

Appendix 36: Electrical Networks and Distribution Connection Works

1 Introduction

This annexure provides guidance to the Bidders on the Electrical Networks, the Delivery Point options within each Electrical Network, and the Distribution Connection Works required for each Delivery Point option.

A diagram of the overall concept for the Facility Connection Works and Distribution Connection Works is provided in Appendix A.

2 Electrical Networks

2.1 Stellenbosch Electrical Network

The Stellenbosch Electrical Network is structured around five 66/11 kV primary substations namely Main substation, Jan Marais substation, Markotter substation, University substation, and Golf Club substation. Main substation is supplied by Eskom at 66 kV from Eskom's adjacent 132/66/11 kV substation. From there, Main substation distributes power to the 11 kV busbar within Main substation, as well as to the other four 66/11 kV substations within the Stellenbosch Electrical Network, via a 66 kV ring.

The location of the Stellenbosch Electrical Network and the five primary substations referred to above are shown in Figure 2-1 below. A single line diagram of the Stellenbosch Electrical Network is provided in Appendix B.



Figure 2-1: Stellenbosch and Cloetesville Substation Locations

2.2 Cloetesville Electrical Network

The Cloetesville Electrical Network is directly adjacent on the northern side of the Stellenbosch Electrical Network.

The Cloetesville substation is supplied from Eskom by a single circuit 66 kV overhead powerline and is equipped with 2 x 20 MVA, 66/11 kV power transformers, owned by Stellenbosch Municipality. Power is distributed in the Cloetesville area at 11 kV.

The location of the Cloetesville Electrical Network is shown in Figure 2-1 above. A single line diagram of the Cloetesville Electrical Network is shown in Figure 2-2.

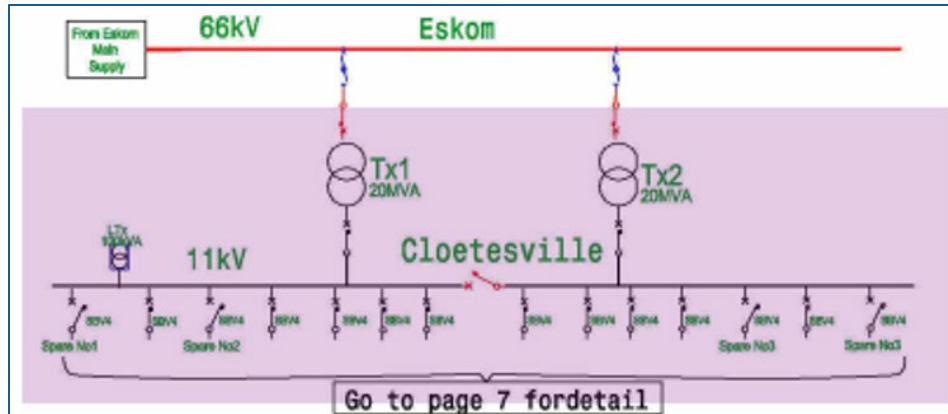


Figure 2-2: Cloetesville Electrical Network SLD

2.3 Franschhoek Electrical Network

The Franschhoek 66/11 kV substation is supplied by ESKOM, via a 66 kV single circuit powerline.

The 66 kV equipment is of the outdoor type, and the Eskom battery limit is the 66 kV busbar isolator. All the other downstream equipment, including the 66 kV busbar, belongs to the Municipality.

The Municipality steps down from 66 kV to 11 kV via two 20 MVA transformers which feed to an indoor switchboard. Power is distributed throughout the Franschhoek Electrical Network at 11 kV.



Figure 2-3 Franschhoek Substation Location

2.4 Bien Donne Electrical Network

Bien Donne Electrical Network currently consists of three separate, small networks which receive their electricity supply from three intake points supplied by Drakenstein Local Municipality. Stellenbosch Municipality will construct a new Eskom substation referred to as Bien Donne, which will effectively combine these three networks with a single intake point supplied directly by Eskom Distribution.



Figure 2-4 Bien Donne Electrical Network

3 Summary of Delivery Point Options

Table 3-1 below provides a summary of the 66 kV and 11 kV Delivery Point options for each Electrical Network.

Table 2 shows the Maximum Capacity (for solar PV and BESS combined) which can be connected per Delivery Point option, based on the network constraints at that Delivery Point. For the avoidance of doubt, the Maximum Contracted Capacity for Solar PV Projects and BESS Projects for each Electrical Network is as per clause 4.2.3.13 and clause 4.2.3.15 of the RFP.

The co-ordinates for each substation location are provided in Table 3-4.

Table 3-1: Summary of Delivery Point Options

Location	66 kV Feed In	11 kV Feed In
Stellenbosch Main (Stellenbosch Network)	66 kV feed-in not possible.	The 11 kV switch room has no space for additional panels. Outdoor RMUs to be constructed.
Jan Marais (Stellenbosch Network)	An additional 66 kV feeder bay can be constructed.	The existing 11 kV switch room has spare space for two (2) additional ABB ZX1.2 panels, that can be added to the existing indoor switchboard.
Markotter (Stellenbosch Network)	An additional 66 kV feeder bay can be constructed.	Existing Suidwal switching station has no space for additional panels. Outdoor RMUs to be considered, adjacent to the Suidwal Switching station.
University (Stellenbosch Network)	An additional 66 kV feeder bay can be constructed.	The 11 kV switch room has no space for additional panels. Outdoor RMUs to be constructed.
Golf (Stellenbosch Network)	66 kV feed-in not possible.	The switch room has spare space for two (2) additional ALSTOM SBV4 panels that can be added to the existing indoor switchboard.
Cloetesville	An additional 66 kV feeder bay can be constructed.	The switch room has spare space for one (1) additional ACTOM SBV4 that can be added to the existing indoor panel.
Franschhoek	An additional 66 kV feeder bay can be constructed.	The switch room has spare space for two (2) additional ALSTOM SBV 4 panels that can be added to the existing indoor switchboard.

Location	66 kV Feed In	11 kV Feed In
Bien Donne	Not considered (too expensive for the size of system at Bien Donne)	<p>Assume the following options:</p> <ol style="list-style-type: none"> 1. Connect to the new Eskom Bien Donne 11 kV switch room which will have spare indoor feeder panels for the IPP to utilise. 2. Connect to the backbone of any of the three existing 11 kV overhead lines (RFG, Pniel, Hollandse Mollen)

Table 3-2: Maximum Capacity (Solar PV and BESS combined) due to Network Constraints per Delivery Point Option

Substation	66 kV Feed In: Maximum Capacity	11 kV Feed In: Maximum Capacity	Additional Capacity Constraints for 11 kV Feed In Options
Stellenbosch Main (Stellenbosch Network)	0 MW	21.0 MW	Maximum 10 MW connected to single transformer
Jan Marais (Stellenbosch Network)	27.8 MW	19.0 MW	Maximum 9.5 MW connected to single transformer
Markotter (Stellenbosch Network)	27.8 MW	21.0 MW	Maximum 7.5 MW connected to single transformer
University (Stellenbosch Network)	27.8 MW	27.8 MW	Maximum 15 MW connected to single transformer
Golf (Stellenbosch Network)	0 MW	27.8 MW	Maximum 15 MW connected to a single transformer
Cloetesville	10.8 MW	10.8 MW	Maximum 10.8 MW connected to single transformer
Franschhoek	9.0 MW	9.0 MW	Maximum 9 MW connected to single transformer

Substation	66 kV Feed In: Maximum Capacity	11 kV Feed In: Maximum Capacity	Additional Capacity Constraints for 11 kV Feed In Options
Bien Donne	0 MW	1.7 MW	None

The figure below shows the maximum capacity (solar PV and BESS combined) that can be connected per Delivery Point without requiring additional network strengthening or protection upgrading.

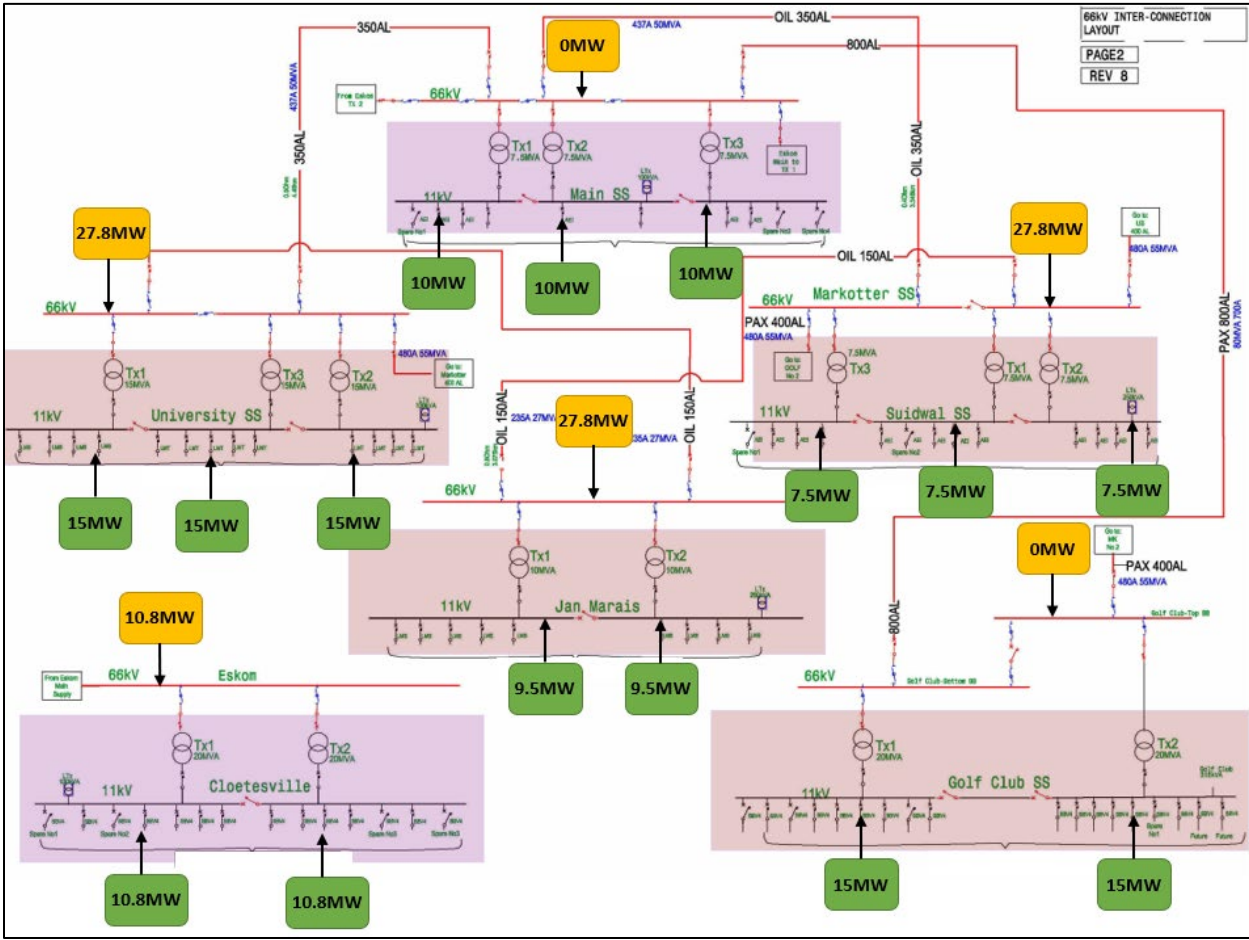


Figure 3-1: Illustration of the maximum capacity to be connected per Delivery Point

Table 3-3: Substation Locations

Substation	Longitude	Latitude
Stellenbosch Main (Stellenbosch Network)	18°49'36.69"E	33°56'33.18"S
Jan Marais (Stellenbosch Network)	18°52'40.33"E	33°55'50.32"S
Markotter (Stellenbosch Network)	18°51'26.10"E	33°56'31.36"S
University (Stellenbosch Network)	18°51'48.55"E	33°55'39.30"S
Golf (Stellenbosch Network)	18°51'10.47"E	33°57'31.38"S
Cloetesville	18°50'48.31"E	33°54'19.90"S
Franschhoek	19° 5'48.99"E	33°53'36.12"S
Bien Donne	18° 58'54.1"E	33°50'42.7"S

- Install new indoor 11 kV indoor switch room, equipped with indoor feeder panels, and metering facilities; or
- Install an outdoor RMU, with circuit breakers, and metering facilities.

5 Jan Marais Substation (Stellenbosch Network)

Jan Marais substation is interlinked within the Stellenbosch 66 kV ring network, through underground 66 kV cables from University and Markotter substations. The station is equipped with 2 x 10 MVA, 66/11 kV transformers.

5.1 66 kV Delivery Point Option

There is sufficient space to construct an additional 66 kV feeder bay at the Jan Marais substation, as illustrated in Figure 5-1 and Figure 5-2.

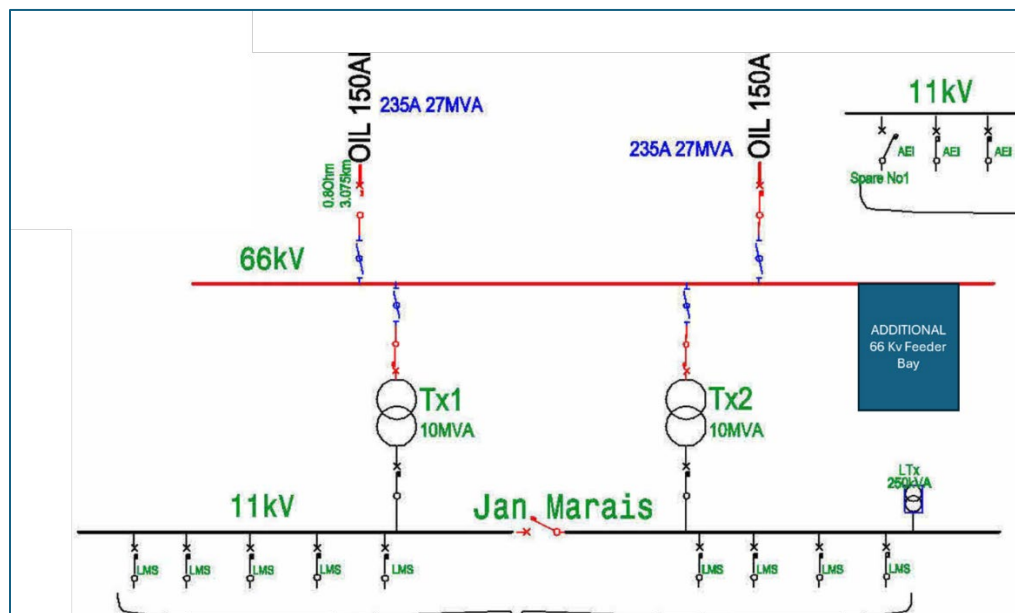


Figure 5-1: Jan Marais SLD



Figure 5-2: Jan Marais Outdoor Yard

Distribution Connection Works at Jan Marais Substation:

- Extend the existing 66 kV busbars.
- Civil Works to accommodate the additional 66 kV feeder bay, platform, foundations, steel support structures.
- Install and connect the feeder bay equipment, line Isolator, CT, circuit breaker, busbar Isolator.
- Supply and install a new protection and control panel, inside the HV control room. Protection panel to match existing units.
- Incorporate the new feeder bay into the existing SCADA system.
- Install a 66 kV underground or overhead feeder from the substation to the Solar PV or BESS Site.

Distribution Connection Works at the Solar PV and/or BESS Site:

- Construct a 66 kV feeder bay, complete with civil works, foundations, steel support structures and a control room.
- Install and connect the feeder bay equipment, line Isolator, CT, circuit breaker.
- Install a new protection, control and metering panel, inside the HV control room.

5.2 11 kV Delivery Point Option

There is sufficient space for two (2) additional 11 kV indoor feeder panels inside the Jan Marais 11 kV switch room. The switchboard make is the ABB ZX 1.2 type, which is a Gas Insulated Switchgear (GIS).

Distribution Connection Works at Jan Marais Substation:

- Install a maximum of two ABB ZX 1.2 indoor feeder panels and connect to existing switchboard
- Extend trench to accommodate the additional panel(s)
- Connect feeder cables to the new panels
- Incorporate the new feeder panel (s) into the existing SCADA system
- Install an 11 kV underground or overhead feeder from the substation to the Solar PV or BESS Site.

Distribution Connection Works at Solar PV and/or BESS Site:

- Install new indoor 11 kV indoor switch room, equipped with indoor feeder panels, and metering facilities; or
- Install an outdoor RMU, with circuit breakers, and metering facilities.



Figure 5-3: ABB ZX 1.2 panel

6 Markotter Substation (Stellenbosch Network)

Markotter substation is interlinked within the Stellenbosch 66 kV ring network, through underground 66 kV cables from Stellenbosch Main, Jan Marais and Golf substations. The station is equipped with 3 x 7.5 MVA, 66/11 kV transformers.

6.1 66 kV Delivery Point Option

The existing busbar at Markotter substation can be extended as highlighted in Figure 6-1 below.

The existing HV control room has no spare space for an additional feeder protection panel, thus will have to be extended.



Figure 6-1: Markotter SS Layout

Distribution Connection Works at Markotter Substation:

- Extend the existing 66 kV busbars.
- Civil Works to accommodate the additional 66 kV feeder bay, platform, foundations, steel support structures.
- Install and connect the feeder bay equipment, line Isolator, CT, circuit breaker, busbar Isolator.
- Extend the existing HV control room, to accommodate an additional protection, control and metering panel.
- Supply and install a new protection and control panel, inside the HV control room. Protection panel to match existing units at Jan Marais substation.
- Incorporate the new feeder bay into the existing SCADA system.

- Install a 66 kV underground or overhead feeder from the substation to the Solar PV or BESS Site.

Distribution Connection Works at the Solar PV and/or BESS Site:

- Construct a 66 kV feeder bay, complete with civil works, foundations, steel support structures and a control room.
- Install and connect the feeder bay equipment, line Isolator, CT, circuit breaker.
- Install a new protection, control and metering panel, inside the HV control room.

6.2 11 kV Delivery Point Option

The Markotter substation transformer feeders supply a nearby 11 kV switching station, namely Suidwal switching station.

The switching station has no additional space for extra feeder panels, therefore bidders are to supply outdoor RMU units should they opt for an 11 kV tie-in.



Figure 6-2: Markotter 66 kV and Suidwal 11 kV Substation Layout

Distribution Connection Works at Suidwal Substation:

- Install an outdoor RMU with metering facilities.
- Install an 11 kV underground or overhead feeder from the substation to the Solar PV or BESS Site.

Distribution Connection Works at the Solar PV and/or BESS Site:

- Install new indoor 11 kV indoor switch room, equipped with indoor feeder panels, and metering facilities; or
- Install an outdoor RMU, with circuit breakers, and metering facilities.

7 University Substation (Stellenbosch Network)

University substation is interlinked within the Stellenbosch 66 kV ring network, through underground 66 kV cables from Stellenbosch Main and Jan Marais substations. The station is equipped with 3 x 15 MVA, 66/11 kV transformers.

7.1 66 kV Delivery Point Option



Distribution Connection Works at University Substation:

- Extend the existing 66 kV busbars.
- Civil Works to accommodate the additional 66 kV feeder bay, platform, foundations, steel support structures.
- Install and connect the feeder bay equipment, line Isolator, CT, circuit breaker, busbar Isolator.
- Supply and install a new protection and control panel, inside the HV control room. Protection panel to match existing units at Jan Marais substation.
- Incorporate the new feeder bay into the existing SCADA system.
- Install a 66 kV underground or overhead feeder from the substation to the Solar PV or BESS Site.

Distribution Connection Works at the Solar PV and/or BESS Site:

- Construct a 66 kV feeder bay, complete with civil works, foundations, steel support structures and a control room.
- Install and connect the feeder bay equipment, line Isolator, CT, circuit breaker.
- Install a new protection, control and metering panel, inside the HV control room.

7.2 11 kV Delivery Point Option

The switching station has no additional space for extra feeder panels, therefore bidders are to consider outdoor RMU units should they opt for an 11 kV tie-in.

Distribution Connection Works at University Substation:

- Install an outdoor RMU with metering facilities.
- Install an 11 kV underground or overhead feeder from the substation to the Solar PV or BESS Site.

Distribution Connection Works at the Solar PV and/or BESS Site:

- Install new indoor 11 kV indoor switch room, equipped with indoor feeder panels, and metering facilities; or
- Install an outdoor RMU, with circuit breakers, and metering facilities.

8 Golf Substation (Stellenbosch Network)

Golf substation is a hybrid indoor / outdoor substation. The 66 kV and 11 kV switchgear are housed within a double storey concrete building, and the transformers are outdoors. The 66 kV switchgear is designed for outdoor usage, but housed indoors, thus the rooms are considered LIVE chambers.

The substation is interlinked within the Stellenbosch 66 kV ring network, through underground 66 kV cables from Stellenbosch Main and Markotter substations. The station is equipped with 2 x 20 MVA, 66/11 kV transformers.

8.1 66 kV Delivery Point Option (No Option)



Figure 8-1: HV Circuit Breaker Located Indoors

Due to the construction of the HV portion of the substation, a 66 kV tie in is not an option.

8.2 11 kV Delivery Point Option

There is sufficient space on the Golf substation 11 kV switchboard to add 2 additional indoor feeder panels.

Distribution Connection Works at Golf Substation:

- Install a maximum of two SBV 4 indoor feeder panels and connect to existing switchboard.
- Connect feeder cables to the new panels.
- Incorporate the new Feeder Panel (s) into the existing SCADA system.

Distribution Connection Works at the Solar PV and/or BESS Site:

- Install new indoor 11 kV indoor switch room, equipped with indoor feeder panels, and metering facilities; or
- Install an outdoor RMU, with circuit breakers, and metering facilities.



Figure 8-2: Space for Additional Panel on the switchboard Right Hand Side



Figure 8-3: Space for additional panel on the Switchboard Left Hand Side

9 Cloetesville Substation

The Cloetesville substation is responsible for supplying electricity to the Cloetesville, Welgevonden Estate, Kayamandi, and La Colline areas within Stellenbosch town.

The Cloetesville substation is equipped with 2 x 20 MVA, 66/11 kV power transformers. It is supplied from the Eskom network by a single circuit 66 kV overhead powerline.

9.1 66 kV Delivery Point Option

The 66 kV equipment is of the outdoor type, and the Eskom battery limit is the 66 kV busbar isolator.

The existing substation can be extended to accommodate an additional 66 kV feeder bay, although this will require an extension of the substation yard.

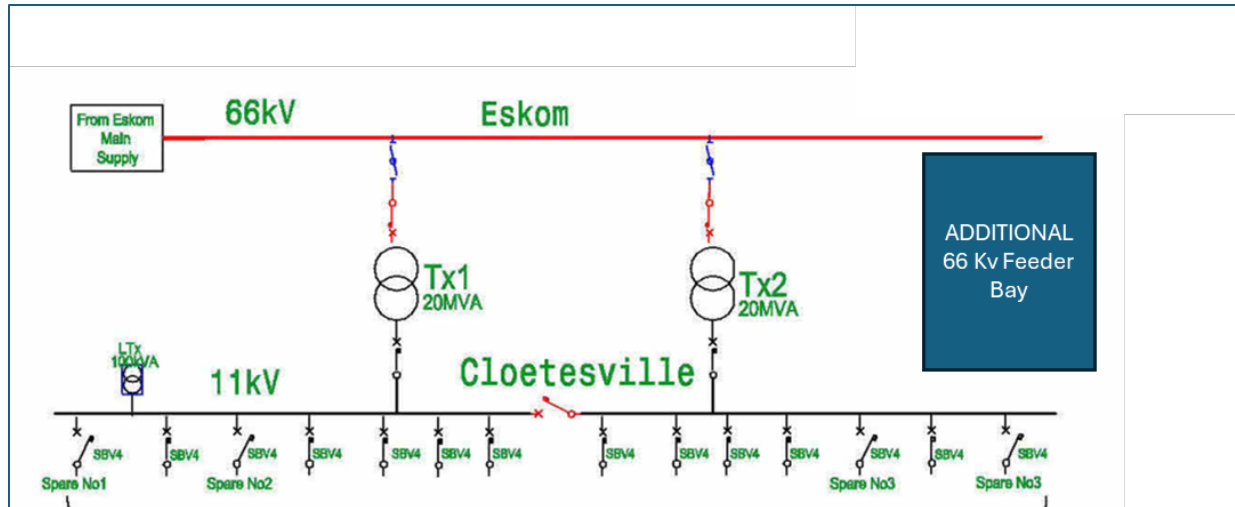


Figure 9-1: Cloetesville SLD

Distribution Connection Works at Cloetesville Substation:

- Extend the existing 66 kV busbars.
- Civil Works to accommodate the additional 66 kV feeder bay, platform, foundations, steel support structures.
- Install and connect the feeder bay equipment, line Isolator, CT, circuit breaker, busbar Isolator.
- Supply and install a new protection and control panel, inside the HV control room. Protection panel to match existing units at Jan Marais substation.
- Incorporate the new feeder bay into the existing SCADA system.
- Install a 66 kV underground or overhead feeder from the substation to the Solar PV or BESS Site.

Distribution Connection Works at the Solar PV and/or BESS Site:

- Construct a 66 kV feeder bay, complete with civil works, foundations, steel support structures and a control room.
- Install and connect the feeder bay equipment, line Isolator, CT, circuit breaker.
- Install a new protection, control and metering panel, inside the HV control room.



Figure 9-2: Cloetesville Outdoor Yard

9.2 11 kV Delivery Point Option

There is sufficient space to accommodate 1 additional Alstom SBV 4 indoor feeder panel at Cloetesville substation, should the Bidders opt for an 11 kV tie-in.

Distribution Connection Works at Cloetesville Substation:

- Install a maximum of 1 x SBV 4 indoor feeder panels and connect to existing switchboard
- Connect feeder cables to the new panels
- Incorporate the new Feeder Panel (s) into the existing SCADA system

Distribution Connection Works at the Solar PV and/or BESS Site:

- Install new indoor 11 kV indoor switch room, equipped with indoor feeder panels, and metering facilities; or
- Install an outdoor RMU, with circuit breakers, and metering facilities.



Figure 9-3: Space for 1 Additional Actom SBV 4 Panel

10 Franschhoek Substation

The Franschhoek 66/11 kV substation is supplied by ESKOM, via a 66 kV single circuit powerline.

The 66 kV equipment is of the outdoor type, and the Eskom battery limit is the 66 kV busbar isolator. All the other downstream equipment, including the 66 kV busbar, belongs to the Municipality.

The Municipality steps down from 66 kV to 11 kV via two 20 MVA transformers which feed to an indoor switchboard.

10.1 66 kV Delivery Point Option

There is sufficient space in the outdoor yard to construct an additional 66 kV outdoor feeder bay, as shown in Figure 10-1 and Figure 10-2 below.

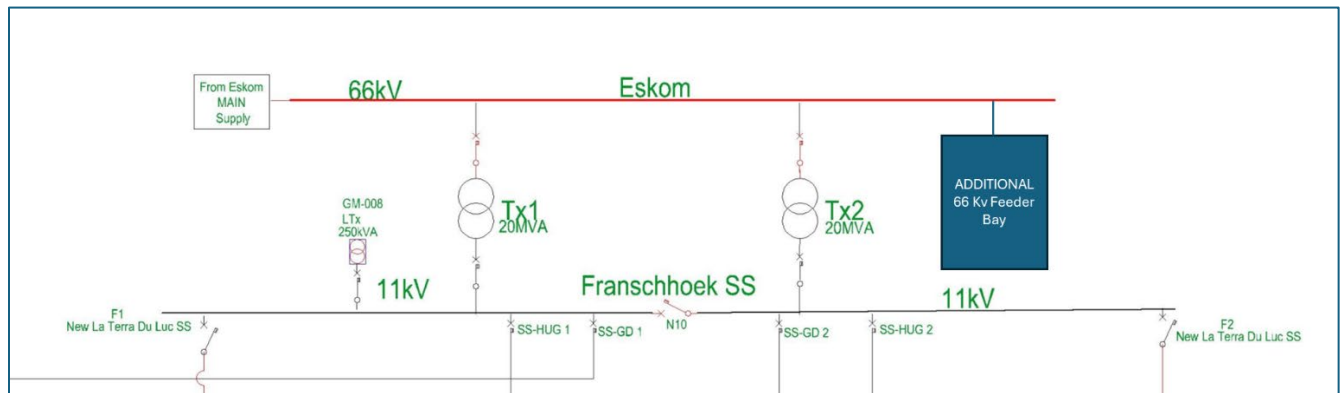


Figure 10-1: Franschhoek Main SLD



Figure 10-2: Franschhoek Main SS Layout

Distribution Connection Works at Franschhoek Substation:

- Extend the existing 66 kV busbars.
- Civil Works to accommodate the additional 66 kV feeder bay, platform, foundations, steel support structures.
- Install and connect the feeder bay equipment, line Isolator, CT, circuit breaker, busbar Isolator.
- Supply and install a new protection and control panel, inside the HV control room. Protection panel to match existing units at Jan Marais substation.
- Incorporate the new feeder bay into the existing SCADA system.
- Install a 66 kV underground or overhead feeder from the substation to the Solar PV or BESS Site.

Distribution Connection Works at the Solar PV and/or BESS Site:

- Construct a 66 kV feeder bay, complete with civil works, foundations, steel support structures and a control room.
- Install and connect the feeder bay equipment, line Isolator, CT, circuit breaker.
- Install a new protection, control and metering panel, inside the HV control room.

10.2 11 kV Delivery Point Option

The current board is equipped with ALSTOM SBV 4 panels, and the Bidder will have to supply exactly the same panels for extension of the switchboard.

The existing 11 kV indoor feeder bay has sufficient space for 2 additional panels.

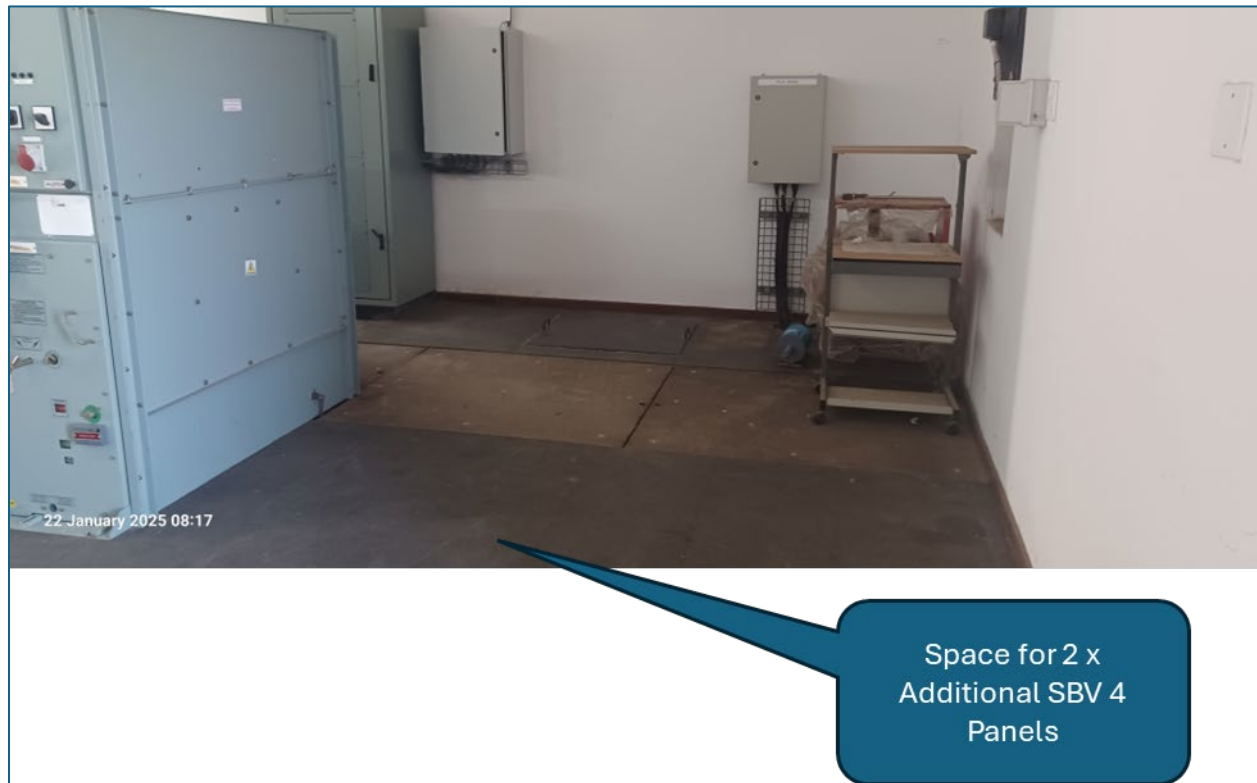


Figure 10-3: Indoor Switchboard Spare Space

Distribution Connection Works at Franschoek Substation:

- Install a maximum of two SBV 4 indoor feeder panels and connect to existing switchboard.
- Extend trench to accommodate the additional panel(s).
- Connect feeder cables to the new panels.
- Incorporate the new Feeder Panel (s) into the existing SCADA system.

Distribution Connection Works at the Solar PV and/or BESS Site:

- Install new indoor 11 kV indoor switch room, equipped with indoor feeder panels, and metering facilities; or
- Install an outdoor RMU, with circuit breakers, and metering facilities.

11 Bien Donne

11.1 11 kV Substation Delivery Point Option

This option involves connection to the new Bien Donne substation (not constructed yet).

Distribution Connection Works at new Bien Donne Substation:

- Connect feeder cables to the existing 11 kV feeder panels.

Distribution Connection Works at the Solar PV and/or BESS Site:

- Install new indoor 11 kV indoor switch room, equipped with indoor feeder panels, and metering facilities; or
- Install an outdoor RMU, with circuit breakers, and metering facilities.

11.2 11 kV Feeder Backbone Delivery Point Option

Distribution Connection Works at the existing 11 kV overhead line / feeder backbone:

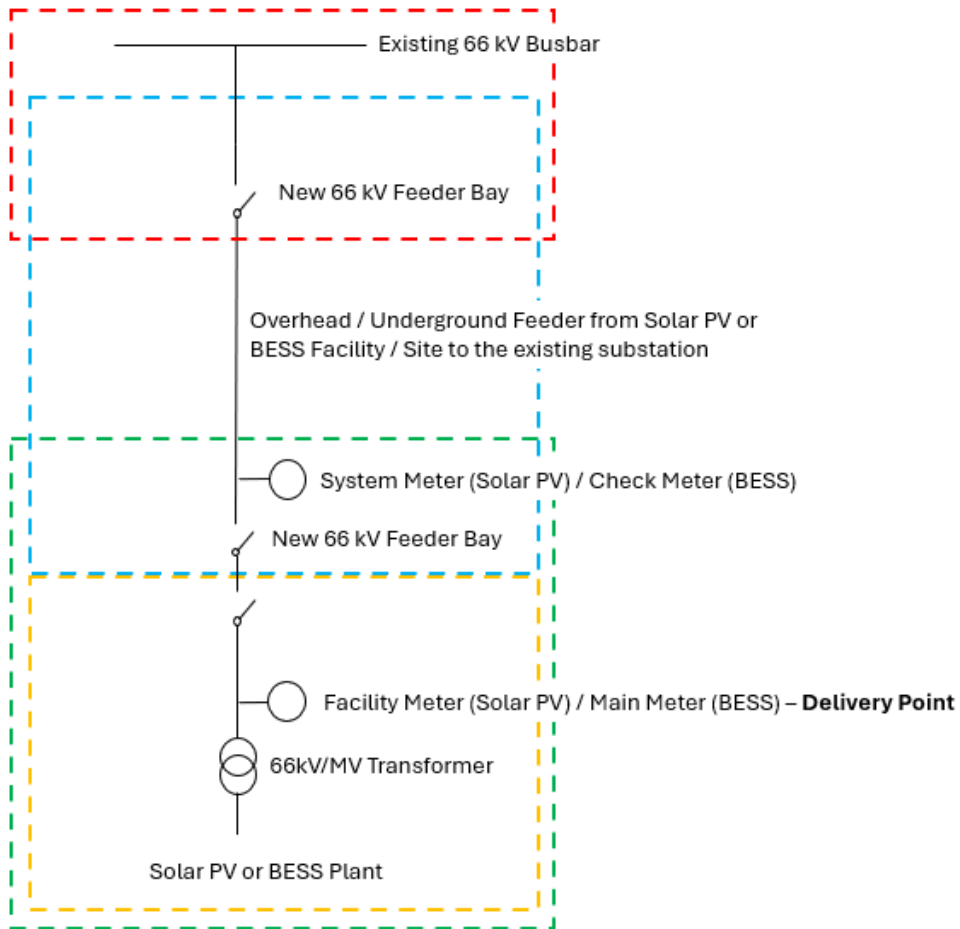
- Install an outdoor RMU, with circuit breakers.
- Connect overhead line (of the same capacity or larger) from the Solar PV and/or BESS Site to the new outdoor RMU.
- Incorporate the new Feeder Panel into the existing SCADA system.

Distribution Connection Works at the Solar PV and/or BESS Site:

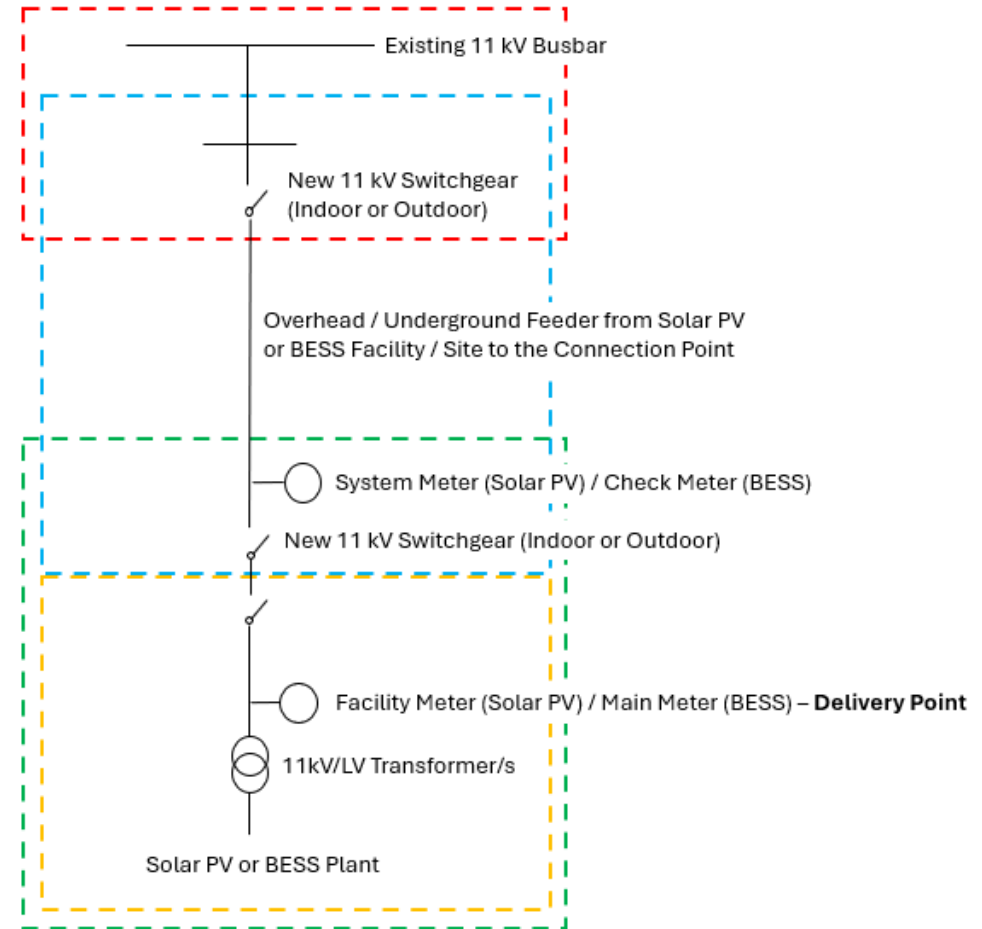
- Install new indoor 11 kV indoor switch room, equipped with indoor feeder panels, and metering facilities; or
- Install an outdoor RMU, with circuit breakers, and metering facilities.

Appendix A: Distribution and Facility Connection Works Concept Diagram

Indicative 66 kV Connection Arrangement



Indicative 11 kV Connection Arrangement



Equipment Located at the existing substation

Equipment Located at the Solar PV or BESS Facility / Site

Distribution Connection Works (Financed, Constructed by Seller. Handed over to Buyer to Own, Operate, Maintain)

Facility Connection Works (Financed, Constructed, Owned, Operated, Maintained by Seller)

Appendix B: Stellenbosch Electrical Network SLD

