

Mozambique - Temane Transmission Project (TTP)

Terms of Reference:

Specialist Preliminary Geotechnical Investigation for proposed substations to be located at Temane, Vilanculos, Chibuto, Matalane and Maputo

Revision (B) 17th December 2018

1. Introduction

Electricidade de Moçambique E.P. (“EDM”), in partnership with Sasol New Energy Holdings Ltd (“Sasol”) and Globeleq Africa Limited (“Globeleq”), is developing a 400-MW Independent Power Producer (“IPP”) project at Temane in the Inhambane Province of Mozambique known as Central Termica de Temane (“CTT”) or the Temane IPP. The plant will use natural gas from the nearby PSA gas fields at Pande and Temane, to be developed and operated by Sasol Petroleum Mozambique Lda.

The Temane IPP will be connected to the electricity grid in the Maputo area in southern Mozambique through a 560-km, 400-kV transmission line including 3 new substations, known as the Temane Transmission Project (“TTP”). The TTP is the first phase of the larger interconnection between Maputo and the Tete Province, known as Sociedade Nacional de Transporte de Energia (“STE”).

The TTP will be implemented as a publicly financed project, which will connect the Temane IPP plant and any other future plant and loads along the TTP corridor to the transmission network.

The services of an external specialist service provider are required to support EDM in establishing preliminary geotechnical information with respect to the new substation sites in order to reduce the risk of unknown ground conditions to prospective EPC contractors prior to the commencement of the procurement process. For this purpose, a geotechnical report is to be prepared to present the findings of the field and laboratory tests, to know the physical and mechanical properties of the soils.

2. Objectives

The primary objective is to determine the geotechnical subsoil conditions relative to the proposed TTP substation earthworks, to identify any potential problems and to confirm the suitability of the sites for substation development according to their geotechnical properties being;

- Site geology and stratigraphy
- Soil and rock classification
- Potential geotechnical problems
- Identification of areas of instability
- Earthworks and platform construction recommendations
- Excavatability of material on site
- Determination of availability of local sources of fill material
- Site drainage
- Soil corrosion protection
- Seismic assessment and classification of the site

3. Information provided for the geotechnical study

Information provided for the purposes of this investigation include;

- Volume TL-3 Line route report dated 2018-03-20 and revised on the 3rd April 2018 conducted as part of the TTP basic design and GPS line coordinates
- ESIA for the TTP
- EDM-1 12.02.2015 Volume SS-1 General Technical Specs – Substations
- EDM-2 12.02.2015 Volume SS-2 Particular Technical Specs Vilanculos Substation – GA of substation
- EDM-3 12.02.2015 Volume SS-3 Particular Technical Specs Chibuto Substation – GA of substation
- EDM-4 12.02.2015 Volume SS-4 Particular Technical Specs Matalane (Marracuene) Substation – GA of substation
- Sketch plan of Temane substation line bays

4. Site description

The sites are fixed and are for the construction of new 400kV substations near the towns of Vilanculos, Chibuto and Matalane. This also includes extension of the Maputo Substation. The position of the substations together with the location of major access roads is provided in Annexure 1

A description of the new TTP substations are as follows;

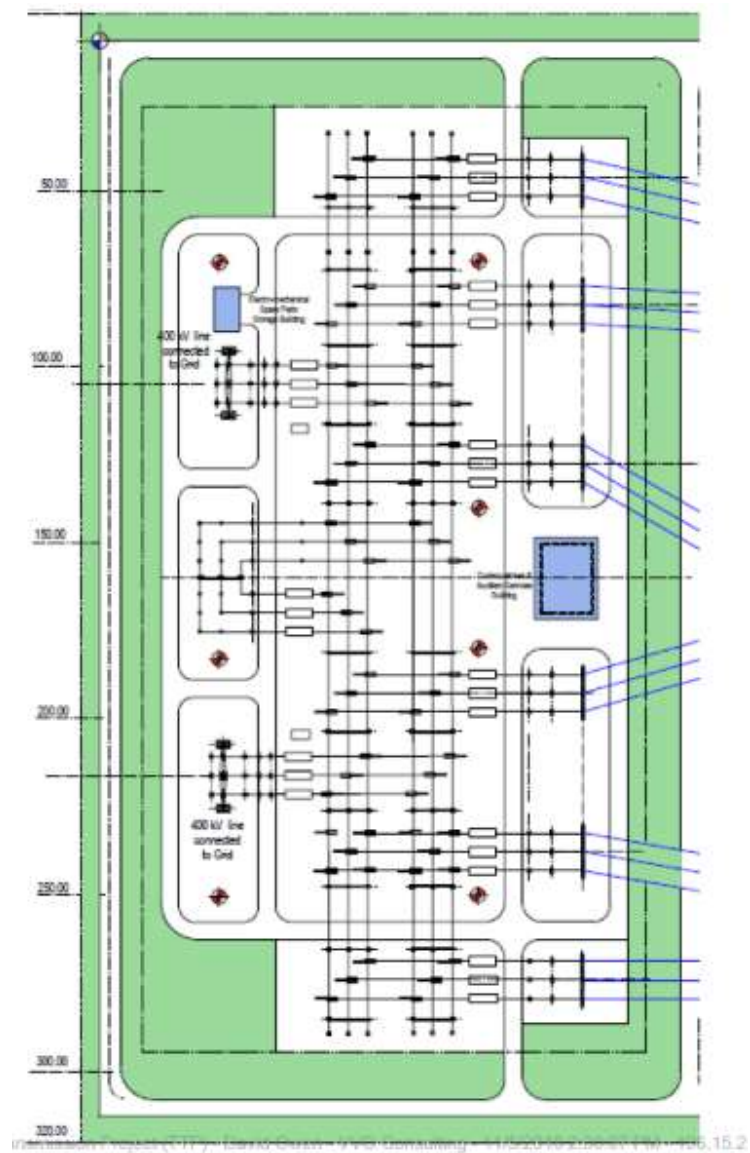
The substations will incorporate standard equipment of transformers, switchgear, reactors, busbars and isolators.

Temane substation

| | |
|------------|---|
| Plant Area | 320mx 50m (Temane - Vilanculos feeder line bay area only) |
| Coordinate | S21° 45' 36.0", E35° 04' 02.7" |

Located adjacent to the proposed CTT power plant and which will include two line bays for the connection of two 400kV transmission lines to the substation located at Vilanculos. The location of the line bays with respect to the transmission line connection is shown in Fig 1.

Figure 1 - Temane substation feeder bay layout

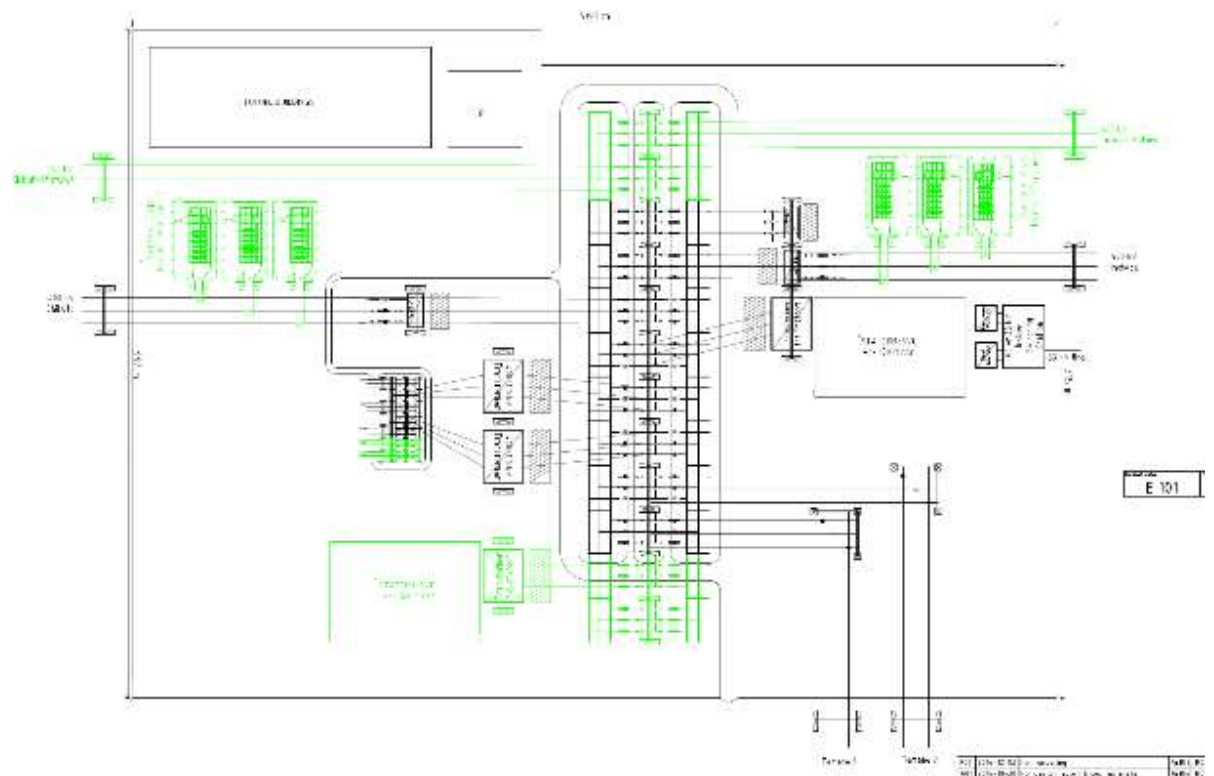


Vilanculos Substation

Plant area 416m x 315m

Coordinate S21° 57' 21.5" E35° 06' 05.7"

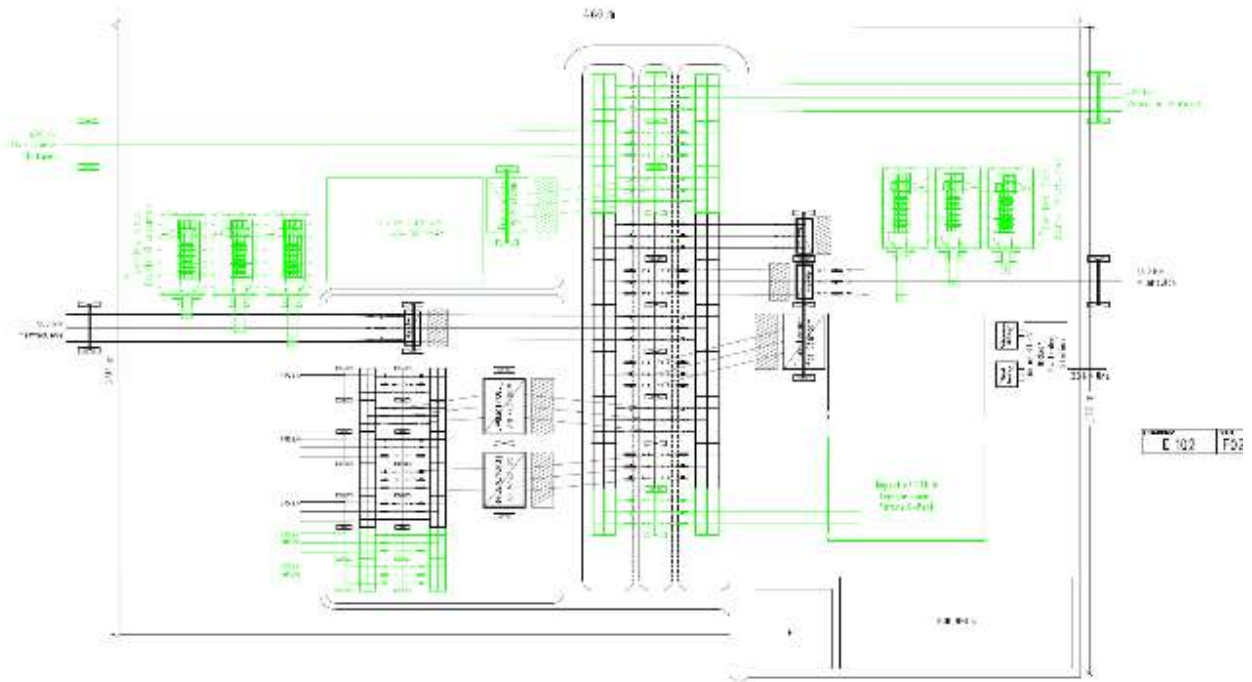
Figure 2 - Vilanculos substation layout



Chibuto substation

| | |
|------------|-------------------------------|
| Plant area | 460m x 310m |
| Coordinate | S24° 38' 08.1" E33° 31' 28.7" |

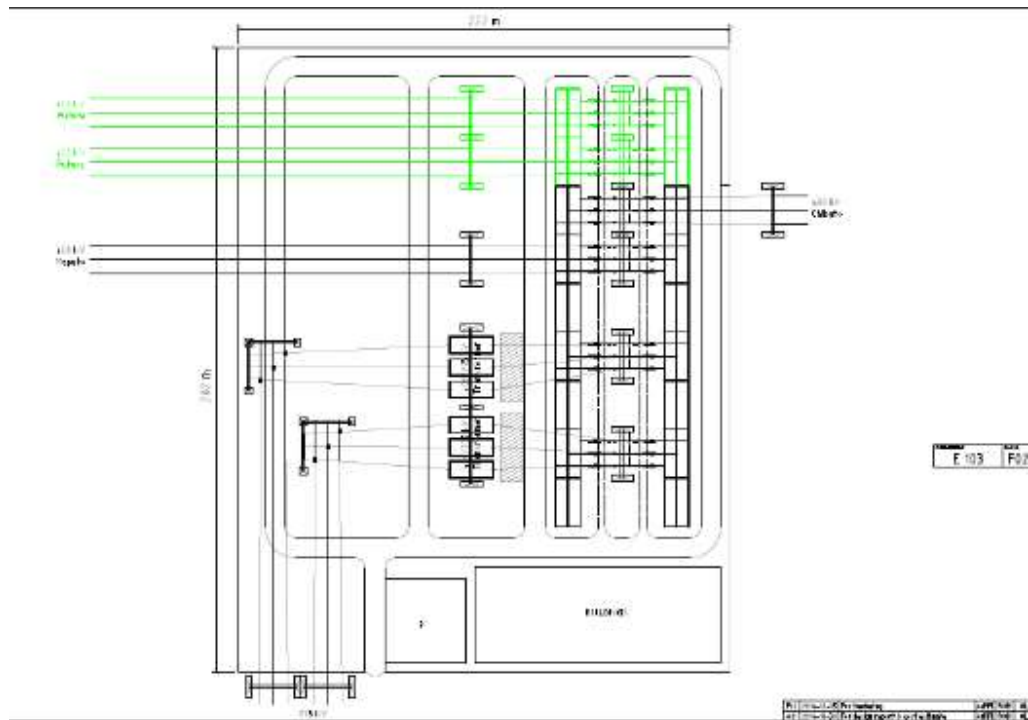
Figure 3 - Chibuto substation layout



Matalane substation

Plant area 282m x 222m
Coordinate S25°40'42.32" E32°37'56.39"

Figure 4 - Matalane substation layout



Maputo substation

Plant area to be advised by the Client

Coordinate S21° 57' 15.9" E 32°22'48.63"



5. The Scope of the geotechnical survey and required deliverables

- a) Desk study of the areas applicable to the substation sites and statement of the regional and local geology applicable to the substation sites including seismic zoning
- b) Topographical survey of the site to enable preliminary geometric designs and the identification of cut and fill requirements
- c) Preliminary geometric design
- d) Test pits.

A total of 15 test pits per substation site at Vilanculos, Chibuto and Matalane shall be carried out at locations to be agreed with the client . 5 test pits shall be excavated at each of the Temane and Maputo sites. Test pit location will be determined by the approximate location of heavy equipment and buildings. Trial pits should be excavated to maximum reach (between 3 and 4m) or refusal

- e) Laboratory testing of soil samples (2 per test pit) of obtained from each of the test pits to determine the geotechnical properties of the soil which shall include;
 - Full grading analysis (Atterberg Limits, particle size distribution, hydrometer analysis)
 - Mod AASHTO dry density
 - California Bearing ratio (CBR)
 - pH
 - Conductivity/Resistivity (Schlumberger method)
 - Chemical Analysis from soil extraction (Basson Index) and Special Digest (BRE)
- f) Dynamic Cone Penetrometer tests (DCP).

A total of 15 DCP (Super Heavy) tests are to be conducted on each substation site adjacent to the test pits (5 CPTu) each in the cases of Maputo and Temane sites) to obtain an indication of the consistency of subsoils underlying the site at shallow to moderate depths. DCP tests should be carried out to refusal on very stiff clays, dense sand or gravel rich horizons or very soft to soft bedrock

- g) Geotechnical Assessment including;
 - Definition of soil classifications (type of soil, etc) to be specified in the Bidding Documents and the Bill of Quantities
 - Recommendations on civil works for foundations of building, transformers, etc
 - Site stability
 - Problem soils

- Seepage areas/groundwater assessment
- Excavatability
- Material suitability
- Earthworks recommendations including storm water management and foundations,
- Seismic activity

6. Deliverables, Payment and Timeline

The study should be completed within 10 weeks of contract award

Payment of 100% of the survey price shall be made within 30 days of submission of the Consultants final report and accompanying invoice

The following deliverables shall be provided by the Consultant with the stated time frames

| Deliverable | Content | Schedule |
|--------------------|---|--|
| Inception report | <ul style="list-style-type: none"> • The survey objectives and survey area boundaries • The survey approach • The survey methodology and tasks • Work programme • Staff organisation • Key staff and responsibilities | 2 weeks from commencement date |
| Draft final report | <ul style="list-style-type: none"> • Background • Purpose and scope • Site conditions • Geography • Geology (regional) • Local bedrock geology and soil • Local unconsolidated deposits • Seismic threats • Site – literature review • Field investigations and laboratory testing • Geotechnical properties of the substation sites (rock and soil properties) • Geotechnical appraisal (baseline characteristics, construction materials, | No later than 8 weeks from the commencement date |

| | | |
|--------------|--|---|
| | concrete aggregate, backfill, excavation methods • Additional exploration studies • References • Appendices including survey results, test pit logs, petrographic analysis | |
| Final report | Amended final draft | No later than 10 weeks from commencement date |

7. Estimated Level of Effort

The Client's estimate of the expected level of effort required to complete the assignment is 60 person-days for all key staff in total

8. Key Staff

Project Manager

The Project Manager should have a minimum 7 years experience in the planning and management of geotechnical surveys the Southern Africa region. The Project Manager should present evidence as having managed and coordinated successfully at least 2 geotechnical surveys of a similar nature.

Geologist

The Geologist should have a minimum of 10 year's experience in carrying out geotechnical surveys in the Southern Africa region and should be a registered Professional Engineer and, as a minimum, hold a BSc (Honours) degree in geology.

Annex 1. Project Map

