Question 2.8

Are there any case studies that can be used to evaluate and compare the simulation results with the actual phenomena on a real power grid?
What are the real world cases, which the current technologies and tools cannot simulate?
Are there any evaluation or assessment tools for obtaining the mismatch between the simulated results and the actual network behaviour? What kind of modifications could be implemented on the simulation software or settings to improve the simulation results and reduce this mismatch? (e.g. the more detailed modelling of a transformer or a DER for example)?

Response to Question 2.8

The growing DER penetrations are introducing the need for increasingly complex and detailed assessment. These necessitate more detailed and accurate models of both the distribution system and the DER.

Managing detailed and accurate distribution system models is not trivial for several reasons. First, distribution system models are subject to numerous errors such as wrong topology, incorrect phasing, impedance parameter errors, etc. Second, in the past, distribution system models have been rarely validated against field measurement data or in other ways. Third, distribution system, particularly the controls, are becoming increasingly complicated. Fourth, distribution engineers are introduced with new software tools, such as advanced distribution management systems, that also leverage distribution models.

EPRI is actively conducting research on distribution model management and validation approaches and practices. Model management is expected to become increasingly important over time and across software tools. At the same time, the increasing amount of measurement data available at the distribution level is opening new doors for model validation and calibration. For example, there is potential to leverage AMI measurements for identifying and calibrating errors in distribution system topologies, phasing, impedance parameters, and more.

Increasingly detailed and accurate DER models are also required to accommodate and integrate the growing DER penetration levels. However, it can be challenging to represent the rapidly evolving DER technologies and their controls. Moreover, distribution utilities often have limited visibility to the configuration and operation of customer-owned DER. Last, there are no widely accepted DER models and confusion on which model to use.

CIGRE WG C6.36 has aimed to address the challenges associated with DER modelling by developing a DER benchmark model framework for quasi-static time-series power flow simulations that are increasingly used by distribution engineers to assess DER. The framework specifies both the structure of the DER models as well as the scope of the benchmark models. The WG has also laid the foundation for DER benchmark models for solar photovoltaics, energy storage systems, and smart inverter controls. The industry would benefit from continued development of publicly available and widely accepted DER benchmark models. There is also need for testing such reference models against the operation of actual DER in the field, as well as benchmarking software tools against accepted reference models.