



Gauteng Department of Economic Development (GDED)

SME Green Support Incentive Program

ENERGY CONSUMPTION ASSESSMENT FOR AQUATRADE

4 Diesel Road, Isando, Kempton Park, South Africa

10 May 2022

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

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

This project report is to remain confidential between the NCPC-SA/CSIR and Aqautrade Solutions and may not be revealed in any way to a third party without the prior written permission of the NCPC-SA/CSIR.

REPORT

ACKNOWLEDGEMENTS

This Energy Efficient Assessment (EEA) Report was adopted from the Resource Efficiency Report prepared on behalf of the National Cleaner Production Centre of South Africa by **NCPC Energy Team**.

DOCUMENT CONTROL

Degree of Confidentiality:	Client Confidential	
Title:	Energy Efficient Assessment of Aquatrade	
Author(s):	NCPC Energy Team	
Project Leader:	Mashudu Madzivhandila	
Date of Issue:	May 2022	
No of Pages:	21	
Issuing Organisation: CSIR Energy Centre Pretoria	Telephone:	(012) 841 7258
Contract Name:	Energy Efficient Assessment of Aquatrade	
Project Number:		
Keywords:	Energy consumption, Renewable Energy, Energy Management	
Issue Number:	01	
Copy Number	01	
APPROVED BY:		
Responsibility	Name	Signature
Author	NCPC Energy Team	
Review (NCPC-SA)	Mashudu Madzivhandila	
RECEIVED BY:		
Responsibility	Name	Signature
NCPC-SA	Victor Manavhela	

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 Aquatrade based in Isando, Johannesburg. This 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 unknown and only based on estimates as there were challenges attaining the total Energy bill from the landlord. The estimates are based on what was seen on the site as well as 4 months data provided to us. Based on the 4 months data provided (April, August, September, and November 2021) the total consumption of R20 675 kWh which amounted to R82 486.

Identified energy efficiency opportunities were identified as follows:

- Opportunity for electrical energy to be sourced from an alternate energy source (saving of 16 000 kWh and R 61 200)
- Estimated Carbon Dioxide reduction of 16.7 tonnes identified
- Overall identified investment cost of R 192 396(Excluding VAT)
- Payback period is 3.15 years

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

Table 1: Solar PV raw material

Solar Equipment	Quantity	Unit	Amount		
Canadian Solar 455 W Super High Power Mono Perc_Hiku with MC4-EV02	26	Unit	2938.93	76412.18	ZAR
SMA, Sunnytripower Inverter	1	Unit	30000	30000.00	ZAR
Freedom Won Lite Home 10/8 LiFePO4 Battery N	1	Unit	58652.22	58652.22	ZAR
CANBUS Cable for Freedom Won and Sunsynk or Goodwe combination	1	Unit	318.55	318.55	ZAR
Three Phase Earth-Neutral Bridge Box For Inverters Up To 12kWac	1	Unit	1765.79	1765.79	ZAR
70mm2 Battery Cable (H01N2-D) 2m – PAIR	1	Unit	948.78	948.78	ZAR
600V Protection Box 2 Inputs 2 Outputs 16A Isolator Type I_II SPD	1	Unit	6554.17	6554.17	ZAR
4mm2 single-core DC cable 50m - Black & Red	1	Unit	1366.37	1366.37	ZAR
MC4-Evo2 1500V DC Connector Twin Pack 0086/0087 (Kit 1)	10	Unit	164.82	1648.20	ZAR
MC4 Pre terminated cable 2m (1 Pack)	4	Unit	138.05	552.20	ZAR
KETO 1 BaCery Disconnecter with 250A Fuses	1	Unit	1882.36	1882.36	ZAR
10 Panel Mounting Kit - IBR Roof c/w earth plate clamp kit & profile splice	2	Unit	4942.72	9885.44	ZAR
70mm2 by M10 Ring Terminal Lug	1	Unit	468.79	468.79	ZAR

Energy Efficient Assessment of Aquatrade, Gauteng

BaCery Hazard label Li-ion (230mm * 90mm)	6	Unit	39.28	235.68	ZAR
BaCery Hazard label Li-ion (230mm * 90mm)	1	Unit	42.86	42.86	ZAR
PV on Roof and Hazard Labels Pack	1	Unit	135.51	135.51	ZAR
Delivery to Germiston	1	Unit	1527.48	1527.48	ZAR
				192 396.58	ZAR
				28 859.49	ZAR
Total				221 256.07	ZAR

TABLE OF CONTENTS

1. INTRODUCTION.....	6
2. COMPANY INFORMATION	8
3. PLANT PROFILE.....	9
3.1 SITE SOLAR ENERGY RESOURCES.....	10
4. PRODUCTION PROCESS FLOW CHART.....	11
5. ENERGY CONSUMPTION.....	12
5.1 ELECTRICITY.....	12
5.2 BASELINE ESTABLISHMENT	13
5.3 IDENTIFICATION OF SIGNIFICANT ENERGY USERS	13
6. DETAILED ASSESSMENT FINDINGS AND RECOMMENDATIONS	15
6.1 INSTALLATION OF SOLAR PV.....	15
7. IMPLEMENTATION PLAN.....	21
8. CONCLUSION-TEAM.....	22

LIST OF FIGURES

Figure 1: The roof view of Aquatrade with low and high Solar System Installation capacity.....	10
Figure 2: Global and Diffuse Radiations are shown together.	10
Figure 3: Global and diffuse radiation data.....	11
Figure 4: Process flow diagram	11
Figure 5: Significant Energy Users	14
Figure 6. The available roof Aquatrade roof space and it maximum PV Installation capacity.....	
Figure 7. Line diagram for the space budgeted for.	17
Figure 8: The actual setup of the PV system that is budgeted for and will be deployed. The model places it at the recommended space.....	17
Figure 9 Monthly Electricity generation relative to the plane of array and global horizontal irradiance.	18
Figure 10. Sources of System Loss.....	18

LIST OF TABLES

Table 1: Solar PV raw material	4
Table 2: Company Information.....	8
Table 4: Bill of Quantities for the Aquatrade.....	19

1. INTRODUCTION

Aquatrade is a South African-based company located in Isando, Kempton Park, in Gauteng. Aquatrade supplies a diverse range of speciality chemicals including calcium sulphate removal, chemical raw materials and allied services to industries and specialise in Reverse Osmosis water purification and Reverse Osmosis cleaning. Although primarily manufacturing orientated, Aquatrade provides technology to clients and does its own research and development where necessary. Aquatrade has been operating since 2001. Occupying a factory in Isando, Kempton Park and do manufacturing, toll manufacturing, technical consulting, collections and deliveries for customers. Aquatrade has approximately 30 employees. Administration office and production hours operate from 08h00 to 16h30. The factory consumes electricity supplied by the Ekurhuleni and has no other sources of energy.

The Energy Assessment commenced on the 22 April 2022 with a brief introduction meeting with the establishment owner and accompanied by the NCPG-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	Aquatrade
Physical Address	4 Diesel Road, Isando
Phone	011 394 8762
Trading Since (year)	2001
No. of Full time Employees	30
Industrial Processes	Chemicals
Company Contact Person:	
Name:	Mr Hein v Niekerk
Designation:	Managing Director
Telephone:	011 394 8762
Mobile:	082 410 5540
E-mail:	hein@manno.co.za

3. PLANT PROFILE

Aquatrade, operates in the chemical and water industry, as indicated in the introduction. The company has relocated to new premises in the industrial zone of Kempton Park, at Isando. Their services are in using chemicals to preserve and purify water, which is the most valuable natural resource. Their services are invaluable to the society because of increased levels of toxins in drinking water. Unlike in their previous location, where they were renting and had limited space, the new location is bigger, and they own it. This enables them to widen their scope of services, increase their clientele and expand further.

The company was selected for the Green Incentive program, even though they are in new premises because they are migrating their offerings as they are to the new premises. Since the difference is only space, the energy audit is presented in this report based on their last year's energy consumption in their old premises. The resulting recommendations that are outlined in this report can be implemented in their new site and fulfil their purpose.

Figure 1 shows the Google Earth's Aerial view of the new Aquatrade premises, to expose their available roof space. The Company operates in a large building, which include offices, laboratories, a warehouse, storerooms, and few other processes building. The large building has a large flat surface, on which a PV system can be installed. The online PVWatts® Calculator shows that the total available estimate roof surface 1792 m² (left), can be divided into smaller approximately 335 m² (right) sections with the potential system direct current (DC) generation capacities of 268.8 kW and 50.2 kW respectively. The orientation of about 35° east of north. Since the roof surface is flat, the solar panels will be tilted to harvest most solar energy. Currently, the company get its electricity from the Municipality, and they pay handsomely. Since the business operates only during the day, the following discussion in this report seeks to lower the electricity bill and investigate whether a grid tied PV system could be ideal and more practical to supplement power supplied by City Power with a PV system.



Figure 1: The roof view of Aquatrade with low and high Solar System Installation capacity.

3.1 Site Solar Energy Resources

Electricity generation from solar energy is dependent on the available solar radiation, which come on and surface of the earth in the form of Global Horizontal (GHI) and Plane of Array (POA) Irradiances. generation Gauteng Global Irradiation will be used to determine the annual energy yields. The SMA Sunny Design website estimates Gauteng’s global annual irradiation at 2046.98 kWh/m²year. The daily global irradiation for each month of the year is reflected in Figure 2 below. The graph shows that the site has a significant component of its radiation that comes from diffuse radiation. This is an indication of notable environmental features such as mist, clouds, smoke and dust.

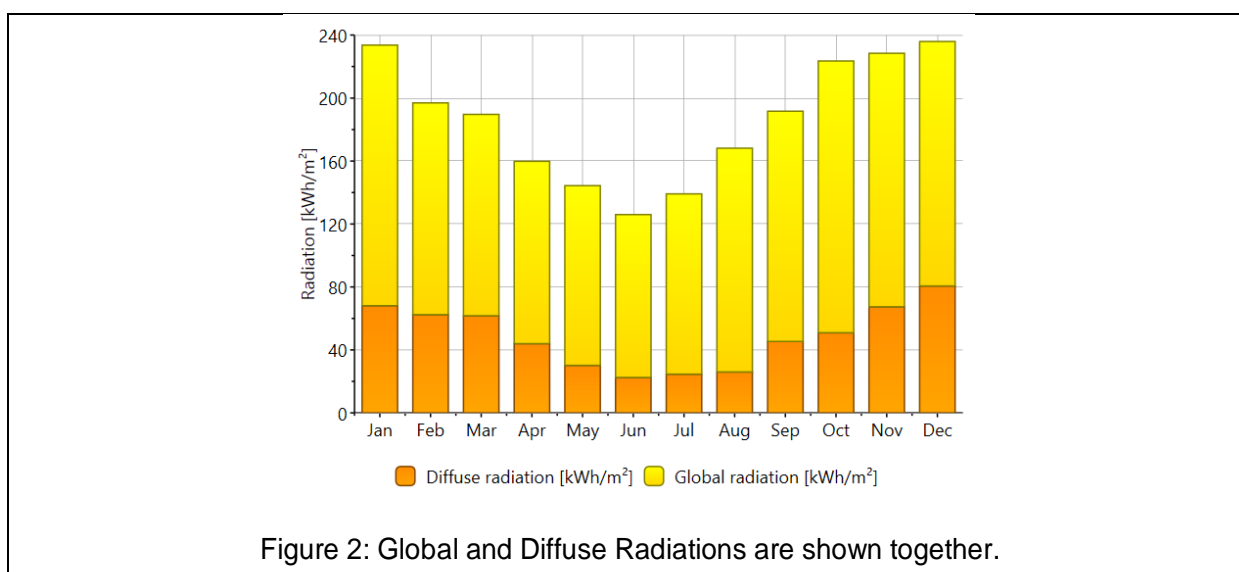


Figure 2: Global and Diffuse Radiations are shown together.

Figure 3: Global and diffuse 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 diffuse radiation follows the same pattern. For Aquatrade site to be suitable for using solar energy as an alternative source of energy and for the PV system installations, the lowest solar radiation must be sufficient to generate enough energy for production.

4. PRODUCTION PROCESS FLOW CHART

Aquatrade provides chemicals based on customers' requirements. These chemicals are mainly made of water and chemicals. These chemicals come in form of solids and liquids. When the raw material is received, it is inserted inside the vessels and mixed until homogeneity is established. The product consists of 90% water and its then stored inside drums and placed at the warehouse for dispatch.

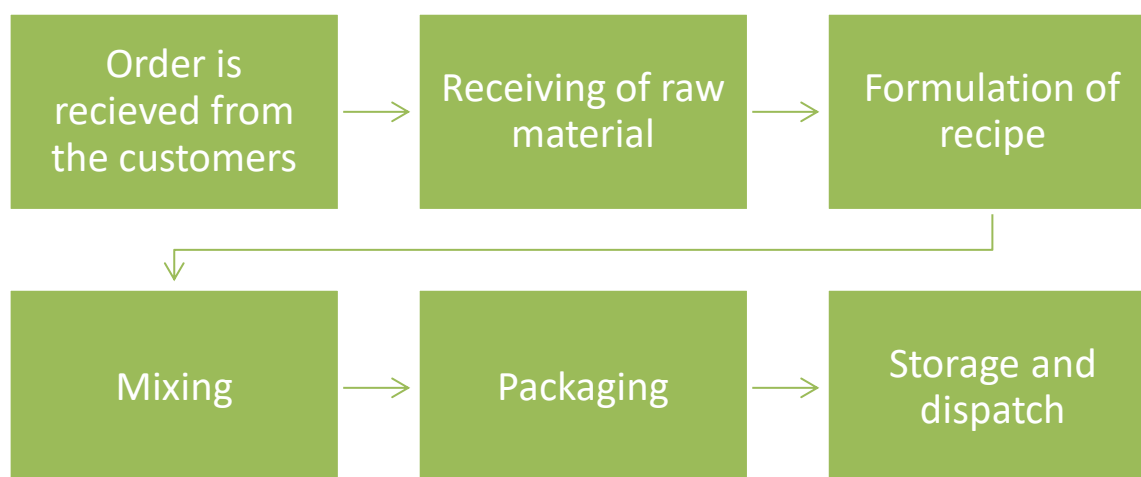


Figure 4: Process flow diagram

5. ENERGY CONSUMPTION

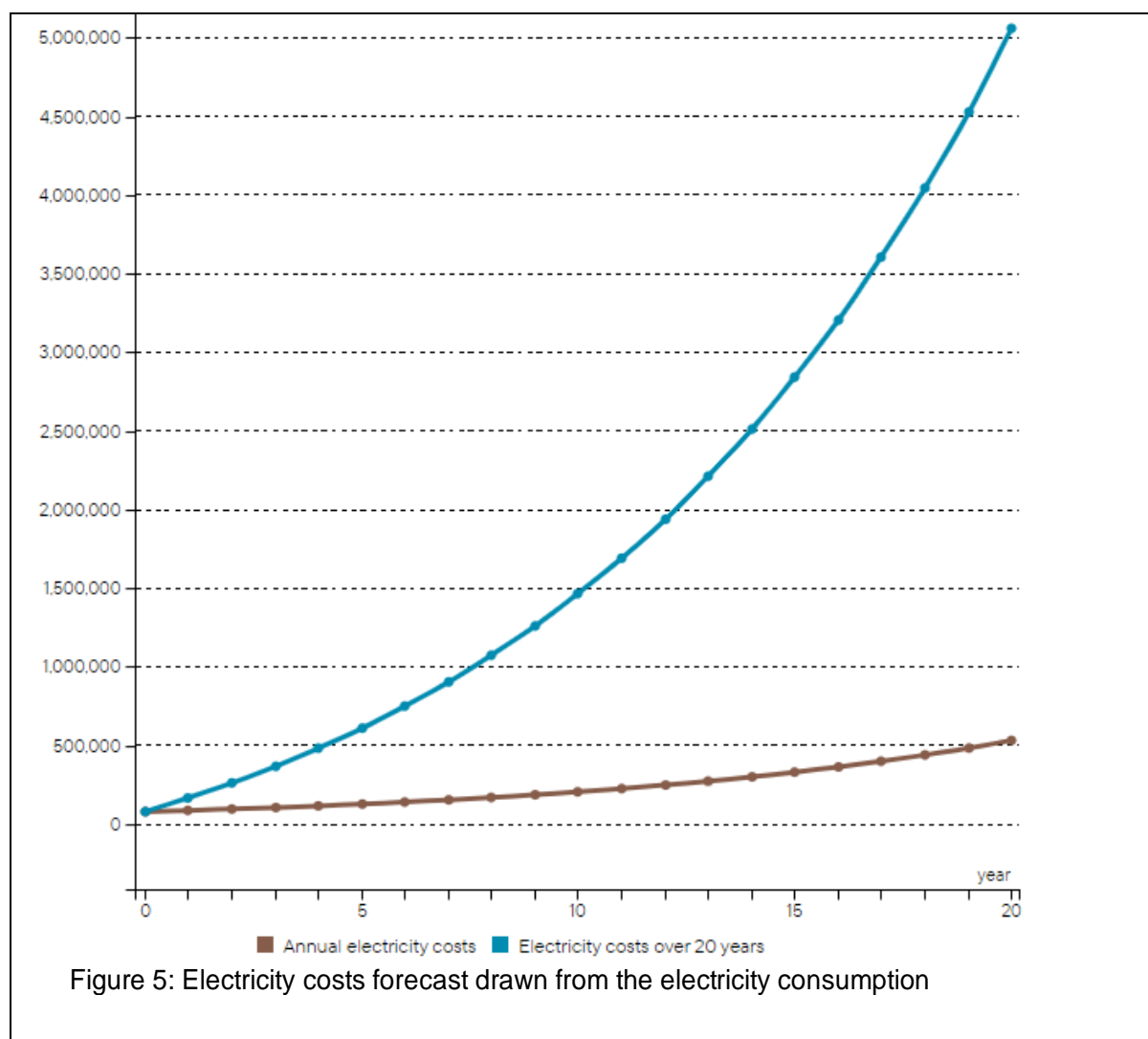
5.1 Electricity

The following tables shows monthly electricity data. The information is not complete as the billing is done by the landlord and there was difficulty attaining other months. This results in having few months reported on this assessment. The recorded months gives an idea of how much electricity is being used but it doesn't complete the total puzzle. Without the data, it is difficult to know the monthly consumption also to understand the trends of electricity on a monthly basis. They will be a challenge in establishing an energy balance especially that they are moving into a new site for operations.

Table 3: Electricity consumption

Months	Electricity(kWh)	Cost/Month	Cost/kWh
Jan 21	-	-	-
Feb 21	-	-	-
Mar 21	-	-	-
Apr 21	3 878.00	R 10 817.42	R 2.79
May 21	-	-	-
Jun 21	-	-	-
Jul 21	-	-	-
Aug 21	6 072.00	R 23 726.63	R 3.91
Sep 21	6 295.00	R 33 431.57	R 5.31
Oct 21	-	-	-
Nov 21	4 430.00	R 14 510.00	R 3.28
Total (4 months)	20 675.00	R 82 485.62	R 15.28
Monthly Average	5 168.75	R 6 873.80	R 3.47

The



5.2 Baseline Establishment

A baseline could not be established because there is no available data for production. The production data is not recorded. The electricity data has some months that are missing.

5.3 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.

The above table shows an estimate of energy consumption on site. Because the electricity data is incomplete, the balance will be based on the average of the given months. As it can be seen the biggest user of electricity is the Mixing tanks. They utilize 87% of the energy on

site as there are mainly used to mix chemicals as per order received. The second use would be gysers followed by the lighting present are the old fluorescent lights which are present in both factory and offices. The other users of energy are the day to day

Table 5: Installed capacity & estimated energy usage

Equipment	Estimated kWh/year	%Energy Consumed
Mixing tanks	5 070	87%
Gyser,150L	312	5%
Lighting	242	4%
Fridge	32	1%
Microwave	1	0.01%
Desktop	35	0.59%
Printer	0	0.00%
Air-conditioner	168	2.88%
Total	5860	100%

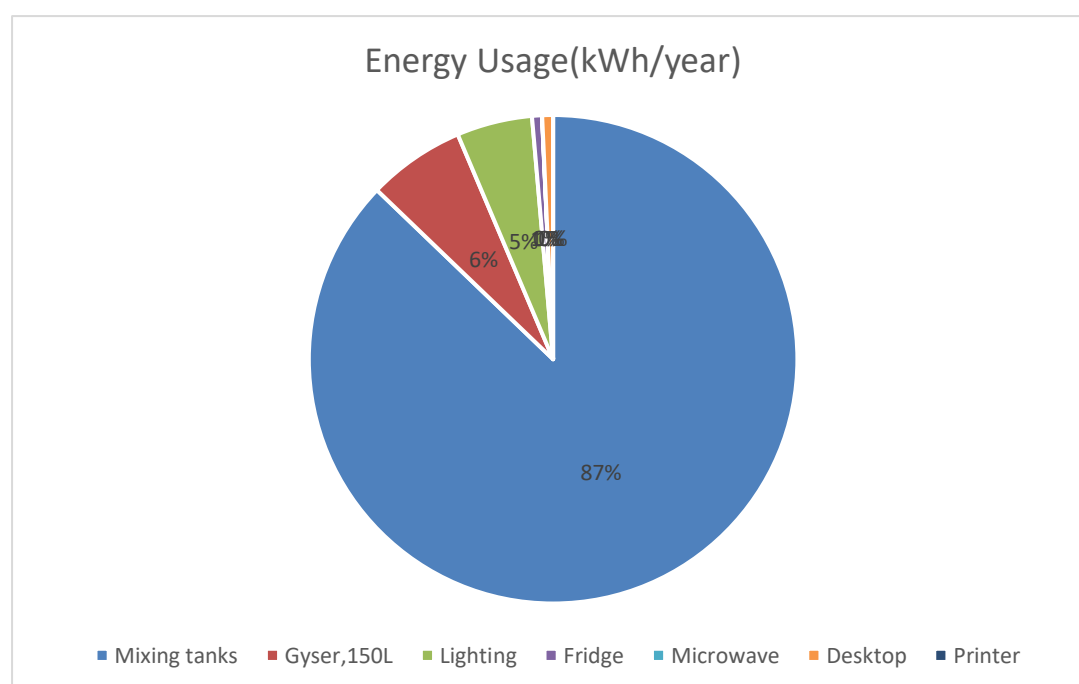


Figure 6: Significant Energy Users

Table 4: The cost-benefit analysis of the PV system, daytime

Calculated annual energy consumption	20 675	kWh
Blended Tariff (R/kWh)	R3.82	/kWh
Average Monthly Daytime consumption	Day time 100%	
	5168.75	kWh
Average Daily consumption (5 Days per week)	238.6	kWh
System Size (based on the minimum and average hrs/day peak sun hours) (kWp)	54	52
PV System Size according to the Budget (kWp)	16	
Estimated Annual production (kWh)	7 959	8 342
Percentage annual savings	38.50%	40.35%
Value of annual PV production	R30 425.06	R31 887.13
The cost of the system	R400 000.00	
Payback period	13	
Average annual total bill	R82 485.62	
Percentage Savings on Total Bill	36.89%	

Solar PV System deployment

The company 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. The following table shows the sizing of the PV system that is recommended for installation on the large roof of Aquatrade.

Figure 8 shows the line diagram of the system, with components connections, the module and inverter specifications and wires dimensions highlighted.

Energy Efficient Assessment of Aquatrade, Gauteng

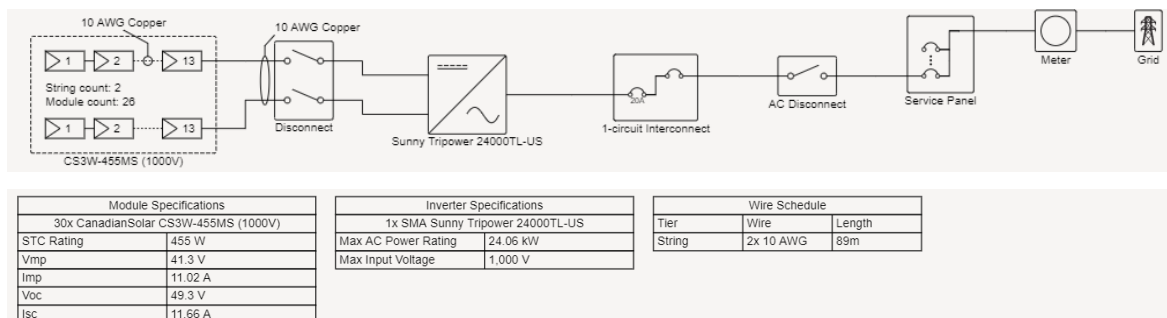


Figure 8. Line diagram for the space budgeted for.

Error! Reference source not found. presents the actual solar system model. The diagram was created using the Helioscope. The system has one inverter.



Figure 9: The actual setup of the PV system that is budgeted for and will be deployed. The model places it at the recommended space.

Figure 10 presents the predicted grid power output in relation to the plane of array irradiance and the global horizontal irradiance. The grid performance is in line with plane of array irradiance, especially in March and April as well as September and October. This can be attributed to the equinox impact. On the other hand, the GHI is high in summer and low in winter

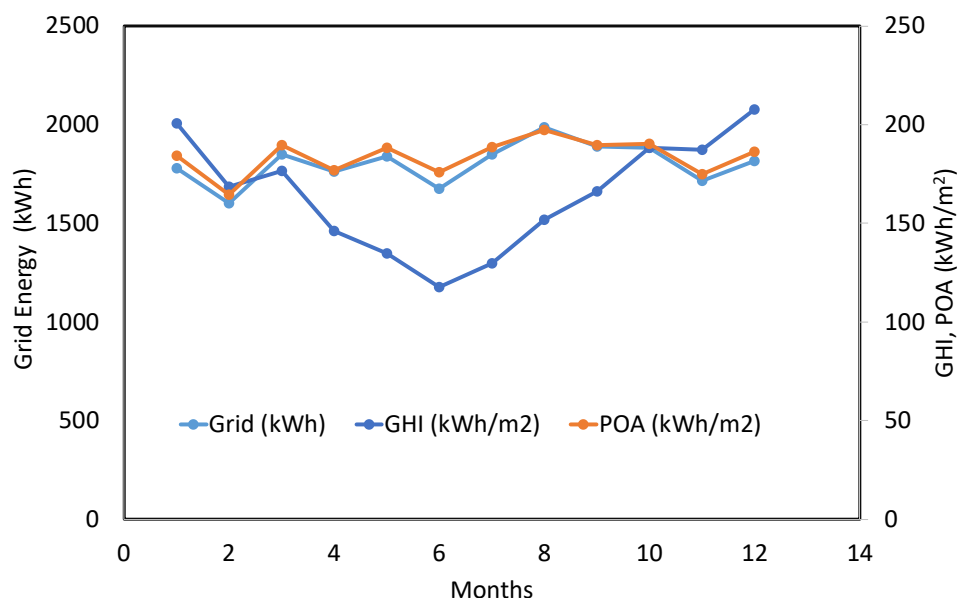


Figure 10 Monthly Electricity generation relative to the plane of array and global horizontal irradiance.

Figure 11 shows several losses that the system can incur from both the environment and the system itself.

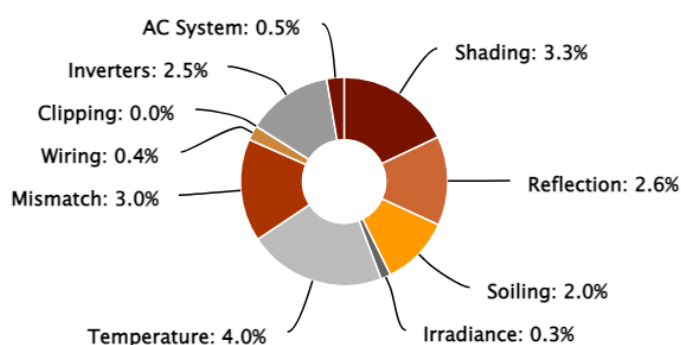


Figure 11. Sources of System Loss

The major power losses can be seen with module temperature, mismatch, shading, reflection, inverters and soiling. which occur at environmental high temperatures. Losses due to high temperatures can be minimised by selecting modules with low temperature coefficients. Losses due to mismatch, even though it is not specified, they

can be attributed to a wrong tilt angle, and less sensitivity of one module technology to the properties of the spectral irradiance. PV module surfaces are also reflective and this adds some power losses. Soiling also brings about losses on the solar panels. This can be minimised by cleaning the modules at some scheduled and unscheduled times. By minimising these losses, higher outputs can be achieved. It therefore recommended that contractors include a maintenance/ training agreement with the recipient of the Green Incentive.

Solar PV System Cost of Investment

Table 5: Bill of Quantities for the Aquatrade

Solar Equipment	Quantity	Unit	Amount		
Canadian Solar 455 W Super High Power Mono Perc_Hiku with MC4-EV02	26	Unit	2938.93	76412.18	ZAR
SMA, Sunnytripower Inverter	1	Unit	30000	30000.00	ZAR
Freedom Won Lite Home 10/8 LiFePO4 Battery N	1	Unit	58652.22	58652.22	ZAR
CANBUS Cable for Freedom Won and Sunsynk or Goodwe combination	1	Unit	318.55	318.55	ZAR
Three Phase Earth-Neutral Bridge Box For Inverters Up To 12kWac	1	Unit	1765.79	1765.79	ZAR
70mm2 Battery Cable (H01N2-D) 2m – PAIR	1	Unit	948.78	948.78	ZAR
600V Protection Box 2 Inputs 2 Outputs 16A Isolator Type I_II SPD	1	Unit	6554.17	6554.17	ZAR
4mm2 single-core DC cable 50m - Black & Red	1	Unit	1366.37	1366.37	ZAR
MC4-Evo2 1500V DC Connector Twin Pack 0086/0087 (Kit 1)	10	Unit	164.82	1648.20	ZAR
MC4 Pre terminated cable 2m (1 Pack)	4	Unit	138.05	552.20	ZAR
KETO 1 BaCery Disconnecter with 250A Fuses	1	Unit	1882.36	1882.36	ZAR
10 Panel Mounting Kit - IBR Roof c/w earth plate clamp kit & profile splice	2	Unit	4942.72	9885.44	ZAR
70mm2 by M10 Ring Terminal Lug	1	Unit	468.79	468.79	ZAR
BaCery Hazard label Li-ion (230mm * 90mm)	6	Unit	39.28	235.68	ZAR
BaCery Hazard label Li-ion (230mm * 90mm)	1	Unit	42.86	42.86	ZAR
PV on Roof and Hazard Labels Pack	1	Unit	135.51	135.51	ZAR
Delivery to Germiston	1	Unit	1527.48	1527.48	ZAR
Total				192396.58	ZAR
				28859.49	ZAR

	221256.07	ZAR
--	------------------	------------

Summary of Electricity and Cost Savings

Total Electricity saved per year: 16 000 kWh

Total Cost savings: R 61 200

Investment Cost: R192 396 (excluding labour)

Payback period: 3.15 years

7. IMPLEMENTATION PLAN

The objective of the implementation plan is to provide Aquatrade Solution with the confidence that all the energy saving opportunities will be considered when implementing the project, and make sure a to-do list for tasks is done. Activities and processes involved in producing deliverables are highlighted. It is also to make decision on the allocation of resources and specifying the project priority levels. This plan will enable the track down of implemented opportunity and the savings they bring about.

8. CONCLUSION

Aquatrade 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 to know and understand more on this topic.