# INNOVATION STRATEGY CLOSE-OUT REPORT

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| PROJECT TITLE | New RoCoF settings for Distributed Generators |
| PROJECT OWNER | Tony Hearne, DSO-TSO Interface Manager, ESB Networks |
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## BRIEF OVERVIEW OF PROJECT & EXPECTED BENEFITS

This project is a key enabler to ensure distributed generators are able to withstand system frequency changes driven by the increased amount of renewable generation connected to the network. The task of setting new Rate of Change of Frequency (RoCoF) relay settings for distributed generators arose from ongoing interactions with EirGrid under the general umbrella of DS3.

DS3 is a programme of work that is necessary in order to operate the power system with up to 75% of the instantaneous power coming from non-synchronous sources. In such a world, following disturbance, the frequency can change at a rate of up to 1 Hz/s. The issue is that legacy distribution connected generators have relays on them that are designed, for legitimate anti-islanding reasons, to trip at 0.4-0.6 Hz/s. If this situation were allowed to continue and all other workstreams progressed to a stage that 75% non-synchronous penetration was allowed, then in the event of such a disturbance, all distribution connected generation [up to half of the generation] would also trip out. Such a scenario would likely lead to a total system black out. The task of setting new Rate of Change of Frequency (RoCoF) relay settings for distributed generators was implemented to avoid this.

Failure to achieve this would have resulted in the ratio of non-synchronous generation on the system being capped at 60%, as opposed to the target of 75%, upon which the Republic of Ireland's carbon targets are based. Attainment of this milestone is one of the conditions for and enables the achievement of 75% System Non-Synchronous Penetration (SNSP).

## RESULTS

This project has taken a high degree of effort and time to achieve. The objective was to change the RoCoF settings on protection relays on a sufficient quantum of distribution connected generation.

On the face of it, this may appear straightforward but, in the execution, many challenges surfaced:

- Wind generators, who had no financial incentive to make the changes were slow to do so and required further engagement. In the event however, ultimately, all did change settings.
- For non-wind, non-exporting generators, these were different for a number of reasons;
    - They have no financial incentive to co-operate
    - These generators reside in factories, hospitals and businesses. In general, the plant owners had little interest in or were not aware of the issues. Communicating the message to them was quite challenging
    - Any technical discussions had to take place with the Original Equipment Manufacturers [OEMs] or their agents.
    - Whilst the wind generation fleet was generally large, this fleet was characterised by a large number [c600] of sites with relatively small generator sizes.
    - There are many variants of topology and configurations among this cohort, which affect how they contribute to the global issue at hand.
- The target volume was debated but ultimately a pragmatic target of 340MW of high-risk generation for this cohort was agreed for 2018, on the basis of realisable effort.

## LEARNINGS

Along this journey, much has been learnt. Some are itemised below.

- The complexity and variations in topologies and modes of operation were better understood and this informed a more surgical approach.
- A five-step plan for engagement was devised to adequately reflect the triangular relationship between System Operator, Plant Owner and OEM.
- The messaging for the plant owners was refined.

## BENEFITS REALISED/VALIDATED

- On target to achieve 75% SNSP.
- The non-exporting, non-wind cohort formed a representative body, Synchronous Generators Ireland [SGI] and are now a member of the Distribution Code Review Panel.
- Good relationships have been formed to address technical issues with the SGI

## NEXT STEPS – BAU, TRANSFER OF OWNERSHIP

As of November 2018, the targets, as understood by ESB Networks, were deemed to be met.

At the time of writing active discussions are ongoing, involving, EirGrid/SONI, ESBN/NIEN and CRU/UR as to how much additional change is needed to give Eirgrid/SONI sufficient comfort such that trials to validate the release of the remaining steps of SNSP up to 75% can begin. This will likely drive a new project.

## FINAL TIMELINES (REASONS FOR ANY DELAYS IF THEY OCCURRED)

End 2018. Start c 2014.

Reasons and challenges for delays are outlined above.

## FINAL COSTS

This project was resourced from existing staff in Future Networks.

There were no capital costs other than a small amount incurred in the procurement of sample relays to carry out injection tests in the early stages of the project.