Emergency Solutions for Power Supply to Isolation centres/ health facilities for COVID-19 crisis relief

DISCUSSION DOCUMENT

APRIL 2020

SUSTAINABLE ENERGY FOR ALL (SEforALL)

Contents

Executive Summary

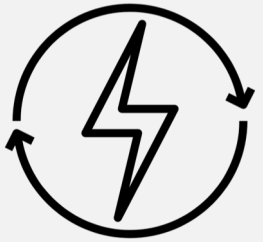
In response to the COVID-19 pandemic, governments, donors and multilaterals have expressed interest in granting emergency funding for solutions to power and strengthen frontline health service delivery in developing countries.

Criteria:

1. Provide solutions for reliable, 24-hour power supply to Isolation centres/ Health facilities during the COVID-19 pandemic and beyond.
2. The systems have been designed to power 25, 50 and 100 bed health facilities with laboratory testing, ventilators, vaccine fridges, water boreholes and power points for charging.
3. Are quick-to-deploy with a reasonably guaranteed supply chain during this period of global uncertainty.
4. Have a simple, cost-effective modular design that can be scaled-up easily in the future.

This deck proposes technical solutions and high-level cost estimates (based on the information at hand) to aid governments, donors and multilateral with their funding decisions and provide immediate relief to isolation centres/ health facilities during the COVID-19 crisis.

Critical Health Response



Uninterrupted Power Supply

Isolation from the public

Executive Summary

To enable preparation of this proposal an isolation hospital for about 100 patients with the required facilities and services was modelled (this maybe an existing structure or a newly constructed facility):

- **Section A:** Administrative offices, laboratory and diagnostics (blue)
- **Section B:** ICUs, private rooms, theater and pharmacy (mortuary in annex) (orange)
- **Section C:** Female ward and nurse's station (green)
- **Section D:** Male ward and nurse's station (orange)

Adequate courtyards, lobbies and corridors proposed for compartmentalization

Executive Summary

Microgrid for Health Requirements

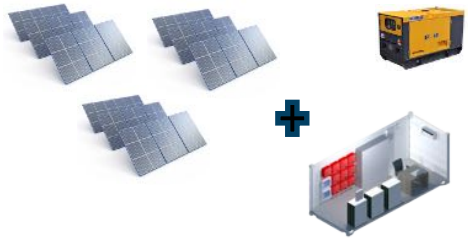
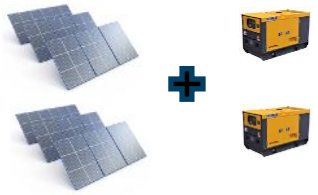
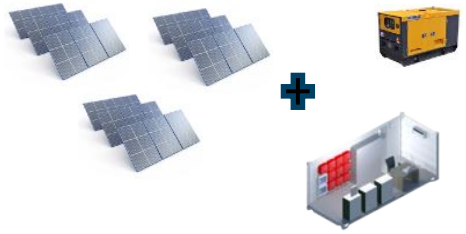
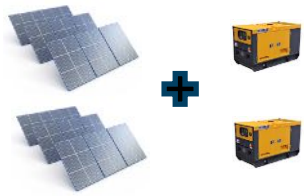
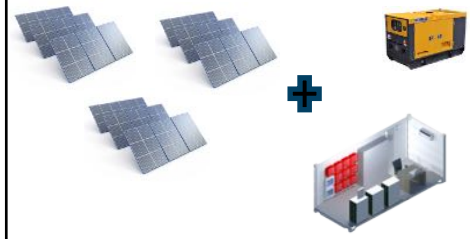
1. The solution should offset unreliable grid power
2. The solution should use both PV, storage and metering components
3. The solution should be available in multiple sizing options that meet the needs of the market
4. The solution must compete price-wise as much as possible with alternatives (small petrol / diesel generators)
5. The solution should be modular & easily scalable so that additional PV / storage can be added as demand of the off-taker grows
6. The solution should maximize energy efficiency
7. The solution should be preassembled, and factory tested before transportation to the field → it should minimize the construction time
8. The solution should be easily transportable and rugged to withstand Nigeria's harsh climate and environment
9. The solution should use an "ikea" framework in its' design → quick to deploy
10. The solution should comply to code (detailed in the table beside)

Code/ Standard	Description
IEC 62446	Grid Connected PV Systems Standard
IEC 61194	Characteristics parameters of stand-alone PV Systems
IEEE 1526	IEEE Recommended Practice for Testing the Performance of Stand-Alone PV Systems
IEC 62124	PV Stand Alone Systems – Design Verification
British Code (BS8110)	Concrete works
ASTM Code	Standards generally geared toward the testing and certification of materials and material properties – Steel Racks
American Standard AS ASCE7-10	Minimum design load for buildings & other structures
British Code BS5950	Steel design
British Code BS6399	Code of practice for dead and imposed loads

Executive Summary

Proposed solutions for Isolation centres and Healthcare facilities

**preferred option*

	OPTION 1 DG	OPTION 2 PV + DG	OPTION 3* PV + STORAGE + DG	Total daily (estimated loads)
100 bed facility				763.24 kWh
50 bed facility				503.56 kWh
25 bed facility				379.15 kWh

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Energy Solutions

OPTION 1 – Generators

Load

Day

Night

	100 bed facility	50 bed facility	25 bed facility
Estimated daily Load	**763.24 kWh**	**503.56 kWh**	**379.15 kWh**
Proposed solution	2 x 150 kW Gen sets	2 x 100 kW Gen sets	2 x 50 kW Gen sets
CAPEX*	$75,025.76	$52,548.58	$29,936.96
OPEX/ yr*	$148,799.39	$89,006.34	$43,245.45
Break-even Point (Years)	N/A	N/A	N/A

*Detailed breakdown available upon request

Energy Solutions

OPTION 2 – Solar hybrid

Load

Solar

Fuel Saver Controller

Day

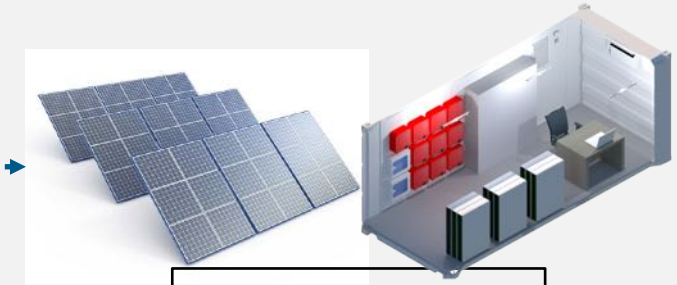
Night

	100 bed facility	50 bed facility	25 bed facility
Estimated daily Load	**763.24 kWh**	**503.56 kWh**	**379.15 kWh**
Proposed solution	100kWp + 1x150kW + 1x100kW Solar Hybrid + Gen sets	60kWp + 2x100kW Solar Hybrid + Gen sets	40kWp + 2x50kW Solar Hybrid + Gen sets
CAPEX*	$278,623.28	$190,062.11	$141,780.73
OPEX/ yr*	$92,785.04	$60,260.06	$21,755.75
Break-even Point (Years)	3.63	4.78	5.2

*Detailed breakdown available upon request

Energy Solutions

OPTION 3 – Solar hybrid with Storage
(preferred option)



Solar & Storage

Fuel Saver Controller

Load

Day (peak loads)

	100 bed facility	50 bed facility	25 bed facility
Estimated daily Load	**763.24 kWh**	**503.56 kWh**	**379.15 kWh**
Proposed solution	150kWp + 750 kWh + 1x150kW Solar Hybrid + Storage + Gen set	100 kWP + 500 kWh + 1x100 kW Solar Hybrid + Storage + Gen set	60 kWP + 300 kWh + 1x50kW Solar Hybrid + Storage + Gen set
CAPEX*	$504,135.87	$352,133.13	$ 231,985.77
OPEX/ yr*	$73,945.54	$43,849.32	$17,344.65
Break-even Point (Years)	5.73	6.63	7.8

*Detailed breakdown available upon request

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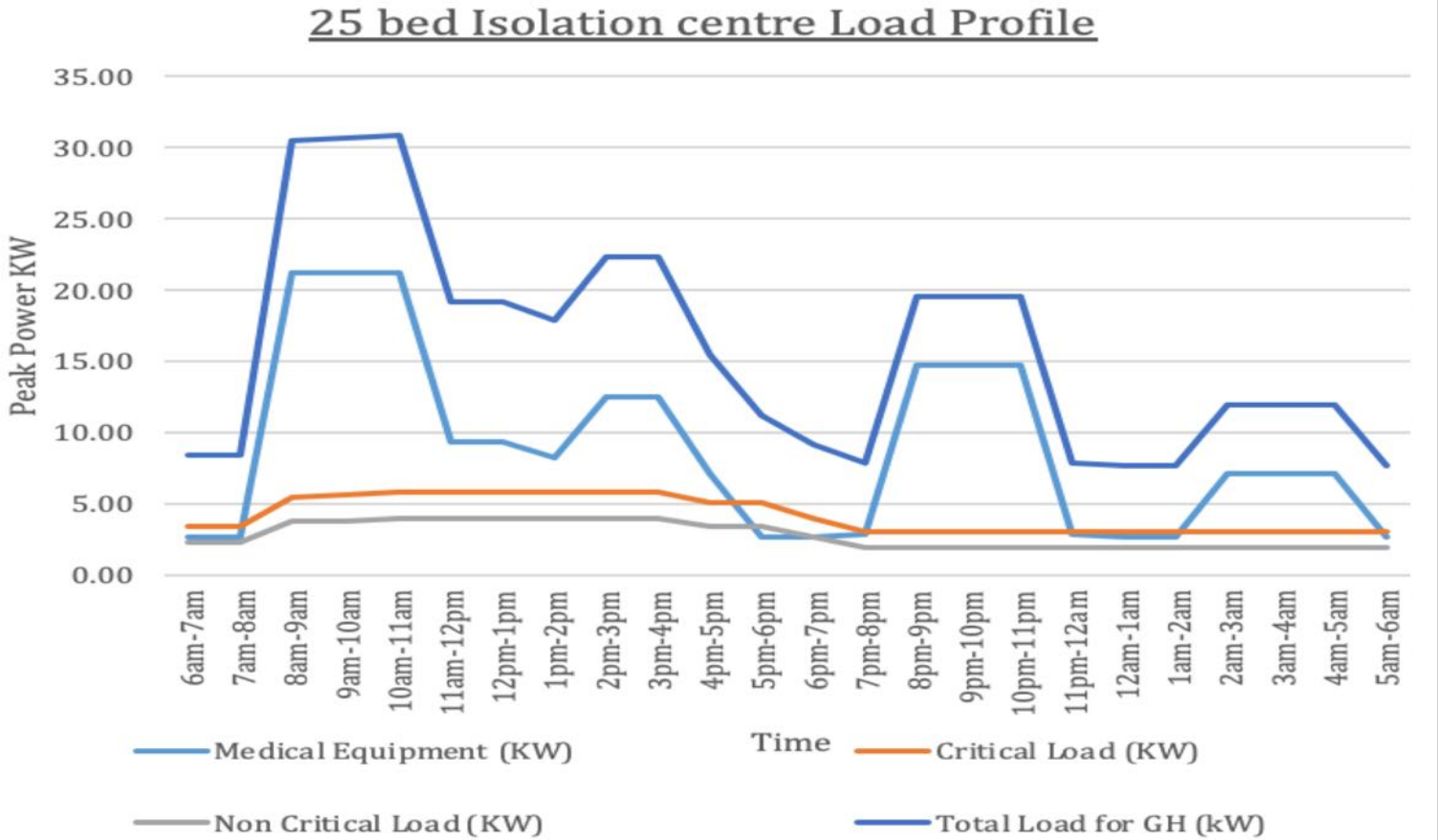
Load Profile

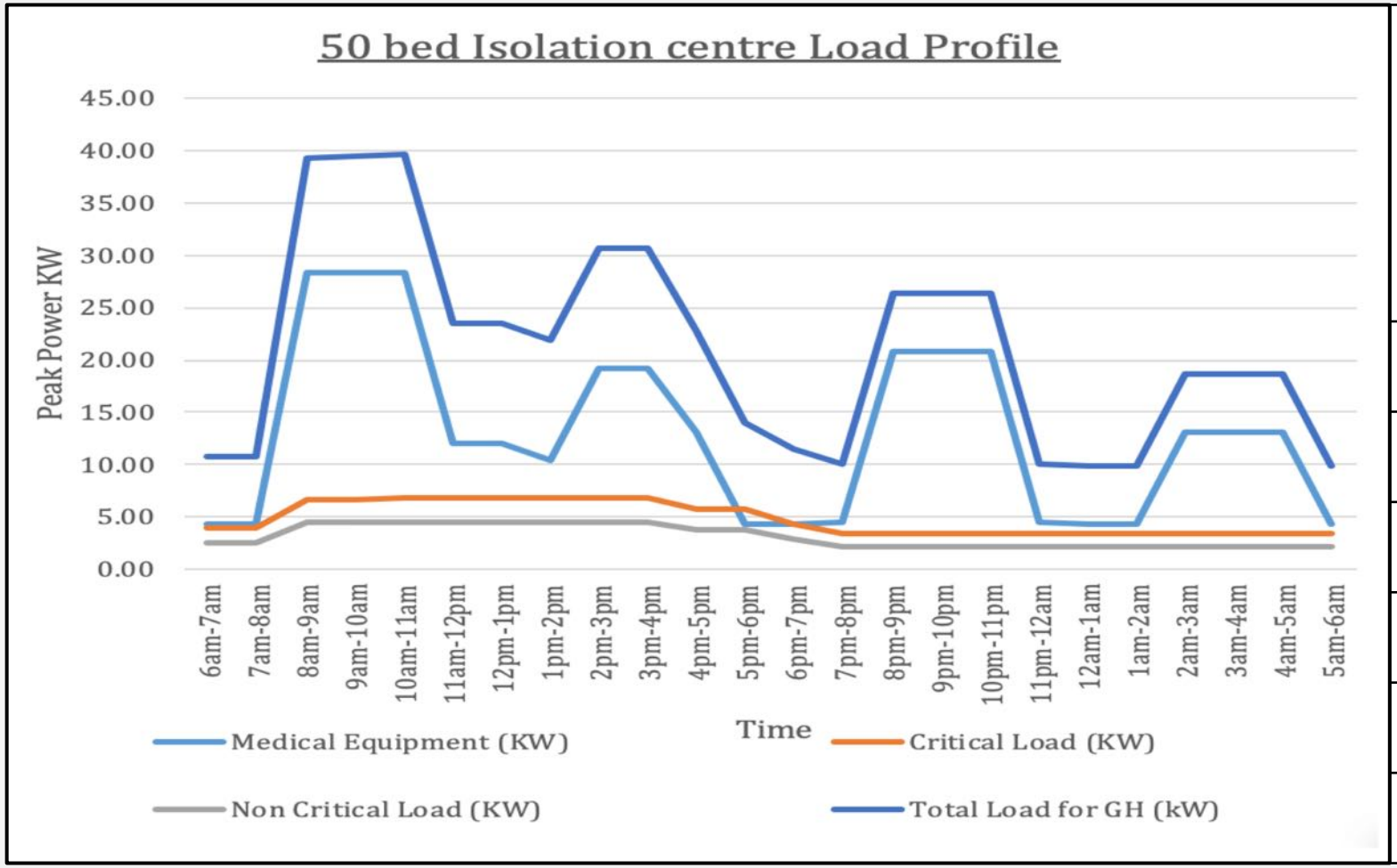
25 bed Isolation centre/ healthcare facilities



Period	Peak Power KW			
		Main Hospital		
	Medical Equipment	Critical Load	Non-Critical Load	Total Load for GH
Peak Power Day (kW)	21.2335	5.85	3.9	**30.9835**
Peak Power Night (kW)	14.7275	3.888	2.592	**19.6375**
Day Load (kWh)	130.98	63.462	42.308	**236.75**
Night Load (kWh)	81.91	36.294	24.196	**142.4**
Total Daily Load (kWh)	**212.89**	**99.756**	**66.504**	**379.15**
Load Usage (%)	**56.15%**	**26.31%**	**17.54%**	**100%**

Load Profile

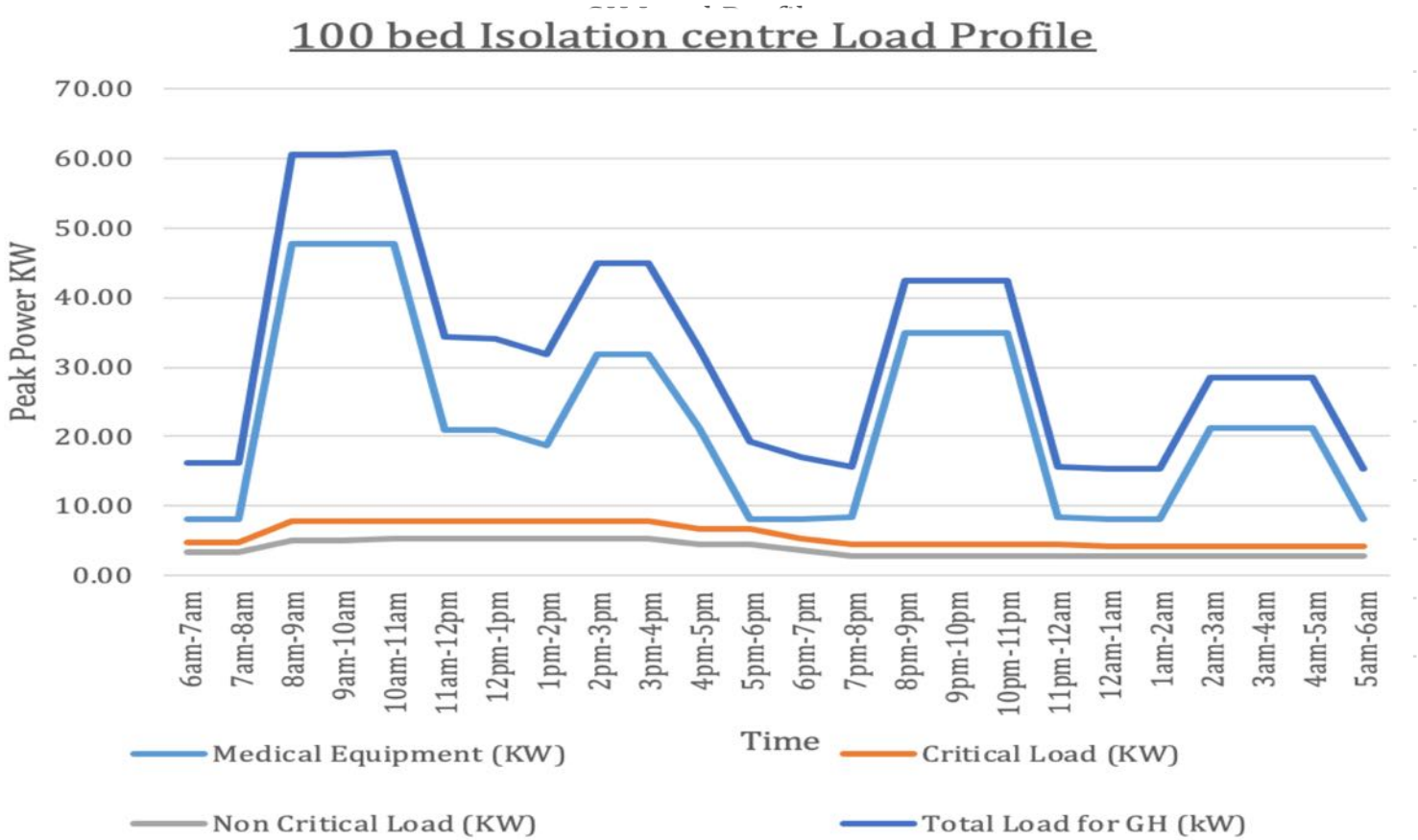
50 bed Isolation centre/ healthcare facilities



Period	Peak Power KW			
		Main Hospital		
	Medical Equipment	Critical Load	Non-Critical Load	Total Load for GH
Peak Power Day (kW)	28.271	6.852	4.568	**39.691**
Peak Power Night (kW)	20.755	4.317	2.878	**26.38**
Day Load (kWh)	183.76	73.77	49.18	**306.71**
Night Load (kWh)	127.78	41.442	27.628	**196.85**
Total Daily Load (kWh)	**311.54**	**115.212**	**76.808**	**503.56**
Load Usage (%)	**61.87%**	**22.88%**	**15.25%**	**100%**

Load Profile

100 bed Isolation centre/ healthcare facilities



Period	Peak Power KW			
		Main Hospital		
	Medical Equipment	Critical Load	Non-Critical Load	Total Load for GH
Peak Power Day (kW)	47.6535	7.914	5.276	**60.8435**
Peak Power Night (kW)	34.9575	5.415	3.61	**42.3125**
Day Load (kWh)	312.83	86.25	57.5	**456.58**
Night Load (kWh)	217.75	53.346	35.564	**306.66**
Total Daily Load (kWh)	**530.58**	**139.596**	**93.064**	**763.24**
Load Usage (%)	**69.52%**	**18.29%**	**12.19%**	**100%**

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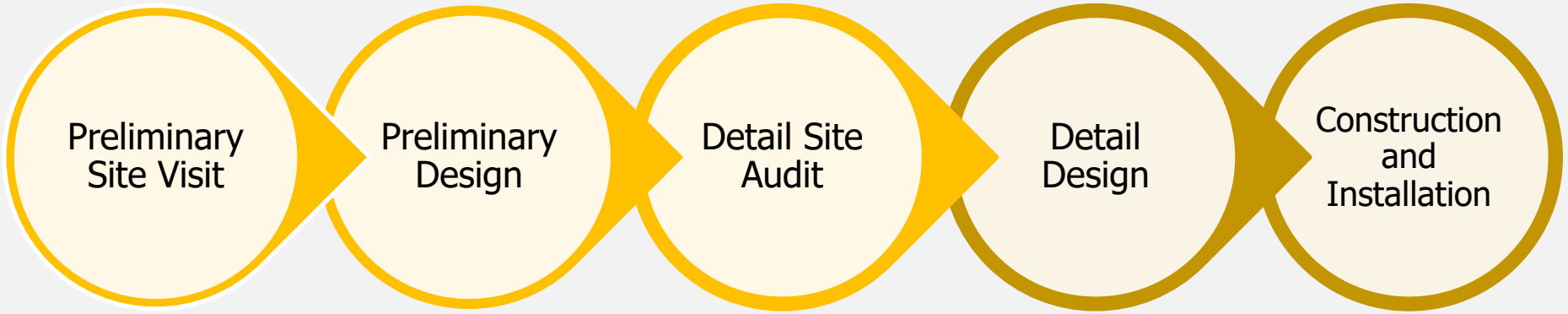
Implementation Approach



Stage:	Preliminary site visit	Preliminary design	Detailed site audit	Detailed design	Handover for construction
Activities:	• Energy audit • Interconnection Survey • PV Survey	• Preliminary layout/ SLD • Capacity estimation • Energy simulation • Preliminary system sizing	• Detailed energy audit • Detailed site audit • Detailed PV survey • Geotechnical investigation	• Detailed electrical designs and calculations • Detailed civil and mechanical designs & calculations • Detailed distribution network designs and calculations • Final contract specifications • Final vendor Specifications	• Civil and mechanical construction and installation • Installation of PV plant • Installation of LV line • Retrofit (if applicable) • Test and commissioning

Limitations

- Estimated loads assumes availability and use of energy-efficient appliances in line with global analyses and recommendations* ; additional load prioritization assessment is recommended
- Estimated loads based on existing centres in only one African country
- Estimated costs based on local procurement and increase of 20 to 25% should be put for importation
- Fastrack Air cargo & sea freight options to be explored
- Expedited clearing required at sea-port and air-port for sea- and air-cargo respectively
- Government support required for movement to site
- Implementation timeline on the response required to allow detailing the project plan

* *WHO/WB (2014):* ***Access to modern energy services for health facilities in resource-constrained settings***

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