SA Power Networks does not take any responsibility for the accuracy or validity of any information provided by you or your agent. This response does not in any way acknowledge or accept the correctness of the information you have provided. SA Power Networks has not undertaken any validation or verification of the information you have provided. Any information found to be incorrect in any way in the future will invalidate this response.

Attachment 1: Requirements and Information

1. Installation to take place at 150 Quinliven Road, Aldinga, SA 5173, with connection to the SA Power Networks distribution network on the Willunga West 11kV feeder, MV63, at the existing 2MVA padmount transformer, TC65381.

2. One of 119.6kVA Photovoltaic Inverter (PVI) system, consisting of 4 of Sungrow (SG30CX) 29.9kVA Inverters, suitable network protection equipment (NPU), listed as a Woodward Easyprotec protection relay, and other ancillary equipment, to be installed at this location.

Note: SA Power Networks has not undertaken any validation or verification of the proposed inverters. It is the responsibility of the customer or customer's representative to ensure that the capability and functionality of all inverters meet all requirements of SA Power Networks' technical standards (TS130) including the power quality response modes. If there are existing generating systems on site, please ensure that the settings of the existing inverters are updated to the latest technical requirements if capable to do so to avoid potential operational issues between the new and old generating systems.

The following applies as of the 28th of September 2020, as per SA Government's Electricity (General) (Technical Standards) Regulations 2020:

Generating Systems connecting to the SA Power Networks distribution network are required to have the capability for remote disconnection/reconnection functionality by the 31st December 2020. The responsibility is on the installer/manufacturer to ensure systems are compliant with the regulation requirements, and on the system owner to ensure it is functional. SA Power Networks will require all Generating System owners to specify their Relevant Agent and the intended technical solution to be used to achieve remote disconnection/reconnection.

Additionally, any Generating System connected via an inverter to the SA Power Networks distribution network must comply with new undervoltage ride-through performance standards designed to mitigate impacts on the South Australian power system during disturbances. Hence any inverter used within the Generating System must be a designated inverter listed on the VDRT approved inverter list from the OTR. In the case that the proposed inverter has not yet listed on the VDRT approved inverter list, the Proponent must provide written confirmation that they are aware the inverters are non-compliant, they accept all liability for revision of the Engineering Report. This includes all associated fees should the inverters need to be changed, including any losses incurred should SA Power Networks deny or delay connection of the Generating System until the inverter is listed. Please refer to the link below for further information:
https://www.energymining.sa.gov.au/energy_and_technical_regulation/energy_resources_and_supply/regulatory_changes_for_smarter_homes

3. Location currently defined by supplied NMI number: 20023458749.

4. Customer, or Customer's representative, should advise SA Power Networks, Patricia McHendrie, of the proposed date of commissioning of the installation.

5. Customer or Customer's representative should supply to SA Power Networks, Patricia McHendrie, a signed and dated document indicating that the PVI system has been installed as per the single line diagram and other relevant information not previously supplied.

6. Pre- and post-commissioning logger test is deemed not required for this project.

7. Final Settings:
So that SA Power Networks can make a final assessment on the suitability of the PVI Generating System connection, the Customer should submit any outstanding protection settings or any other additional items SA Power Networks have requested in the Offer letter.

- This must be **1 month prior** to the date the Customer wishes to demonstrate the compliance tests
- The information will include, but is not be limited to:
    - Settings for the inverters
    - Settings for the back up anti-islanding protection device(s)
- The setting information may be included as part of the commissioning program.

SA Power Networks will review and comment on these final settings within **10 business days**.

8. All PVI systems supplied from the same transformer/service point/NMI, on the same property, should have a common network protection unit/back-up anti-islanding device relevant to their respective functions. Those systems, which share a common transformer/service point/NMI, but not an NPU, will need a valid reason why this is not feasible, and this should be submitted in writing to SA Power Networks.

9. All Low Voltage cables selected for the PVI system should be correctly rated for the expected PVI generated currents and associated voltage rise across these conductors.

10. Model analysis of the proposed PVI system has been done using *LV Drop Software* and ENA-supplied analysis application.

11. For the purposes of the model and analysis, with respect to the Customer's internal wiring, the following conductor details have been used:
(a) Conductor between transformer TC65381 and the MSB is modelled as 25m of 400mm^2 1C Cu/PVC cable, 1 conductor per phase.
(b) Conductor between the MSB and the Solartune PVDB containing the network protection unit (NPU) is modelled as 15m of 95mm^2 1C Cu/PVC cable, 1 conductor per phase.
(c) Conductor between the Solartune PVDB and Inverter 1 is modelled as 3.5m of 10mm^2 4C+E Cu/PVC cable, 1 conductor per phase.
(d) Conductor between the Solartune PVDB and Inverter 2 is modelled as 5m of 10mm^2 4C+E Cu/PVC cable, 1 conductor per phase.
(e) Conductor between the Solartune PVDB and Inverter 3 is modelled as 6.5m of 10mm^2 4C+E Cu/PVC cable, 1 conductor per phase.
(f) Conductor between the Solartune PVDB and Inverter 4 is modelled as 8m of 10mm^2 4C+E Cu/PVC cable, 1 conductor per phase.

This information should be forwarded to the Customer's representative for confirmation and if incorrect, the correct details should be supplied to SA Power Networks in order that a more accurate model can be developed. The Customer's representative should confirm in writing that the conductor details described here are accurate. Failure to do so may result in the Customer's obligation to compensate for any augmentation required by SA Power Networks to ensure the PVI system operates correctly. This could include replacing the existing distribution transformer with a unit capable of adjusting the Low Voltage levels associated with this system.

12. The wiring of the network protection unit, (Anti-Islanding relay), should be such that its operation does not cause the loss of network supply to the Main Switchboard or any other part of the premises not directly connected to the PVI system, unless the installed system is specifically designed to be able to operate in an islanded state, utilizing the PVI generated energy or the stored energy component of the system during periods of SA Power Networks network supply outage, **refer to paragraph 20 below.**

13. It is recommended that the Anti-Islanding/network protection unit, which controls the disconnection of the PVI system from the SA Power Networks network through circuit breakers or contactors, should be a device with an adjustable reset period, (as per AS4777.2:2020, set for 60 seconds, following a system healthy check), that will reclose automatically, (after the system healthy check and set delay). Alternatively, if the circuit breaker/contactor does not have an automatic reset option, then some form of warning to alert the Customer of a PVI failure should be installed.

14. The PVI installation, (inverters and network protection unit), should be installed in such a way so as not to be accessible to the general public or persons not involved in the construction/installation, commissioning, operation and maintenance of the PVI system.

15. The presence of all PVI systems should be clearly labelled on all distribution boards where mechanical isolation will be required to make the site safe. The existence and locations of all PVI systems on the same property should be clearly exhibited on all distribution boards, including directions to each of the PVI systems' mechanical points of isolation, whether or not these systems share the same transformer/service point/NMI.

16. Whilst generating electricity and connected to the Network, the Proponent must maintain at the Connection Point a power factor dictated by the power quality response modes (4.3 Volt Response Modes) that are enabled from the inverter system which may vary from time to time to suit the Network requirements, taking into consideration the technical and reasonable limitations of the Generating System.

17. In the event that the Customer has, or intends to install, rotational back-up generation; the Customer should be made aware of the importance of isolating the proposed PVI system **BEFORE** operating any on-site rotational generator, (break before make isolation). Failure to do so may result in damage to the PVI system and / or the malfunctioning of the rotational generating unit. Customer /Contractor should be aware of the SA Power Networks recommendation that ANY stand-by generator should not be operated in parallel with the proposed PVI system.

18. In the event that the Customer's PVI installation cause Power Quality issues affecting this and other Customers connected to the same SA Power Networks electrical network, SA Power Networks will request that the Customer alter inverter and / or protection relay settings in order to comply with SA Power Networks requirements which are based upon the Electricity Industry of South Australia Act and Regulations, (1995), National Electricity Rules of Australia, (2015), relevant Australian Standards, SA Power Networks Service and Installation Rules and relevant SA Power Networks Technical Standards.

19. This Photovoltaic Inverter system shall be compliant with all relevant sections of: (a) The Electricity Industry of South Australia Act and Regulations, (1995); (b) The National Electricity Rules of Australia, (2015); (c) Australian Standards, specifically AS/NZS 4777.2:2020 Part 2: Inverter Requirements, AS/NZS 4777.1:2016 Installation Requirements, AS 62040.1.1 Uninterruptable Power Systems (UPS), AS/NZS 3000:2018 Wiring Rules, AS/NZS 5033:2014: Installation and Safety Requirements for photovoltaic (PV) arrays; (d) SA Power Networks Service and Installation Rules; (e) SA Power Networks Technical Standards.

20. If the Energy Storage Inverter System, (ESI System – Batteries), is to be installed so as to be able to supply electrical power to the property at which the device is installed during periods when the SA Power Networks network is not energised, (stand-alone / islanded operation), then **under no circumstances should the system be able to export electrical energy to the SA Power Networks network during a network outage.**

A clearly labelled physical disconnection device between the Customer's network and the SA Power Networks network must be installed. This device shall be operated manually or automatically in order to create an "islanded" electrical network **prior** to the utilisation of locally generated or stored electrical energy when the SA Power Networks network is de-energised. The device's status should be clearly visible without the need to check this condition using electrical testing equipment. The successful operation of this device should be demonstrated at commissioning

21. Your responsibilities as a generator of electricity

You also need to be aware that by installing a LEG/SEG, you are taking on the responsibilities and obligations of a generator of electricity. We strongly recommend that you read and understand that by proceeding with the LEG/SEG installation you will be deemed to have agreed to SA Power Networks terms and conditions, including the requirements specified in SA Power Networks Embedded Generation Technical Guidelines:

https://www.sapowernetworks.com.au/centric/customers/embedded_generation.jsp

Should SA Power Networks find your LEG/SEG installation is interfering with the electricity supply to others in your area you may be required to take action to remedy this situation, including turning off or modifying your LEG/SEG installation in accordance with the requirements of the SA Distribution Code. It is a requirement of the Electricity Act (1996), the National Energy Retail Regulations and the National Electricity Laws of the National Electricity Market that all SEG installations connected to the SA Power Networks distribution network must be connected to metering that measures both import and export energy flows. In addition, in accordance with SA Power Networks Service and Installation Rules (February 2016) rule 7.5.1 and 7.5.1.4, where a customer initiates a change to their electrical installation that necessitates a change to their existing metering requirements, such as the installation of a LEG/SEG, the customer must at their cost install meter isolator(s) on their meter board prior to the installation of the new meter(s).

22. Note the following:

Depending on the installed capacity of the embedded generator, the customer may need to obtain a Generating License, (or exemption), from the Essential Services Commission of South Australia. Provision of a Generation License is the responsibility of the generator customer. Further details on licensing requirements are available on the ESCOSA internet site (http://www.escosa.sa.gov.au).

Generation operations which require a licence,

Section 15(2) (a) of the *Electricity Act 1996* (the Act) is explicit in that it requires a person that carries on the operation of the generation of electricity to hold a licence. This requirement applies to all generators with the exception of a generator that can rely on:

(1) one of the statutory exemptions specified in the *Electricity (General) Regulations 1997* (Regulations) outlined below;

(2) an individual exemption issued by the Commission, (with the approval of the Minister), pursuant to section 80(1) of the Act; or

(3) an exemption made by the Governor under a regulation pursuant to section 98(2) (e) of the Act.

Pursuant to Regulations 6(1) and (2), the following generators are exempt from the requirement to hold a generation licence:

- a generator whose generating plant has a rated nameplate output of 100kVA or less;
- a generator that does not supply electricity for reward to or by means of a transmission or distribution network;
- a generator that generates electricity for the sole consumption of that generator or a designated body, (such bodies must be designated by the Minister); or
- a generator that generates electricity for a person at a premises occupied or used by the person as a tenant or licensee, (whether directly or indirectly), of the generator, (or a designated body), where that person is not charged for the supply of electricity except by a licensed retailer/generator or as an unspecified part of rent or charges for the occupation or use of the premises.

23. Metering: Prior to requesting a commissioning witnessing by SA Power Networks, the Customer must ensure the following with respect to the metering of the site.
With reference to the Service and Installation Rules, Section 7.5.5
23.1 There must be installed at the Supply Address, a metering installation which is either a bi-directional meter that measures net Watts and Volt-Amperes for both import and export electricity flows or interval type metering which enables the gross measurement of Watts and VArh for both import and export electricity flows;
23.2 The Embedded Generator must remain locked off, and may not be connected to the Distribution Network until the metering installation installed at the Supply Address is compliant with 23.1 above.

<u>Attachment 2:</u> Additional network augmentation and/or other work required prior to, (or after), connection/commissioning of proposed 119.6kVA PVI system:
Nil.

<u>Attachment 3</u>:
(a) Inverter settings for PVI and/or ESI systems

PROTECTION	TYPE	SETTING (e.g. 230/400V)	TRIP DELAY TIME (SEC)	MAXIMUM DISCONNECTION TIME (SEC)
Over Voltage 1	V	115% Nominal Voltage (265V)	1	2
Over Voltage 2	V	120% Nominal Voltage (275V)	-	0.2
Under Voltage 1	V	78% Nominal Voltage (180V)	10	11
Under Voltage 2	V	30% Nominal Voltage (70V)	1	2
Sustained over-voltage[1]	V	112% Nominal Voltage (258V)	-	-
Over Frequency	f	52 Hz	-	0.2
Under Frequency	f	47 Hz	1	2

(b) PVI & ESI back-up Anti-Islanding protection settings

PROTECTION	TYPE	SETTING (e.g. 230/400V)	TRIP DELAY TIME (SEC)
Over Voltage 1	V	115% Nominal Voltage (265V)	2
Over Voltage 2	V	120% Nominal Voltage (275V)	0.2
Under Voltage 1	V	78% Nominal Voltage (180V)	11
Under Voltage 2	V	30% Nominal Voltage (70V)	2
Sustained over-voltage[1]	V	112% Nominal Voltage (258V)	-
Over Frequency	f	52 Hz	2
Under Frequency	f	47 Hz	2

<u>Grid protection requirements</u>

- The grid protection device shall operate if supply from the grid is disrupted, when the grid voltage or frequency goes outside pre-set parameters, or to prevent islanding.
- Under/over voltage and frequency requirements are passive anti-islanding protection.
- The grid protection device shall incorporate at least one method of active anti-islanding protection. This is required to prevent islanding occurring in a situation where multiple inverters provide a frequency and voltage reference for one another, causing the passive anti-islanding protection to fail.

[1] based on average value over a period of 10min

- Reconnection is permitted with Soft Ramp up after reconnect enable 16.67% when voltage and frequency are in the acceptable range for at least 60 seconds and the inverter energy system and the electricity distribution network are synchronized and in-phase with each other.

(c) Rate of Change of Frequency (ROCOF)

As the capacity of the Generating System is greater than 30kVA, a protection system must be installed that includes ROCOF protection. The Generating System must be capable of continuous uninterrupted operation for one of the following rate of change of frequencies:

ROCOF	DURATION
Hz/s	**Sec**
±4	0.25
±3	1

It should also be noted that additional protection and control approaches may be required by the distributor in isolated electricity distribution networks and exceptional, atypical circumstances.

Attachment 4: Further important information which should be noted and acted upon by the Installer and Customer

4.1 Customer/Contractor and Installer should ensure that they familiarize themselves with the Australian/New Zealand Standard: AS/NZS 4777.1:2016, (Part 1 Installation Requirements), and AS/NZS 4777.2:2020, (Part 2 Inverter Requirements), so as to ensure that the proposed PVI system is compliant with these standards. No exceptions will be permitted. Proposed compliant inverters should also be accurately described on the current Clean Energy Council list of approved inverters.

4.2 Demand Response Mode
Australian/New Zealand Standard AS4777.2:2020 specifies that inverters installed shall have Demand Response Modes, (DRM), available and connected to a Demand Response Enabling Device, (DRED), Section 3, (generally), and Section 3.2.2, (specifically).
Customers/consultants should familiarize themselves with the standard, and, with respect to voltage rise control, the following section:

4.3 Volt Response Modes
Customer should consider the relay and inverter settings as per Attachment 2 enclosed here and confirm the proposed settings for this PVI system, and you and your electrical contractor/PVI/ESI installer shall ensure the following power quality response modes have been set in the inverter/s, (as per AS4777.2:2020 Section 3.3), and may not be changed without written approval from SA Power Networks. These settings should be confirmed at commissioning irrespective of the make and model of inverter installed.

Both power quality response mode settings must be enabled for inverters if a fixed power factor is not specified in Attachment 2. If a fixed power factor is specified in Attachment 2, only Volt-Watt is required to be enabled.

Sustained operation for Voltage variations (Clause 4.5.2 of AS 4777.2: 2020)

Reference	Voltage in Volts
$V_{nom-max}$	258

Volt-VAr response mode (Table 3.7 of AS 4777.2: 2020)

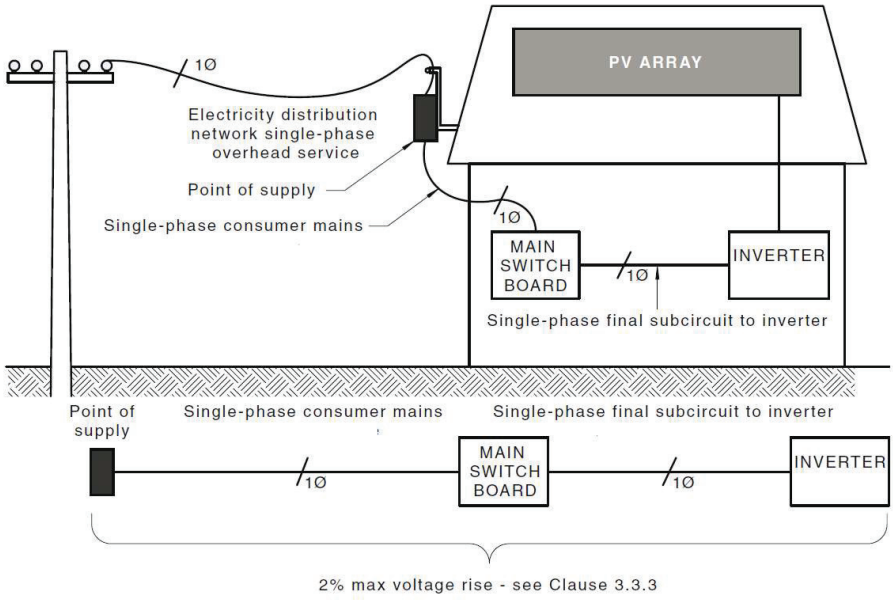
REFERENCE	VOLTAGE (e.g. 230/400V)	VAr % RATED VA
V_{V1}	90% Nominal Voltage (207V)	44% leading (sourcing VArs, 3.4%/V)
V_{V2}	96% Nominal Voltage (220V)	0
V_{V3}	104% Nominal Voltage (240V)	0
V_{V4}	112% Nominal Voltage (258V)	60% lagging (sinking VArs, 3.3%/V)

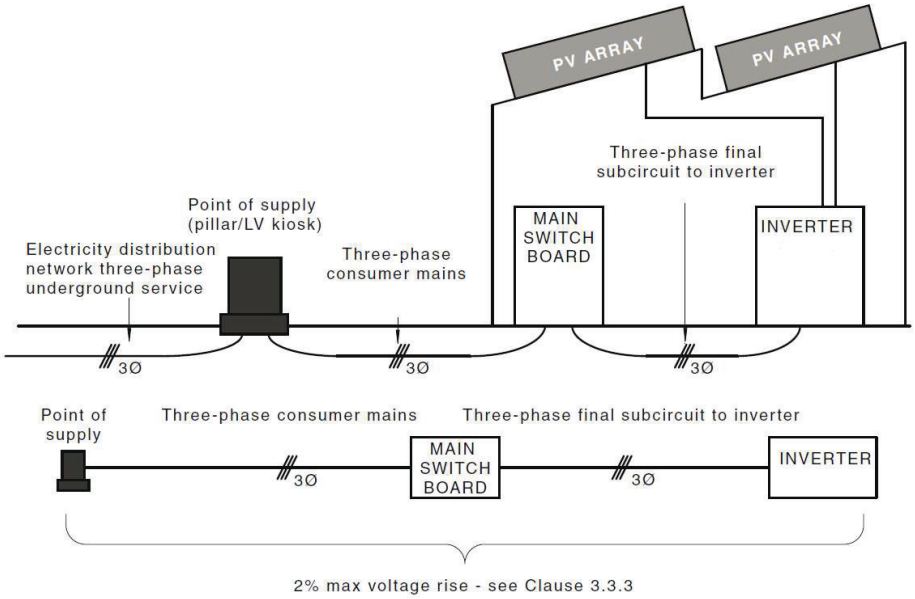
Volt-Watt response mode (Table 3.6 of AS 4777.2-2020)

REFERENCE	VOLTAGE (e.g. 230/400V)	W % RATED VA
V_{W1}	110% Nominal Voltage (253V)	100%
V_{W2}	113% Nominal Voltage (260V)	20% (11.4%/V)

4.4 Voltage Rise: Voltage Rise provisions: single and three phase systems

The voltage rise between the inverter and the distributor point of supply is to be less than 2%.





The allowable voltage drop as per AS/NZS 3000:2018, between the last general power outlet and the customer point of supply is currently 5%. However, for conditions of energy export, inverter outage caused by excessive voltage RISE may occur for some installations. Within the 5% window, the voltage at the inverter can move outside the AS4777.2:2020 voltage set points, while the voltage at the point of supply remains within distributor's regulatory limits. This discrepancy has resulted in two allowable voltage variations across Customer's wiring: that for volt drop, (5%), and the other for volt rise, (2%).

Disclaimer:

SA Power Networks takes no responsibility for any damage to any of the customer's infrastructure during Periods when the inverter(s) may be operating at voltages outside of the current Australian Voltage Standard.

Attachment 5: Commissioning Program Requirements

The commissioning and correct operation of the Generating System is the customer's responsibility. The components described in this document are to be used as a guide in order to satisfy SA Power Networks compliance requirements. The customer should communicate with the relevant Network Project Officer, (NPO), in order to determine a proposed commissioning witnessing date.

5.1 Commissioning Checklist:

As part of witnessing the compliance tests, the Customer must utilise the commissioning checklist template that outlines the testing that will be done on any of the equipment that may affect the security of the electricity Network and to allow SA Power Networks to understand what is proposed to be tested and the pass/fail criteria for each test. The commissioning checklist is available on line at: https://www.sapowernetworks.com.au/public/download.jsp?id=310392
or if the customer cannot access this, the Network Project Officer will forward a copy of the SAPN Commissioning Witnessing Checklist to the customer for use during site commissioning.

5.2 Other Documents:

SA Power Networks will not attend site and witness the compliance tests until the Customer has submitted the following:

- Documents showing compliance with all relevant Standards, including:
- A copy of the Electrical Certificate of Compliance;
- Single-Line Diagram (As Built)

The Customer must submit these documents to SA Power Networks **at least 5 business days prior** to the date the Customer wants SA Power Networks to attend site.
SAPN commissioning Officer will contact the customer a minimum of 2 business days before the target commissioning date to confirm the readiness of their system. Please note that if a rescheduled date is required by the customer, an extra fee may apply.

5.3 Commissioning Report:

The Customer must submit to SA Power Networks a copy of the commissioning test results within **20 business days** of undertaking the tests.
The test results should include:

- Completed and signed commissioning program.
- Measurement data, in a format suitable from a power quality logging device. If logging is required as specified in the Customer Offer, and the customer requests SAPN install the device, then the Network Project Officer will issue a sales order to the customer in order to recover the cost, and ensure payment has been received before proceeding further.

The commissioning report shall include a sign off sheet for the Customer, the Consultant or Installer and SA Power Networks.

PART 4 – QUALITY OF SUPPLY AND POWER FACTOR

QUALITY OF SUPPLY

Changes of voltage (e.g. resulting from starting motors) and harmonic distortion levels must comply with the National Electricity Rules and the Electricity Distribution Code.

Maximum limits are as detailed in the following table.

Generating System Capacity to be installed	119.6kW
Proposed SA Power Networks Service Size	1,500kVA
Maximum Design Fault Level at Service Point	47.6kA
Maximum allowable harmonic distortion at the point of common coupling (PCC): • total • any individual odd harmonic • any individual even harmonic	 1.67% 1.33% 0.67%

NOTE: If complaints of interference arise from the operation of your equipment, SA Power Networks will require that you take remedial action to our satisfaction.

POWER FACTOR

Unless we otherwise agree, you must, at times of your monthly maximum demand, keep the power factor of your electrical installation within the relevant range set out in the table below and take all reasonable steps to maintain its power factor within the specified range at all other times.

Supply Voltage in kV	Power Factor Range for Customer Maximum Demand and Voltage					
	Up to 100 kVA		Over 100 kVA - 2 MVA		Over 2 MVA	
	Minimum Lagging	Minimum Leading	Minimum Lagging	Minimum Leading	Minimum Lagging	Minimum Leading
< 6.6	0.80	0.80	0.85	0.80	0.90	0.85
6.6 - < 66	0.80	0.80	0.85	0.85	0.90	0.90
66 and above	As specified under Section S5.3.5 of the National Electricity Rules					

In order to comply with Power Factor requirements, it may be necessary to fit Volts Amps Reactive (VAR) support equipment.

PART 5 - TARIFF SUMMARY SHEET

1. The Authorised Service Capacity for this Connection is: **1,500kVA**

2. The applicable Network Tariff for this Connection is:

   LBAD-SA – Large Business Annual Demand

- The initial Peak Demand for this Connection is: 30kVA
- The initial Anytime Demand for this Connection is: 115kVA

X Gen – Zero Rate – Solar Co Gen

The meaning of the above terms is explained in clause 35 of the Construction Terms booklet.