenance/renovation can be channeled to cover costs of small stand-alone solar PV systems for schools in off-grid communities.

Investment Considerations and Recommendations

- With approximately 1,745 (77.2%) secondary schools needing electrification, an estimated \$90 million (\$70m CAPEX and \$20m OPEX cost) is required to provide 8 MWp of installed solar PV systems for lighting and equipment to operate a small computer lab and facilities to serve as a WASSCE examination center.
- For the long-term, attention could focus on extending grid connectivity where possible and expanding off-grid connectivity to new facilities in last-mile communities.
- MBSSE could explore funding opportunities within GoSL spending, for example through performance-based financing and community-based funding models to supplement O&M costs.
- Donor grants and subsidies can facilitate purchase of energy efficient appliances and retrofits for health facilities, cover a portion of CAPEX expenses and fund indicated capacity building programs.
- Meanwhile, GoSL could work with DPs towards mitigating financial risks by providing blended financing options including performance-based grants, subsidies, equity and debt financing for private sector energy services companies. Long-term concessionary loans from impact investors are required to encourage private sector energy service companies to participate in the electrification of education facilities.

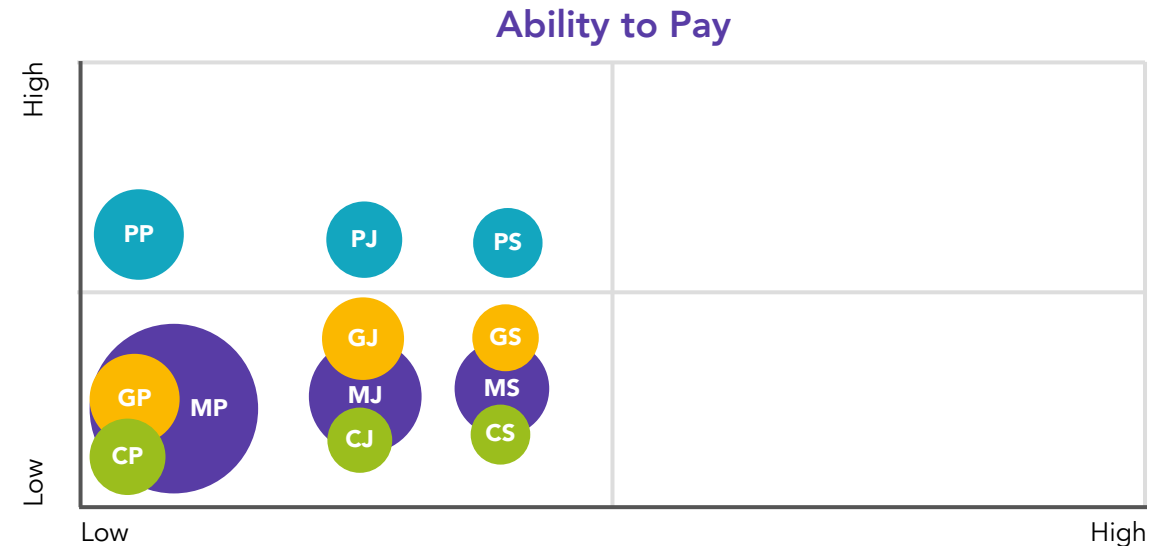


CHAPTER 6

Delivery Models & Financing Mechanisms

Access and Ability to Pay

- The size of the circles depicted in the illustration reflects the number of schools owned by each category
- Majority of schools are owned by religious missions across all levels – primary, junior secondary and senior secondary.
- Government and private ownership of schools are relatively similar in number, followed by community owned schools.
- In terms of ability to pay, Community owned schools are categorized as the least, followed by Mission owned and Government owned. Private owned schools have the highest ability to pay due to the nature of their ownership and consistency of cash flow.
- Access to electricity across all ownership categories is worst for all primary schools at 86% (therefore placed in the lower left quadrant), followed by 64% for Junior Secondary Schools (placed in the mid left quadrant) and 45% for Senior Secondary Schools (placed in the furthest right of the lower left quadrant).



Access to electricity

Mission owned	Government owned
MP – Mission Primary MJ – Mission Junior Secondary MS – Mission Senior Secondary	GP – Government Primary GJ – Government Junior Secondary GS – Government Senior Secondary
Private owned	Community owned
PP – Private Primary PJ – Private Junior Secondary PS – Private Senior Secondary	CP – Community Primary CJ – Community Junior Secondary CS – Community Senior Secondary

Delivery Models to Electrify Public Institutions

The 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., school. The asset is owned by the public institution or agency. This has been the predominant model for most social infrastructure electrification interventions implemented in Sierra Leone. The main strength of this model is that it makes deployments easier and quicker, as funds are usually readily available from donors, reducing the burden of having to raise funds for private sector or waiting for government allocations. Its main weakness is that there is limited scope for O&M or provisions for replacements, making it difficult to sustain deployed systems beyond the project timelines. These constraints are mitigated if the public agency allocates dedicated funds for repairs, maintenance and replacements. The traditional equipment ownership model is well suited for small and remote schools with a very low ability to pay, since they require smaller sized stand-alone PV systems with minimal O&M requirements.





The 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, 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 are rendered accordingly. Depending on the operating model, assets are either owned by the public institution or the private service provider for a pre-defined period. This model is suitable in instances where public sector financial management, compliance management and procurement management capacities are strong, with effective regulatory frameworks, long-term financing supported by local banks, active off-grid industry and institutional trust for government to fulfil its fiduciary and legal agreements. This is not entirely the case in the Sierra Leonian context. Privately operated schools are more suited to this commercial service-based model or its hybrid variants as they tend to show the ability and willingness to pay for electricity services from a private developer. While multiple financing mechanisms can be implemented across different business models, overall, some of the identified credit enhancement instruments that can enhance the viability of service based and hybrid models include guarantee mechanisms, grant subsidies, concessional funding, and renewable energy credits.

The hybrid model: 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. The role of donors here could be to provide grant funds for aggregated procurement of energy efficiency upgrades for the education facilities such as lights, fans, ICT equipment, or electrical wiring, as well as supply-side subsidies to cover portions of the RE system CAPEX or in form of RBFs to the private sector ESCO. The private sector ESCO raises concessional funding through impact investors, DFIs, corporates or philanthropies. The hybrid model can be considered for medium to large sized private and some government owned schools with some revenue stream and ability to pay for utilities. In the case of Sierra Leone, a hybrid model could consider a community/ecosystem approach whereby the school is not the main anchor client upon which OPEX and revenues will be generated. Based on the actual energy needs, various categories of energy systems/technology can be provided on an energy-as-a-service model with some incentives for the ESCOs.



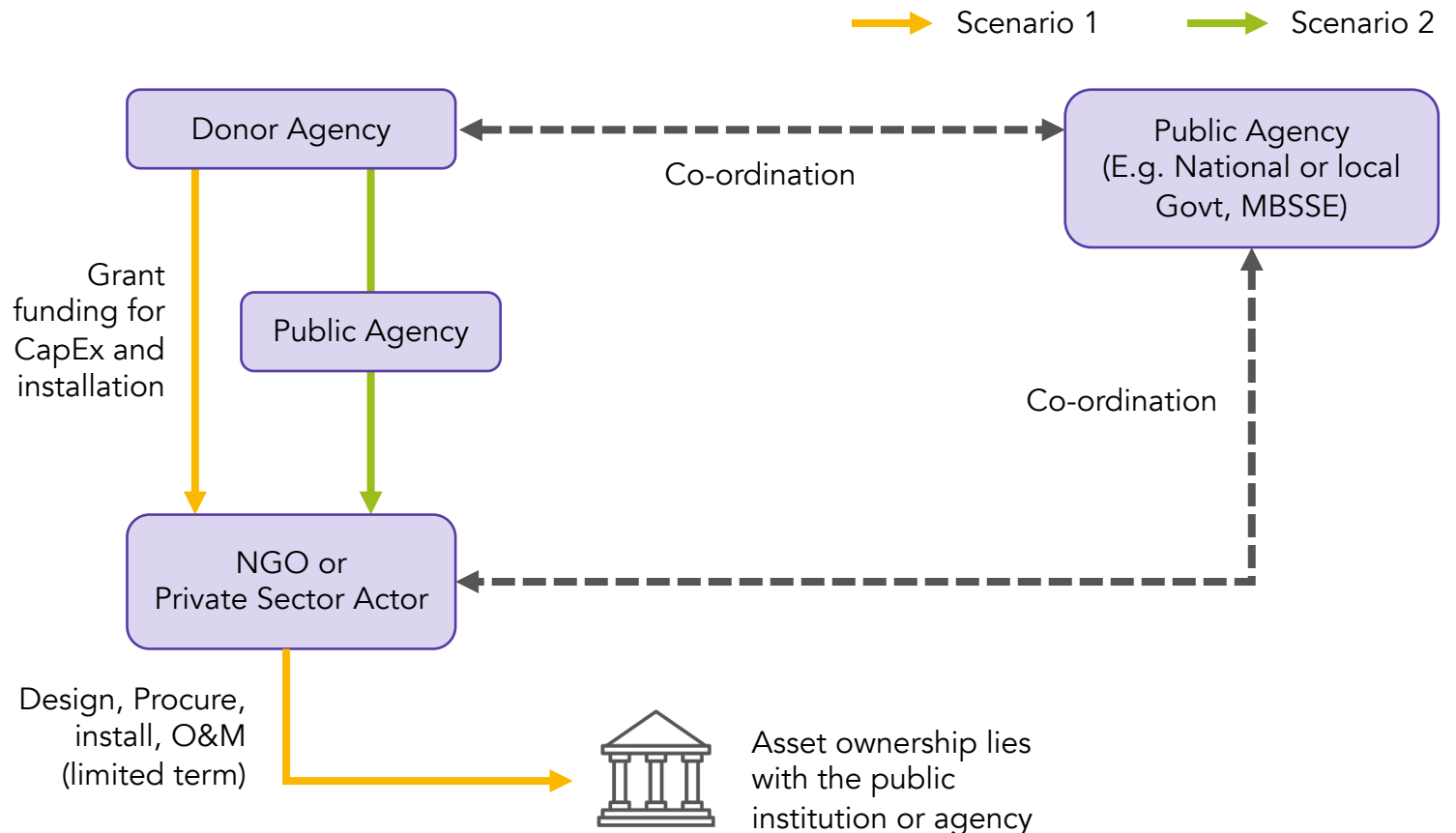
Traditional Equipment Ownership Approach

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 school.

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 school.



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

Traditional Equipment Ownership Approach – SWOT

Strengths

- Targeted funds making it easier for quick deployment
- Removes or lessens burden of raising finance for public and private stakeholders

Weaknesses

- Short-term scope
- Limited term and funds for O&M
- No or unclear provision for replacements, repairs
- Lack of institutional capacity to manage and maintain systems limited

Opportunities

- Aggregation of procurement and implementation

Threats

- Free donations tend to be viewed as 'nobody's property'



Service-based Model Approach

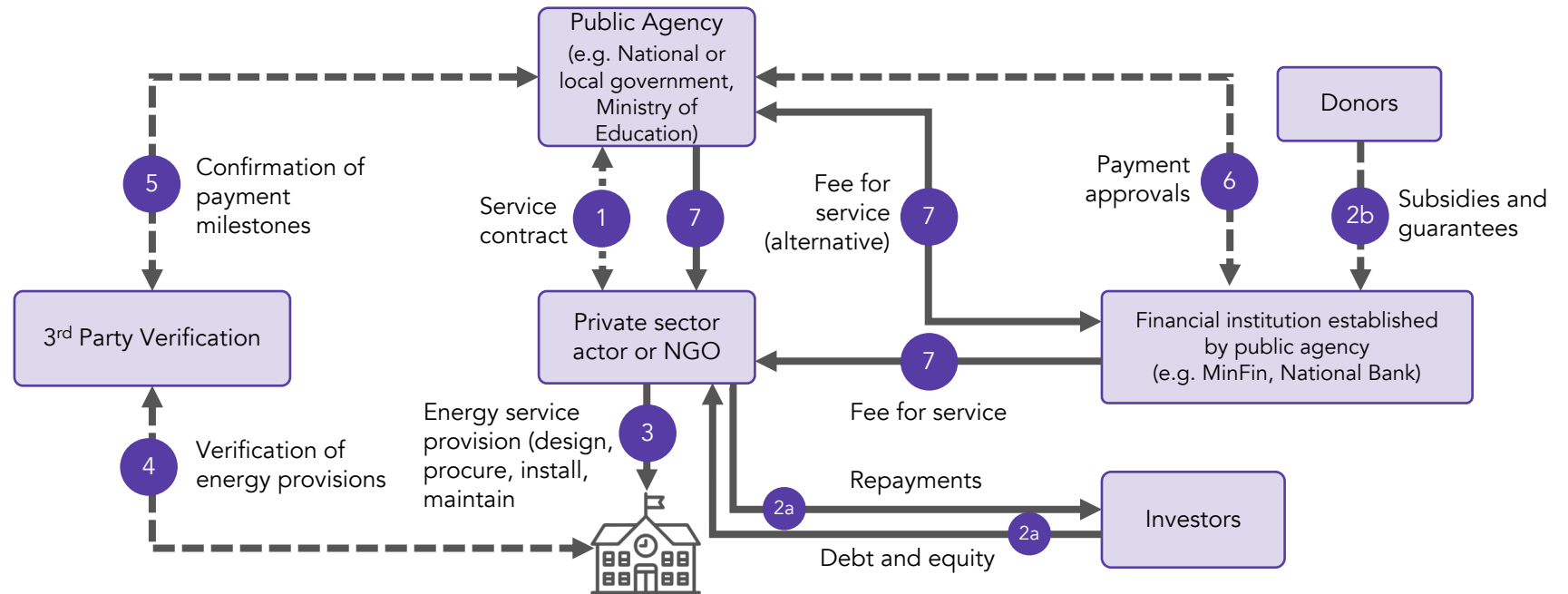
01 A service contract is signed between the service provider and the public agency

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 health, public education, etc.

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

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

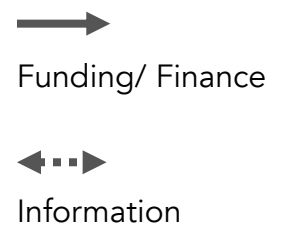


05 The third-party verifier sends confirmation that payment milestones have been met to the public agency

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.



Service-based Model Approach – SWOT

- Bilateral service-based models can be that the school contracts an energy service provider directly
- The service provider funds the CAPEX and ensures that contractual agreements are met.
- The school pays the service provider on a regular basis, as it would with other utilities

Strengths

- Service provider has technical capacity to manage systems post-implementation
- Generation assets can be subsidized
- Revenue generation from service provision, O&M
- Ownership and responsibilities clearly defined

Opportunities

- Entry point to communities to provide other energy-related/ ecosystem services
- Opportunity for aggregation of clusters

Weaknesses

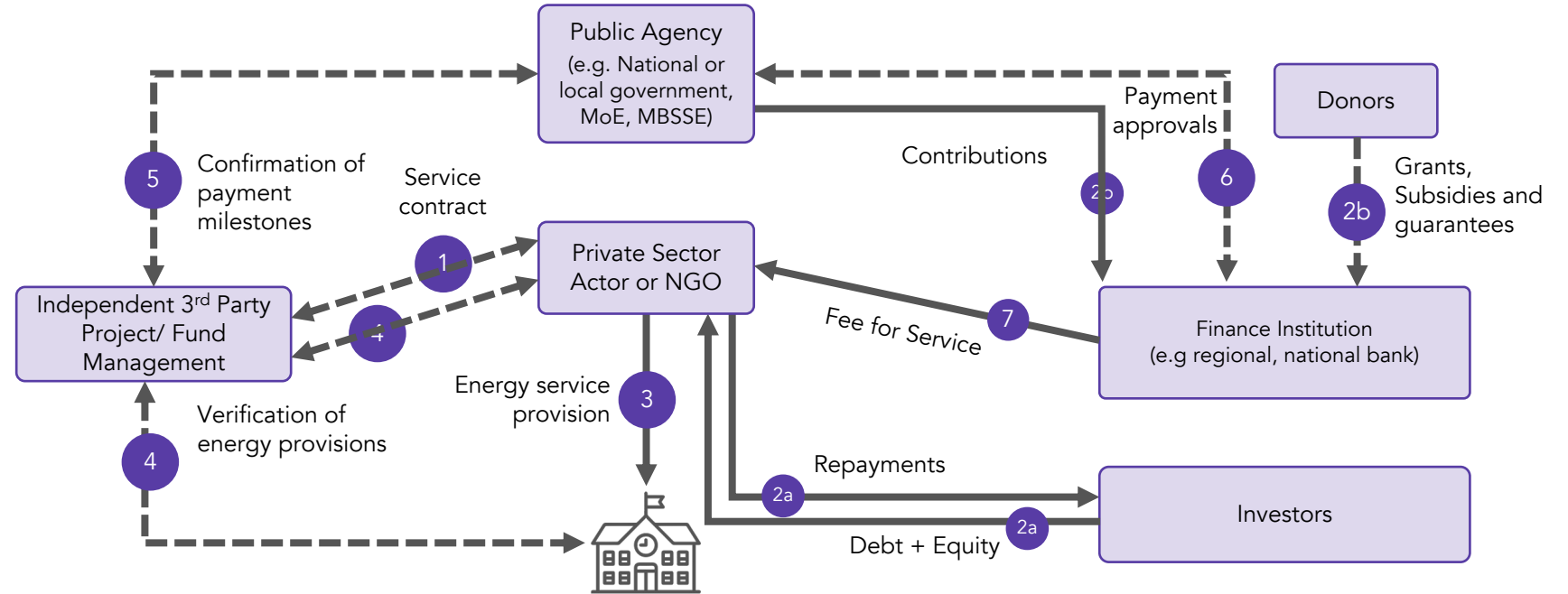
- High risk of non-repayment for electricity by public institutions
- Not enough incentive exist to make PHCs entry points/anchors for community electrification

Threats

- For Standalone SHS systems, may become irrelevant when MGs arrive
- Highly dependent on agreements with government agencies
- Authoritative dynamics fluid

Hybrid Model Approach

→ Funding / Finance
 ↔ Information



01 A service contract is signed between the service provider and the public agency e.g MBSSE, 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 end user starts using energy 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

Hybrid Model Approach – SWOT



Strengths

- Ideally, private sector ESCO dependence on contracts with public agency limited, reduced risk of failed contracts in case of change of administration
- Oversight of funds and repayments managed by dedicated project management entity

Opportunities

- Aggregation of locations by districts
- Opportunities for bundled services provision e.g. solar water pumps, internet access with a laptops for record keeping/ business center services, 2-3 wheeler electric motorcycles/tricycles charging of the installed solar system

Weaknesses

- Challenges with capacity to design, procure, install, operate and maintain systems, may require long-term technical assistance and skills transfer for MGs

Threats

- Consistency of contributions from public agency required for sustainability and building confidence of private sector ESCOs and investors
- Highly dependent on agreements with government agencies and independence of project management entity

Main Findings and Recommendations

Planning

- Operational sustainability needs to be enshrined in project planning and budgets
- Due to the small size of the market opportunity and private sector players, an aggregated approach with possible concessions can be considered either for Private ESCOs with subsidies and/or CAPEX grants.

Capacity

- Better harmonization between MoE and MoHS interventions can create the basis for building capacity of public operational capabilities, public fund availability and planning to finance and sustainably maintain HF electricity assets.
- Technical assistance would still be required for project/portfolio management assisting government and private sector to navigate the ecosystem as the sector takes shape

Standards

- Minimum standards and service levels have to be set for technologies to be deployed to education facilities



03

Roadmap: Powering Schools



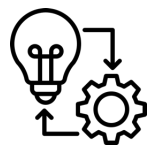
Global Energy Alliance
for People and Planet



Foreign, Commonwealth
& Development Office

Proposed implementation phases for sustainable electrification of all levels of schools by 2030

	Phase 1: Structuring and feasibility 2023 – 2024	Phase 2: Development and demonstration 2024 – 2026	Phase 3: Scale up 2026 – 2029
Key activities	<ul style="list-style-type: none"> • Consultations initiated between MBSSE, MoE, IPs and other stakeholders and structures set-up on powering social infrastructure. • Comprehensive assessment of the energy-education ecosystem; energy audits/assessment of school facilities. • Technical assistance and programmatic support provided to MBSSE/MoE for developing proof-of-concept for i) school electrification; ii) strengthening ASC into a central and dynamic database with real time applications accessible to all stakeholders. 	<ul style="list-style-type: none"> • Implementation plans and delivery models on financing and ownership defined. • Investment plans (modular system design and costing) developed for different school size categories. • Funding sources identified and structured to electrify an initial 2,500 schools, in partnership with IPs (primary schools with more basic needs). • O&M and MEL performance management frameworks developed and tested. 	<ul style="list-style-type: none"> • Scale-up plans developed, and funding partnerships established. • Implementation plans and delivery models on financing and ownership models refined based on MEL from Phase 2. • Investment plans developed and funding secured for additional electrification of 7,069 schools. • O&M and MEL performance management frameworks completely developed and fully operational.
Key outputs	<ul style="list-style-type: none"> • Report on energy-education ecosystem, energy audits/assessments; proof-of-concept for school electrification; ASC strengthened into a central and dynamic database with real time application and accessible to all stakeholders. 	<ul style="list-style-type: none"> • Pilot school electrification and demonstration of delivery models on financing, ownership and O&M. • 2,500 schools electrified, and associated O&M and MEL procedures established. 	<ul style="list-style-type: none"> • Additional 7,069 schools electrified; associated O&M and MEL procedures fully operational; data from O&M/MEL procedures feeding central and dynamic database in real time.



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 establish PMU, as well as undertake energy-education ecosystem mapping and energy audits/assessment.
- Undertake comprehensive energy-education ecosystem mapping, energy audits/assessments and electrification needs of schools.
- Commit and provide resources for technical assistance and programmatic support to MBSSE & MoE for developing proof-of-concept on school electrification.
- Strengthening of the ASC into central and dynamic database with real time application commences at MBSSE.
- PMU commences and begin to provide technical assistance, leads school electrification plan and engage all stakeholders, including GoSL, IPs, private sector, etc.

Phase 2: Development and demonstration (2024 – 2026)

- Implement pilots on school electrification with different financing, ownership and operating models/practices; gather lessons learnt through MEL.
- PMU use initial MEL outputs to refine investment and aggregation of school electrification plans, as well as MEL plans.
- Launch school electrification programme and engage donors, GoSL, IPs and the private sector (EPCs) to activate school electrification programme
- Funding and financing mechanisms are secured and electrification (including design, procurement and installation) of 2,500 schools 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 7,069 schools, including a complete and functional O&M/MEL framework
- Data on O&M/MEL framework feeding directly into central and dynamic database in real time for impact evaluation.

Recommendations, Roles and Actions

Challenges	Recommendations	Proposed actions	Stakeholders
01 Data collection, digitalization and visualization	Undertake comprehensive energy audits/assessments on electrification status, including information on current expenditure on electricity, current O&M regimes, funding and financing, as well as ownership and governance arrangements.	Commission comprehensive energy audit/assessment and data gathering for education facilities, including electrification status.	MBSSE, MoE, IPs, school electrification programme, donors.
	Strengthening the ASC and build a central and dynamic national database that captures, aggregates and presents real time information on school infrastructure, including heatmaps on the electrification status of all schools.	Expand and strengthen the ASC database with the possibility of real time visualization of school infrastructure, including the electrification status of all schools.	School electrification programme, donors, MBSSE.
	Digitalization of data collection systems for schools could support record keeping, remote monitoring of deployed renewable energy systems, as well as monitoring and reporting of impacts.	Invest in computers and internet access across all schools.	School electrification programme, private sector, civil society, IPs, donors.
02 Funding, financing and ownership	Mitigate financial risks for private sector energy services companies by providing blended financing options and instruments including performance-based grants, subsidies, guarantees, equity and debt financing.	Develop and pilot school electrification projects with blended financing options and instruments targeted at a selection of schools.	School electrification programme donors, IPs, investors.
	Long-term concessionary loans from impact investors are required to encourage private sector energy service companies to participate in health facilities electrification.	Provide access to concessionary loans to private sector.	IPs, investors.
	Explore funding opportunities with the BHCPF and community-based funding models to supplement operational maintenance and retrofit costs.	Allocate percentage of GoSL budget on education for O&M of deployed renewable energy infrastructure.	GoSL, local government councils

Challenges	Recommendations	Proposed actions	Stakeholders
03 Technology, standards and energy efficiency	Technology choice of standalone solar PV systems (serving single user) or mini-grids (serving multiple users) should be guided by both functionality and least-cost burden based on the size and energy needs of each school.		
	Factor in minimum standards for school electrification in terms of critical and non-critical equipment, appliances and staff accommodation when sizing renewable energy systems.	Support standard high quality and appropriate technology products and choices.	School electrification programmes, either donors or government-led, private sector, EPA-SL, REASL.
	Invest in use of energy efficient appliances and equipment for schools.		
Commit to adhering to acceptable international standards and guidelines at programme level, e.g., internationally approved quality standards for solar PV components, and the environmental guidelines of the Ministry of Environment/EPA-SL throughout project lifecycle and especially for handling e-waste and disposal of used batteries.			
04 Sustainability and delivery approach	Strongly consider preconditions when selecting delivery models, such as organizational capacity, financial and technical robustness during design and implementation of 'fit for purpose' delivery models for the electrification of various levels of education facilities. Ownership, funds availability or sources, energy service delivery levels must be clearly and realistically defined.	Invest in pilots of outlined delivery models for different school level and add-on modular system from design and costing	School electrification programmes, either donors or government-led.
	Leverage on O&M guidelines being developed locally by REASL-EnDev and other similar initiatives for powering social infrastructure and ensure that proper safeguards are in place to ensure sustainability. The ability to operate, maintain, replace electricity supply systems is paramount to long-term sustainability and performance.	Adhere to sustainability guidelines.	School electrification programmes, either donors or government-led, private sector, investors.
	Support and build capacity of existing efforts to create cluster networks, community of practice (CoP) and community champions, to enhance community participation, physically monitor system performance and provide accountability for O&M requirements and procedures with private sector actors.	Invest in technical capacity building programmes.	School electrification programmes, either donors or government-led, private sector actors, REASL.



Challenges

Recommendations

Proposed Actions

Stakeholders

05

Coordination and information exchange

Leverage existing coalition and relations between MBSSE, other GoSL ministries and agencies, IPs, donors, local government and civil society to foster dialogue, information exchange, bridge gap between education and energy stakeholders and get buy-in for creating a policy framework conducive O&M and sustainability of school electrification.

Strengthen role and structure of coalition to provide a framework for engagement.

School electrification programme donors, MBSSE, local government, civil society

Provide technical assistance and programmatic support to MBSSE/MoE at pre-implementation, implementation and post implementation stages.

Establish and invest in technical assistance through proposed PMU on school electrification

School electrification programme donors.

Support capacity development and build on existing skill development initiatives by REASL/EnDev for a strong and responsive technical, commercial, legal, institutional capacity for public agencies supporting HFE interventions.

Invest in technical capacity building programmes.

School electrification programme, either donors GoSL-driven, capacity building institutions REASL

Develop or align and implement school electrification programs in consonance with existing education and energy sector plans e.g., GoSL plans to increase renewable energy contribution in the national energy mix to 65% by 2023 and transforming the education sector into a well resourced and functioning national education delivery system.

Adopt a phased approach to delivery in line with GoSL energy access plans and strategy.

School electrification programme, either donors or GoSL-driven, private sector, investors

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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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