

**Green Support Incentive  
Program for  
Small Enterprise in Gauteng  
Creinex Management  
Solar PV system due diligence  
04/07/2022**

**Document control**

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## **Acknowledgements**

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I, **Molebatsi Ramahudu**, in my capacity as the technical consultant, hereby confirm that I have assessed, analysed, and compiled this solar feasibility study at **Creinex Management**. I confirm all the report findings and representative reflection of the current status of **Creinex Management**.

## **Executive summary**

This report serves as a due diligence for a solar Photo Voltaic (PV) system under which the main aim was to determine the alternate supplementary energy source for Creinex Management as guided by their needs. The study is related to challenges of both load shedding that disrupts business operations and power outages that occur on a frequent basis. This report takes into account the current status and needs of Creinex Management with regards to electricity usage and business prospects.

The methodology consists of the assessment procedure, literature consultation, and additional online resources. All in all, the status of and capacity of the site's needs is outlined and measures with regards to the solar irradiation (South Africa, Pretoria) are used to estimate possible solar PV output per month with respect to corresponding cost analysis.

## **Key Findings and Recommendations**

- Creinex management has not implemented any cleaner productions interventions.
- The factory is situated in an area where there are frequent power outages due to municipality maintenance issues and load shedding. These outages can last up to two days and more
- The estimated annual electricity consumption is 13 065 kwh/year, amounting to R33 554, assuming that the site operates on full capacity without power outages.
- The system was designed based on the energy required to run the business with minimal interruptions taking into account the Green Support incentive budget cap of R220 000.

The proposed solar PV system will generate 7.07 kWp with a 20-kWh battery storage. The potential energy savings a year is 11 751kWh equivalent to R 30 199/year. The project requires an investment of R187 347 with a payback period of 6.20 years. The CO<sub>2</sub> offset from the use of renewable energy (solar PV) is 12.25 tons a year.

## Abbreviations

|                  |                                                        |
|------------------|--------------------------------------------------------|
| CO <sub>2e</sub> | Carbon dioxide equivalents                             |
| CP               | Cleaner Production                                     |
| Deg. C           | Degrees Celsius                                        |
| FC               | Fraction Capacity                                      |
| HRS              | Hours                                                  |
| IPA              | In-Plant Assessment                                    |
| Kj               | Kilojoules                                             |
| Kl               | Kilolitres                                             |
| kWp              | Kilowatt peak                                          |
| 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 <sup>2</sup>   | 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                                                  |

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## 1. Introduction

This initiative was made possible by Gauteng Province's green incentive to Small, Medium, and Micro Enterprise (SMME) upliftment to support business success with a hope of promoting employment retention and economic growth within the SMME in corporation with the NCPC and DTI.

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

### 1.1 Background

Creinex Management, a level 1 BBB-EE company founded by a black female in 2015. It is Located in Boshkop Pretoria East operating in the field of bulk bags Manufacturing and Supply Services of Various Products. It produces products such as bulk Bags that are known as Flexible Intermediate Bulk Containers (FIBC) using weaved virgin polypropylene fabric of different types of strength and type as per application and Design and According to South African National standards (SANS).

The site has an 8am to 4pm Monday to Friday operating model in which production is determined by demand/orders from customers such that sometimes because of the power outages challenges, they operate during the night and weekends to meet customer's turnaround time.

The assessment commenced on the 17th of June 2022 with an inception meeting followed by a site walkthrough to identify scope and boundary. During the site walk, observations were made, and an electrical equipment register was developed. The objective was to identify all the energy inputs with its use and the electrical load according to its discrete function

## 2. Company Information

|                 |                                                  |
|-----------------|--------------------------------------------------|
| Company name    | Creinex Management                               |
| Address         | 196B Boschkop Rd, Mooiplats, Pretoria East, 0036 |
| GPS Coordinates | -25.827855399247078, 28.426029655322537          |

|                      |                              |
|----------------------|------------------------------|
| Phone, Fax           | +27 (0) 61 546 5312          |
| e-mail               | olivia@creinexmanagement.com |
| Website              | www.creinexmanagement.com    |
| Trading since (year) | 2015                         |

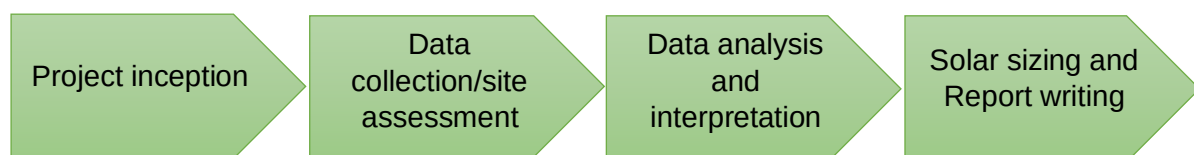


### 3. Methodology

The adopted methodology is comprised of data collection, analysis, and measures as guided by the cleaner production principles, supported by online resources and literature.

#### 3.1. Scope and Boundary

The focus of the assessment is on the entire operations of Creinex Management with the emphasis on electricity usage within the factory and the scope is to conduct a solar PV feasibility study as shown by the methodology below in **Error! Reference source not found..**



*Figure 1: Overview of the project methodology*

The following steps were followed to conduct a solar PV feasibility study:

- Study the existing factory capacities and its performance to assess its operations.
- Collection of requisite data to analyse and identify areas with potential for conservation of energy.



- Determine the overall electricity usage using the electrical register and calculate electricity consumption per department/section.
- Measurements of operational parameters and calculations of energy balance.
- Design a solar PV system based on the collected data, online resource such as PVGIS software and literature studies.
- Calculations of cost benefit analysis in terms of savings in energy consumption and pay-back period

#### 4. Reference energy resource landmark

As already highlighted, South Africa has some of the highest solar irradiation in the world, with measures amounting to about  $263\text{--}278\text{W/m}^2$  (Figure 2). This gives an ideal space for large and small solar PV installation. However during winter, the irradiation subsides (Figure 3:  $3.9\text{kWh/m}^2$  as compared to summer with a  $7\text{kWh/m}^2$ ) it is still commercially viable to reduce significant amount of energy demand from the national grid.

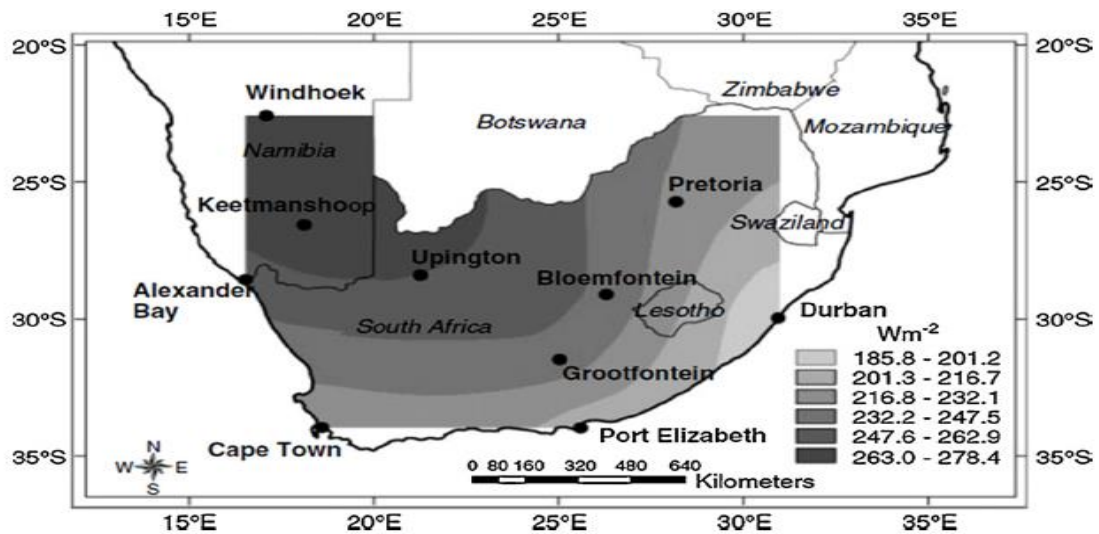


Figure 2: South Africa's solar irradiation capacity per region<sup>[1]</sup>

<sup>1</sup> Power HC, Mills DM. Solar radiation climate change over Southern Africa and assessment of the radiative impact of volcanic eruptions. International Journal of Climatology 2005;25: 295–318.

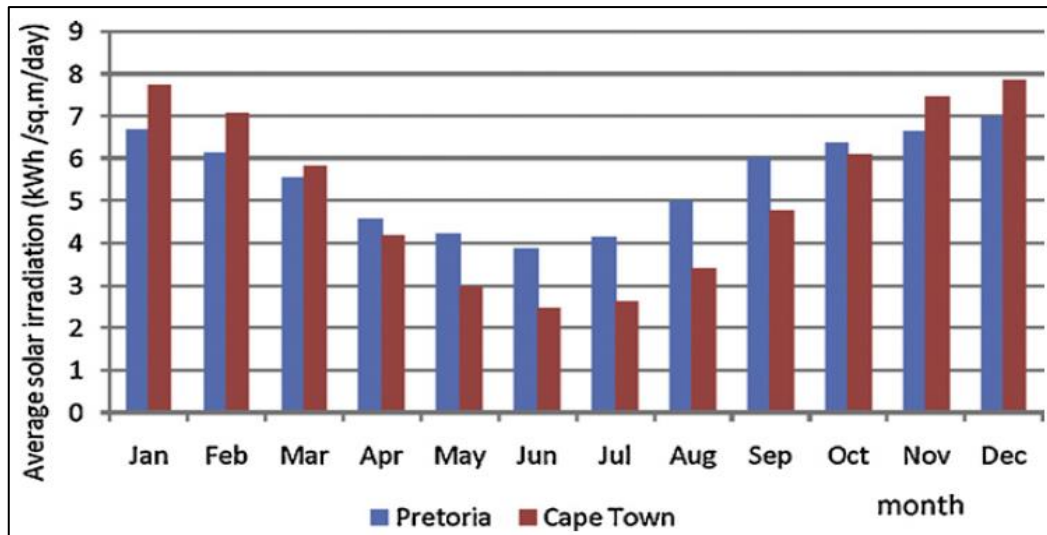


Figure 3: Average monthly solar irradiation in the north and south of South Africa <sup>[2]</sup>

## 5. In plant assessment

During the site walk, a better understanding of the business needs was elicited from the process and business discussions with the site personnel. Beginning with the ready highlighted challenges (power outages, load shedding), the site has decided that they foresee a need to have a supplementary alternate energy source that will be reliable and will relief the cost of electricity.

It was highlighted by the assessors that the green fund project has a budget of R220 000. From this, the site personnel emphasised the importance of exhausting the budget to size the system, hence the approach (scenario based/assumptions).

### 5.1. Site energy trend

Figure 4 below shows electricity usage per equipment used in the factory. The hot wire foam cutter and sewing machines consumes most of the electricity as opposed to others equipment's.

<sup>2</sup> Doneva, G., van Sarka, W., Bloka, K., Dintchev, O. 2012. Solar water heating potential in South Africa in dynamic energy market conditions. Renewable and Sustainable Energy Reviews 16. pp 1-13.

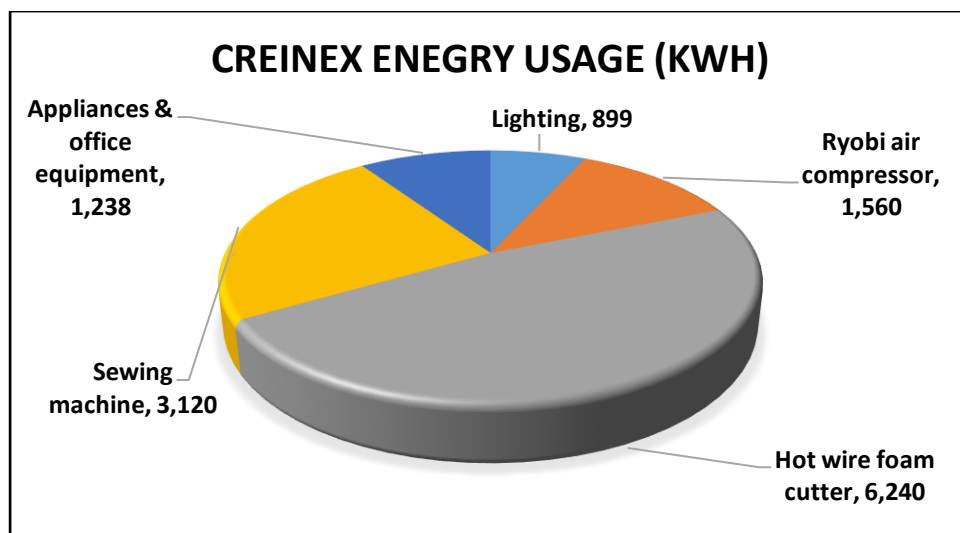


Figure 4: Energy consumption and energy costs per month

## 5.2. Solar PV measures and sizing

This section outlines the sizing of the solar PV system along with related cost measures that determines the financial feasibility (**Error! Reference source not found.**) of the system.

Table 1: Solar PV system specifications and cost measures

|                                                                         |          |              |
|-------------------------------------------------------------------------|----------|--------------|
| Estimated annual electricity demand (kwh)                               | 13,065   | kwh          |
| Energy costs                                                            | 33,554   | Rands        |
| Daily load (kwh)                                                        | 50       | kwh          |
| Specific yield based on PV GIS                                          | 1,661    | kWh/kWp/year |
| PV Generator Size (Canadian Solar 350w Poly Kupower Half-Cell With Mc4) | 350      | Wp           |
| Pure Sine Wave Inverter 7.2kw 48V                                       | 1        |              |
| Number of panels (350W/panel)                                           | 20       | modules      |
| System production (kWh/annum)                                           | 11,751   |              |
| System production (kWh/day)                                             | 32.2     |              |
| Battery (kWh/day)/Storage                                               | 20       |              |
| Number of batteries (21.3kWh/battery)                                   | 1        |              |
|                                                                         |          |              |
| Energy costs savings                                                    | R30,199  | Rands        |
| CO2equivalence reduced                                                  | 12.25    | tCO2/year    |
| Investment costs                                                        | R187,347 | Rands        |
| Payback period                                                          | 6.20     | Years        |

The proposed system is called a Hybrid system it runs on solar power and grid electricity. This system has a battery backup for power outages or period where there's not enough sun. The maximum daily energy demand for the factory is 50 kWh/day, which is 13 065 kWh/year. The projected annual energy produced is 11,751kWh/year, therefore, the solar system can supply 90% of the factory's energy use.

The solar system will have a battery backup of 20kWh lithium battery to power the production in case there's inadequate power supply from the PV modules. The facility has plenty of roof space that can be installed with solar panels as shown below. The figure below shows the projected monthly energy production.

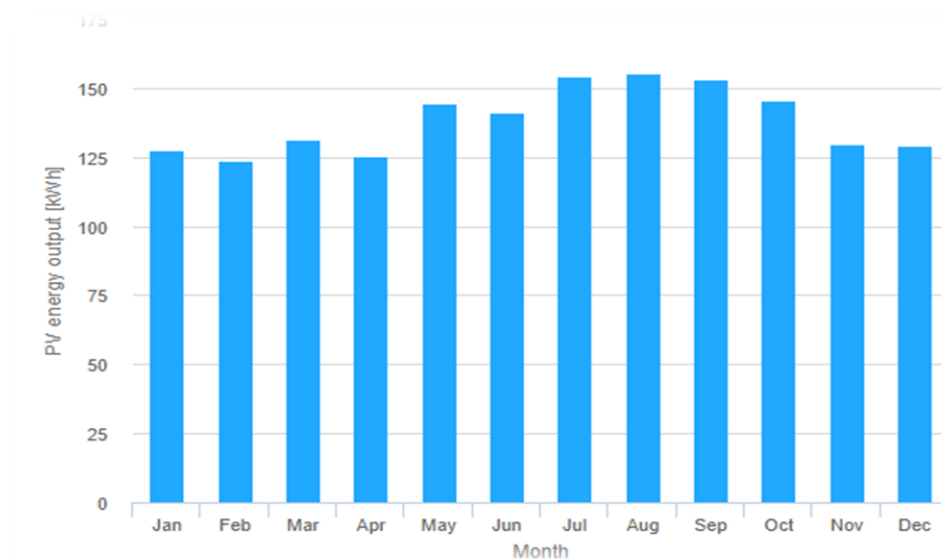


Figure 5: Projected energy yield

The projected annual energy cost savings is R33 554/year, which is 90% of the annual electricity bill. The project cost R30 199 including labour installations with a payback period of 6.20 years as shown table 1.

The following table shows the main components and the cost breakdown of the proposed solar PV system.

Table 2: Solar PV system costs

| Main components                                    | #  | Unit Price | Total   |
|----------------------------------------------------|----|------------|---------|
| Canadian Solar 300w Poly Kupper half-cell with MC4 | 20 | R2,800     | R56,591 |
| KODAK grid tied inverter 7.2kw 48V                 | 1  | R18,725    | R18,725 |

|                                                  |   |         |                 |
|--------------------------------------------------|---|---------|-----------------|
| Pylontech Force Series - Force L1 21.31          | 1 | R55,000 | R55,000         |
| <b>Balance of system</b>                         |   |         |                 |
| Cables (DC and AC)                               |   |         | R5,000          |
| Mounting system (rails, roof hooks, clamps etc.) |   |         | R3,000          |
| Switches and safety devices                      |   |         | R2,000          |
| Monitoring system                                |   |         | R10,000         |
| Installation costs                               |   |         | R20,000         |
| Contingency (10%)                                |   |         | R17,031.56      |
| <b>Total Excl. Vat</b>                           |   |         | <b>R187,347</b> |

### 5.3. Financial projection of the good years of the system

Noting that at the theoretically solar PV systems operate for  $\pm 20$  year with a linear degradation of about 0.7%/year, by the time the system's performance becomes infeasible to operate the site would have saved a significant amount of money as compared to what otherwise could have been (figure 6).

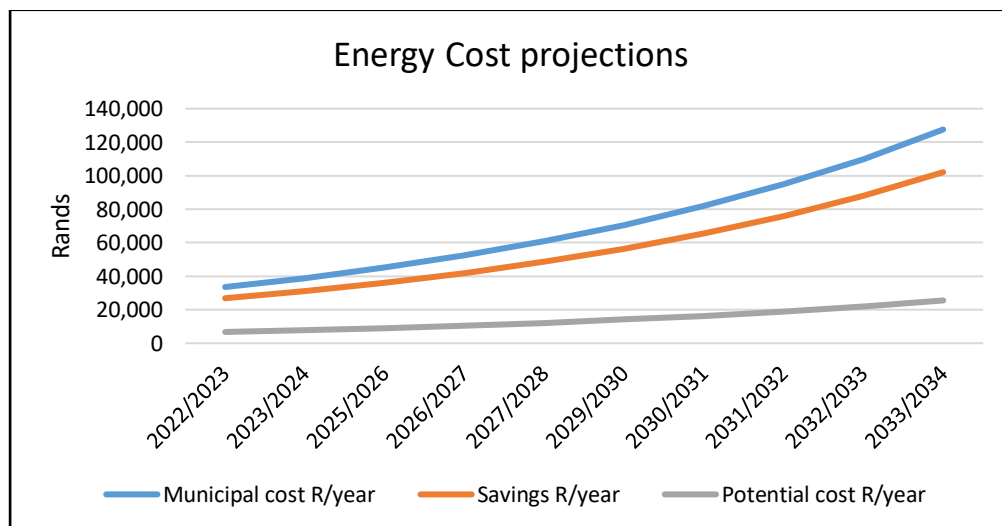


Figure 6: Projected financial performance of the system

Figure 6 shows the financial projections of how the system can be beneficial to the site. In a 10 years period the potential energy costs to the municipality will be R715 428. This happens because of the forever increasing electricity prices from the services provider, with the installation of a solar system, the factory can save about R643 885.

## **6. Conclusion**

The site can be able to capitalise on an alternate source of energy in relation to their challenges. Over a period of 10 years the factory will realise a considerable amount of energy savings. This will surely contribute to increased profits that will continue to promote business growth and Gauteng province's economic growth at the SMME level's capacity. At this point of the project, specifics with regards to the type/brand of the system are not highlighted as they will be at hand of the client or later on recommended by the consultant should there be a necessity.

## Appendices

### Appendix 1: Solar sizing iterations

| Climate information                         |                                  |                 |      |
|---------------------------------------------|----------------------------------|-----------------|------|
| Annual electricity demand (kwh)             | 13,056                           | kwh             |      |
| Energy costs                                | 33,554                           |                 |      |
| Daily load (kwh) (261 working day)          | 50                               | kwh             |      |
| Specific yield based on PV GIS              | 1,661                            | kWh/kWp/year    |      |
|                                             | 4.55                             | kWh/kWp/day     |      |
| Based on Creinex operating Hrs.             | 1,188                            | kWh/kWp/year    |      |
| Maximum Global irradiance (G(i))            | 1,146                            | W/m2            |      |
| PV generator                                |                                  |                 |      |
| PV Generator Size (CANADIAN SOLAR 350W)     | 350                              | Wp              |      |
| Module outside Width                        | 1048                             | mm              |      |
| Module outside Length                       | 1,765                            | mm              |      |
|                                             |                                  |                 |      |
| PV Generator Size - based on Consumption    |                                  |                 |      |
| Generator size /PV capacity needed (in kWp) | 7.86                             | kWp             |      |
|                                             | 7.07                             |                 |      |
| Number of modules based on generator size   | 20                               | modules         |      |
|                                             |                                  |                 |      |
| Power sizing for inventor                   |                                  |                 |      |
| Ppv-DC                                      | 7.07                             | kWp             |      |
| Inverter 20% smaller than PV Generator      | 5.66                             | < inverter AC > | 8.49 |
| Suitable Inverter AC Output range           | <b><u>5.03 kw to 7.55 kw</u></b> |                 |      |
| Pure Sine Wave Inverter 7.2kw 48V           |                                  |                 |      |
| Inverter Maximum input Voltage:             | 500                              | V               |      |

|                                                   |                                                          |             |         |
|---------------------------------------------------|----------------------------------------------------------|-------------|---------|
| Inverter MPP range:                               | 125-425                                                  | V           |         |
| Inverter Start/Min voltage:                       | 150                                                      | V           |         |
| Number of MPPTs:                                  | 2                                                        |             |         |
| Max input Current per MPPT:                       | 18 & 9                                                   | A           |         |
| <b>Battery Sizing</b>                             |                                                          |             |         |
|                                                   |                                                          |             |         |
| Capacity                                          | Daily Energy Consumption * Autonomy/DoD * System voltage |             |         |
|                                                   |                                                          |             |         |
| Customer's backup consumption 8 hrs.:             |                                                          |             |         |
| Autonomy time                                     | 8                                                        | Hrs.        |         |
| DoD (Depth of Discharge)                          | 90%                                                      | for lithium |         |
| System Voltage DC                                 | 48                                                       | V           |         |
| Battery Capacity                                  | <b>18.5</b>                                              | kwh         | 386.0Ah |
|                                                   |                                                          |             |         |
| Battery chosen: Pylontech Force Series - Force L1 |                                                          |             |         |
| Battery Module 6                                  |                                                          |             |         |
| Battery system capacity: 21.31 kWh                |                                                          |             |         |
| No of Batteries in Battery Bank                   | 1                                                        |             |         |
| Cycles>                                           | 6,000                                                    |             |         |
| Price                                             | 90,000                                                   |             |         |
| price per cycle                                   | 15                                                       |             |         |
| <b>Cost benefit analysis</b>                      |                                                          |             |         |
| Current Energy consumption                        | 13,056                                                   |             |         |
| Energy costs                                      | 33,554                                                   |             |         |
| Potential yield                                   | 11,751                                                   |             |         |
| Energy cost savings                               | 30,199                                                   |             |         |
| CO2equivalence (tCO2/year) reduced                | 12.25                                                    |             |         |
| Payback year                                      | 6.20                                                     |             |         |



## Appendix 2: Annual energy trend for solar PV production

| Pretoria irradiation (kWh/m <sup>2</sup> /month) |      | % Irradiation/m <sup>2</sup> /month | Solar generation<br>kWh/60m <sup>2</sup> /month |
|--------------------------------------------------|------|-------------------------------------|-------------------------------------------------|
| Jan                                              | 6,8  | 10%                                 | 2069                                            |
| Feb                                              | 6    | 9%                                  | 1826                                            |
| Mar                                              | 5,5  | 8%                                  | 1673                                            |
| Apr                                              | 4,5  | 7%                                  | 1369                                            |
| May                                              | 4,1  | 6%                                  | 1247                                            |
| Jun                                              | 3,9  | 6%                                  | 1187                                            |
| Jul                                              | 4,1  | 6%                                  | 1247                                            |
| Aug                                              | 5    | 8%                                  | 1521                                            |
| Sep                                              | 6    | 9%                                  | 1826                                            |
| Oct                                              | 6,2  | 9%                                  | 1886                                            |
| Nov                                              | 6,7  | 10%                                 | 2039                                            |
| Dec                                              | 7    | 11%                                 | 2130                                            |
| Total                                            | 65,8 | 100%                                | 20020                                           |

## Appendix 3: Detailed financial projections of the system

| Period (years) | Municipal consumption<br>kWh/year | Solar generation<br>kWh/year | Savings<br>kWh/year | Incremental<br>R/kWh | Municipal cost R/year | Savings<br>R/year | Potential cost<br>R/year |
|----------------|-----------------------------------|------------------------------|---------------------|----------------------|-----------------------|-------------------|--------------------------|
| 2020/2021      | 13,056                            | 10,445                       | 2,611               | 2.57                 | 33,554                | 26,843            | 6711                     |
| 2021/2022      | 13,056                            | 10,445                       | 2,611               | 2.98                 | 38,923                | 31,138            | 7785                     |
| 2022/2023      | 13,056                            | 10,445                       | 2,611               | 3.46                 | 45,151                | 36,121            | 9030                     |
| 2023/2024      | 13,056                            | 10,445                       | 2,611               | 4.01                 | 52,375                | 41,900            | 10475                    |
| 2024/2025      | 13,056                            | 10,445                       | 2,611               | 4.65                 | 60,755                | 48,604            | 12151                    |

|           |                |                |              |             |                |                |                |
|-----------|----------------|----------------|--------------|-------------|----------------|----------------|----------------|
| 2025/2026 | 13,056         | 10,445         | 2,611        | 5.40        | 70,476         | 56,380         | 14095          |
| 2026/2027 | 13,056         | 10,445         | 2,611        | 6.26        | 81,752         | 65,401         | 16350          |
| 2027/2028 | 13,056         | 10,445         | 2,611        | 7.26        | 94,832         | 75,866         | 18966          |
| 2028/2029 | 13,056         | 10,445         | 2,611        | 8.43        | 110,005        | 88,004         | 22001          |
| 2029/2030 | 13,056         | 10,445         | 2,611        | 9.77        | 127,606        | 102,085        | 25521          |
| Total     | <b>130,562</b> | <b>104,449</b> | <b>26112</b> | <b>5.48</b> | <b>715,428</b> | <b>572,342</b> | <b>143,086</b> |