Large scale photovoltaic installations

Process for photovoltaic installations greater than 200kW connected via inverters to the ActewAGL high voltage and sub-transmission network

ActewAGL

Introduction

ActewAGL guidelines for photovoltaic (PV) installations up to 200kW connected via inverters to the ActewAGL network are for micro and medium scale PV installations connected to the low voltage network.

Large scale PV installations, that is, PV installations greater than 200kW will require connection to either the high voltage (11kV) or sub-transmission (132kV) network depending on the size and complexity of the connection.

Although the principles stipulated in the medium scale guidelines can generally be applied to large scale installations this document describes the process unique to large scale installations.

Step 1: customer advises ActewAGL of intention to connect

The customer must advise ActewAGL of the proposed connection by submitting a completed *Large Scale renewable energy system connection enquiry* form. This must be done prior to the customer undertaking any detailed design or committing to expenditure, materials or resources. ActewAGL will respond to any reasonable request for information about its network that will enable the customer to prepare a connection enquiry that meets their technical and commercial requirements. Information on the network layout and ratings of a specific section of the network will be provided where considered reasonable by ActewAGL.

The charge for processing this connection enquiry is $500 (excluding GST). After receipt of the connection enquiry, ActewAGL will send a *Quotation for work/tax invoice* to the customer. Payment of this charge must be made before the enquiry can be processed by ActewAGL.

The customer must also advise the Construction Services branch at the Environment and Sustainable Development Directorate (ESDD) of their intention to connect to the network by calling **02 6207 7775**.

Step 2: initial response from ActewAGL

ActewAGL will process the connection enquiry and respond within four weeks. The response will include advice on:

- the technical feasibility of the proposed connection based on the preliminary information provided
- the need for network technical studies to determine the impact of the installation on the ActewAGL network – refer to step 3 below.

Step 3: ActewAGL requests customer to conduct network technical study

ActewAGL is committed to connecting renewable generation to its network while also ensuring that the power supply to its customers is delivered in accordance with ActewAGL and industry safety and reliability standards. In order of importance ActewAGL's prime directives are as follows.

1. The safety of personnel who work on the electricity network and to the general public
2. To minimise asset loss of life, reduced performance and to prevent damage to electricity network assets
3. To minimise disruption to all customers (quality of supply) inclusive of the applicant's site.

ActewAGL will conduct a network technical study for PV connections to the low voltage network only. For large scale PV installations that require connection to the high voltage (11kV) or the sub-transmission (132kV) network the applicant is required to have a network technical study prepared by an engineering consultant body with relevant knowledge, expertise and experience.

Network technical study

To facilitate ActewAGL's prime directives for the connection of large scale PVs to the high voltage (11kV) and sub-transmission (132kV) network the applicant is required to conduct a network technical study.

The scope of the network technical study is to:

- assess the performance of the proposed large scale PV installation and the impact of the connection to the ActewAGL network against the technical requirements listed under clause S5.2.5 of the *National Electricity Rules* (NER)
- formulate appropriate access standards for the connection
- provide adequate supporting information in the form of computer simulations and calculations to demonstrate compliance with the NER, technical requirements and proposed access standards
- evaluate inverters with an individual rating of greater than 30kW as outlined below.

The study must include, but should not be limited to the following.

- The development of network models.
- Steady state and dynamic load flow studies.
- A fault level study.
- Harmonics and voltage flicker and fluctuation studies.
- Equipment ratings.
- Network augmentation and modification requirements.
- Protection, supervisory control and data acquisition (SCADA) and communication and metering requirements as listed below.
    - Protection requirements (main and backup), including but not limited to:
        - anti-islanding
        - over/under voltage and frequency

    - neutral voltage displacement
    - overcurrent and earthfault
    - negative sequence voltage and current
    - synchronisation
    - intertrip.
  - SCADA for control and monitoring.
  - Effects on existing protection settings, such as zone substations.
  - Communication system to comply with existing ActewAGL system.
  - Metering to comply with National Electricity Market (NEM) requirements.
- Evaluation of inverters > 30kW must include, but not be limited to the following.
  - A review of Australian standard AS4777 and determination of how the principles of this standard can be applied to larger systems and the requirements for larger inverters.
  - An evaluation and assessment of the power electronics and associated circuitry used to achieve the protection and SCADA functions.
  - Testing standards which include the method of testing and expected results, such as:
    - inverter – type tests and routine tests
    - protection tests
    - performance tests
    - periodic tests
    - power factor tests
    - harmonic current limit tests
    - transient voltage limit tests
    - quality of supply tests.
  - An evaluation of the required level of safety and performance of the inverter including, control of real and reactive power and the circuitry used, the power factor, performance degradation over time and lifetime expectancy.
  - Inverter data, such as impedances, fault levels and ratings required for network technical studies.
  - A risk assessment, including type and failure modes, the probability of failure, impact on personnel and public safety, network assets and quality of supply.
  - Information on Australian and overseas experience (safety and operational) with a particular inverter, including details of where it was installed and operational.
- Evidence of communication with TransGrid, including the expected impact on the network and their requirements. This is required for connections to the 132kV network.
- Evidence of communication with Australian Energy Market Operator (AEMO) and their requirements.
- Project timelines.
- The required augmentation or modification to ActewAGL network.

Provision of ActewAGL data

ActewAGL will cooperate with the applicant in their preparation of the network technical study and provide relevant network data in a timely manner to enable the study to be conducted. Information may include equipment ratings, impedances, fault levels and asset locations.

Costs

The applicant must pay the total cost of the network technical study, including the cost incurred by ActewAGL for the provision of network data and an analysis of the results of the study. An initial payment of $11,250 (excluding GST) for the ActewAGL component of the study is required before ActewAGL proceeds with any work. If this amount is exceeded ActewAGL will apply an hourly rate for additional work.

Step 4: Preliminary offer to connect by ActewAGL

The outcome of the above studies and reviews will provide the basis for ActewAGL's preparation of a *Preliminary Offer to Connect* for the customer. The *Preliminary Offer to Connect* will include the following.

- Advice on the maximum PV generation capacity and the details of the connection arrangement that can be accepted at the proposed location.
- Details of the network augmentation or modification required to enable the proposed connection.
- A schedule of itemised estimated costs to be funded by the customer, including network augmentation or modification costs if required.
- A program of works to complete the connection, including augmentation or modification work, if required.
- Applicable service standards.

Step 5: customer to notify ActewAGL if connection conditions are acceptable

Upon receiving the *Preliminary Offer to Connect* the customer must decide if the connection conditions are acceptable and if so, the customer must lodge a formal application to connect to

the network in accordance with the *Electricity Network Capital Contribution Code*.

On receipt of the application to connect, ActewAGL will prepare the connection plans, which include the cost to augment the electricity network to enable a connection to occur. ActewAGL will require a non-refundable design charge with the application, which will be offset against the cost should the customer choose to accept the offer to proceed with the construction.

ActewAGL will proceed with the construction once payment of the customer contribution is received.

Step 6: customer to notify ActewAGL if connection conditions are acceptable

If the customer decides to proceed with the connection they will be required to enter into a contract as described in Section 5.2 of the *Guidelines for photovoltaic installations up to 200kW connected via inverters to the ActewAGL network*.

Step 7: customer contacts the ESDD

The installer working on the PV system must advise ESDD of the electrical work taking place. At this stage the installer may start the installation of the PV system. The work is not complete until ESDD has inspected and approved the installation and ActewAGL has set-up the required metering arrangement.

Step 8: installer completes PV installation

The installer and electrician will complete the PV installation to a point where it is ready for a meter to be fitted.

Step 9: request an appointment

The customer's installer must submit a *Request for Service* form to ActewAGL for an appointment to install metering.

The installer can submit this form at any time after the *Preliminary Offer to Connect* has been received by the customer. It is at this point ActewAGL becomes aware that the PV installation is proceeding to completion and that the customer will require a new meter or meter replacement. ActewAGL will arrange a suitable appointment date with the installer to carry out this work.

Step 10: installation of new metering arrangement by ActewAGL

ActewAGL will meet the customer's installer on-site to install a second electricity meter or replace the existing meter. ActewAGL will only install the meter and connect the PV system to the network once steps 1 to 9, as set out in this document have been completed.

Step 11: ESDD notification

The installer must advise ESDD that the installation is complete and ready for inspection by submitting a *Certificate of Electrical Safety*.

Step 12: ESDD inspection

ESDD will carry out an inspection of the wiring and other electrical work. If the installation passes the inspection ESDD will place an approval sticker adjacent to the existing metering installation or in the meter panel.

Step 13: installer commissions PV installation

The installer must submit detailed commissioning instructions to ActewAGL for approval. The instructions must include, testing of all protection schemes (main and backup), control systems (SCADA) and all inverter protection and safety features. Once approval has been granted by ActewAGL, the installer must give ActewAGL at least two weeks notice to enable ActewAGL personnel to witness the testing. Following the successful commissioning of the installation, certified copies of the test results must be provided to ActewAGL.

Large scale renewable energy system connection enquiry

Details of applicant

Company name:

Address:

Contact person:

Phone number:

Email address:

Project description, including expected project duration:

Connection details

Proposed site:

Proposed connection point:

System details

Type of generation:

Power capacity:

Proposed connection voltage:

Single line diagram
Attach a single line diagram showing the configuration of the system and the proposed network connection point.

Signature: ..... **Date:** .....

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