Rate of Change of Frequency (RoCoF) project Six Monthly Report for June 2016

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1. Introduction

This report provides an update on the status of the RoCoF Generator Implementation Project in Northern Ireland including the DSO implementation project associated with RoCoF modification. The Utility Regulator for Northern Ireland (URegNI) Decision Paper, Rate of Change of Frequency modification to the Grid Code requires that generators undertake technical studies to confirm their compliance with the new RoCoF standard. This new standard is required to facilitate the increased penetration of renewables, mainly wind, on the system and is a key part of the DS3 Programme.

This project formally commenced on 21st November 2014. Each unit on the system has been categorised as high or low priority with a deadline to complete their studies by the end of May 2016, or November 2017 respectively.

There are a number of projects being carried out in parallel to the RoCoF Generator Implementation Project in Ireland as part of the overall RoCoF Implementation Project. These are the Ireland Generator Implementation Project, the TSO alternative/complementary solutions studies and the DSO implementation projects in Ireland and Northern Ireland. Progress on these projects is reported on with the overall DS3 Programme, available here on the EirGrid website.

2. Background

SONI and Eirgrid have embarked upon a multi-year programme “Delivering a Secure, Sustainable Electricity System” (the DS3 programme), which is designed to ensure the power system can be operated with increasing amounts of variable non-synchronous renewable generation over the coming years. Together with the on-going work on infrastructure development (Grid25 and Network25) and the addition of renewable generation capacity, the DS3 programme is critical to meeting the renewable electricity targets by 2020. The DS3 programme includes enhancing generation portfolio performance, developing new operational policies and system tools to efficiently use the generation portfolio to the best of its capabilities, and regularly reviewing the needs of the system as the portfolio capability evolves.

Detailed technical studies undertaken by SONI and EirGrid have indicated that, during times of high wind generation following the loss of the single largest credible contingency, RoCoF values of greater than 0.5Hz/s but no greater than 1.0Hz/s could be experienced on the island power system. In Northern Ireland in a system separation event there is a potential that RoCoF values up to 2Hz/s could be experienced. The conventional generators have stated that they do not know what

the impact of a 2Hz/s RoCoF event will be and must undertake extensive studies to assess the impact.

In its decision paper UregNI approved, in principle, the proposed Grid Code modification and the RoCoF withstand level of up to 1.0Hz/s over a sliding window of 500ms. However, URegNI will not apply the new standard in the Grid Code until it has received confirmation from SONI that a sufficient number of generators can comply with the standard to allow SONI to safely operate the system in a manner reliant on the new RoCoF standard.

3. Final approval categorisation list

The Utility Regulator RoCoF decision paper directed SONI to categorise each generating unit according to the priority in which their declaration of compliance, or submission of a derogation request, should be made in a window from 18 months to 36 months from the commencement date of the RoCoF Implementation Project.

In response to this direction, SONI wrote to the Utility Regulator on 7th July 2014 with a draft proposal for categorisation of generating units. SONI's draft assessment of prioritisation was based on its judgment of the relative importance of the generators and consideration of the existing and forecast run hours of individual generators during high wind scenarios as a result of generators being in merit, constrained on or having priority dispatch.

The draft categorisation list was shared and discussed with generators at a meeting in July 2014 and was also discussed during subsequent meetings between SONI and individual generators in December 2014.

Following these discussions with the generators SONI produced a modified list which was submitted to the Utility Regulator for approval. The agreed final categorisation list is included in Figure 1 below. A 24 month, mid priority, category is included in the ROI decision but not in the NI decision but the table below includes this period for comparison. The Capacity values in Figure 1 have been amended to better reflect the capacity of the units from a RoCoF compliance requirement perspective and the removal of an exempt unit that is now decommissioned. The categorisation of the units in NI remains unchanged from the initial submission.

Category	Northern Ireland Units			
	Station	Unit ID	Capacity (MW)	Owner
1- High Priority 18 mths	Kilroot	K1	256	AES
		K2	238	AES
	Ballylumford	B10	101	AES
		B31	245	AES
		B32	245	AES
	Coolkeeragh	C30	402	ESB
2- Mid Priority 24 mths	(UR decision does not reference a 24 month period)			
3 - Low Priority 36 mths	Ballylumford	BGT1	58	AES
		BGT2	58	AES
	Kilroot	KTG1	29	AES
		KTG2	29	AES
		KTG3	42	AES
		KTG4	42	AES
	Coolkeeragh	CTG8	53	ESB
4 - Exempted	Ballylumford	BST4	144	AES
		BST5	147	AES
5 - New	(None)			

Figure 1 NI Generator RoCoF categorisation list

4. Project Progress

4.1 Background

Though one of the issues in raising the RoCoF level for the large conventional generators is the risk of losing synchronous stability during leading power factor operation the conventional generators have stated that they do not know what the full impact of a 2Hz/s RoCoF event on their plant will be. Some conventional generators have cited safety concerns (e.g. catastrophic failure of a unit) as well as the potential adverse impacts of frequent high RoCoF events on the lifetime of the plant equipment. Therefore, detailed technical studies have to be undertaken by the generators in order to determine compliance with the new RoCoF standard. Typically, plants will have to be adequately represented with its electro-mechanical limitations, such as flame stability and combustion controls, mechanical stress and transient torque on the turbine and rotor shaft, generator control and instrumentation equipment (e.g. excitation, PSS, protection), and additional auxiliary equipment required to operate the unit.

While the exact nature and scope of the studies units will have to undertake will vary, the scope of studies has been divided in to two broad sets of studies:

- Electrical dynamic simulations: The purpose of these studies is to assist SONI in assessing the impact on the transmission system of each generation unit's response to 2Hz/s over 500ms RoCoF values.
- Mechanical/Plant integrity studies: This set of studies aims to examine whether the safety or plant integrity issues previously raised by some generators are material.

The DSO has a significant amount of generation connected to the distribution system in NI, currently approximately 90% of the wind generation in NI is connected on the distribution system. There is also a significant amount of small-scale conventional generation connected to the distribution system and both this and the wind have to be included in the RoCoF change implementation plan to allow the TSO to operate the system at higher levels of renewable generation. As such there is a DSO project as part of the RoCoF changes and as required by the UregNI RoCoF decision, an update on the DSO implementation project is to be included in this six monthly update. This is included in section 4.3 below.

4.2 Progress of conventional generators

The RoCoF Implementation project formally commenced on the 21st November 2014, bilateral meetings were held between the generators and SONI at the end of Q4 2014 to start the process. Each Generator was requested to provide a detailed project plan to which progress could be monitored and measured against.

This section contains the progress for Q1 of 2016, the third progress report, for the generation stations identified in the approved categorisation list. In the report all category 3 units are assumed to be on target at this stage as the focus to date has been on category 1 units and putting the relevant contracts in place to ensure the targets for these units are met.

Progress for each category 1 generator and the overall project status is assessed against the project programme using corresponding "traffic light" indicators as shown in Table 1. A summary for the progress of each Power Station is then presented.

Overall Summary	
All generators have started the project with high priority plant generally further advanced than low priority plant. As can be seen in the reports a number of units have failed to comply with the category 1 deadline. It has also been highlighted that should the studies necessitate remedial action then it may not be possible to complete the works within the time period.	
Overall Status	R
Station/Unit	**Progress**
Ballylumford B10	
Ballylumford B31	
Ballylumford B32	
Kilroot K1	
Kilroot K2	
Coolkeeragh C30	

Table 1 Project progress

Generator	Progress
AES Ballylumford Power station	
AES have engaged with the OEM for the three CCGTs in this station and the initial studies for B31 and B32 have been reviewed by SONI. Comments were returned and an amended report has now been received by SONI. B31 and B32 are now in the six month review period with the aim to have reports finalised and the units tested during this period. No studies have been received for the unit B10 and as such the progress for Ballylumford Power station has been marked as Amber. The unit B10 will incur a GPI from the 1st June 16.	

Generator	Progress
AES Kilroot Power station	
AES have engaged with the OEM. This OEM had a significant number of requests for studies from generators on the island as a whole and this subsequently led to a delay in engagement with AES. Thus because of this initial delay and complexity of the studies there has been a subsequent delay in completing the relevant studies for these two units and so the category 1 timeframe has not been met, hence the red in the progress report. AES will incur a GPI for these units from the 1st June 16.	

Generator	Progress
ESB Coolkeeragh Power Station	
ESB have the majority of generating units on the island within the project spread across all three stages (high, mid (in ROI) and low priority). The Coolkeeragh unit (C30) has multiple OEMs and ESB has appointed two separate consultants. One to study the RoCoF capability of the Gas Turbine and associated generator. A second consultant has been appointed to study the Steam Turbine and associated	

generator as well as the interaction between both units. A partial report has been received for the Steam turbine and associated generator but no report for the Gas turbine and associated generator. As the completed reports for the unit as a whole has not been received in the category 1 timeframe the progress has been changed to red. Coolkeeragh ESB (CESB) will incur a GPI for this unit form the 1st June 16.

4.3 Progress of DSO

DSO	Progress
NIE	
NIE Networks have revised the completion dates of their tasks in the RoCoF work stream. The completion date for the NIE Networks work is now shown as Q3 2017 in line with end of the Generation studies. The completion of the NIE Networks work is dependent on several factors: a positive outcome from academic research; agreement between NIE Networks and Health & Safety Executive Northern Ireland with regards to an acceptable increase in risk; cooperation from generators in amending Loss of Mains (LOM) protection settings and implementation of the necessary code changes. Based on the latest information from NIE Networks they are on schedule.	