*Australian*
*PV Association*

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# APVA Response to James Cook University Cyclone Testing Unit Solar Panel Alert

**March 2011**

## Background

In November 2010, the James Cook University (JCU) Cyclone Testing Centre wrote to the Governments of Queensland, Northern Territory and Western Australia raising concerns about the ability of PV modules and arrays to withstand cyclones. They raised concerns about the ability of the total system, and of the modules themselves, to withstand hail and flying debris and state that there is no codified data on wind loadings for PV systems which could be used to ascertain cyclone resistance or safety.

The Cyclone Testing Centre asserts that the PV industry has not undertaken the necessary research to ensure PV systems are installed safely, has recommended that building standards be enforced for PV arrays and is seeking $60,000 to $100,000 in funding for wind tunnel experiments and the development of new wind loading standards.

In a related article they raise issues of:

- Public safety during PV installations
- Compatibility of PV and building components, and
- PV impacts on the weather tightness of roofs

In response to the JCU letter, the Northern Territory government has rejected a request to exempt PV installations from the requirement to obtain a building permit and has set an external pressure coefficient (Cpe) of -1.3 for panels installed flat to the roofline and a setback of 1200mm from roof edges. In a more recent decision, it added a requirement to installations in non-cyclone areas, calling for proof of roof soundness from a certified person. For cyclone areas, building approvals must be sought, as well as an extra certificate from the PV manufacturer as to its wind load rating.

## APVA Response

**The APVA is of the view that existing Australian and international standards adequately cover PV installations in both cyclone and non-cyclone areas. These standards have been developed over the past 40 years, taking account of developments in PV technology developments and use. Therefore:**

- **PV systems installed in cyclone areas must comply with cyclone area wind loading requirements set under the building codes**
- **PV systems installed in non-cyclone areas should not need to comply with requirements for cyclone prone areas and**

- **Development approval should not be required for standard small-scale PV systems installed to the standards by accredited installers.**

**Nevertheless, there is a continuing need to ensure that all installers are fully aware of the Standards and comply with them. To this end, and to capture the evolution of PV products and Standards, a formal structure for Professional Development for installers is recommended.**

## General comments

The PV industry takes safety and system integrity very seriously. PV modules are built to last decades – many are in service after 40 or more years – and long warranties are provided, typically 15 to 25 years. Around the world, over 20 GW of PV is now installed. Other than in cases of severe weather, where all manmade structures as well as trees, river banks and other natural structures have also been lost, there is little indication that PV has been either especially vulnerable to damage or has caused injury during extreme weather events. In fact, PV is considered to be one of the essential elements of disaster proof building structures (Young 2005) and is now routinely used around the world for power supply after disasters.

Australian PV standards are some of the most advanced in the world, often serving as the basis for national standards in the Asia-Pacific region and also for international standards. The Chair of Australia's *Standards Committee EL42: Renewable Energy Systems*, Ted Spooner, is also co-convenor of *Working Group 3: PV Systems* for the International Electro-technical Commission Technical Committee 82: Solar Photovoltaic Energy Systems.

All current Australian government support for PV has been accompanied by requirements to use products which meet Australian standards and which are installed by accredited installers. With such a fast growing industry, keeping standards up to date with available products and applications is critically important, but requires significant effort. The industry typically uses guidelines as an interim measure to ensure safety and reliability, converting these to standards only when new developments are well established. The aim is to balance the need for innovation and new products with safety and standardised procedures. Nevertheless, standards have been set for both cyclone and non-cyclone areas and, as is the case internationally, there is no evidence of PV panels or systems causing harm under extreme weather events.

The Australian PV industry has for many years had its own internal procedures for checking installations and removing accreditation from installers if their systems are not safe. There is currently an enhanced inspection program underway, funded by the Commonwealth Government.

## Hail

Hail testing is mandatory under Australian and international PV standards. IEC 61215 and IEC 61645 for crystalline and thin film modules respectively require modules to survive 25mm diameter ice balls fired at 23m/s on 11 points across the module for the Moderate Hail Test (Class MH) or 75mm under the Severe Hail Damage Resistance Test (Class SH) (TUV Rheinland 2009). Nevertheless, severe hail or falling debris may well damage the glass top covers of PV modules under extreme circumstances.

It should be noted that, in most cases, because individual cells within the modules are interconnected, and since there is also a back sheet to the module, the module itself would not typically fall apart as a result of damage by hail or flying objects. However, in cyclonic conditions on a Pacific island, there have been reports of PV cells being blown away, leaving the module frame in

place. The cells themselves are lightweight and would not be expected to cause serious damage or injury.

## Wind Loading

### *International experience*

Several US research centres have monitored PV systems during hurricane seasons.

The Florida Solar Energy Center examined 61 PV systems after the 2004 hurricane season and found all still operating with 3 suffering minor damage, one as a result of being hit by the neighbouring roof. 50 had been directly in the hurricane path (Young 2005). It collated information from other areas and found 7 out of 42 PV systems had experienced some damage. There is no mention of injury or damage to other structures. Many residents were using their PV systems as emergency power supplies.

▽ After Hurricane Andrew in Dade County, Florida, this PV-powered street light was the only illumination surviving the destruction within five miles. Solar power kept the lights on in several communities for the two- or three-week period until utility power could be restored. The 64W system shown here was installed by Solar Outdoor Lighting, Stuart, Florida. *[Photo courtesy Solar Outdoor Lighting]*

Source: (Sandia National Laboratories n.d.)

NREL (National Renewable Energy Laboratories 2005) tethered its PV test arrays during Hurricane Charley in 2004 and found the only damage suffered was due to the tethers themselves:

**Typical crack in modules after Hurricane Charley (NREL, 2005)**

After Hurricane Andrew in Florida, a PV street light was been found to be the only light operating in a 5 mile radius (Sandia National Laboratories n.d.):

## *The Australian situation*

Prior to the recent cyclone season, there were two known reports of PV damage after high winds: a Bushlight system hit by a tree branch during high winds at Chula outstation, Lockhart River. One module and the surrounding array frame were badly damaged, but remained in place. Some adjoining modules were cracked but still in place. PV panels were reported to have blown off a roof at Lennox Head after a tornado destroyed 12 homes and the caravan park, unroofed many other houses and brought down power lines around the town. It is difficult to envisage any PV standards that would have prevented this.

**House in Picnic Bay after Yasi (Photo Ergon Energy)**

In the recent cyclone Yasi, which hit Queensland and the Northern Territory, little damage has been found on PV arrays. Of the 3500 modules installed by Ergon Energy, only one was lost - the corner panel closest to the sea on a Magnetic Island installation. One module in another installation was moved out of alignment. There were reports of the PV arrays providing structural strength to roofs, with roof areas secured by panels remaining in place and other areas of the roof being blown off (Northern Miner 2011).

Module standards IEC 61215 and IEC 61645 for crystalline and thin film modules respectively require modules to survive three cycles of 2400 Pa at uniform load applied to the front and back of the module alternatively (TUV Rheinland 2009).

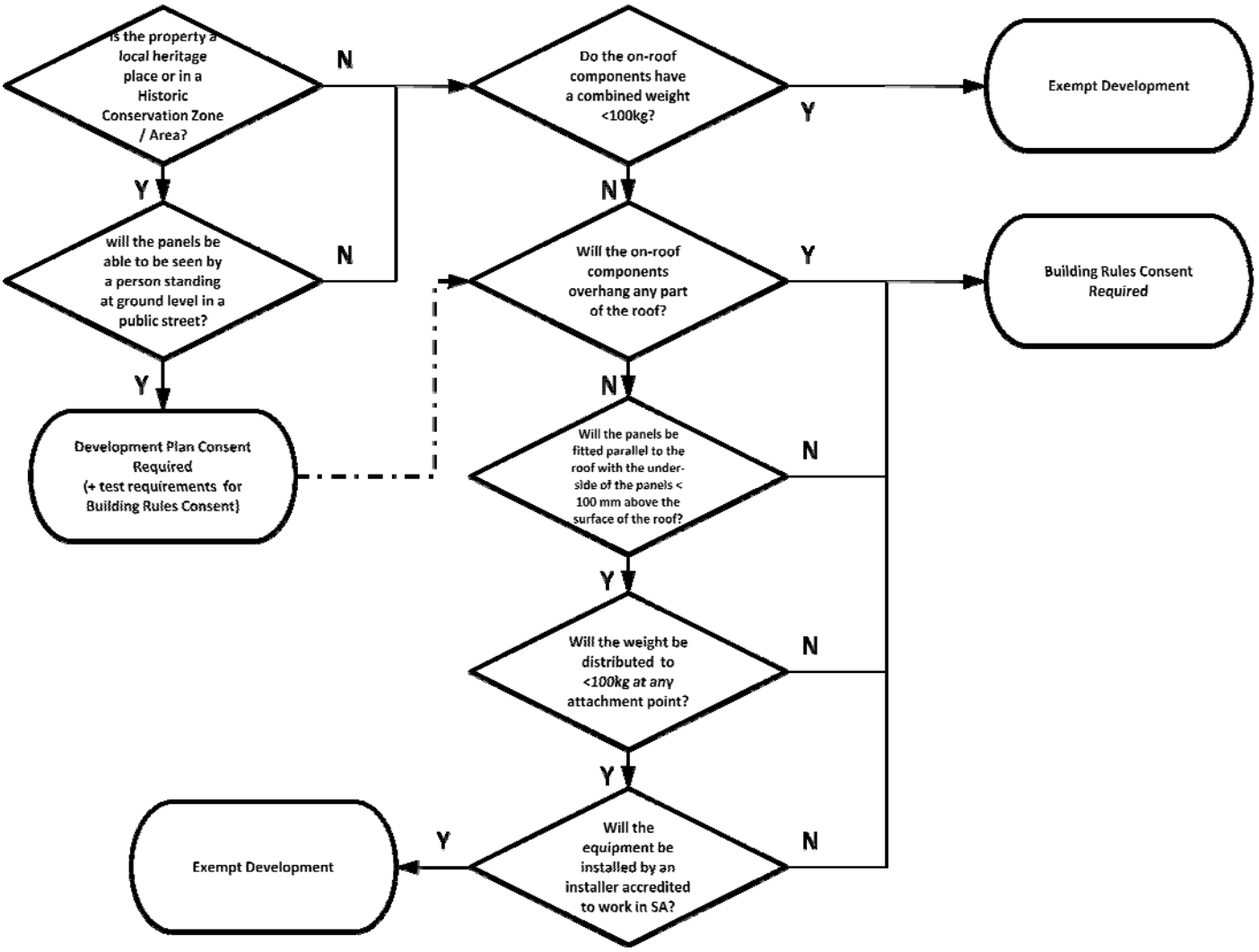
The Australian Standards Committee is in the process of updating its wind loading and structural support sections, which refer to the international standards. Installers must already comply with related standard AS1170.2 Part 2: Wind Loads, use mounting fixtures suitable for the highest wind speeds in non-cyclonic regions and more stringent testing regimes under BCA Part 3.10 .1( f) in cyclonic regions.

The APVA convened a meeting between a range of interested parties in July 2010 to discuss further requirements and a sub-committee was formed. Some guidance is provided in AS5033 and more detailed instructions developed by Sharp Corporation (Sharp Corporation Australia 2010) have been circulated to installers for use until the Standard is updated. This draws on a range of related standards, including those for high wind areas, such as Part 3.10.1 Volume Two of the Building Code of Australia and AS1684.2-2006 Residential Timber Framed Construction Part 3: Cyclonic Areas. The APVA is offering short-courses for installers to ensure they are well informed of the standards required.

## Building Approvals

Standard small-scale PV installations which comply with existing standards and are installed by accredited installers should not need to go through a Development Application process. PV standards and designer guidelines already call up relevant building codes.

In NSW, systems less than 20 kW which do not protrude more than 1 m from the surface of the roof and do not impact on the structural integrity of the building are considered exempt developments. In SA, systems weighing less than 100kg are exempt and those over 100 kg are exempt if they do not overhang the roof, are parallel to the roof with a gap of less than 100mm and do not have any point where the weight is larger than 100 kg, as shown below. In both States, heritage buildings are treated separately.




**South Australian PV Approval Process**

In the APVA's publication: Best Practise Guidelines for Local Governments (Australian PV Association 2009), the following recommendations are made to ensure that PV installations are not unduly impeded:

- Provide training on PV for Council staff likely to have to deal with enquiries
- Provide information on PV to ratepayers, including local accredited installers and components approved for use in Australia
- Provide clear definitions of PV systems which do not require Council consent
- Provide a simple guide to the processes required for approval of PV systems which require DAs
- Work with other Councils and with Local Government Associations to standardise processes across Councils and States/Territories

- Waive fees
- Consider pre-approved PV types for heritage areas
- Better define elevations from which PV should not be visible in heritage areas, for instance, to allow installations which may be visible from little used back lanes
- Consider facilitation of bulk purchase arrangements which reduce PV costs for ratepayers
- Support moves to standardise insurance of installers and systems, in line with normal building codes.

More details on all aspects of PV relevant to Local Governments, including solar access and heritage issues are also contained in the Guidelines.

The APVA considers that such pro-active approaches would allay fears, reduce costs and encourage appropriate PV development. In particular, it considers that development approval should not be required for standard small-scale PV systems installed to the standards by accredited installers. In SA, the government was concerned about roof structural support and has added a roof structure module to its requirement for PV installer certification.

## Conclusions

The APVA is of the view that existing Australian and international standards adequately cover PV installations in both cyclone and non-cyclone areas. PV systems installed in non-cyclone areas should not need to comply with requirements for cyclone prone areas, which require cyclic pressure sequence certification in accordance with the BCA. Should roof structure be of concern, adding a requirement to the training of PV installers, as is done in South Australia, would be a more straightforward and less costly approach than requiring an independent building certificate.

The APVA will continue to monitor progress being made to certify modules and to assess ongoing or new requirements in this respect, as well as for other issues arising, such as flood damage. There have been no reports of danger posed by PV modules during recent cyclones, and the APVA is of the view that existing international standards, developed over 40 years, under strict testing regimes, are adequate. The PV industry is global and has worked hard to achieve global standards, so as to facilitate uptake. There is no reason for a small part of Australia to apply separate or additional rules which will add to PV system costs for everyone.

Given the large number of new PV installers which have entered the market in recent years, and the continual updating of Standards, a structured process of Professional Development should be instigated. The APVA welcomes any support or promotion from State and Territory governments for such a process.

Further clarifications will continue to be added to existing PV standards over time, but guidelines are available in the interim. Regular, random site inspections should also continue as part of the industry's safety and accreditation process.

## Works Cited

Australian PV Association. “Best Practice Guidelines for Local Government Approval of Solar PV Systems.” June 2009.

National Renewable Energy Laboratories. Golden, Colarado: NREL, 2005.

Northern Miner. “NQ Solar versus Yasi.” *Northern Miner*, 11 February 2011: 11.

Sandia National Laboratories. *PV for Disaster Relief.* Sandia.

Sharp Corporation Australia. *Sharp YS-2 AU Angle Attach Mounting System for NU-A188EY Solar Panels: Structural Analysis.* Sydney: Sharp, 2010.

TUV Rheinland. *Design Qualification and Type Approval of PV Modules acc. to IEC 61215:2005 / IEC 61646:2008.* TUV, 2009.

Young, W. *Renewable Energy and Disaster-Resistent Buildings.* Florida: Florida Solar Energy Centre, 2005.