Solar Plant Project

EXECUTIVE SUMMARY FOR TREASURY APPROVAL AND FOR PUBLIC PARTICIPATION

September 2015
Introduction and Background

Introduction

• The Polokwane Municipality commissioned the development of a Sustainable Energy Strategy for the municipality, which was completed and adopted by the IDP 2030;
• Furthermore, green energy is noted as an important priority in the Polokwane Smart City by 2030 objectives;
• It is with this background that the municipality seeks to roll out a 90 Megawatt (MW) Solar Photovoltaic Power Project;
• Municipality has a constitutional mandate to provide energy to its community and business;
• A pre-feasibility study seeks to demonstrate the concept and viability of a solar powered electricity generation plant established within the service area of Polokwane Municipality, with projected output of up to 90MW.

Objectives

The Municipality wants to procure the services of experienced developers to:

• Design a transparent, fair, open and competitive procurement process as well as to develop procurement documentation i.e. the request for prequalification (RFQ), the request for proposals (RFP) inclusive of the selection and evaluation criteria, and technology specific power purchase agreements;
• Support the Municipality during the competitive bidding process, i.e. the management of a open, fair and transparent process and providing the PM with administrative support, communication and clarification with the short listed bidders; and
• support and advise the Municipality on the design and management of a fair and transparent evaluation process according to the evaluation criteria, as well as the drafting of the evaluation reports for final decision-making.
Concept and feasibility study

Pre-feasibility Study
• The purpose of the pre-feasibility and concept report is to assess whether the intention to construct a 90MW Solar Generating Plant as an Independent Power Producer (IPP) within the Polokwane municipal electrical supply area is sufficiently developed as a proposal to commit to the costs for a comprehensive feasibility study.

Comprehensive Feasibility
• The purpose of the full or comprehensive feasibility study will be to investigate in detail whether the project is a desirable, viable and achievable investment.

• The comprehensive feasibility study will expand on the preliminary scoping in the concept pre-feasibility to enable a more thorough assessment of the designs, environmental acceptability, capital and operating costs, value for money analysis, financial viability and benefits and risks. It will further refine its development for the appropriate procurement process.

• As many role-players will be involved in this project and many stakeholders will be affected, the feasibility study needs to be considered from various perspectives, amongst others:
  – The users (consumers of energy within Polokwane Municipality);
  – The broader community, i.e. residents of the Province of Limpopo;
  – Municipal Government (the Energy Department in particular);
  – ESKOM;
  – The impact the proposed power plant will have on the existing electrical network, energy and maximum demand payments made to Eskom;
  – The successful bidding consortium, etc.
Conceptual Analysis of needs

• Polokwane Municipality has identified “Electricity Infrastructure” and “Alternative Energy Development” as key elements of the scope of the Infrastructure Development interventions that form part of the “Physical Cluster” of the Polokwane 2030 Economic Growth & Development Plan, also known as the municipality’s 2030 Smart City Vision.

• The Infrastructure Development charter of the strategy includes the promotion of “a well-functioning service sector which provides water, electricity, sanitation and waste removal in a long term sustainable manner. This includes “services to conduct feasibility assessments into the establishment of solar and wind farms for electricity generation”, as well as “alternative funding of infrastructure projects”.

• Polokwane Municipality is planning a procurement process to implement a 90MW Solar Plant as through IPP. The Municipality current energy consumption is approximately 161MW. The energy generated by the solar plant will be fully purchased by the municipality to supply the customers. The proposed model with the IPP will be a Design-Build-Operate-Transfer (“DBOT”) where the concession will be over a period of 20 years. The preferred IPP will be required to collect data, conduct feasibility study, and conduct all the necessary environmental studies and approvals. The concession will be over a period of 20 years (maximum) under a power purchase agreement (PPA). The private party will transfer the solar plant after 20 years to the municipality on a good working condition.
Analysis of the solutions

Technology options

- From available and established technology in the alternative energy generation field, the technology options of biomass, landfill gas, and solar generation power plants may be considered as readily implementable in the Polokwane environment.
- Solar plant technology has been successfully implemented to produce medium to large scale power generation facilities in the South African industry.
- Options such as natural gas, geothermal, onshore wind, and hydropower are not considered readily implementable due to the absence or lack of the natural energy resource in the Polokwane area that can be exploited for use in a power plant of significant size.

Solar plant technology

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Institutional Environment

- According to Chapter 7 clause 152 of the Constitution of the Republic of South Africa (Act 106 of 1998, as amended), “Objects of local government”, the objects of local government are inter alia, “to ensure the provision of services to communities in a sustainable manner”. Local government is also responsible for: “... electricity and gas reticulation”

- Municipalities are empowered in terms of various pieces of legislation to provide electricity to their residents

- The Limpopo Department of Economic Development, Environment and Tourism published the Green Economy Plan (LGEP) to assist the enabling of a “Green Economy” in support of achieving the main objective of Limpopo Employment Growth and Development Plan (LEGDP) which is to “improve the quality of life of the people in the (Limpopo) Province”. The LGEP includes in its vision the elements of an “ecological economy”, a “low carbon economy” and a “circular economy” to achieve environmentally sustainable practices.
Environment Compliance

The project shall be required to comply with the relevant international and local environmental standards including:

- IFC Performance Standards dated 2012
- World Bank Environmental Health & Safety (EHS) Guidelines dated 30 April 2007
- Government Notice Regulation (GN R) 545; and
- The Equator Principles III (2013)

The development and construction of the project will need for the Department of Environmental Affairs (DEA) to review all applications for environmental authorisations. The DEA require that all applications for environmental authorisations and amendments be submitted as set out below:

- Final Basic Assessment Reports;
- Final Environmental Impact Assessment Reports (EIA); and
- Applications for amendment to Environmental Authorisations for non-substantial amendments.
Types of solar plants

Photovoltaic Solar Energy Plant
• Photovoltaic cells/modules convert solar energy (sunlight) directly into electricity. The capacity of a photovoltaic power station is rated in megawatt-peak (MWp) and refers to the solar arrays aggregate direct current (DC) power output.
• Most solar PV facilities use ground mounted systems, with the PV panels mounted either at a fixed tilt angle or using a tracking system. The tracking system orients the mounted panels toward the sun either along one axis (mono-axis system) or two axes (dual-axis system).
• The tracking system reduces the angle of incidence between the incoming sunlight and the PV panel which increases the power generation efficiency.
• Solar panels produce DC electricity, thus the facility requires the use of inverters to convert to alternating current (AC) electricity.

Solar Thermal energy plant
• This technology converts solar energy to generate thermal energy or electrical energy. High temperature collector systems are used in the electricity generation application. In solar thermal energy plants, solar radiation is concentrated by mirrors or lenses to obtain higher temperatures – a technique called Concentrated Solar Power (CSP), which utilises steam turbines (up to ±600°C) and gas turbines (above ± 600°C) for electricity generation.

Parabolic Troughs
• This system uses a curved, mirrored trough which reflects the direct solar radiation onto a glass tube containing a fluid (also called a receiver, absorber or collector) running the length of the trough, positioned at the focal point of the reflectors. The trough is parabolic along one axis and linear in the orthogonal axis. For change of the daily position of the sun perpendicular to the receiver, the trough tilts east to west so that the direct radiation remains focused on the receiver.
• A fluid (also called heat transfer fluid) passes through the receiver and becomes very hot. Common fluids are synthetic oil, molten salt and pressurized steam. The fluid containing the heat is transported to a heat engine where about a third of the heat is converted to electricity.
Types of solar plants (cont)

**Solar Dish**

- This system uses a large, reflective, parabolic dish (similar in shape to a satellite television dish). It focuses all the sunlight that strikes the dish up onto a single point above the dish, where a receiver captures the heat and transforms it into a useful form.
- Typically the dish is coupled with a Stirling engine in a Dish-Stirling System, but also sometimes a steam engine is used.
- These create rotational kinetic energy that can be converted to electricity using an electric generator

**Solar Power Tower**

- This system design captures and focuses the sun's thermal energy with thousands of tracking mirrors (called heliostats) in “heliostat field” with a tower (or central receiver) in the center of the heliostat field.
- The heliostats focus concentrated sunlight on a receiver which sits on top of the tower. Within the receiver the concentrated sunlight heats molten salt to over 1,000 °F (538 °C).
- The heated molten salt then flows into a thermal storage tank where it is stored, maintaining 98% thermal efficiency, and eventually pumped to a steam generator.
- The steam drives a standard turbine to generate electricity. This process, also known as the "Rankine cycle" is similar to a standard coal-fired power plant, except it is fueled by clean and free solar energy.
Recently Implemented Solar Plants

The following table depicts the solar photovoltaic plants that have been selected for the REIPPPP implementation. These projects are at various stages of development, ranging from financial closure to implementation.

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<thead>
<tr>
<th>Title</th>
<th>Technology</th>
<th>Closest Town</th>
<th>Capacity (MW)</th>
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<td>Solar Photovoltaic (PV)</td>
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Recently Implemented Solar Plants in Limpopo Province
- Two photovoltaic power plants at Soutpan (28MW) and Witkop (30MW) in Limpopo were implemented by SunEdison and are currently operational. Both projects use tracking to raise efficiency of the plants.
Other Local Government and Small to Medium Scale Power Generation

Several local government entities have established alternative energy power generating plants, for example:

• City of Johannesburg Metropolitan Municipality
  – Robinson Deep Landfill Gas to Electricity
  – Marie Louise project Landfill Gas to Electricity
  – Three further projects Landfill Gas to Electricity

• eThekwini Metropolitan Municipality
  – Marianhill Landfill Gas to Electricity
  – Bisasar Road Landfill Gas to Electricity

• Manguang Metropolitan Municipality
  – 10MW Photovoltaic Solar Plant (project in procurement phase)

• City of Cape Town Metropolitan Municipality
  – Steenbras Dam Pumped Storage Hydropower

• Bethlehem Hydro
  – Merino Power Station Hydropower
  – Sol Plaatje Power Station Hydropower
Benefits of Solar Plant

There are number of benefits to implementation of a solar plant for generation of energy. Some of the benefits are:

• Potential to own and control clean energy generation capacity. Since the plant will be implemented on Build Own Transfer model
• Eskom has been under pressure with the generation of energy which resulted in load shedding, the solar plant will assist to secure energy supply and take off pressure from the Eskom grid;
• The solar energy is cheaper in the long run v/s Eskom;
• Solar energy is not only sustainable, it is renewable and this means that we will never run out of it. It is about as natural a source of power as it is possible to generate electricity;
• The creation of solar energy requires little maintenance. Once the solar panels have been installed and are working at maximum efficiency there is only a small amount of maintenance required each year to ensure they are in working order;
• They are a silent producer of energy. There is absolutely no noise made from photovoltaic panels as they convert sunlight into usable electricity;
• Job creation during construction and maintenance over the period;
• During operation solar electricity power plants produce zero emissions.
• Local economic stimulation, through direct foreign (foreign to Polokwane or foreign to SA) investment
• Local black ownership opportunity
Solution Options

Option 1: Private Developers
1. The Municipality can implement the project by engaging private developers. This means the Municipality will go out on tender and request for private developers to do the project;
2. The Municipality has to draw up appropriate Purchasing Power Agreement (PPA);
3. Issues such as timelines, bankability and other contingencies will be covered by the PPA;
4. The Municipality need to engage with National Treasury on the most appropriate approach;
5. This option entails the municipality inviting bids from private party, who will also do a thorough feasibility study on the project;
6. Municipality will allocate land to the private party and commence the development. The contact will be based on the tariff receivable from consumers;
7. The Private Party will engage with Eskom on the most appropriate procurement and connection fees. This engagement may be done without the municipality incurring any cost to it;
8. The private party has to comply with National Energy Regulator of South Africa (NERSA) Generation Code and NRS requirements;
9. The generation licence has to be transferred from private part to the Municipality at the end of the concession period.

Option 2: Municipality owned
1. The municipality can do the project on its own;
2. This may prove costly as they have to have the expertise and know-how to do the project;
3. The municipality does not have the balance sheet to fund the project;
4. It’s a relatively new field in south africa.

The recommended option is that the municipality implements option 1 due to the fact that the full risk will be transferred to the private party such as a financial, operational, technical risk.
Recommendations

The significant recommendations from this report include:

**Develop a project plan for project execution and implementation, including**

- Verify permitting and processes required
- Develop detailed output criteria during feasibility development
- Establish framework and process for evaluation of proposed options
- Financial and Technical analysis, including assessing the impact on end-user

**Procurement per Project Stage**

- Establish Terms of Reference for procurement of feasibility study
- Full verification of project feasibility before financial commitment
- Limit the cost impact of premature termination if project is terminated at any stage
- Enable selection of appropriate resources per project stage
- Procurement of Private Party

**Review PPA against Legislation Governing or Impacting on Local Government**

- Establish mandate for municipality to enter into a PPA that typically covers a 20 year period
- Maintain the option of having the agreement include future Transfer of Plant / Renewal of Operating Contract
- Include requirements for future export to ESKOM grid
- Ensure revenue/income flows to municipality

**Other**

- The municipality cannot afford to buy energy from the IPP at a rate which is higher than the current ESKOM rate;
- The land contribution to the private party could be used as a possible rebate on tariff;
- The Municipality will issue the IPP agreement to the private party (Developer).
- The municipality may use its own substation for distribution of the electricity. If they are to use Eskom lines, those costs have to be agreed with them.