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Project Name: WESTVILLE SOLAR PANEL PROJECT

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1. Introduction

Grid reliability in South Africa has been severely reduced over the past few years. Load shedding and lack of maintenance on electrical infrastructure have resulted in an increase in both frequency and duration of outages to customers, Electricity tariffs increases have exceeded inflation while the costs associated with rooftop PV installations (including battery backup) have continually reduced. In addition, there has been a continual improvement of PV, inverter and battery technology, As such, Eskom distribution has been looking to install rooftop PV with battery backup at selected Eskom owned premises.

The initial proposal is to investigate options for the installation of PV and Battery backup on 6 Eskom owned CNC buildings and the Westville Call Centre facility.

2. Project Scope Definition

Alternate supply for the Westville office complex, located at 3 Menston Road, Westville (29°50'7,38"S 30°55'8,95"E) is to be limited to the following:

1. The main building ground floor
2. The main building 1st floor (contact centre), including the server room
3. HVAC and external lighting for main building is required

To note:

a) Rooftop PV to be maximised

b) Battery energy storage to cater for 4 hour daily load shedding

c) A 250kVA generator is installed. This should be integrated as part of the standby power option

3. Load Estimation

Estimated load requirements as per section 2 are as follows:

1) An alternate electrical powe source for the main building, including:
   a. Ground and First floor
   b. HVAC loads
   c. Server Room
   d. Excludes (Annex)

A standby time from battery of a minimum of 4 hours is proposed

To estimate the power requirements for the two options, various data was used:

1. Actual electrical meter readings for the facility and monthly extrapolation using OPENSOLAR.
2. A walk down of the first floor, recording all electrical devices
3. Logging of the facility by Eskom market research department.

3.1. Data from Electricity Meters

Utility meter data, from the Ethekweni facility meters was used. Values obtained are shown below in table 1.

Table 1: Ethekweni Meter data

	Date	Value	Days	k	kWh per day
Meter reading 1	2022/12/09	50798	-	160	-
Meter reading 2	2023/06/06	52879	179	160	1860
Meter reading 3	2023/09/08	53568	94	160	1173
Meter reading 4	2024/02/28	55291	173	160	1594
Average for period			446		1612
Estimated Breakdown					
Westville Gnd Floor	10%				161
Westville 1st Floor	30%				484
HVAC	50%				806
Annex	10%				161

3.2. Distribution Board logging

In addition, five LV data loggers were installed and electrical parameters were logged at two minute intervals. The raw data is available. The graphs below represent a seven day period for the two load groupings

Ground Floor, First floor, Server room and HVAC

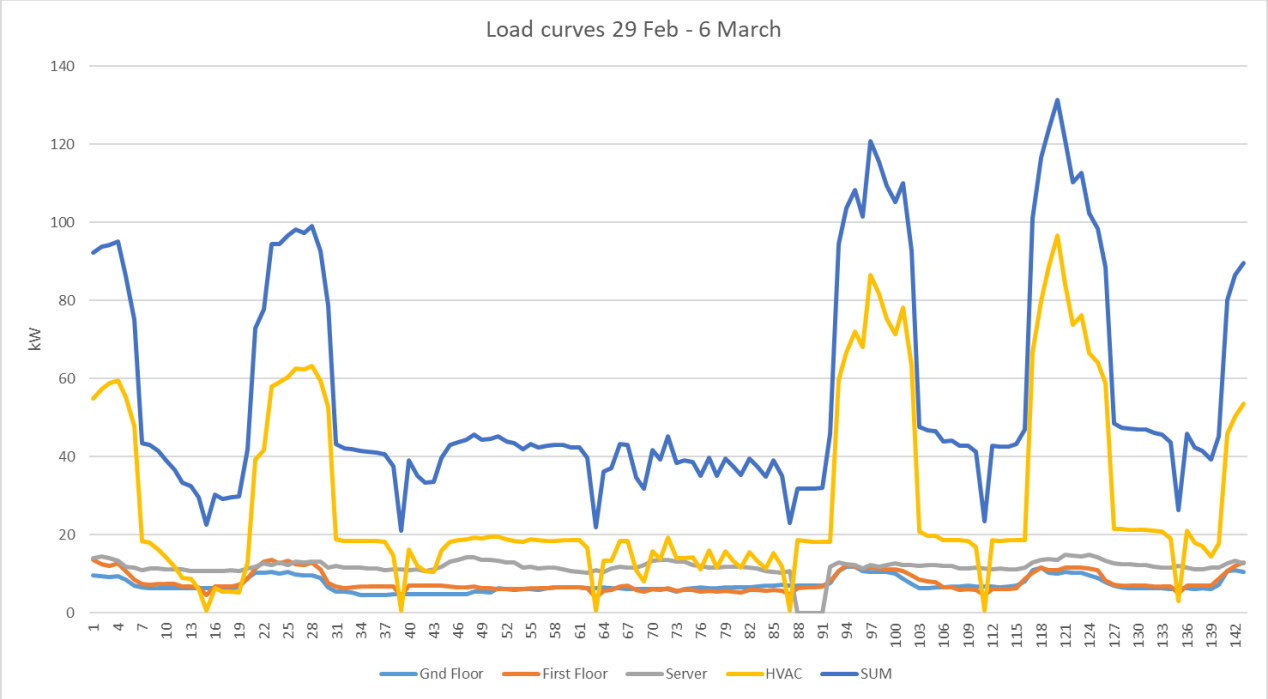

Figure 1: Load logging for Westville Main Building

4. Storage Options

The personnel using the Westville main building requested that backup for a four hour outage ride through has been allowed for. The table below details assumed power requirements per hour of outage.

- Peak 4 hour concurrent demand used.
- Maximum batteries discharge assumed to be 80%

4.2 Option 2 Storage Requirements

Table 2: Storage sizing for Westville Main Building

Values from Logging Period	kWh	Storage requirements
Average Daily Consumption	1327	
1 Hr Backup Worst Case	131	164
2 Hr Backup Worst Case	255	319
3 Hr Backup Worst Case	376	470
4 Hr Backup Worst Case	493	616
5 Hr Backup Worst Case	603	754
6 Hr Backup Worst Case	716	895
7 Hr Backup Worst Case	817	1021
8 Hr Backup Worst Case	919	1149
9 Hr Backup Worst Case	1017	1272
10 Hr Backup Worst Case	1106	1382

5. System Design for Westville Main Building

Ground Floor, Call center, server room and HVAC

PV Panel Installation

Conceptual design has estimated that PV panelling can be been maximised to a total of 90kW. The solution is to maximise possible PV on the main building roof subject to structural analysis. A structural engineer will be required to assess reinforcement requirements. To note, where required, PV panel installations on the adjacent carports may be considered.

Figure 2: Proposed PV Panelling layout

Inverter

A single 150kW 3 phase inverter is proposed

Storage

As per table 2, a total of 616kWh of energy storage is required to provide electrical backup for a four hour outage.

Additional

An allowance has been made in the costing for additional items:

a. Various additional electrical work related to the PV/BESS installation
b. Structural work for the PV Panels
c. Electrical Compliance and Professional sign-off.
d. Adherence to any requirements by Ethekweni municipality

6. Projected System Performance

An estimation of the daily energy output of the 161 x 550W panels that are proposed for installation on the Westville office complex roof is show below in figure 6. A hybrid system is required as the PV installation is unable to supply the total load of the office complex.

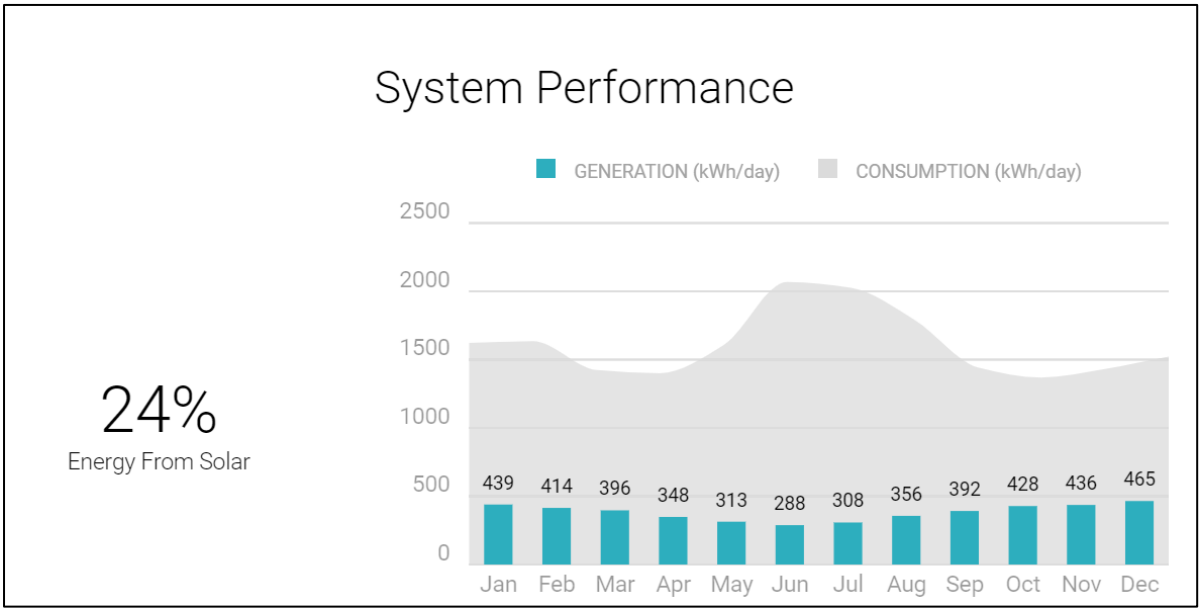

Figure 3: PV System performance