



Solis technical review of new regulations

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Revision History

- Version 1.0- August 2020: Initial release

1. Background

The Australian renewable energy market has proposed several modifications and changes to the standards and regulations.

- Standards Australia issued the draft version of AS/NZS 4777.2:2020 as a revision of AS/NZS 4777.2:2015 and added some detailed additional requirements for inverters.
- Australian Energy Market Operator (AEMO) together with South Australian Government proposed some regulatory changes in several consultation papers for public comments.

Solis, a leading solar inverter manufacturer on the Australian market, closely follows the latest and advanced updates of different standards and requirements to ensure the compliance of the products in a timely manner. It is precisely because of this, Solis can always provide qualified and reliable products to our customers around the world.

In the following sections of the article, Solis will explain some of the major proposed changes in Australian standards together with the status of the compliance of Solis products.

2. Draft AS/NZS 4777.2:2020

The current AS/NZS 4777.2:2015 was published in October 2015. Standards Australia has now published the draft revised version which is open for public comments. Even though it is not a finalized version, Solis has already started the process of reviewing the changes and is prepared to meet the revised requirements of the draft document.

- **Isolation of energy sources Clause 2.12**

The draft AS/NZS 4777.2:2020 defines the requirements for isolating devices that are part of and within the inverter which was originally from AS/NZS 5033. In that case, PV inverters can have the DC switch integrated within the inverter, as long as it can meet the specific requirements on the utilization category, current rating, etc.

Solis currently do not supply the integrated DC switch due to the requirement of the external DC isolators. However, Solis is capable of providing the integrated DC switch per the current and upcoming standards. The existing Solis Australian inverters already have the reserved port for the DC switch with enough internal space to include a DC switch manufactured to meet the requirements of both AS/NZS 5033 and the draft AS/NZS 4777.2:2020.

• **Inverter power quality response modes Clause 3.3**

The draft AS/NZS 4777.2:2020 modified the original set points to give a detailed and flexible setting capability. Compared with previous united set points for the country, the draft standard specifies 3 sets of parameters for different applications.

- **Australia A:** Intended for application in large interconnected power systems.
- **Australia B:** Intended for application in small interconnected power systems.
- **Australia C:** Intended for application in isolated or remote power systems.

For different kinds of applications, different default voltage response set points are applied which can more accurately define the response in different scenarios. Meanwhile, a wider allowed range is defined which suits for special applications. Besides, V-P mode is allowed to be used with V-Q, Fix-PF, Fix-Q modes together to achieve a more flexible solution for voltage rise issue in Australia

The advanced power quality response requirements as set out are quite similar to the California Rule21 requirements in the United States. The Solis products currently offered in the US market meet these requirements with full compliance. Solis has the experience and understanding of the power quality response requirements of the draft AS/NZS 4777.2:2020. After the final standard comes becomes available, Solis can fully comply with the new power quality response modes with a fast firmware modification.

Voltage and frequency limits (Passive anti-islanding protection) Clause 4.4

The draft AS/NZS 4777.2:2020 defined a more detailed two-level voltage and frequency protection compared with the previous version.

Protection Function	Protection Function Limit	Trip Delay Time	Maximum Disconnection Time
Undervoltage 2(V<<)	70V	1s	2s
Undervoltage 1(V<)	180V	10s	11s
Overvoltage 1(V>)	265V	1s	2s
Overvoltage 2(V>>)	275V	-	0.2s
Underfrequency 1 (F<)*	47Hz	1s	2s
Overfrequency 1 (F>)*	51.5Hz	300s	310s
Overfrequency 2 (F>>)*	52Hz	-	0.2s

* Take the Australia A set points as an example

Two-levels of protection can have a faster response on the drastic change of the grid voltage and frequency. Solis inverters have already been developed to support this requirement with a simple parameter modification.

Generation Control Function Section 6

The draft AS/NZS 4777.2:2020 introduced the requirements on generation limit control and export limit control. Generation limit control indicates the limiting on the inverter output port to reduce the inverter output power thus meeting the specific connection requirement. Export limit control indicates the limiting on the system connection point by considering the dynamic changes of both generation and load consumption.

Solis already supports the generation limit control by using the inverter internal measurements and a simple setting on the inverter program is able to de-rate the inverter generation.

As for the export limit control, Solis supports connecting a smart meter or Solis export power manager to achieve it which has already been widely used in Australia with a high accuracy and fast response time.

In addition, draft standard requires the inverter to cease generation in case of a fault or loss of operability to prevent any excess export power during a communication failure, etc. The Solis 'fail-safe' function, as required in the UK G100 standard, is already included in our products.

Above sections may not cover all the changes of the draft standard, Solis is in the process of analyzing the full draft document of AS/NZS 4777.2:2020 and guarantees the future full compliance of the officially released standard requirements.

3. Consultation papers from AEMO and SA government

Recently AEMO worked with the SA government and performed several technical investigations and tests. They created a technical report about minimum operational demand thresholds in South Australia, as prepared by AEMO for SA government.

With a higher penetration of distributed energy resources within the SA network, the minimum operational demand reaches a lowest value of 458MW in 2019 at noon, one day of Nov 2019, while it is estimated to continuously decrease to zero by late 2022. This also brings some challenges on the stability of the SA network which may lead to serious system disturbances and security issues afterwards. With this background, AEMO proposed several mitigation measures for SA government in the technical report. And SA government has issued the consultation papers and tried to realize the corresponding measures. Following are the corresponding consultation topics related to solar inverters.

Figure 2 Effect on South Australian operational demand from increasing distributed PV generation (10 November 2019)

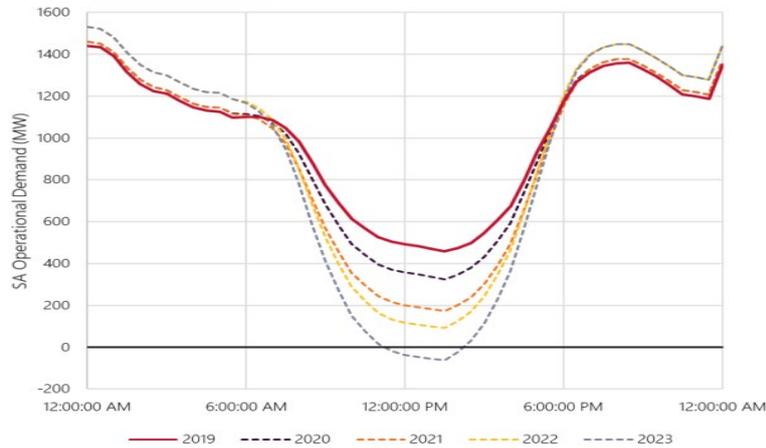
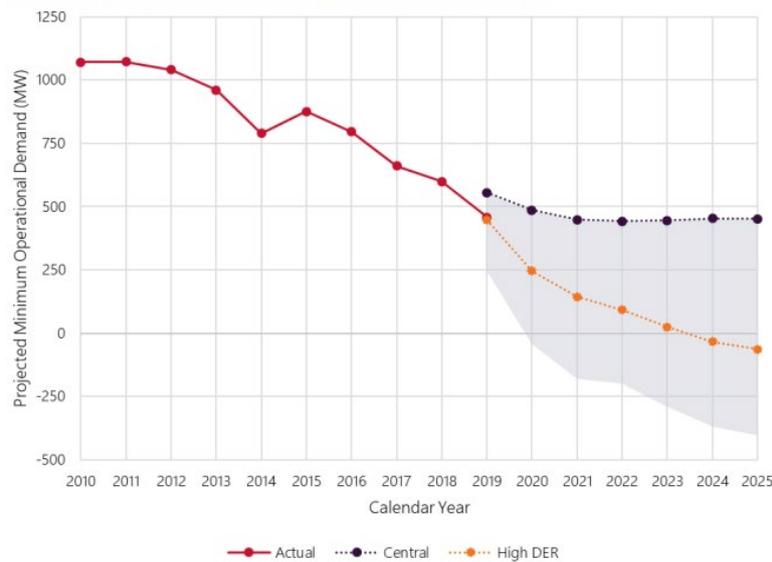


Figure 3 Minimum operational demand projections for South Australia



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- **Remote disconnection and reconnection requirements for distributed solar generating plants**

The SA government has proposed to require the PV system to be capable of being remotely disconnected and reconnected by an agent registered with the Technical Regulator. They are trying to gain more control of the PV systems and shutdown the generation if possible to match the demand, thus preventing the unstable situations. There have not been any details about the agent and about how the agent should control the inverters. Potentially, this control may be achieved through the DRM0 (Demand response mode zero) or through the specific communication between the inverter and the agent. Clean Energy Council also strongly prefers a “technology neutral” approach to achieving the requirement.

Solis has already supported the DRM control or the Modbus control in the Australian version inverters. There is no technical difficulty on Solis inverters to achieve the requirement.

- **Export limit requirements for distributed solar generating systems**

The SA government proposed to require the solar system to be capable of being export limited and for export limits to be updated remotely. And the proposal is technology neutral which allows for variety of ways to achieve this. This function can also bring the SA network with a flexible control of the system export power.

Current Solis Australian inverters can perfectly meet this requirement, by either using a Solis smart meter for one inverter or using an external Solis export power manager for multiple units of inverters. The overall system export power can be dynamically limited to a certain value as defined on the inverter or on the export power manager. Through the Solis monitoring system, Solis technicians are able to modify the export limits remotely as requested by customers or the network operator without a person being required to attend the site.

- **New low voltage ride-through requirements for smart inverters**

AEMO and the SA government have done tests on solar inverters in the Australian market and discovered that many products do not have the capability to withstand the voltage disturbance, which can easily disconnect from the network and lead to a worse situation on the voltage disturbances within the network. This voltage disturbance withstand capability is essential for system stability and has also been added into the draft AS/NZS 4777.2: 2020.

The SA government proposed a test to demonstrate that an inverter can remain connected and in a sustained, continuous operation for a short duration, transmission undervoltage step reduction (50V or 20% retained voltage for duration of 80-220ms).

After receiving the detailed test procedure from AEMO, Solis engineering and testing departments have launched the initial test for current Solis Australian inverters, having a positive test result. Solis will continually work with a 3rd party certification organization on these testing requirements to ensure a certified test report can be provided to AEMO, SA government or the Clean Energy Council for updating the approval list.

4. Summary

Solis, one of the major inverter suppliers in Australia and we will keep following the latest standard and regulation proposals, updating the products when necessary to meet the all requirements as soon as possible. Solis is fully prepared for the coming changes in the Australian market and is always keen to provide trusted and reliable products.