
Gauteng Department of Economic Development (GDED)

SME Green Support Incentive Program

**ENERGY CONSUMPTION ASSESSMENT FOR
Mr Bin Cleaner and Waste Management**

PROTEA GLEN, SOWETO, 1819. GAUTENG

11 May 2022

Prepared for: CSIR National Cleaner Production Centre South Africa
CSIR Pretoria Campus
Pretoria

Prepared by: CSIR Energy Centre
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This project report is to remain confidential between the NCPC-SA/CSIR and Mr Bin Cleaner and Waste Management and may not be revealed in any way to a third party without the prior written permission of the NCPC-SA/CSIR.

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Nomenclature

CDD	Cooling Degree Days
CFL	Compact fluorescent lamp/light
CO _{2e}	Carbon dioxide equivalents
CP	Cleaner Production
Deg.C	Degrees Celsius
Hr	Hours
kL	Kilolitres
kVA	Kilovolt Amperes
kW	Kilowatts
kWp	Kilowatt Peak
kWh	Kilowatt-hours
LED	Light-emitting diode
NCPC-SA	National Cleaner Production Centre of South Africa
R	Rands
PV	Photo-voltaic
RECP	Resource Efficient and Cleaner Production
W	Watts

EXECUTIVE SUMMARY

An Energy Assessment was conducted at Mr Bin Cleaner and Waste Management based in Protea Glen, Soweto, Johannesburg. The GPS coordinates are (-26.283913, 27.811163). The assessment was done to evaluate the company's operation by assessing how much energy they utilize on their site and assist in cost reduction of the consumed energy. The annual Electricity consumption per year is R62 300 with a 24 000 kWh consumption.

Identified energy efficiency opportunities were identified as follows:

- Opportunity for approximately 67% of electrical energy to be sourced from an alternate energy source (saving of 16 000 kWh and R 40 000)
- Estimated Carbon Dioxide reduction of 16 tonnes identified
- Overall identified investment cost of R 221021.
- Payback period of 5.5 years

A summary of the material to be purchased is contained below:

Table 1: Solar Panel Raw Material

Solar Equipment	Quantity	Unit	Rate		Amount	
Sunsynk Sun 12kW Three Phase LV Hybrid Inverter	20	Unit	2938.93	ZAR	58778.60	ZAR
Freedom Won Lite Home 10/8 LiFePO4 Battery N	1	Unit	47429.14	ZAR	47429.14	ZAR
CANBUS Cable for Freedom Won and Sunsynk or Goodwe combination	1	Unit	58652.22	ZAR	58652.22	ZAR
Three Phase Earth-Neutral Bridge Box For Inverters Up To 12kWac	1	Unit	318.55	ZAR	318.55	ZAR
70mm2 Battery Cable (H01N2-D) 2m – PAIR	1	Unit	1765.79	ZAR	1765.79	ZAR
600V Protection Box 2 Inputs 2 Outputs 16A Isolator Type I II SPD	1	Unit	948.78	ZAR	948.78	ZAR
4mm2 single-core DC cable 50m - Black & Red	1	Unit	6554.17	ZAR	6554.17	ZAR
MC4-Evo2 1500V DC Connector Twin Pack 0086/0087 (Kit 1)	1	Unit	1366.37	ZAR	1366.37	ZAR
MC4 Pre terminated cable 2m (1 Pack)	10	Unit	164.82	ZAR	1648.20	ZAR
KETO 1 BaCery Disconnecter with 250A Fuses	4	Unit	138.05	ZAR	552.20	ZAR
10 Panel Mounting Kit - IBR Roof c/w earth plate clamp kit & profile splice	1	Unit	1882.36	ZAR	1882.36	ZAR
70mm2 by M10 Ring Terminal Lug	2	Unit	4942.72	ZAR	9885.44	ZAR
BaCery Hazard label Li-ion (230mm * 90mm)	1	Unit	468.79	ZAR	468.79	ZAR
BaCery Hazard label Li-ion (230mm * 90mm)	6	Unit	39.28	ZAR	235.68	ZAR
PV on Roof and Hazard Labels Pack	1	Unit	42.86	ZAR	42.86	ZAR
	1	Unit	135.51		135.51	ZAR
Delivery to Germiston	1	Unit	1527.48	ZAR	1527.48	ZAR
Total				Subtotal	192,192.14	ZAR
				Vat: 15%	28828.82	ZAR

	Total	221020.96	ZAR
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1. INTRODUCTION

Mr Bin Cleaner and Waste Management is a South African-based company located in Protea Glen, Soweto, in Gauteng. Mr Bin Cleaner and Waste Management is an environmental waste management and recycling company. The waste is collected, packaged, and transported to the local South African market. The company has five employees working 8 hours shift. The company uses electricity supplied by City Power and has no other sources of energy. Mr Bin Cleaner and Waste Management has been operating since 2013.

Mr Bin Cleaner and Waste Management is a local and private company. We are a bin specialist company dealing with all issues relating to wheelie bins from hygiene to waste. Our services are dedicated to constantly provide quality services and customer satisfaction by being professional and reliable.

The Energy Assessment commenced on the 29 April 2022 with a brief introduction meeting with the establishment owner and accompanied by the NCPC-SA representative, followed by the site walk-through and the assessment continuing for the rest of the day on-site.

This review forms part of the Gauteng Department of Economic Development (GDED)'s SMMEs Green Support Incentive Program whose objectives are to assist SMMEs based in Gauteng to instal alternative sources of energy to mitigate the high cost of energy and green their operations through reduced carbon emissions. This review report presents the relevant findings contained in the RCEP Assessment Report and information obtained from the site visit relating to energy usage and opportunities for energy performance improvements and renewable energy resources that can supplement grid power. The opportunities are evaluated for technical and financial feasibility. High level investment costs, energy and cost savings and simple payback periods are presented.

2. COMPANY INFORMATION

Table 2: Company Information

Assessment Type	Review of Energy Efficiency and Renewable Energy opportunities
Assessment Period	April 2022
Company Name	Mr Bin Cleaner and Waste Management
Physical Address	11168 Wattle Street, protea Glen Ext 12.
Phone	072 289 0735
Trading Since (year)	2013
No. of Full time Employees	5
Industrial Processes	Environmental Waste Management
Company Contact Person:	
Name:	Joseph Ramogale
Designation:	Managing Director
Mobile:	072 289 0735
E-mail:	ramogalejm@gmail.com

3. PLANT PROFILE

Figure 1 shows the location of Mr Bin Cleaner and Waste Management premises according to Google Earth's Aerial View. The space occupied by the factory is clearly marked in the figure. The Mr Bin premises occupies a land mass of area 3,835.3 m². Currently, the company has no building structure, but they work in partnership with mentorship from the University of Johannesburg, with a plan to build a structure that will have a solar system intended roof space. It is in that building where their industrial operations will take place. With limited infrastructure, they have managed to operate successfully for a period of Qualifying for the Green Incentive program was made possible because of the concrete plans and the support they have from professional mentorship, to guarantee high chances of success. The company has enough land to build a strong initial but permanent building with a north-facing roof to optimally mount a highly efficient solar system for renewable electricity generation. Since the business operates only during the day, a Solar PV system would be ideal and more practical to supplement power supplied by City Power.



Figure 1: The land mass (left) and the temporary buildings that are in Mr. Bin's premises.

The temporary structures were shifted to make way for the desired building. Figure 2 shows the building that Mr. Bin could afford to build at this stage of the their business in preparation for Solar System Installation.



Figure 2: The building structure that Mr. Bin has built in preparation for Solar System Installation.

4. PRODUCTION PROCESS

The production process begins when they receive recyclables materials from their external suppliers. This material comes in a scattered form. The material is then inserted inside a balling machine where it is compressed to produce a large pallet. The reason of balling this material is to make easier for transportation process and to make it easier to manage the waste. The baled material is then wrapped with a string or a shrink wrap and then stored and later transported to the customers for further processing.

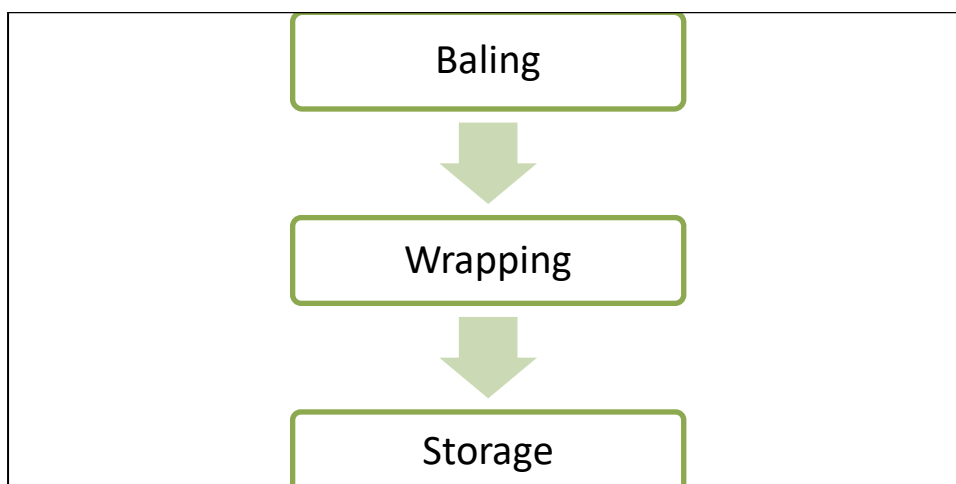


Figure 3: Process flow diagram

5. ENERGY CONSUMPTION

Electricity consumption data was provided by Mr Bin Cleaner and Waste Management for the period January 2021 to December 2022

5.1 Electricity

Electricity is the only energy source used at the factory. Table 3 below shows electricity consumption values and cost for 12 months starting from January 2021 to December 2022.

The number of weeks in a month calculated as

Table 3: Electricity consumption

Months	Electricity(kWh)	Cost/Month	Cost/kWh (Rands)
Jan 21	1 929	4 340.25	R2.25
Feb 21	1 602	4 069.08	R2.54
Mar 21	2 334	5 928.36	R2.54
Apr 21	2 310	5 751.90	R2.49
May 21	2 202	4 976.52	R2.26
Jun 21	2 253	6 781.53	R3.01
Jul 21	1 359	4 131.36	R3.04
Aug 21	3 015	8 773.65	R2.91
Sep 21	1 215	3 462.75	R2.85
Oct 21	2 082	5 663.04	R2.72
Nov 21	1 815	4 446.75	R2.45
Dec 21	1 977	3 973.77	R2.01
Total	24 093	R62 298.96	31.07
Monthly Average	2007.75	R5 191.58	R2.59
Daily Average	92.74	239.80	0.12

5.2 Identification of Significant Energy Users

An energy balance was done on site accounting everything that utilises electricity on site. The total on the balance would tie up with the total from their electricity balance. It is purely based on estimates and simply highlights where the electricity on site is going to. This aids in establishing the Significant energy users on the site.

Table 5 highlights the energy balance and identifies the significant energy users. The biggest energy users on the site is the balling machine which marks the heart of the business. The machine operates daily for 8 hours a day and it is the one equipment that enables the company to be sustained. The second users would be the lighting systems for offices and the

warehouse. The company uses the fluorescent lightings which ranges from 36W to 58W of consumption. The other equipment uses less energy as they have a very low utilization ration as per the energy balance.

Table 5: Installed capacity & estimated energy usage

Equipment	Estimated kWh/year	%Energy Consumed
Balling Machine	22 357	93%
Lighting	698.88	3%
Fridge	570.52	2%
Microwave	7.8	0.03%
Desktop	192.00	0.80%
Printer	36.00	0.15%
CCTV	230.40	0.96%
Total	24 093	100%

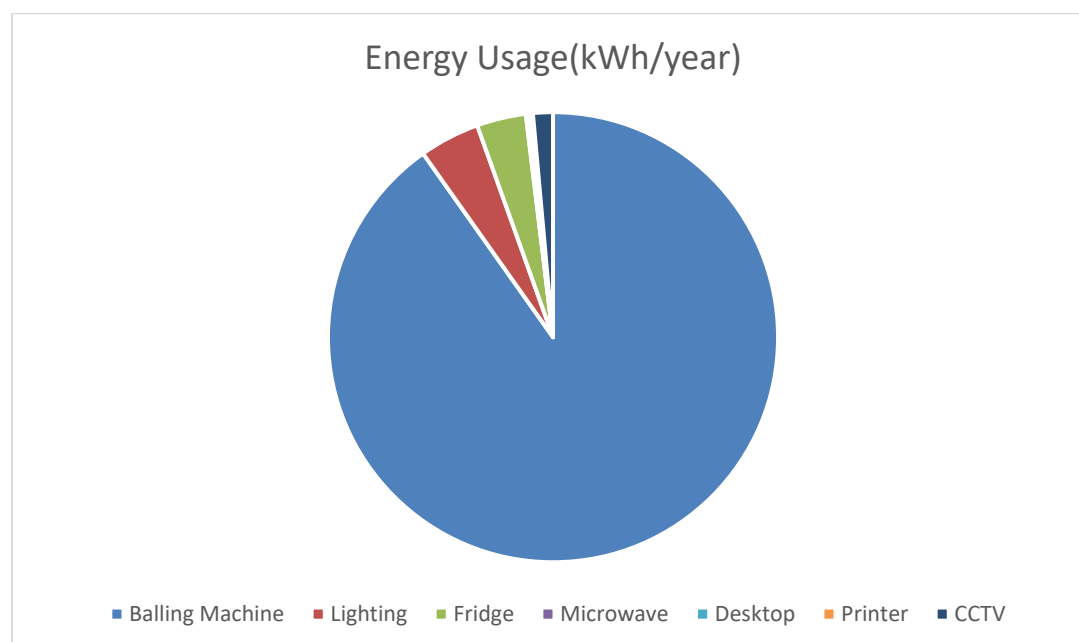


Figure 4: SEU's

5.3 Baseline Establishment

Since there is currently no production figures available, the baseline can only be projected and only attributed to lights.

6. DETAILED ASSESSMENT FINDINGS AND RECOMMENDATIONS

6.1 Installation of Solar PV

Rationale

The company will install LED lighting and will implement RECP principles in the operations of their plant.



Figure 5. The roof space of Mr Bin Cleaner and Waste Management and its maximum as well as the maximum solar system installation capacity

6.2 Solar PV System Sizing

The company operates from 08h00 to 17h00, and while this places them in a position to exploit solar energy to generate electricity for their plant operations, the fact that they are building the structure to satisfy maximum solar energy harvesting, they will utilise the maximum number of sun hours in their area.

Based on the estimated 12-month energy consumption of 24 093.00 kWh calculated earlier, as well as the projected 2007.75 kWh monthly and the 8.8 kWh daily consumption, it is possible to run the entire plant on renewable energy, considering

that about 9 kWh/day of energy and much more, can be supplied from the available roof space.

Table 2 shows the sizing of the PV system that is recommended for installation on the large roof of Mr Bin Cleaner and Waste Management. While company operates from 8h00 to 17h00, and it can be able to operate with no need for battery bank, the recommendation is a hybrid system to cater for the never-ending load shedding.

Table 2. Solar PV System Sizing and the Corresponding Equipment

Item	RESULTS		
Operating hours (Only 8 to 5)	9		9
Operating days a week	5		
Operating Weeks in a month	4.33		
Operating month in a year	4		
Estimated Consumption split Day vs Night	Total		
Consumption Split	100%		
Average Monthly Consumption (kWh)	2007.75		
Blended Tariff (R/kWh)	R2.59		
Time of Maximum Demand	Dependent only on monthly kWh consumed		
Is Tariff Correct & the Best Option?	YES		
PV Module Wattage (Wp)	455		
Solar Insolation (Worst: winter and Average) or peak sun hours	Minimum	Average	
	5.36	5.96	hrs
System Size Comments	Roof mount system		

The cost-benefit analysis of the PV system, day time			
Calculated annual energy consumption	24 093	kWh	
Average Monthly consumption	2007.75	kWh	
Average Daily consumption (5 Days a week)	92.7	kWh	
Blended Tariff (R/kWh)	R2.59	/kWh	
System Size (based on the minimum and average hrs/day peak sun hours)	Minimum sun hours (worst case)	Average	
	22	20	kWp
PV System Size according to the Budget	10		kWp
Estimated Annual production	4 645	5 165	kWh
Percentage annual savings	19.28%	21.44%	
Value of annual PV production	R12 027.54	R13 373.91	
The cost of the system	R235 000.00		

Average annual total bill	R62 298.96		
Percentage Savings on Total Bill	19.31%		

6.3 Solar PV System Components

MAJOR COMPONENT DETAILS

CS3W-455MS-EVO2 Canadian Solar 455W Super High Power Mono PERC HIKU with MC4-EVO2 	ACDB-3PHASE-ARENB-32A Three Phase Earth-Neutral Bridge Box For Inverters Up To 12kWac 
Rating 455 W VMPP 41.3 V Voc 49.3 V Horizontal 1048 mm Vertical 2108 mm Type Monocrystalline Connection EVO2	Box Width 150 mm Box Length 140 mm Box Height 70 mm

Figure 6. The proposed Canadianc Solar Module, and the three-phase Earth-Neutral Bridge Box for Inverters

SUN-12.0-3PH Sunsynk Sun 12kW Three Phase LV Hybrid Inverter 	F-WON-L-HOME-10-8-N Freedom Won Lite Home 10/8 LiFePO4 Battery N 
Rating 12000 Min PP 160 V Max PP 800 V Max DC 1000 V Connection MC4 Connector Round Post 10mm Min DC 40 V Max DC 60 V Max Battery Current 240 A	Length 1 mm Area 50 mm ² Cores 1 Connector Round Post Colour Red and Black Type Lithium Ion Voltage 48 V Nominal Energy 10000 Wh Connector Cable with 50mm lug
DCB-NF-2I-600V-I16A-I_II-20 600V Protection Box 2 Inputs 2 Outputs 16A Isolator Type I_II SPD 	KETO-1-250A KETO 1 Battery Disconnecter with 250A Fuses 
Battery Switch No Poles 2 Max Voltage 500 V Max Cable 35 mm Rated Current 16 A Rated Voltage 500 V	Battery Switch Yes Poles 4 Max Voltage 440 V Max Cable 50 mm Rated Current 250 A Rated Voltage 440 V

Figure 7 The Sunsynk Sun 12 kW Three-phase LV Hybrid Inverter, and the battery and protection

6.4 Solar PV System Output Analysis

Figure 5 shows the line diagram for the PV system setup.

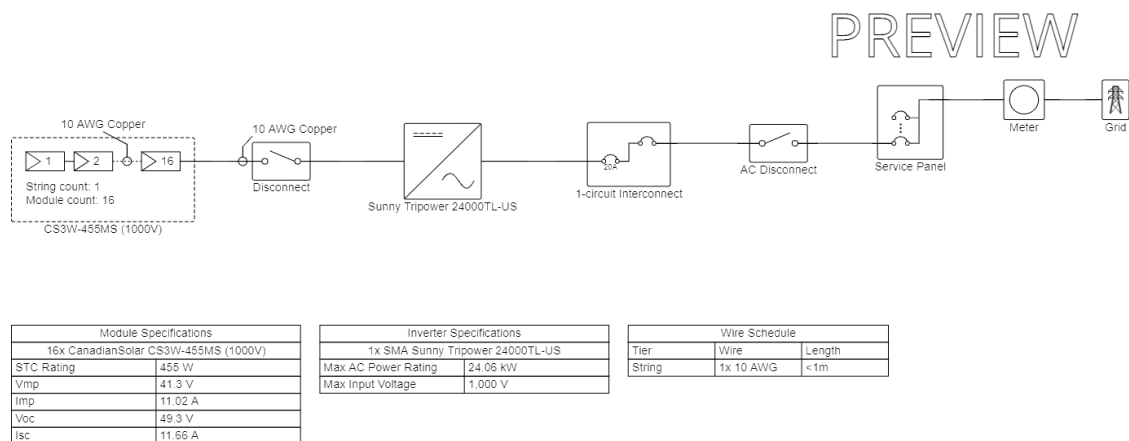
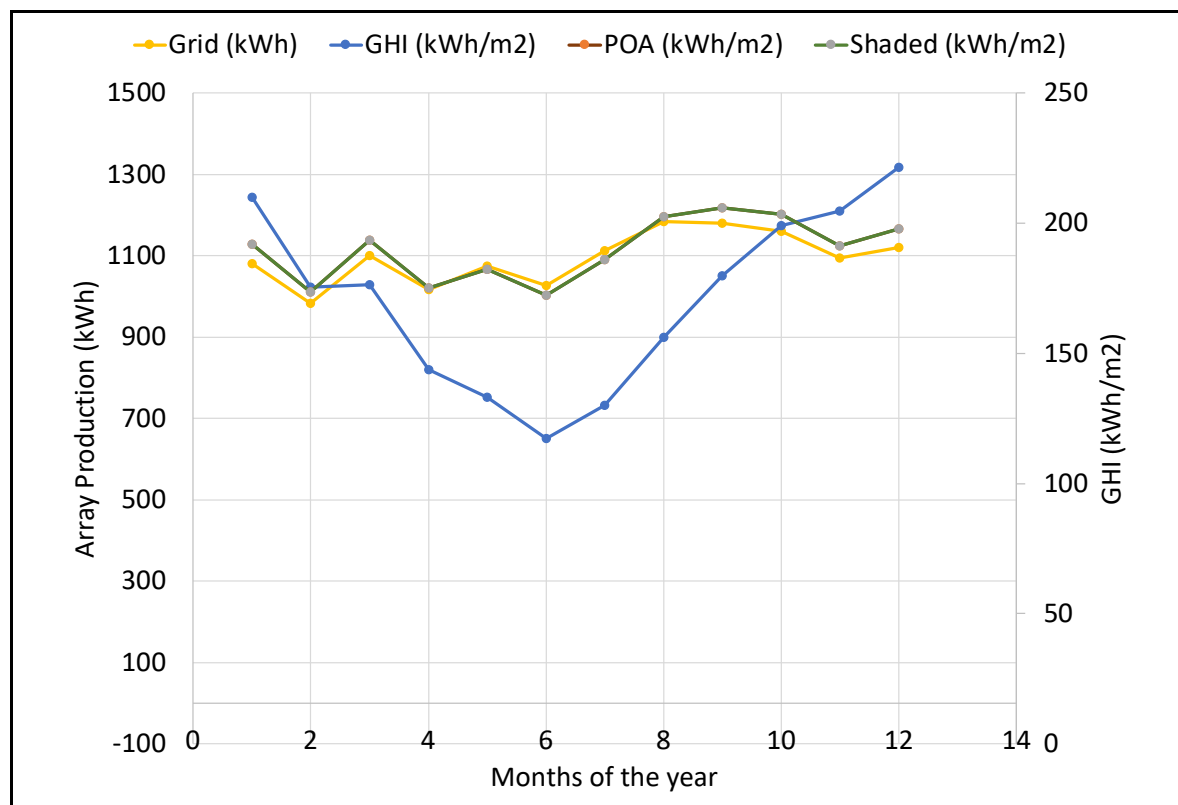


Figure 8. The line diagram for the setup.

Solar Resource And Output Analysis



Loss analysis

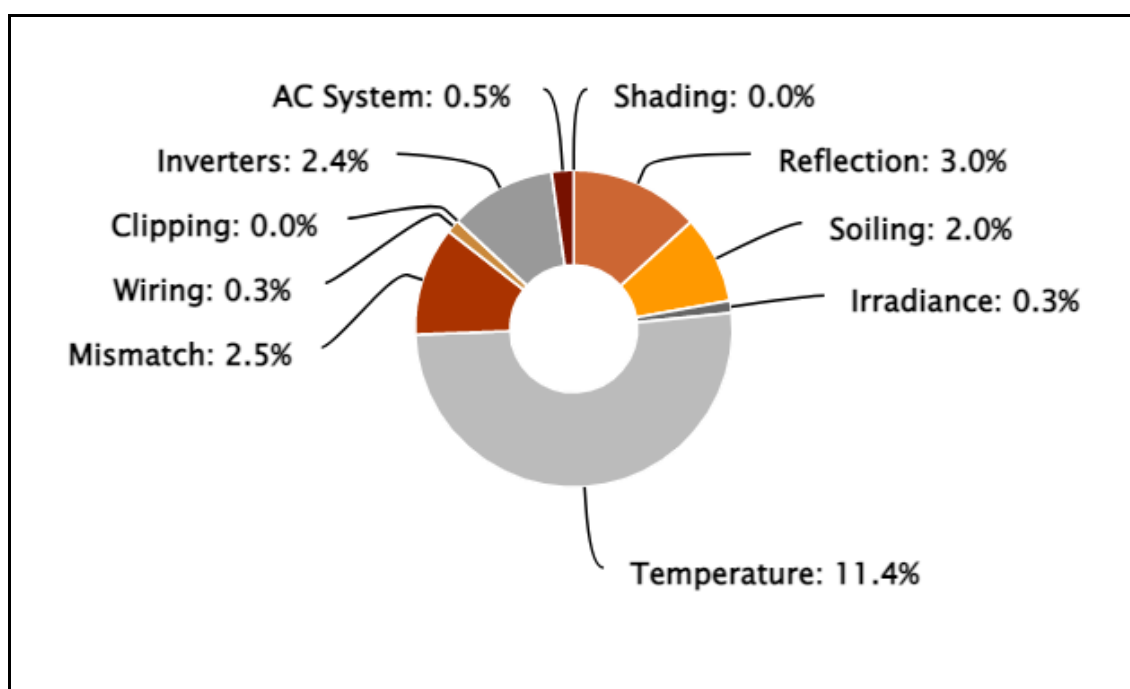


Figure 6 and 6 shows the Canadian Solar panel that is selected for installation.

Error! Reference source not found. shows the roof space that the company, that Mr Bin Cleaner and Waste Management (Pty) Ltd has, on which a solar system can be installed. The figure also shows the maximum solar system installation capacity.

Potential Issues

The size of the space indicates the potential or the limitations it has for harvesting solar energy. The buildings have few sections that face north-west, which is the area that is recommended for PV installation is the north-west facing. The other face that has a potential is the north-east facing space. **Error! Reference source not found.** shows the recommended Installation capacity before sizing.

Indicative Cost Benefit

Cost Indicative Benefits

Potential annual Cost savings: R 40 000

Potential annual Consumption savings: 16 000 kWh

Investment cost;

Table 3: Solar PV raw material

Solar Equipment	Quantity	Unit	Rate		Amount	
Sunsynk Sun 12kW Three Phase LV Hybrid Inverter	20	Unit	2938.93	ZAR	58778.60	ZAR
Freedom Won Lite Home 10/8 LiFePO4 Battery N	1	Unit	47429.14	ZAR	47429.14	ZAR
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4mm2 single-core DC cable 50m - Black & Red	1	Unit	6554.17	ZAR	6554.17	ZAR
MC4-Evo2 1500V DC Connector Twin Pack 0086/0087 (Kit 1)	1	Unit	1366.37	ZAR	1366.37	ZAR
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Total				Subtotal	192,192.14	ZAR
				Vat: 15%	28828.82	ZAR
				Total	221020.96	ZAR

Payback period: 5,5years

7. IMPLEMENTATION PLAN

The objective of the implementation plan is to provide Mr Bin Cleaner and Waste Management with the confidence that all the energy saving opportunities will be considered when implementing the project, and make sure a to list the tasks is done, activities and processes involved in producing deliverables. It is also to make decision on the allocaton of resources and specifying the project priority levels. The objective of the implementation plan is to provide Demco gas Solution with the confidence that all the energy saving opportunities will be considered when implementing the project, and make sure a to list the tasks is done, activities and processes involved in producing deliverables. It is also to make decision on the allocaton of resources and specifying the project priority levels. The report highlights the sizing option for the Solar OV installation. The plan is highlighted and discussed on the report. A service provider would be able to install the PV's per the scope of the report.

8. CONCLUSION

Mr Bin Cleaner and Waste Management sees the importance of being energy efficient in their operations. Due to being charged high amounts of access charge, implementation of Energy Efficiency projects is of high importance. And the company is in the process of enlarging its facility by addition of other operations. They will be able to adopt what has been done on the current operations and implement this on the new facility. Because of the Energy Audit, they have seen the importance of understanding more about Energy and would like to do courses at the NCPC-SA to know and understand more on this topic.