Public

CM0105: Standardisation of Power Flow Metering Polarity

Workgroup 1, 20 January 2026

Online Meeting via Teams

NESO
National Energy System Operator

WELCOME

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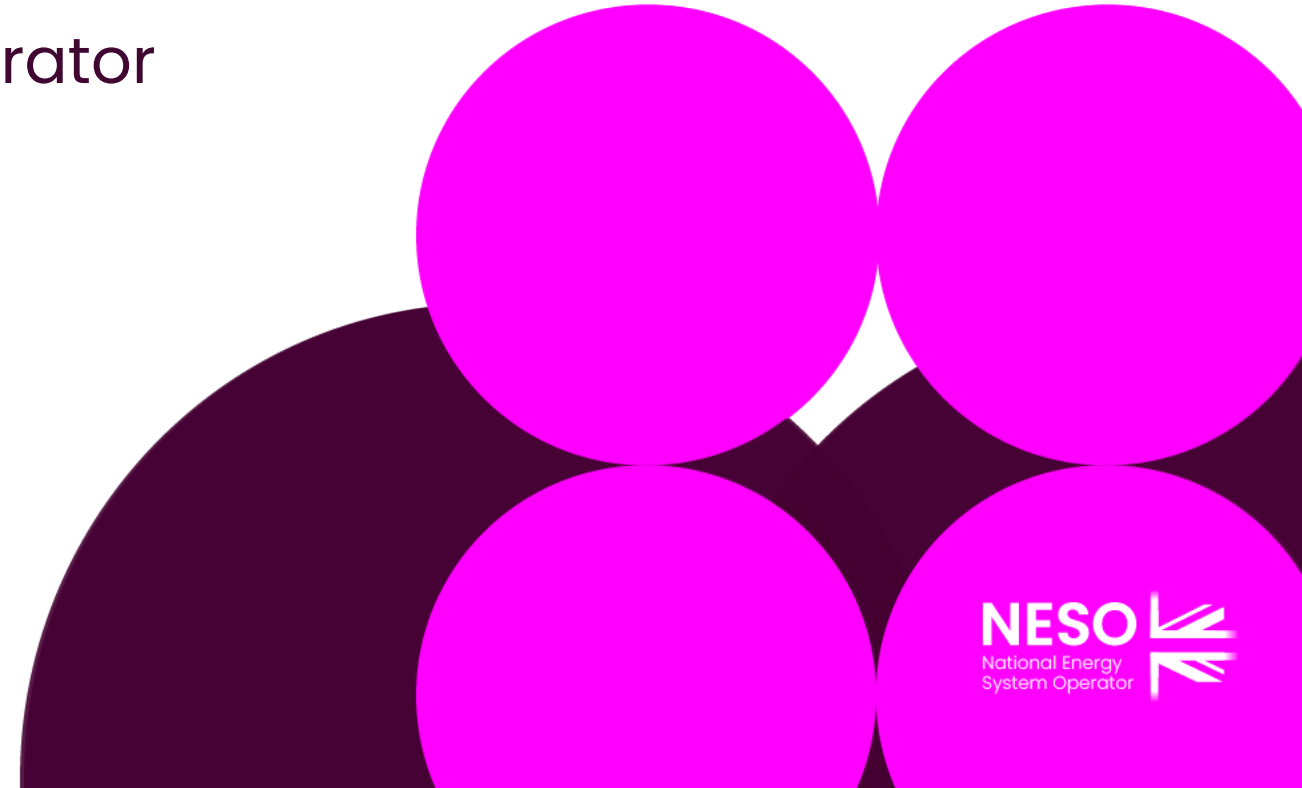
Agenda

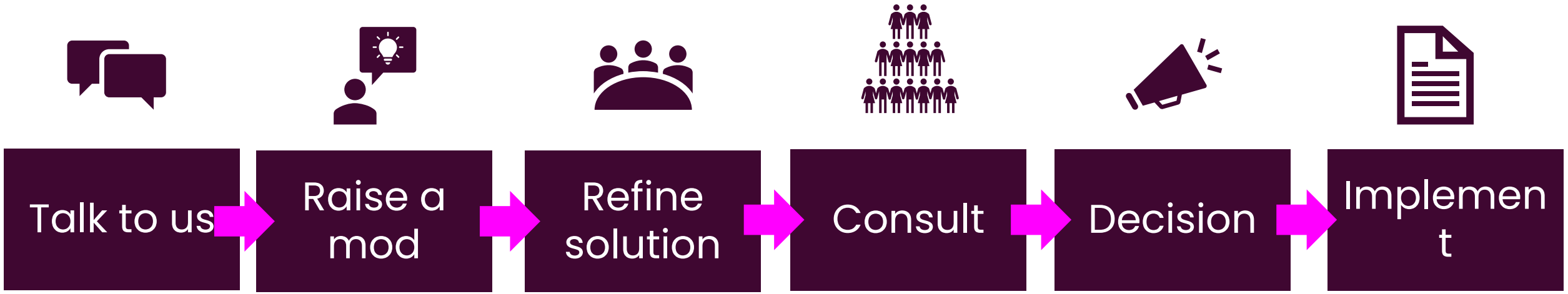
Topics to be discussed	Lead
Introductions	Chair
Code Modification Process Overview • Workgroup Responsibilities • Workgroup Alternatives and Workgroup Vote	Chair
Objectives and Timeline • Walk-through of the timeline for the modification	Chair
Review Terms of Reference	All
Proposer presentation	Proposer
Legal Text Update	NESO Representative
Any Other Business	Chair
Next Steps	Chair

Modification Process

Prisca Evans – NESO Code Administrator



Code Modification Process Overview



Forums

Panels

Workgroups
(Workgroup Consultations)

Ofgem/Panel

Refine Solution

Workgroups

- If the proposed solution requires further input from industry in order to develop the solution, a Workgroup will be set up.
- The Workgroup will:
  - further refine the solution, in their discussions and by holding a **Workgroup Consultation**
  - Consider other solutions, and may raise **Alternative Modifications** to be considered alongside the Original Modification
  - Have a **Workgroup Vote** so views of the Workgroup members can be expressed in the Workgroup Report which is presented to Panel

Consult

Code Administrator Consultation

- The Code Administrator runs a consultation on the **final solution(s)**, to gather final views from industry before a decision is made on the modification.

- After this, the modification report is voted on by Panel who also give their views on the solution.

Decision

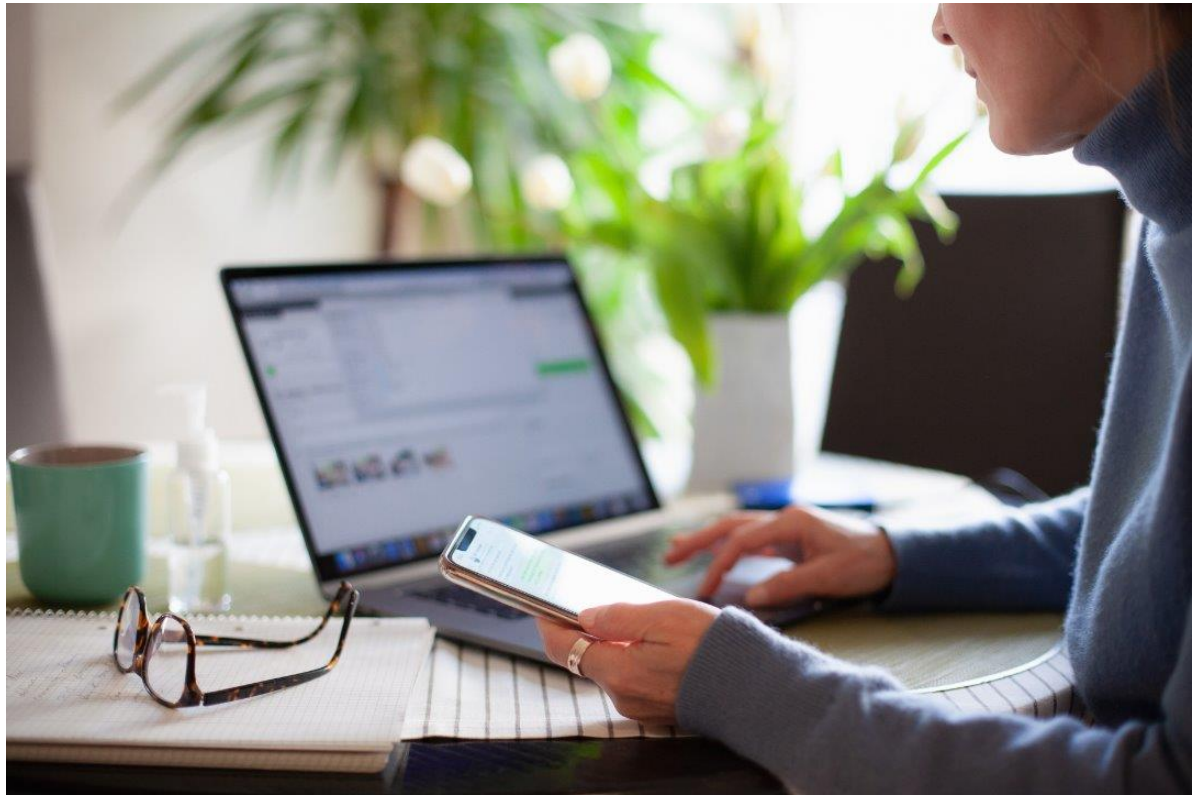
- Dependent on the Governance Route that was decided by Panel when the modification was raised

- **Standard Governance:** Ofgem makes the decision on whether or not the modification is implemented

- **Self-Governance:** Panel makes the decision on whether or not the modification is implemented
    - an appeals window is opened for 15 days following the Final Self Governance Modification Report being published

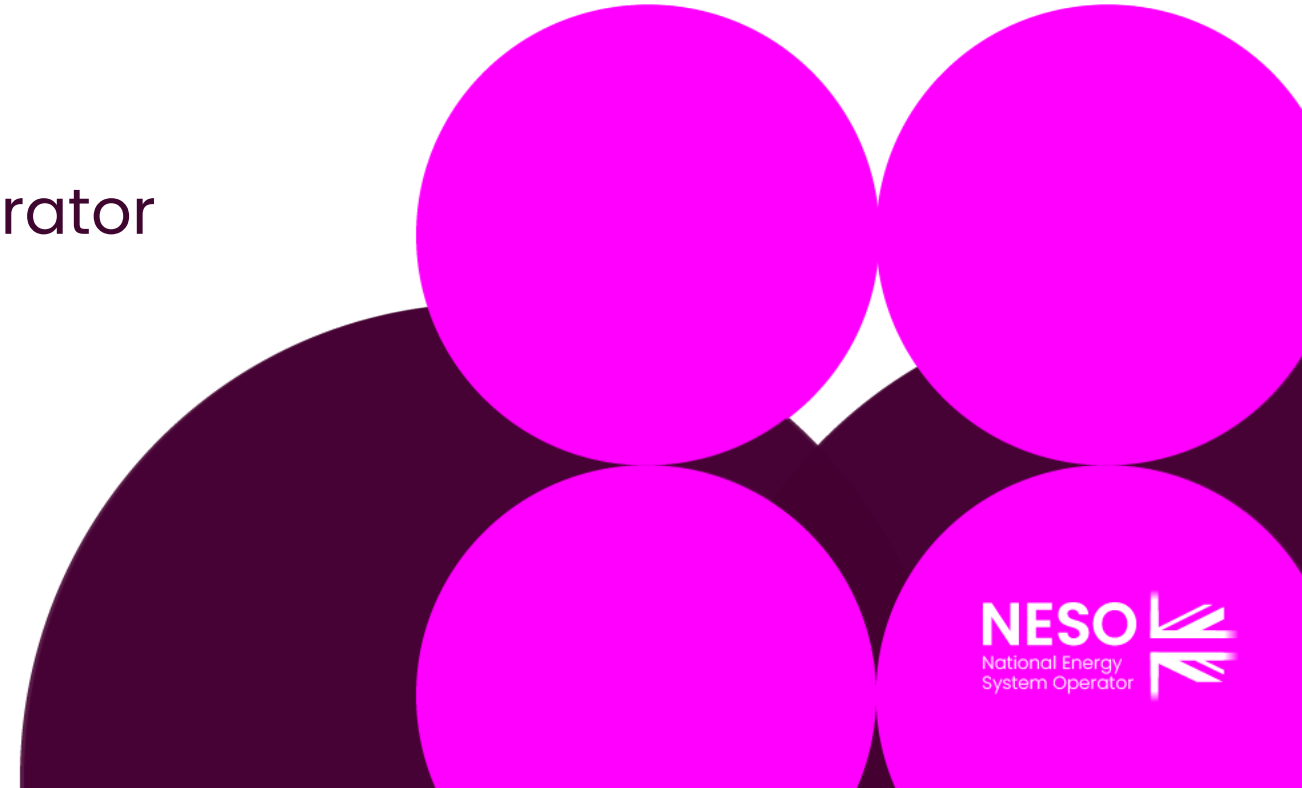
Implement

- The Code Administrator implements the final change which was decided by the Panel / Ofgem on the agreed date.



Workgroup Responsibilities and Membership

Prisca Evans – NESO Code Administrator



Expectations of a Workgroup Member

- Contribute to the discussion
- Be respectful of each other's opinions
- Language and Conduct to be consistent with the values of equality and diversity
- Do not share commercially sensitive information
- Be prepared - Review Papers and Reports ahead of meetings
- Complete actions in a timely manner
- Keep to agreed scope
- Email communications to/cc'ing the .box email

Your Roles

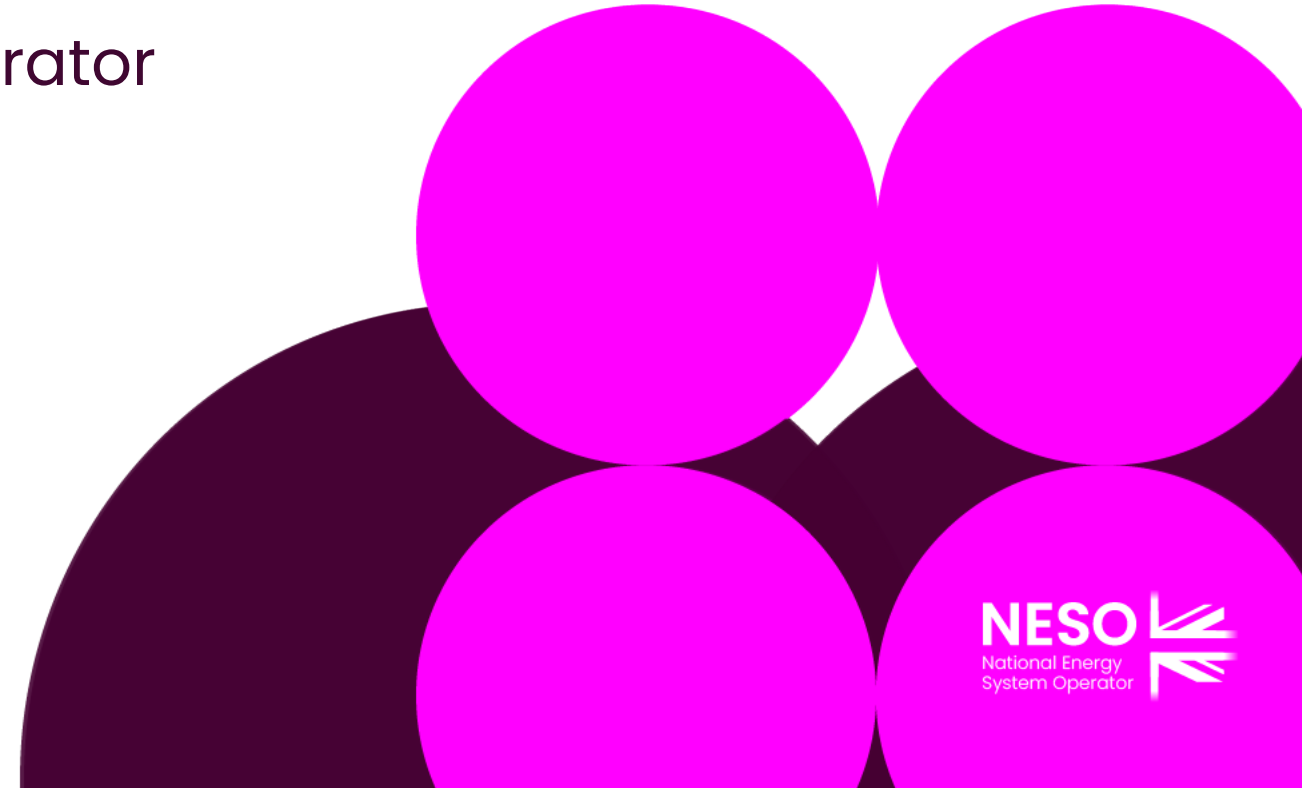
- Help refine/develop the solution(s)
- Bring forward alternatives as early as possible
- Vote on whether or not to proceed with requests for Alternatives
- Vote on whether the solution(s) better facilitate the Code Objectives

Workgroup Membership

Role	Name	Company	Alternative
Proposer	Thomas Goss	NESO	Pritesh Patel
NESO Representative	Hao Guo	NESO	
Workgroup Member	Gillian Brailsford	SSE	Katrina Brown
Workgroup Member	Graeme Vincent	SP Energy Network	Alan Convery
Observer	Andrew Urquhart	SSE Generation	Andrew Urquhart
Authority Representative	TBC	Ofgem	

Workgroup Alternatives and Workgroup Vote

Prisca Evans – NESO Code Administrator



What is the Alternative Request?

What is an Alternative Request? The formal starting point for a Workgroup Alternative Modification to be developed which can be raised up until the Workgroup Vote.

What do I need to include in my Alternative Request form? The requirements are the same for a Modification Proposal you need to articulate in writing:
- a description (in reasonable but not excessive detail) of the issue or defect which the proposal seeks to address compared to the current proposed solution(s);
- the reasons why the you believe that the proposed alternative request would better facilitate the Applicable Objectives compared with the current proposed solution(s) together with background information;
- where possible, an indication of those parts of the Code which would need amending in order to give effect to (and/or would otherwise be affected by) the proposed alterative request and an indication of the impacts of those amendments or effects; and
- where possible, an indication of the impact of the proposed alterative request on relevant computer systems and processes.

How do Alternative Requests become formal Workgroup Alternative Modifications? The Workgroup will carry out a Vote on Alternatives Requests. If the majority of the Workgroup members or the Workgroup Chair believe the Alternative Request will better facilitate the Applicable Objectives than the current proposed solution(s), the Workgroup will develop it as a Workgroup Alternative Modification.

Who develops the legal text for Workgroup Alternative Modifications? NESO will assist Proposers and Workgroups with the production of draft legal text once a clear solution has been developed to support discussion and understanding of the Workgroup Alternative Modifications.

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Can I vote? And What is the Alternative Vote?

To participate in any votes, Workgroup members need to have attended at least 50% of meetings. The vote shall be decided by simple majority of those present at the meeting at which the vote takes place (whether in person or by teleconference)

Stage 1 – Alternative Vote

- Vote on whether Workgroup Alternative Requests should become Workgroup Alternative CUSC Modifications.

- The Alternative vote is carried out to identify the level of Workgroup support there is for any potential alternative options that have been brought forward by either any member of the Workgroup OR an Industry Participant as part of the Workgroup Consultation.

- **Should the majority of the Workgroup OR the Chair believe that the potential alternative solution may better facilitate the CUSC objectives than the Original then the potential alternative will be fully developed by the Workgroup with legal text to form a Workgroup Alternative CUSC modification (WACM)** and submitted to the Panel and Authority alongside the Original solution for the Panel Recommendation vote and the Authority decision.

Can I vote? And What is the Alternative Vote?

To participate in any votes, Workgroup members need to have attended at least 50% of meetings. The vote shall be decided by simple majority of those present at the meeting at which the vote takes place (whether in person or by teleconference)

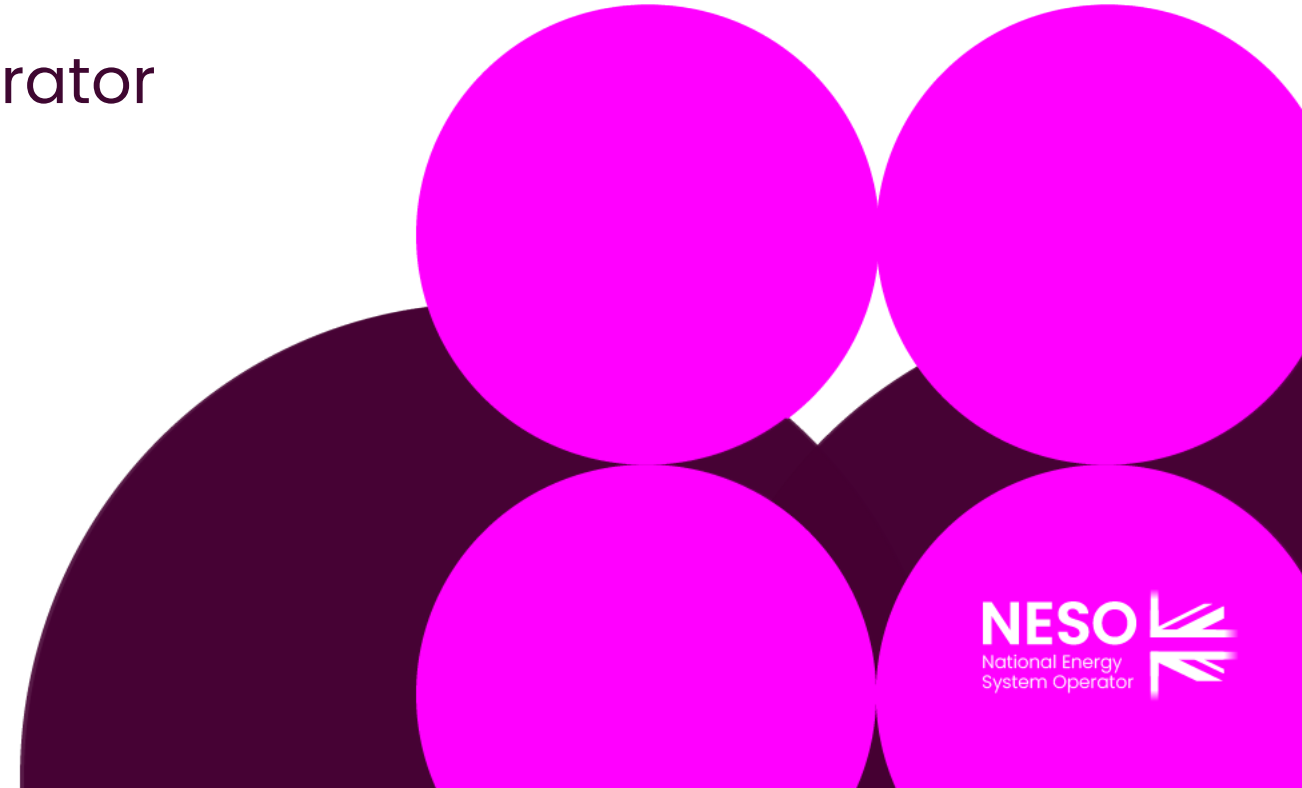
Stage 2 – Workgroup Vote

- 2a) Assess the original and Workgroup Alternative (if there are any) against the relevant Applicable Objectives compared to the baseline (the current code)
- 2b) Vote on which of the options is best.

Alternate Requests cannot be raised after the Stage 2 – Workgroup Vote

Objectives and Timeline

Prisca Evans – NESO Code Administrator

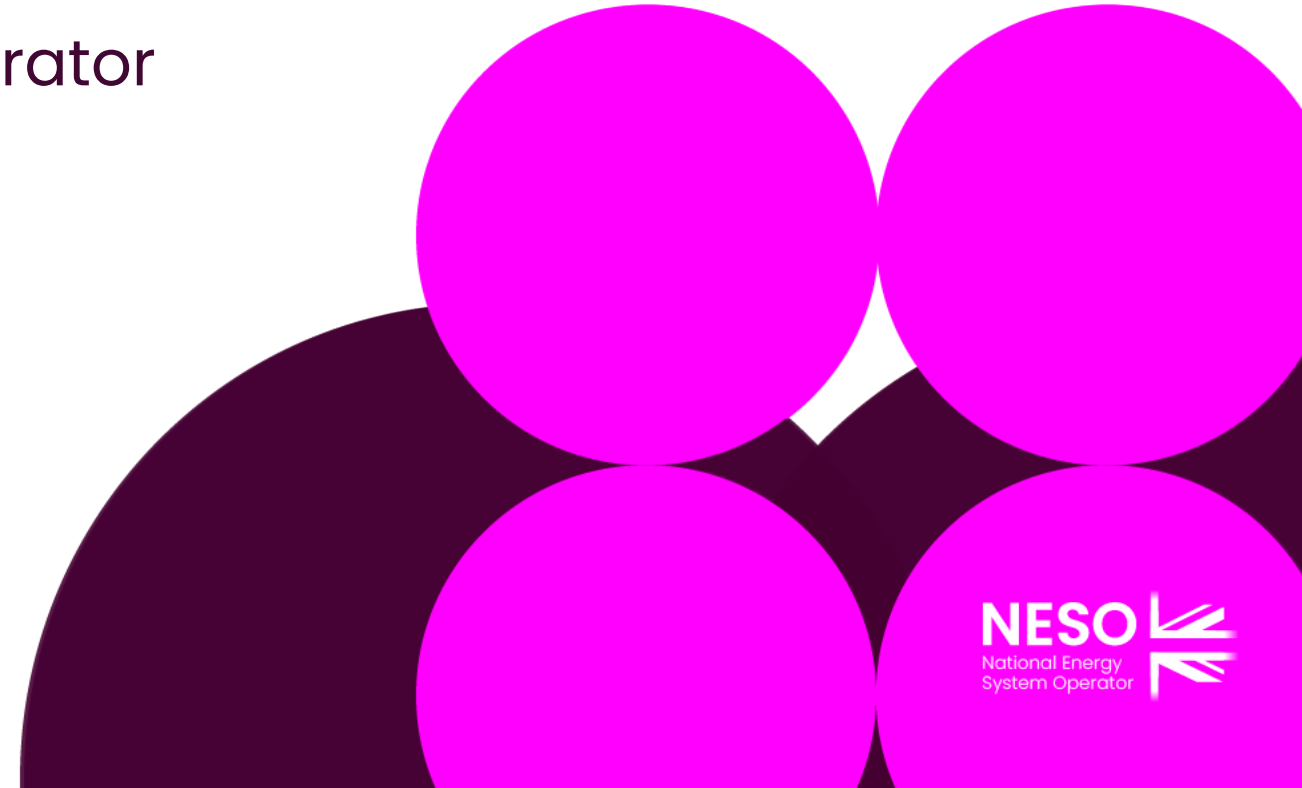


Proposed Timeline for CM0105 as of 12 January 2026

Milestone	Date	Milestone	Date
Modification presented to Panel	29/10/25	Code Administrator Consultation	06/10/26 - 06/11/26
Workgroup Nominations (Extended)	05/11/25 - 05/01/26	Draft Final Modification Report (DFMR) issued to Panel (5 business days)	18/11/26
Workgroups 1, 2 and 3	• 20/01/26 • 09/02/26 • 19/02/26	Panel undertake DFMR recommendation vote	25/11/26
Workgroup Consultation (21 business days)	02/03/26 - 20/03/26	Final Modification Report issued to Panel to check votes recorded correctly	02/12/26 - 08/12/26
Workgroups 4 and 5	• 07/04/26 • 14/05/26	Final Modification Report issued to Ofgem	09/12/26
Workgroup report issued to Panel	08/06/26	Ofgem decision needed by	TBC
Panel sign off that Workgroup Report has met its Terms of Reference	24/06/26	Implementation Date	TBC

Terms of Reference Discussion (Live)

Prisca Evans – NESO Code Administrator

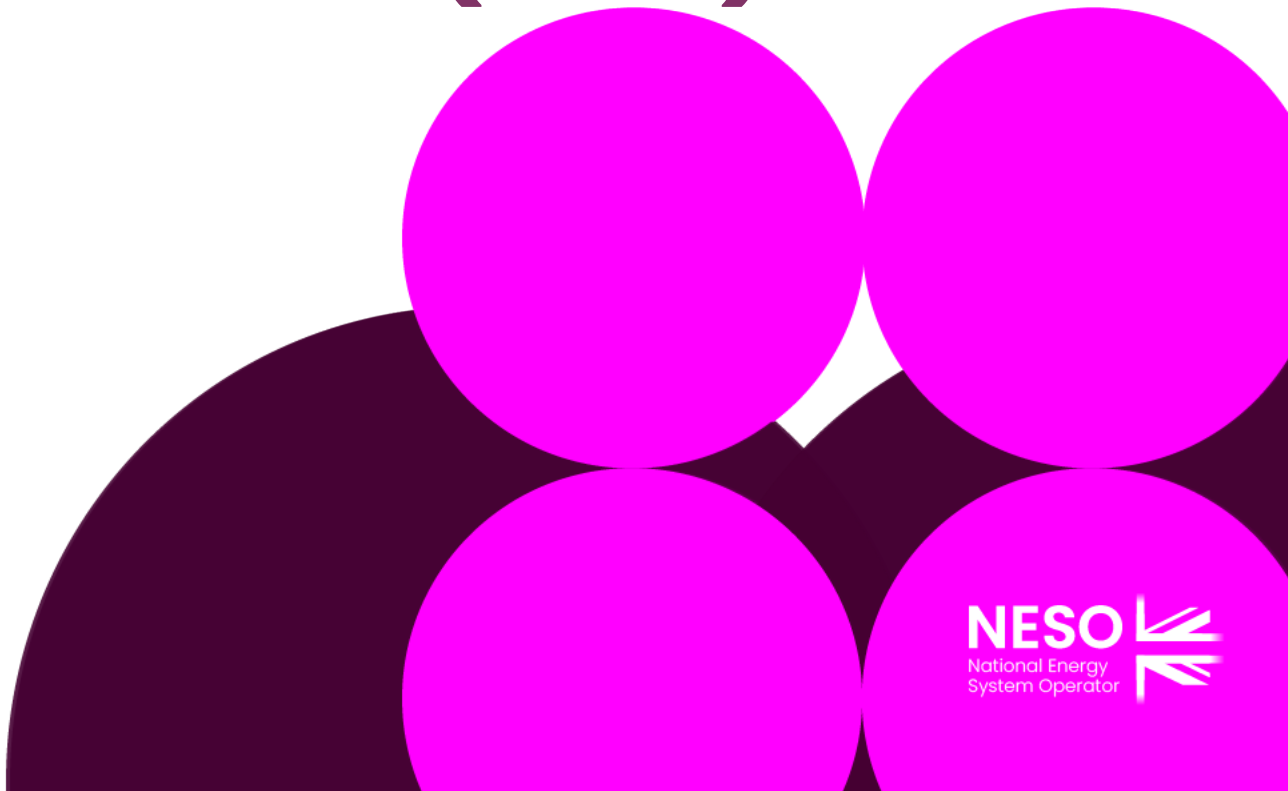


CM0105 Terms of Reference

Workgroup Terms of Reference
a. Implementation
b. Review and support the legal text drafting;
c. Ensure the appropriate Industry experts or stakeholders are engaged in the Workgroup to ensure that all potentially affected stakeholders have the opportunity to be represented in the Workgroup
d. The cross Code impacts this Modification has, in particular the CUSC and the Grid Code

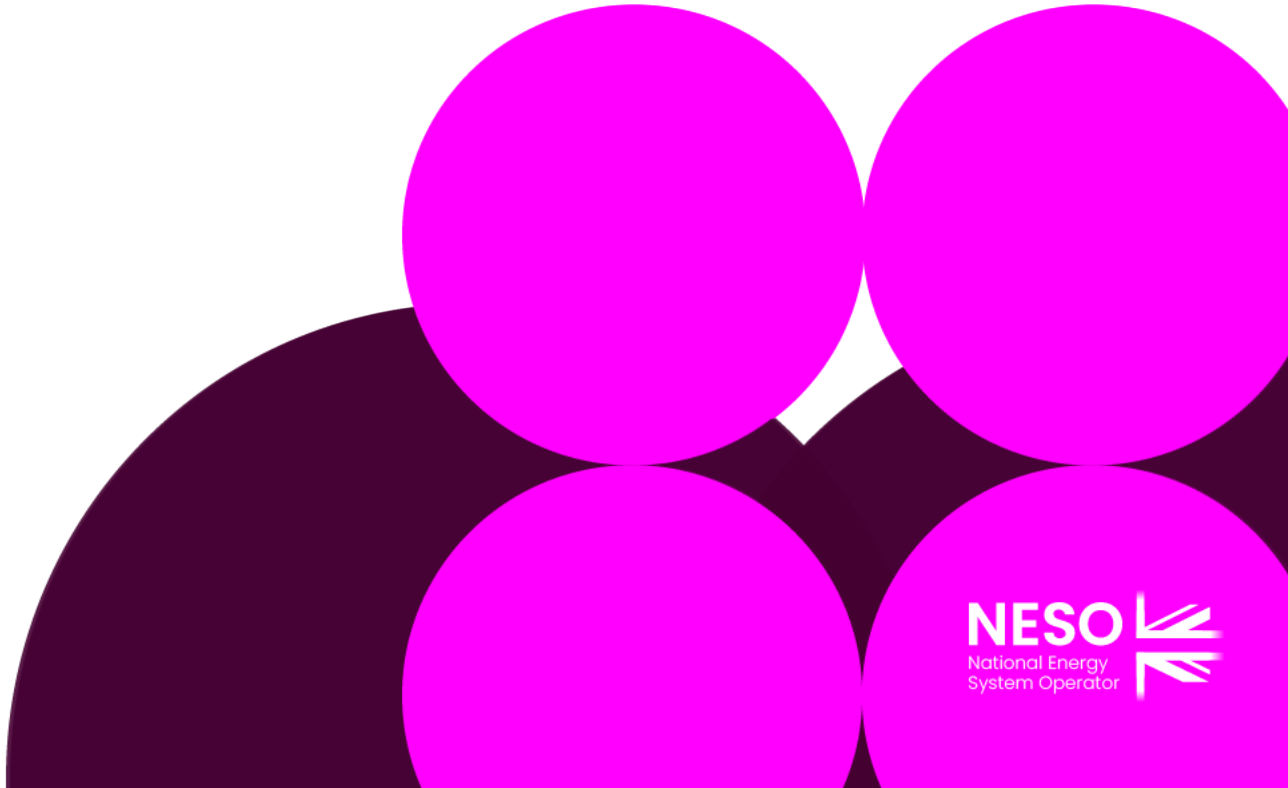
Agree Terms of Reference (Live)

All



Proposer Presentation

Thomas Goss – NESO



Public

Power Flow Metering Polarity Issues and proposed solution

Workgroup 1

Presenter: Thomas Goss – Technical Codes

January 2026

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Power Flow Metering Polarity – Issue

- **Issue**
  - "Incorrect/inconsistent" polarity for power flow metering data fed into the NESO SCADA system, for example negative instead of positive flow
- **Impact for NESO**
  - Deteriorating accuracy in NESO management system
  - Reduced State Estimation reliability impacting situational awareness
  - Reduced system security and potential SQSS breach due to less effective contingency analysis
  - Additional balancing cost incurred by less efficient output from downstream NESO balancing and forecast system
- **Impact for other stakeholders**
  - Delay in setting up metering for new connections
  - Increased workload due to updating and correcting metering polarity
  - Delay in NESO's decision making for outages and commissioning
  - Potential billing errors for settlements between NESO and energy providers

Power Flow Metering Polarity – Current Status and Effort

- **Current Status**
  - No clear and unified power flow polarity standard in STC or Grid Code for power flow data sent to NESO
  - No clauses in STC/STCP, Grid Code, or licence obligation requesting parties to follow a power flow polarity standard and parties may choose their own convention which could be inconsistent with other parts of the network
  - No clauses in STC/STCP or Grid Code requesting parties sending power flow metering with “incorrect” polarity to fix the issue

- **Current Effort**
  - NESO regularly audits, investigates and fix meters with incorrect polarity internally, but workaround fix is temporary and not sustainable
  - NESO tries to establish communication channel with relevant parties to investigate and resolve the issues
  - NESO has set up an internal Working group aiming to seek solutions in terms of code, standard, policy and process
  - A Grid Code Mod is already in progress: GC0182, recently completed the 2nd Workgroup stage, which is based on the information from the aforementioned NESO Working group.

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Power Flow Metering Polarity – Criticality of Issue

- **Currently 818 meters** have been identified as having incorrect polarity, this could increase if new connections do not follow the polarity standard.
  - OFTO – 416
  - TO/Generator – 402

- **Impact of incorrect polarity** could be incurred during NESO Operation
  3 potential scenarios:

  - **Underestimate in requirement of system response and reserve level**
    Insufficient level of response and reserve to deal with contingency for real-time operation -> system security issue and potential SQSS breach

  - **Overestimate in requirement of system response and reserve level**:
    *Extra Cost = Price of MWh * Amount of Overestimate MW * duration*

    e.g. Assume a total 10GW error causes NESO to believe additional response and reserve is required for approximately 200 hours across a year. With the average price for system response and reserve being £50/MWh, the repeating annual cost would be £50 * 10,000 * 200 = **£100m**

Power Flow Metering Polarity – Criticality of Issue

- **Impact of incorrect polarity** could be incurred during NESO Operation
  3 potential scenarios (continued):

  - **Extra cost when managing a constraint**:
    *Extra Cost = Price of MWh to increase Generation in Area A * Amount of Incorrect MW * duration - Price of MWh to reduce Generation in Area B * Amount of Incorrect MW * duration*

    e.g. Assume a constraint is broken by 500MW for 4 hours so generation in Area A is reduced by 500MW, however, due to group demand error resulting from incorrect polarity this was an oversell of 200MW. Generation in Area B had to be increased by 200MW to cover this unnecessary sell. Average cost of the sell MW was £40/MWh whilst buy MW was £120/MWh, Extra Cost = £120 * 200 * 4 - £40 * 200 * 4 = **£64k**.

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Power Flow Metering Polarity – Example Cost to Fix

- Cost to fix the meter polarity issue (based on TO data)
  (1) BAU activity: **no cost**

  (2) Software re-config and wiring changes are required on site: **£4,000 / meter**

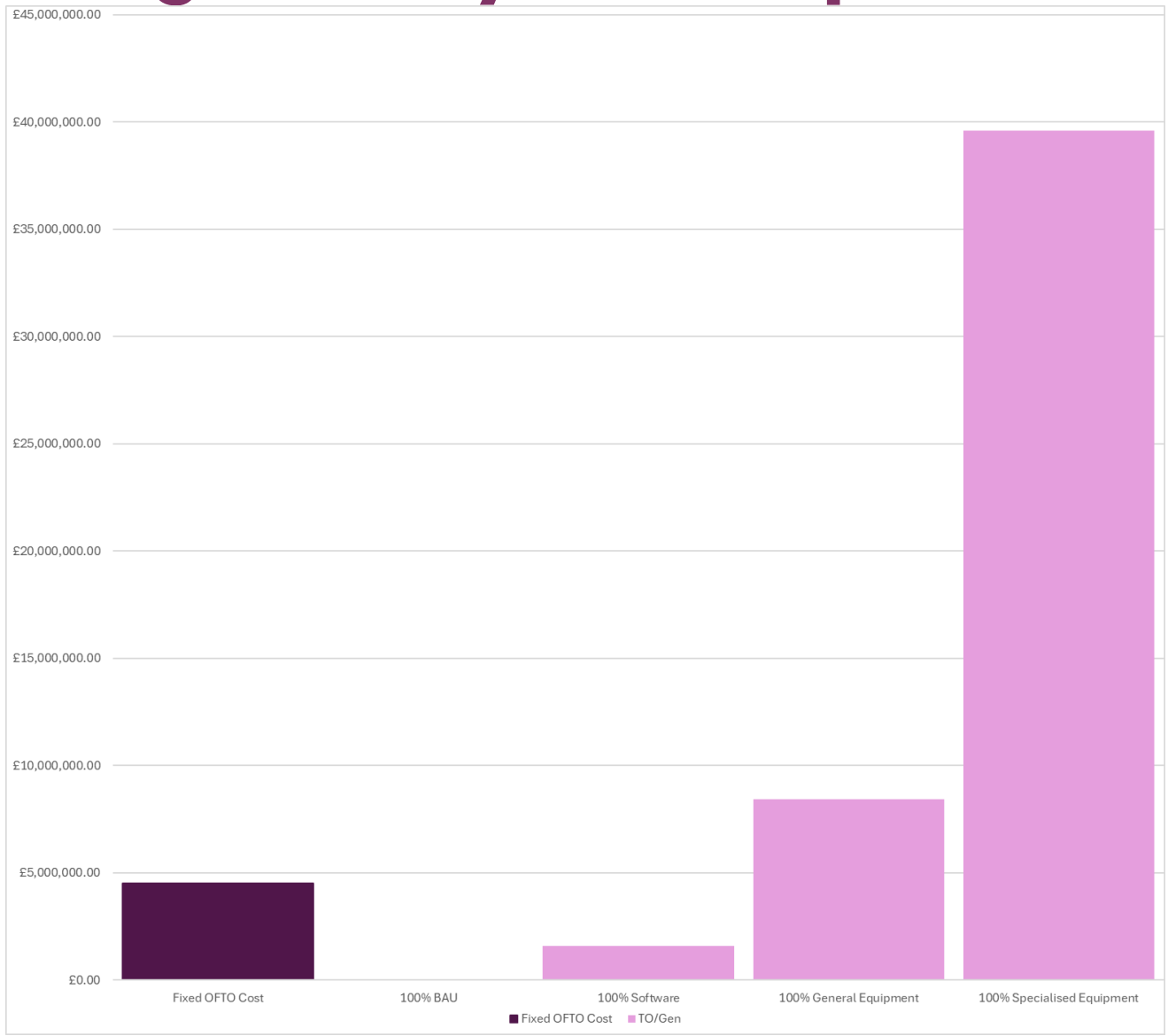
  (3) New equipment needs to be ordered and replaced on site: **£21,000 / meter**

  (4) Meter points with 4G requirements needs to be ordered and replaced: **£98,524 / meter**

- Additional Cost for OFTO is **£100,000 / site**
  - 45 sites in total

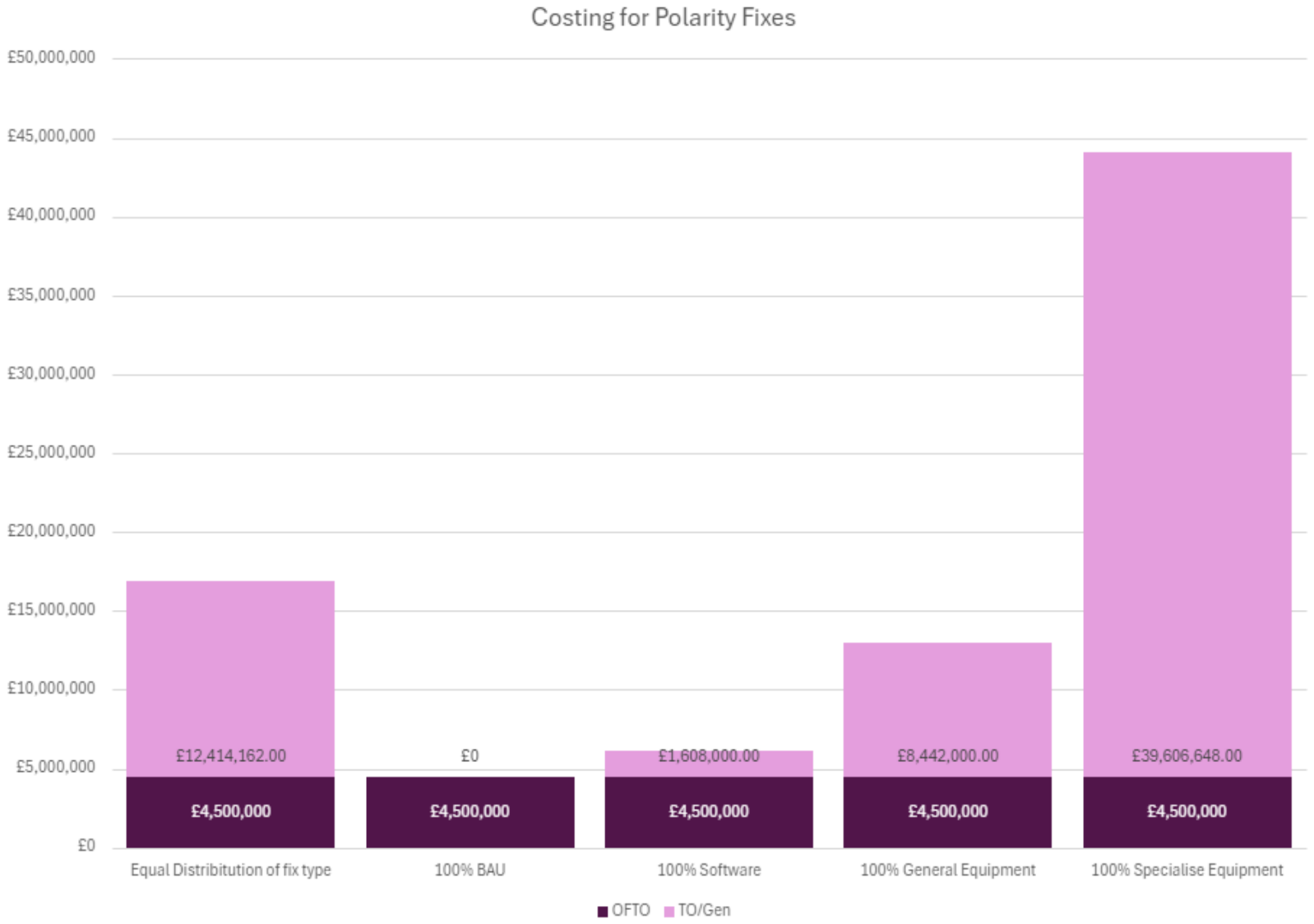
Power Flow Metering Polarity – Example Cost to Fix

- For the 416 OFTO meters across 45 sites, total expected cost will be: **£4.5m**
- For 402 TO/Generator meters we have assumed only 1 of the 4 options has been implemented. The lowest cost would be **£0**, the highest cost would be **£39.6m**
- Therefore, the total industry cost ranges between **£4.5m to £44.1m**



Considering the costs

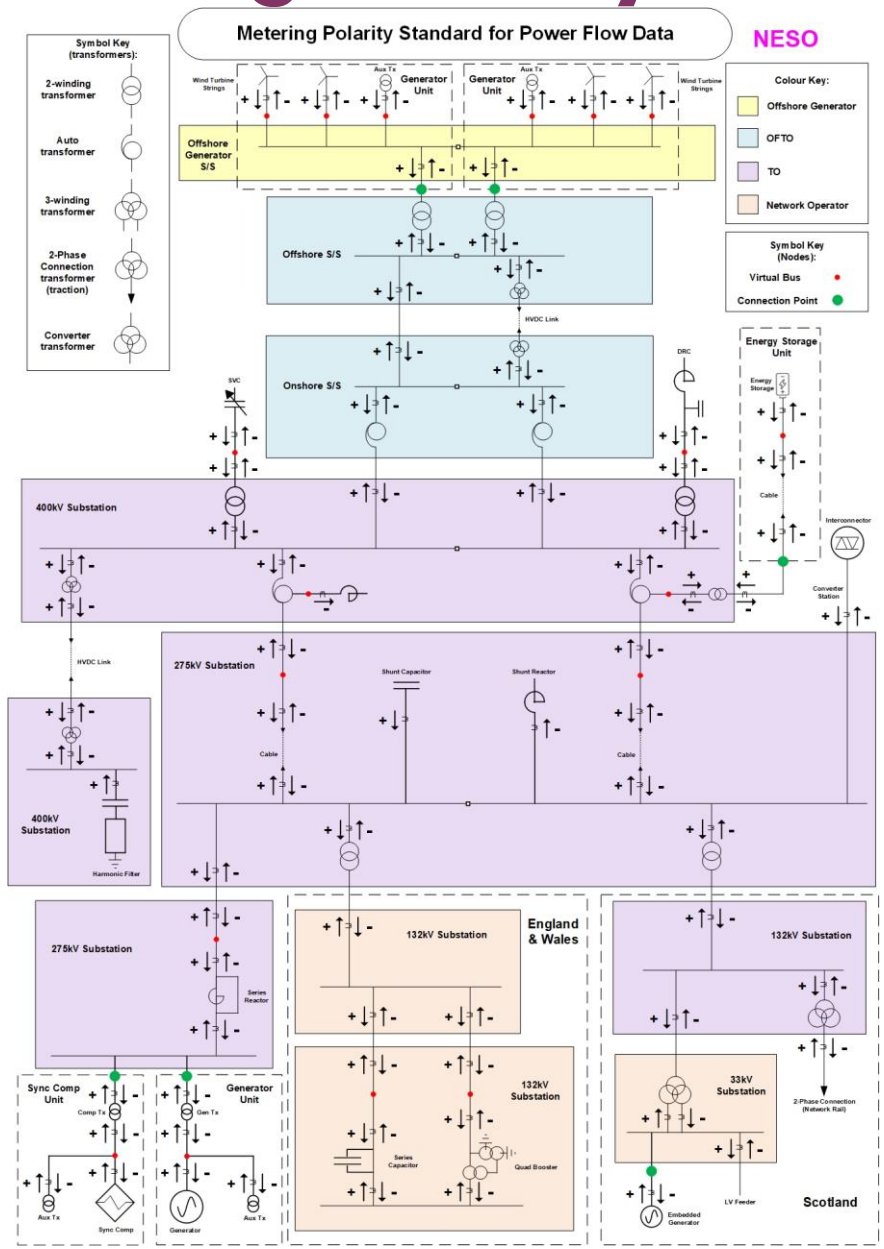
- Based on hypothesis and theoretical calculation:
  - Extra balancing cost incurred due to incorrect polarity estimated at **£100m / year**
  - Cost to fix all meters with incorrect polarity estimated maximum of **£44m one off**
  - More cost efficient to fix the meters compared to spending extra money to offset the impact of incorrect polarity on a continuous basis



Power Flow Metering Polarity – Proposed Solution

- **Proposed Solution**
  - To develop a unified power flow polarity standard in the form of a diagram with explanatory description
  - To publish the diagram and description which will be referred in the STC/STCP and Grid Code.
  - To improve/modify processes between NESO and other parties so that the standard will be followed and referenced when setting up metering connections to NESO SCADA
  - To ensure the polarity standard is followed during ongoing operation
  - To implement for new connections as well as new meters at existing sites at this stage

Power Flow Metering Polarity – Proposed Solution



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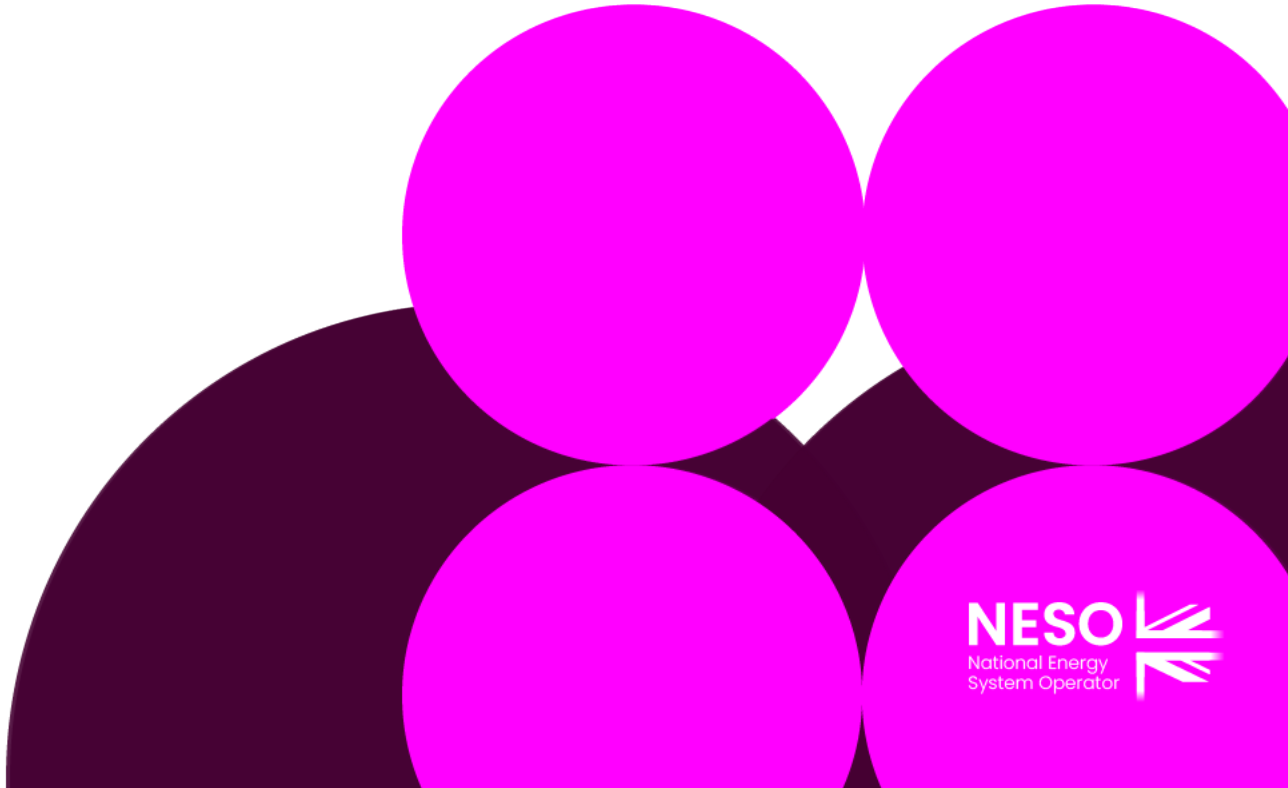
Implementation Plan for CM0105

Hao Guo– NESO



Implementation Plan for GM0105

Step 1: To publish a Guidance Note on Meter Polarity on NESO Website

(1.1) Diagram + Explanatory Text in the Guidance Note to help industry stakeholders when setting up their operational metering

- Sites being covered
  - Offshore Generator S/S
  - OFTO Offshore and Onshore S/S
  - TO S/S
  - Network Operator S/S

- Apparatus being covered
  - Connections between GB substations: OHL, cable, LV feeder, transformer
  - Shunt Connected Reactive apparatus: Shunt Capacitor, Shunt Reactor, Harmonic Filter, SVC, DRC
  - Series Connected Reactive apparatus: Series Reactor, Series Capacitor, Quad Booster
  - Generator Connection including all assets from the Generator up to the connection point: Wind Turbine, Embedded Generator, Sync Comp, Energy Storage, aux transformer
  - Interconnectors

- Sign (+/-) and Arrow to indicate flow direction of each Apparatus

(1.2) The principles outlined in this guidance are not mandatory, however, it indicates the best practice approach and will be beneficial for all to ensure correct and efficient operation of the network.

The purpose of publishing the Guidance Note is to notify as many industry stakeholders as possible, as early as possible, that there will be a unified meter polarity standard that needs to be followed, and it is undergoing a Grid Code and STC modification process.

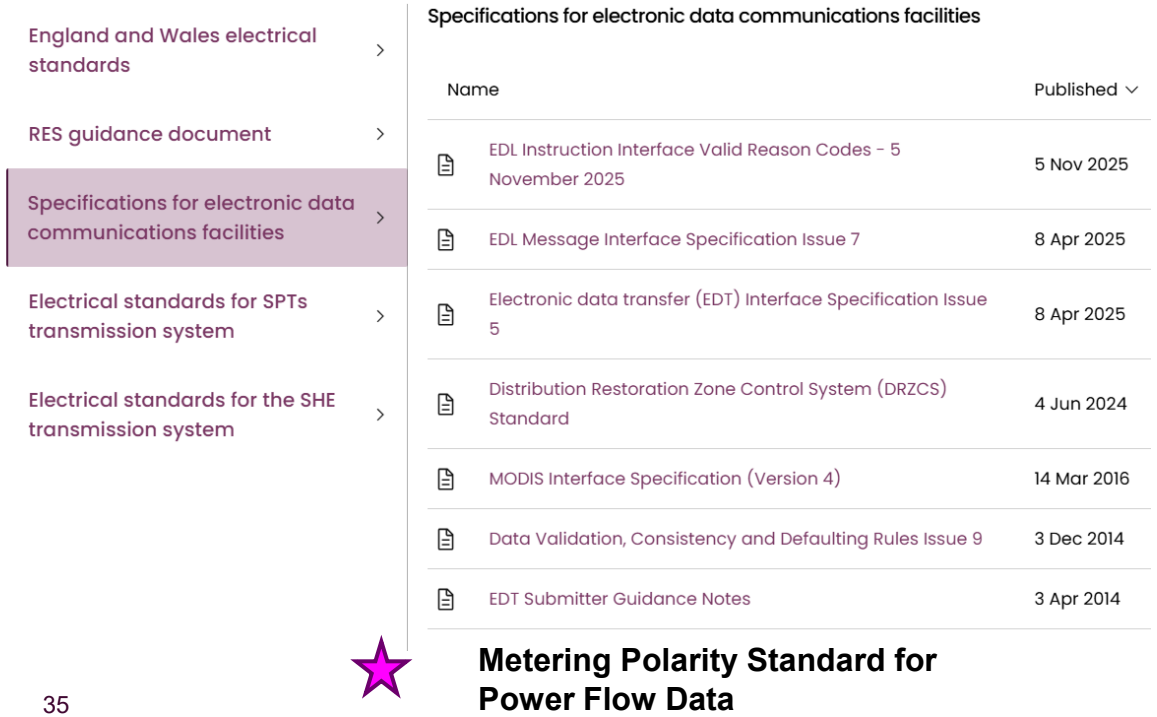
Implementation Plan for GM0105

Step 2: Grid Code Mod GC0182

(2.1) To publish Metering Polarity Standard for Power Flow Data as a new Electrical Standard and add reference to Part II (b) of Annex to the General Condition of Grid Code. Note that Part II will only exist once GC0103 is implemented and it is assumed it will be implemented before GC0182 and GM0105.

[Metering Polarity Standard for Power Flow Data - 05 Dec 2025.docx]

[Electrical Standard Website]



Metering Polarity Standard for Power Flow Data

(b) Electronic data communications facilities and other requirements applicable in all **Transmission Areas**.

Communications Standards for Electronic Data Communication Facilities and Automatic Logging Devices	Version 9	8th April 2025
EDT Interface Specification	Issue 5	8th April 2025
EDT Submitter Guidance Note	Issue 1	21st Dec 2001
EDL Message Interface Specification	Issue 7	8th April 2025
EDL Instruction Interface Valid Reason Codes	Issue 9	7th Nov 2024
MODIS Interface Specification	Version 4	26th May 2015
Control Telephony Electrical Standard	Issue 4	8th April 2025
Distribution Restoration Zone Control System High Level Functional Requirements	1.0	4th June 2024
Metering Polarity Standard for Power Flow Data	Issue 1	1st January 2027

Implementation Plan for GM0105

Step 3: STC Mod GM0105

(3.1) Proposed Legal Text for GM0105

STCP 04-3 Appendix B5 (Proposed New Section under **3.3 Analogues** & new Appendix after B4)

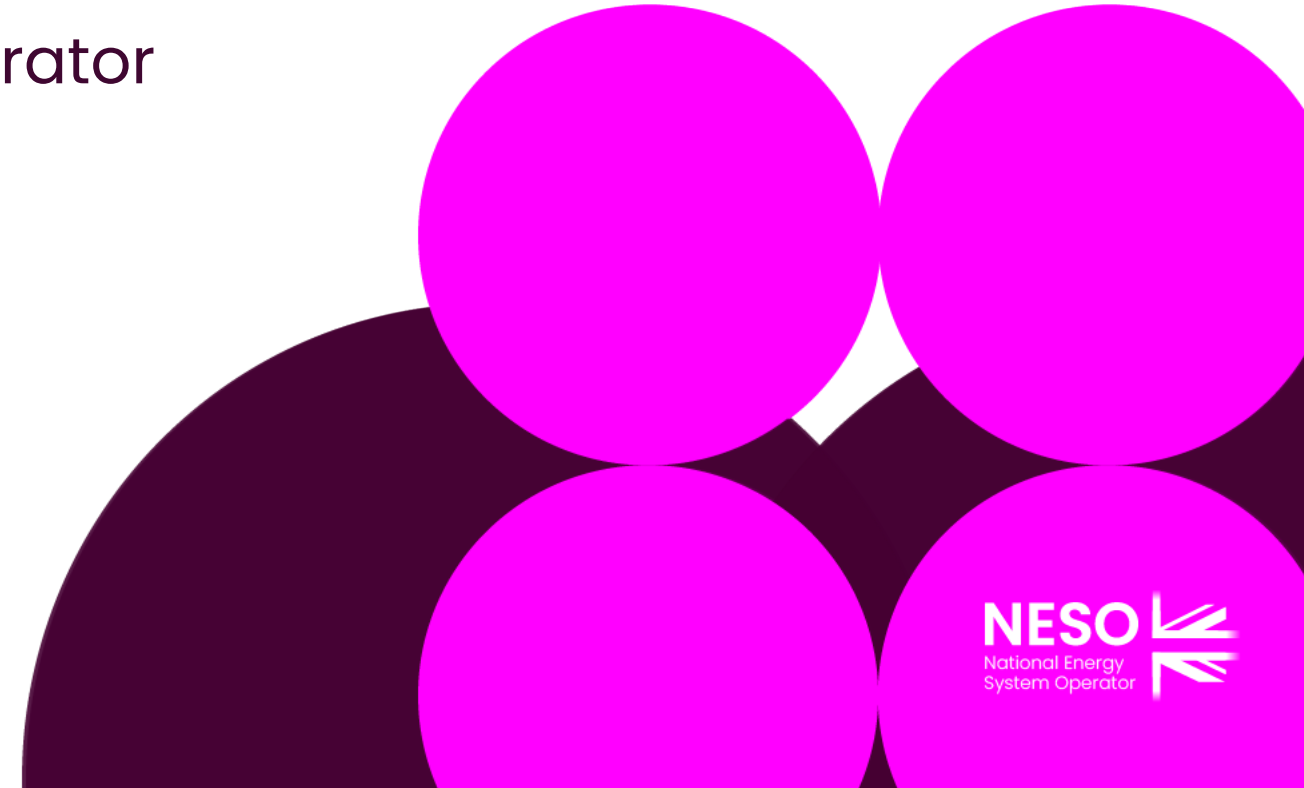
(a) Where a **Relevant Party** installs or upgrades its operational metering on or after **DD/MM/YYYY** (this being the GM0105 implementation date and should be consistent with that of GC0182), the **Party** must ensure the operation metering conform to the Metering Polarity Standard for Power Flow Data (how do we refer to Electrical Standard in STC?). The **Relevant Party** shall provide the list of metering points being installed or upgraded to **The Company** and these metering points will be checked and validated by The Company and agreed with the **Relevant Party**.

Implementation Plan for GM0105

Step 4: To Remove Guidance Note from NESO Website once GM0105 is implemented

Any Other Business

Prisca Evans – NESO Code Administrator



Next Steps

Prisca Evans– NESO Code Administrator