

Draft Final Modification Report

CM085: To clarify OFTO reactive power requirements at <20% output

Overview: It is unclear what the requirements are on OFTOs to provide access to reactive power capability at low windfarm outputs. This modification seeks to clarify that where reactive capability is available it should be provided which is operationally useful to the ESO.

Modification process & timetable



Have 5 minutes? Read our [Executive summary](#)

Have 20 minutes? Read the full [Second Draft Final Modification Report](#)

Have 30 minutes? Read the full Second Draft Final Modification Report and Annexes.

Status summary This report will be submitted to the Authority for them to decide whether this change should happen.

Panel recommendation: The Panel will meet on 28 February 2024 to carry out their recommendation vote.

This modification is expected to have a: **Low impact**

OFTOs and generators (specifically offshore windfarms)

Governance route This modification followed the Standard Governance route and proceeded straight to Code Administrator Consultation.

Who can I talk to about the change?	Proposer: Terry Baldwin terry.baldwin@nationalgrideso.com 07354901925	Code Administrator Contact: Jonathan Whitaker jonathan.whitaker@nationalgrideso.com 07354901925

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Executive summary

It is unclear what the requirements are on OFTOs to provide access to reactive power capability at low windfarm outputs. This modification (CM085) seeks to clarify that where reactive capability is available it should be provided which is operationally useful to the ESO.

The Proposer believes that the particular case that this seeks to address is where, as part of an offshore windfarm connection, onshore reactive compensation has been installed often to compensate for the capacitive impact of an offshore cable network. At low windfarm outputs clearly, this onshore reactive capability remains and if it is instructible by the ESO is a considerable help in maintaining system voltage within acceptable limits.

What is the issue?

In the Proposer's view it has become apparent that the requirements on OFTOs to provide access to reactive power capability at low windfarm outputs are unclear with the consequence that there have been instances when reactive capability has been withheld. Having predictable and firm access to reactive capability is essential to the ESO in operating the system. Where this cannot be assured it leads to the ESO having to spend money in taking additional operational actions.

What is the solution and when will it come into effect?

Proposer's solution:

OFTOs are generally required to fulfil SQSS voltage obligations, and the provision of reactive range is set out in the STC section K which stems in turn from the requirements on generators as set out in the Grid Code.

Below 20% output, while OFTOs may continue to provide voltage control utilising any available reactive capability this is not set out as a definitive obligation. It is proposed to make minor changes to the STC text to confirm that any reactive capability that is available should be provided when requested by the ESO. This change will not require any changes to equipment but will help to clarify an area of uncertainty.

Following discussions with the OFTOs it is apparent that there are concerns regarding the regular utilisation of reactive equipment, for example synchronous compensators, for general system reasons rather than as part of the compliant operation of a windfarm, and the additional costs that might be incurred associated with wear and tear. However, the ESO still needs to determine the overall most efficient solutions for consumers which in this case are likely to be using the equipment that is already there rather than prompting further system reinforcements.

The legal text has been written and revised to try to achieve a balance while helping to clarify that equipment that forms part of a TO or OFTOs regulatory asset base should generally be available unless there is good reason.

Implementation date: CM085 modification will be implemented 10 working days after Authority's decision.

Panel recommendation: The Panel will meet on 28 February 2024 to carry out their recommendation vote.

What is the impact if this change is made?

The Proposer believes that by ensuring the availability of reactive equipment this will help the ESO to efficiently operate the system.

Interactions

- | | | | |
|--|---|--------------------------------|-------------------------------|
| <input type="checkbox"/> Grid Code | <input type="checkbox"/> BSC | <input type="checkbox"/> CUSC | <input type="checkbox"/> SQSS |
| <input type="checkbox"/> European
Network Codes | <input type="checkbox"/> Other
modifications | <input type="checkbox"/> Other | |

None.

What is the issue?

The Proposer believes it has become apparent that the requirements on OFTOs to provide access to reactive power capability at low windfarm outputs are unclear with the consequence that there have been instances when reactive capability has been withheld. In the Proposer's view having predictable and firm access to reactive capability is essential to the ESO in operating the system.

Why change?

CM085 modification seeks to clarify that where reactive capability is available at low windfarm outputs, access to this by the ESO should be provided by the OFTOs.

The Proposer believes the particular case that CM085 seeks to address is where, as part of an offshore windfarm connection, onshore reactive compensation has been installed often to compensate for the capacitive impact of an offshore cable network. At low windfarm outputs clearly, this onshore reactive capability remains and if it is instructible by the ESO is a considerable help in maintaining system voltage within acceptable limits.

What is the solution?

Proposer's solution

OFTOs are generally required to fulfil SQSS voltage obligations, and the provision of reactive range is set out in the STC Section K which stems in turn from the requirements on generators as set out in the Grid Code.

Below 20% output, while OFTOs may continue to provide voltage control utilising any available reactive capability this is not set out as a definitive obligation. The Proposer is seeking to make minor changes to the STC text to confirm that any reactive capability that is available should be provided when required. This change will not require any changes to equipment or additional costs but will help to clarify an area of uncertainty.

Following discussions with the OFTOs it is apparent that there are concerns regarding the regular utilisation of reactive equipment, for example synchronous compensators, for general system reasons rather than as part of the compliant operation of a windfarm, and the additional costs that might be incurred associated with wear and tear. However, the

ESO still needs to determine the overall most efficient solutions for consumers which in this case are likely to be using the equipment that is already there rather than prompting further system reinforcements.

The legal text has been written and revised to try to achieve a balance while helping to clarify that equipment that forms part of a TO or OFTOs regulatory asset base should generally be available unless there is good reason.

Legal text

The legal text for this change can be found in Annex 2.

What is the impact of this change?

Proposer's assessment of the impact of the modification on the stakeholder / consumer benefit categories

Stakeholder / consumer benefit categories	Identified impact
Improved safety and reliability of the system	Positive Helps to ensure cost effective and secure operation of the system.
Lower bills than would otherwise be the case	Positive In clarifying the availability and use of existing equipment this modification avoids the ESO having to over-invest in additional reactive support.
Benefits for society as a whole	Positive Efficient and secure operation of the electricity transmission system.
Reduced environmental damage	Neutral
Improved quality of service	Neutral

Proposer's assessment against the Applicable Objectives

Proposer's assessment against STC Objectives

Relevant Objective	Identified impact
(a) efficient discharge of the obligations imposed upon transmission licensees by transmission licences and the Act	Positive
(b) development, maintenance and operation of an efficient, economical and coordinated system of electricity transmission	Positive By ensuring the availability of reactive equipment this will help the ESO to efficiently operate the system
(c) facilitating effective competition in the generation and supply of electricity, and (so far as consistent therewith) facilitating such competition in the distribution of electricity	Neutral
(d) protection of the security and quality of supply and safe operation of the national electricity transmission system	Positive

insofar as it relates to interactions between transmission licensees	
(e) promotion of good industry practice and efficiency in the implementation and administration of the arrangements described in the STC	Positive Helps to clarify an area of the STC
(f) facilitation of access to the national electricity transmission system for generation not yet connected to the national electricity transmission system or distribution system;	Neutral
(g) compliance with the Electricity Regulation and any relevant legally binding decision of the European Commission and/or the Agency.	Neutral

Authority Decision to send back CM085

CM085 – Addressing the Ofgem Send-Back

Why did Ofgem send-back CM085?

On 31 March 2023, Ofgem sent back the Final Modification Report for System Operator (“SO”) – Transmission Owner (“TO”) Code (“STC”) CM085 – To clarify OFTO reactive power requirements at 20% output and noted the following:

- **Deficiencies of Final Modification Report**

Whereas the FMR recognises concerns raised by (Offshore Transmission Owners) OFTOs regarding the regular utilisation of their reactive power equipment, it fails to address these concerns in sufficient detail for the Authority to understand the impacts on OFTOs. Additionally, there are further concerns that were raised by Code Administrator Consultation respondents.

- **Ofgem’s Expectations**

Ofgem expect the revised FMR to fully explore, perhaps through a Workgroup, the impact on OFTOs and address the Code Administrator Consultation respondents’ comments some of which are below:

1. Why existing processes cannot be used to access the reactive capability at windfarm outputs below 20%. For consideration are:
 - a. STC Section C Clause 3.3.2 that allows the National Grid Electricity System Operator (NGESO) to propose modifications to the minimum Offshore Transmission Owner’s Services Capability Specification
 - b. STC Section C Clause 4.14 that requires TOs to respond to NGESO requests for provision of temporary Transmission Services in excess of their Normal Capability Limits. The clause also allows for the Transmission Owner to notify NGESO of any conditions that apply to the use of such temporary Transmission Services at technical limits above their Normal Capability Limits.
 - c. STCP 11.4 through which Enhanced Operational Capability Limits can be accessed.

2. The process through which each OFTO system's capabilities would be calculated and confirm that each OFTOs reactive power compensation equipment would have been tested to this level as part of the commissioning process.
3. The cost benefits to the consumer because of the proposed modification, in particular:
 - a. The amount of reactive power capability that would be unlocked by the proposals that can be relied upon by NGENSO in discharging their operational obligations and relevant TOs in discharging their obligations under the SQSS.
 - b. The cost that NGENSO would expect to incur to procure the reactive power that could otherwise be unlocked through this modification.
 - c. The additional operation and maintenance costs that would be incurred by the OFTO in providing this service and any consequential impact on an OFTOs tender revenue stream.

What approach was agreed at STC Panel to address this?

The STC Panel on 26 April 2023 agreed next steps following the Authority send-back on 31 March 2023. The STC Panel agreed that a Workgroup was needed to discuss Ofgem's reasons for the send-back prior to this being re-presented for Panel to hold their recommendation vote.

Agreed Terms of Reference to address Send-Back

Workgroup Term of Reference

- a. Address concerns raised by OFTO's regarding the regular utilisation of their reactive power equipment in sufficient detail to allow Ofgem to understand the impacts on OFTO's
- b. Discuss and document why existing processes cannot be used to access the reactive capability at windfarm outputs below 20%, as suggested in STC Section C Clause 3.3.2/STC Section C Clause 4.14 and STCP 11.4
- c. Confirm the process through which each OFTO system's capabilities would be calculated and confirm that each OFTOs reactive power compensation equipment would have been tested to this level as part of the commissioning process
- d. Advise what the cost benefits to consumers will be by implementing this modification:

The amount of reactive power capability that would be unlocked by the proposals that can be relied upon by NGENSO in discharging their operational obligations and relevant TOs in discharging their obligations under the SQSS.

The cost that NGENSO would expect to incur to procure the reactive power that could otherwise be unlocked through this modification.

The additional operation and maintenance costs that would be incurred by the OFTO in providing this service and any consequential impact on an OFTOs tender revenue stream.

- e. Revise the FMR (final Modification Report) with documented details showing that Terms of Reference have been met. Resubmit to the STC Panel for review before sending back to Ofgem for a decision.

Workgroup Discussions following Authority send back

The Workgroup met on 06 June 2023 and 09 November 2023 to address these Terms of Reference and these discussions and conclusions are set out below under each Term of Reference heading below:

Term of Reference A; Address concerns raised by OFTO's regarding the regular utilisation of their reactive power equipment in sufficient detail to allow Ofgem to understand the impacts on OFTO's

Workgroup Discussions/Conclusions:

During the Workgroups OFTOs repeated concerns relating to the regular utilisation of reactive equipment at high loads (such as the proposals would impose), for example Static VAR compensators (SVCs), for general system reasons rather than as part of the compliant operation of a windfarm, and the additional costs that might be incurred associated with wear and tear. OFTOs said that there are two commercial implications with the proposals (i) increased Opex (Operational Expenditure) and Repex (Replacement Expenditure) as a result of higher loadings / utilisation and the potential financial implications of non-compliance if the equipment is faulty. OFTO's highlighted that the additional Opex / Repex will vary as there are numerous designs of equipment, but typically the additional costs are estimated to be £75k pa / SVC; hence the costs over the remaining life of the OFTO are significant to the asset owner, but perhaps not significant in relation to the potential savings to the consumer. The OFTO's worries regarding the compliance is perhaps more difficult to quantify financially but could be resolved by addressing the current lack of clarity in STC Section K on its application in operational timescales.

The ESO cannot say how often OFTOs would be utilised when output is <20%. However, analysis of 19 offshore windfarms during 2020 shows that generation was <20% rated output between 28-45% of the year.

The ESO has emphasised that this modification would have a greater impact on mitigating over-investment in reactive compensation equipment, rather than reducing utilisation on other assets (TO or generators). A Workgroup member responded advising they believe that this modification is avoiding long term investment in whole system resilience and improvements that could be made to better the overall National Electricity Transmission System (NETS). They agree that there is a need for reactive power from OFTOs but with the ever-evolving Transmission Network believe that an overall holistic network requirements approach would be better suited.

Further workgroup discussions and work on the balance of costs between the OFTOS and consumers is included below under Term of Reference D.

Term of Reference B; Discuss and document why existing processes cannot be used to access the reactive capability at windfarm outputs below 20%, as suggested in STC Section C Clause 3.3.2/STC Section C Clause 4.14 and STCP 11.4

Workgroup Discussions/Conclusions:

The Proposer advised that ESO are not proposing to request enhanced capability from the asset but simply want to have confidence that the existing declared capability of the asset is accessible to them. This enables the ESO to use it in studies and provide effective and efficient planning of the system without needing to install additional reactive equipment. The assets will be operated within the existing declared capabilities and therefore there is no need to change asset settings or re-commission assets. The ESO advised that the Cost Benefit Analysis (CBA) undertaken demonstrates that the value from the modification is in savings made by not installing additional reactive capability, not by increasing the utilisation of OFTO assets.

A Workgroup member commented that the ESO were reiterating the same points that OFTOs disagreed with previously. These concerns relate to those listed above under 'Term of Reference A,' the regular utilisation of reactive equipment, for example synchronous compensators, for general system reasons rather than as part of the compliant operation of a windfarm, and the additional costs that might be incurred associated with wear and tear.

Term of Reference C; Confirm the process through which each OFTO system's capabilities would be calculated and confirm that each OFTOs reactive power compensation equipment would have been tested to this level as part of the commissioning process

Workgroup Discussions/Conclusions:

The Proposer set out their response by stating that 'it is not proposed to operate the asset outside of its stated capability, therefore there is no requirement to recommission the asset. The alternative is for ESO to procure additional reactive power, which has to be procured locationally making direct cost comparisons difficult. It is expected that in normal operation OFTOs would be running their reactive power assets whilst the wind farm is outputting lower than 20% of its rated MW due to the reactive gain of the cables and the requirement to maintain unity power factor (+/- 5%) therefore additional costs should be minimal.

Within the OFTO transmission licence the formula for IAT (Income Adjusting Event Revenue Adjustment) allows the OFTO to recover costs from a circumstance as a result of an STC change. Therefore, if there were an increase in maintenance costs that could be evidenced to be a consequence of this modification it could be recovered by this method and would be financially neutral to the OFTO. Future tenders should factor this into the bid and so would be a level playing field.

OFTOs voiced concern that they may not be able to use this recovery method due to the high hurdle and that it varies by OFTO.

Term of Reference D; Advise what the cost benefits to consumers will be by implementing this modification

Workgroup Discussions/Conclusions:

The Workgroup discussed the balance of costs between consumers and the OFTOs. A Workgroup member was concerned that consumer costs would simply be moved from one pot to another. The Workgroup agreed that it will be useful to investigate how much additional capacity the ESO will be able to access and how much maintenance costs

would be borne by the OFTOs. There was an action created for OFTOs to share detailed metrics of how often wind output is lower than 20% and share with ESO for comparison. The OFTOs were unable to extract and supply this data. The Workgroup agreed that the value provided by the ESO CBA was reasonable in the absence of other data.

The Workgroup discussed the funding of reactive power held by OFTOs. A Workgroup member stated that all reactive compensation equipment and filters are funded by the Generators, meaning customers do not directly pay for any of this equipment through transmission charges. The ESO were of the impression the equipment is paid for by consumers already via the OFTO settlement. An action was created for all to check their understanding of funding of reactive power held by OFTOs.

During further discussions the Proposer responded to the action to check their understanding of funding of reactive power held by OFTOs stating that following some internal investigation, it was confirmed that the funding for OFTO reactive equipment is funded through the local circuit charges. The ESO doesn't believe this funding arrangements impact the CM085 modification. The OFTO's view on this is that this is not a socialised cost then the consumer shouldn't get the benefit for free and this shouldn't be expropriated. CM085 considers the arrangements with the OFTO and not the generators connected to that OFTO. Any issues with how the reactive equipment is funded should be raised via a CUSC modification. **CMP418: Refine the allocation of Dynamic Reactive Compensation Equipment (DRCE) costs at OFTO transfer** seeks to socialise DRCE costs through wider TNUoS charges. This modification is now at Workgroup stage.

The ESO has undertaken a cost benefit analysis for CM085. This is provided as a response to the Ofgem send back letter. The full cost benefit analysis can be found in Annex 4.

The findings of the cost benefit analysis are summarised below:

- a) Amount of reactive power unlocked by the proposals that could be relied upon by NGENSO in discharging their operational obligations and relevant TOs in discharging their obligations under the SQSS
 - £48m - £65m in investment savings for 2027, more in future years
 - The ESO undertook power system studies to investigate the reactive power absorption requirements in 2027. The ESO created a baseline study with no reactive power provision from OFTOs. The ESO then included reactive power capability from OFTOs set at 0.33p.u. and 0.12p.u. This reflects potential capability based on reactive obligations in STC Section K.
 - In 2027, there is 21GW of OFTO offshore wind. Access to this reactive power capability could reduce the need to invest in 6-8 reactors.
 - At a cost of £8.1m¹ per reactor, this equates to £48m - £65m of over investment.
 - SVCs are more expensive. If this mod mitigates SVC investment, the savings will be greater.
 - It would also prevent bays being used for additional reactive assets when there are challenges to connecting new customers.
- b) Cost that NGENSO would expect to incur to procure the reactive power that could otherwise be unlocked through this modification

¹ NGET costs for the Pennine voltage pathfinder were assessed to be £8.1m for a 200MVAr shunt reactor.

- This is difficult to quantify, however Dogger Bank C who received a contract for the Pennine voltage pathfinder could potentially have reduced regional voltage costs by ~£20m (~33%) in 2022/23.
 - The East England voltage region is accruing ~£8m per quarter in voltage costs which could be reduced as new offshore wind connects in the region with this modification.
- c) Additional operation and maintenance costs that would be incurred by the OFTO in providing this service and any consequential impact on an OFTOs tender revenue stream
- Costs ~£75k pa as outlined in Terms of Reference A.

Second Panel Recommendation vote

The Panel will meet on 28 February 2024 to carry out their recommendation vote.

They will vote whether a change should be made to the STC by assessing the proposed change and any alternatives against the Applicable Objectives.

Vote 1: Does the Original, facilitate the objectives better than the Baseline?

Panel Member: **Anthony Johnson, ESO**

	Better facilitates AO (a)?	Better facilitates AO (b)?	Better facilitates AO (c)?	Better facilitates AO (d)?	Better facilitates AO (e)?	Better facilitates AO (f)?	Better facilitates AO (g)?	Overall (Y/N)
Original								
Voting Statement								

Vote 1: Does the Original, facilitate the objectives better than the Baseline?

Panel Member: **Neil Sandison/Neil Bennett SHET**

	Better facilitates AO (a)?	Better facilitates AO (b)?	Better facilitates AO (c)?	Better facilitates AO (d)?	Better facilitates AO (e)?	Better facilitates AO (f)?	Better facilitates AO (g)?	Overall (Y/N)
Original								
Voting Statement								

Vote 1: Does the Original, facilitate the objectives better than the Baseline?

Panel Member: **Gareth Williams, SPT**

	Better facilitates AO (a)?	Better facilitates AO (b)?	Better facilitates AO (c)?	Better facilitates AO (d)?	Better facilitates AO (e)?	Better facilitates AO (f)?	Better facilitates AO (g)?	Overall (Y/N)
Original								
Voting Statement								

Vote 1: Does the Original, facilitate the objectives better than the Baseline?

Panel Member: **Mike Lee/Joel Matthews, OFTO**

	Better facilitates AO (a)?	Better facilitates AO (b)?	Better facilitates AO (c)?	Better facilitates AO (d)?	Better facilitates AO (e)?	Better facilitates AO (f)?	Better facilitates AO (g)?	Overall (Y/N)
Original								
Voting Statement								

Vote 1: Does the Original, facilitate the objectives better than the Baseline?

Panel Member: **Richard Woodward, NGET**

	Better facilitates AO (a)?	Better facilitates AO (b)?	Better facilitates AO (c)?	Better facilitates AO (d)?	Better facilitates AO (e)?	Better facilitates AO (f)?	Better facilitates AO (g)?	Overall (Y/N)
Original								
Voting Statement								

Vote 2 – Which option is the best?

Panel Member	BEST Option?	Which objectives does this option better facilitate? (If baseline not applicable).
Anthony Johnson		
Neil Sandison/Neil Bennett		
Gareth Williams		
Mike Lee/Joel Matthews		
Richard Woodward		

Panel conclusion

Panel will meet on 28 February 2024 to carry out their recommendation vote.

When will this change take place?

Implementation date

This modification will be implemented 10 working days following Authority’s decision.

Date decision required by

As soon as possible.

Implementation approach

OFTOs will need to be aware of this change to make sure that reactive capability is available unless there is a good reason for it not to be – such as a fault or ongoing maintenance.

Interactions

- Grid Code
- BSC
- STC
- SQSS

European
Network Codes

EBR Article 18
T&Cs²

Other
modifications

Other

None

Acronyms, key terms and reference material

Acronym / key term	Meaning
BSC	Balancing and Settlement Code
CBA	Cost Benefit Analysis
CMP	CUSC Modification Proposal
CUSC	Connection and Use of System Code
DRCE	Dynamic Reactive Compensation Equipment
EBR	Electricity Balancing Regulation
ESO	Electricity System Operator
OFTO	Offshore Transmission Operator
Opex	Operational Expenditure
IAT	Income Adjusting Event Revenue Adjustment
NETS	National Electricity Transmission System
Repex	Replacement Expenditure
STC	System Operator Transmission Owner Code
SQSS	Security and Quality of Supply Standards
SVCs	Static VAR compensators
T&Cs	Terms and Conditions

Annexes

Annex	Information
Annex 1	Proposal form
Annex 2	Legal Text
Annex 3	Code Administrator Consultation responses/summary
Annex 4	Ofgem Send back letter
Annex 5	Cost Benefit Analysis
Annex 6	SVC Slides

² If the modification has an impact on Article 18 T&Cs, it will need to follow the process set out in Article 18 of the European Electricity Balancing Guideline (EBGL – EU Regulation 2017/2195) – the main aspect of this is that the modification will need to be consulted on for 1 month in the Code Administrator Consultation phase. N.B. This will also satisfy the requirements of the NCER process.