Contribution for Question 14 – What are the worldwide experiences in situations where the overall power system model failed to predict an actual system event or ongoing occurrences of abnormal responses, and were the causes could be deterministically identified and rectified?

Power system modelling is a fundamental to many engineering activities that underpin secure operation of power system such as development of operating envelope, identifying stability limits and understanding consequences of contingency events. Therefore, it is necessary to have sufficient confidence in the power system model that is being used to support power system operation. The power system model should be validated or benchmarked against real time disturbances to provide confidence in the accuracy of the model.

The Australian Energy Market Operator (AEMO) operates power system of the National Electricity Market (NEM). The NEM has seen an exponential growth in the inverter-based resources (IBR). The connection and operation of a grid with high share of IBR has unique challenges. West Murray is an area of the NEM which has number of IBRs connected in the close proximity to each other.

During 2018 -19, based on a wide-area Electromagnetic Transient (EMT) modelling, AEMO identified poorly damped voltage oscillations following a contingency. A real-time system test shown similar outcome. This exercise proved the capability of capturing this phenomenon through wide-area EMT models.

Since August 2020, the west-Murray area is experiencing intermittent power system oscillation with a frequency of around 17 Hz. The oscillations have been observed with and without any large disturbance. A wide-area EMT model of the network could not manage to replicate the event. This is largely because there is no single event that is causing the oscillations to appear. A reduced order EMT model of the network could replicate the voltage oscillations when the system strength of the area is reduced.