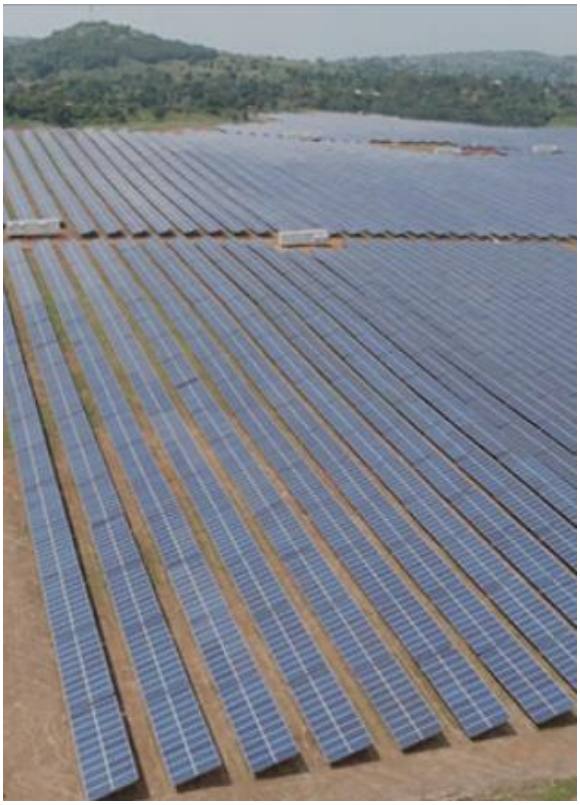
ENERGY SECTOR

2025

20 MW Solar Plus 10 MW Battery Storage Project

Primary energy input	Renewable
Technology	Solar
Installed capacity	20 MW
Location of project	To be determined
Estimated cost (US$)	42 million
Coordinating ministry	Ministry of Energy
Supervising agency	Electrical Generation and Transmission Company
Jobs created	To be determined
Construction time	24 months



During the dry season (December to April), when the run-of-river hydro output is minimal, reliable electricity supply has been a problem since the commissioning of Bumbuna I.

Recent studies by engineering services firm Tetra Tech have indicated that a programme of solar power with associated battery storage can be part of measures to increase the dry season output.

Investment proposition

Private sector investors are sought for the detailed design, feasibility, power purchase agreement (PPA) negotiation, construction and operation of a 20 MW solar power and 10 MW battery storage facility, as an initial pilot project within a 12-site programme. This is an exciting and innovative project in bringing modern clean energy technology to West Africa and utilising battery storage to enhance the reliability and stability of the electricity supply.

The facilities are intended to provide power and fill the battery during the day. The battery storage will both partly cover peak demand after sunset and provide system stability services to ensure reliability of supply. These services are a prerequisite for Sierra Leone's continuing participation in the inter-country Côte d'Ivoire-Liberia-Sierra Leone-Guinea (CLSG) line which will form part of the country's transmission grid as the map below demonstrates.

The initial analysis undertaken in the Millennium Challenge Corporation Compact Preparatory Programme regarding design, geotechnical data and environmental impacts will be available. Subject to successful performance of this contract for the first pilot project site, the partner chosen will also be invited to participate in the procurement process for the remaining sites. Appropriate guarantees will be provided if necessary.

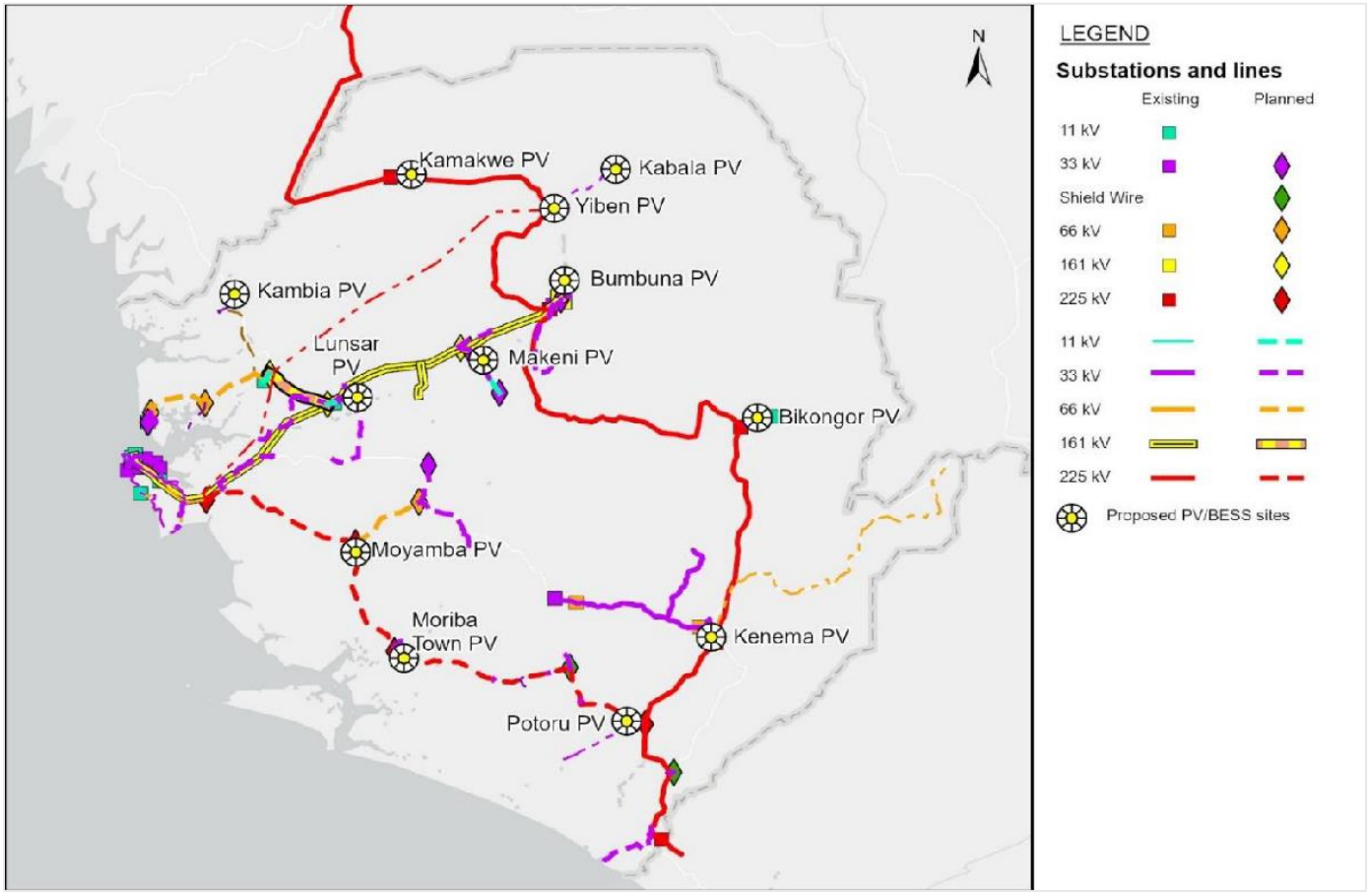
The budgeted cost of the project including contingencies is US$42 million and the estimated construction period after contract agreement is two years.

Key facts

While the overall programme is for 12 sites, the government recognises the need to test the proposal with an initial project consisting of one site that can then be replicated.

The sites identified are indicated in the map below:

Figure 1. Identified sites for a solar power and battery storage facility



A major reason for starting with one site is to allow a full analysis and negotiation of the commercial terms. The PPA cannot be based on a single per kWh price and will need to recognise the different values of rainy season daytime, rainy season peak, dry season daytime, dry season peak and ancillary services re. system stability, even if a composite price is finally agreed. In addition, terms will need to be agreed between the Electricity Distribution and Supply Authority (EDSA) and CLSG for the use of the CLSG line for transmission of power as a pre-condition for the PPA.

Although a final decision is to be made as to the pilot site, it will be co-located near one of the following substations on the CLSG line: Kamakiwe, Yiben, Kenema, Bumbuna and Bikongor. The preferred Government of Sierra Leone (GoSL) sites are Bumbuna and Kamakwie. Highest solar input will be in the northeast, and the installation should preferably also be close to loads that are currently underserved or unreliable. Benefits for the Electrical Generation and Transmission Company (EGTC), EDSA and CLSG system stability should also be considered.

Based on a HelioScope meteorological analysis, annual energy levels are close to 40 GWh for all sites except the floating solar at Bumbuna where the annual energy level is 32 GWh, based on the reservoir-gorge surrounding the floating panels. The energy from the proposed photovoltaic (PV) projects in 2035 amounts to 468 GWh versus a total national energy figure of 2,200 GWh in 2035, which is 20% and aligns with the GoSL's Sierra Leone Energy Policy 2016. Taking other PV independent power producer (IPP) and funder projects into accounts, the PV energy percentage increases to 28% by 2035.

The solar PV sites are standardised to 20 MW for the following reasons:

- 15% reserve margin on a ~1001–50 MW system is 20 MW.
- Largest existing generation units on the power system (e.g., Bumbuna is 25 MW).
- Largest infeed e.g., 27 MW CLSG imports.
- Economies of scale from large, standardised projects.
- Ease of comparison of IPP or engineering, procurement and construction prices for different sites.
- Optimisation of spares-holding.
- Standardised PPAs.
- Standardised 33 kV connection equipment and designs.
- Standardised connection and use of system agreements.

Battery Energy Storage Systems (BESS) assumptions are as follows:

- BESS installations should be co-located with the PV installations – this reduces PV → BESS charging losses and co-locates BESS with loads.
- BESS MW capacity should be half the capacity of the PV capacity. This is to enable half the PV plant to provide the load and half the PV to charge batteries. Based on the PV analysis, this implies 120 MW of BESS capacity by 2035.
- BESS duration should be six hours for morning and evening peak loads.
- 50 MW of BESS should be ring-fenced for primary (or Frequency Containment) reserve i.e., not available for daily load-shifting. The capacities of these batteries can match their associated PV capacities. 50 MW is based on the loss of the largest generating unit in Sierra Leone or the loss of 27 MW of imported power. Note that this assumption will need to be tested in the PPA negotiations as it will have a significant impact on the price(s) agreed.