

# GRID-TIED MUNICIPAL SOLAR PV

Ekurhuleni  
Metropolitan  
Municipality

Project:  
Leeupan solar  
PV project

Leeupan solar array: panels mounted on support steel structure.  
Image: EMM Alternative and Renewable Energy Division.  
Source: GIZ 2014

“This solar plant is signalling greater things to come in our City”, said Executive Mayor Mondli Gungebele at the launch of the Leeupan Solar PV plant<sup>1</sup>. The solar photovoltaic (PV) plant was developed as a visible and practical demonstration of the ambitious commitment of Ekurhuleni Metropolitan Municipality (EMM) to achieving a target of 10% green energy supply by 2020. Pioneering this new area of work is the Alternative and Renewable Energy Division of the Energy Services Directorate of EMM, established in 2010 to implement the municipality’s 2007 Energy and Climate Strategy objectives.

## Project Overview

The Leeupan solar PV project was developed as a demonstration project by EMM. The hosting of COP 17 in Durban in 2011 was a strong motivator for the project and facilitated a speedy procurement process. The OR Tambo Cultural Precinct, a municipal-owned centre for environmental learning and demonstration, provided a perfect site for the project, nestled amongst other environmental demonstration interventions. The centre is neighbour to the Wattville community and the project also hoped to demonstrate the potential to power low income homes.

The construction of the plant, completed in October 2012, was financed through the municipality’s capital expenditure (CAPEX), or investment, budget. Capital expenditure involved both civil works costs to prepare the ground, and the hardware and

installation costs of the plant itself. The project is exempt from requiring an electricity generation license as it was developed for demonstration purposes.

The capacity of the plant is 200kWp. The solar array is connected to the Eskom low voltage (LV) distribution grid in accordance with the connection conditions as set out in the South African Grid Code: the Network Code (version 7.0, 2008). The electricity generated by the system powers the OR Tambo Cultural Precinct where it is erected. The power output is lower than the overall on-site power requirements. There is no Power Purchase Agreement with Eskom, and it has been agreed between the two parties that any excess power is simply a contribution to the grid.

<sup>1</sup> SA Government News Agency, 12-10-1012

Key Project Data

Location

O. R. Tambo  
Cultural Precinct  
Wattville, Benoni, Gauteng



Technology

Array of grid-inter-  
active monocrystalline  
solar modules (185-245 Wp)



Key Actors

Owners

Ekurhuleni  
Metro



Developers

Ekurhuleni  
Metro



Financers

Ekurhuleni  
Metro



Some Indicators

Powered mid income  
households

(based on an average  
monthly consumption  
of 500 kWh)

60



Average output  
per MW  
installed

1 750  
MWh/MW installed/year



Capacity factor

[= ratio of actual output  
to potential output at  
full capacity, over the  
same period of time]

20%



Capital cost per  
MW installed

(MZAR/MW installed)

R 47.5\*  
million

(\*value in 2012, NB: the price of PV  
has drastically decreased since 2012)



Operational cost per  
MW installed

(ZAR/MW installed/  
month)

Minimal



Operational costs  
per MWh

(ZAR/MWh)

Minimal





## Technical Description

The OR Tambo Cultural Precinct, is municipal-owned land, which had to be prepared to carry the plant. This involved an initial civil works contract. The PV installation is grid-tied with no storage. 860 monocrystalline KSS-6P6A solar modules (made in Taiwan) were mounted on a support steel structure, with approximately 54 solar panels connected together in a string. Each string feeds individually into the main isolation distribution board, where each string can be isolated for maintenance. A set of 18 inverters (made in Germany) and one combiner unit located in the storage house alongside the array convert the solar plant's DC (Direct Current) into AC (Alternative Current). A 300 meter cable connects the plant from the combiner unit to the grid through a 380V kiosk. The lifespan of the plant, with good maintenance, is anticipated to be 20 – 25 years.



The solar panels  
Source: *Energy Department:  
Alternative and renewable  
Energy, Ekurhuleni  
Municipality*

The plant has an integrated monitoring system which manages the power flow. This makes it possible for the Precinct to be supplied with solar power from the panels and draw its additional power requirements from the Eskom grid. Although the power generated is unlikely to feed back into the grid given the demand requirements of the Precinct, the inverters have anti-islanding functionality to ensure safety: thus the solar plant will only operate when Eskom's grid is active, and will shut down when Eskom's power grid is inactive.

<sup>2</sup> See Municipal Supply Chain Management Model Policy: Model policy for adoption by municipalities and municipal entities in terms of section 111 of the Municipal Finance Management Act, No 56 of 2003, and the Municipal Supply Chain Management Regulations. National Treasury.

## Project Business Model

The project is entirely owned by Ekurhuleni Municipality and all financing came from the municipality's capital expenditure budget. The electricity produced is a saving on the electricity bill of the Precinct.

The project concept was developed and approved by council in mid-2011. The Energy Unit was able to depart from the standard tender process through Section 36 of the Municipal Supply Chain Management Policy<sup>2</sup> (emergency procedure). This speed up the procurement process, to ensure that the project would be built as a demonstration for the hosting of COP 17 in 2011. The Energy Division of the municipality was able to approach three service providers with a request for quotation. The specifications for the technology and mounting structure were developed internally, with the support of international expertise through DANIDA.

LTE Energy was appointed to build the plant. Operations and Maintenance (O&M) sits with the Energy Division of the municipality. Although routine maintenance is fairly low key, unanticipated operational challenges, notably the theft of panels, have impacted on the power production. Where a panel is removed, the effected string is left inactive. This has not been easy to fix as the procurement and installation of parts is technically complex and does not fall within any standard procedures. The municipality had to resort to tender process, which greatly delayed the replacement and repair work. Outsourcing of the O&M is considered an important next step.

In general, any electricity production requires licensing through the National Energy Regulator. However, there are licensing exemptions listed in Schedule 2 of the Electricity Regulation Act of 2006:

1. Any generation plant constructed and operated for demonstration purposes only; and
2. Any generation plant not connected to interconnected power supply
3. Any generation plant constructed for own use.

The plant qualified for generation license exemption on the grounds of being a demonstration project.



The power house containing the inverters (amongst others)  
Source: Energy Department: Alternative and renewable Energy,  
Ekurhuleni Municipality

## Project Timeline

**2007**

EMM Energy and Climate Strategy, with 10% renewable energy target, approved by council.

**2010**

EMM Energy and Climate Strategy, with 10% renewable energy target, approved by council.

**June 2011**

Project concept and budget request approved by Council.

**September 2011**

Procurement process: 3 service providers approached (in line with Section 36, para (a) of the MFMA) for quotations.

**May 2012**

Construction started with the first installations underway.

**October 2012**

Plant commissioned.



## Challenges, enablers and lessons learnt

The EMM Leeupan solar array was a first of its kind project in a South African municipality. “Hooking” the project to a high-profile international event provided stimulus and motivation for a faster procurement process.

### Permit and licensing processes

As the project was developed for demonstration purposes, linked to COP 17, the development was exempt from generating licensing requirements, in line with Schedule 2 of the Electricity Regulation Act. The installation complied with the national Grid Code for Renewable Power Plants.

Although the OR Tambo Cultural Precinct, site of the plant, remains a net-consumer of Eskom electricity and no power purchase agreement, or wheeling agreement had to be developed, the Energy Unit of EMM says that it would ensure in a future development that the installation was within their own distribution grid. The reason for this is that this would enable the municipality to scale up production, while still remaining a net-consumer, producing for ‘own use’. This facilitates installations as it bypasses the need for generation licenses and wheeling agreements.

### Procurement and contracting

As this was a ground breaking project, the procurement and contracting process was felt by the officials involved to be onerous. The lack of local suppliers at that time meant that procurement had to rely on long supply chains. Despite such challenges, enormous capacity was developed relating to procurement of such projects.

### Capacity building

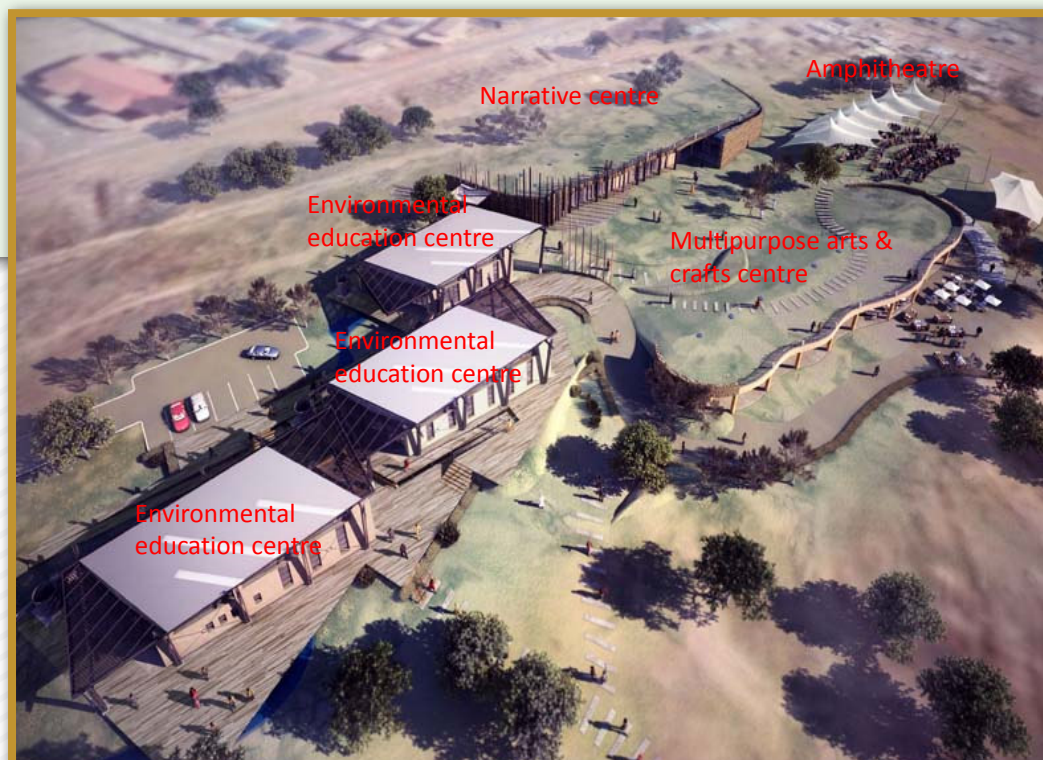
Enormous capacity has been built within the City, and the Energy Division in particular, relating to these technologies and

related procurement, installation, management and monitoring processes. The support of experienced, international technical assistance, through DANIDA, helped develop capacity around the specifications development. These new capacities will be brought to bear in the City’s ongoing renewable energy programme: the municipality is busy with the installation of solar rooftop PV on municipal buildings and has landfill gas to electricity projects underway.

### Operational challenges

**Operations and maintenance contract:** The experience of the municipality has been that they should have had an operations and maintenance contract in place following the commissioning of the project. Even though maintenance is minimal, there is no line function for this within the City and no standard procurement for technically unique and complex parts, and this can result in plants becoming run-down. The plant has produced far below anticipated output levels as a result of panel theft and the lengthy procurement processes that had to be undertaken in order to replace stolen panels and repair inactive strings.

**Location in relation to theft issues:** The location has been a problem as the panels are vulnerable to theft. In future the City would consider location carefully, trying to minimize this risk. It is recognized, however, that this is difficult, even where installations are on rooftops.



Overview of OR Tambo Centre  
Source: Energy Department: Alternative and renewable Energy, Ekurhuleni Municipality

## Key Project Data

### Start of operations

October  
**2012**

### Capacity

**200 kw**

### Average electrical output

**350**  
MWh/year

## Business Model

### Project delivery model

Municipal  
demonstration  
project

### Electricity production

Own use  
with excess electricity  
fed back into the grid

## Cost

### Capital cost

**R 9.5**  
million

### Operational cost

**Minimal**

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