

**Financial Planning of a Solar Photovoltaic Power Plant in Lungi, Sierra Leone**

**Nelson Vandy Lemoh. Ministry of Finance, Sierra Leone.**

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**Executive Summary**

Sierra Leone has a power problem over the years. The state-owned electricity company, Electrical Distribution and Supply Authority (EDSA) charged with the mandate to distribute and supply electricity to the entire country has a long history of losses both due to ageing thermal power generation machines leading to the emission of CO2 and cannot meet the energy required in the country.

It is against this backdrop, the government of Sierra Leone in its Medium-Term National Development Plan (MTNDP) for 2024-2030 outlines several key initiatives in the energy sector aimed at improving access to reliable and sustainable energy. The plan emphasizes increasing the use of renewable energy sources, such as solar power plants, to reduce reliance on fossil fuels and enhance energy security. This create a modern and efficient national electricity distribution infrastructure that fills the energy needs.

This report analyses some ideal support to promote solar projects and offers recommendation to the government.

FinPlan model was adopted to construct a comprehensive financial study on the purposed Lungi Solar Power plant. The analysis is highlighted in the base case, the Lungi Power NPV result to SLE 390,375.47 million. The IRR is 19.79%, the NPV is positive and the IRR is larger than the discount rate. The economic conditions of the project baseline if favourable for the implementation of the project. However, a well-balanced review needs to the done on the sensitivity of the project as the project will not be profitable if there in and increase exchange rate from SLE/US$, electricity price increase, and drop in the total quantity of electricity produced.

**1. Introduction**

Financial modelling of power systems is a significant step towards the realization of energy access projects in developing countries in sub-Saharan Africa.

The report gives a background of the financial modelling and results analysis of a proposed power project in Sierra Leone. The proposed project is located in the North/West part of Sierra Leone in a town called Lungi, Port Loko District. This is an important location due to the reason that it hosts the only national Airport in the country, as well as it lies within a close proximity to Freetown – the capital city. As showing below.



The project proposed comprised the installation of a 65 Mega-watts power solar photovoltaic plant integrated with a 50,000 Mega-watts-hour battery energy storage system, to be primarily used for the supply of electricity to Freetown, and to provide back-up power supply to Freetown International Airport in Lungi. The project is yet to be implemented, and financial planning is in-process. A summary of the general information related to the project is provided in the following table.

*Table 1:*

|  |  |
| --- | --- |
| **Project Name** | Lungi Power Development 65MWp/50MW solar power plant in Lungi |
| **Project / Site Location** | Kaffu Bullum Chiefdom, Kagbelay Community, Lungi, Port Loko District |
| **Contract Term** | Twenty-Five (25) years |
| **Commercial Operation Date** | After construction period. 2027 |
| **Construction Duration** | 2 years |
| **Project Cost** | Total project cost US$116 million |
| **Description of the asset the project will provide** | The project would construct a Solar PV plant, Battery and Submarine cable to transport electricity in Freetown |

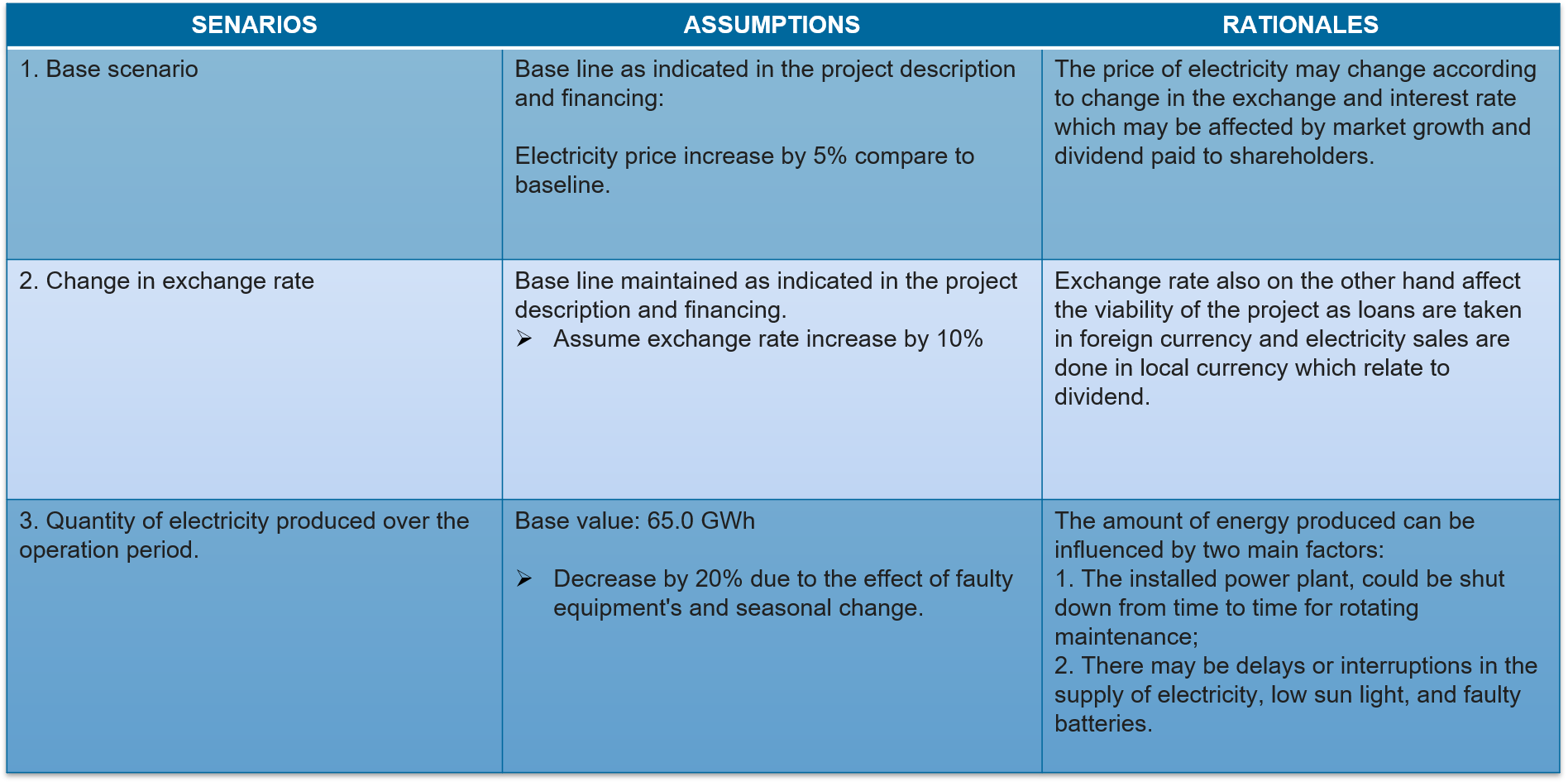
**Objective and aims**

The aim of the study is to carry out a financial modelling and analysis of the proposed solar PV power plant to determine its financial viability, and economic performance.

The objectives include:

* To collect data on related to project financing and economics
* To use the collected data and other assumptions as inputs to model various alternative scenarios of financing for the project using the FINPLAN software. Three scenarios were used, increase in price of electricity, increase in exchange rate, and decrease in quantity supply all aim at ascertaining the project viability.

**2. Methodology**

- **Modelling Approach/Tool Implemented**

Three scenarios were run using the FINPLAN modelling software as shown in the table above. The FINPLAN modelling software calculates the financial performance of the project over its entire lifetime. The software utilizes specific financial, technical and economic inputs related to the project in case-study to simulate outputs related to the performance of the project

Data on project technical and financial variables were obtained from Ministry of Finance and Ministry of Energy of the Government of Sierra Leone. The following table gives a description of the data used in the modelling

**Financing Model**

The following variables were considered in the financial modelling of the case-study project

* The total project cost is estimated at **US$ 116** for a period of 25 years.
* The proposed financing method is 30% equity and 70% loan 100 percent equity financing.

The table below outlines the various Financing Assumptions related to the project

*Table 2:*

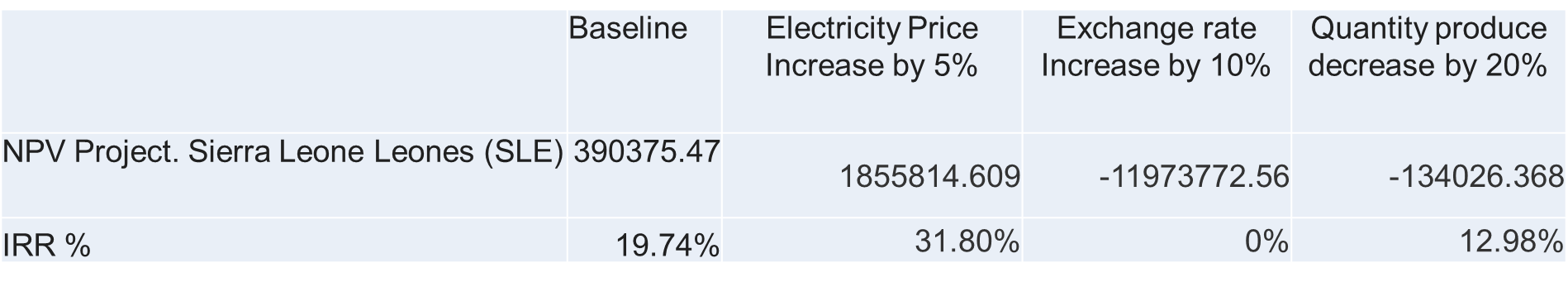
|  |  |  |
| --- | --- | --- |
| **TECHNICAL** | **ECONOMIC** | **FINANCE** |
| **Technology:** Solar PV plant, battery and submarine cable  **Solar Mini-Grid Capacity**: 65MW  **Construction Period:** 2 years  **Year of Operation:** 25 years  **First year of Operation:** 2027  **Annual Production:** 65.0 GWh/year | **Tariff:** 66450.7kWh  **Interest rate**:4%  **Local inflation:** 31%  **Exchange rate:** US$ 1 → SLE 22,500  **Tax rate**: 15% steady rate  **Depreciation:** 15 years (linear) | **Investment:** US$ 116 million  **Sources of Finance:** 30% Equity, 70% loan |

The upward change in exchange risk, drop in quantity supply, and increase in exchange rate were the three scenarios used to the determine the possible financial viability the Lungi Solar Power Mini-Grid. This examine how exchange rate affect interest payment, the supply of electricity impacts revenue, and how price increases influence dividends. Following the estimate that the selling price of the electricity is SLE 66450.7 per kWh, of which exclude the Value Added Tax (VAT), but include the Goods and Service Tax (GST). This will cover the Operation and Maintenance costs, and other further expenses in the project life cycle.

**3. Results**

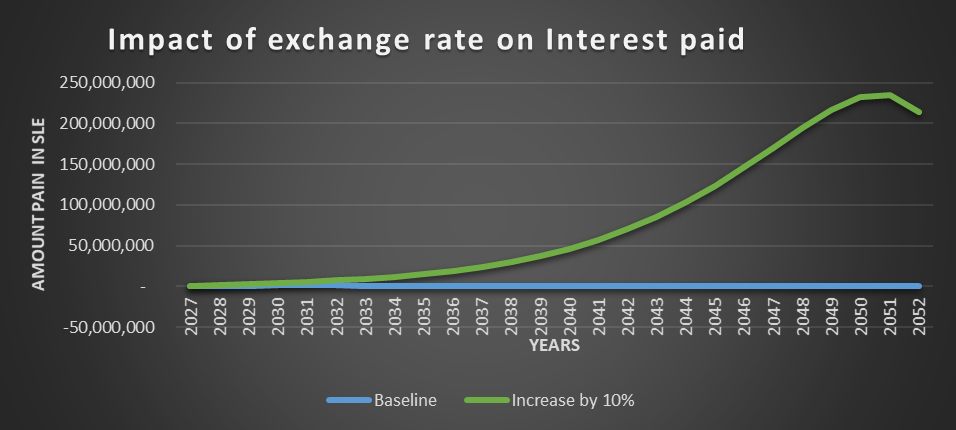
At the base case, the NPV of Lungi Power Solar-Mini Grid is SLE 3,903,75.47 million, of which the IRR is 19.79%. This shows that the NPV is positive and the IRR is higher that the discount rate showing that the project is potentially profitable. The debt-equity ratio within 0.7, that is acceptable for the lenders, and a zero stand by facility indication that this loan from the bank for financial support or liquidation was hardly used in the construction period of the project. The Short-term deposits flows is low period and beyond, also indication that the money was not deposited in the construction period, which shows a balanced project.

*Figure 1: NPV and IRR baseline on the scenarios.*



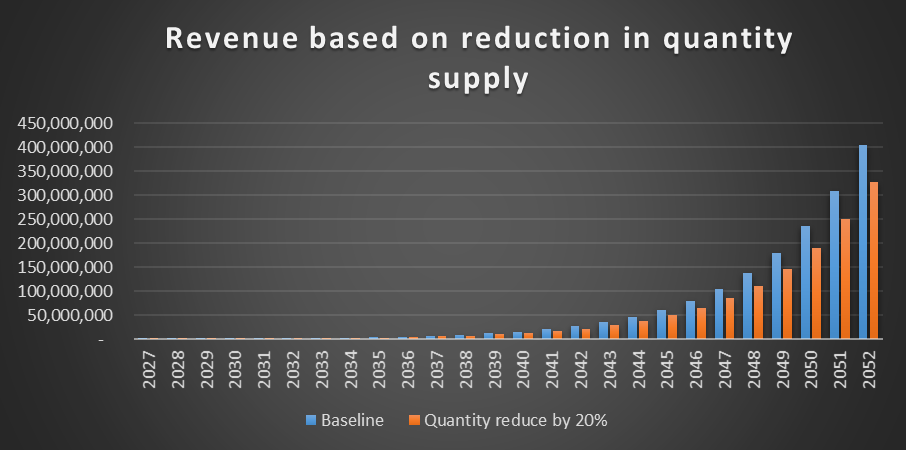
The NPV and IRR baseline on the three scenarios shown that a percentage change in any of the scenarios has as effect of the NPV and IRR. In the case of the 5% increase in electricity price of SLE 83,273.9GWh the NPV increased from SLE 3,903,75.47 million to SLE 1,855,814.6 million with IRR increasing from 19.74% to 31.80% indicating that the project will not be well positioned in an increase of 5% of the electricity price as customers in Lungi cannot afford the price increase based on their eringd. If exchange rate increase by 10% the NPV is negative of SLE -11,973,772.5 with a zero percent IRR indication high wrinkle effect in the exchange rate from the Sierra Leone Leones to the United State Dollar. Lastly a 20% reduction in the quantity of electricity produce suggests a decent return rate, of 12.98% with a negative NPV of SLE -134026.4 indicates that the project might not be financially viable overall.

*Figure 2: Impact of Exchange rate on Interest paid.*



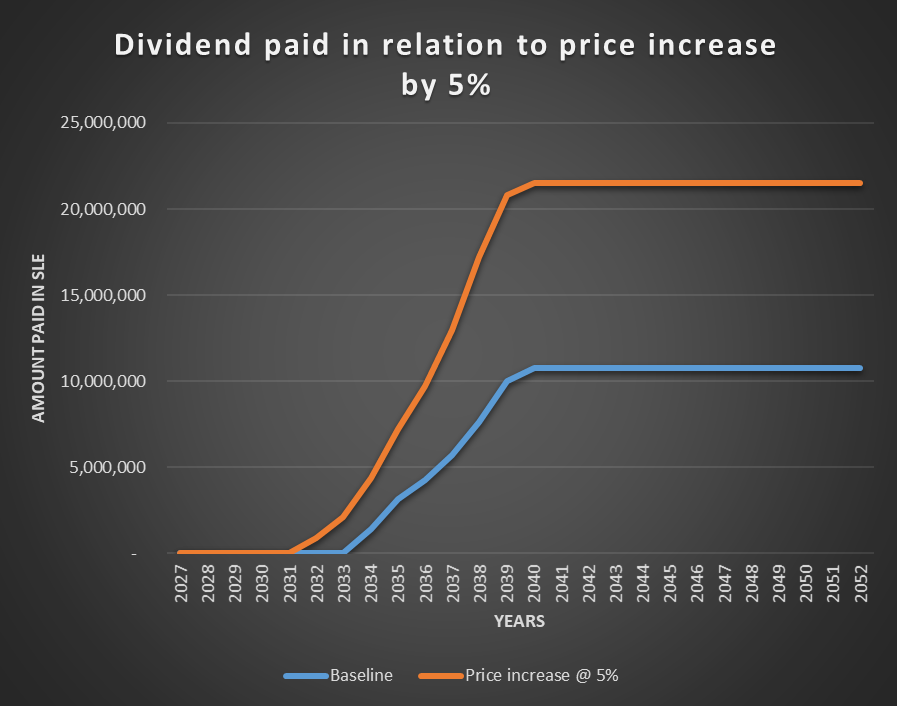
The increase in exchange rate shown a higher impact on interest rate paid as loans are taken in US$. In this scenario when was a SLE 22,500/US$ the interest rate paid from loans was below SLE 50 million from the begging of the operation year 2027 to 2039. With the 10% increase in the exchange rate the interest rate increased from SLE 50 million to more than SLE 200 million from 2050 till the closure of the project. This shows a huge gap from the baseline of more than 200%. Resulting to the point that the project will not be viable in the event of week local currency.

*Figure 3: Impact of Exchange rate on Interest paid*



In this case the if the baseline shows a steady increase of revenue over the years. When electricity reduction by 20% the revenue highly decrease compares to baseline, suggesting the reducing quantity supply by 20% can lead to a lower revenue by 35%in the long run. This indicate that a reduction in quantity supply will negatively affect the revenue growth over an extended period.

*Figure 4: Dividend pain as a result to price increment*



Also, the price increase by 5% remains constant at the top throughout the years. The price increase by 5% starts below baseline in 2028 but gradually approaches the baseline over some period. The increase in price indicate that there is a high dividend paid at SLE 20,500,000 by 2040 as prise increase by 5% at 2032 of SLE 3,000,000 eventually surpassing the baseline level and keeps on rising till 2040.

**4. Discussion**

These financial analyses revealed that the Lungi Solar Power Plant can be profitable if the Government of Sierra Leone do a proper feasibility study and review the project documents including its finances. The Solar Plant project will provide a unique energy mix, by reducing on the reliance of fuel as this been powered by a natural resource thus reduce carbon emissions in comprising to Hydro Power plants by contributing to net zero emissions. The clean energy will contribute the actions in combating climate change. The Lungi Solar Power project will provide job creation and stimulate economic activities the Lungi township and beyond as the locality is the gate way to Sierra Leone. One main challenge of this project is the exchange rate from the Sierra Leone Leones to the United State Dollar thereby affecting the total output, and this distress the price of electricity sales and the cost of the operation and maintenance in the long run.

The first policy implementation is that the government put measures in place to combat negative decrease of the Leones to the US$ as this the total project output from all aspect. Also, government should institute a tariff not more than SLE 66450.7 per kWh, as this will help the middle man level to purchase more from solar generated electricity which has less or no effect on CO2 emulsions. For the project to maintain a good financial health, the government should ensure that the supplied electricity is well-positioned to match the electricity demand for revenue to pay the loans and undertake the daily operations and maintenances as required in the plant.

There are limitations in the study, one of which is the government capability to undertake in the project in the shortest period of time, also the time to install the submarine cable technology use that will be used to evaluate in Freetown from Lungi cannot be meet in the project construction period, thus will affect the project time lines. The model does not cove the consumers behaviour in energy consumption, environmental and social factors, and the model cannot be customized to country specifics.

**5. Conclusion**

A renewable energy transition would support the growth of industries (such as mining, tourism, construction and agriculture). This would create new business and employment opportunities for Lungi as well as providing a real boost to their quality of life through improved education, recreation and health.

As the Government of Sierra Leone is on the verge of transiting from Thermal Power Plants to a renewable and clean energy required which required huge investment, this affect the government’s ability to execute the project swiftly is uncertain. The use of submarine cable technology between Lungi and Freetown may not be feasible within the project timeline, potentially causing delays in the implementation. In addressing these measures and limitations, od this Solar Energy project, is decisive for government to design policy measures to ensure the project’s financial stability and its contribution to sustainable energy development by fostering collaboration amongst stakeholders, in which the project can effectively overcome its limitations and achieve its goals. Given the project’s sensitivity to change in exchange rate and economic conditions, it is essential for government to cover all project requirement’s comprehensively.

In conclusion, it is recommended that government should include the project in a budget line of the 2025 financial year. This is vital as the country is facing shortage in electricity supply impacted the socio-economic activities of the entire township and its surroundings. Additionally, instead of transporting electricity to Freetown, it is advised that the project focus on electrifying Lungi and its surroundings to reduce excess operation and maintenance expenses. This strategic focus ensure the project’s success and contribute to the overall development of the region.

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