Rate of Change of Frequency Modification to the Northern Ireland Grid Code

Utility Regulator Decision Paper



About the Utility Regulator

The Utility Regulator is the independent non-ministerial government department responsible for regulating Northern Ireland's electricity, gas, water and sewerage industries, to promote the short and long-term interests of consumers.

We are not a policy-making department of government, but we make sure that the energy and water utility industries in Northern Ireland are regulated and developed within ministerial policy as set out in our statutory duties.

We are governed by a Board of Directors and are accountable to the Northern Ireland Assembly through financial and annual reporting obligations.

We are based at Queens House in the centre of Belfast. The Chief Executive leads a management team of directors representing each of the key functional areas in the organisation: Corporate Affairs; Electricity; Gas; Retail and Social; and Water. The staff team includes economists, engineers, accountants, utility specialists, legal advisors and administration professionals.

Our Mission	Value and sustainability in energy and water.
Our Vision	We will make a difference for consumers by listening, innovating and leading.

Our Values

Be a best practice regulator: transparent, consistent, proportional, accountable, and targeted.

Be a united team.

Be collaborative and co-operative.

Be professional.

Listen and explain.

Make a difference.

Act with integrity.

Abstract

The electricity transmission System Operator for Northern Ireland (SONI) has proposed a modification to the Northern Ireland Grid Code that will introduce a minimum Rate of Change of Frequency (RoCoF) requirement. This will have the effect of helping to facilitate a greater penetration of renewable generation on the Northern Ireland grid.

This paper presents our decision on the matter.

Audience

Regulators, transmission system operators, distribution system operators, generators, large energy users, manufacturing groups, consumers and interested parties

Consumer impact

Accepting this proposal will help SONI facilitate higher levels of renewable generation on the Northern Ireland power system. This will in turn help facilitate achieving the 40% renewable target set out in the Strategic Energy Framework for Northern Ireland.

Executive Summary

The electricity transmission System Operator for Northern Ireland (SONI) has proposed a modification to the Northern Ireland Grid Code that will introduce a minimum Rate of Change of Frequency (RoCoF) requirement of 1Hz/s measured over 500ms. This will have the effect of helping to facilitate a greater penetration of renewable generation on the Northern Ireland grid.

On 27 August 2013, we published a minded to decision paper on this proposed modification and invited comment from all interested parties. Ten responses to this paper were received and are published alongside this decision.

Having considered these responses, we remain of the view that the introduction of a Grid Code standard that introduces a minimum RoCoF requirement is necessary to meet Northern Ireland renewable targets. Based on this assessment we approve in principle the proposed modification so as to facilitate progress in relation to generator studies.

In order to facilitate the implementation of this new standard, we request that SONI identify a list of priority generator units. These units will be given a period of 18 months to carry out studies (should they be required) to ensure compliance with the new standard. This timeframe will close on 10 November 2015. Other units may be given a further 18 months to comply with the new standard provided they have received a Grid Code derogation.

Further to this we request that SONI oversee the process for implementation, establish a working group to facilitate consistent delivery of studies and review any derogation requests received from generators. If a generator is to be exempt from the incentive (GPI) mechanism set out in this paper then any application for a derogation must be submitted to us by 10 August 2015.

As part of the overall programme SONI are requested to submit regular six-monthly reports to us. The first report is due on 10 November 2014. These reports should also outline the scope and progress of work carried out on examining other options on reducing RoCoF events. Any complimentary options being pursued should not duplicate ongoing work to increase levels of SNSP in the DS3 workstream.

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Introduction

1.1. Purpose of the paper

On 27 August 2014, we published a minded to decision paper on proposed modifications to the Northern Ireland Grid Code that will introduce a minimum RoCoF requirement and invited comment from all interested parties.

We have engaged with the Commission for Energy Regulation (CER) on the matter to review the proposed grid code modification and to co-ordinate our decisions and their implementation.

Ten responses were received from industry. All of these were non-confidential and have been published on our website along with this paper.

- SSE
- SONI
- NIRIG
- Ipower
- PPB
- RES
- Energia
- ESB
- EAI
- AES

Of the responses three expressed approval of the minded to decision and seven disagreed. The following paper will discuss the main themes of responses along with our views. This will be followed by our decision on the Grid Code modification submitted by the SONI.

1.2. Background

Northern Ireland energy policy, as set out in the Strategic Energy Framework 2010, is to achieve 40% renewable electricity in the supplied energy mix by 2020. This target is aimed at improving environmental sustainability and providing energy supply security and shall ensure Northern Ireland meets EU legislation and targets.

The requirement for a RoCoF standard has been brought about primarily by changes in the generation supply mix that will be required to meet the 2020 targets. This situation is not unique to Northern Ireland and electricity systems across the EU have either implemented, or are looking to implement, RoCoF standards into their respective network codes. In order to meet the targets, a large portion of the generation supply mix will be brought about by System Non Synchronous Penetration (SNSP) generation such as onshore wind. This has led to a number of challenges facing the power network. As the level of wind in the generation mix increases, the contribution from conventional generation units decreases and the system will lose their contribution to the stability of the system. Wind farms have a considerable impact upon system frequency, mainly through their lack of contribution to the moment of inertia on the system.

In order to facilitate the delivery of the targets whilst maintaining operational security on the power system SONI have proposed the introduction of a RoCoF modification for Northern Ireland. SONI has indicated that the introduction of a 1Hz/s measured over 500ms RoCoF capability could facilitate higher levels of SNSP than the current operational limit of 50%.

The RoCoF change alongside other DS3 initiatives will be required to reach the SNSP of 75%; the target at the completion of the DS3 programme. Therefore without this higher RoCoF standard, the curtailment of wind will be higher (SNSP cannot exceed 50%, a threshold which is being hit with increasing regularity as more wind connects to the system) and the overall 40% target may not be achieved by 2020.

1.3. Structure of the Decision paper

This paper is structured in the following manner:

Section 1.1 to 1.3 covers the introduction and background to our decision

Section 2.1 to 2.5 covers the issues raised in comments made by respondents in respect of the minded to decision paper and our response

Section 3.1 to 3.7 covers our decision on the SONI Rate of Change of Frequency Grid Code Modification

Responses to the Minded to Decision Paper

In our minded to decision paper, we proposed to accept the SONI request to introduce a 1Hz/s measured over 500ms RoCoF standard into the Northern Ireland Grid Code. Generators would be given a period of 18 months to comply with the standard and carry out any studies to ensure compliance. We stated that any studies should assess the impact of a RoCoF of up to 2 Hz/s (TSO studies have shown that instantaneous RoCoF values in excess of 2 Hz/s could be experienced in Northern Ireland if system separation were to occur on the island). We were also minded to endorse proposals developed by the CER to introduce a Generator Performance Incentive (GPI) for non-compliance with the standard.

Of the ten responses received three agreed with the proposals and seven were against. Below is an outline of some issues raised in the responses and other general comments.

2.1 Respondent views on our minded to decision to accept the SONI Grid Code Modification

A majority of the respondents expressed the view that we should not accept the proposed SONI modification at the current time. It was suggested that until studies are carried out on the generating units we would not be in a position to either accept or reject the modification. However, a minority of respondents disagreed and expressed their support for the modification with one respondent commenting it *"strongly supports the proposal to accept the SONI proposal to introduce a 1Hz/s RoCoF standard into the Northern Ireland Grid Code."*

Our Response

We acknowledge that both the generators, TSOs and the CER consultants PPA all indicated that technical studies on generating units are likely to be required to ensure compliance with the standard. The studies will help to assess the impact of a RoCoF event on plant equipment and should identify any amendments to plant equipment to ensure compliance, if required. In our minded to decision we gave a period of 18 months to allow for studies to be carried out and any changes, if required, to be made to plant equipment. We noted that timelines for studies to be carried out have been estimated at 12-18 months, hence this timeline would

allow for their completion. However we do acknowledge the difficulties faced, as outlined below, by the original equipment manufacturers (OEMs) to carry out studies in all plant within this timeframe.

2.2 Respondents views on the proposed decision to allow 18 months before the modification comes into practice.

Responses regarding the implementation of the RoCoF standard generally focused on the timelines set out in our minded to decision. The majority of respondents stated that the 18-month timescale was unrealistically short. In support of this position respondents then went on to state that given the specialised nature of the studies OEMs expect to face resource constraints, thereby making it difficult to carry out multiple studies simultaneously.

However this was not the view taken by all respondents. One respondent commented that the extended 18-month period would likely delay the implementation of policy changes. There was also support for the timescales, with one response stating their support for the timelines for the introduction of the standard and they further noted that it is essential that there are no delays in its delivery.

Our Response

We acknowledge that carrying out generator studies is a complex process that represents a significant amount of work for all parties involved.

In our minded to decision we concluded that an 18-month timeframe would be necessary to enable each generator and its original equipment manufacturer (OEM) to carry out studies, if necessary, that would confirm compliance with the new standard or identify amendments needed to enable compliance. The 18-month timeframe was highlighted by a number of respondents as the maximum time it would take for studies to be carried out on generators equipment.

As there are a small number of units in Northern Ireland we do not believe that the argument of OEM resource constraints is strong enough for us to alter our initial timeframe. However, as we detail in our decision, we recognise that it may be more important for certain priority units to comply with the new standard.

Consideration of this priority will be given when deciding upon any derogation requests in relation to the new standard.

2.3 Respondents views on the proposed introduction of a GPI for non-compliance.

The majority of respondents were of the view that the GPI proposed in the CER consultation, that we were minded to implement, was disproportionate and unfair. The view was that an imposition of GPIs for non compliance created a situation where one class of system user are impelled to provide a system for others and would be hit by a penal and unfair GPI if they could not. One respondent stated that given that it is not entirely clear if all generators can comply with the proposed modification *"the size of the level of penalty is disproportionate and unfair given the uncertainties which still exist"*.

Our Response

We note that the proposed GPI would be dependent upon SONI being able to confirm that the new standard could be safely implemented. Taking this into consideration we consider that the application of a GPI for non-compliance is appropriate.

That being said we also note the concerns of respondents regarding the scale of the GPI. This was designed to take into consideration the importance of the issue and the need to resolve the technical uncertainties within a set timeframe.

In response to the comments received we, along with CER, have reviewed the GPI modification and its cost implications from the minded to decision. These changes, combined with a phased implementation will result in a lower GPI and a longer period of time in which to determine compliance.

2.4 Respondents views on SONI overseeing the implementation of studies and compliance with the modification

While there was considerable comment on the subject of who should manage the project there was no consensus on the exact approach that should be taken. Some respondents were in favour of the TSOs leading the project, with one

stating, *"undoubtedly the TSOs are in the best position to co-ordinate the responses from generators and determine when that level of plant has been attained"*. Another respondent felt that a third party technical advisor with detailed knowledge of generator behaviour would best manage the project. SONI themselves also provided their thoughts on the issue stating that they disagreed with our view that they ensure that compliance with a higher RoCoF value is achieved.

Our Response

We welcome all comment received in this area and the concerns raised by SONI. The lack of consensus in this area highlights the merit of a range of options that exist with regards to whom should oversee the project. After reviewing all comments we have taken the view that all parties will have an important role to play and a collaborative approach should be adopted.

As SONI have responsibility in relation to Grid Code and SONI engineers carry out testing and monitoring of plant and plant equipment to ensure compliance, the Utility Regulator considers that they possess the knowledge and are best placed to manage the project. If disputes arise between SONI and the generators the Utility Regulator can (as appropriate) act as a dispute body.

We remain of the view that SONI is best placed to oversee the project to carry out generator studies and ensure compliance with the Grid Code modification. We also take the view that the obligation must be placed on generators to perform studies and provide such information to SONI as they require to assess compliance.

Given the low number of units involved in Northern Ireland the Utility Regulator also believes that external assistance is not required at this time. However we are happy to review this position should the need arise. If SONI require additional technical support in relation to this workstream then any associated costs will be considered within the normal price control process.

2.5 Respondents views on other solutions to increase the levels of wind penetration

Some respondents have stated that detailed studies should be carried out on alternative options that could reduce RoCoF levels and possibly remove the

requirement for a Grid Code modification. One respondent went further, detailing a number of areas that could be explored in detail and asking that we instruct SONI to identify all technically feasible methods and undertake a study to see if they are a viable means of managing the system with higher levels of SNSP.

Our Response

Currently both Regulatory Authorities are working with the TSOs to bring forward a significant workstream that is examining the best methods to facilitate the integration of high levels of instantaneous renewable penetration across the island. This project focused on the Delivery of a Secure, Sustainable Electricity System (DS3). The DS3 project is undertaking a comprehensive analysis of the long term needs of the power system and is identifying options and products that will facilitate the meeting of renewable targets.

Nevertheless studies into complementary options should be carried out to ensure that all aspects are explored that will reduce the impacts of RoCoF events. These studies should not duplicate the work that is being undertaken in the comprehensive DS3 project. Should other options arise as part of the studies that are deemed to be viable they will be considered alongside the current approach.

Our decision on the proposed Grid Code amendment

3.1 Our Decision

We consider that the introduction of a Grid Code standard that introduces a minimum RoCoF requirement is necessary to meet Northern Ireland renewable targets. Based on this the Utility Regulator approves in principle the proposed modification so as to facilitate progress in relation to generator studies. However our decision will only come into effect following confirmation from SONI that from a system security perspective it can be implemented.

3.2 Phased Implementation

Following a review of the SONI recommendation, responses from industry, further submissions from individual generators and the PPA report we have decided that as part of the implementation of a new RoCoF standard, SONI should identify a priority list of generating units. Priority units are expected to be units with relatively high run hours and will frequently be constrained on and run at times of high wind. It is not expected that these units will be granted any derogation in respect of this Grid Code requirement.

Other units may be given a further 18 months to comply, provided they have received a Grid Code derogation. For all generating units that do not expect to be able to comply with the new RoCoF standard within the stipulated period, their priority status will be an important factor in determining whether to grant any derogation from the standard. Any derogation granted is expected to be time limited.

Priority generators will most likely be running during periods of high wind penetration. It is therefore important that they are capable of being able to comply with the standard within the stated timeframe. In order for any unit, both priority and non-priority, to be excluded from the GPI for non-compliance a derogation request must be submitted to us no later than 10 August 2015. If no derogation request is submitted within this timeframe then it will be assumed that the plant is able to comply with the standard and so the GPI for non-compliance

shall apply. Details on the proposed GPI are set out in section 3.3 of the paper.

This approach is expected to allow sufficient time for generator studies, should they be required, to be completed and for SONI to confirm safe operation of the system. Any studies should assess compliance up to 2Hz/s, as this could potentially be required in the event of system separation between the Northern Ireland and Republic of Ireland networks.

SONI will, in 18 months, assess the possibility of operating the system at a higher penetration of non-synchronous generation where a portion of the generation fleet has demonstrated compliance with the new standard and a portion has not. SONI will also continually assess the viability of relying on the dispatch of compliant generators at these times. Under such circumstances non-compliant generators would be considered technically unavailable when the SNSP (or equivalent metric) is over 50%.

3.3 Financial Arrangements

While we appreciate the views of generators who feel that they are required to pay for expensive studies to prove compliance with a modification which will, upon implementation, actively disadvantage their plant, we do not consider that this is sufficient to warrant a change in cost provision regarding Grid Code modifications.

Electricity systems across the world are demanding greater flexibility from generators in response to initiatives to diversify supplies and increase renewable (often-intermittent) penetration. We are of the view that it is not unreasonable to expect improved flexibility from all generators on the system. The appropriateness of rewarding generations for enhanced flexibility is being considered as part of the DS3 and I-SEM workstream.

We do however acknowledge that in addition to the costs associated with the studies there may be operational cost implications with higher RoCoF events. In this regard we will continue to explore appropriate incentives and rewards for proving flexibility in relation to the DS3 and I-SEM workstreams and the Harmonised Ancillary Services (HAS) arrangements. We will work with the CER to bring a recommendation to the SEM Committee in this regard.

We consider it important that a GPI shall also be put in place for non-compliance.

Both the Utility Regulator and CER have revised the design of the GPI and have decided to phase its introduction. Units shall become eligible for the GPI according to the deadline associated with their categorisation. Together with the CER we will recommend, to the SEM Committee that a GPI of the form set out below be applied on an all-island basis. This will be confirmed alongside confirmation of our decision on this matter on 10 November 2015.

Formula:

$$(a - b) \times (€5{,}500) \times (d) \times (e) = c$$

Where a=RoCoF standard;

b=Unit's RoCoF level;

d=scalar associated with size of unit;

e=scalar associated with the period of time from the publication of this paper; and

c=the daily charge.[1]

Reg. Cap	**D**	**Annual charge**	18 months **e= 25%**	24 months **e= 50%**	30 months **e= 75%**	36 months **e= 100%**
≥ 400MW	1	€1,003,750	€250,938	€501,875.0	€752,812.50	€1,003,750
≥ 300MW	0.75	€752,813	€188,203	€376,406.3	€564,609.38	€752,813
≥ 200MW	0.5	€501,875	€125,469	€250,937.5	€376,406.25	€501,875
≥ 100MW	0.25	€250,938	€62,734	€125,468.8	€188,203.13	€250,938
≥ 50MW	0.15	€150,563	€37,641	€75,281.3	€112,921.88	€150,563
< 50MW	0.05	€50,188	€12,547	€25,093.8	€37,640.63	€50,188

It should be noted that it may be possible to operate the system at the new standard with a set of generators who are compliant, and excluding those that are not, at times of high non-synchronous generation. Under such circumstances non-compliant generators would not be technically available which may have an impact on market payments. All generators will require a derogation if they are to be made exempt from the charges.

[1] For example a 450MW unit, categorised as high-priority, and that had not demonstrated compliance after 18 months would face a daily charge of €687.5 and €1,375 after 24 months, etc.

3.4 Generator Studies

We have given consideration to which party should oversee the implementation of the above proposals. Our decision on the matter is set out below:

- SONI is to oversee the process and a Grid Code working group is to be established between SONI, Generators and other relevant parties to ensure consistent delivery of studies and that a fair and transparent process is applied.

- The working group will define the terms for carrying out studies, which will include the minimum level of information which the generator will need to obtain from their respective OEM. SONI will submit a report on the working groups progress to the Utility Regulator every 6 months, with the first report due on 10 November 2014.

- The generator studies themselves will be project managed by the generator concerned with an agreed report structure to ensure consistency across all studies. Specifically SONI will input into the generator's study at the outset, at pre-agreed interim milestones and at the study's conclusion.

- Upon conclusion of the generators study it will be sent to SONI who will carry out a review to determine the overall security of the system with the new RoCoF standard.

Given the low number of units involved, we do not consider that external assistance is required. However if SONI require additional technical support then any associated costs will be considered by the Utility Regulator within the normal price control process. We would have no objection to the working group collaborating with any equivalent group in the Republic of Ireland.

3.5 TSO-DSO Implementation project

The generation that will be within the scope of this decision paper will be limited to transmission connected generation and to >5MW power stations connected to the 33kV distribution network. Whilst the TSO will be responsible for overall governance of the RoCoF implementation project in respect of Grid Code

compliance studies, impact on demand customers, and quality of supply, this will necessarily require support and cooperation from the DSO in respect of consideration of impact to the 33kV distribution network. This interaction will also be required to ensure coordination with proposed Distribution Code RoCoF requirements. An update on this work stream will form part of the overall working group report detailed in section 3.4

3.6 Solutions to compliment the RoCoF modification

There is merit in considering complimentary solutions to reduce the requirement of the RoCoF standard. In this context we request that SONI consider its approach to identifying and assessing the feasibility of these and we would ask that SONI consider and review the following aspects:

- the impact of the introduction of Synthetic Inertia,
- measures to increase inertia on the system through network investments, Storage and strategic investment.
- Changes to operational policy
- Any other matters the TSO considers relevant.

This work should not duplicate what is being carried out as part of the DS3 workstream and progress should be reflected in the overall working group report detailed in section 3.4.

3.7 Change in Law

For the avoidance of doubt we do not consider that the changes outlined in this decision constitute a relevant change in law for the purposes of the Power Station Agreement (PSA) and Generating Unit Agreement (GUA) contracts.