

Lessons from the Australian System Blackout

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Motivation

The South Australian region of the National Electricity Market had a cascading failure to system black on 28th September 2016. Many factors were involved, including unanticipated behaviour of wind farms. This event offers valuable insights to other system operators in operating through major disturbances with large quantities of wind generation.

Problem Statement

The system black event involved the following stages:

- A severe storm event
- Three transmission lines were lost within a period of minutes
- The loss of transmission lines caused a series of faults.
- The wind farms had settings that counted the number of faults experienced, and tripped after the pre-set number was exceeded. This setting was unknown to AEMO.
- Half of the wind farms in South Australia unexpectedly tripped.
- The sudden large generation deficit led to the interconnector overloading, tripping, and then due to low inertia, cascading failure.

Methodology

AEMO has extensively studied this event to understand the behaviour of the system, and the ways in which the system could be made more robust to such events in future. This has included dynamic power system modelling, exploring the operation of the Under Frequency Load Shedding Scheme under high Rate of Change of Frequency, and analysing the operation of the control room and the system during the event, and through the system restart process.

Results

Interventions following this event have included changes to the settings on wind farms that count faults. AEMO (with the transmission network service provider, ElectraNet) is also in the process of designing a Special Protection Scheme, which would rapidly trip load to correct a large imbalance, and prevent separation. The system restart process and control room processes through this event have also been investigated and adapted.

Conclusions

The system black event in South Australia offers valuable insights to other power system operators, especially when considering integration of large quantities of wind and photo-voltaic generation.