# THEMEDA PV

## TECHNICAL LAYOUT DEVELOPMENT REPORT FOR THEMEDA PV

(PV Magazine, 2018)

**Prepared for:**

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## 1. INTRODUCTION

The Applicant, Themeda PV (Pty) Ltd, is proposing the construction of a photovoltaic (PV) solar energy facility (known as the Themeda PV facility) located on a site approximately 5km north west of the town of Lichtenburg in the North West Province. The solar PV facility will comprise several arrays of PV panels and associated infrastructure and will have a contracted capacity of up to 120 MW. The development area is situated within the Ditsobotla Local Municipality within the Ngaka Modiri Molema District Municipality on Portion 7 of Farm Elandsfontein 34. The site is accessible via the R503, located south east of the development area.

An additional 120 MW PV facility (Aristida PV) is concurrently being considered on the project site (within Portion 7 of Farm Elandsfontein 34) and is being assessed through a separate Environmental Impact Assessment (EIA) process.

An assessment area of approximately 200 ha is being assessed as part of this EIA process and the infrastructure associated with the 120 MW facility includes:

- PV modules and mounting structures (monofacial or bifacial) with fixed, single or double axis tracking mounting structures;
- Inverter-station, transformers and internal electrical reticulation (underground cabling where practical);
- Battery Energy Storage System (BESS);
- Site and internal access roads (up to 10 m wide);
- Auxiliary buildings (MV switch room, gate-house and security, control centre, office, warehouse, canteen & visitors centre, staff lockers etc.);
- Temporary and permanent laydown area;
- Perimeter fencing and security infrastructure;
- Rainwater Tanks; and
- Grid connection solution, including:
  - Medium-voltage cabling between the project components and the facility substation; and
  - Up to 132 kV facility substation;

Figure 1 below depicts a typical layout of a solar PV energy facility.

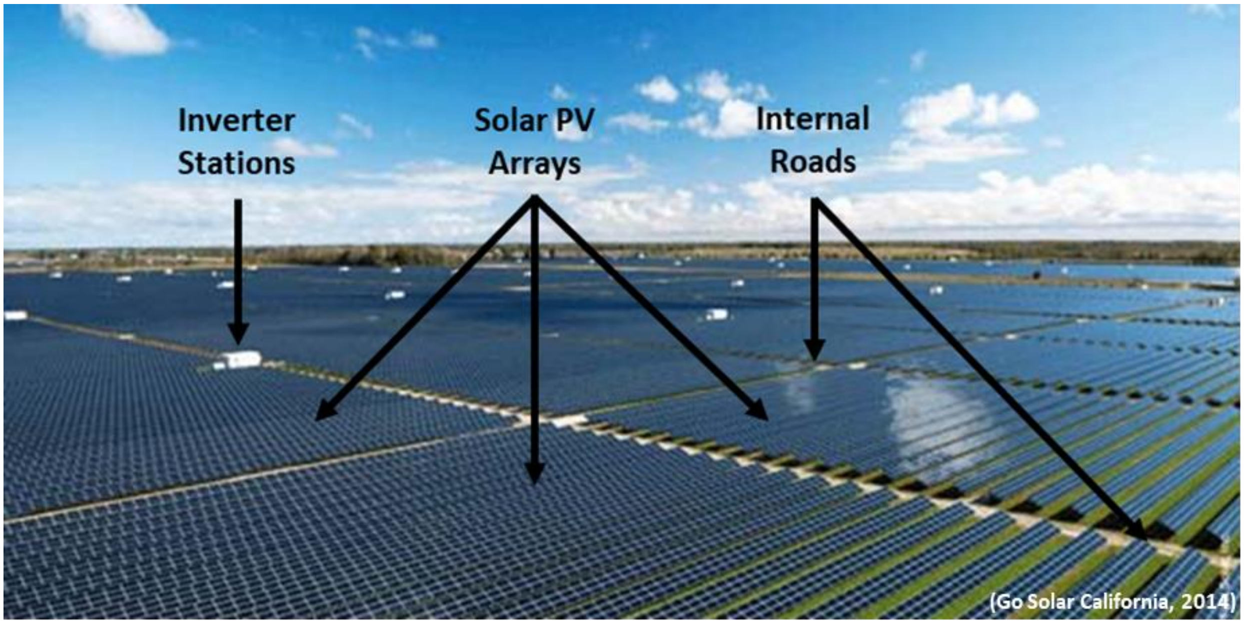


*Figure 1: Typical Layout of a Solar PV Energy Facility*

Themeda PV will have a net generating capacity of 120 MW with an estimated maximum footprint of ± 200 ha. The approximate area that each component of Themeda PV will occupy is summarised in Table 1 below.

*Table 1:Component Areas and % of Total Project Area*

| SEF Component | Estimated Area | % of Total Area (± 200 ha) | % of Study Area (± 530 ha) |
|---|---|---|---|
| **PV array** | ± 178 ha | 89,00% | 33,58% |
| **Permanent and construction laydown** | Up to 5 ha | 2,50% | 0,94% |
| **Auxiliary buildings** | ± 1 ha | 0,50% | 0,19% |
| **Internal roads** | ± 8 ha | 4,00% | 1,51% |
| **Substation** | ± 1 ha | 0,50% | 0,19% |
| **Main Road** | Approx. 3 ha | 1,50% | 0,57% |
| **BESS** | Up to 4 ha | 2,00% | 0,75% |


*Figure 2: Property boundary (white), Themeda PV Study Area (yellow) & Proposed Development Area (orange)*

# 2. Project Alternatives

## 2.1 LOCATION ALTERNATIVES

The site selection process for a PV facility is almost always underpinned by a good solar resource. Other key considerations include environmental and social constraints, proximity to various planning units and strategic areas, terrain and availability of grid connection infrastructure.

Based on the above site-specific attributes discussed in more detail in the Site Selection Motivation report, the study area is considered to be highly preferred in terms of the development of a solar PV facility. As such, no property / location alternatives will be considered.

## 2.2 SITE LAYOUT ALTERNATIVES

It is customary to develop the final/detailed construction layout of the solar PV facility only once an Independent Power Producer (IPP) is awarded a successful bid under the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) or an alternative programme, after which major contracts are negotiated and final equipment suppliers identified.

For the purpose of the Environmental Impact Assessment (EIA), site layout alternatives will not be comparatively assessed, but rather a single layout (including access road) will be refined as additional information becomes available throughout the EIA process (e.g. specialist input, additional site surveys, ongoing stakeholder engagement).

The development area presented in the Scoping Report has been selected as a practicable option for the facility, considering technical preference and constraints, as well as initial No-Go layers informed by specialist site surveys.

Following further site screening by the avifaunal and biodiversity specialist (scheduled to take place during the EIA phase), the development footprint[1] will be finalised for impact assessment.

[1] The development footprint is the defined area (located within the development area) where the PV panel array and other associated infrastructure for Themeda PV facility is planned to be constructed. This is the actual footprint of the facility, and the area which would be disturbed.

# 3. OVERVIEW OF THE SOLAR ENERGY FACILITY

The following section presents an overview of the main components of Themeda PV.

## 3.1 SOLAR ARRAY

Solar PV modules are connected in series to form a string. A number of strings are then wired in parallel to form an array of modules. PV modules are mounted on structures that are either fixed, north-facing at a defined angle, or mounted to a single or double axis tracker to optimise electricity yield.

## 3.2 MOUNTING STRUCTURES

Various options exist for mounting structure foundations, which include cast/ pre-cast concrete (shown in Figure 3), driven/ rammed piles (Figure 4), or ground/ earth screws mounting systems (Figure 8).

*Figure 3: Cast Concrete Foundation*

(Solar Power Plant Business, 2013)

*Figure 4: Driven/ Rammed Steel Pile*

(SolarPro, 2010)

*Figure 5: Ground Screw*

(PV MAGAZINE, 2014)

The impact on agricultural resources and production of these options are considered to be the same, however concrete is least preferred due the effort required at a decommissioning phase in order to remove the concrete from the soil, and therefore its impact on the environment. Themeda PV will therefore aim to make the most use of pre drilling and backfilling of holes prior to either driven/ rammed piles, or ground/ earth screws mounting systems, and only in certain instances resort to concrete foundations should geotechnical studies necessitate this.

## 3.3 AUXILIARY BUILDINGS

The auxiliary buildings will comprise the following as a minimum:

1. 33 kV switch room;
2. Control building/ centre;
3. Offices;
4. Warehouses;
5. Canteen & visitors centre;
6. Staff lockers & ablution; and
7. Gate-house and security.

The total area occupied is approximately 1 ha, excluding the facility switching station/ substation.

## 3.4 GRID CONNECTION AND CABLING

The Themeda PV grid connection infrastructure includes:

- Underground medium-voltage cabling between the project components and the facility substation; and
- Up to 132kV on-site facility substation.

The Themeda PV facility substation (as well as the Aristida PV facility substation) will be located directly adjacent to the Elandsfontein collector switching station in the north-western corner of the proposed development area.

The Themeda PV facility intends to connect to the National Grid via the Watershed Main Transmission Substation (MTS) approximately 5.5 km east of the facility. The grid connection infrastructure associated with this grid solution (i.e. the Elandsfontein collector switching station and an up to 132kV overhead powerline) is being assessed as part of a separate Environmental Application

### 3.5 BATTERY STORAGE

Renewable energy can currently achieve lower costs than fossil fuels. By incorporating energy storage technologies into renewable energy facilities, electricity can be stored during generation peaks and supplied during demand peaks.

Lower costs coupled with improved efficiencies, high energy density, lightweight design and low environmental risks, make non-liquid/ solid-state (e.g. Lithium battery technologies) the preferred alternative (refer to standalone Battery Storage Technical Development Report).

Themeda PV BESS will cover a maximum area of approximately 4 ha.

### 3.6 ACCESS ROUTES AND INTERNAL ROADS

The site will be accessible via the regional road R503 located to the west of the project site.

A traffic specialist has been appointed to facilitate and guide the identification of a technically feasible access road routing to be assessed during the EIA phase. The selected route will take cognisance of safe access points and oversized vehicle / abnormal load constraints.

Where possible, the proposed routing will follow existing gravel farm roads and endeavour to fall within the disturbance footprint of the proposed Arstida PV where practically possible (e.g. it will follow the boundary fence or share access where possible).

Portions of the access road may require widening up to 10 m (inclusive of storm water infrastructure). Where new sections of road need to be constructed (/lengthened), this will be gravel/hard surfaced access road and only tarred if necessary. Overall, the route is estimated to be up to 2 km in length (although this will be confirmed during the EIA phase).

A network of gravel internal access roads and a perimeter road, each with a width of up to ± 5 m, will be constructed to provide access to the various components of the Themeda PV development.

Precautionary measures will be taken to mitigate the risk of ground disturbances where access roads will be constructed. Special attention will be given to drainage, water flow and erosion by applying appropriate building methods.


*Figure 6: Envisioned Themeda PV Access Route (orange) in relation to Aristida PV Development Area*

## 3.7 SERVICES REQUIRED

### 3.7.1 Waste Management

#### 3.7.1.1 Solid Waste

Solid waste during the construction phase will mainly be in the form of construction material, excavated substrate and domestic solid waste. All waste will be disposed of in scavenger proof bins and temporarily placed in a central location for removal by the contractor. Any other waste and excess material will be removed once construction is complete and disposed of at a registered waste facility. Excess excavation material will either be spoiled offsite at a registered facility or used for landscaping berms within the overall PV footprint.

#### 3.7.1.2 Sewerage

During the construction phase, chemical ablution facilities will be utilised. These ablution facilities will be maintained, serviced and emptied by an appointed contractor, who will dispose of the effluent at a licensed facility off site. Once construction is complete, the chemical ablution facilities will be removed from the study area. A conservancy tank which will be regularly emptied by a registered service provider will be installed at the Operations & Maintenance building and on-site/ facility substation and the BESS control room.

### 3.7.2 Hazardous substances

During the construction phase, use of the following hazardous substances is anticipated:

1. Cement associated with piling activities and construction of buildings and inverter station plinths;
2. Petrol/ diesel for construction plant; and
3. Limited amounts of lubricants and transformer oils.

Temporary storage and disposal of hazardous waste will be done in compliance with relevant legislation (i.e. stored in covered containers with appropriate bunding). Refuelling areas to be in designated positions, with suitable mitigation to reduce the risk of hydrocarbon spills.

### 3.7.3 Water Supply

Water required during the construction and operation phases will be sourced from (in order of priority):

1. The Local Municipality (LM) - Specific arrangements will be agreed with the Ditsobotla Local Municipality in a Service Level Agreement (SLA). Most likely the water will be either trucked in, or otherwise made available for collection at their Water Treatment Plant via a metered standpipe.
2. Investigation into a third-party water supplier which may include a private services company.
3. The investigation of drilling a borehole on site, which includes complete geohydrological testing, groundwater census and a Water Use License Application (WULA) in terms of section 21a of the National Water Act, 1998.

# 4. CONCLUSION

The layout proposed at scoping phase has been developed based on key criteria identified above, including inter alia, accessibility, proximity to the Watershed MTS, as well as consideration of sensitive areas to minimise ecological and other impacts.

# 5. LIST OF REFERENCES


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