DS3:
Model Development & Studies Workstream Plan 2015

CONTEXT

The Facilitation of Renewables (FOR) study was a detailed and wide-ranging study that covered many different aspects of power system stability and power system operation with high levels of wind. The purpose of the DS3 programme is to implement the necessary actions arising from the FOR study results:

- Introduce changes to operational policies where necessary;
- Develop mitigation strategies;
- Change or improve the standards via Grid Code and Performance Monitoring;
- Incentivise system services via the System Services review; and
- Develop our existing dynamic models and run new studies and simulations where necessary.

The Model Development and Studies (MDS) workstream will provide inputs into the Frequency Control and Voltage Control workstreams. It will also interact closely with the WSAT Development plan

OBJECTIVES

The main aim of this workstream is to inform future operational policies related to the integration of large amounts of wind onto the Ireland and Northern Ireland system. In order to do this a range of technical studies and analysis is to be performed. This analysis includes steady-state load-flow, quasi steady-state PV load-flow, short-circuit, dynamic stability, transient stability and frequency response analysis. A significant factor in this is to develop and validate the dynamic model of the Ireland and Northern Ireland system so that the TSOs would have confidence in the results of the studies carried out using those models. Another aim is to streamline and automate the studies process, so that extensive studies on different aspects of power system operation can be carried out more quickly.

WORK COMPLETED IN 2012

In 2012, work commenced on establishing a model of the network that could be used for 2020 studies. This model has been completed; PSS/E cases together with dynamic data are available for the year 2020. There was also significant work carried out on TSO processes necessary to validate different types of model such as exciters and governors.
Several studies were also carried out during 2012, including:

- Loss of Largest Infeed Study
- Historic Analysis of System Frequency Events
- Analysis of Ramping Requirements for System Services

WORK COMPLETED IN 2013

In 2013, the following pilot studies were completed for the Voltage Control and Frequency Control workstreams:

- Pilot Voltage Dip-Induced Frequency Dip Study

- Pilot PV Analysis of the Donegal area
- Short-term System Frequency Response Study

Additionally, the testing of the new TSAT dynamic generic wind farm models from Powertech has been completed. The new models include voltage control modes, emulated inertia, governor droop characteristic, reactive response in fault ride-through mode and slow active power recovery following a fault.

WORK COMPLETED IN 2014

In 2014, the following studies were completed for the Voltage Control and Frequency Control workstreams:
- All-Island Minimum Generation Study
- Over-frequency generation shedding settings schedule study
- Short-Term Frequency Response Study
- Analysis of pilot nodal voltage control project on a wind farms cluster

Significant analysis was also carried out on:
- Voltage Dip-Induced Frequency Dip Study
- Ramping Policy Study

One of the major developments in the MDS workstream in 2014 was the establishment of the Operational Review Panel (OPR). The OPR consisted of members of the EirGrid Group Operations management team. The OPR had the remit of reviewing technical analysis and proposed operational policies before they would be implemented in the Control Centres.

The OPR provides a vehicle for recommendations from the MDS studies to be considered and appraised. Studies from the DS3 MDS workstream have been reviewed by the OPR throughout 2014.

Another milestone achieved in 2014 was the development of an automated approach to large-scale dynamic studies. This approach takes dispatch inputs from Plexos and creates a series of loadflows to be used as the basis of voltage and transient simulations. It is anticipated that this automation tool will allow for more detailed analysis of key technical issues relating to DS3.

FOCUS AREAS FOR 2015

System Studies that will be a major focus of the workstream are:
- Completion of Voltage Dip Induced Frequency Dips studies
- Analysis into short term frequency response and impact on operational policies

There are a number of tasks in this work stream plan that are replicated in other DS3 work stream plans, (in particular Voltage Control and Frequency Control), and have now been removed from this plan to avoid duplication. Similarly a number of other tasks are deemed to now move into EirGrid Group 'business as usual' and will no longer be reported as part of the DS3 Programme.

HIGH-LEVEL PLAN

TASK NO.	DELIVERABLES / TASKS	RESPONSIBLE	ORIGINAL DUE DATE	DUE DATE
Model Development and Validation				
MDS.1.1	Develop all-island model for PSS/E / WSAT	TSOs	Q2 2012	Complete
MDS.1.2	Develop process for Exciter validation	TSOs	Q2 2012	Complete
MDS.1.3	Develop process for validating all–island model against system events	TSOs	Q3 2012	Complete
Enhanced Modelling Capability				
MDS.2.1	Develop generic tuneable wind farm models that can represent behaviours set out in the wind farm Grid Code modifications	TSOs	Q3 2013	Complete
MDS.2.2	Investigate and decide on settings for generic tuneable wind farm models	TSOs	New task	Complete
MDS.2.3	Include new generic tuneable wind farm models in on-going high wind studies	TSOs	New task	Complete
MDS.2.4.1	Pilot version of automated approach to large-scale dynamic studies using Plexos	TSOs	New task	Complete
MDS.2.4.2	Full version of automated approach to large-scale dynamic studies using Plexos	TSOs	New task	Complete
MDS.2.4.3	Scope operational studies using automated Plexos approach based on existing and proposed operational policies	TSOs	New task	Complete
Frequency Control Studies				
MDS.3.1	Frequency Response following a large disturbance	TSOs	Q2 2012	Complete
MDS.3.2	Loss of Largest In-feed Study	TSOs	Q1 2012	Complete
MDS.3.4.1	Study of Ramping Requirements	TSOs	Q2 2012	Complete
MDS.3.5.1	Pilot study to investigate voltage dip-induced frequency dip	TSOs	Q1 2013	Complete
MDS.3.5.2	Full study to investigate voltage dip-induced frequency dip	TSOs	Q1 2013	Q1 2015
MDS.3.5.3	Study to assess the need for STATCOMs due to voltage dip-induced frequency dips	TSOs	New Task	Q1 2015
MDS.3.7	Over-frequency generation shedding settings schedule study	TSOs	New task	Complete
Voltage Control Studies				
MDS.4.1.1	Distributed Voltage Control and Dynamic Voltage Support Study Scoping	TSOs	Q2 2013	Q2 2013
MDS.4.1.2	Distributed Voltage Control and Dynamic Voltage Support Study Analysis	TSOs	Q4 2013	Q4 2013

MDS.4.2.1	Pilot PV study with existing operational practice to determine the level of dynamic reactive power compensation required on the power system	TSOs	New Task	Q4 2013
MDS.4.2.2	Full version of PV study with existing operational practices and sensitivity of new ones	TSOs	Q3 2014	Q1 2015
MDS.4.3	Analysis for pilot nodal voltage control project on a wind farms cluster	TSOs	New Task	Q1 2014
Other System Studies				
MDS.5.1	All-Island Minimum Generation Study	TSOs	Q3 2013	Complete
MDS.5.2	Report back on analysis of wind farm locational stability and system short-circuit strength from Cigre working group'	TSOs	Q4 2013	Quarterly
MDS.5.3	Metrics for assessing system security and stability	TSOs	Q4 2013	Complete
MDS.5.4	Other potential studies: FOR 2 - Consolidation of Renewables (CoR)	TSOs	2014/2015	2016