PV Training challenges & how they affect installations

Since being established in 1998, GSES has focused on assisting the growth of Australian and international PV industries through providing quality training. GSES is recognised for its expertise in providing the training required for grid connected PV design and install accreditation. In training many electricians and engineers, GSES has identified certain areas that prove to be more challenging than others. This article outlines just a few of these challenges and how they affect installations.

Responsibility for wind loading requirements

During training, students often express concern regarding who is responsible for the structural safety of PV arrays and mounting systems. Electricians installing PV arrays are typically not also structural engineers or builders experienced in dealing with structural requirements, and therefore they can't be expected to conduct wind loading calculations to guarantee structural safety.

To ensure PV arrays are safely secured, AS/NZS5033:2014 requires that the array framing has engineering certification for wind and mechanical loading. Rather than acquiring site specific certification for every installation, the most common method of achieving certification is to install mounting systems that are pre-certified for a range of site parameters. These pre-certified mounting systems require that the manufacturer's installation instructions are followed for the certification to be valid. However if the site parameters do not apply, or installation instructions are not strictly followed then the certification is void and the responsibility of the wind and mechanical loading falls on the installer.

Below are some key installation aspects that installers must consider in order to adhere to manufacturer's instructions:

- Varying requirements for different roof zones: The manufacturer may specify limits or exclusions zones for where the array can or cannot be located on a roof. Also, areas closer to roof edges may require additional fixings;
- Fixing method requirements: The manufacturer may specify the quantity, type, length and gauge of screws. The material and size of roof battens/purlins may also be specified;
- Varying requirements for different wind regions and terrain: Requirements will vary depending on where in Australian the system is located (corresponding to wind regions - Figure 1) and the local terrain (the structures in the area that would affect the wind). Wind regions are designated in AS/NZS1170.2: Section 3.2.

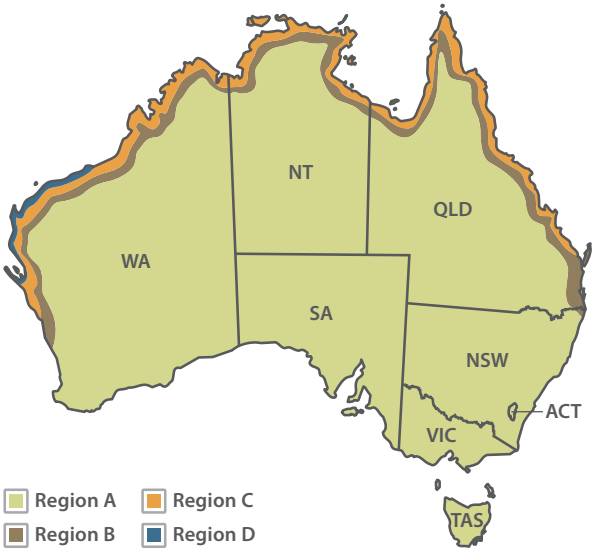

Figure 1: *Map of Australia showing the four different wind regions. A more detailed version of this map showing regional centres can be found in AS/NZS1170.2: (Section 3.2)*

PV array maximum voltage calculation

Grid connected PV students are expected to have prior training in basic electrical calculations, but PV arrays have unique electrical characteristics that must be understood in order to design and install a safe and efficient system. One of the more complicated calculations associated with PV is one which determines the PV array maximum voltage. All DC equipment between the PV array and the inverter must be rated to withstand PV array maximum voltage and therefore it is important that this value is understood and calculated correctly.

The maximum array voltage occurs when the array is at its open circuit voltage, and its minimum operating temperature. This is calculated using the formula found in AS/NZS 5033:2014 Section 4.2. Before the 2012 update of AS/NZS 5033, maximum voltage was approximated using a fixed multiplier of 1.2 of the array voltage at standard test conditions; not accounting for site specific minimum temperatures. Calculating the PV array maximum voltage according to AS/NZS 5033:2014 and appropriately applying it to equipment ratings ensures that equipment will be rated correctly for each installation's weather conditions.

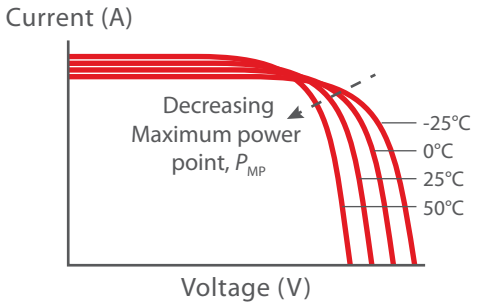

Figure 2: *Effect of increasing temperature on current and voltage - as temperature decreases, voltage increases*

Proper signage

PV systems' unique electrical characteristics and safety concerns make appropriate signage crucial for communicating to both emergency workers and contractors. Installations may require over 10 different types of signs in different locations around the system. To help cover the signage requirements, signage packs are readily available. While these packs are useful and some advertise CEC approval, they cannot be assumed to be sufficient for every installation. Furthermore, they may become out of date as new requirements come into effect with standards updates. It is essential that installers check the wording and quality of any signage packs against what is required in AS/NZS 5033:2014. The responsibility of installing signage that has the correct labelling and is indelible falls solely on the installer.

Sizing PV Array DC isolators

The requirements for isolation devices on DC systems vary greatly from that of AC systems. Many of the protection and isolation requirements that electricians practice in relation to AC systems do not apply to PV DC systems. For example, in AC systems circuit breakers are used to protect wiring and components; this is not always required in a PV system, as a PV array is current limited – the short circuit current from a string of PV modules is generally less than 10A. Therefore PV systems only require (DC rated) isolation devices that do not (necessarily) offer over current protection.

The requirements for PV Array DC isolators take into account various primary and secondary fault scenarios and therefore it is vital that they are understood and followed.

Further information on sizing PV array DC isolators can be found in the following GSES technical articles:

- *DC Isolators: What are the Manufacturer's Specification Sheets Really Telling You?*
- *DC Isolator Sizing requirements*

Installing PV systems without accreditation

One question that frequently arises is whether or not CEC Accreditation is required to install PV systems. In the past CEC accreditation was only required if the installer was applying for Small Technology Certificates (STCs). This is a stipulation imposed by the Clean Energy Regulator who awards STC for PV systems, and is an effort to ensure quality installations throughout Australia. Therefore if an installer did not wish to claim STCs on a system, there was no requirement for them to be CEC accredited.

However, today many network providers require CEC accreditation for connections to the grid. As network operators adopt this requirement the opportunities to install grid connected PV systems without CEC accreditation are greatly reduced.

Keeping on top of changes in the industry

To assist PV installers and designers in keeping on top of changes in the industry, the CEC have put in place a continuous professional development (CPD) program. In response to this, GSES provides Professional Development Days at locations around Australia, which give installers the opportunity to achieve their yearly required 100 CPD points in a single day. Topics covered in recent GSES Professional Development days include:

- Commissioning, Maintenance and Fault Finding
- Responding to Solar Tenders: Technical Content
- PV Module Power Conditioning and Control Devices.

For the current topics, schedule and locations visit www.gses.com.au and follow the links to training.

GSES welcomes feedback on technical papers and other resources available on www.gses.com.au, please contact GSES by email at info@gses.com.au or by telephone on 1300 265 525.