Short Duration Undervoltage Disturbance Ride-Through Test Procedure

A Consultation

We acknowledge the Traditional Owners of country throughout Australia and recognise their continuing connection to land, waters and culture.
We pay our respects to their Elders past, present and emerging.

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Background

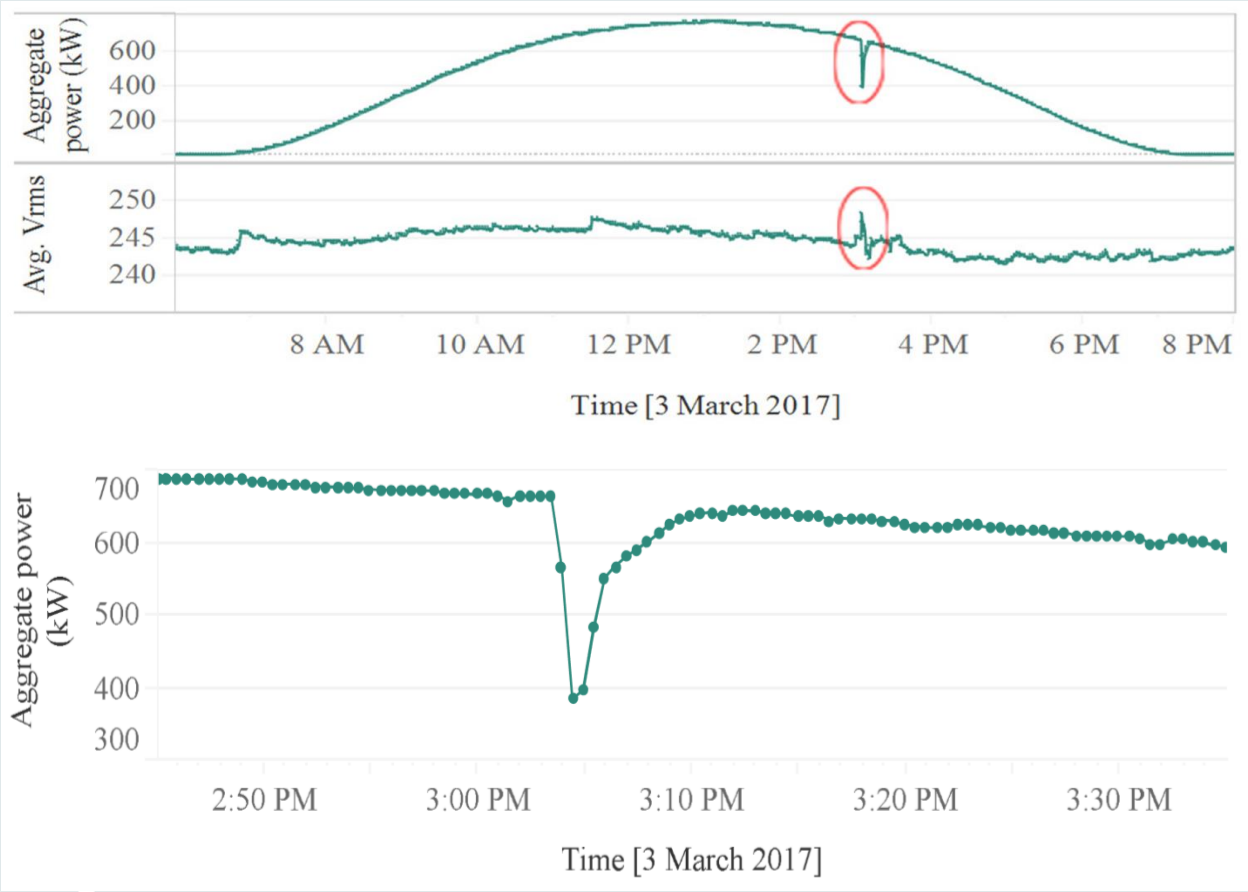
- South Australia has 1.2 gigawatts (GW) of Distributed Photovoltaic (DPV).
- There have been times when this fleet has generated over 50% of SA's demand.
- Approx. 40% of South Australia's inverters don't meet Australian Standards (AS/NZS 4777.2:2015) and disconnect following a transmission-level undervoltage fault.
- This means that an undervoltage fault could cause an unknown portion of the fleet to suddenly disconnect, which risks system security
- This presents operational challenges for AEMO to manage the contingency size following these events, and risks system security
- We need the inverters to behave in a predictable way during faults, so that AEMO can take appropriate steps to maintain security in all circumstances.

Short Duration Undervoltage Disturbance Response

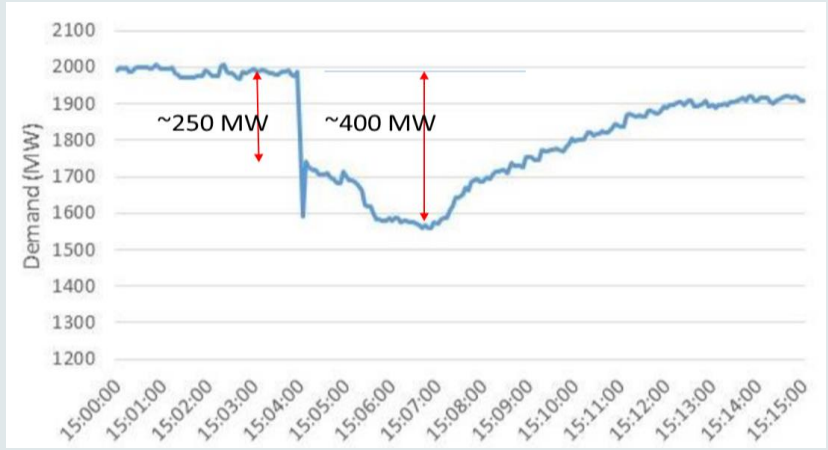
AS/NZS 4777.2 Requirements and Bench Testing

Increasing contingency sizes due to PV disconnection

- The behaviour of inverters shown on 3 March 2017 demonstrates the disconnection:



Generation by distributed PV

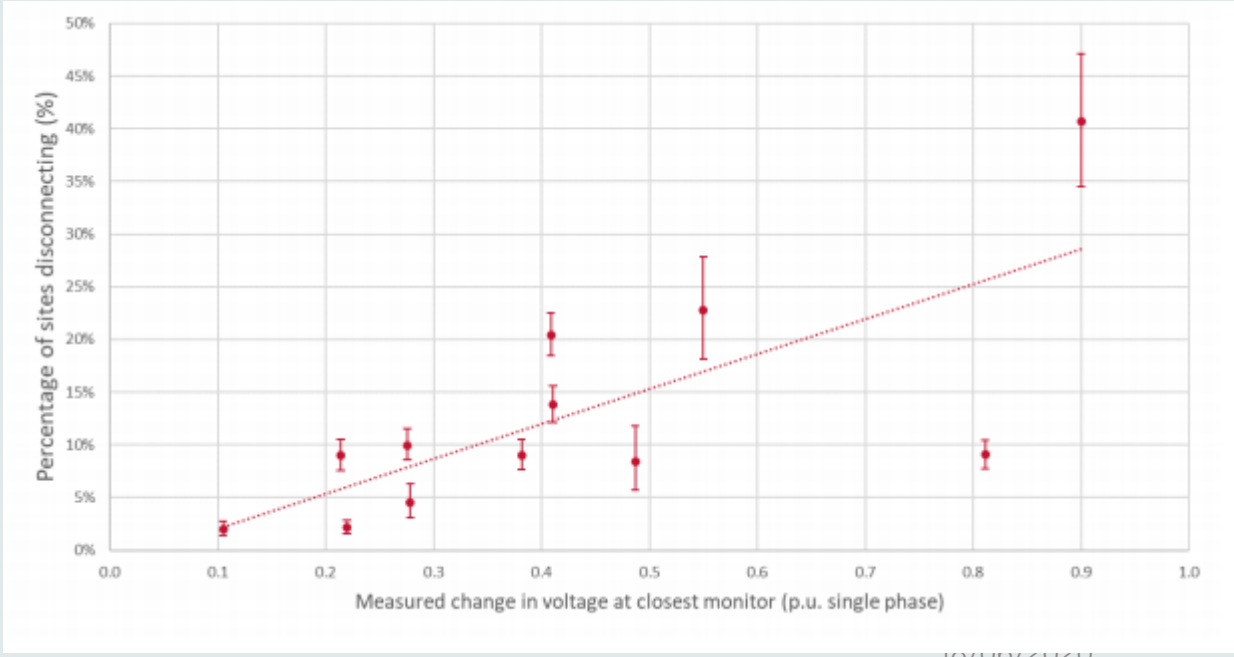


3 March 2017: Demand in South Australia

Inverter Performance to Fast Voltage Steps

UNSW Bench Testing available here (Test 27): http://pvinverters.ee.unsw.edu.au/

- Bench Testing has identified that:
  - 10 of 17 inverters designed against AS/NZS4777.2:2015 can already withstand this fault.
- DPV observed to disconnect based on severity of voltage disturbances



Impacts on SA

1. More DPV will trip off compared to load.
2. If this event occurred in 2019 on the highest solar insolation period in Adelaide Metro already experienced a net loss of generation of up to 280 MW.
3. In the worse case, these values could be additional to the loss of a synchronous generating unit.
4. Looking at the possible net loss of PV:
    1. 2020 projected contingency size: up to 500 MW
    2. 2023 projected contingency size: up to 700 MW
5. This becomes even more problematic when SA is islanded:
    1. Impacts UFLS
    2. Leads to cascaded tripping and major supply disruption

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Requirements in Standard

- Implicitly defined in the rules
- Testing Procedure in Appendix G.2 does not explicitly test this requirement

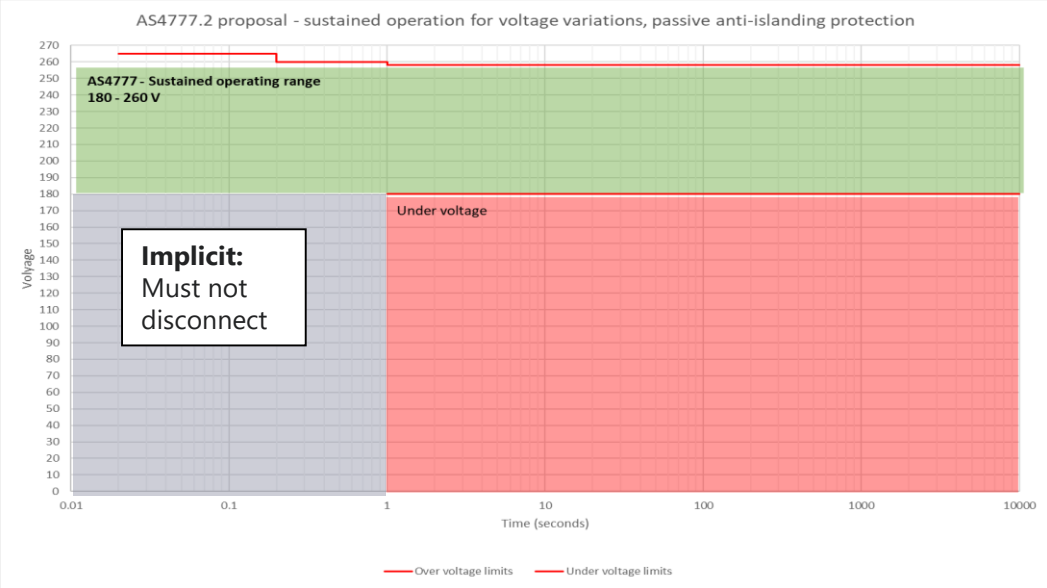
- Current AS/NZS4777.2:2015

TABLE 13

PASSIVE ANTI-ISLANDING SET-POINT VALUES

Protective function	Protective function limit	Trip delay time	Maximum disconnection time
Undervoltage (V<)	180 V	1 s	2 s
Overvoltage 1 (V>)	260 V	1 s	2 s
Overvoltage 2 (V>>)	265 V	—	0.2 s
Under-frequency (F<)	47 Hz (Australia) 45 Hz (New Zealand)	1 s	2 s
Over-frequency (F>)	52 Hz	—	0.2 s

NOTE 1: When voltage falls below the undervoltage limit of Table 13 it is permissible to continue, reduce or stop the inverter output during the trip time delay and if voltage returns above the limit during the trip time delay period it may resume normal operation.



Proposed Test Procedure

VDRT test procedure

Seeking feedback on the test procedure proposed.

- Applies to inverters that are already compliant with the full suite of tests within AS/NZS4777.2:2015.
- Additional test only seeks to confirm the DEFAULT response of the inverter.
- This proposed test report seeks to confirm two aspects of the inverter's behaviour:
  - Inverter remains connected during an event where the voltage reduces to below 180 V and consequently returns above 180 V within one second or less.
  - Inverter disconnects after 1 second following an event where the voltage reduces and remains below 180 V.

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Conformance and registration

Proposed (but feedback is welcome)

- Testing via AS/NZS 4777.2 testing laboratories
- CEC confirms inverters have met necessary requirements and publish an approved inverter list for SA installations

Requesting feedback on:

- Conformance Testing
- Timelines
- Process
- Number of current models of inverters

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Questions & Feedback

Consultation – Next Steps

Submissions & feedback

- The consultation paper can be found under AEMO's 'Current and Closed Consultations' section:
  - Short duration undervoltage disturbance ride-through test procedure
- A stakeholder forum 2:30pm Friday, 12 June 2020 (AEST)
- Submissions accepted up to 5:00pm Friday, 26 June 2020 (AEST)
- All submissions, and questions, to be sent to: DERProgram@aemo.com.au

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