**Documentation for Naomi's Solar Panel and Battery Cost Analysis Model**

## **Purpose of the Model**

The model is used to calculate Naomi's potential savings in electricity expenditures when she installs solar panels on her home. The model calculates the cost effectiveness of purchasing and installing a new battery to store extra electricity generated by solar panels. The model also calculates the additional amount of electricity that can be met with the new combination of batteries and solar panels rather than simply a solar panel, as well as the savings in electricity prices she gains. Furthermore, it computes the Net Present Value (NPV) and Internal Rate of Return (IRR) of the battery investment in two scenarios. When the inflation rate rises by 4%, as previously announced by the government, and the second is Naomi's prognosis of a 0.25% increase in inflation per year on top of the previous year's.

## **The Data**

The data presented is for solar electricity generated and electricity utilised in hourly increments in the year 2020. Naomi has also supplied facts such as her current funds, the length of time she intends to use the solar panels, the government, and her own inflation rates and annual discount rate. The dataset has four columns: the time of day, the date and time, the quantity of solar energy generated, and the amount of energy spent in electricity. The model is designed to function with these columns.

### **The checks;**

The model verifies the data's availability and accuracy.

- It ensures that the data on solar energy generation and power usage is complete and covers all important hours of the year.

- It ensures that the information on electricity prices is consistent and appropriate.

### **Assumptions**

* The battery has a maximum storage capacity of 12.5 kWh and a minimum storage capacity of 0 kWh.
* Any excess electricity produced when the battery is fully charged cannot be kept.
* Current solar electricity generation is used first, followed by any stored battery energy, and ultimately by purchasing electricity from the provider.
* The installation of the battery costs $7,000, and its projected working life is 20 years.
* The annual discount rate for NPV calculations is 6%.

### **Methodology**

The methodology is to build a model using Python that can analyze the cost-effectiveness of the battery installation:

### **Step 1: Data Validation –**

The model validates the provided data for availability and accuracy.

- It ensures that the data on solar energy generation and power usage is complete and covers all important hours of the year.

- It ensures that the information on electricity prices is consistent and appropriate.

### **Step 2: Determine Extra Electricity and Cost Savings**

- The model computes the additional quantity of electricity that can be generated by the solar panel and battery combo above only solar panels.

- To determine the additional electricity met, it considers solar electricity generation, battery storage capacity, and electricity usage.

- By multiplying the excess electricity met by the electricity price, the model determines the estimated cash reduction in power costs.

### **Step 3: Determine the Net Present Value (NPV).**

- The model computes the net present value of the battery investment under two scenarios.

- Scenario 1 estimates a rise in electricity costs equal to the government's predicted yearly inflation rate of 4%.

- Scenario 2 assumes that electricity prices rise by the expected annual inflation rate of 4% plus 0.25% per year.

- The NPV is determined by discounting the predicted cash flows (electricity cost savings) over the battery's expected operating lifetime at a rate of 6% per year.

### **Step 4: Calculation of the IRR Using Numpy Financial –**

The model computes the IRR, which is the discount rate that results in the NPV of the predicted cash flows equaling the initial cost of the battery investment.

**5. Additional Checks:**

The model performs the following additional checks: - It confirms that the excess electricity calculated is within the storage capacity restrictions of the battery.

- It verifies that the estimated monetary savings in energy expenses are fair and consistent with the facts presented.

- It verifies the accuracy of the NPV and IRR computations.

Please keep in mind that the model assumes that no other factors, such as maintenance or replacement prices, have a substantial impact on the cost-effectiveness analysis. If these factors are available, they can be incorporated into the model.