NCPC
NATIONAL CLEANER PRODUCTION CENTRE
SOUTH AFRICA

Green Support Incentive Program for SME in Gauteng

Baseline report

GrandstageTrading Pty (Ltd)

Edenvale

Date: 25/04/2022

Prepared by: Manz Engineering Service

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Department:
Trade, Industry and Competition
REPUBLIC OF SOUTH AFRICA

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Baseline report for Green Support Incentive Programme at Grandstage Trading (Pty) Ltd Edenvale

April 2022

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This report was prepared on behalf of the National Cleaner Production Centre South Africa by **Manz Engineering Services**, and the NCPC-SA wishes to acknowledge the work undertaken by **Edmore Manzunzu**

I, **Edmore Manzunzu,** in my capacity as the technical consultant, hereby confirm that I have assessed **Grandstage Edenvale** and have analysed and compiled this **Baseline and solar feasibility study**. I confirm all the report findings and representative reflection of the current status of **Grandstage Edenvale.**

Executive Summary

The report serves as a baseline and solar PV feasibility study for the Grandstage (Pty) Ltd plant in Edenvale. The report addresses potential Solar PV generation from available roof space and the amount of energy saved. The report serves as a baseline against which any problem areas or gaps in Solar PV installation, process technology, and environmental authorisations are identified. Future performance goals, objectives, targets, and activities can be set based on this baseline report.

IBC, SAM software and Google Earth were used to simulate the number of solar panels that can be installed on the rooftop and the potential solar energy that can be harvested. The Gauteng Global annual radiation is 2 042.98kWh/m^2/year.

The facility can install 6.4 kWp solar panels with a 20 kWh battery storage. The annual energy consumption for the site is 41,470kWh for R 103,675. The potential energy savings a year is 12,024 kWh equivalent to R 30,060 /year. The project requires an investment of R221,000 with a payback period of 7.4 years. The CO_2 offset from the use of renewable energy (solar PV) is 12.5 tons a year.

Table 1: Summary of potential solar energy savings and cost

Building	Capacity (kWp)	Energy Yield (MWh)	No of Modules	Energy Revenue	Capital Cost	TCO2	Payback
Office block	6.4	12.024	20	R30,060	R221,000	12.5	7.4
Totals		12.024	20	R30,060	R221,000	12.5	7.4

The summary of raw materials and labour cost are shown below.

Table 2: Raw materials summary

Grandstage Solar PV raw materials			
Description	Unit cost	Quantity	Total cost
Solar panels (canadian CS1H-320MS)	3,500	20	70,000
Inverter (SMA SB6.01AV-41) single phase	65,000	1	65,000
Lithium batteries 20kWh (Tri power storage 60)	50,000	1	50,000
SMA controller, connecting wires,fuses and other electrical accessories	15,000	1	15,000
Solar installation labour charges	21,000	1	21,000
Total			221,000
Solar energy savings (R/year)			30,060
Payback period (years)			7.4

1 Abbreviations

CO_{2e}	Carbon dioxide equivalents
CP	Cleaner Production
Deg. C	Degrees Celsius
FC	Fraction Capacity
HRS	Hours
IPA	In-Plant Assessment
Kj	Kilojoules
Kl	Kilolitres
R/W	Rands per Watt
GDED	Gauteng Department of Economic Development
GHG	Greenhouse Gas
MWh	MegaWatt Hour
PV	Photovoltaic
MW	MegaWatt
LPM	Litres per minute
M^2	square metres
NCPC-SA	The National Cleaner Production Centre of South Africa
P	Power
QS Assessment	Quick-scan Assessment
R	Rands
SME	Small and Medium Enterprises
GSIP	Green Support Incentive Programme
TE	Transfer efficiency
W	Watts

Contents

2 Introduction

This project is an initiative of the Gauteng Provincial government to aid in the economic recovery of businesses still reeling from the devastating impact of Covid-19, which was followed by the July 2021 civil unrest leading to further economic damage in the province.

The program aims to provide financial support for renewable energy implementation in SMEs affected by the economic downturn. The interventions are evaluated for feasibility in terms of estimated investment costs and project financial metrics are applied to evaluate project feasibility.

"The Southern African region, and the whole of Africa, has sunshine all year round. The annual 24-hour global solar radiation average is about 220 W/m2 for South Africa, compared with about 150 W/m2 for parts of the USA and about 100 W/m2 for Europe and the United Kingdom. This makes South Africa's local resources one of the highest in the world. Most areas in South Africa average more than 2 500 hours of sunshine per year, and average solar-radiation levels range between 4.5 and 6.5 kWh/m2 in one day", www.energy.gov.za.

2.1 Site Solar Energy Resources

The Gauteng Global Irradiation will be used to determine the annual energy yields. SMA Sunny Design website estimates Pretoria's global annual irradiation at **2 046.98kWh/m²year.** The daily global irradiation for each month of the year is reflected in figure 1 below

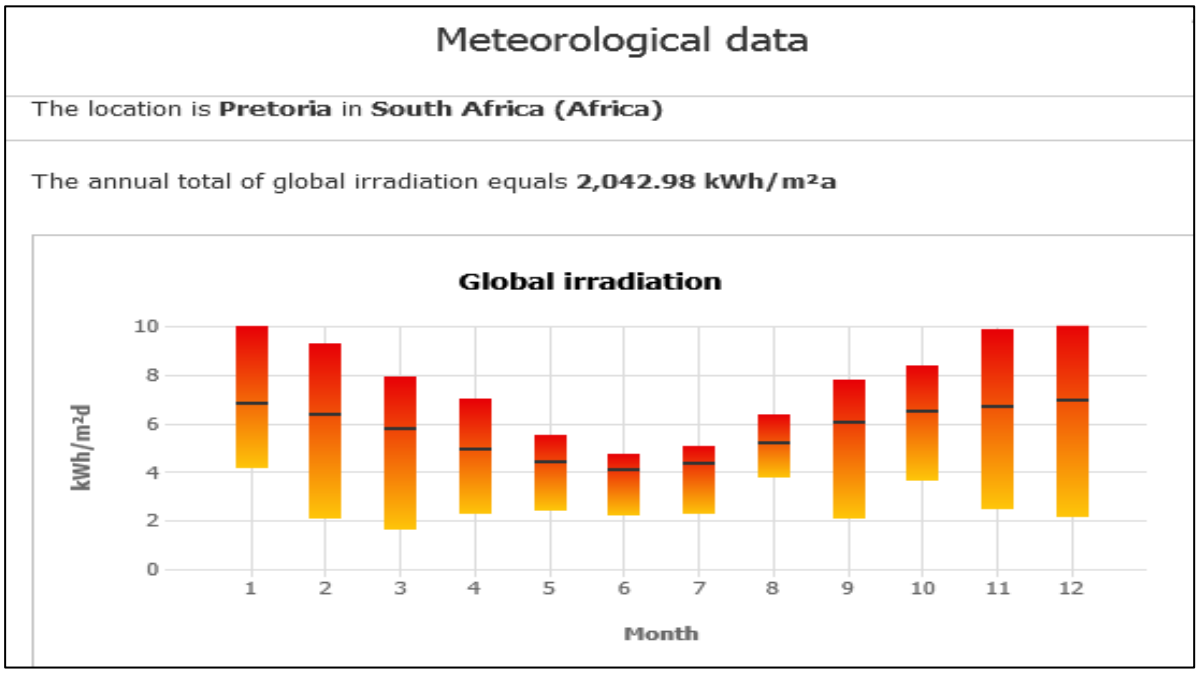


Figure 1: Global radiation data

The global irradiation data for Gauteng is shown above. The months with the lowest Irradiation data are June and July and the highest are November, December, and January. The black arrows show average energy, and the band shows how skilled the data is from the average.

2.2 Project Methodology

Table 3: Project methodology

Step	Action Plan	Purpose and results
1	Plan and organise (walk through audit and informal Interview)	Resource planning, Organise instruments and time frame, Macro data collection, Familiarisation of process and plant activities
2	Conduct brief meetings with stakeholders	Building up cooperation, awareness creation and issuing a questionnaire
3	Primary data gathering, a Process flow diagram	Historical data analysis and baseline data collection.
4	Conduct detailed trials for different solar panels, inverters and batteries	Trials on new products available on the market
5	Identification and development of potential value addition products	Conceive, develop, and refine ideas. Review previously suggested ideas and contact vendors for new/efficient technologies.
6	Cost-benefit Analysis	Assess technical feasibility, economic feasibility and prioritisation of the most promising projects. Prioritise short, medium and long-term measures.
7	Reporting and Presentation to top management	Documentation and report presentation to top management
8	Implementation and follow-up	Assist and implement recommendation

2.3 Design Resources Used

IBC website was used to place modules on top of the different buildings found suitable for this purpose with Google Earth's help for the buildings' location. The software determines the optimum number of modules that can be placed, hence determining the solar plant's size. Given the operating cost of energy, the software can also determine the annual yields and savings resulting from solar use.

To determine the capacities of the installation and energy yields, the following IBC Solar PV module was used: See table 3 below. A spreadsheet model was used to determine both the technical and financial viability of the project.

Table 4 Solar PV module specification

Module Name	*Canadian solar CS1H-320MS HiDM*	
Type of Module	*Mono-Crystalline*	
Power (STC)	*320*	W_p
Efficiency	*20.9*	*%*
Open circuit voltage (Voc)		*V*
Open circuit current (Isc/A)	*9.5*	*Amps*
Module Orientation	*N (6°)*	
Nodule Inclination	*20*	°

The design's main aim was to determine the maximum energy that could be harvested from the roof of the buildings and operate the buildings with a hybrid system of solar and grid electricity.

Currently, both the Municipality and Eskom are not obliged to buy green energy from IPP (Independent Power Producers). Eskom only buys from grid-scale suppliers as per declared rounds as announced by the Department of Energy and this is an auction process where energy is bought first from the least cost suppliers until the amount of energy required is fulfilled.

Power X is South Africa's first energy exchange (they have the license to buy and sell green energy and trade). The following are the stipulated in terms of the Power-X purchase contracts:

- Any term can be signed 1 - 20 years
- No minimum supply commitments are required (Power-X will buy whatever the generator produces)
- The generator can be located anywhere in the country in an Eskom or municipal area where Power-X has a System agreement.
- The generator will be paid directly.

The following parameters were used for the economic analysis of the Solar PV plants:

Table 5 Solar PV Economic Analysis Input Variables

Input Variables	**Amount**
Panel Degradation (%)	0.50%
Discount Rate (%)	10.00%
Maintenance (%)	2.00%
Tariff Increase	15.00%

2.4 Design Criteria

The design concept to be used here is a hybrid solar PV system. It is important to note that during load shedding, when the grid is not available, the hybrid connected PV system will be available to supply the premises until the batteries power stored is 10%.

Considering the above points, a distributed design approach was adopted as it offers more benefits from a security point of view (i.e. backup configuration). It also takes advantage of the electrical infrastructure already available (i.e. low voltage electrical panels and smart meters).

It is also important to note that a generator greater than 100 MW requires a licence to operate.

3 Company information

Grandstage trading (Pty) Ltd is a 100% black women-owned specializing in the production of LED lights and renewable energy solutions. The products produced are LED rechargeable

smart lamps, LED solar-backed LEDs, solar-powered water pumps for irrigation and domestic use, solar panels and inverters and energy storage systems (batteries), LED solar street lights, and outdoor flood lights and industrial lighting for commercial buildings and mining operations.

The Edenvale plant assembles, high-performing LEDs with long life as they are manufactured according to local standards.

Figure 2: Google map site location

The circled part is the plant location, and the roof type and orientation.

3.1 Contact details

Table 5: Company information

Company name	Grandstage Trading Pty (Ltd) Edenvale
Address	9th Floor West,Atrium 5th ,Sandton,Johannesburg,2196
Phone, Fax	+27112820702
e-mail	info@grandstaget.com
Website	https://www.grandstaget.com
Trading since (year)	2017
No. of Employees	*10*
Contact person:	
Name	*Christina Masaiti*
Position	*Facilities Management team member*
Phone & mobile numbers	*082 886 6164*

4 Initial environmental assessment

Grandstage Trading (Pty) Ltd Edenvale uses an integrated waste management system that encourages waste segregation at the source.

Table 6: Rating table

	GOOD	FAIR	POOR
Storm-water	X		
Waste separation	X		
Wastewater	X		
Solid waste		X	
Air quality		X	
Noise		X	
Hazardous materials (including intermediates and by-products)			X
Energy		X	
Environmental policy			X

This section summarises the plant's current state in terms of wastewater quality, raw materials, air quality, hazardous waste, noise management, and general management of the premises.

Table 7: Environmental questionnaire

Water Quality Management **Stormwater** Do you know where the stormwater drains on your premises are located? X Yes ☐☐No ☐☐N/A Do you have any features or procedures in place to prevent stormwater pollution? X Yes ☐☐No ☐☐N/A Is the stormwater drains around your business free of pollution? (litter, Sand, metal shavings etc.) X Yes ☐☐No ☐☐N/A Do you store all equipment, materials and liquids so that spills or leaks could not enter the stormwater system? X Yes ☐☐No ☐☐N/A Do you regularly clean up the surface areas around your premises? X Yes ☐☐No ☐☐N/A Do you use a broom instead of a hose to sweep and clean up the surface areas around your premises? X Yes ☐☐No ☐☐N/A **Wastewater** Do you have a permit from the local water authority (if needed)? X Yes ☐☐No ☐☐N/A Do floor drains in the work area drain to either a storage tank or directly to the sewer? X Yes ☐☐No ☐☐ N/A Do you use a vacuum cleaner (appropriate to the process) to clean up dust and Sand? X Yes ☐☐No ☐☐ N/A	**Raw Material** Do you know the composition of your materials? X Yes ☐☐No ☐☐N/A If a supplier was willing to take your waste for reuse, can you guarantee a regular supply? X Yes ☐☐No ☐☐N/A Do you have a licensed waste transporter to transport: General production waste? X Yes ☐☐No ☐☐N/A waste chemicals? X Yes ☐☐No ☐☐N/A liquid wastes? X Yes ☐☐No ☐☐N/A **Air Quality Management** Do you take measures to prevent dust from leaving your premises? X Yes ☐☐ No ☐☐N/A Do you take measures to prevent fumes and vapour (including odorous emissions) from leaving your premises? X Yes ☐☐No ☐☐ N/A **Hazardous Materials** Do you store all hazardous materials (such as resins, catalysts) in a bunded, covered area that will not allow any spilt or leaked materials to enter the stormwater system? X Yes ☐☐No ☐☐N/A Do you have a Dangerous Goods Licence, if needed? X Yes ☐☐No ☐☐N/A Do you have all the relevant material safety data sheets (MSDS) and keep them in an accessible place? X Yes ☐☐No ☐☐N/A

Groundwater Do you know if your site has groundwater under it? □□Yes x No □□N/A If groundwater is under your site, do you take precautions to prevent pollutants from entering the groundwater? X Yes □□No □□N/A **Noise Management** Do you regularly check and carry out maintenance on noisy equipment? X Yes □□No □□N/A Have you identified the noise source and taken steps to reduce its effects if you have had noise complaints? X Yes □□No □□N/A	Do you have spill fighting equipment and written procedures? X Yes □□No □□N/A **Management of Premises** Have you made any changes to your business for environmental reasons? X Yes □□No □□N/A Do you have an environmental policy or plan? X Yes □□ No □□N/A If you answered no of the questions in this checklist, you could use the information in this package to develop an environmental improvement program that will be good for you, your staff and customers. Now that you have completed this checklist and identified the areas where you can make improvements: • Read through the environmental information sheets. • Get started on an environmental improvement program that will be good for you, your staff and your customers.

Note: N/A stands for “not applicable”.

5 In-Plant Assessment Phase

5.1 Pre-assessment Phase (preparation phase)

It is imperative to use the correct rate when performing the economic analysis of the solar PV feasibility study. Since solar energy is only available between 8 am and 5 pm during the day, the effective rate should be determined for this period. This rate was used to calculate an effective electricity rate applicable to the consumption of solar energy. The effective rate was calculated to be **R2.5,** and this is the rate that will be used to perform the Solar PV system’s economic feasibility.

5.2 Energy Consumption Trends

The Grandstage Trading plant consumed **41,47MWh** and a monthly average of **3.456MWh**. the energy used is for 2019, as 2020 was biased due to the lockdown and low business.

Table 8: Energy Consumption and Costs Trends

Month	Energy (kWh) Year 2019	Energy (kWh) Year 2020
January		2,476
February		3,767
March	3,542	1,081
April	2,566	1,084
May	3,989	1,112
June	3,075	919
July	2,966	1,334
August	2,325	1,715
September	4,551	1,221
October	4,125	1,862
November	4,690	2,057
December	2,730	1,971
totals	34,559	20,599
Average	3,456	1,717
Annuals	41,471	20,599

Figure 3 below shows the energy consumption profile.

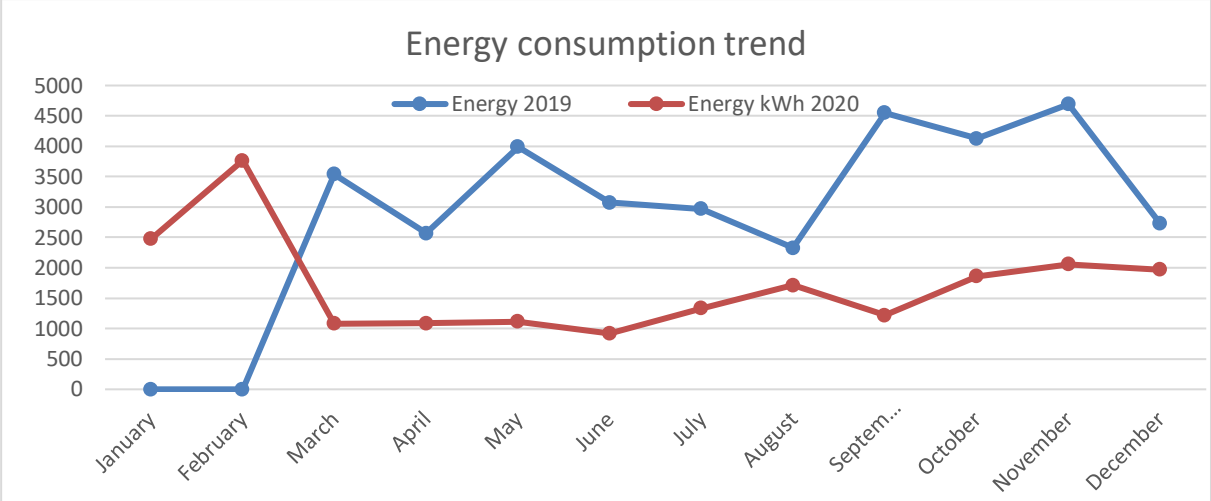


Figure 3 Energy Consumption Profile

The figure above shows the energy consumption trend. Energy consumption was lowest in 2020 due to lockdown. January and February 2019 data was not available.

5.2.1 Baseline data

The energy driver for the facility is production units (number of lights produced). The table below shows the multivariable regression analysis summary.

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0.99							
R Square	0.98							
Adjusted R Square	0.98							
Standard Error	180.7597							
Observations	22							
ANOVA								
	df	*SS*	*MS*	*F*	*Significance F*			
Regression	1	29468918	29468918	901.905515	0.000			
Residual	20	653481	32674					
Total	21	30122399						
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	250.6	84.4	3.0	0.007613926	74.43	426.74	74.43	426.74
Production units	1.5	0.0	30.0	0.0000	1.38	1.59	1.38	1.59

Figure 4: Multivariable regression summary

The model has an F and P values of less than 0.05; the model and the variables are relevant. The R^2 value is more than 75%; therefore, the model can be used to predict future energy consumption relative to production.

6 CARBON INVENTORY

6.1 Scope and Boundaries

Activities taking place within a specific area can generate greenhouse gas (GHG) emissions that occur inside the area's boundary and outside the area's boundary. To distinguish between them, the Global Protocol for Community-scale Greenhouse Gas Emission Inventories (GPC) groups emissions into three categories based on where they occur, as summarised in the following table.

Table 9: Scope definitions for GHG inventories

Scope	Definition
Scope 1	GHG emissions from sources located within an area's boundary.
Scope 2	GHG emissions are occurring because of grid-supplied electricity, heat, steam and cooling within a city boundary.

Scope	Definition
Scope 3	All other GHG emissions that occur outside a boundary result from activities taking place within the limit, e.g. transmission and distribution losses from grid-supplied energy consumption for stationary energy, emissions from transboundary journeys, waste streams generated within the city boundary but landfilled or treated outside the city boundary.

Source: GPC

The scope and boundaries of the carbon inventory are defined for the entire facility. As a minimum, the Carbon emissions from on-site electricity consumption will be considered. Electricity consumption data were available with the base year (March 2019 to February 2020), and the only resource for which data is available is electricity. Thereafter, estimates are made for the plant's common area, based on its estimated contribution to these emissions.

Based on available activity data, the emissions included in the inventory are as follows:

- Scope 2 emissions from grid-supplied electricity.

Emissions excluded from this inventory (due to a lack of activity data) are as follows:

- Scope 1 fugitive emissions from air conditioning and refrigeration leaks:
- Scope 1 emissions from fuels used by employees' vehicles;
- Scope 1 and 3 emissions from fuels used by suppliers and distributors entering the site;
- Scope 3 emissions from business travel of employees and plant trips
- Scope 3 emissions from waste produced on-site but landfilled elsewhere.

The carbon emissions can be direct or indirect emissions, direct emissions for the Grandstage Trading Edenvale plant come from diesel used by trucks, and indirect emissions are from electricity consumption that is generated using coal. The greenhouse gas emissions factors for South Africa are summarised in the table below.

Table 11: Greenhouse gas emissions factors

SA IEEP Phase II GHG Emission Factors		
Fuel	tCO2/GJ	tCO2/MWh

Grid Electricity	0.2896	1.0425
Natural Gas	0.0561	0.2020
LPG	0.0631	0.2272
Diesel	0.0741	0.2668
Residual Oil	0.0774	0.2786
Motor Gasoline	0.0693	0.2495
Kerosene	0.0719	0.2588
Coal Bituminous	0.0946	0.3406
Coal Sub-bituminous	0.0961	0.3460
Coal Anthracite	0.0983	0.3539
Coal Lignite	0.1010	0.3636
Charcoal	0.1120	0.4032
Metallurgical Coke	0.1070	0.3852
Wood fuel	0.1120	0.4032

Grandstage trading Edenvale plant's carbon footprint will be based on electricity data only. The base year for carbon emissions calculation is from March 2021 to February 2022. GrandstageEdenvale consumed 41.47MWh, and the equivalent carbon produced is 43,2 tCO_2/year.

6.2 Development of inventory

GrandstageEdenvale consumed 41.47MWh, as shown in Table 8 above, and the equivalent carbon produced is 43.2 tCO_2/year.

6.3 Carbon management

The setting of IEE objectives, goals, and targets will give the company direction on how to manage the utilities, reduce emissions from the use of energy-efficient technologies, and develop purchasing policies that consider lifecycle costs and efficient use of resources.

GrandstageEdenvale can improve the way they operate by being proactive through gathering information on resource usage and consumption patterns. Grandstage trading Edenvale should record data, as shown in the table below.

Table12: Sample carbon reporting format

Scopes and categories	Metric tons CO_2e
Scope 1: Direct emissions from owned/controlled operations	
Scope 2: Indirect emissions from the use of purchased electricity, steam, heating, and cooling	
Upstream scope three emissions	
Category 1: Purchased goods and services	
Category 2: Capital goods	
Category 3: Fuel- and energy-related activities (not included in scope 1 or scope 2)	
Category 4: Upstream transportation and distribution	
Category 5: Waste generated in operations	
Category 6: Business travel	
Category 7: Employee commuting	
Category 8: Upstream leased assets	
Downstream scope 3 emissions	
Category 9: Downstream transportation and distribution	
Category 10: Processing of sold products	
Category 12: End-of-life treatment of sold products	
Category 13: Downstream leased assets	
Category 14: Franchises	
Category 15: Investments[1]	

A sample of the objectives the company can set are

- Promotion of organisational behavioural change
- Conservation of energy and improving energy efficiency
- Maximise the use of renewable energy sources
- Reducing the carbon footprint of the chillers, trucks and lighting.

7 Detailed design

7.1 Whole facility approach

The main constraint in the design is the available budget, therefore, management of the facility suggested that the solar panels to be installed should service key equipment like an ageing plant, lights and computers

The maximum daily energy demand for the office block is 172.8 kWh/day, which is 41,471 kWh/year. The facility has plenty of roof space that can be installed with solar panels as shown below.

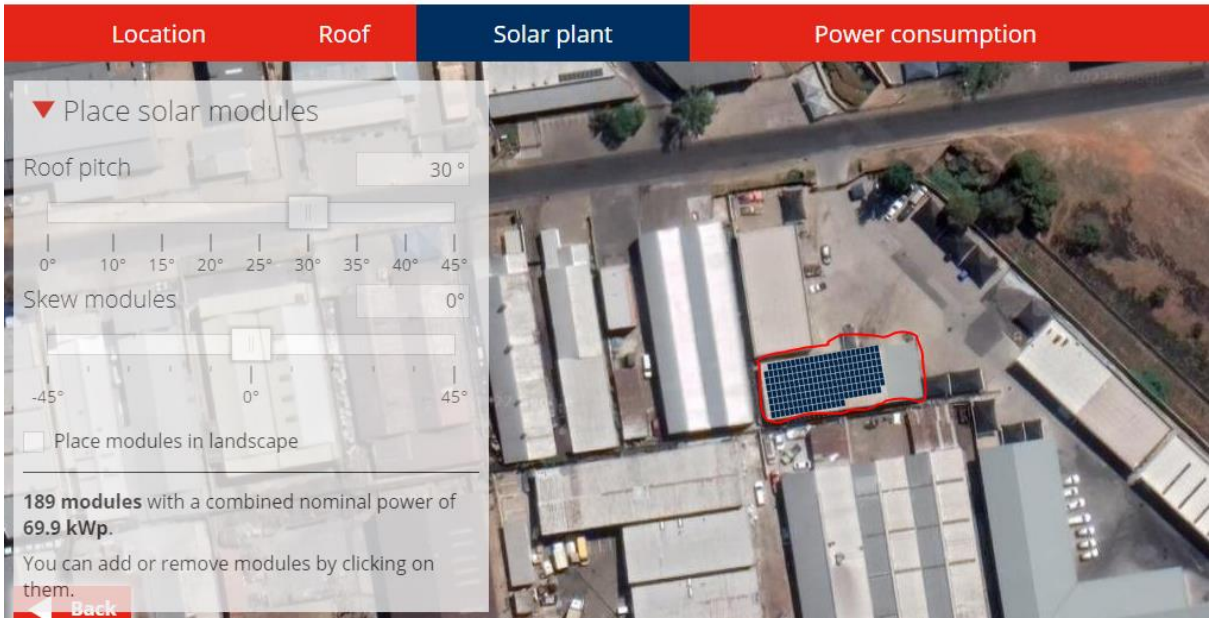
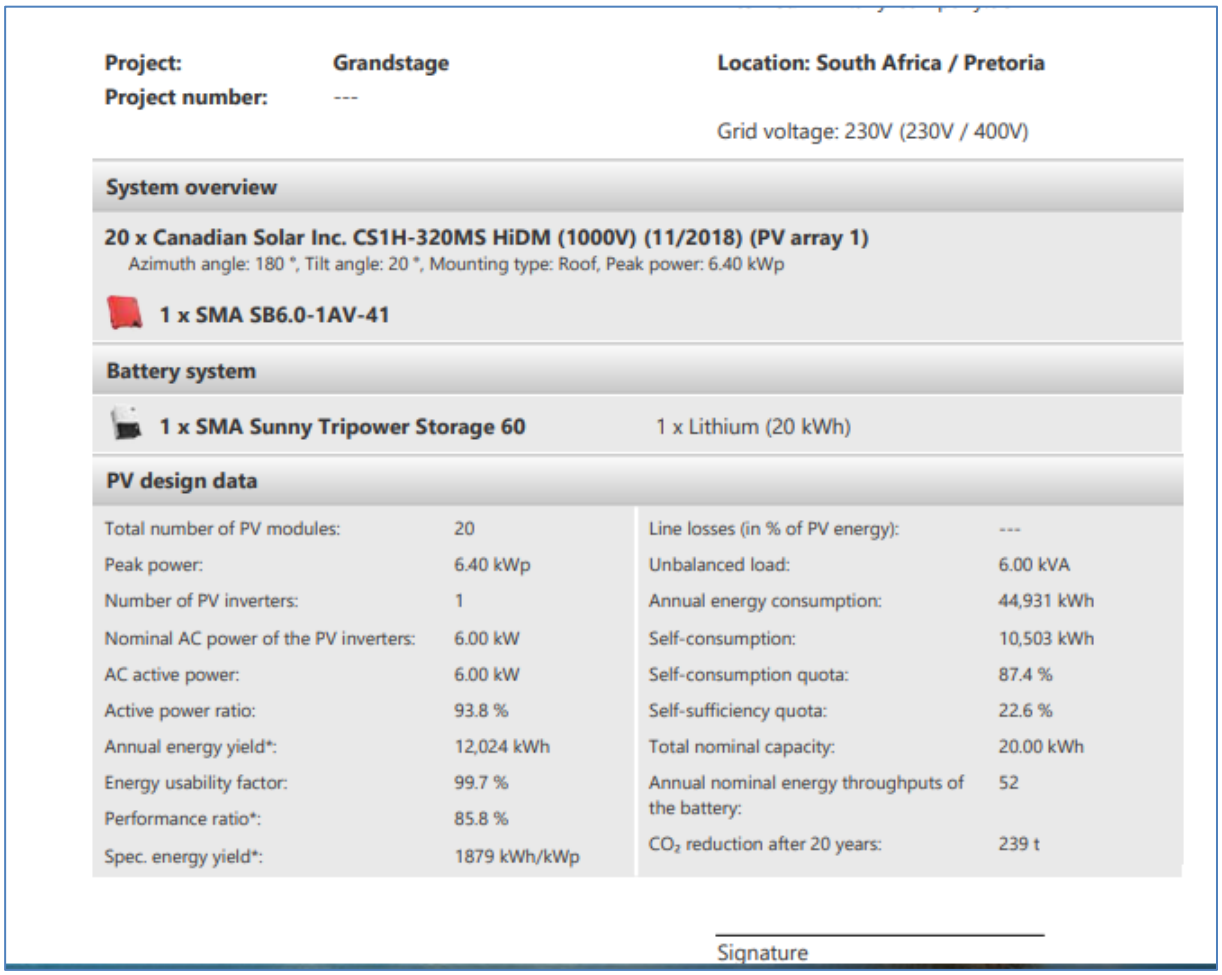


Figure 5: Roof space available

The circled area is the facility's roof space. The suggested design according to the financial constraints the facility can install is shown below.



Project: Grandstage
Project number: ---
Location: South Africa / Pretoria
Grid voltage: 230V (230V / 400V)

System overview

20 x Canadian Solar Inc. CS1H-320MS HiDM (1000V) (11/2018) (PV array 1)
Azimuth angle: 180 °, Tilt angle: 20 °, Mounting type: Roof, Peak power: 6.40 kWp

1 x SMA SB6.0-1AV-41

Battery system

1 x SMA Sunny Tripower Storage 60 1 x Lithium (20 kWh)

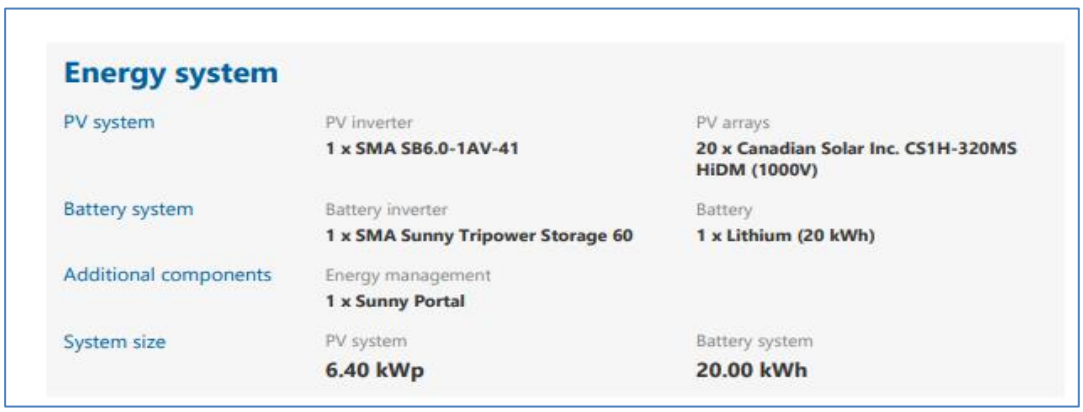
PV design data

Total number of PV modules:	20	Line losses (in % of PV energy):	---
Peak power:	6.40 kWp	Unbalanced load:	6.00 kVA
Number of PV inverters:	1	Annual energy consumption:	44,931 kWh
Nominal AC power of the PV inverters:	6.00 kW	Self-consumption:	10,503 kWh
AC active power:	6.00 kW	Self-consumption quota:	87.4 %
Active power ratio:	93.8 %	Self-sufficiency quota:	22.6 %
Annual energy yield*:	12,024 kWh	Total nominal capacity:	20.00 kWh
Energy usability factor:	99.7 %	Annual nominal energy throughputs of the battery:	52
Performance ratio*:	85.8 %		
Spec. energy yield*:	1879 kWh/kWp	CO_2 reduction after 20 years:	239 t

Signature

Figure 6: Annual energy generated from solar summary

The projected annual energy produced is 12,024kWh/year, and the yearly building demand is 41,471 kWh/year; therefore, the solar system can manage to supply 28% of the facility's energy use. The system size is summarised below.



Energy system

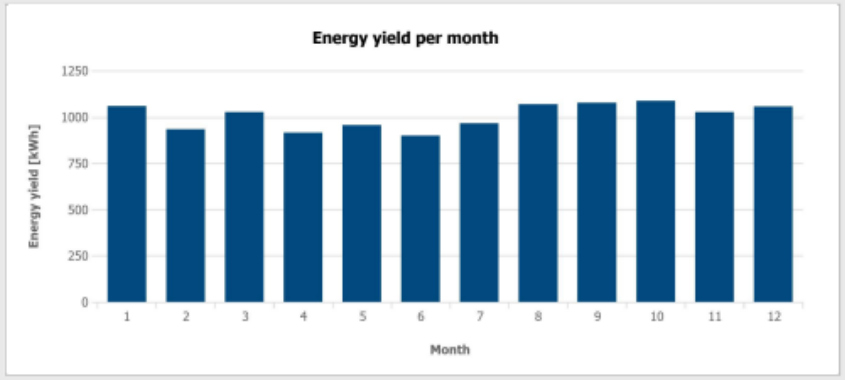
PV system	PV inverter **1 x SMA SB6.0-1AV-41**	PV arrays **20 x Canadian Solar Inc. CS1H-320MS HiDM (1000V)**
Battery system	Battery inverter **1 x SMA Sunny Tripower Storage 60**	Battery **1 x Lithium (20 kWh)**
Additional components	Energy management **1 x Sunny Portal**	
System size	PV system **6.40 kWp**	Battery system **20.00 kWh**

Figure 7:Solar system specifications

The solar system will have a battery backup of 20kWh lithium battery and 20 Canadian solar panels that will generate 6.4kWp. The figure below shows the projected monthly energy production.

Project: Grandstage **Location: South Africa / Pretoria**
Project number:

Diagram



Table

Month	Energy yield [kWh]	Self-consumption [kWh]	Grid feed-in [kWh]	Purchased electricity [kWh]
1	1054 (8.8 %)	946	108	3024
2	930 (7.7 %)	836	94	2633
3	1022 (8.5 %)	850	172	2973
4	912 (7.6 %)	801	110	2847
5	953 (7.9 %)	820	132	3150
6	896 (7.5 %)	809	87	2849
7	963 (8.0 %)	847	115	2970
8	1065 (8.9 %)	938	127	3032
9	1073 (8.9 %)	907	166	2600
10	1083 (9.0 %)	940	143	3025
11	1022 (8.5 %)	912	110	2890
12	1053 (8.8 %)	896	156	2775

Figure 8: Monthly energy production trend

The monthly energy produced is less than the monthly demand, therefore the plant cannot be off the grid but a hybrid system of solar and grid electricity. The annual energy cost savings is R30,060 /year, which is 29% of the annual electricity bill.

The project cost R221,000 including labour and accessories with a payback period of 7 years as shown in the figure below.

Cost estimate (non binding)

Project: Grandstage — **Location: South Africa / Pretoria**
Project number:

Project costs			
PV system		**Unit price**	**Total**
20	**Canadian Solar Inc. CS1H-320MS HiDM (1000V)**	3,500.00 ZAR	70,000.00 ZAR
1	**SMA SB6.0-1AV-41**	65,000.00 ZAR	65,000.00 ZAR
1	**labour**	21,000.00 ZAR	21,000.00 ZAR
1	**racks, fuses and accessories**	15,000.00 ZAR	15,000.00 ZAR
Battery system			
1	**SMA Sunny Tripower Storage 60**	50,000.00 ZAR	50,000.00 ZAR
Subtotal (net sum)			**221,000.00 ZAR**
Discount		---	---
Total (net)			**221,000.00 ZAR**
Value-added tax		---	---
Total amount (gross)			**221,000.00 ZAR**
Fixed cost			
Annual fixed costs (as percentage of capital expenditure)	1.50 % of investment costs		3,315.00 ZAR

Figure 9: Main components cost breakdown

8 Solar PV feasibility study summary

The table below tabulates the results of the solar PV feasibility assessment. This table indicates both the technical and economic feasibility.

Table 9: Summary of recommendations

Building	Capacity (kWp)	Energy Yield (MWh)	No of Modules	Energy Revenue	Capital Cost	TCO2	Payback
Office block	6.4	12.024	20	R30,060	R221,000	12.5	7
Totals		12.024	20	R30,060	R221,000	12.5	7

9 Conclusion

Grandstage Trading Edenvale can install rooftop solar panels on the available building space and generate much-needed energy from solar PV. Due to financial constraints, the project can fund a 6.4kWp solar system, with 20kWh battery storage. The system can be extended in the future to supply the whole office block and the production plant because the roof space can accommodate more panels. The proposed system should reduce the electricity bill by 29%, and have a battery to power critical equipment (ageing equipment and lights) during load-shedding.

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10 Annexures

10.1 Battery specifications

OPzS Solar type	OPzS Solar 910	OPzS Solar 1210	OPzS Solar 1520	OPzS Solar 1830	OPzS Solar 2280	OPzS Solar 3040	OPzS Solar 3800	OPzS Solar 4560
Nominal capacity (120 hr / 20°C)	910Ah	1210Ah	1520Ah	1830Ah	2280Ah	3040Ah	3800Ah	4560Ah
Capacity (10 hr / 20°C)	640Ah	853Ah	1065Ah	1278Ah	1613Ah	2143Ah	2675Ah	3208Ah
Capacity 2 / 5 / 10 hours (% of 10 hr capacity)	60 / 85 / 100 (@ 68°F/20°C, end of discharge 1,8 Volt per cell)							
Capacity 20 / 24 / 48 / 72 hours (% of 120 hr capacity)	77 / 80 / 89 / 95 (@ 68°F/20°C, end of discharge 1,85 Volt per cell)							
Capacity 100 / 120 / 240 hours (% of 120 hr capacity)	99 / 100 / 104 (@ 68°F/20°C, end of discharge 1,85 Volt per cell)							
Self-discharge @ 70°F/20°C	3% per month							
Absorption voltage (V) @ 70°F/20°C	2,35 to 2,50V/cell (28,2 to 30,0V for a 24 Volt battery)							
Float voltage (V) @ 70°F/20°C	2,23 to 2,30V/cell (26,8 to 27,6V for a 24 Volt battery)							
Storage voltage (V) @ 70°F/20°C	2,18 to 2,22V/cell (26,2 to 26,6V for a 24 Volt battery)							
Float design life @ 70°F/20°C	20 years							
Cycle design life @ 80% discharge	1500							
Cycle design life @ 50% discharge	2800							
Cycle design life @ 30% discharge	5200							
Dimensions (lxwxh, mm)	145 x 206 x 711	210 x 191 x 711	210 x 233 x 711	210 x 275 x 711	210 x 275 x 861	212 x 397 x 837	212 x 487 x 837	212 x 576 x 837
Dimensions (lxwxh, inches)	5,7 x 8,1 x 28	8,3 x 7,5 x 28	8,3 x 9,2 x 28	8,3 x 10,8 x 28	8,3 x 10,8 x 33,9	8,4 x15,6 x 32,9	8,4 x 19,2 x 32,9	8,4 x 22,7 x 32,9
Weight without acid (kg / pounds)	35 / 77	46 / 101	57 / 126	66 / 146	88 / 194	115 / 254	145 / 320	170 / 375
Weight with acid (kg / pounds)	50 / 110	65 / 143	80 / 177	93 / 205	119 / 262	160 / 253	200 / 441	240 / 530