Public

Grid Code Development Forum

2 April 2025

NESO
National Energy System Operator

Agenda

1	Introduction, meeting objectives and review of previous actions - **Claire Newton, NESO**
2	95% Grid Code Compliance Tests – **Garry Cotter, Orsted**
3	Evolving Grid Code Requirements, Grid Code vs Guidance Notes, Sub Synchronoss Oscillations – **Steve Sommerville, AURORA POWER CONSULTING**
4	The Grid Code development process and achieving CP2030 - **Andrew Larkins, SYGENSYS**
5	AOB and Meeting Close - **Claire Newton, NESO**

GCDF – Objectives and Expectations

Objective
Develop ideas, understand impacts to industry and modification content discussion, in relation to Grid Code related issues.
Anyone can bring an agenda item (not just NESO!)

Expectations
Explain acronyms and context of the update or change
Be respectful of each other's opinions and polite when providing feedback and asking questions
Contribute to the discussion
Language and Conduct to be consistent with the values of equality and diversity
Keep to agreed scope

The Forum will be recorded and made available on the GCDF webpage along with summary notes.

95% Grid Code Compliance Tests

Garry Cotter

Grid Connection Manager

Orsted

25th March, 2025

Purpose

- Meet the requirements as specified in:
  - Grid Code (GC).
  - Connection and Use of System Code (CUSC).
  - Bilateral Connection Agreement.
- Section ECP.A.6 of the GC describes the general testing requirements.
- Sections ECP.6.4, ECP.A.6.5 and ECP.A.6.6 describes different tests for reactive power, voltage control and Frequency control.

Test Conditions

- Windfarm has a TEC of 1.8GW.
  - Consists of two offshore platforms.
  - Two BMUs and four PPMs per platform whereby
    - each PPM is controlling fifteen 15MW WTGs i.e. 225MW.
- At least 95% of the WTGs within the power park module PPM under test shall be in service and contribute to frequency control.
- Each balancing mechanism unit (BMU) has two PPMs.
- Wind farm voltage at the 66kV PPM busbar must be within ±5% of nominal voltage.

Dilemma

- Wind turbines have increased in size i.e. blade size, hub height and hence MW rating.
- Number of PPMs and BMUs is increasing since offshore windfarms are increasing in number of wind turbines, name-plate capacity and TEC.
- If a single PPM consists of three strings with a total of fifteen 15 MW wind turbines i.e. 225MW, when a single wind turbine is not in service then the:
  - Available capacity per that PPM is 210MW which is 93.3% of 225MW.
- In essence the 95% requirement becomes identical to 100% since all WTGs per PPM need to be available.

Proposal

- Instead of stipulating that 95% of installed capacity needs to be online could the requirement be that the test can be performed if one wind turbine per PPM is not in service, with the Grid Code text modified as following where applicable in relevant sections of ECP.A.6

"…*at least 95% of the Power Park Units within the Power Park Module in service or with one Power Park Unit within the Power Park Module out of service, whatever is less…".*

AURORA
POWER CONSULTING

Grid Code Development Forum

Evolving Grid Code Requirements
Grid Code vs Guidance Notes
Sub Synchronoss Oscillations

info@aurora-power.co.uk
www.aurora-power.co.uk

Compliance Process & Contracts

Evolution over Contract Duration

- A general principal in all contracts is that they are formed around the documents that are in existence when the contract is signed. They cannot anticipate new documents or changes.
- Project timescales are easily 12+ months – multiple changes can occur.
- NESO are facing challenges, and the Grid Code requirements are evolving. Therefore, the Grid Code and the Guidance Notes are being updated frequently.
- Big Changes i.e. GC0141 are caught and implemented fairly well – but a lot of smaller changes are being missed.

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Grid Code vs Guidance Notes

Grid Code vs Guidance Notes

- The general approach should be that the Grid Code is the legal text and Guidance notes inform / clarify scope.
- In recent years this has become complicated, and Guidance Notes are including new requirements over and above the Grid Code.
- Some ambiguities are to be expected and are usually easily resolved via discussion.
- For small changes this is not unreasonable, as modifying the Grid Code is complicated – but it should not bring in changes that materially affect design and project timescales.

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www.aurora-power.co.uk

Grid Code vs Guidance Notes

Grid Code vs Guidance Notes

- Most of the issues relate to FRT and LVRT response.
- GC0141 includes a requirement to validate the FRT of a unit against the OEM results. This is not realistic / credible. FAT tests are carried out in labs not the field against different conditions.
- Guidance notes refer to accurate FRT tests being carried out in EMT. The Grid Code does not require this: ECP A.3.5 requires simulations to be RMS only.
- PC A.9.3 – suggest simulations should be **balanced**, this inherently will not give accurate results, and is not possible for FRT.

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SSO Studies Impact

General Issues

- Requirement has been brought in without consultation.
- Just because a generator can oscillate does not mean it will – no mechanism to consider actual modes on the NESO system.
- No formal requirement in Grid Code for SSO – existing requirements only cover synchronous machines.
- Too many scenarios and combinations. Reporting and Review process has not been considered – masses of long tabulated results / plots. Enough NESO resource?
- Significant delay to all projects – 12 to 36 weeks.

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SSO Studies Impact

Quantity of Study Cases

- Too many scenarios and combinations
  - x2 (max and min fault level)
  - x3 (different control modes)
  - x6 (different loadings modes 20%, 50% and 100% at both import and export)
  - x3 (different reactive power levels of min, max and unity)
- Volume of Study Cases not credible – even with automation
  - Method 1 = 864 cases => ((2+2+4) x 2 x 3 x 6 x 3)
  - Method 2i (Small signal voltage oscillation) = 10908 cases => (101x2x3x6x3)
  - Method 2ii (Small signal voltage angle) = 10908 cases => (101x2x3x6x3)
  - Method 3 = 108 cases =>(2 x 3 x 6 x 3)
  - Method 4 = verbally confirmed as not required by NESO
  - Total = 864+10908+10908+108 = **22788**
- Even with automation
  - Assume 60s case for run time and review by exception
  - 22788*60 = 380 hours = 10 weeks!
  - Any change to the network invalidates all the results

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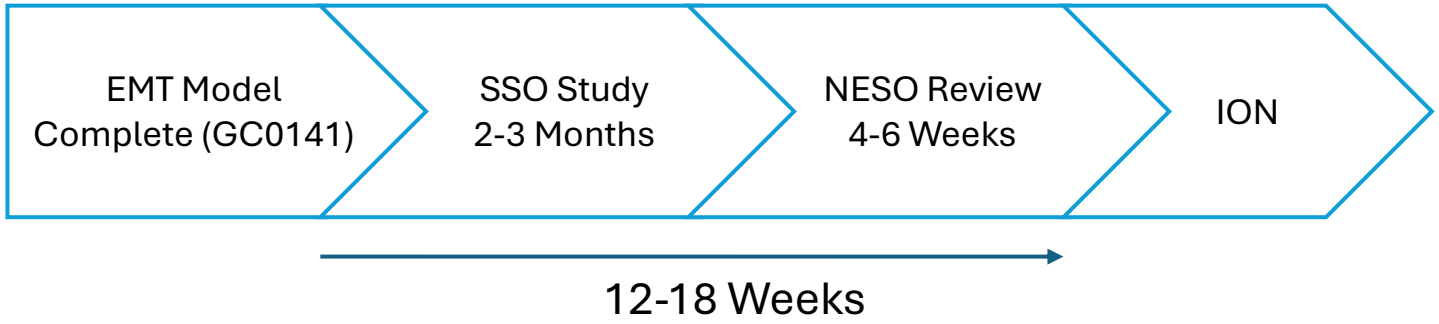
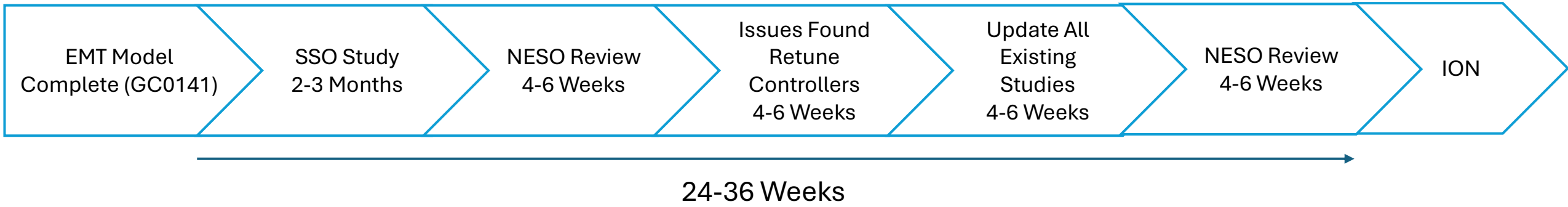
SSO Studies Impact

Production & Review Timescales

Best Case



Realistic Case



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The Grid Code development process and achieving CP2030.

Presentation to the Grid Code Development Forum

Andrew Larkins

2 April 2025

Objectives

- This presentation aims to provoke discussion and continuing improvement actions.
- It provides observations to GCDF and broader groups involved in code modifications, based on input from a wide range of sources.

Alongside being constructively critical it is important to acknowledge:-

- The transition to renewables is a period of rapid change
- Hard working staff in code change and admin teams
- Skilled Subject Matter Experts within NESO
- Vital contribution from WG members/observers who are volunteers
- OFGEMs oversight of code development

- Even after the Heathrow incident, compared to other counties globally we have a highly reliable grid combined with a fast transition to renewables.

Is the Grid Code development process failing to meet the needs of Users and Consumers?

- The GC mod process is struggling to adequately support the rapid transition required to meet government and broader societal objectives.
- It is seen by some in the industry as a barrier to achieving CP2030 and NZ2050
- On occasions it is delivering poor outcomes for stakeholders including consumers, generators operators, DNOs and NESO.

- The remainder of the presentation are examples of challenges and ideas for areas of potential improvements, grouped under three headings
  - Timescales
  - Stakeholders
  - Data (see appendix)

We are looking for your input, please put questions and comments in the Teams chat as we go along. There will be lots of time for discussion after the presentation.

Timescales

The timescales and GC processes for some mods are so slow as to

1. discourage involvement in work groups for all but the most committed (well funded)
2. mean mods can easily be overtaken by changes in external circumstance
3. contribute to inefficient markets and increased costs
4. **have significant adverse real-world impacts**

GC modifications: Undesired tripping due to falling inertia and outdated Loss of Mains protection settings

OFGEM GC0079 LoM decision letter

"This modification is the second from a long standing WG. Originally founded as GC0035 the first WG meeting was 14 **June 2013**, there have been 37 meetings with the most recent being 26 **September 2017**.

The WG has not yet fully discharged the terms of reference and further modification proposals are expected."

The slow speed addressing a known issue contributed to

- Loss of supply in the **August 2019** event
- Cost of operational actions of holding additional response services
- Cost of ALoMCP program
- Disruption to generator operators due to the need for retrospective changes

Timescales: Related industry observations

- *The meetings frequence are drawn out – and this is exacerbated by the tendance to have ‘short meetings (morning or afternoon) of circa two hours which, with updates etc., means that there is perhaps an hour and a half at most of ‘progress’ every month or two….hence why it can take years….*
- *Momentum and collective memory is too easily lost between meetings leading to a great deal of clarification and repetition in meetings.*
- *WG efficiency is not helped by the brief minutes and actions which are often indecipherable at the next meeting two months later.*
- *The approaches taken to deal with disagreements within some WG discussions have tended towards "a war of attrition", contributing to extended timelines.*
- *It does not have to be this way (and it tends not to be this way with mods NESO wants urgently which can happen quickly!).*
- *Guidance notes may be used by NESO to quickly introduce “requirements” on stakeholders, without their input which would be mandatory though the slow formal review process required for GC mods.*

Stakeholders' involvement

- The GC mod process does not adequately consider the impact on all stakeholders, especially those from groups not represented by WG members.

- Relying on volunteers favors those with the strongest commercial interests
- WG are dominated by large incumbents, not newer entrants such as aggregators, or connections consultants who are directly impacted by code mods.
- The trickle-down impacts on small distribution connected generation is represented by few stakeholders.
- No WG members primary role is to act as the voice of the consumer – Citizens Advice?

NESOs role is as the proposer with a strong viewpoint, rather than a neutral WG facilitator.

- The code mod proposal is of the form
  1. This is the problem
  2. Here is the solution that should be implemented
- Now try to change the proposers mind within the WG process

That said there are some great examples of pre code mod proposal collaborative working

Consultants supporting stakeholders

- Consultants are on occasions commissioned by the NESO to support WG activities, via technical analysis and Cost Benefit Analysis.

- This work may occur after the proposed solution has been submitted as a modification.
- Consultants are briefed by and paid for by NESO, rather than generally supporting the work of the WG, which has the potential to reinforce conflicts.

It is a tough job for consultants to provide unbiased, open and transparent advice, as publicly criticising the proposal which has already been submitted by your client is not a good way for a consultancy to get further work.

- WG members representing specific stakeholder groups, should not jointly commission consultancy to support their position.
- Due to legal concerns competitors must be careful not even be seen to collaborate outside the public WG meetings to avoid being accused of acting as a cartel.

Consideration of impact on all stakeholders

- Early consideration of the impact on all stakeholders is important.
  - Ideally this should be before there is a firm proposal

Examples:-

GC0117 STCP 19-3 Operational Notification & Compliance Testing SLA

Proposal to increase the review time for connection submissions was presented as "No adverse impacts identified" A failure of early consideration of the impact on key stakeholders?

GC0156 Electricity System Restoration

Proposal for 72 hours power backup for BMU communications impacts aggregators of small assets, only considered late on resulting in OFGEM Send Back of GC0148

GC0137 GB Grid Forming

NESO Compliance team presentation to GCGF experts' group recently highlighted there was no trial run of the compliance assessment ahead of the code modification, it was not clear how to confirm the newly defined requirements had been met.

Facilitating early stakeholder input is preferable to late-stage interventions, but there may no awareness within key stakeholder groups, a fear of speaking up, or a commercial interest in late intervention prolonging the status quo.

OFGEM Expectations

OFGEM: NESO Licence Expectations document 2025 to 26

"Managing codes changes

- Quality code administration service in line with other industry codes.
- Provide a code change process that supports widest participation of industry participants as possible and integrates effectively with changes to other codes.
- Provides unbiased, detailed analysis or modelling to support code modifications."

How can GCDF contribute to helping NESO achieve these OFGEM expectations which appear to be well aligned with industry needs?

Summary/Discussion

- Do you agree that, on occasions, the Grid Code development process failing to meet the needs of Users and Consumers?

Do you agrees “It does not have to be this way”?

- What are the biggest barriers to efficient code modification?
- If you could change one thing, what would it be?

- Next steps – Who, What, When?

Appendix

Data Access

- There is limited use of data to support the modification development process
- Often there is a strong information asymmetry with data available to NESO, but not other WG members.

Reasons given for absence of data “We have done the analysis but can not share it because….

- “Confidentiality of users”
- “Commercially sensitive”
- “National security”
- “Too difficult to get hold of”
- “Its TO/DNO/ELEXON data not NESO”

Resulting impression:

- Trust me I'm a Doctor.
- Nothing to see here, lets move on.

How can the WG reasonable data needs be identified earlier, triaged and stakeholder access to data be improved?

Data: Forward vision

- GC mods are considered independently without good consideration of interactions or broad public visibility of potential future mods.
  - Multiple changes lead to increased implementation/compliance costs
- Early awareness of potential changes, ahead of formal code mod proposal, would be useful to the industry. Does NESO have a list, is publicly available?

February GDCF meeting was cancelled due to no agenda items. Could discussion topics have included visibility of future modifications? Clean Power 2030 / Annex 3: Operability and operations analysis published 5 Nov 2024.
"Acceleration of Grid Code changes to mandate grid-forming (GFM) capability for new example, resources (IBR) to support the provision of grid stability services.

- Acceleration of Grid Code changes to mandate fault ride-through (FRT) capability for **large demand users**,e.g. data centres and electrolysers to ensure cost-effective planning of response and reserve services.

Are large demand Users represented on GCDF, for example, here today?

- Acceleration of Grid Code changes to mandate reactive power provision from existing and new IBRs, e.g. wind farms, batteries (irrespective of their active power output level).

The proposal for **mandatory retrospective change** could have major implications for some existing generators. Will this be mandated alongside the proposed grid forming mandate to make design updates more efficient for OEMs and other stakeholders?

AOB

NESO
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