APPENDIX F: PV PLANT ELECTRICAL POINT OF CONNECTION REQUIREMENTS

1. SCOPE OF WORK

1. The PV plant will be integrated at the existing 132kV Skaapvlei Substation located within the Sere Wind Farm site. The connection point will be on the Eskom's Distribution (Dx) System that the Wind Farm is connected to. The grid connection scope is as documented in 562/21- Sere 19.5MW PV Proposed Primary Plant Functional Scope and 562/22 - Sere 19.5MW PV Proposed Control Plant Functional Scope Report. The Contractor shall comply with these Dx requirements.
2. The points indicated below highlight critical requirements for the connection scope of the PV Plant.
3. The PV Plant will be connected to the 132kV busbar through a dedicated 132/22kV transformer. The 132kV busbar will serve as the point of connection service provider (PoC) and will be designed and constructed as part of this project.

   The Grid connection scope is as follows:

   a. Extent the existing 132kV busbar with one (1) 132kV feeder bay to the PV farm with tariff and power quality metering.
   b. Establish a new 132/22kV transformer bay.
   c. Install a new 40MVA 132/22kV transformer.
   d. Establish a new 22kV busbar with minimum two (2) 22kV feeder bays to the PV farm with energy metering.
   e. Install all control, protection, and telecommunications equipment in a suitable relay house.
   f. Install 22kV NEC/R/T.

2. RETICULATION AND OPERATING PHILOSOPHY

1. All the power generated will be evacuated to the grid through a 22kV PV switchgear. The 22kV switchgear is proposed to be fitted in the existing 33kV Wind Farm MV Switchgear room. It is proposed that fixed-pattern switchgear is used to obtain a smaller footprint. The Contractor shall verify if the available space is sufficient for the required switchgear and protection equipment.
2. The Contractor shall evaluate the option for placing a PV collector substation at the PV plant. Should the Contractor elect to place a PV collector substation at the PV plant, then the collector substation shall accommodate all the PV feeders coming from the PV plant.
3. The electrical reticulation of the Sere PV plant comprises of equipment required to generate, distribute, and inject electrical power into the grid.

   a. The reticulation is designed to maximise availability of the plant as far as possible.
   b. The Contractor designs a suitable electrical reticulation system. An indicative single line drawing in this specification (Appendix B) employs a ring type topology design for the PV generators, enabling a ring or cluster of rings to be connected to a central collector system viz. the 22kV busbar.
   c. The PV plant is connected to the 22kV switching station via minimum two (2) feeder bays.
   d. The PV generator stations are an integrated system that provides power conversion, voltage transformation, and power distribution.

4. The maximum combined generation output of the Sere Wind Farm facility and the PV facility shall not exceed the Maximum Export Capacity (MEC) of 105.8 MWac. This limitation will impact the PV plant operating philosophy:
    a. No curtailment will be imposed on the PV plant if the combined generating output of the Sere Wind Farm facility and the PV facility is less than or equal to 105.8 MWac.
    b. Curtailment will be imposed on the Solar PV plant if the combined generating output of the Sere Wind Farm facility and the PV facility would exceed the limitation of 105.8 MWac.
    c. The annual wind generation profile for the Sere Wind Farm facility for the financial year 2017 is provided in Appendix H (hourly intervals) by the Employer, enabling the Contractor to approximate the expected curtailment of the Solar PV plant and optimise the design. Take note that the annual wind profile varies and the data provides an indication of MW sent out.

3. ENGINEERING DESIGN

1. It is a requirement by Eskom Distribution that the Engineering Design performed under the self-built agreement, be performed by a Consulting Engineer accredited by Eskom Distribution for Substations, Control Plant, and HV lines. The same Consultant shall also design the 22kV PV Switching station and Collector substation where possible which will share a common platform and adjacent earth mats.
2. The EPC Contractor shall appoint such an Eskom accredited Consultant who shall be responsible for the design as well as the submission for approval to Eskom in terms of Eskom Distribution processes.
3. In terms of the self-built agreement requirements by Eskom Distribution, the Eskom accredited Engineering Consultant shall remain involved during the construction process to oversee that the design is implemented correctly.
4. The Engineering Consultant shall also provide an Eskom approved Clerk of Works (CoW) with suitable High Voltage Regulations (ORHVS) qualifications to act as Clerk of Works on behalf of the Developer, and shall carry out all inspections prior to, during and after all visits by Eskom Distribution Clerk of Works. The Clerk of Works shall maintain the hand-over file for handing over to Eskom at the end of the project. The Hand-over file shall as a minimum contain all test certificates, copies of inspections sheets, test reports and eventually, the as-built drawings. The Eskom accredited Engineering Consultant or his appointed Clerk of Works shall maintain a full-time presence during factory acceptance tests, site acceptance tests, and commissioning to witness the tests.

4. GRID CONNECTION WORKS SUB-CONTRACTOR

1. It is a requirement by Eskom Distribution that the construction works performed under the self-built agreement, be performed by a contractor accredited by Eskom Distribution for Substations, Control Plant and HV lines.
2. It is advisable that the EPC Contractor also appoints the same Sub-contractor to construct both the IPP as well as the Eskom parts of the Grid Connection Works.

5. ENVIRONMENTAL AGGRESSIVENESS

1. The Contractor shall take into account the conditions found at the Site and in the subsurface layers in order to avoid any corrosion problems above and underground, especially with equipment installed outdoors. Additionally, respective environmental requirements shall be included and taken into consideration after the respective EIA submission. Given the location of the Site, the Contractor shall confirm the atmosphere and soil corrosivity category for further observation and proper design accordingly protection to SANS 12944 Part 1 to 8 for steel structures. Additionally, corrosion protection shall be designed, as a minimum, for design operational lifespan of 25 years and the

specific location conditions, such as soil chemical testing results, humidity, wind loading, ambient temperature, proximity to ocean/sea for salt mist concentration and air corrosivity, etc.

2. The Contractor shall ensure that precautions are taken in packing and crating, to avoid damage to the protective treatment during transportation to the Site. Any damage to paintwork which occurs during transport shall be made good at Site. All surfaces shall be thoroughly cleaned prior to any painting, in accordance with the requirements of the specific paint used.
3. Paint shall be stored in dry covered conditions and shall not be used if it has been in storage for more than three (3) months or not used for more than six (6) months after the manufacture date.
4. Unless otherwise specified, galvanising shall be hot dip galvanising in accordance with SANS 121 and SANS 14713 Part 2. Bolts, nuts, and washers together with all other threaded components used as fasteners shall be finished with a centrifugal galvanised coating in accordance with this standard.
5. The thickness of zinc in every galvanized element shall be higher than the calculated minimum thickness required in all its sides and parts. Local mean thicknesses below the minimum calculated thickness shall be avoided.
6. All drilling, punching, stamping, cutting and welding of parts together and removal of burrs shall be completed before articles are galvanised in accordance with SANS 121 and SANS 14713 Part 2. Any Site modifications of galvanised steelwork shall be made good with an approved cold galvanising system as reviewed by the Employer.
7. Materials and coatings for all structures shall be based on the findings of the soil chemical testing and with a durability range of at least 25 years.
8. Details shall be provided of any special finishes including those on components manufactured from sheet aluminium or steel.
9. All ferrous metals shall be protected from corrosion in accordance with SANS 121, SANS 14713, SANS 12944 or equivalent local or internationally recognised standards. The exposure conditions to be used shall be entirely suitable for the type and intended purpose of each structure, taking full account of the components' and Plant's location.
10. Where the Contractor uses a paint system for corrosion protection, the Contractor shall ensure that the paint system is applied in full accordance with the manufacturers' recommendations and that each coat applied to any member shall be from the same manufacturer.
11. The Contractor shall submit full details of its proposals for corrosion protection for Employer's consideration. Proper analysis for avoidance of galvanic corrosion due to contact between different metals shall be done and justified if required.
12. All external coating systems shall be designed to be UV resistant from the UV radiation spectrum expected for the Site.
13. Considerations must be given to fauna protection of all equipment and materials which may come into contact with rodents or other vermin. This includes cable sheaths, outdoor switchboards transformers and switchgear buildings, etc. Means of protection shall be valid under planning approval conditions and environmental management plan.
14. The Works shall be adequately protected against any kind of frost damage if applicable to the location.

6. GRID CODE REQUIREMENTS

1. The Contractor shall ensure that his design complies with the requirements of the Grid Connection Code for Renewable Power Plants (RPPs) Connected to the Electricity Transmission System (TS) or the Distribution System (DS) in South Africa.

2. In addition, the protection and telecommunication system of the substations shall comply with Standard for The Interconnection of Embedded Generation (240-61268576).

7. CRITICAL REFERENCES

1. Normative references (Section 2.2.1) of 474-12955 viz, this Functional Specification
2. Appendix C: PV Plant Codes and Standards